APPENDIX A

Preliminary Hydrology and Hydraulics Report

Note: The Section 508 amendment of the Rehabilitation Act of 1973 requires that the information in federal documents be accessible to individuals with disabilities. The U.S. Army Corps of Engineers (Corps) has made every effort to ensure that the information in this appendix is accessible. However, this appendix is not fully compliant with Section 508, and readers with disabilities are encouraged to contact Mr. Jayson Hudson at the Corps at (409) 766-3108 or at SWG201601027@usace.army.mil if they would like access to the information.

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Preliminary Hydrology and Hydraulics Report

DCC Harris Reservoir Expansion EIS

2018-0568.0-TX

Prepared for:

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Acronyms and Terminology

ac	acre
AEP	Annual Exceedance Probability (relates to floodplain flooding risk)
AF	acre feet
ARS	Agriculture Research Service, USDA
BFE	Base Flood Elevation
BRA	Brazos River Authority
BWA	Brazosport Water Authority
cfs	Cubic feet per second
DCC	Dow Chemical Company
Dow	Dow Chemical Company
EIS	Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FIS	Flood Insurance Study
FPP	Floodplain Protection Planning Study
ft	feet
GCWA	Gulf Coast Water Authority
gpm	Gallons per minute
HEC-HMS	Hydraulic Engineering Center-Hydrologic Modeling System, USACE
HEC-RAS	Hydraulic Engineering Center-River Analysis System, USACE
HMG	Hydrologic Modeling Guidelines, USACE
HUC	Hydrologic Unit Code
MGD	Million gallons per day
mi^2	Miles squared
mph	Miles per hour
MSL	Mean sea level
NAVD88	North American Vertical Datum of 1988
NCDC	National Climatic Data Center, NOAA
NOAA	National Oceanic and Atmospheric Agency
NRCS	Natural Resource Conservation Service, USDA
NWS	National Weather Service, NOAA

Riverware™	River and Reservoir Modeling Software, University of Colorado Boulder
SCS	Soil Conservation Service (predecessor of the NRCS)
sq mi	Square miles
SSC	Suspended sediment concentration
TCEQ	Texas Commission on Environmental Quality
TDS	Total Dissolved Solids
TWDB	Texas Water Development Board
TX	Texas
TxRR	Texas Rainfall-Runoff Model
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USGS	United States Geological Survey
WAM	Water Availability Model
WSEL	Water Surface Elevation

0 Executive Summary

The Dow Chemical Company (Dow) and Regional Water Planning Group identified at least as early as 2011 the need for Dow to undertake steps to ensure reliable water supply to their plant located in Freeport, Texas. For purposes of this analysis, the time horizon was at least 50 years into the future for resiliency and water supply needs.

0.1 Project Summary

A full detail of the project Purpose and Need is provided in the Dow Individual Permit application to the US Army Corps of Engineers (USACE). Dow currently operates two reservoirs, Harris and Brazoria Reservoirs, for a total effective storage of approximately 28,000 acre-foot (AF), which is no more than 68 days of storage based on current water use. The Texas Commission on Environmental Quality (TCEQ) recommendations for water suppliers to have at least 180 days of water storage or they are at risk for shortages during drought conditions.

Dow proposes to construct an approximately 50,000 AF off-channel impoundment reservoir adjacent and upstream of the existing Harris Reservoir, referred to in the permit application as the Harris Reservoir Expansion (Proposed Project). The proposed impoundment is located directly upstream and adjacent to the existing Harris Reservoir but will work independently. The proposed reservoir covers approximately 2,000 acres (ac). The proposed reservoir includes a pumped intake station on the Brazos River and gravity outfall to Oyster Creek via a new bypass channel.

Dow proposes to operate the three reservoirs in a manner similar to current operations with the Proposed Project increasing available storage from 68 days of water to 180 days. During periods of drought, the Proposed Project reservoir would be exhausted first, followed by the existing Harris Reservoir, and then the Brazoria Reservoir. The decision for emergency releases due to severe weather, such as tropical storms and hurricanes with wind speeds that can overtop the embankments, would remain unchanged.

0.2 Environmental Setting

The Brazos River is a major river system within the State of Texas with its headwaters located near Blackwater Draw, New Mexico and its mouth near Freeport, Texas. The river is highly managed through a series of dams and off-channel storage (reservoirs) throughout its length. This is due to the high variability of flows as the primary water source is rainfall to store water for dry season use but also for flood control. The proposed project is located within segment 1201, which is tidally influenced.

The general climate for the project area includes high potential rainfall events from tropical storms and hurricanes with long periods of drought. Future rainfall is predicted to trend towards lower rainfall levels and higher temperatures. Sea level is expected to rise by one to two feet in the next 50 years, which will tend to push the estuary farther upstream (referred to as the salt wedge) and storm surge could reach farther upstream from current conditions. The historic sediment load for the Brazos River has decreased for particles larger than sand but has increased overall for sand and smaller size particles.

Dow currently operates two reservoirs, Harris Reservoir located at River Mile 46 with effective storage capacity of 7,000 AF and Brazoria Reservoir located at River Mile 25 with effective storage capacity of 21,000 AF, to provide potable water to the Dow chemical plan and other users. Dow has reported periodic but not regularly scheduled maintenance dredging on the existing reservoirs, which has resulted in loss of storage by up to half of the original design volume. During drought conditions, Dow estimates the two-reservoir system provides 68 days or less of necessary water supplies. Texas Council on Environmental Quality (TCEQ) identified that facilities with less than 180 days of water storage are at risk during droughts.

0.3 Summary of Modeling and Analysis

Modeling included HEC-HMS, Riverware™, and HEC-RAS. HEC-HMS provides hydrologic modeling, Riverware™ provides reservoir operational modeling, and HEC-RAS provides hydraulic modeling. Using data provided by Dow and supplemented by various local, state, and federal data and reports, the modeling and analysis focused on drought conditions during the life of the project. The assumed project life is 50 years for analysis purposes although the current Dow plant has been in operation for more than 60 years. The assumed project life is not an indication of maximal life for the project and only used for modeling purposes.

0.4 Analysis of Potential Impacts

0.4.1 Floodplain Storage Loss

The Proposed Project site is approximately 2,000 acres in the shared Brazos River and Oyster Creek 100-year floodplain. The loss of floodplain storage for the Brazos River is negligible under current development conditions. However, there is a 316 AF loss of storage for Oyster Creek as a result of the proposed project. Credits for floodplain storage within the project footprint, namely the overflow channel, is approximately 199 AF, which results in a net loss of 117 AF of floodplain storage on Oyster Creek. While Dow presented modeling results for No Rise, meaning that the water surface level in Oyster Creek meets Federal Emergency Management Agency (FEMA) requirements for not creating impacts to the stream, the concern is that the excess water resulting from high flows such as a 100-year flood event (0.1-percent chance of occurring in any given year) that are no longer stored on the proposed project site will result in hydromodification downstream as that means the flows are typically faster past the site.

0.4.2 Hydromodification of Oyster Creek

Oyster Creek will be hydro-modified from 3,600 ft. north (Project 1) of the northeast of the proposed reservoir to the proposed reservoir outlet channel which is a length of 21,300 feet (ft). Project 2 follows the original Oyster creek for the first 12,860 ft. until the original channel flows east into an old oxbow before meeting up with the proposed reservoir outlet channel downstream. Project 3 is an overflow channel 8,440 ft. in length which parallels the proposed reservoir's eastern embankment until it joins with the proposed reservoir outlet channel. The overflow channel is designed to allow water to enter at the 25 yr. 24 hr. storm event. The hydromodification of Oyster Creek by channel benching will contribute to the overall stability of the channel.

The hydromodification of Oyster Creek does not alleviate the floodplain storage loss along Oyster Creek caused by the construction of the proposed reservoir embankment. In fact the construction of the embankment west of Oyster Creek will block the floodplain storage that was possible previously and the overflow channel will diminish the storage potential in the oxbow and shorten the waters flow path resulting in the peak storm discharge to flow downstream in a shorter time which could increase the amount of water at a given time period.

0.5 Conclusions

0.5.1 Near Term

Dow estimates that the current two-reservoir system can provide no more than 68 days of water supply to Dow's Freeport plant and other users Dow is under contract to supply with potable water. Based on TCEQ water storage recommendations, recent drought events, and loss of contract water availability, Dow estimates that they need at least 180 days of storage to provide the necessary water to the users during an extended drought. The existing reservoirs, even with maintenance dredging to original storage volumes, would not meet the stated water supply needs for the Dow Freeport plant and other users in the near term. The proposed reservoir would more than double the storage capacity and in the near term provide approximately 180 days of water supply storage at project completion.

The modeling and analysis support Dow's analysis that the current two-reservoir system provides less than 68 days of potable water to their Freeport plant and other water supply users. The analysis indicates that the proposed capacity (volume of 50,000 AF) is the minimum size to meet near term water supply needs. The effective storage capacity of the existing reservoirs is likely less than assumed by Dow (Dow assumes 28,000 AF and maybe actually as low as 18,000 AF). This means the proposed project likely does not meet the 180 days of water supply storage stated in Dow's need statement. Dow could conduct a new survey of the existing reservoirs to confirm actual effective capacity and this would confirm the actual total days of storage of the combined reservoir system.

The proposed design meets current reservoir standards for dam safety including considerations for wind and wave conditions, which are likely to increase due to more severe and frequent tropical storm and hurricane events.

0.5.2 Long-Term

Changes in rainfall patterns, anticipated increases to average air temperatures (resulting in increased evaporation), rising sea levels, and high fine sediment loads in the Brazos River are all considerations for a long-term outlook on the project. The existing reservoirs have been in operation for more than 50 years and shown a nearly 50% loss in storage capacity due to sedimentation. Using a similar projection of approximately 50 years, sedimentation presents the highest risk for long-term viability of the 180 days of total combined water storage. This is further put at risk as Dow proposes to capture high flow events to refill the proposed and existing reservoirs as part of their normal operations. Without planned and regularly executed maintenance removal of solids from all three reservoirs, the Proposed Project purpose and need of 180 days of storage cannot be maintained and will fall below that level.

0.5.3 Recommendations

1. The purpose and need of the project is to provide 180 days of water storage for drought conditions. The existing Harris and Brazoria Reservoirs have an estimated capacity of 28,000 AF, which may be overestimated by Dow and that could result in the total storage with the three-reservoir system being less than 180 days of water storage.
    a. A survey of the existing reservoirs should be conducted to confirm capacity.
    b. An Operation and Maintenance Plan should be required for the existing reservoirs, which have lost capacity due to sedimentation. The O&M Plan should require scheduled solids removal, which can be based on a number of different indicators such as a depth gage or probing.
2. Sustained discharge from the proposed new reservoir will likely result in significant downstream erosion of Oyster Creek. To address this, we recommend that a discharge operation plan (can be included in the overall O&M Plan) be developed for the new reservoir that minimizes the potential for downstream erosion of Oyster Creek.
    a. Dow should note that FEMA may require a floodplain amendment due to the changes in the Oyster Creek and floodplain from the restoration project. This determination would be made by the local Flood Plain Administrator.
    b. Erosion control is recommended at the inlet and outlet to the stream restoration section, especially for the Project 3 Overflow segment.
3. Repeated filling and draining to create wet then dry conditions over the short term can result in hydromodification to the reservoirs and the receiving waters, which is specifically a concern for Oyster Creek due to the low natural flow. The repeated wet/dry conditions can break down the soil structure and lead to erosion. Oyster Creek between the Proposed Project discharge point and the existing Harris Reservoir discharge point are at highest near-term risk due to the changed conditions and regular inspection should be required along with a management plan to minimize erosion.
4. Dow should consider additional water storage as the proposed project likely does not meet the 180-day storage recommendation by TCEQ.
    a. This could include maintenance dredging to original or deepening the existing reservoirs, assuming dam safety concerns can be addressed.
    b. Another option is to contract storage in an upstream reservoir.
    c. Other water saving and conservation measures at the Dow plant could be considered, including water reuse through systems such as reverse osmosis. However, these systems tend to have a high energy requirement.
5. This analysis assumes 100,000 gpm discharge rates. If Dow does increase their discharge to 175,000 gpm, which is possible if Dow exercises their full water right, the water storage would be insufficient to meet the 180 days of water storage.
    a. Of note is that the Proposed Project shifts the current discharge rate into Oyster Creek upstream of the adjacent existing Harris Reservoir. This is a minor change that did not result in a changed condition for Oyster Creek. However, nearly doubling the discharge could have an impact on Oyster Creek for both the

existing Harris Reservoir as well as the Proposed Project. This would represent a significant increase in flows in Oyster Creek and the periodic nature could make Oyster Creek more susceptible to hydromodification and erosion.

b. A change in withdrawal rate from Brazos River to 175,000 gpm, expect possibly at the lowest of river flows during drought, would not be anticipated to cause a change to the river due to the large natural flows through the project vicinity.

1 Introduction

The report describes the hydrologic and hydraulic analysis conducted to inform the US Army Corps of Engineers (USACE) determination if the proposed Dow Chemical Company (Dow) Harris Reservoir Expansion project meets hydrology requirements in Section 404 of the Clean Water Act (CWA). The analysis followed the guidance provided in the USACE Hydrology Modeling Guidelines (HMG) for conducting the hydrologic and hydraulic modeling. The USACE developed Hydrologic Modeling Guidelines to assign project managers and applicants in determining how to address hydrology and specifically how to approach hydrologic modeling for primary and secondary effects.

The purpose of the proposed Project is to expand Dow's water storage capacity at or near the existing Harris Reservoir to improve the long-term reliability of water supply during drought for the Texas Operations facilities in Freeport, Texas as well as other industrial, community and potable water users that rely on Dow's water supply. It is also planned to allow more efficient utilization of Dow's existing Brazos River surface water rights.

Dow currently manages the Brazoria and Harris reservoirs for water supply and water quality (at the Dow intake for industrial water supply), which has a reported combined effective storage capacity of 28,000 AF. This provides approximately 68 days or less of stored water. Texas Commission on Environmental Quality (TCEQ) recommendation for storage to meet drought preparedness and response standards is 180 days of storage. This recommendation is based on the Texas Administrative Code Title 30, Part 1, Chapter 290, Subchapter D, Rule §290.41, which under b.1 states that retail public utilities should report when they have less than 180 days of water supply storage and should develop a drought contingency plan (State of Texas, Revised 2013).

The proposed Harris Reservoir Expansion (Proposed Project) will include an approximately 2,000-acre off-channel impoundment facility that will increase Dow's storage capacity by about 50,000 AF. The facility will include an auxiliary spillway outlet from the reservoir and an intake and pump station to divert Brazos River water within Dow's existing water rights. The Proposed Project in conjunction with the existing two reservoirs, which Dow estimates to have approximately 28,000 AF of effective capacity, may result in 180 days of water storage when that reservoir comes online. There is uncertainty as to the existing reservoir capacities, which may be as low as a combined storage of 18,000 AF.

2 Environmental Setting

This section describes the general environmental conditions that define the setting of the Proposed Project. This includes the physical setting as well as other hazards that are considered when analyzing the Proposed Project.

2.1 Watershed

The Proposed Project is located along the Brazos River, one of the second largest watershed by area in Texas (see Figure 1) (TWDB, 2019). The watershed generally runs northwest to southeast with the headwaters in New Mexico and discharges to the Gulf of Mexico near Freeport, Texas. The Brazos River has the largest average annual flow of any river in the state.

The Brazos River flow is primarily supplied through precipitation with many creeks and streams along the main stem. The upper basin was historically underutilized for withdrawals for irrigation, livestock water, and other agricultural purposes until recently with the decline in groundwater supplies, in particular the overuse of the Ogallala Aquifer (TWDB, 2019). This has led to decreasing supplies farther downstream in the more populated areas of the basin, especially during low rainfall and drought years.

The Brazos River is a highly managed and regulated river system with three Brazos River Authority (BRA) reservoirs, eight USACE Flood Control Dams, and numerous other large to small impoundments (Figure 2). There are over 1,200 adjudicated water rights in the Lower Brazos River alone. In addition, Dow is also a potable water supplier for industries and municipal users near their plant in Freeport, Texas.

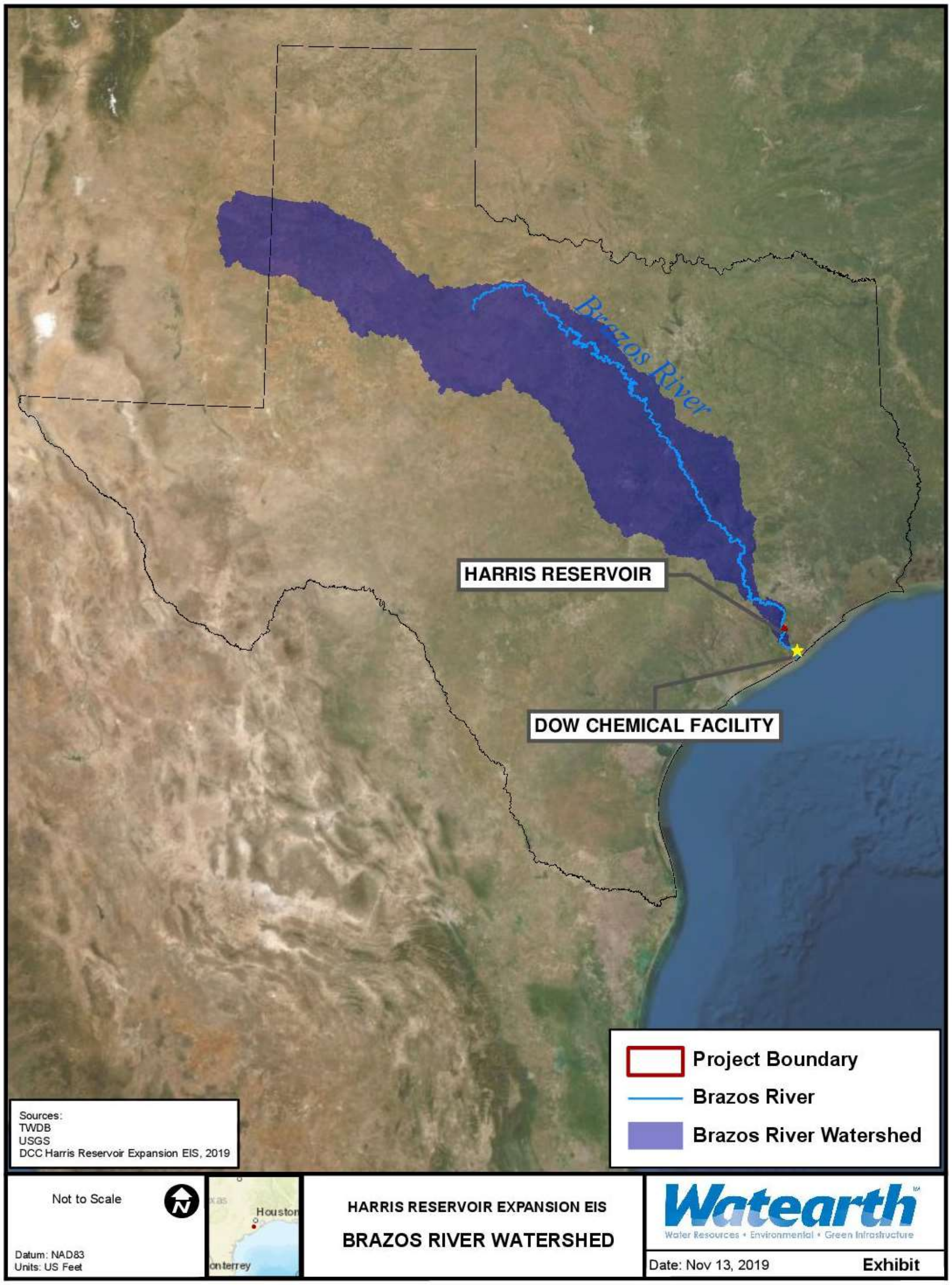


Figure 1: Brazos River Watershed

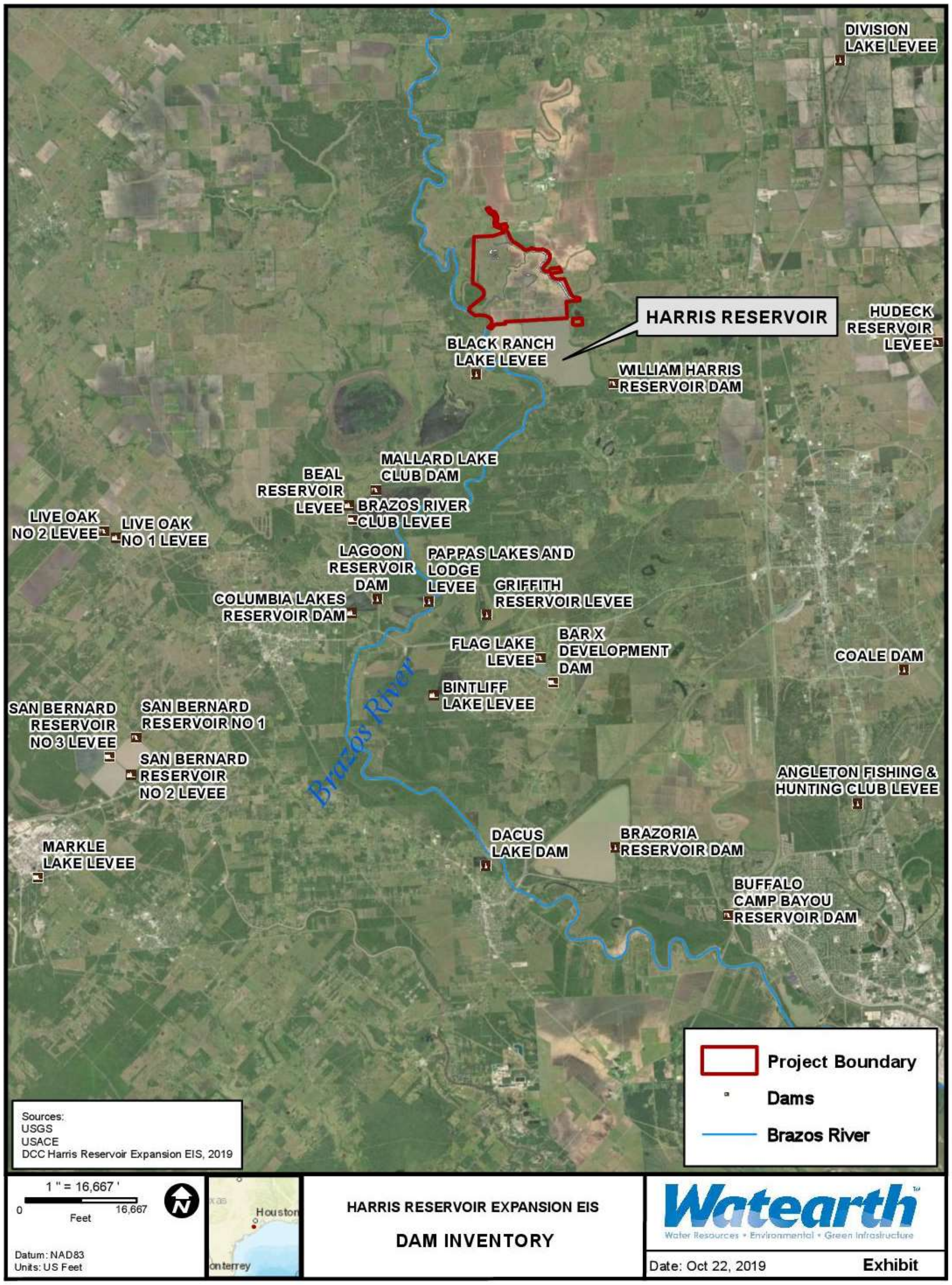


Figure 2: Dam Inventory for Lower Brazos River (Segment 1201)

2.2 Surface Waters and Local Hydrology

The Brazos River Basin is more than 820 miles long and crosses nearly every physiographic region in Texas (TWDB, 2019; BRA, 2019). The watershed is approximately 42,000 sq mi descends at a rate of three feet to one-half foot per river mile.

The Lower Brazos River sub-basin includes the area from Waco, Texas to the Gulf of Mexico (Halff, 2019). The focus of this report is the lowest portion of the Lower Brazos River and limited to Brazoria and Fort Bend Counties. Figure 3 shows the project area drainage areas in the Lower Brazos River sub-basin.

The topography in this area is level with minimal rise as shown by the height of the gages along the Brazos River in Table 1 (USGS, 2019; USGS, 2019). The gages along the Brazos River are reported in NGVD29 and NAVD88. The conversion factor for vertical datums in the project area is NAVD88 is equal to USGS gage elevation in NGVD29 minus 0.975 ft (Heitmuller & Greene, 2009). As Table 1 shows, there is minimal elevation change between the Freeport gage and the Rosharon gage. The thalweg of the Brazos River does not rise above mean sea level until above the Rosharon gage.

Table 1: Gage Elevations

Location	Brazos River Mile	Elevation (NAVD88)
Freeport Gage (08772440)	6	-4.51ft
Rosharaon Gage (08116650)	57	-0.98 ft
Richmond Gage (08114000)	92	+27.02 ft

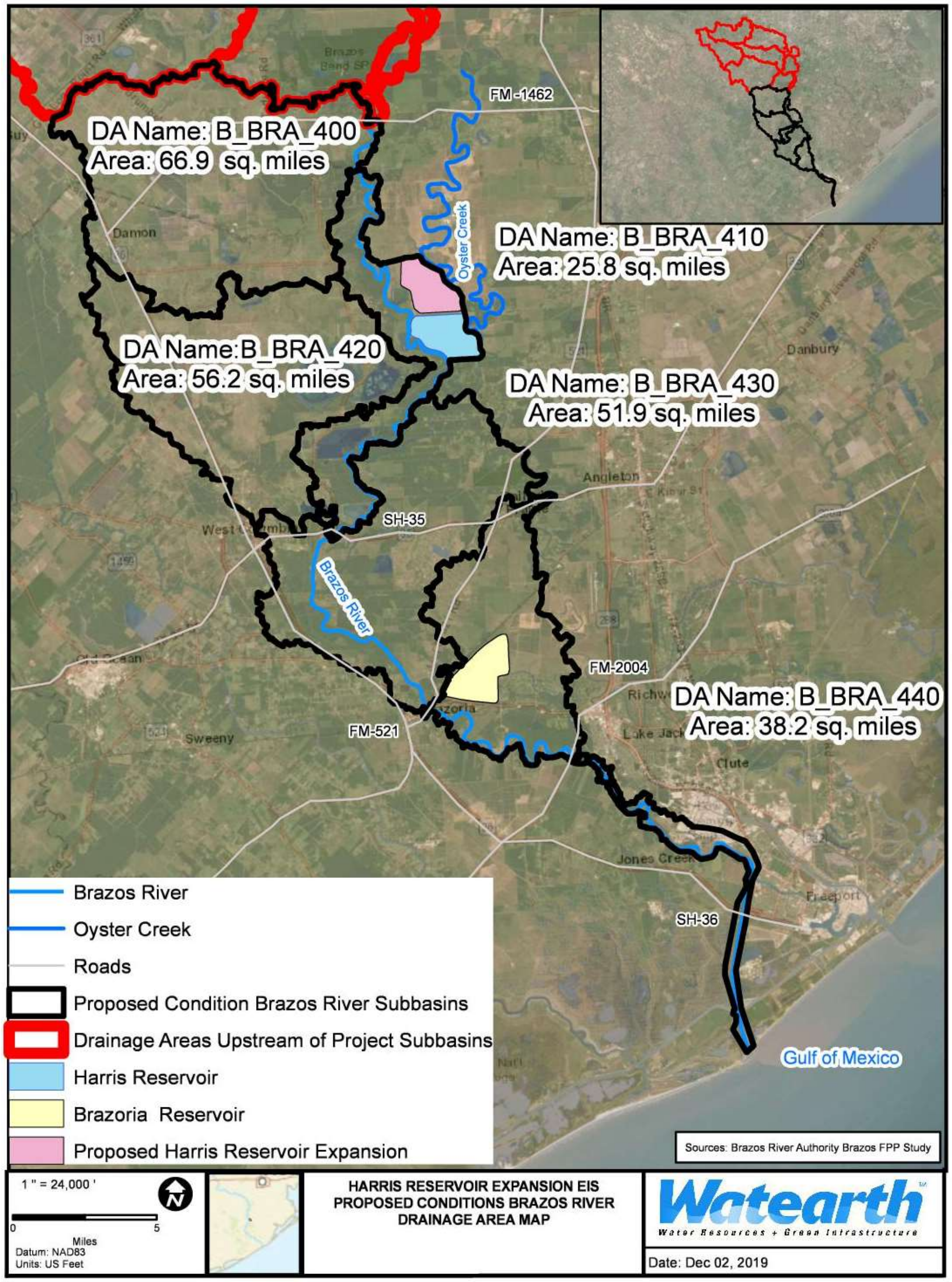


Figure 3 Lower Brazos River and Oyster Creek Sub-Basins in Project Vicinity

2.3 Rainfall and Temperature Change

The USACE has developed predictive models for changes in rainfall and temperature, among other climate predictors. The USACE Region 12 (Texas-Gulf Region) report summarizes current climate and hydrology literature for the general project area. Seasonal precipitation is expected to decrease slightly with warmer annual temperatures, although intense rainfall events may increase in frequency. This means that mean annual rainfall may decrease while the variance from year to year increases. Figure 4 shows projected seasonal precipitation changes in 2085 (USACE, 2015).

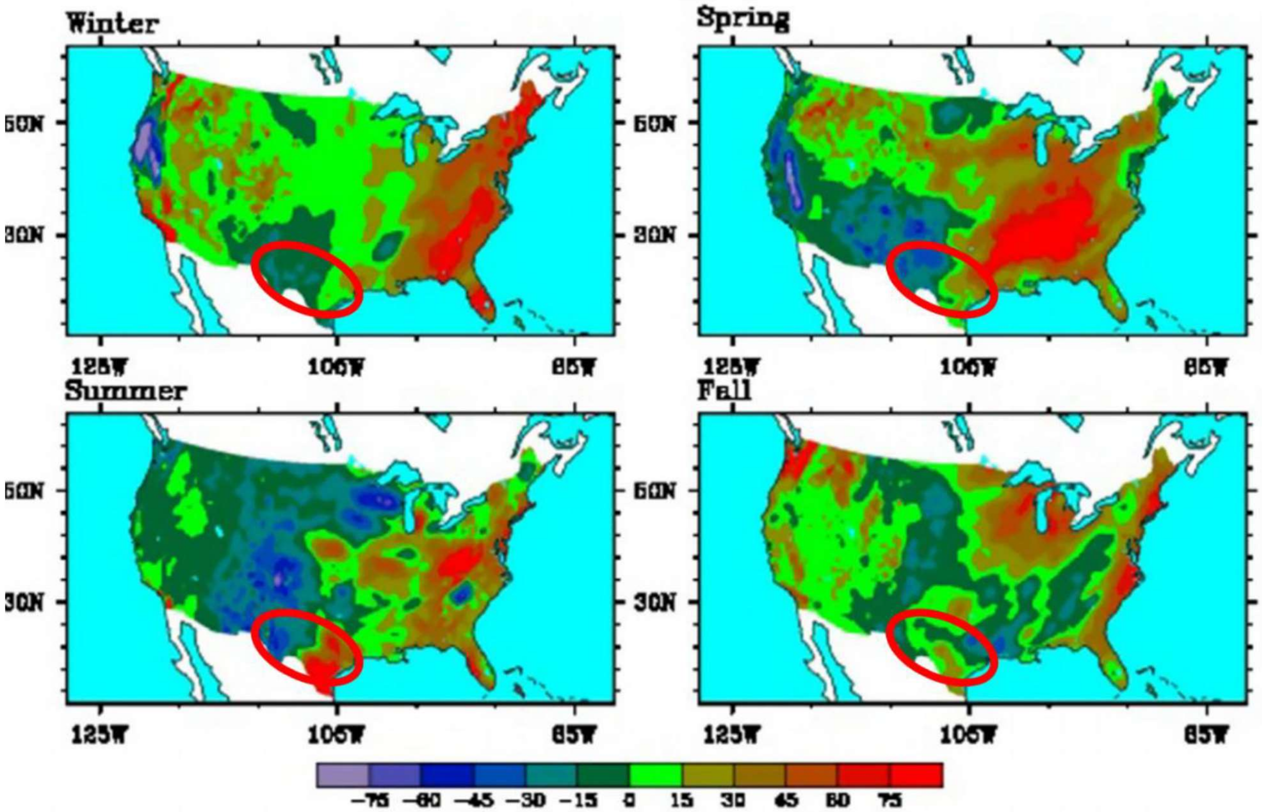


Figure 4: Projected changes in seasonal precipitation, 2085 vs. 1985 mm (from (USACE, 2015)). Texas region circled with red oval.

Although Figure 4 shows a slight decrease in precipitation in southern Texas, projections of future precipitation change are especially uncertain in this region because it is located in a transition zone between projected drier conditions to the south and projected wetter conditions to the north, which could have mixed effects on river flows at the project site. Due to these uncertainties, the assumption that future precipitation in the project area will be roughly similar to past precipitation appears to be justified.

2.4 Watershed Vulnerability and Hydrology Assessment

The project proponent, Dow, developed a Hydrology and Floodplain Analysis (Attachment J of the USACE Individual Permit Application). The focus of the Attachment J analysis was on flooding risk and high flow events and that full analysis is not repeated here. The USACE watershed vulnerability tool was used to screen the vulnerability of the project area to flooding under future conditions (USACE, 2019b). For the Brazos River Watershed (HUC 1207), the projected future risk is expected to be low for the dry scenario, and moderate for the wet scenario. Figure 5 shows the vulnerability of the Brazos River watershed for 2050 and 2085 conditions.

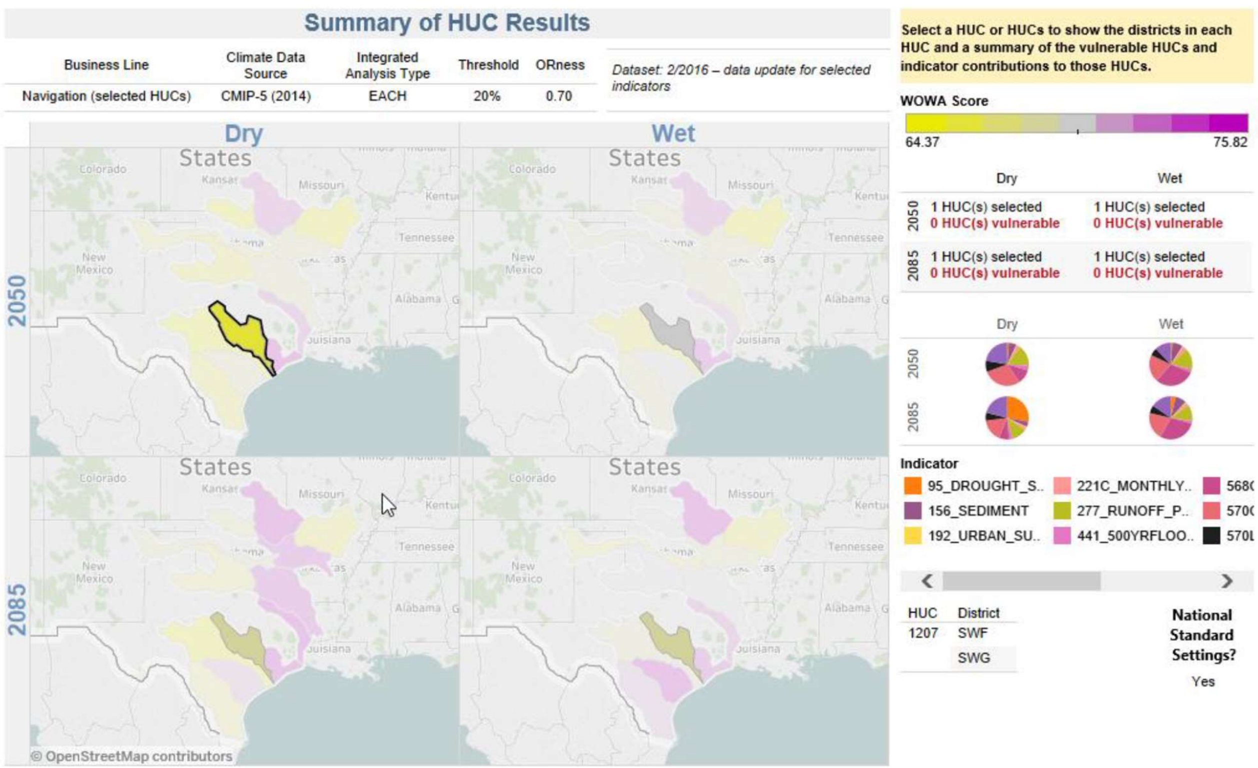


Figure 5: Watershed vulnerability for the Brazos River watershed (HUC 1207) from the USACE watershed vulnerability tool.

The climate hydrology assessment tool was also used to assess the predicted trends of the peak annual discharge for the Brazos River (USACE, 2019a). Figure 6 shows the trends in projected peak annual flowrate, which represent the mean of 93 projected future hydrology models for the Brazos River watershed (HUC-1207). The projected annual maximum monthly streamflow for the Brazos River is expected to remain relatively constant, with the potential for a very small increase in flow rates in the future based on the climate hydrology model results shown in Figure 6. However, there is considerable uncertainty in making such specific predictions of future peak annual discharges. It is important to note that this data is not to be used for quantitative analysis.

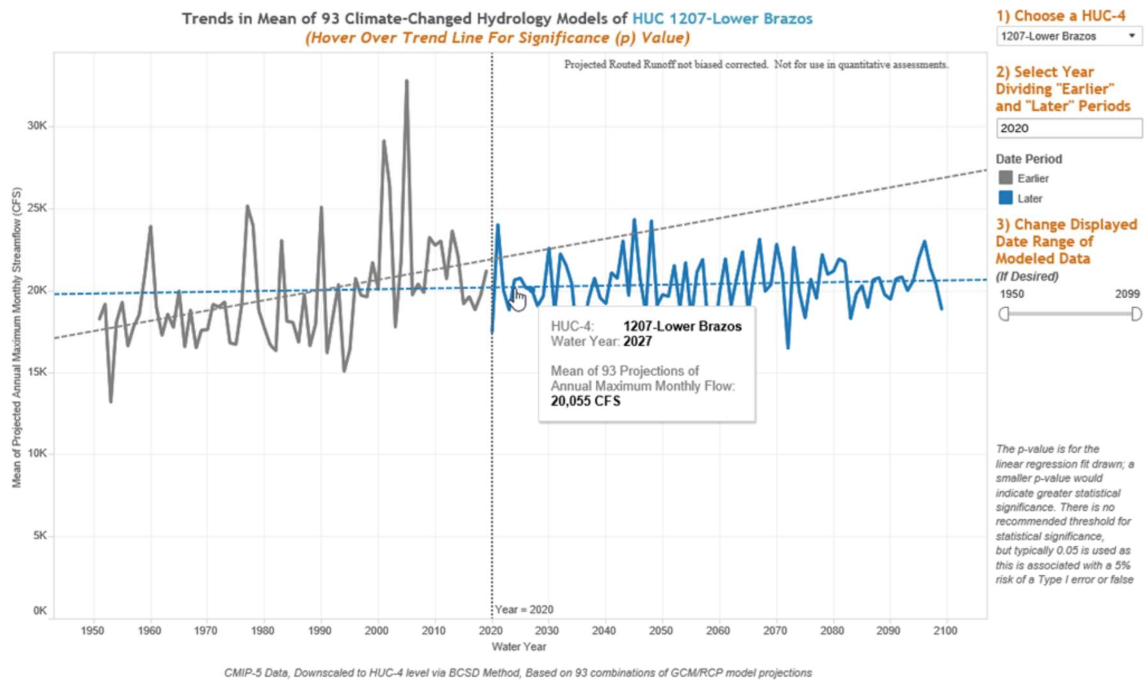


Figure 6: Trends in mean modeled annual maximum streamflow. The mean (dotted blue line) is the average of 93 Climate-Change Hydrology Models of HUC 1207.

The consensus in the recent literature points toward mild increases in annual precipitation and streamflow in the Texas-Gulf Region over the past century. In some studies, and some locations, statistically significant trends have been quantified, however, the trends at the Brazos project site remain insignificant or unclear. The discussion above should be used for qualitative analysis of the hydrology, precipitation, and temperature impacts for the Proposed Project.

2.5 Storm Surge

The Gulf Coast shoreline is susceptible to storm surge, which is an abnormal rise in seawater level during a storm as a result of on-shore high winds. Storm surge is measured as the height above the normal predicted astronomical tide. The distance on-shore that storm surge travels can be compounded if associated with high tides, especially unusually high tides called king tides. The increased sea level height means that the tidal influence area is extended upstream from normal conditions temporarily. Storm surge and associated winds can be damaging to human development and infrastructure farther upstream than under normal conditions. FEMA calibrates and validates storm surge using historic recorded storms in development of the Flood Insurance Study (FIS) for Texas Coastal Counties (FEMA, 1999). FEMA selected Carla (1961), Claudette (2003), Rita (2005), and Ike (2008) as potential validation storms due to their intensity and proximity to the project site (Figure 7). The storm tracks for these storms are shown in Figure 7. Due to the flat topography in the project area, inundation of brackish and saline water will reach farther upstream than under normal conditions. Based on sampling data provided by Dow, the salt wedge ranged from river mile 15 to 43 and could potentially reach river mile 49.

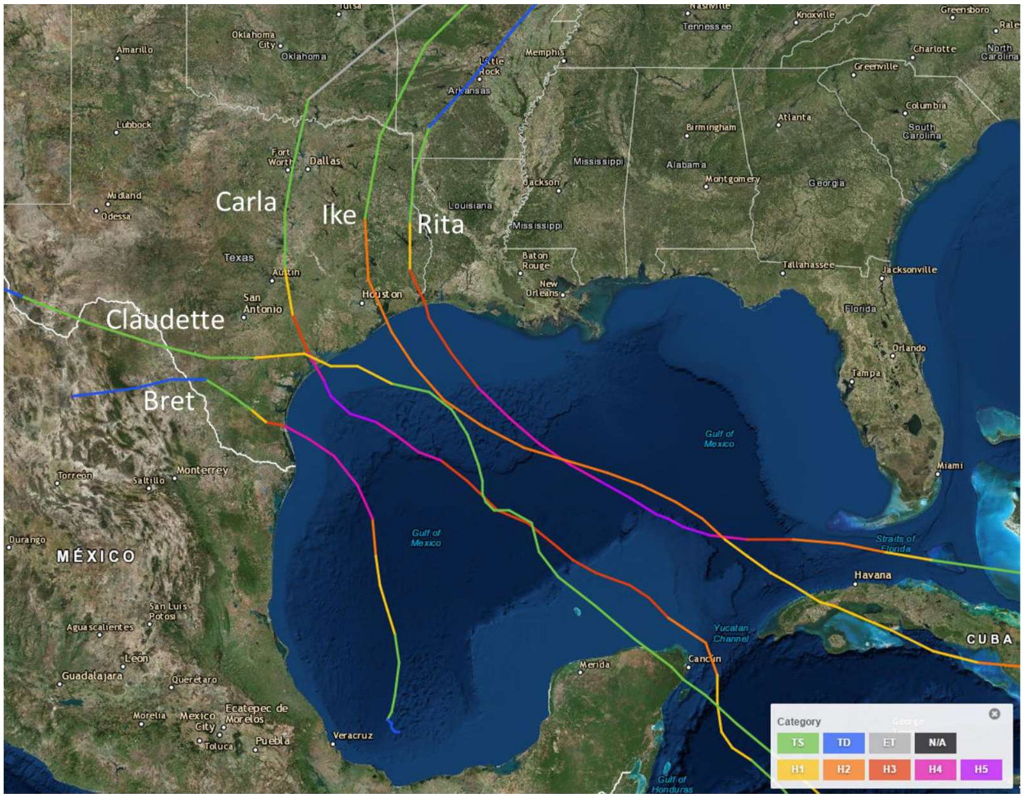


Figure 7: Historical Storm Tracks near the Project Site (FEMA, 1999).

2.6 Relative Sea Level Rise

The global sea level has been rising over the last century and current prediction models indicate that this will accelerate over the next century. Low lying and flat topography areas such as the project area are more likely to experience direct effects including inundation and extension of the brackish water upstream compared to past conditions. The Brazos River estuary extends above the Brazoria Reservoir located at river mile 25 periodically throughout the year. Dow monitors and tracks the location of the salt wedge, as defined as greater than 500 milligrams/liter of chloride. As discussed above, Dow provided the salt wedge position tracking data and found the salt wedge fluctuates between river mile 15 and 43 and could potentially reach river mile 49. The existing Harris Reservoir is located at river mile 46.

The USACE developed a relative sea level rise calculation and mapping tool (USACE, 2014). The tool uses USGS gage data, NOAA Atlas 14 rainfall rates, and other data to provide three scenarios for relative sea level change, which reflects different rates of sea level rise based on the scientific literature.

The assumed project start date (substantial completion of the Proposed Project) is 2022 with the planning horizon of 2072 (50 years). Data was obtained using the web tool from the closest available gage, 8772440 at Freeport, TX, which is located approximately six miles from the Brazos River mouth. Tool assumptions include a base flood elevation (BFE) of 12 feet (FEMA, 1999). Model predictions range from approximately one foot to four feet in 2070 and two feet to over eight feet in 2122.

Figure 8 shows the resulting relative sea level change over the planning horizon (until 2075) and 100 years from the project start date (2122). Figure 9 displays the resulting inundation from the USACE high sea level change scenario in 2122, which is 100 years from project start.

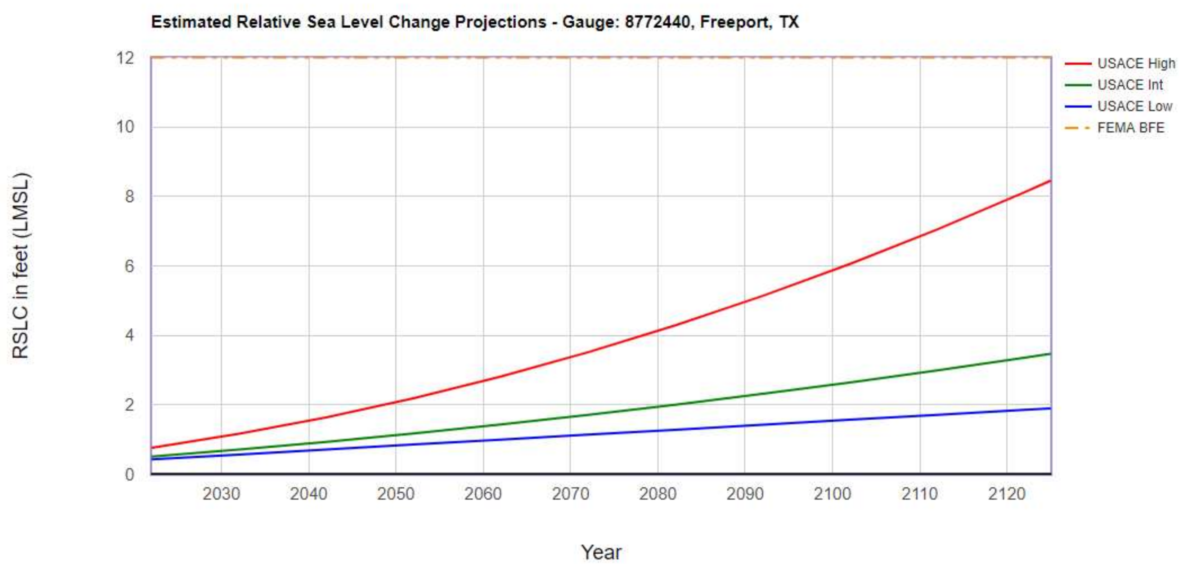


Figure 8: USACE projected RSLR, at NOAA gage 8772440, Freeport TX over 100-Year Period of Analysis (2022 Base Year, 2075 End of 50-Year Project Planning Horizon, 2122 End of 100-Year).

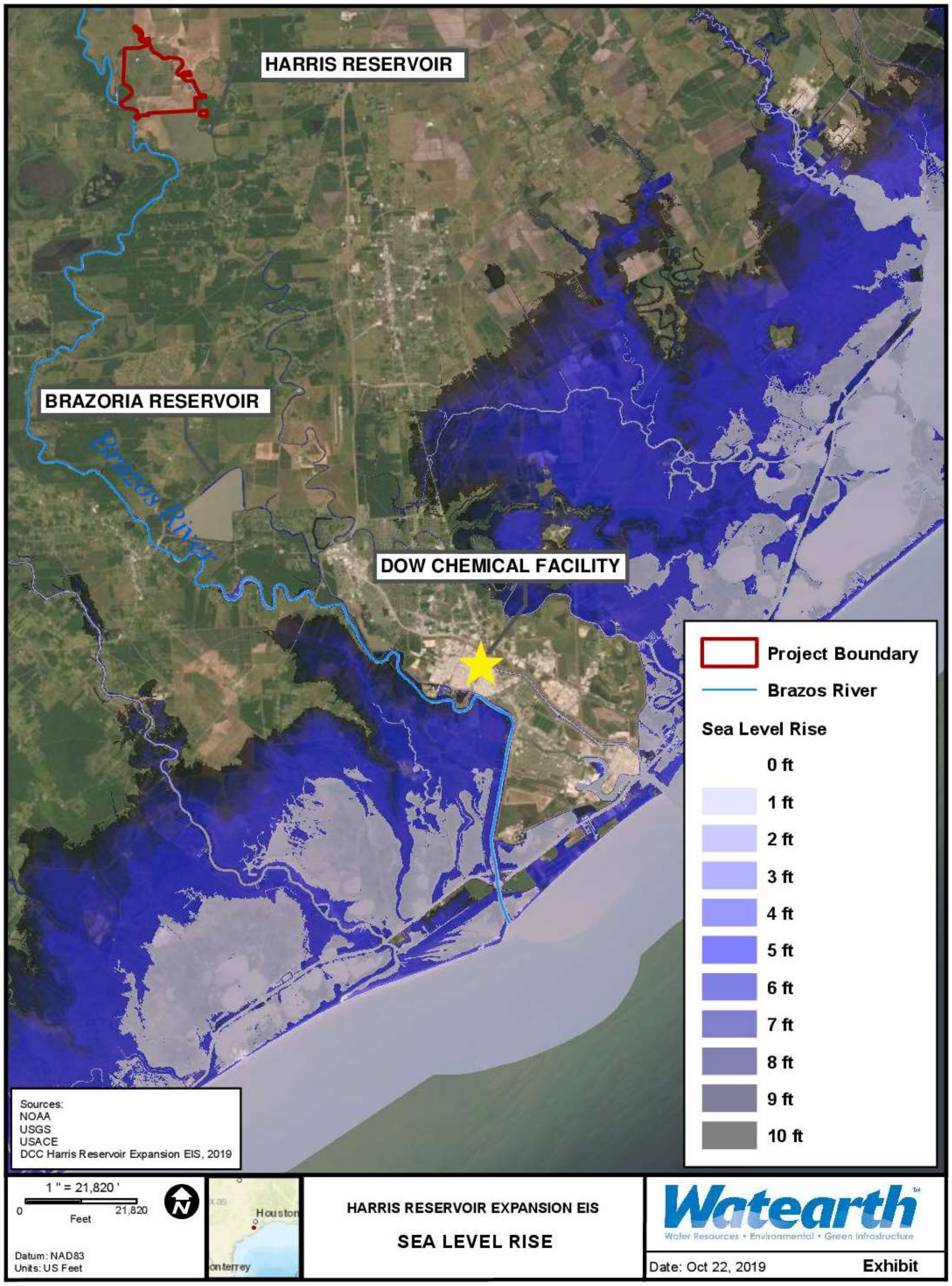


Figure 9: Gulf Coast inundation map for mean sea level in the year 2122 under the high sea level rise scenario.

3 Existing Site Conditions

This project provides a unique set of existing site conditions because the existing condition is comprised of a water supply system spanning over nearly 40 river miles of the Brazos River, cross basin interactions between the Brazos River and Oyster Creek, a series of canals, and multiple reservoirs.

3.1 Proposed Project Boundaries

The Proposed Project is development of an approximately 50,000 AF reservoir directly upstream of the existing Harris Reservoir. The proposed reservoir site land use is current agriculture. According to project information provided by Dow, the proposed reservoir site has wetlands and acts as the floodplain for both the Brazos River and Oyster Creek.

The Proposed Project must be considered in the context of the system it will contribute, specifically the water supply system that serves the Dow plant and other users in Freeport, Texas. For modeling purposes, the project boundaries include the Brazos River from the Rosharon USGS stream gage to the mouth of the Brazos River at the Gulf of Mexico and portions of Oyster Creek used for inter-basin transfers of water through the existing Harris and Brazoria Reservoirs.

As shown in Figure 10, Dow operates two off channel impoundments (information provided by Dow). The existing Harris Reservoir, located at river mile 46, lies between the Brazos River and Oyster Creek in their shared floodplain. The Brazoria Reservoir, located at river mile 25, is deeper than the existing Harris Reservoir and designed for three times the storage.

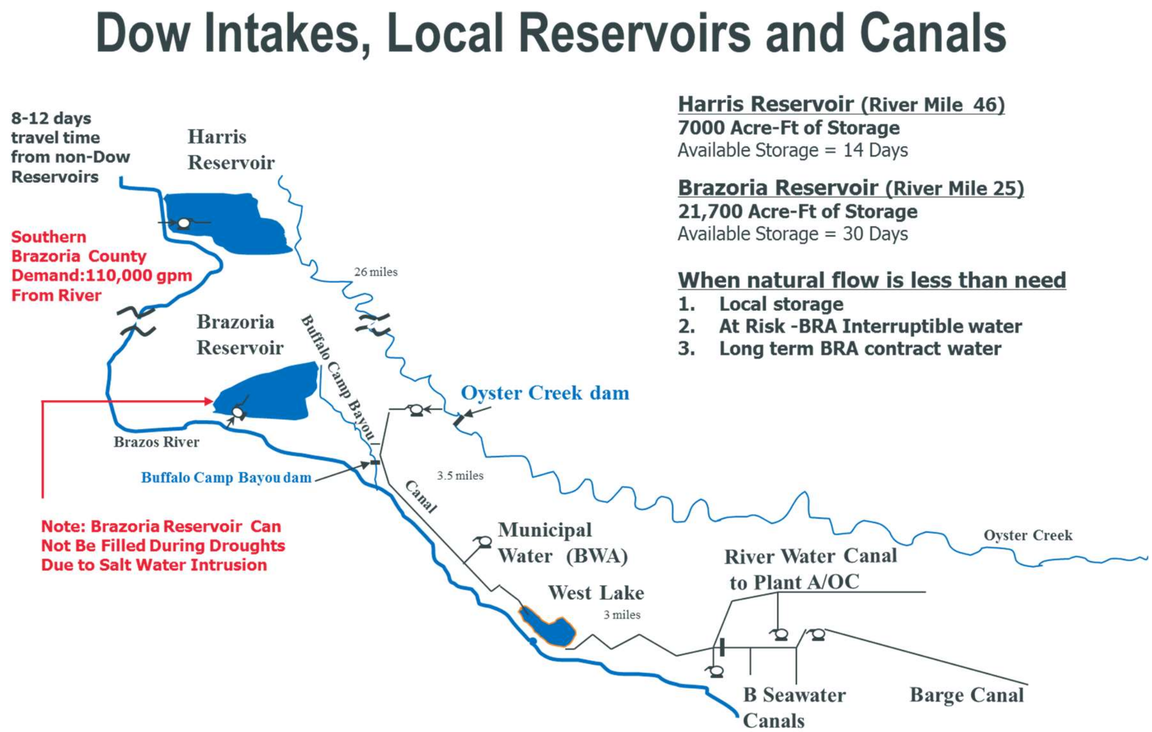


Figure 10: Dow Reservoir Water Supply Map (provided by Dow)

3.2 Dow Managed Water Storage

Dow's existing surface water intakes for the Brazoria and Harris Reservoirs are located in segment 1201 of the Brazos River, which are tidally influenced. During low flow conditions in the Brazos River, saline water moves up from the Gulf of Mexico to upstream locations on the river (saltwater wedge), ranging from river mile 15 to 43 per Dow provided data on chloride sampling. When flow conditions at the Brazos River pump station (river mile 25) are reduced to approximately 1,730 cfs or lower, Dow is unable to divert water into the Brazoria Reservoir due to saltwater intrusion from the Gulf and must rely on water delivered from the existing Harris Reservoir. When river flows are sufficient at the existing Harris pump station intake on the Brazos River, river water is transferred through the reservoir to Oyster Creek by pumping from the river into the reservoir and then discharging to the creek through a siphon system. When flow conditions limit pumping to the existing Harris Reservoir, water supply needs of Dow and others are met by withdrawing water stored in Harris and Brazoria Reservoirs.

3.2.1 Dow's Brazos River Water Rights

Dow has a Brazos River water right of 238,156 AF per year for industrial, municipal, domestic and livestock uses. In addition, they have an Oyster Creek water right for 60,000 AF per year for industrial and municipal uses and a Buffalo Bayou water right of 7,560 AF per year for industrial and municipal uses. There are no water rights holders with more senior rights compared to Dow in the river segment between the Rosharon USGS gage and the Gulf of Mexico. Dow's combined water rights allows a maximum diversion rate of 630 cubic feet per second (cfs) from the Brazos River.

3.2.2 Water Supply Needs

As discussed below in the Local Drought section, the Freeport, TX area, like much of Texas, experienced drought conditions that reduced the flows in many local rivers and streams. During this time there was significant population growth and corresponding demands for additional potable water. Portions of the Brazos River Watershed are undergoing significant development.

Dow undertook efforts to reduce potable water needs. Even with these demand reduction measures in place, the raw water use rate for Dow and water customers is about 3,000 AF per week (approximately 430 AF per day or 97,000 gpm). At this rate, and without any additional storage, the existing two reservoirs (when full) would provide a storage reserve of approximately 68 days or less, assuming all stored water could be accessed. This is significantly fewer days than drought preparedness and response standards established by the state. The Texas Commission on Environmental Quality considers water systems with 180 days or fewer of available water supply at risk during drought.

3.3 Recent Drought Conditions

A multi-year drought began throughout Texas in 2005 with 2011 being the driest year on record in Texas. By October 2011, 97-percent of the state was in extreme or exceptional drought conditions. During this drought period, flows in the river were significantly lower than during average conditions. Had such severe drought conditions continued, Dow may have had to reduce essential functions at their facility and curtail usage for the industries and municipal users that rely on its water supply system for a reliable source of water.

Additionally, WAM modeling provided by Dow indicates that Dow's run-of-the river rights in the Brazos River (the rights diverted into the existing reservoirs) may not be available for diversion from the River during a repeat of the drought of record observed during the period of record for the Brazos River. There are significant periods (multi-month) of time when water from the Brazos River would not be available during a repeat of the drought of record. Modeling indicates that when upstream junior water rights holders divert their full authorization, availability for diversion will be decreased.

During recent years, Dow has successfully reduced its freshwater consumption from the Brazos River by more than 20,000 AF per year for production at the Texas Operations through onsite recycling and water efficiency practices. Additional water conservation/water use efficiency measures are planned for implementation over time as technology and cost-effective approaches develop. It is anticipated that these future water savings in combination with savings already achieved would meet future water demands associated with operations and production growth during most climate conditions; however, these investments in water conservation do not provide the additional storage capacity required to sustain operations during extended drought.

3.4 Lower Brazos River Watershed

The drainage area of the entire Brazos River is approximately 45,560 sq mi (TWDB, 2011). The drainage area starts 50 miles west of the Texas – New Mexico border and runs approximately 1050 miles to the Gulf of Mexico (Figure 1). The Lower Brazos River drainage basin that includes the Proposed Project is approximately 9,766 sq mi. and has no major structures that control the river flow. The Lower Brazos River affects the southern Texas counties of Falls, Limestone, Robertson, Milam, Lee, Burleson, Grimes, Washington, Waller, Austin, Fort Bend and Brazoria. This area is one of the fastest growing areas in the country and this region has experienced substantial flooding over the last four years such as the Memorial Day Flood (2015), Tax Day Flood (2016) and Hurricane Harvey (2017).

3.4.1 Basin Hydrology

The following hydrologic data corresponds to the hydrologic studies completed by the Texas Water Development Board (TWDB) for Brazos River (TWDB, 2011). The Brazos River Estuary Hydrology Study covers the period of record from 1977 to 2009.

Hydrologic analysis results provided a volumetric runoff balance in AF, which includes the following contributions:

$$Balance = gaged + modeled - diversion + return - evaporation + precipitation$$

Note that there is no gaged data at the coastal sub-watershed (below the Rosharon Gage) that is not subject to tidal influences. Therefore, a rainfall-runoff hydrologic model is needed. Where gaged flows are obtained from USGS gages, modeled are rainfall-runoff values estimated using the Texas Rainfall-Runoff Model (TxRR) model, diversions and returns are flows associated with water rights and holders of discharge permits, and evaporation and precipitation include a contribution from each process on the surface area exclusively (TWDB, 2011). Note that the TxRR model results were obtained from the TWDB. The TxRR model is conceptually similar to the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS; formerly the Soil Conservation Service (SCS)) curve number method, which was developed by research conducted by the USDA Agricultural Research Service (ARS).

Figure 11 shows over the study period, gaged inflow from the USGS station on the Brazos River near Rosharon accounted for approximately 86-percent of combined inflow, while modeled flows (rainfall-runoff) accounted for almost 3-percent of the balance. Hence, the river discharge on the Brazos River is significantly dominated by upstream riverine processes rather than precipitation-induced discharges in the coastal plain. Therefore, precipitation processes can be ignored in the analysis. Such behavior is expected due large drainage area. It is possible that heavy local rainfall between the Rosharon gage and the Harris Reservoir Project intersection could influence hydrodynamics at the project site. However long-term trends indicate that is an infrequent event, which would likely not alter the long-term hydrodynamics that river flows at the project site.

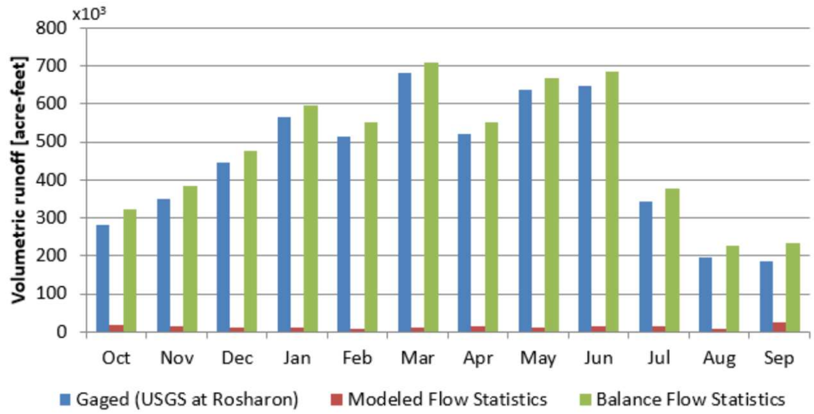


Figure 11: Brazos River long-term monthly mean freshwater inflow hydrology data over the period from 1977 to 2009. Data is shown in water year from October 1st to September 30th (TWDB, 2011).

3.4.2 Analysis of Flow Gage Data Trends

USGS maintains stream gages throughout the project watershed including on the mainstem Brazos River as well as tributaries (Figure 12). The nearest upstream gage to the project is located near Rosharon Texas. For purposes of modeling, this was selected as the upper limit of the project area for analysis. The Richmond Texas gage was used to confirm stream flow conditions. The West Columbia gage is subject to tidal and estuary conditions.

To evaluate the long-term trends of precipitation on river discharge, a trend analysis was conducted on the annual peak discharges at the Rosharon, Texas and Richmond, Texas USGS gages for the Brazos River. Figures showing the peak annual discharges are shown below in Figure 13 and Figure 14 for the Brazos Rosharon gage and Brazos Richmond gage, respectively.

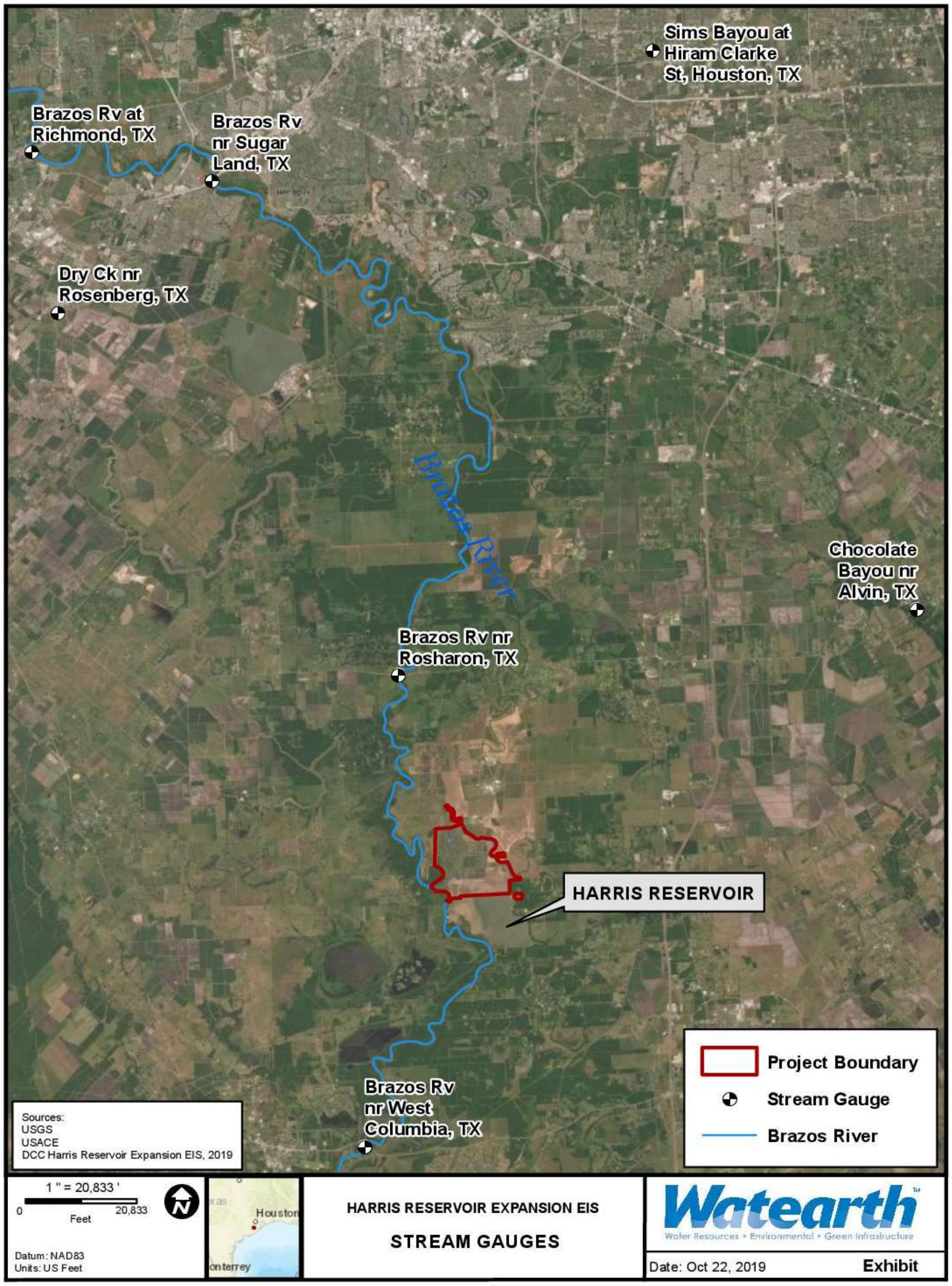


Figure 12: Stream Gages in Vicinity of Proposed Project

A USGS gauge upstream of the project site at Brazos River (USGS 08116650 Brazos River near Rosharon, TX) shows the flow time series fluctuates significantly in a relatively short period of time. Historical records show that daily flows within one month can go from 800 cfs to more than 100,000 cfs and back to low flows again within the next month.

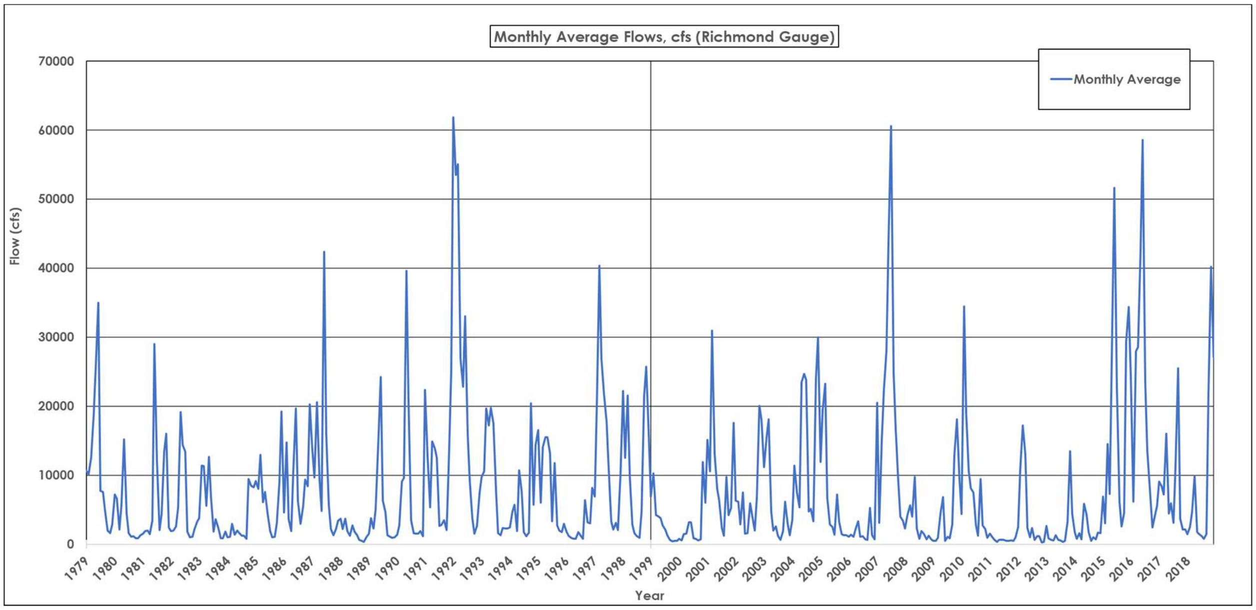


Figure 13: Monthly Average Flows, Richmond, TX Gage

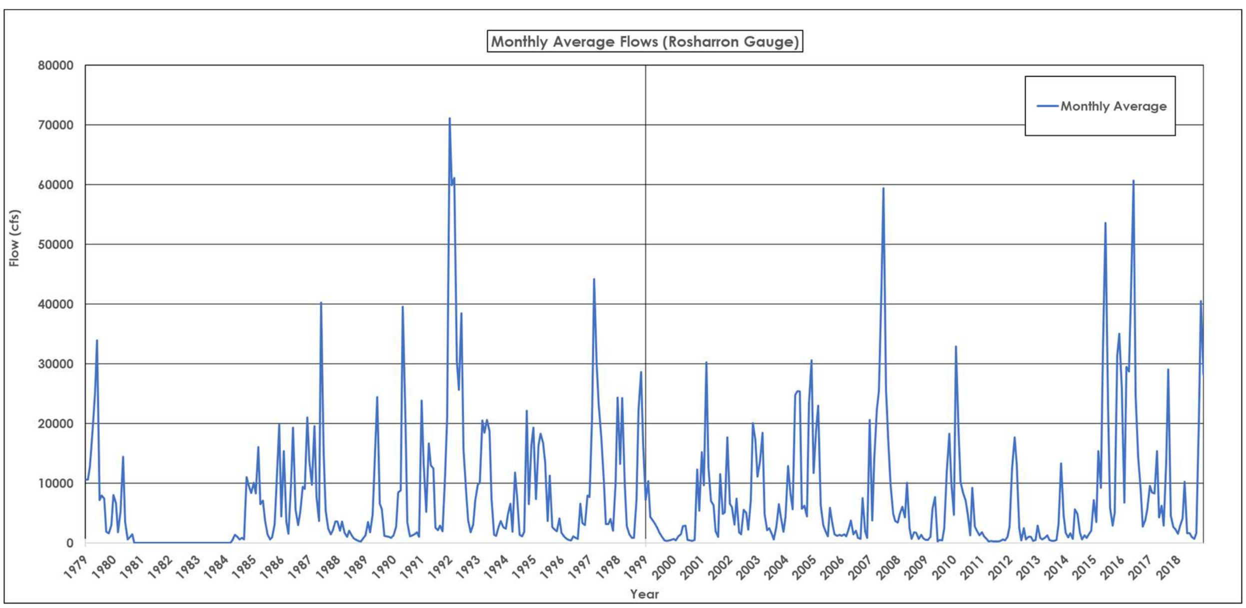


Figure 14: Monthly Average Flows, Rosharon, TX Gage

The comparison of this data shows that over the entire period of record, the monthly mean peak discharge attenuates in the downstream direction. The maximum monthly mean discharge drops from 14,200 cfs to 12,400 cfs in May. Such attenuation is expected in the lower sections of the

Brazos River, “as elevated flows enter storage in the low elevation terrain and are released over longer time periods” (USGS, undated). Conversely the lower flows seen during November, December, January, February, March, April, June, July, April, and September increase in the downstream reach. June is when the highest monthly average discharge occurs in the Brazos River.

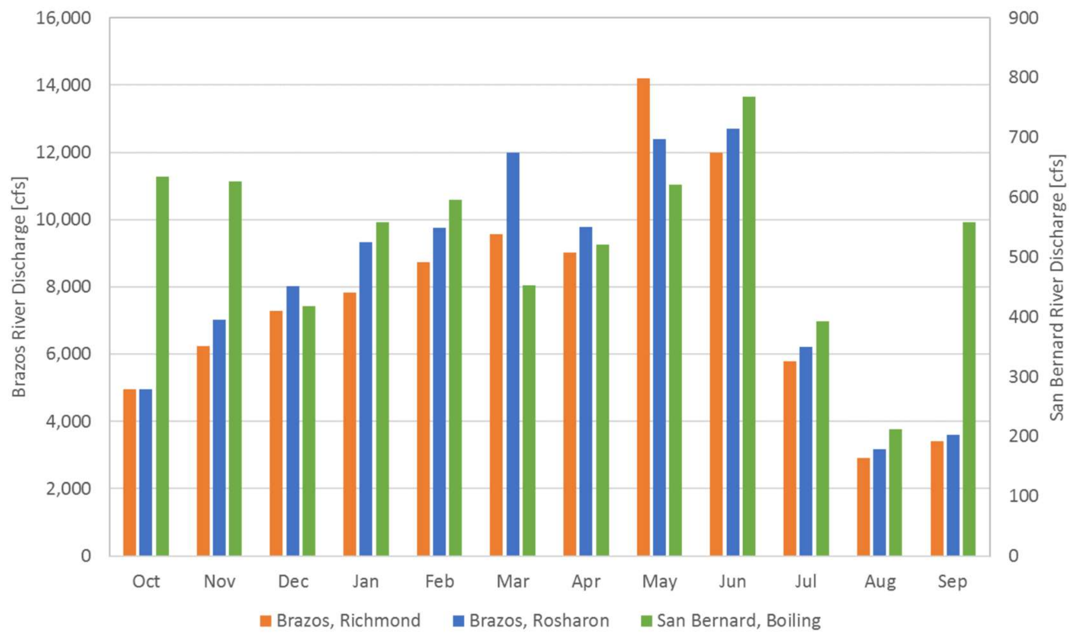


Figure 15: Long-term monthly mean streamflow discharge at USGS stations Brazos River near Richmond (upstream in blue), Brazos River near Rosharon (downstream in red) and San Bernard River near Boling. Data is shown in water year from October 1st to September 30th

3.5 Sedimentation Loads in Brazos River

3.5.1 Introduction

Sediment transport is a function of riverine systems. The velocity of flow determines sediment load and gradation size as higher velocities carry larger particle sizes and resist settling. Increases in velocities can also resuspend sediment of larger particle sizes as well.

3.5.2 Brazos River Sediment Load

Sand-sized sediment transport has been decreasing since measurements were taken starting in 1969, which is at least partially attributable to the effects of reservoirs placed into operation during the same time period (USGS, 2001). The reservoirs reduced high peak flows, which can transport larger particles for longer distances, and trapped sediment within their boundaries. The scatter plot in Figure 16 shows the relationship to discharge rates and concentration of sand particles with a Locally Weighted Scatterplot Smoothing (LOWESS) line providing graphical comparison between the two time periods shown without assigning a statistical significance to the difference (USGS, 2001). At similar discharge rates, the suspended-sand load is reduced during the latter period

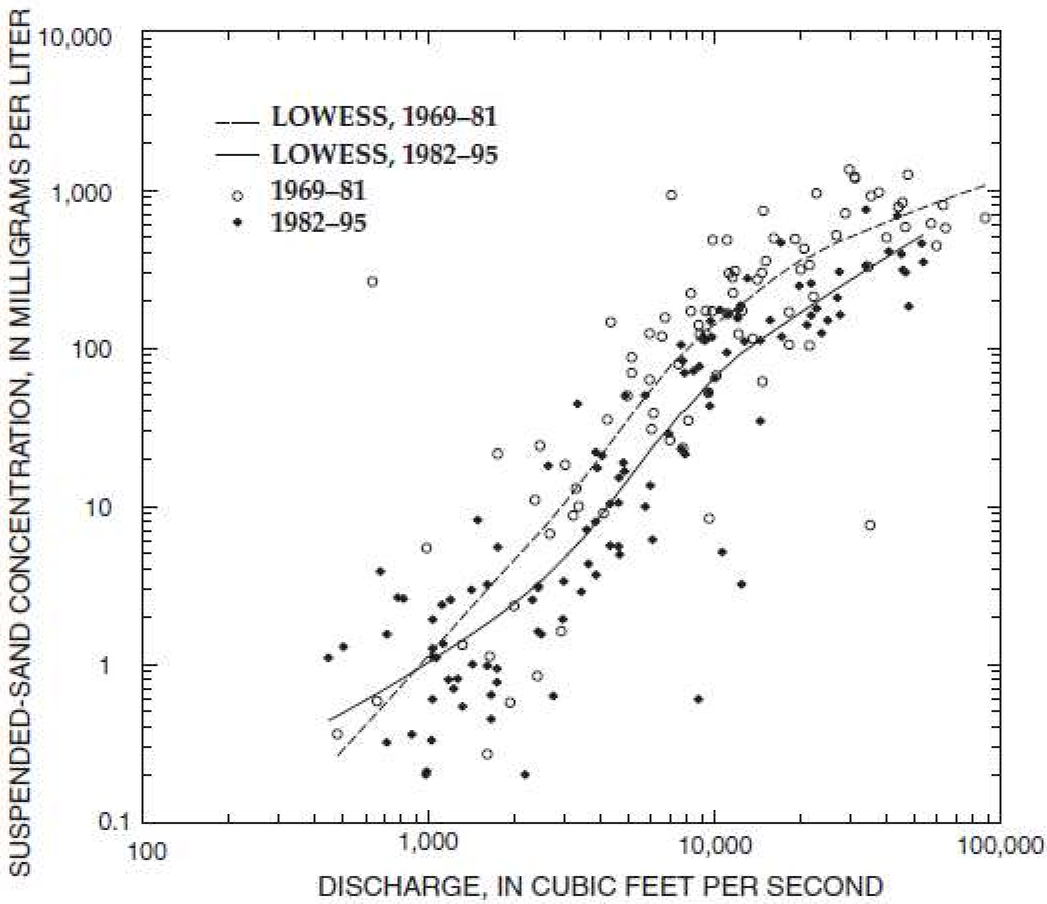


Figure 16: Relation of Suspended Sand Concentration to Discharge at Streamflow-Gaging Station 08114000 Brazos River at Richmond, Texas, 1969-1995 (USGS, 2001)

BRAZORIA RESERVOIR

AUTHORIZED			1990 SURVEY			ADJUSTED 1990 SURVEY		
Volume-Area-Depth			Volume-Area-Depth			Volume-Area-Depth		
Volume ac-ft	Area acres	Elevation feet	Volume ac-ft	Area acres	Elevation feet	Volume ac-ft	Area acres	Elevation feet
0	0	13.6	0	0	16.0	0	0	16.0
160	200	15.2	90	300	17.6	160	200	17.6
900	400	17.6	900	800	20.0	900	400	20.0
2,257	830	19.6	2,000	1,300	22.0	2,257	830	22.0
4,587	1,500	21.6	4,650	1,830	24.0	4,587	1,500	24.0
6,262	1,850	22.6	6,000	1,850	25.0	6,262	1,850	25.0
9,103	1,860	24.2	8,500	1,860	26.6	9,103	1,860	26.6
21,710	1,870	31.0	17,300	1,870	31.0	17,309	1,870	31.0

Authorized: 2.36 feet lower bottom than Adjusted 1990 Survey.

HARRIS RESERVOIR

AUTHORIZED				1990 SURVEY			ADJUSTED 1990 SURVEY		
Volume ac-ft	Area acres	Elevation feet		Volume ac-ft	Area acres	Elevation feet	Volume ac-ft	Area acres	Elevation feet
0	0	29.8		0	0	32.0	0	0	32.0
13	50	30.3	0.5	20	200	32.5	13	50	32.5
88	100	31.3	1.0	50	480	33.5	88	100	33.5
493	170	34.3	3.0	200	1,220	35.5	493	170	36.5
728	300	35.3	1.0	400	1,450	36.5	728	300	37.5
813	550	35.5	0.2	1,000	1,600	37.7	813	550	37.7
1,593	1,400	36.3	0.8	1,500	1,655	38.5	1,593	1,400	38.5
2,355	1,650	36.8	0.5	3,000	1,660	39.9	2,355	1,650	39.0
5,173	1,665	38.5	1.7	4,500	1,665	40.7	5,173	1,665	40.7
10,199	1,675	41.5	3.0	6,500	1,675	41.5	6,509	1,675	41.5

Authorized: 2.21 feet lower bottom than Adjusted 1990 Survey.

Figure 17: Effective Capacity of Brazoria and Harris Reservoirs

The amount and gradation of the sediment carried by the Brazos River is highly dependent on the velocity of the river. High flows carry sands, silt and clay but low flows carry mostly clay. The intake pump inlets for both existing reservoirs is below the natural stream bed and likely results in sediment intake at all flow conditions. The Proposed Project intake has a similar location compared to the natural stream bed.

Historical suspended sediment concentration (SSC) was recorded in the Brazos River at USGS Station 08116650 (Rosharon Gage) at an approximately monthly frequency between 1973 and 1981, and again between 2008 and 2015 (Figure 18).

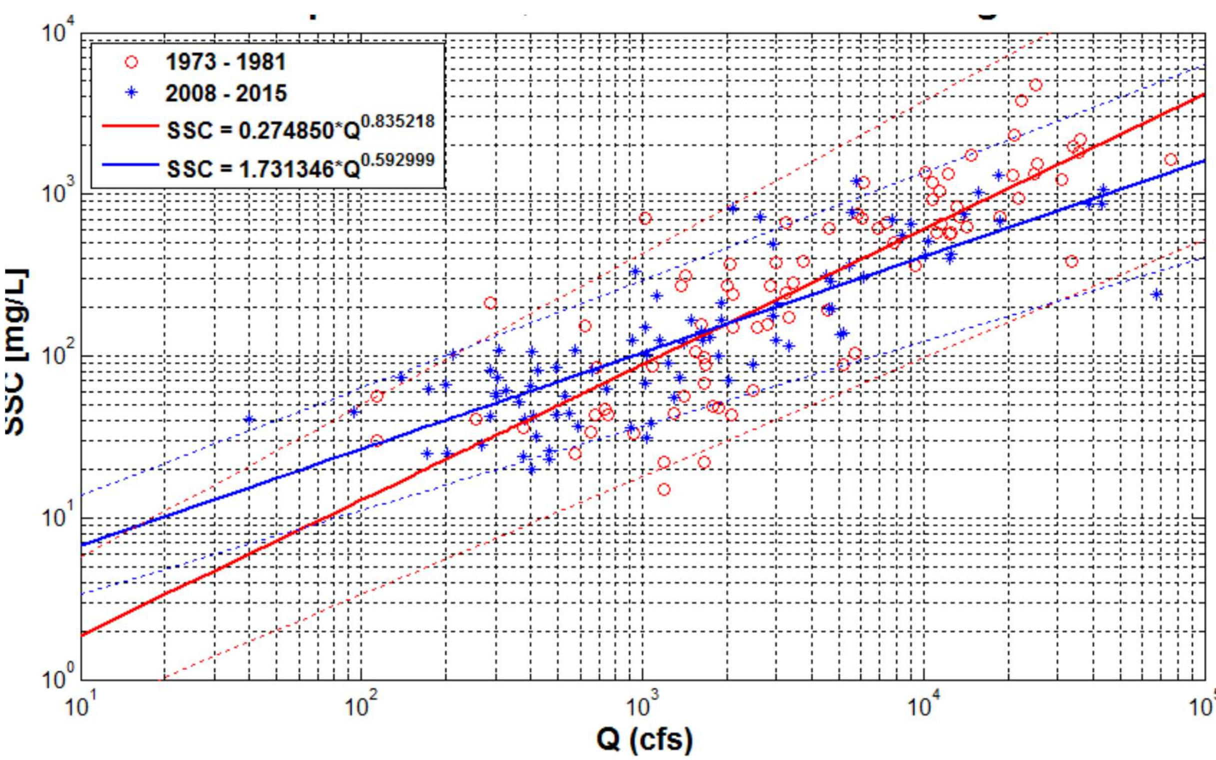


Figure 18: Sediment load curve at Brazos River, Rosharon gage based on measured data.

Dow reported periodic sediment removal by dewatering the existing Harris reservoir and removing sediment by a bulldozer however the frequency of past sediment removal and future maintenance at the two current reservoirs was not provided. They also reported in their reply to questions concerning the "Dow Water Rights and Supply – Fast Facts and Information" document that Dow has a permit authorizing dredging of solids from the reservoirs with specified, limited releases to the Brazos River under certain river flow conditions. Dow also indicated they have concerns with embankment stability if dredging was performed. But there is a possibility to dredge these reservoirs back to their original authorized capacity with the modern equipment that could be used with global positioning systems (GPS) that would control location and depth of dredging. Dredging to original or deeper contours could increase available water but would not increase reservoir surface area where the evaporation occurs.

As described in Figure 17 and show in Table 2, the historical reservoir capacity loss for Brazoria Reservoir was a 111 AF/yr from 1954 to 1990. The straight-line projection of 111 AF/yr storage loss by sediment for another 29 years to 2019 would mean that an addition storage loss of approximately 3,200 AF. This would reduce the 2019 Brazoria Reservoir storage volume to approximately 14,100 AF. However, as provided by Dow and shown in Figure 10, Dow is assuming an effective storage capacity of 21,000 AF, noting in other correspondence with Dow that 16,000 AF is available via the siphon outlet but that the remaining 5,000 AF would need to be pumped.

As described in Figure 17 and show in Table 2, the historical reservoir capacity loss for Harris Reservoir was 81 AF/yr from 1947 to 1990. The straight-line projection of 81 AF/yr storage loss by sediment for another 29 years to 2019 would mean that an addition storage loss of approximately 2,350 AF. This would reduce the 2019 Harris Reservoir storage volume to approximately 4,150 AF. However, as provided by Dow and shown in Figure 10, Dow is assuming an effective storage capacity of 7,000 AF, noting in other correspondence with Dow that 3,000 AF is available via the siphon outlet but that the remaining 4,000 AF would need to be pumped.

Table 2: Effective Storage Capacity for Harris and Brazoria Reservoirs

Year (Estimate by)	Harris Reservoir (AF)	Brazoria Reservoir (AF)	Total Effective Storage (AF)
1947	10,200	-	10,200
1954	-	22,000	32,200
1990 (Dow by survey)	6,500	17,300	22,800
2018 (Dow USACE Application)*	**7,000**	**21,000**	**28,000**
2019 (Watearth)	4,150	14,100	18,250

* Dow USACE application storage values are used for purposes of analysis and modeling. Other values, including Watearth estimates are shown for informational purposes.

Without a more recent survey of the existing reservoirs, the actual effective storage volume could range from 18,000 AF to 28,000 AF, as described above for different sedimentation rate calculations.

3.6 Other Hazards Considered

3.6.1 Wind

The proposed reservoir location is close to the Gulf of Mexico and can be subject to high winds from tropical storms and hurricanes. The preliminary design report supplied by ch2m was reviewed concerning their design approach to how wind may affect the proposed reservoir design. The design report indicates that in 2017 a wind speed of 185 miles per hour (mph) was report from a Hurricane Harvey.

These high winds traveling across open water in the reservoir (the fetch) can generate waves that could damage the embankment or even overtop the embankment. The preliminary design indicates that these concerns were taken into consideration and elements such as the soil-cement embankment protection, the wave wall at the intersection of the top and interior slope, and the operational drawdown prior to the forecasted storm events.

3.6.2 Wave

The preliminary proposed embankment design addresses the embankment slope protection from wave action by the placement of 8-inch stair stepped soil-cement lifts on the interior slope above elevation 60.93. Dow also prepares for large storm events by drawing down the reservoir pool elevation whenever a hurricane alert is issued for any magnitude hurricane that may make landfall near the reservoirs. This allows for more freeboard below the top of the embankment.

The preliminary design also addresses overtopping, which is the most common reason for an embankment breach and uncontrolled release of water. Anchored into the soil-cement is a three-foot tall bullnose (or parapet) wall at the interior edge of the embankment top to reduce overtopping of embankment. Using the USBR breach equation, Watearth estimated that approximately 12,500 cfs of water could be released into the Brazos River or Oyster Creek in the event of a breach. While this is a significant quantity of water, the downstream floodplain would quickly dissipate this volume and little to no long-term effects would be anticipated under current land use conditions.

3.6.3 Tidal Elevations

The lowest extent of the project is the confluence of Brazos River with the Gulf of Mexico near Freeport, Texas. In addition, nearly the entire project area is subject to estuarine conditions with one of the factors being tides. Tides are determined by the lunar cycle, distance and position of the moon in comparison to the sun, and gravitational forces. The lunar day is 24 hours and 50 minutes, this results in two high tides per lunar day every 12 hour and 25 minutes with the accompanying low tide occurring 6 hours and 12.5 minutes after the high tide. Due to the relationship between the moon and the position on Earth experiencing a tide, there will be a higher and lower high tide during the lunar day. With other influences such as the position to the sun, higher than normal tides can occur (sometimes referred to as king tides).

The Gulf of Mexico is tidally influenced with tidal conditions similar to an inland sea due to a large coastal shelf and relatively narrow entrance blocked by Cuba and other Caribbean islands. As such, tides can be highly influenced by storm conditions.

The tidal gauge at Freeport, Texas (gauge 8772447), located six miles northeast of the mouth of the Brazos River, measures tidal conditions near the project area (Figure 19) (NOAA, 2019). The average monthly high tide fluctuation is 1.67 ft (MSL) with the largest recorded fluctuation being 5.4 ft (MSL). The average fluctuation between the monthly lowest low tide and the highest high tide is 3.65 ft (MSL) with the largest recorded fluctuation being 7.25 ft (MSL). This is a relatively narrow band of water surface elevation changes related to tides but when taken in consideration with the low nearshore topography, can present design and inundation risks, especially during storm surge. The flat topography carries relatively far inland as the bottom of the Rosharon gauge is below MSL.

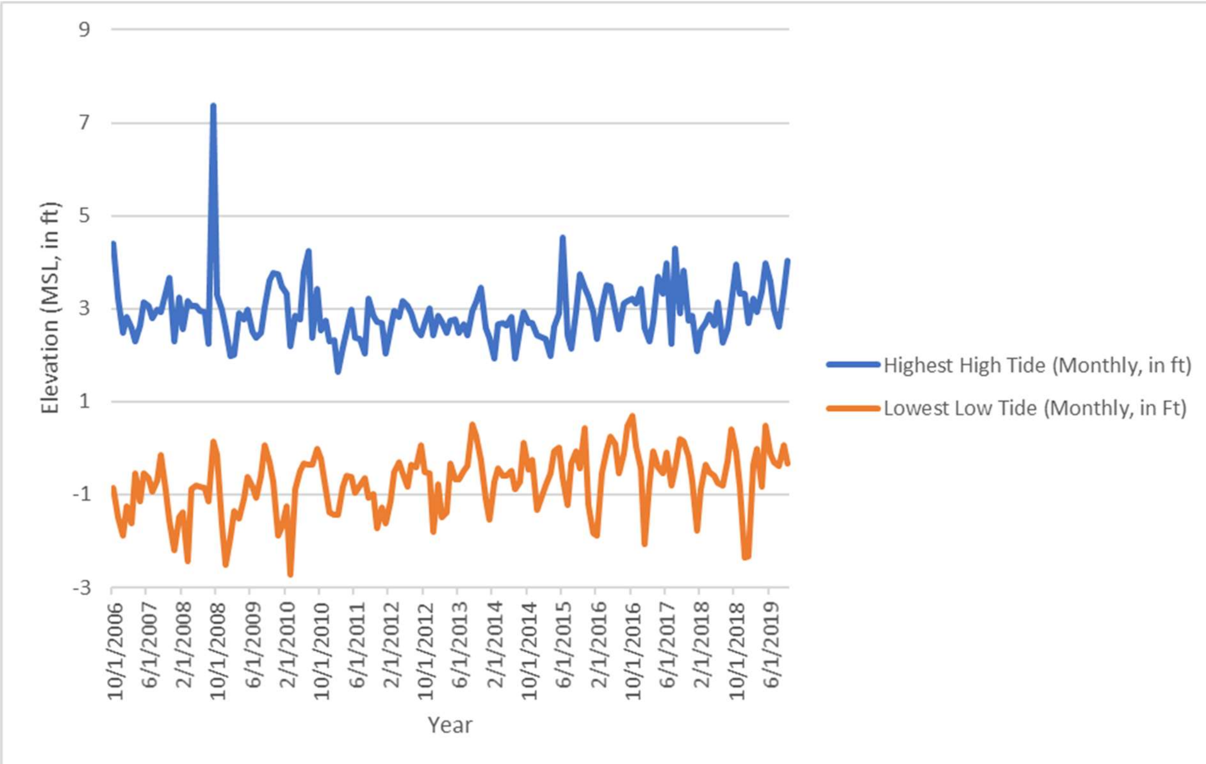


Figure 19: Highest High Tide and Lowest Low Tide (Monthly, in ft) for Freeport, TX gauge 8772447

4 Proposed Project

The Proposed Project, referred to as Harris Reservoir Expansion in the permit application to USACE Regulatory, is located immediately north of the existing Harris Reservoir site (Figure 20). The Proposed Project would include a 1,929-acre impoundment with a nominal storage capacity of 50,000 acre-feet, an intake and pump station to divert Dow's existing surface water rights from the Brazos River, an outlet to Oyster Creek and an emergency spillway. The Project also includes floodplain enhancements in Oyster Creek, stream restoration, and temporary construction staging and laydown areas.

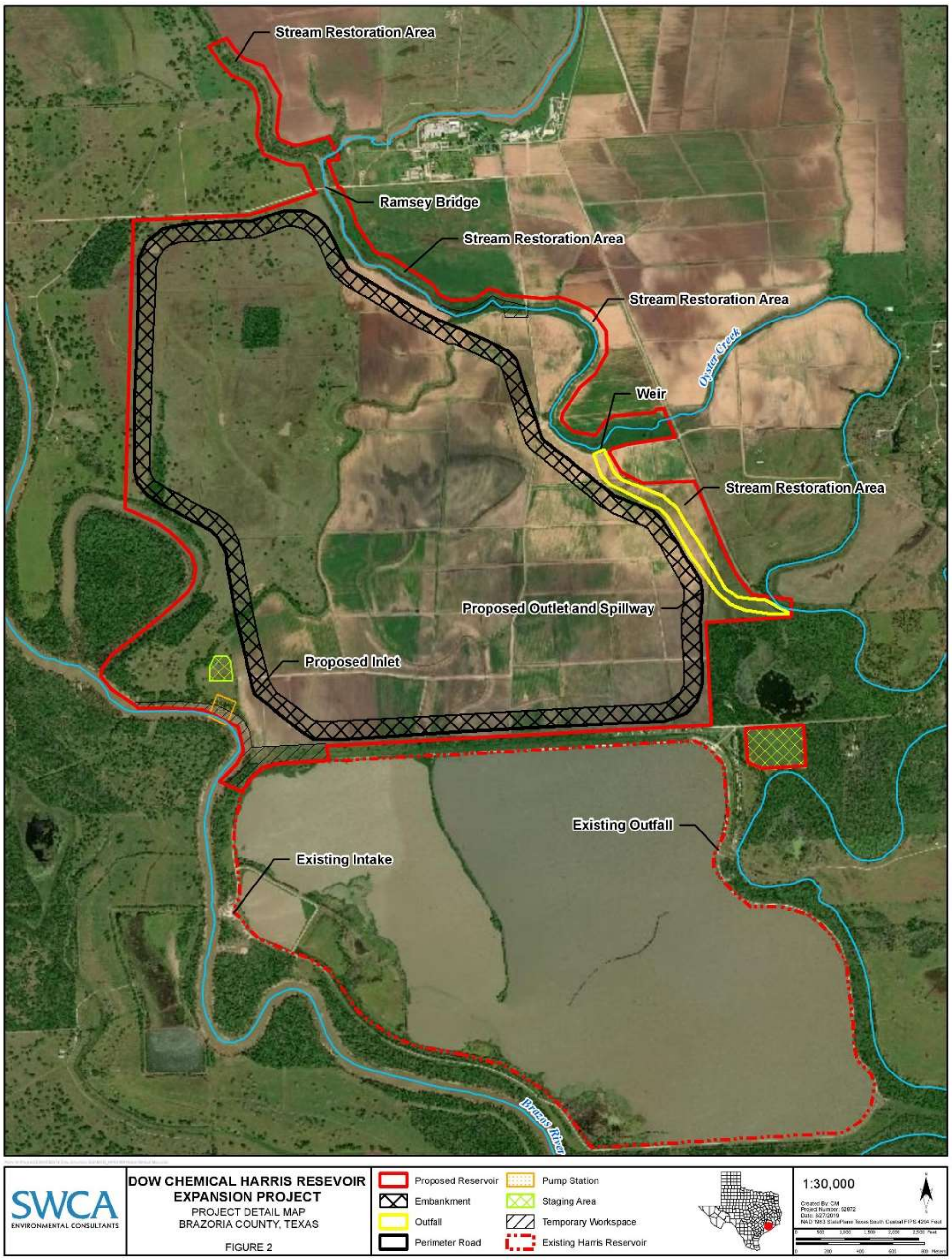


Figure 20: Project Elements for Hydrologic Analysis

4.1 Harris Reservoir Expansion

The embankment will be constructed to a nominal elevation of 72.7 feet with borrow material from the interior of the reservoir leaving 400 feet no borrow zone from the embankment toe (Figure 21). The embankment will have a three-foot-wide vertical chimney drain located five-feet downstream of embankment center line draining into a horizontal blanket drain which will exit into the embankment tow drain. The interior slope will have a sacrificial lower slope with an upper slope stepped soil-cement wave protection. Anchored into the soil-cement at the intersection of the interior embankment slope and the top of the embankment is a three-feet tall (top of wall is El. 75.7 feet) precast concrete wave wall.

A 2.5-foot-wide vertical seepage barrier wall is to be constructed 35 feet upstream from the embankment centerline. The seepage barrier is to be constructed under the entire embankment length of approximately 36,059 feet. The depth of the seepage barrier wall varies from approximately 17 feet below natural ground to approximately 55 feet below natural ground.

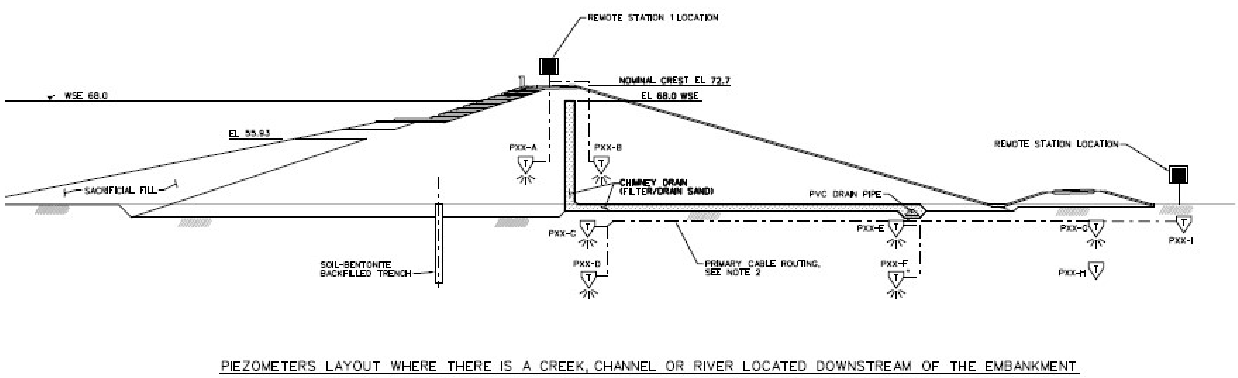


Figure 21: Embankment Cross Section

The proposed pump station in located near the southwest corner of the Proposed Project at embankment STA 113+89 and has a capacity of 150,000 gpm (334 cfs). The water in pumped from the Brazos River intake through the pump house up and over the embankment in a 72-inch pipe into the Project intake structure. The suction centerline elevation will be set at 8.5 feet NAV88, which will require a vacuum priming system to fill the pump suction lines. The pumps can be isolated for maintenance regardless of the river level. The 72-inch pipe will have a gooseneck air vent at the top of the embankment so that gravity flow down the interior of the reservoir embankment to an energy dissipation structure inside the reservoir at the end of the pipe. The combined gated outlet and auxiliary spillway structures are located on the southeast side of the reservoir at STA 227+29.88. The outlet structure has two 36" wide by 48'' high sluice gates which allows water to flow in an outlet conduit through the embankment into a stilling basin at rates from 60 cfs to slightly over 1,000 cfs. The baffled drop inlet auxiliary spillway structure also flows into the outlet conduit. The baffled outlet structure will be designed to allow the reservoir to be lowered 3 feet (from normal maximum water surface elevation prior to storm events). A one foot per day draw down requires slightly more than 900 cfs release rate. The stilling basin outlets into the Oyster Creek flood mitigation channel.

The Northeast part of the Project includes enhancement of the Oyster Creek flood capacity and also provide riparian restoration. The enhancement starts on an unnamed tributary to Oyster Creek which flows into Oyster Creek where riparian restoration and flood plain benching is planned. A weir will be constructed that will allow large discharges to flow down the flood mitigation channel which parallels the Project embankment along the north side until it flows back into Oyster creek below the gated outlet and auxiliary spillway outlet.

There will also be a temporary staging area and temporary workspace located southeast of the Project and due north of the current Harris Reservoir. This area will be restored back to natural conditions after the Project is completed.

4.2 Oyster Creek Enhancements

As part of the proposed expansion project, Oyster Creek is planned to be enhanced with three projects. These projects are planned to improve the flood capacity and provide restoration and enrichment to the riparian habitat along the three project lengths. Geomorphic design principles were utilized to provide a bankfull benching creating floodplain storage, riparian habitat, and channel conveyance to accommodate the proposed reservoir outlet flow in to Oyster Creek.

Project 1 is approximately 3,600 feet long from STA 5+00 to STA 41+00 on an unnamed tributary north of the proposed project's northeast corner Figure 20. It flows into Oyster Creek a short distance north of the northeast corner which is the start of Project 2. Project 2 is approximately 12,860 feet long from STA 41+00 to STA 169+60 and is in the main channel of Oyster Creek. Project 3 is an improved flood overflow channel that flows along the east side of the proposed reservoir until the overflow channel intersects again at approximate STA 254+00 with the main Oyster Creek channel and the proposed reservoir outlet channel. Figure 22 shows a typical cross section of the Project 1 and 2 stream restoration to recreate the multiple level channel morphology.

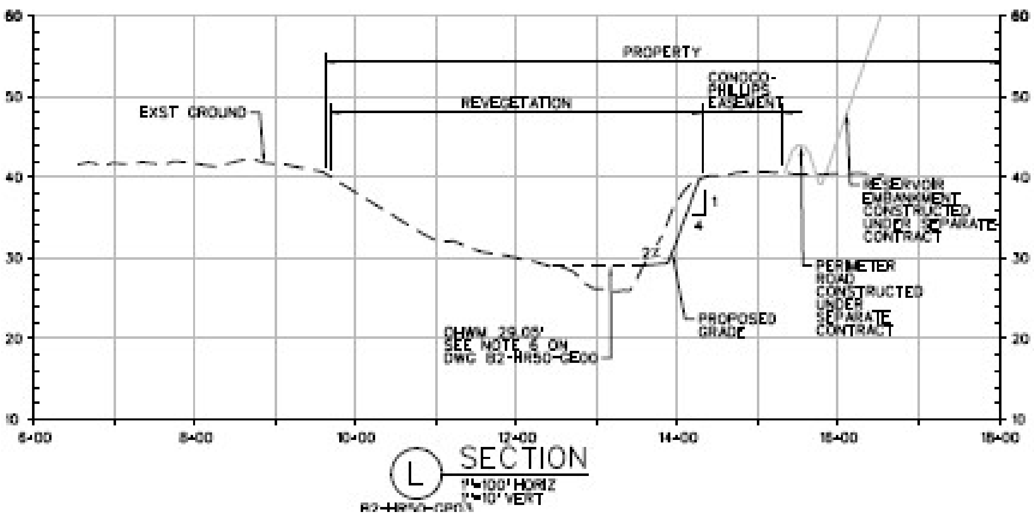


Figure 22 Cross Section of Oyster Creek Restoration in Area Adjacent to the Reservoir Embankment

4.3 Water Supply Needs

Dow conducted calculations and modeling, which were confirmed by Watearth, that indicate Dow needs a minimum of about 78,000 AF of water storage capacity to supply the Texas Operations for 180 days during an extended drought using their existing water supplies and water rights. Dow needs 430 AF/day of water supply to meet their daily water supply obligations including to BWA which supplies approximately 16,000 AF per year to their customers through the Dow water pumping and reservoir facilities. The current combined storage capacity in the existing Brazoria and Harris reservoirs is approximately 28,000 AF. Therefore, Dow will need to develop additional storage capacity of at least 49,000 AF to provide a reliable water supply during drought, which cannot be achieved by maintenance dredging or deepening Dow's existing reservoirs.

Use of Dow's existing water rights and storage facilities, existing pumping and conveyance system through Oyster Creek and Buffalo Camp Bayou, and existing industrial plant canal system supplemented with expanded storage at the Harris Reservoir site provides a cost-effective and financially viable means of meeting the storage requirements and increasing drought resilience at the Texas Operations, industries, and the BWA. Without additional storage capacity that would allow more efficient use of Dow's existing surface water rights from the Brazos River, production at the Dow Texas Operations and reliable public water supplies for the BWA customers would be at risk during extended drought conditions. Reduction of production would result in severe economic hardship for the local economy – potentially affecting the approximately 6,700 direct jobs at the Dow Texas Operations as well as the health and safety of the seven cities in Brazoria and Fort Bend counties who currently obtain approximately 16,000 AF per year of drinking water from Dow's water supply system through the BWA. Furthermore, interruption of production from the Texas Operations site would impact material supply across the state and the nation.

The recent drought conditions demonstrated the urgency for implementation of a project to provide additional storage and increase the reliability of water supply during drought in an environmentally responsible and financially viable manner. Without additional water storage to increase Dow's resilience to drought, essential functions at the Texas Operations site would be at risk during times of water shortage. The Proposed Project is intended to reduce the risk of water shortage during drought.

5 Hydrology, Operational, and Hydraulic Modeling

The purpose of this section is to provide methodologies for the three models developed to analyze the Proposed Project potential impacts and for compliance with the Hydrologic Modeling Guidelines (HMG). The models discussed in this section include HEC-HMS, Riverware™, and HEC-RAS.

5.1 Hydrologic Modeling Guidelines

US Army Corps of Engineers (USACE) developed the Hydrologic Modeling Guidelines (HMGs) checklist for use by USACE Regulatory project managers and Applicants to guide their daily data analysis and modeling process. Required information is presented in a form of a series of questions, grouped into three tiers of increasing complexity. Per the HMGs, the USACE permit decision will be based on whether enough information have been provided so that all required aspects of the project are appropriately addressed. From a modeling perspective, this documentation presents a general summary of three models selected for the project in terms of their capabilities on addressing related items in the HMGs checklist.

The models will provide answers to the following items:

1. Flow extent and water depth under both existing and post-project condition
2. Peak and low flow impacts on aquatic resources under both wet and dry hydrology periods

The USACE Regulatory uses the HMGs checklist in determining sufficiency for hydrologic evaluation but does not require the use of specific modeling software, which allows for flexibility in determining which suites of software to use based on the proposed project's potential impacts. In general, any project that includes an existing and/or proposed reservoir will require the use of the RiverWare modeling software due to its unique capabilities to model complex reservoir operations including input of water rights and water supply. As more fully discussed in the Hydrology and Hydraulic Modeling White Paper and the Environmental Modeling Approach prepared for this project, HEC-HMS has reservoir modeling capabilities but these are limited compared to RiverWare in that HEC-HMS uses a science-based hydrologic model whereas RiverWare models the type and ownership of the water in the system to identify the owner of water based on water rights priority is passing at any location. RiverWare also allows for prioritizing of different objectives, such as water diversion, flood control, environmental flow compliance, etc., making it possible to solve very complex water resources problems.

In addition to RiverWare, the USACE developed HEC-HMS and HEC-RAS models are necessary to fully address the HMGs checklist. The three models have different strengths in responding to the questions posed in the HMGs and need to be used collaboratively as none of them individually provide the full picture of potential impacts due to proposed project conditions.

5.2 Model Descriptions

This section describes several different models used in the analysis of the project with specific attention to the three models developed as part of this analysis; HEC-HMS, Riverware™, and HEC-RAS.

USACE **Hydraulic Engineering Center-Hydrologic Modeling System (HEC-HMS)** is designed to simulate the complete hydrologic processes of dendritic watershed systems. It can be applied to a wide range of geographic areas in solving a wide range of problems, including large river basin water supply, water withdrawal, flood hydrology, and small urban or natural watershed runoff. Flow time series produced by the model can be used in conjunction with other software for studies of water availability, urban drainage, flow forecasting, future urbanization impact, reservoir spillway design, flood damage reduction, floodplain regulation, and systems operation. The software includes many traditional hydrologic analysis procedures such as event infiltration including evapotranspiration, snowmelt, and soil moisture accounting (USACE, 2018). The primary purpose of this model for this analysis was to identify and process hydrologic data including instream flows and precipitation. Rainfall-runoff modeling with HEC-HMS based on gauged precipitation and upstream inflows provided results of river flows into and downstream of the Proposed Project. The results from HEC-HMS are flow hydrographs at points in the watershed where flows are not controlled by the Proposed Project operations.

Riverware™ is a reservoir and river basin modeling software decision support tool. Users can model the topology, physical processes and operating policies of river and reservoir systems, and make decisions on how to operate these systems by understanding and evaluating the trade-offs among the various basin operation and management objectives, in both simulation and forecast modes. The model's wide variety of applications range from short-term operations to long-term water resources planning, which includes hydropower optimization, reservoir operation optimization, water accounting, water quality, environmental flows and climate change assessments. The Bureau of Reclamation, the Tennessee Valley Authority, and the USACE sponsor ongoing RiverWare™ research and development. It is an ideal platform for operational decision-making, responsive forecasting, operational policy evaluation, system optimization, water accounting, water rights administration and long-term resource planning (University of Colorado at Boulder, 2019). For this analysis, the primary purpose was the prioritization tools for water rights and instream flows. Using outputs from HEC-HMS combined with user defined operating rules and scheduled withdrawals and releases, Riverware™ simulated reservoir operations for the pre-defined 50-year analysis horizon.

USACE **Hydraulic Engineering Center-River Analysis System (HEC-RAS)** is a computer program that models hydraulics of water flow through natural rivers, man-made channels, lakes and reservoirs. The model can perform one-dimensional steady flow, one and two-dimensional unsteady flow, sediment transport and water temperature/water quality modeling. The HEC-RAS model is being developed as a part of the Hydrologic Engineering Center's "Next Generation" (NexGen) of hydrologic engineering software, which will encompass several aspects of hydrologic engineering, including: rainfall-runoff analysis; river hydraulics; reservoir system simulation; flood damage analysis; and real-time river forecasting for reservoir operations (USACE, 2018). For this project, river hydraulics were performed with HEC-RAS using unsteady flow modeling for selected drought, average, and storm events. From the hydrographs produced by HEC-HMS, HEC-RAS computed water surface profiles, velocity and stage hydrographs. When used in conjunction with Habitat Suitability Criteria, weighted usable area for certain species habitat could be calculated.

5.2.1 Water Availability Model

The Texas Commission Environmental Quality (TCEQ) **Water Availability Model (WAM)** is a computer-based simulation predicting the amount of water that would be in a river or stream under a specified set of conditions. The model is used in the evaluating water rights applications to help determine if water would be available for a newly requested water right or amendment, or if an amendment might affect other water rights. The WAM model is used by Dow and TCEQ in predicting available flows for water rights in the Brazos River. However, the model cannot be calibrated against gauge records and therefore is insufficient for modeling and analysis needs for the Proposed Project.

5.3 Modeling Assumptions

Due to the conceptual, planning-level nature of the modeling performed for this study, several assumptions were made based on available data, synthesis of multiple data sources provided by Dow, and engineering judgement. Primary assumptions are noted below and where relevant further details are provided in Section 5.4 Modeling Methodology:

1. All elevations and project survey are based upon vertical datum NAVD88.

2. Modeling was performed in HEC-HMS version 4.3, HEC-RAS unsteady flow version 5.0.7, HEC-RAS steady flow version 5.0.7, and Riverware version 7.5.3.

3. HEC-RAS unsteady flow was used for routing flows along the Brazos River, whereas HEC-HMS was used to generate flow hydrographs for use in Riverware and HEC-RAS unsteady flow and was not used for hydrologic routing along the Brazos River in this study.

4. HEC-HMS and HEC-RAS models were not available downstream of the portion of the Oyster Creek watershed where existing and future discharges will occur from the Existing Harris Reservoir and Proposed Harris Reservoir Expansion. Therefore, this analysis is based on analysis of available data and modeling results related to discharges from the Harris Reservoirs at this time.

5. The following models were used as a basis for the modeling performed for this study:
    a. FPP HEC-HMS provided by Brazos River Authority;
    b. FPP HEC-RAS unsteady flow provided by Brazos River Authority;
    c. HEC-RAS steady flow Oyster Creek model by Baker and Lawson and provided by Dow as a HEC-2 model.
    d. HEC-HMS hydrologic model of Oyster Creek by Jacobs.
    e. HEC-RAS steady flow model of Oyster Creek by Jacobs.

6. In their USACE application, Dow estimated the existing reservoir storage capacity as 7,000 AF for Harris Reservoir and 21,000 AF for Brazoria Reservoir, for a combined total of 28,000 AF of existing water storage. The application values presented by Dow were used but as noted in Table 2, the effective storage volume could be as low as 18,000 AF. It was assumed that even if these storage volumes do not exist currently, routine maintenance operations to remove sediment could be performed to restore and/or maintain capacity at the 2018 values reported by Dow.

7. During initial HEC-HMS modeling, existing conditions operations were simulated with numerical relationships rather than with physical structures and pumps due to the manual adjustments regularly made by Dow's operators that override set operational parameters. While this type of manual operation provides "real time" operational control to Dow, it is impractical to capture each detailed nuance within static modeling relationships and conceptual operational protocols for the reservoir modeling and routing. During the initial modeling, the diversions into the existing Harris Reservoir and Brazoria Reservoir are simulated with an inflow-diversion relationship (i.e., flow diverted into the reservoirs is based on flow in the Brazos River). Discharge from the existing Harris Reservoir and Brazoria Reservoir was based on storage-discharge relationships (i.e., discharge from the reservoir into Oyster Creek and the Brazos River, respectively, based on storage in the reservoir at a given time step). Operations of the proposed Harris Reservoir expansion were similarly simulated. However, modeling results with this conceptual approach were not reflective of the actual reservoir operation, inflows, discharges, and water levels.

   As such, the modeling approach was changed to use historical operational data for the Existing Brazoria and Existing Harris Reservoirs, including diversions into the reservoirs and discharges out of the reservoirs. The Proposed Harris Reservoir Expansion was simulated with similar, but scaled up, operational parameters as the Existing Harris Reservoir.

8. Since detailed operational protocol and parameters were not available for the Proposed Harris Reservoir Expansion, the historical operation data (i.e., inflows from the Brazos River and discharges to Oyster Creek) for the Existing Harris Reservoir was scaled up proportionately based on the proposed storage volume versus the existing storage volume.

9. The elevation-volume relationship for the proposed Harris Reservoir expansion was estimated from available design details using the conic approximation method and did not account for detailed bottom grading, if any. It was then adjusted to match the total volume provided by Dow. Small changes to the total estimated volume or the elevation-volume relationship will not have a significant effect on results of this study.

10. Rainfall gage data was not available for the entire period of record for the analysis based on historical operational parameters. As such, precipitation in the very lower reach of the Brazos River below the Rosharon gage was neglected for part of the analysis as watershed processes in the Brazos River are driven by the large upstream watershed rather than by local rainfall.

11. HEC-RAS unsteady flow of the Brazos River was not stable with the negative (flow leaving) diversions into the existing and proposed reservoirs. To stabilize the model and provide a basis of comparison, the diversions into the Harris Reservoir and diversions into and discharges from the Brazoria Reservoir were excluded. The increased diversion into the Proposed Harris Reservoir Expansion was simulated by adding the diverted flows in existing conditions and removing them in proposed conditions.

12. Consistent with the project description, it was assumed that the entire Harris Reservoir expansion is constructed at once and not phased.

13. The objective of the analysis was to evaluate the operation and potential water resources impacts of the proposed Harris Reservoir expansion as designed. As such, the effects of changes in location, volume, or operations were not evaluated.

5.4 Modeling Methodology

This section describes the site-specific model development for the hydrologic, hydraulic, and reservoir operational models.

5.4.1 Brazos River HEC-HMS

The Brazos River HEC-HMS model utilized in this study was taken from the BRA Lower Brazos Flood Protection Planning Study (FPP) HEC-HMS hydrologic model that was approved by the BRA in March of 2019 (Halff, 2019). The original model was truncated upstream of the Richmond USGS gage to reduce run times and eliminate unnecessary data, as none of the sub-basins upstream of the gage are part of the area of study for this report (see Figure 23 Figure 24). While the study area extends from the Rosharon gage to the outlet of the Brazos River at the Gulf of Mexico, the reach upstream was extended to the Richmond gage to provide a more comprehensive model in the project vicinity.

The original FPP Study model did not include either of the existing Harris or Brazoria reservoirs that are operated by Dow. These two reservoirs and their corresponding diversions along the Brazos River were added to the Existing Conditions model along with applicable routing reaches to connect back downstream to the Brazos River and to account for discharge of flows from the existing and proposed Harris Reservoirs into Oyster Creek. The Proposed/Expansion Condition model included all of the aforementioned model elements, but additionally had a diversion added upstream of the existing Harris Reservoir to tie into the Proposed Project reservoir, which was also added to the HEC-HMS model based on the current CH2MHill design (Figure 25).

All hydrologic modeling was performed in HEC-HMS version 4.3 following standard modeling procedures for conceptual or planning-level analysis. The modeling simulations were run on daily time steps, which is appropriate for continuous simulation modeling covering this time-frame, and consistent with the original HEC-HMS model. Table 3 summarizes the HEC-HMS basin model names and the models are included in Appendix A.

Below in Figure 23 there is visual representations of the Drainage Areas, reservoirs, and subasins involved with the exsisting conditions project modeling. The polygons shown in red are part of the Brazos watershed and are upstream of the project area. The area highlighted in yellow is the original drainage area for B_BRA_410 called B_BRA_410_original. Next to B_BRA_410_original is BRA_410 which is the area used within the exsisting condition model and it includes the area within the exsisting Harris Reservoir.

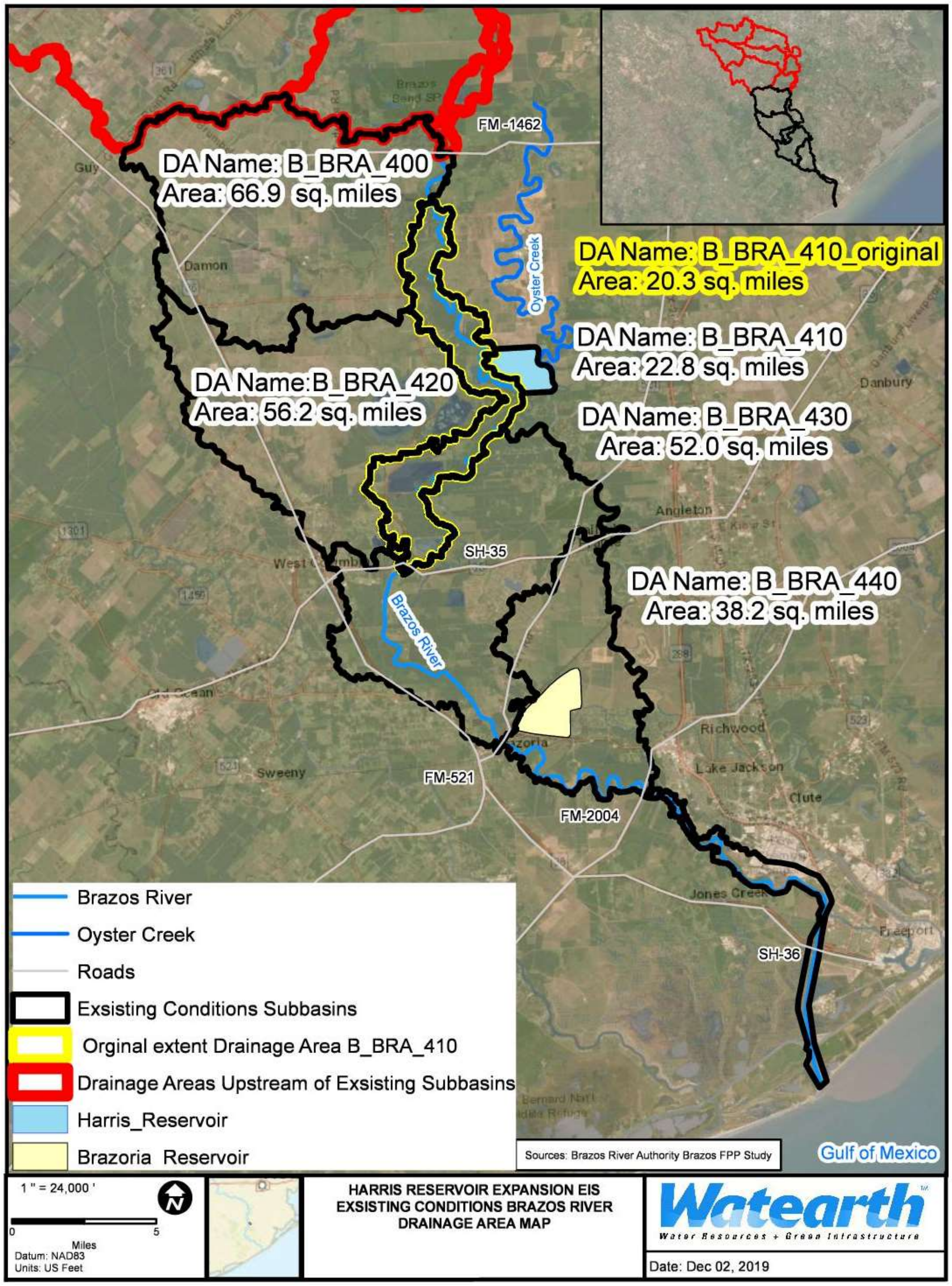


Figure 23 Brazos River Existing Conditions for HEC-HMS Model

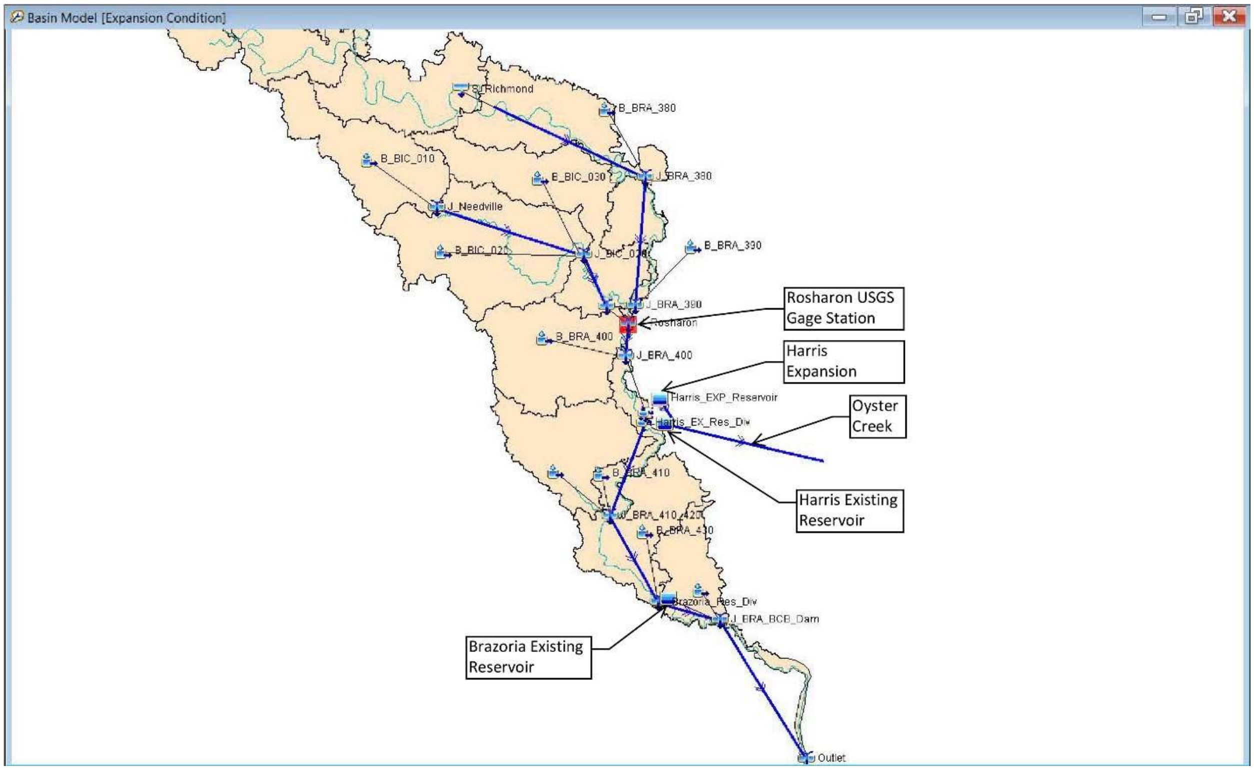


Figure 24: HEC-HMS Model for Harris Reservoir Expansion Project

Table 3: HEC-HMS Basin Model Names

Analysis Conditions	Model Name
Base Conditions[1]	HMS v4.0 B_BRA_410_original
Existing Conditions[2]	Harris_Reservoir_HMS_v4.3 BRA_410 Brazos_Model_Harris_Reservo.hms
Proposed Conditions[3]	Harris_Reservoir_HMS_v4.3 Brazos_Model_Harris_Reservo.hms

[1]Base conditions is the original model obtained from Brazos River Authority.
[2]The existing conditions model adds the existing Brazoria and Harris Reservoirs to the original model.
[3]The proposed conditions model adds the proposed Harris Reservoir expansion to the existing model.

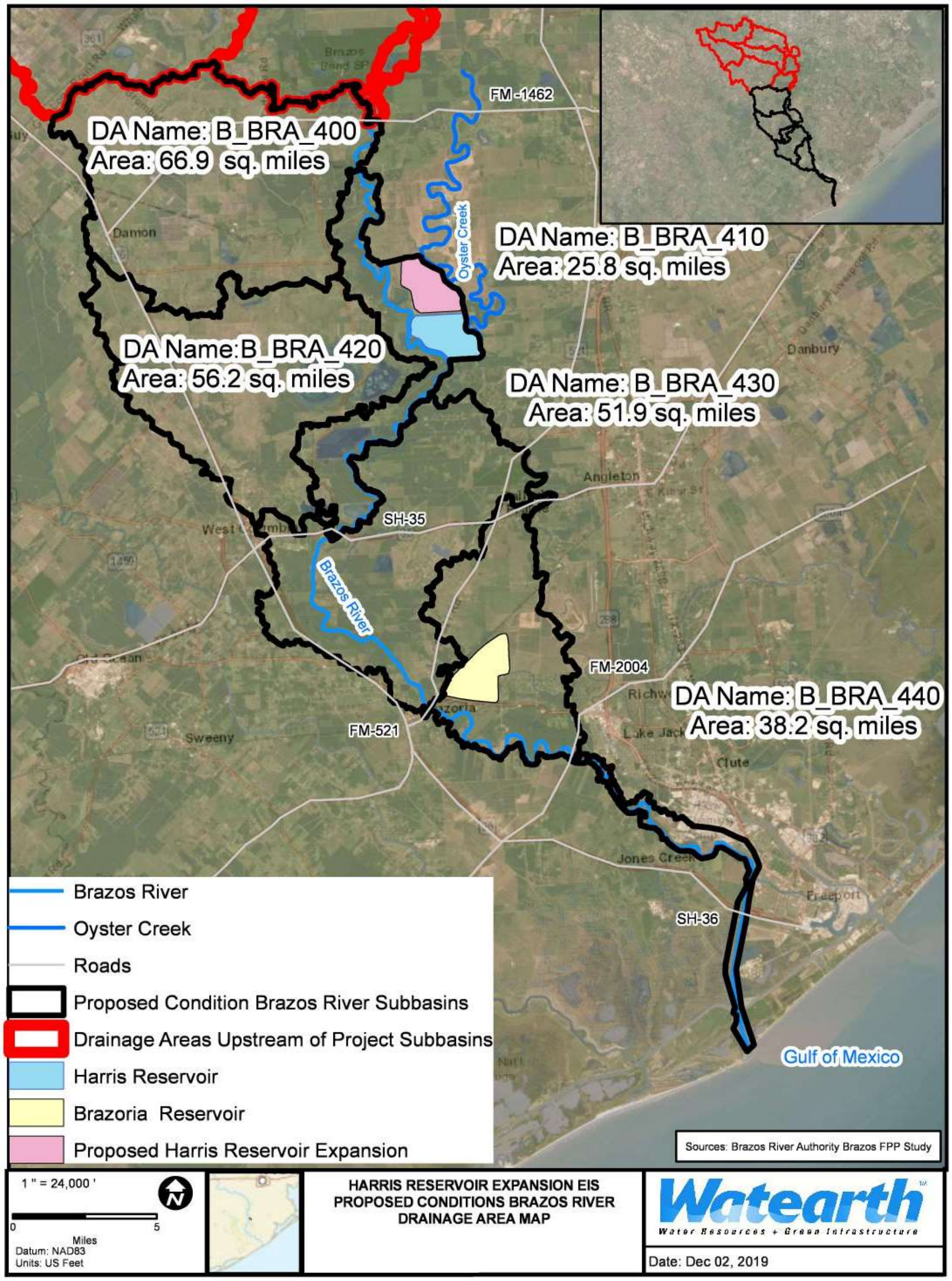


Figure 25 Brazos River Proposed Conditions in HEC-HMS Model

5.4.1.1 Meteorological and Rainfall Data

The meteorological and rainfall data used in the original FPP HEC-HMS model was unable to be maintained for this study. The NOAA National Climatic Data Center (NCDC) Richmond and

Thompson rainfall gages were used to capture hourly rainfall data and rainfall patterns for the 42-year period of record from January 1, 1979 through December 31, 2010. This 42-year record captures historical drought and high rainfall years. For the purposes of this analysis, the simulation was run for the period of record from January 1, 2009 through May 6, 2019 due to the availability of measured inflows and outflows from the existing reservoirs. New gage data was acquired for the study, however the data could not be utilized in the model, because there was missing data from the new set of acquired data. The meteorological model with missing data was preventing the HMS model from running stable, the data for the Richmond and Thompson gages was omitted from the model. Since the rainfall data has little effect on the Brazos River it was found appropriate to not include the meteorological data in the model for the entire simulation period.

Consistent with the original HEC-HMS model, the gage weights method was used to assign one gage for time weighting for each drainage sub-basin and percentages of each of the two gages for depth weighting for each drainage sub-basin. While a continuous simulation model, neither tree canopy interception nor evaporation were considered in the original HEC-HMS hydrology model or the existing or proposed conditions models modified for this study.

5.4.1.2 Gage Data

Historical gage data was used from the United States Geological Service (USGS) for daily maximum flows at the Richmond and Rosharon gages in the project vicinity for the 10-1/2 -year period of record from January 1, 2009 through May 6, 2019 (Figure 13 and Figure 14). The Richmond gage was placed at J_BRA_380 as a discharge gage representative of discharge from the entire Brazos River watershed upstream of this junction. The Rosharon gage was placed at the J_Rosharon junction as an observed flow gage. As discussed above, the simulation was run for the period of record from January 1, 2009 through May 6, 2019 due to the availability of measured inflows and outflows from the existing reservoirs. The data found in the original model did not cover the new analysis period. The Brazos river Rosharon gage data was acquired for the study. The data for the Rosharon gage extended through the full simulation period, however the data had a substantial amount of information gaps (missing river gage information) , thus results are reported for the period of available flow data for both gages. Gage data for the Richmond and Rosharon gages for this time period are provided in Figure 26 and Figure 27.

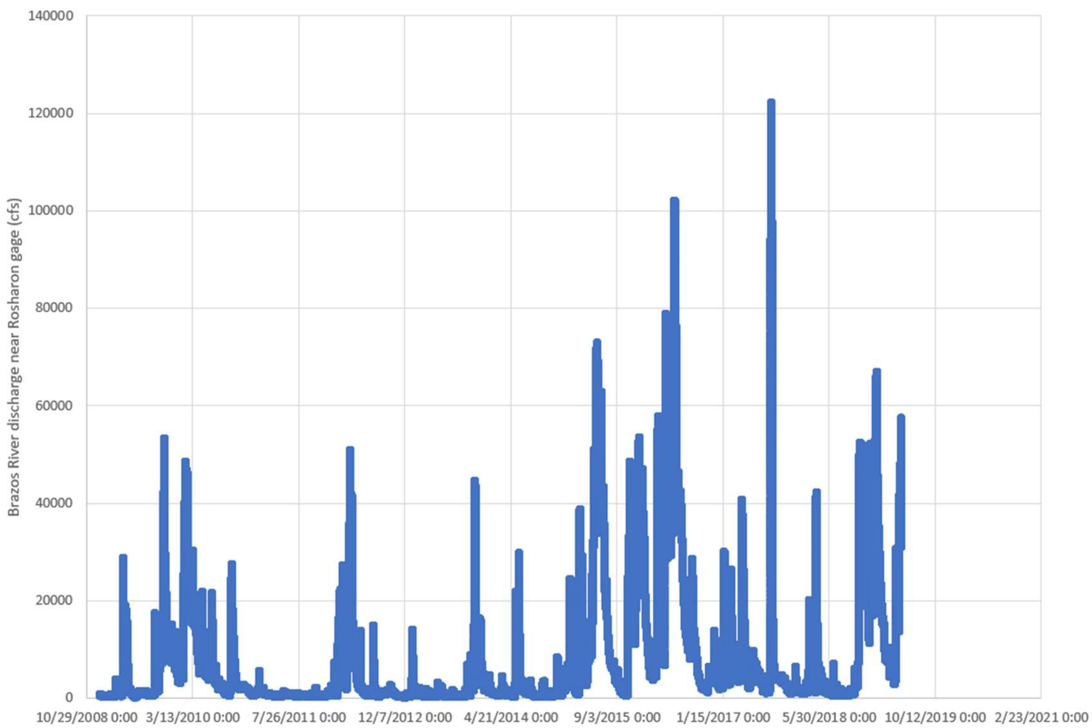


Figure 26 Flow for Brazos River for the USGS Richmond Gage from January 1 2009 through May 6, 2019

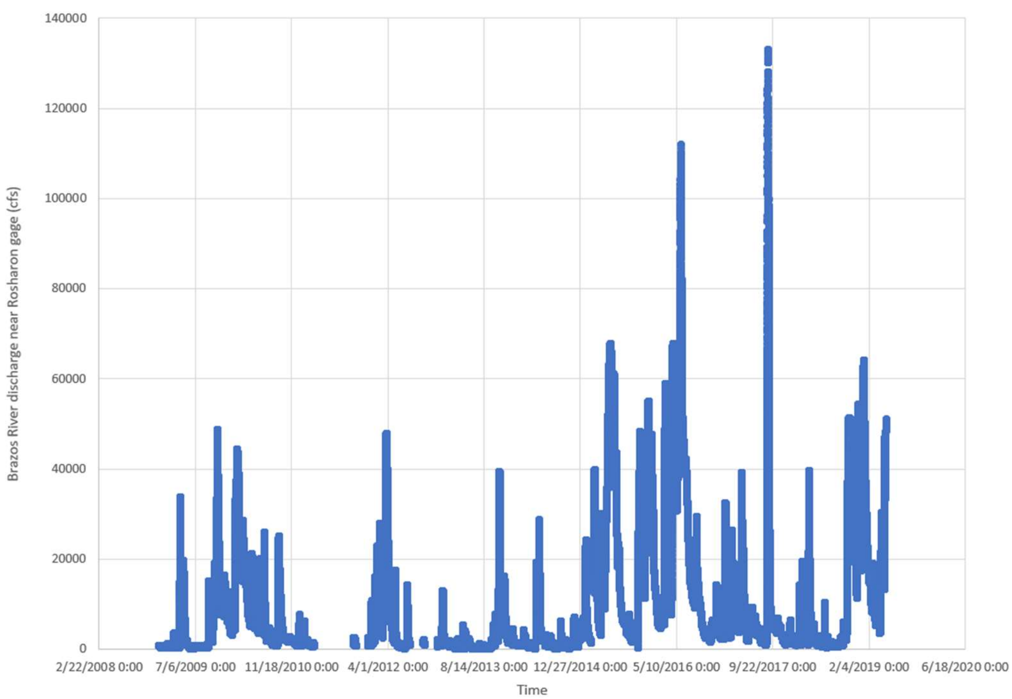


Figure 27 Flow for the Brazos River for the USGS Rosharon Gage from January 1, 2009 through May 6, 2019

5.4.1.3 Drainage Sub-Basins

Figure 23 and Figure 25 depict the portion of the Brazos River watershed included in the HEC-HMS model. As stated previously, both the Richmond and Rosharon gages are included in the model, although results reporting is focused from the Rosharon gage to the outlet at the Gulf of Mexico.

The existing approximately 1,675-acre (2.62-square mile) Brazoria Reservoir is located in the B_BRA_440 drainage sub-basin. The approximately 1,870-acre (2.92-square mile) existing Harris Reservoir Harris Reservoir and proposed approximately 1,776-acre (2.78-square mile) Harris Reservoir expansion are located adjacent to the B_BRA_410 drainage sub-basin, but are outside the drainage sub-basin boundary in the original model. For existing conditions, the B_BRA_410 drainage sub-basin boundary was expanded to include the existing Harris Reservoir and for proposed conditions further expanded to include the proposed Harris Reservoir expansion. As shown in Table 4, the B_BRA_410 drainage sub-basin area was increased from the original 20.3 square miles to 23.2 square miles and 26.0 square miles in existing and proposed conditions, respectively. Due to the planning-level nature of this analysis, sub-watersheds were not further subdivided.

Table 4: Original, Existing, and Proposed Brazos River Sub-Basin Area Parameters Downstream of Rosharon Gage, Texas

Drainage Sub-Basin Name	Original Area (mi^2)	Exist. Area (mi^2)	Prop. Area (mi^2)
B_BRA_400	66.9	66.9	66.9
B_BRA_410	20.3	23.2	26.0
B_BRA_420	56.2	56.2	56.2
B_BRA_430	52.0	52.0	52.0
B_BRA_440	38.2	38.2	38.2

5.4.1.4 Hydrologic Parameters

The FPP models use the Clark Unit Hydrograph Method, which is a commonly used method in the region, to generate unit hydrographs and transform them into runoff hydrographs. The specific unit hydrograph transformation parameters are the time of concentration (Tc) in hours (hrs) and the Clark's Storage Coefficient (R value) in hrs. The Exponential Loss Method is used to account for soil losses (i.e., infiltration) and is an appropriate loss method for continuous simulation analyses. Due to the planning-level nature of this analysis, all existing conditions hydrologic parameters were left unchanged with the exception of impervious cover.

Impervious cover is used to reflect the percent of each drainage sub-basin occupied by impervious cover that does not allow infiltration of rainfall (or create losses). Areas not occupied by impervious cover are referred to as pervious cover and include all permeable surfaces (i.e., lawns, fields, landscaped areas, etc.). Drainage sub-basins with lower impervious cover, such as the project area, are less developed and have higher potential for infiltration. More developed areas with higher impervious cover have less potential for infiltration and higher runoff from a given rainfall event.

Due to the underlying clay soils, infiltration from the existing Brazoria and Harris Reservoirs and proposed Harris Reservoir Expansion is expected to be minimal especially in saturated and prolonged rainfall conditions. As such, the reservoir surface areas were assumed to be 100% impervious consistent with local hydrology practices and the existing and proposed impervious cover values associated with the drainage areas containing the reservoirs were adjusted as these areas did not seem to be included as impervious cover in the original study.

The existing Harris Reservoir and proposed Harris Reservoir Expansion are generally located within drainage sub-basin B_BRA_410, which was expanded to include the Harris Reservoir. Accounting for the approximately 1,870-acre (2.92-square mile) existing Harris Reservoir increases the existing conditions impervious cover in the 232.2-square mile existing B_BRA_410 drainage sub-basin from 2.4-percent to 14.7-percent. The approximately 1,776-acre (2.78-square mile) reservoir expansion increases the total impervious cover in B_BRA_410 in proposed conditions to 6.19 square miles, resulting in an overall percent impervious cover of 23.8-percent in the 26.0-square mile drainage sub-basin in proposed conditions.

The existing approximately 1,675-acre (2.62-square mile) Brazoria Reservoir is located in the B_BRA_440 drainage sub-basin. Accounting for the reservoir surface area in the impervious cover, increases the existing impervious cover in B_BRA_440 from the 7.7-percent reported in the original study to 5.56 square miles, or 14.6-percent impervious cover. This value remains constant between existing and proposed conditions. Table 5 summarizes hydrologic parameters for the drainage sub-basins located between the Rosharon gauge and the downstream end of the HEC-HMS model or outlet into the Gulf of Mexico. The drainage sub-basins located between the Richmond and Rosharon gages are not included in this table for brevity.

Table 5: Original, Existing, and Proposed Brazos River Hydrologic Parameters Downstream of Rosharon Gage, Texas.

Drainage Sub-Basin Name	Original Area (mi^2)	Exist. Area (mi^2)	Prop. Area (mi^2)	Tc (hr)	Storage Coefficient (R-Value)	Original Impervious Cover	Existing Impervious Cover	Proposed Impervious Cover
B_BRA_400	66.9	66.9	66.9	9.13	31.74	3.4	3.4	3.4
B_BRA_410	20.3	23.2	26.0	13.62	837.35	2.4	14.7	23.8
B_BRA_420	56.2	56.2	56.2	13.25	31.25	3.8	3.8	3.8
B_BRA_430	52.0	52.0	52.0	6.83	51.87	6.0	6.0	6.0
B_BRA_440	38.2	38.2	38.2	3.19	54.65	7.7	14.6	14.6

5.4.1.5 Routing Reaches

Reach routing methods were not used in HEC-HMS for the reaches along the Brazos River as all hydrograph routing is performed in the HEC-RAS unsteady flow model for both this study and the original models. Hydrographs were computed in HEC-HMS and the reaches are simply used to spatially and geographically orient the model and to translate the hydrographs from an upstream junction to a downstream junction. While the hydrographs are translated, there is no real attenuation (dampening of flows) or lag (delay to account for travel time) as these affects of routing or accounted for in the dynamic, or unsteady flow hydraulic routing performed in HEC-RAS unsteady flow. Consistent with the original HEC-HMS model, the Muskingum Cunge reach routing method was maintained for the remaining tributary in the truncated model between the Richmond gage and the Rosharon gage (from Junction J_Needville to Junction J_Rosharon).

Routing reaches (without routing methodology) were added from the existing Harris Reservoir and the proposed Harris Reservoir expansion to simulate flows leaving the system and entering the Oyster Creek system and are named R_OC_Harris_EX and R_OC_Harris_PRO, respectively.

5.4.1.6 Reservoir Data

The elevation-volume relationship for the existing Harris Reservoir and Brazoria Reservoir are included in Table 6 and Table 7, respectively. The total effective storage is based on the 2018 Dow estimate of 7,000 ac-ft and 21,000 ac-ft for the existing Harris and Brazoria Reservoirs, respectively, with an existing total effective storage of 28,000 ac-ft. The elevation-volume relationships were developed using the conic approximation method and based on the existing reservoir surface area of 1,675 ac at the crest elevation of 41.50 ft and bottom area of 0 ac at the bottom elevation of 29.80 ft for the existing Harris Reservoir. For the existing Brazoria reservoir, the existing surface area of 1,870 ac at the crest elevation of 31.00 ft and 0 ac at the bottom elevation of 13.60 ft. These relationships were than multiplied by a factor of 98.4-percent at each elevation to match the 2018 Dow storage volume estimates.

The proposed Harris Reservoir expansion storage volume was estimated at 51,976 AF using the conic approximation method and based on the proposed reservoir surface area of 1,776 ac at the crest elevation of 68.00 ft and bottom area of 1,572 ac at the bottom elevation of 32.00. This volume and associated elevation-volume relationship were adjusted downward by applying a 98.4-percent factor to match the volume of 50,968 AF reported by Dow (Table 8).

Table 6: Existing Harris Reservoir Elevation-Volume Relationship

Existing Harris Reservoir Elevation-Volume Relationship					
Stage (ft)	**Areas (sq ft)**	**Area (ac)**	**Incremental Storage Volume (AF)**	**Adjusted Storage Volume (AF)**	**Cumulative Storage Volume (AF)**
29.80	0	0	0	0	0
30.30	2,178,009	50	13	13	13
31.30	4,356,017	100	88	85	98
34.30	7,405,229	170	493	477	574
35.30	13,068,051	300	728	704	1,278
35.50	23,958,094	550	813	786	2,065
36.30	60,984,238	1,400	1,593	1,540	3,605
36.80	71,874,281	1,650	2,355	2,277	5,882
38.50	72,527,683	1,665	5,173	5,002	10,885
41.50	72,963,285	1,675	10,199	9,862	***20,747***

Table 7: Brazoria Reservoir Elevation-Volume Relationship

Brazoria Reservoir Elevation-Volume Relationship					
Stage (ft)	**Areas (sq ft)**	**Area (ac)**	**Incremental Storage Volume (AF)**	**Adjusted Storage Volume (AF)**	**Cumulative Storage Volume (AF)**
13.60	0	0	0	0	0
15.20	8,712,034	200	160	110	110
17.60	17,424,068	400	900	617	727
19.60	36,154,941	830	2,257	1,548	2,275
21.60	65,340,255	1,500	4,587	3,147	5,422
22.60	80,856,315	1,850	6,262	4,296	9,718
24.20	81,021,916	1,860	9,103	6,245	15,963
31.00	81,457,518	1,870	21,710	14,893	***30,856***

Table 8: Proposed Harris Reservoir Expansion Elevation-Volume Relationship

Proposed Harris Reservoir Expansion							
Conic Approximation Method							
Stage (ft)	**Emb. Slope (1H:1V)**	**Area (SF)**	**Area (ac)**	**Incremental Storage Volume (ac-ft)**	**Incremental Storage Volume (ac-ft)**	**Cumulative Storage Volume (ac-ft)**	**Adjusted Storage Volume (ac-ft)**
32.00	3.5	68,479,108	1572	0.00	0	0	0
40.00	3.5	70,419,590	1617	12,754	4311	4311	4,242
45.00	3.5	71,642,397	1645	8,153	8153	12464	12,265
50.00	3.5	72,872,901	1673	8,294	8294	20758	20,426
55.00	3.5	74,111,101	1701	8,436	8436	29194	28,727
60.00	3.5	75,356,999	1730	8,578	8578	37772	37,168
65.00	3.5	76,610,594	1759	8,722	8722	46494	45,751
68.00	3.5	77,366,445	1776	5,302	5302	51796	50,968
				60,239	***51,796***	***51,796***	***50,968***

As discussed under assumptions, existing conditions operations were simulated using detailed operational data provided by Dow, including diversions into the reservoirs and discharges out of the reservoirs. The proposed Harris Reservoir Expansion was simulated with similar, but scaled up, operational parameters as the Existing Harris Reservoir given the adjacent location in the watershed and similar diversion locations from the Brazos River and discharge locations into Oyster Creek. The proposed 50,968 ac-ft Harris Reservoir Expansion is 7.28 times the Existing Harris Reservoir capacity of 7,000 ac-ft and thus the diversions and existing diversions and discharges were scaled up by a factor of 7.28 to estimate the future diversions and discharges into and out of the proposed Harris Reservoir Expansion.

Diversions from the Brazos River into the Brazoria Reservoir are simulated by the specified flow diversion placed at Brazoria_Res_Div and diversions from the Brazos River into the existing and proposed Harris Reservoir expansion are simulated by the specified flow diversion placed at Harris_Ex_Res_Div and Harris_Pro_Res_Div, respectively. Brazoria Reservoir discharges back into the Brazos River are simulated at J_BRA_BCB_Dam and discharges from the existing and proposed Harris Reservoir expansions are simulated to leave the Brazos River and enter Oyster Creek through reaches R_OC_Harris_EX and R_OC_Harris_PRO, respectively. Discharges from all three reservoirs are modeled with the specified discharge outflow structure method. Table 9, Figure 28, and Figure 29 illustrate the diversion into the reservoirs and discharges out of the reservoirs.

Table 9: Existing Brazoria Reservoir and Harris Reservoir Diversion and Discharges

Reservoir Name	Flow
Brazoria Reservoir	Diversion (Max Flow)
	500 cfs
	Reservoir (Max Discharge)
	521 cfs
Harris Reservoir	Diversion (Max Flow)
	290 cfs
	Reservoir (Max Discharge)
	278 cfs
Proposed Harris Reservoir Expansion	Diversion (Max Flow)
	2,109 cfs
	Reservoir (Max Discharge)
	2,027 cfs

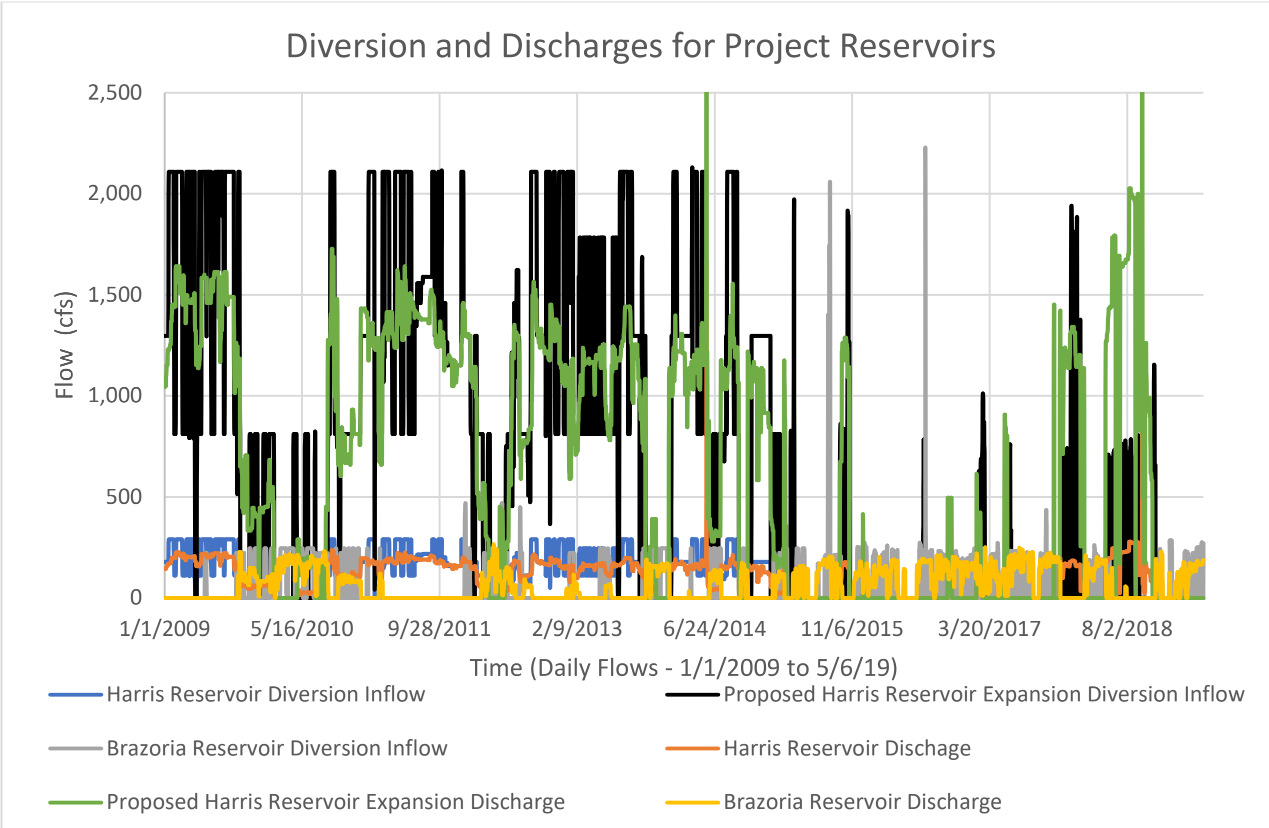


Figure 28 Existing Harris Reservoir, Proposed Harris Reservoir, and Brazoria Reservoir Diversions and Discharges

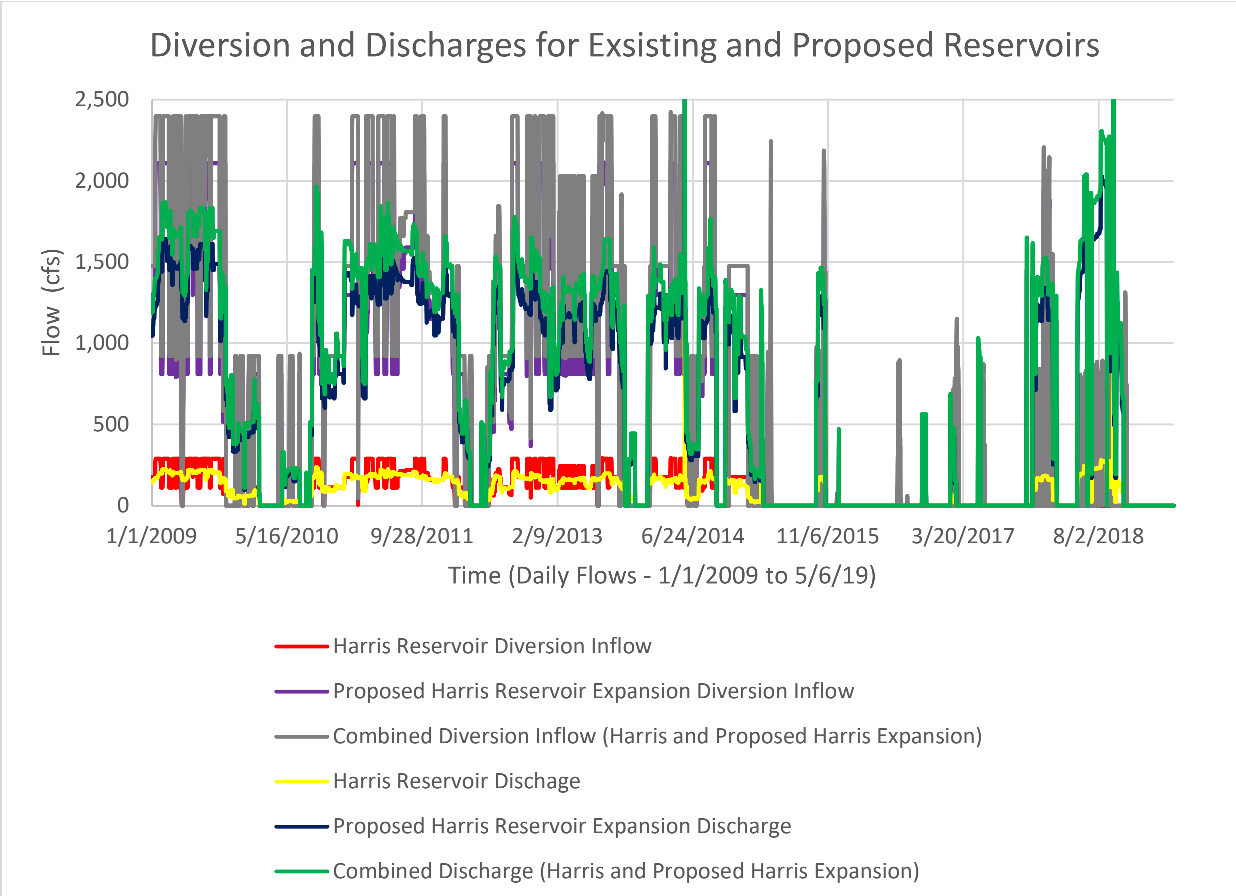


Figure 29 Combined Flows for Harris Reservoir and Proposed Harris Reservoir Expansion Compared to Existing Harris Reservoir Diversions and Discharges

5.4.1.7 HEC-HMS Results

Table 10 lists maximum flows over the 10-½-year simulation for each of the drainage sub-basins and junctions from the Rosharon gage at J_Rosharon to the outlet of the Brazos River at the Gulf of Mexico. Figure 30 through Figure 50 show diversions into each of the reservoirs and discharges out of the reservoirs over the 10-½-year simulation period.

These results and modeling assumptions show no significant changes to diversions into or discharges out of the Brazoria Reservoir into the Brazos River. Similarly, modeling assumptions and results show no significant changes to diversions into or discharges out of the Existing Harris Reservoir into Oyster Creek. The proposed diversion into the Proposed Harris Reservoir and associated discharge into Oyster Creek significantly increase peak flows out of the combined Harris Reservoir into Oyster Creek from an existing range of 0 to 278 cfs to a proposed range of 0 to 2,305 cfs.

Table 10: Table of Existing and Proposed Maximum Flows over the 10-½-Year Simulation Period

HEC HMS NODES	Existing Conditions Maximum Flows (cfs)	Proposed Conditions Maximum Flows (cfs)	Difference between both conditions (cfs)
J_ROSHARON	122,000	122,000	0
HARRIS_PR_RES_DIV	-	2,109	N/A
HARRIS_PR_RES	-	2,027	N/A
R_OC_HAR_PR	-	2,027	N/A
HARRIS_EX_RES_DIV	290	290	0
HARRIS_EX_RES	278	278	0
R_OC_HAR_EX	278	278	0
BRAZORIA_RES_DIV	500	500	0
BRAZORIA_EX RES	521	521	0
J_BRA_BCB_DAM	120,229	120,229	0
OUTLET	120,229	120,229	0

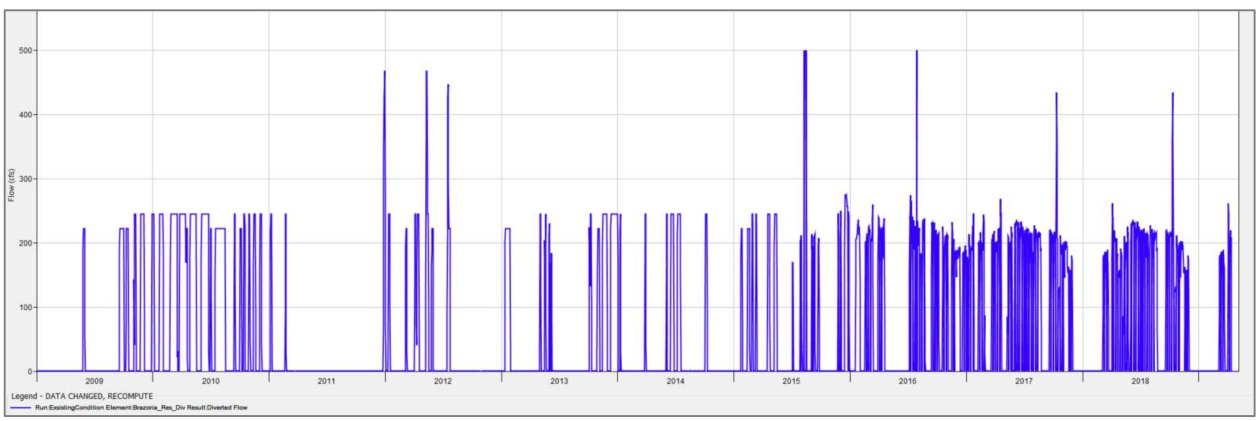


Figure 30 Existing Conditions Diversion into Existing Brazoria Reservoir Over 10- ½ -Year Simulation Period

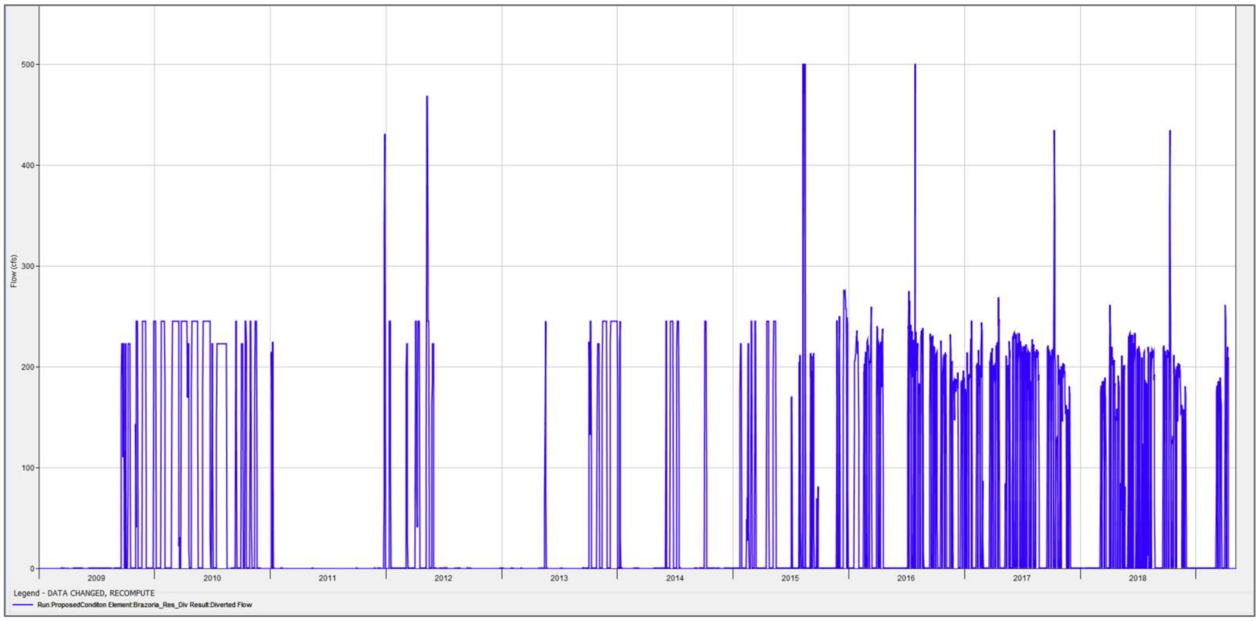


Figure 31 Proposed Conditions Diversion into Existing Brazoria Reservoir Over 10- ½ -Year Simulation Period

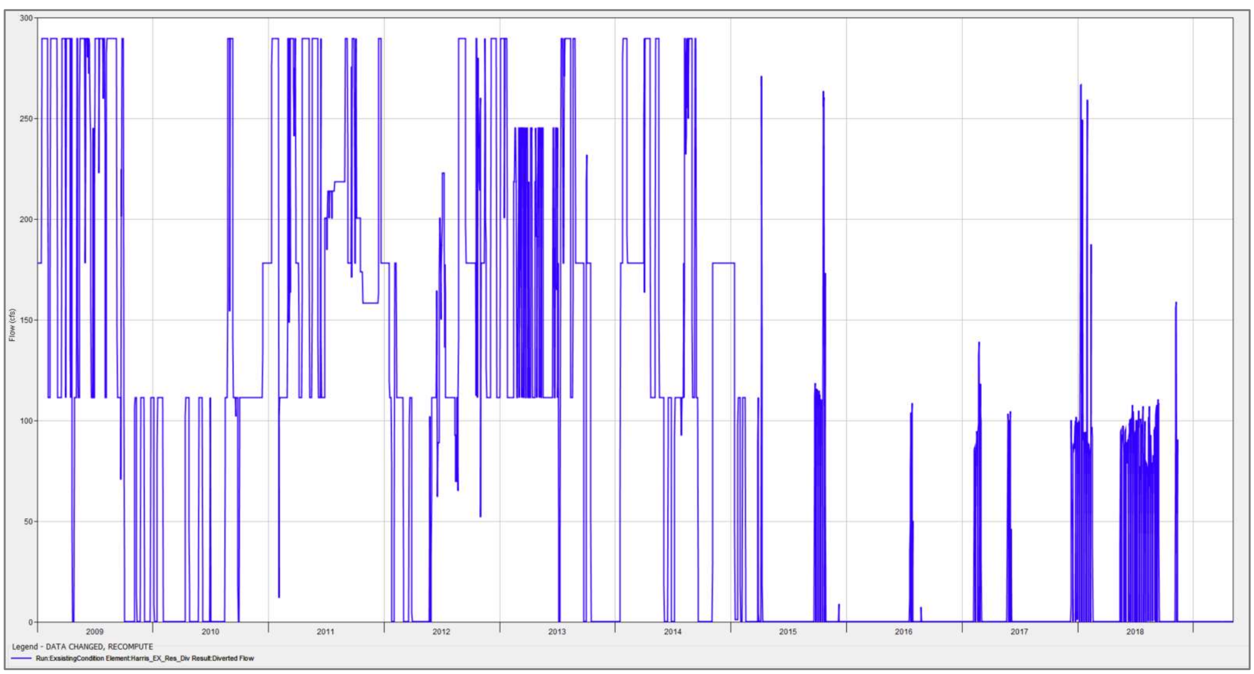


Figure 32 Existing Conditions Diversion into Existing Harris Reservoir Over 10- ½ -Year Simulation Period

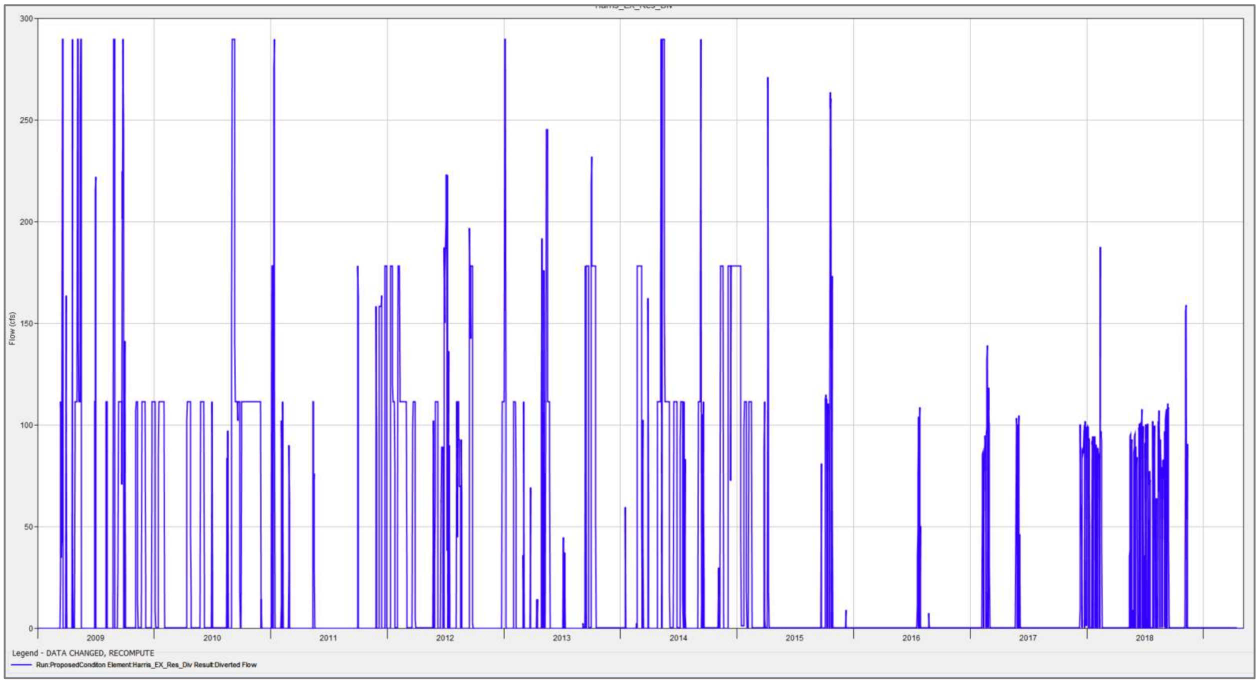


Figure 33 Proposed Conditions Diversion into Existing Harris Reservoir Over 10- ½ -Year Simulation Period

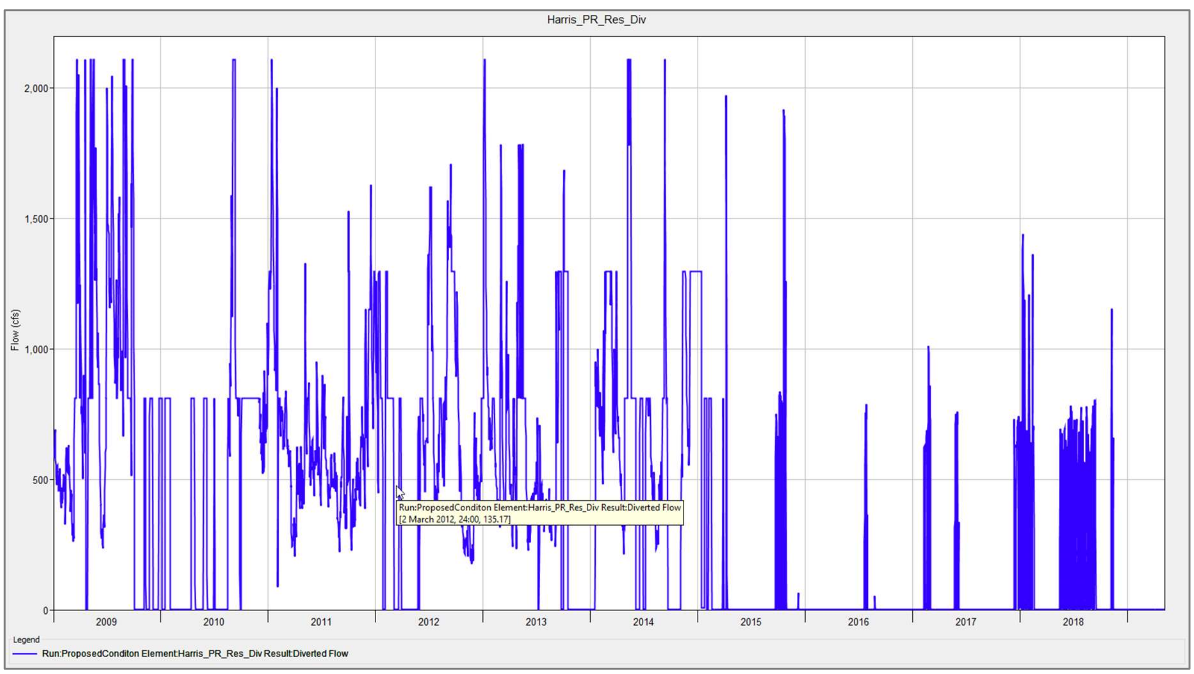


Figure 34: Proposed Conditions Diversion into Proposed Harris Reservoir During 10- ½ -Year Analysis Period

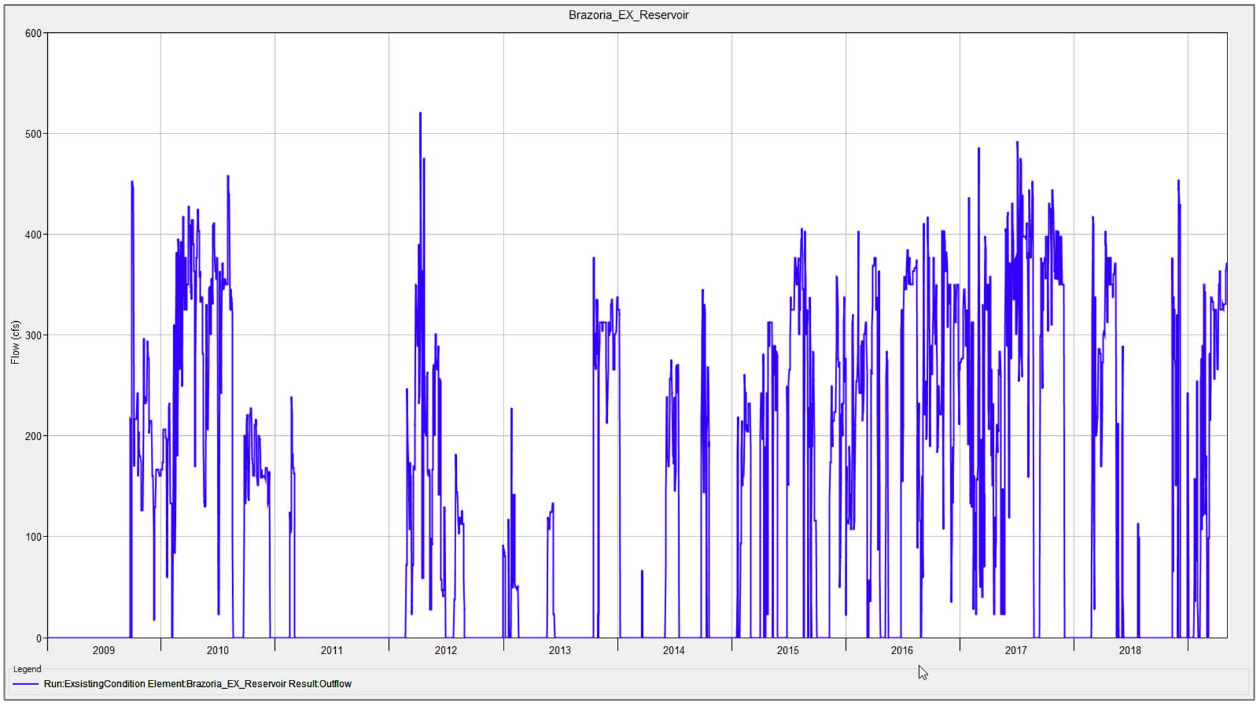


Figure 35: Existing Conditions Discharges from Existing Brazoria Reservoir Over 10-½ -Year Simulation Period

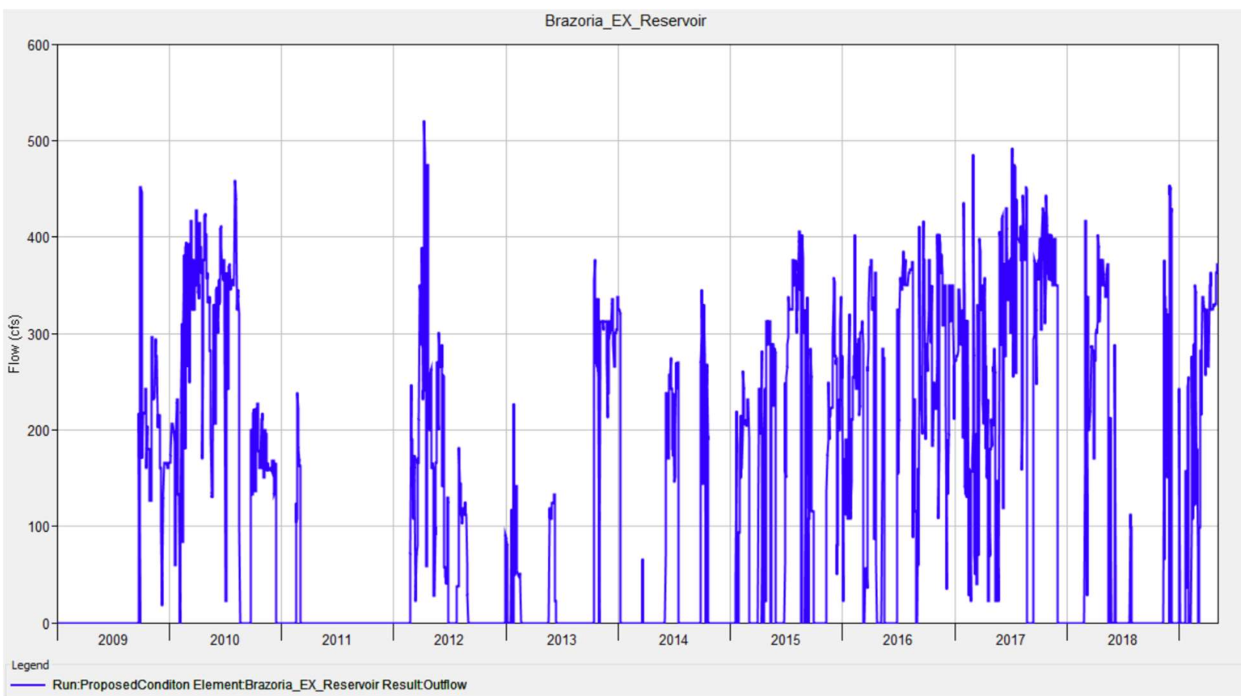


Figure 36: Proposed Conditions Discharges from Existing Brazoria Reservoir Over 10-½ -Year Simulation Period

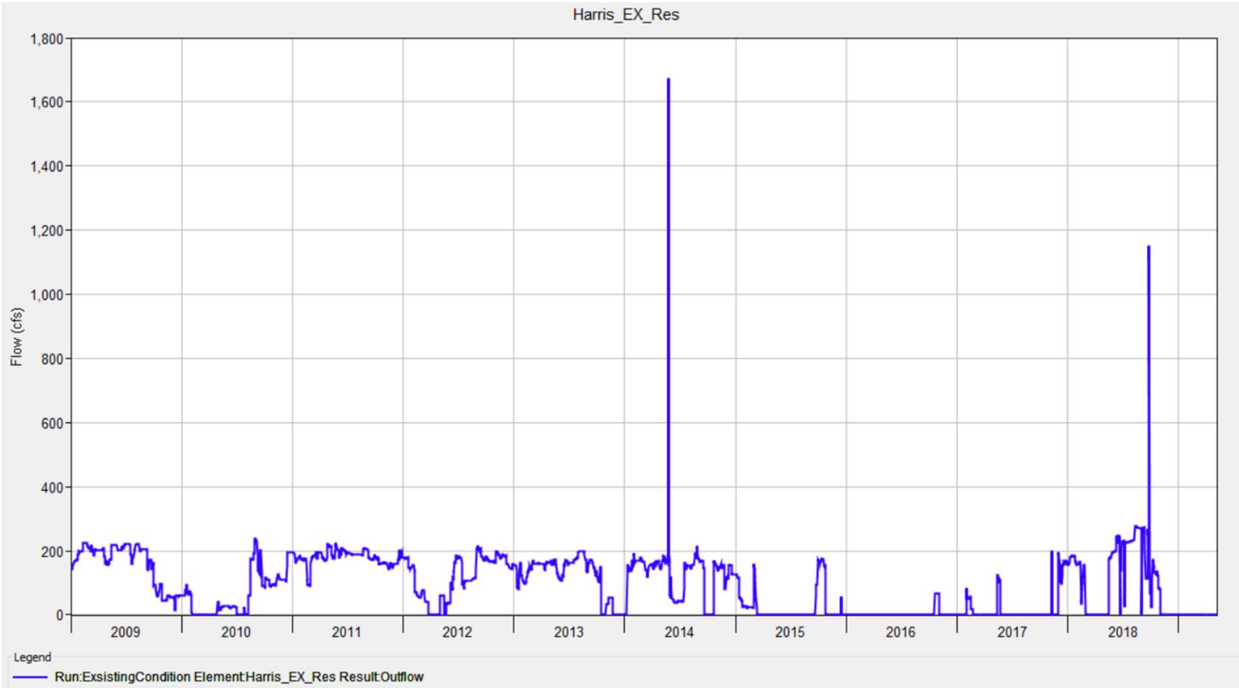


Figure 37: Existing Conditions Discharges from Existing Harris Reservoir Over 10- ½ -Year Simulation Period. Note: the large spikes in 2014 and 2018 data appear to be data outliers

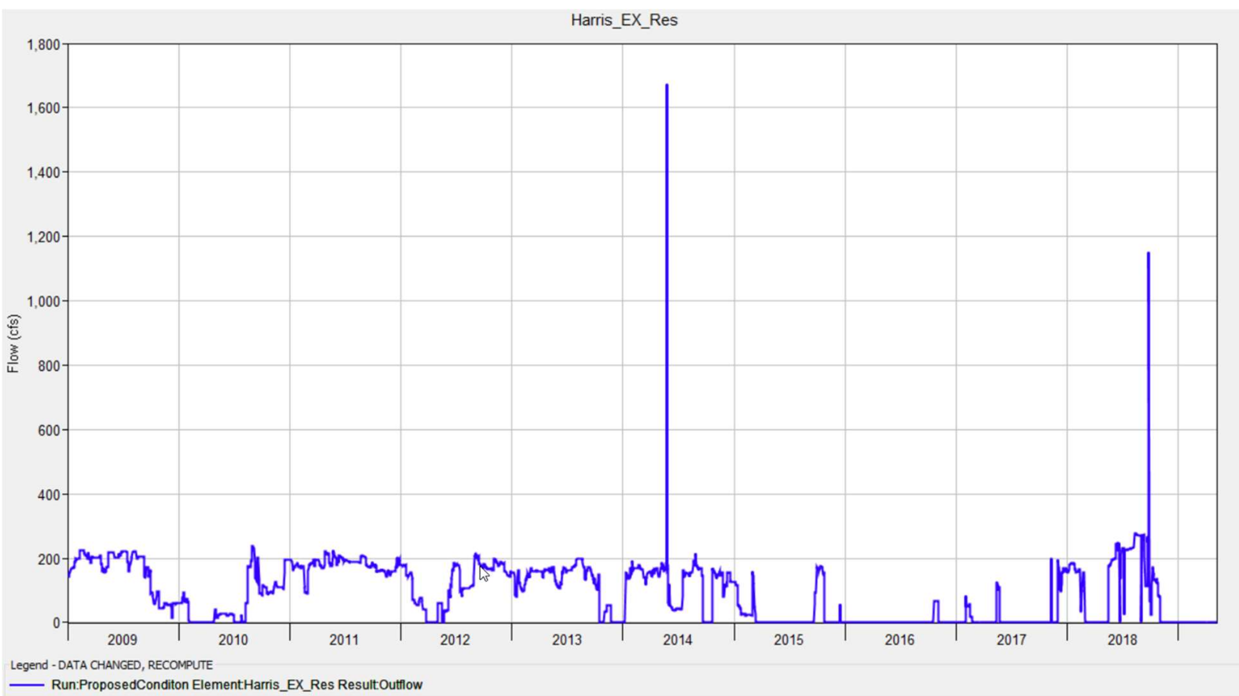


Figure 38: Proposed Conditions Discharges from Existing Harris Reservoir Over 10- ½ -Year Simulation Period

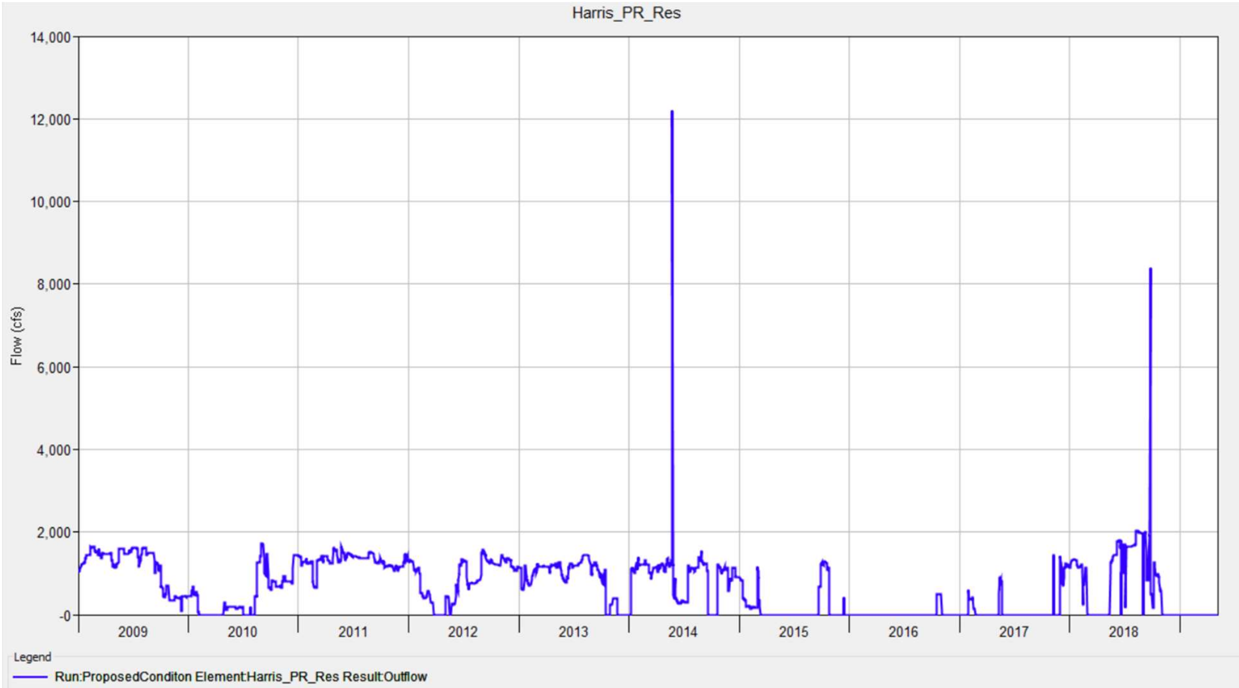


Figure 39: Proposed Conditions Discharges Outflow from Proposed Harris Reservoir Over 10- ½ -Year Simulation Period. Note that there are two outflows hat are outliers in the data)

Figure 40 through Figure 48 depict existing and proposed flow hydrographs at six key analysis points between the Rosharon gage and the outlet at the Gulf of Mexico. The key analysis points are listed in Table 11 and include the Rosharon gage, which is not expected to change between existing and proposed conditions as it is an observed flow condition in the model. While routing along the Brazos River is performed in HEC-RAS unsteady flow rather than HEC-HMS, this is a useful comparison at the outlet as hydrographs are combined along the Brazos River without attenuation or lagging. Downstream of the Rosharon gage, no significant changes in flow are shown in the Brazos River despite assumed increased diversions at peak river flows/stages to maintain the additional storage associated with the Proposed Harris Reservoir Expansion.

Table 11: Key Analysis Points for Results Reporting

Key Analysis Point	Location	HEC-HMS Name
1	Rosharon Gage	J_Rosharon
2	Proposed Harris Reservoir Expansion Diversion (Brazos River)	Harris_Pro_Res_Div
3	Existing Harris Reservoir Diversion (Brazos River)	Harris_Ex_Res_Di
4	Brazoria Reservoir Diversion (Brazos River)	Brazoria_Res_Div
5	Brazoria Discharge/Dow's Water Intake	J_BRA_BCB_Dam
6	Outlet (Mouth)	Outlet

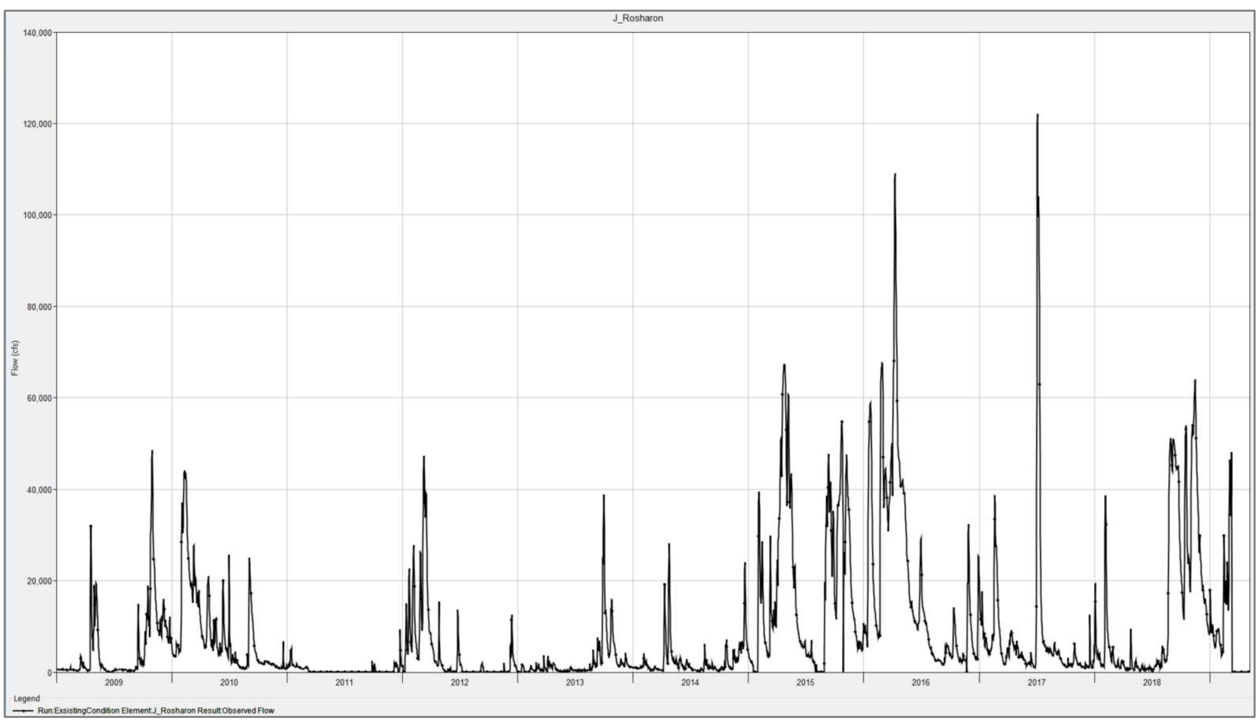


Figure 40: Existing Conditions Flow Hydrograph at Rosharon Gage During 10- ½ -Year Analysis Period

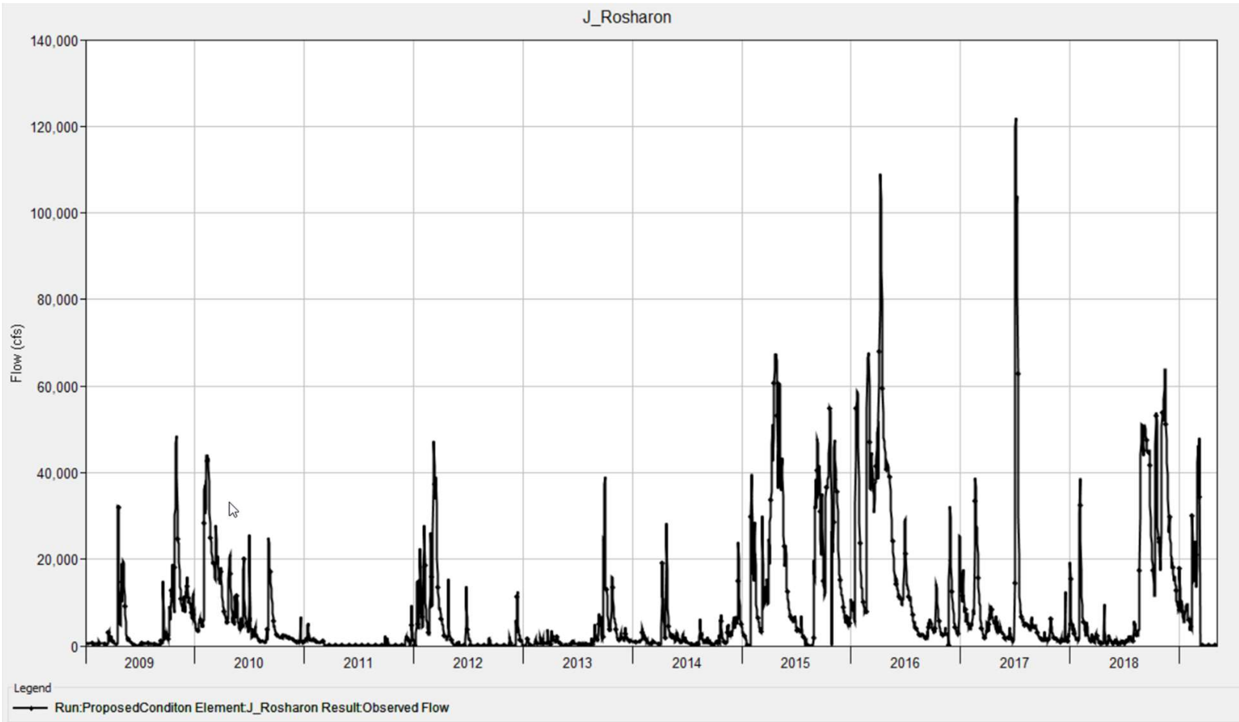


Figure 41: Proposed Conditions Flow Hydrograph at Rosharon Gage During 10- ½ -Year Analysis Period

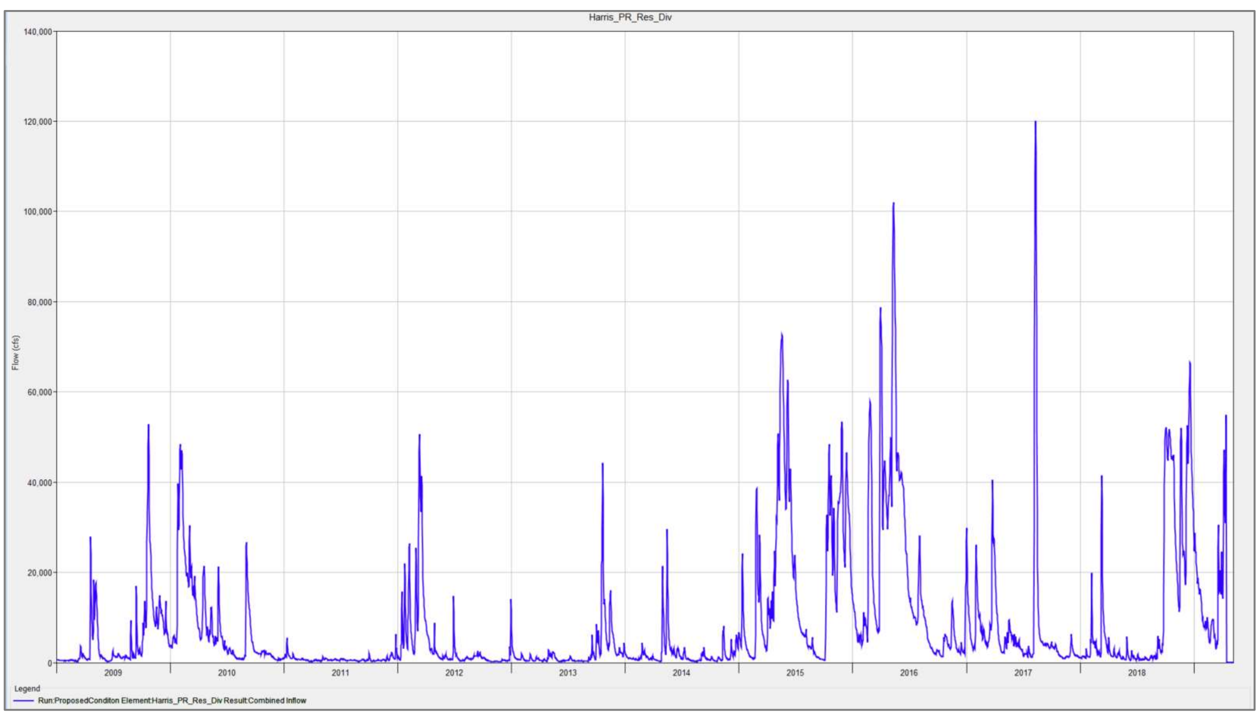


Figure 42: Proposed Conditions Flow Hydrograph at Proposed Harris Reservoir Expansion Diversion (Brazos River) During 10- ½ -Year Analysis Period

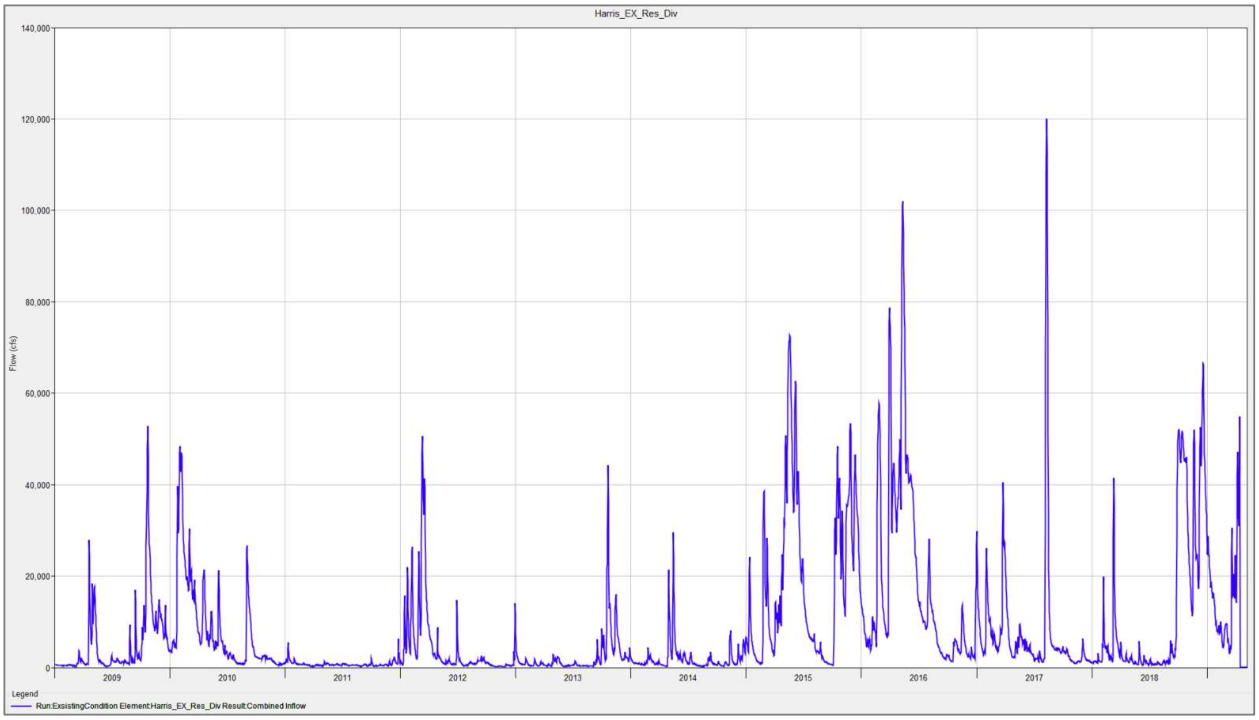


Figure 43: Existing Conditions Flow Hydrograph at Existing Harris Reservoir Diversion (Brazos River) During 10- ½ -Year Analysis Period

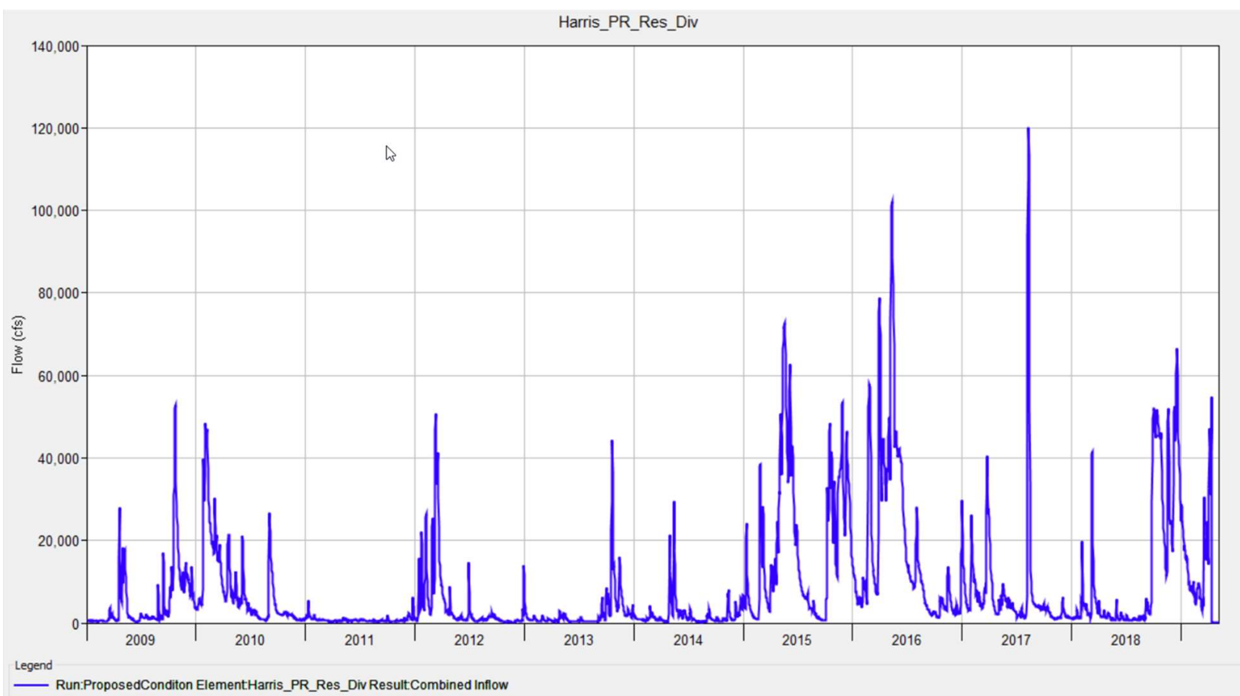


Figure 44: Proposed Conditions Flow Hydrograph at Existing Harris Reservoir Diversion (Brazos River) During 10- ½ -Year Analysis Period

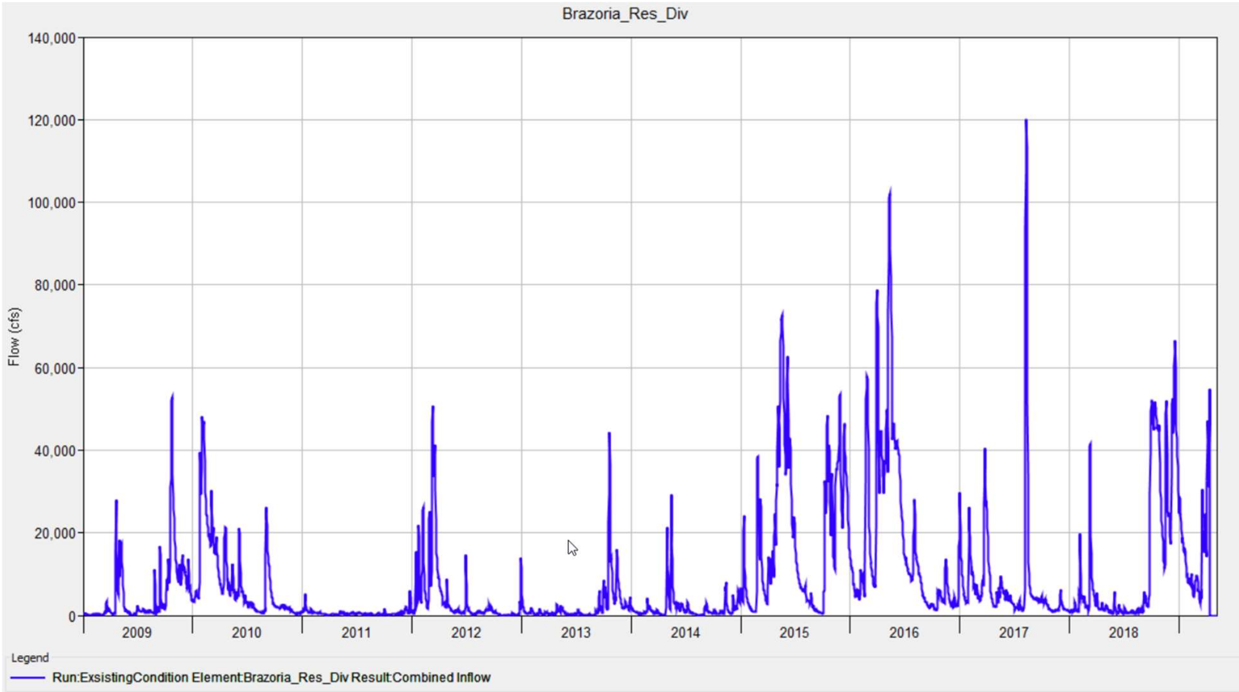


Figure 45: Existing Conditions Flow Hydrograph at Existing Brazoria Reservoir Diversion (Brazos River) During 10- ½ -Year Analysis Period

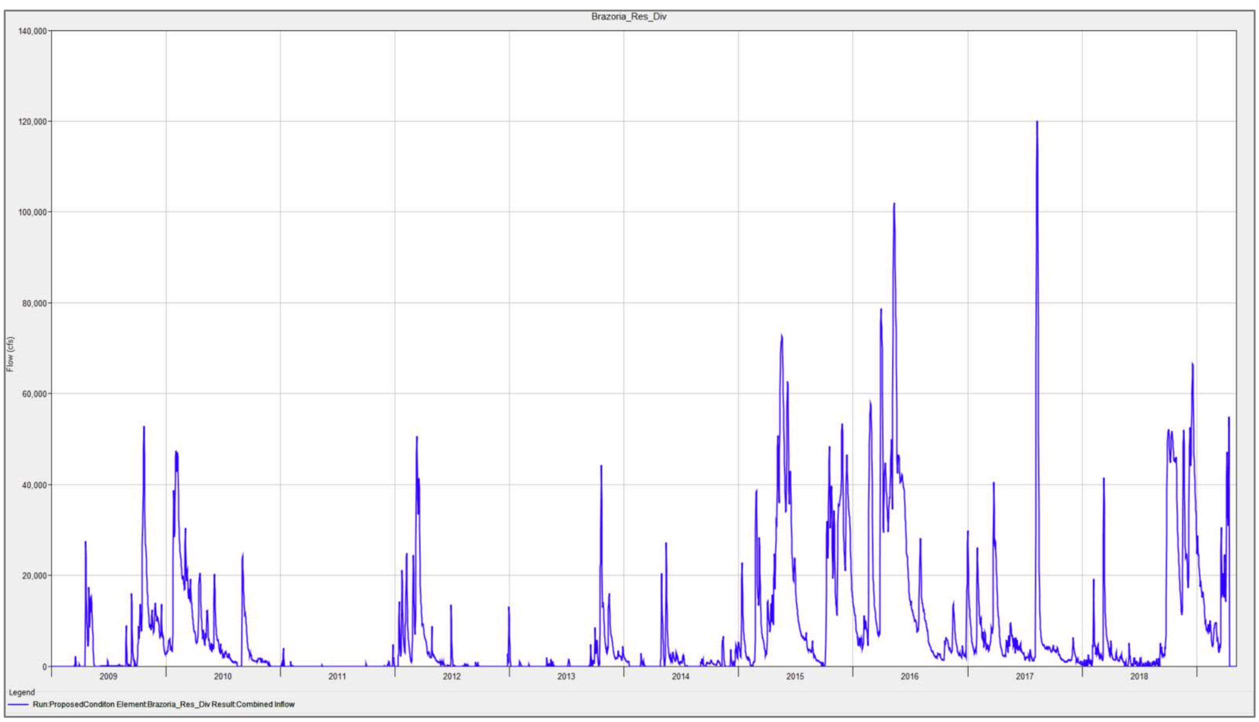


Figure 46: Proposed Conditions Flow Hydrograph at Existing Brazoria Reservoir Diversion (Brazos River) During 10- ½ -Year Analysis Period

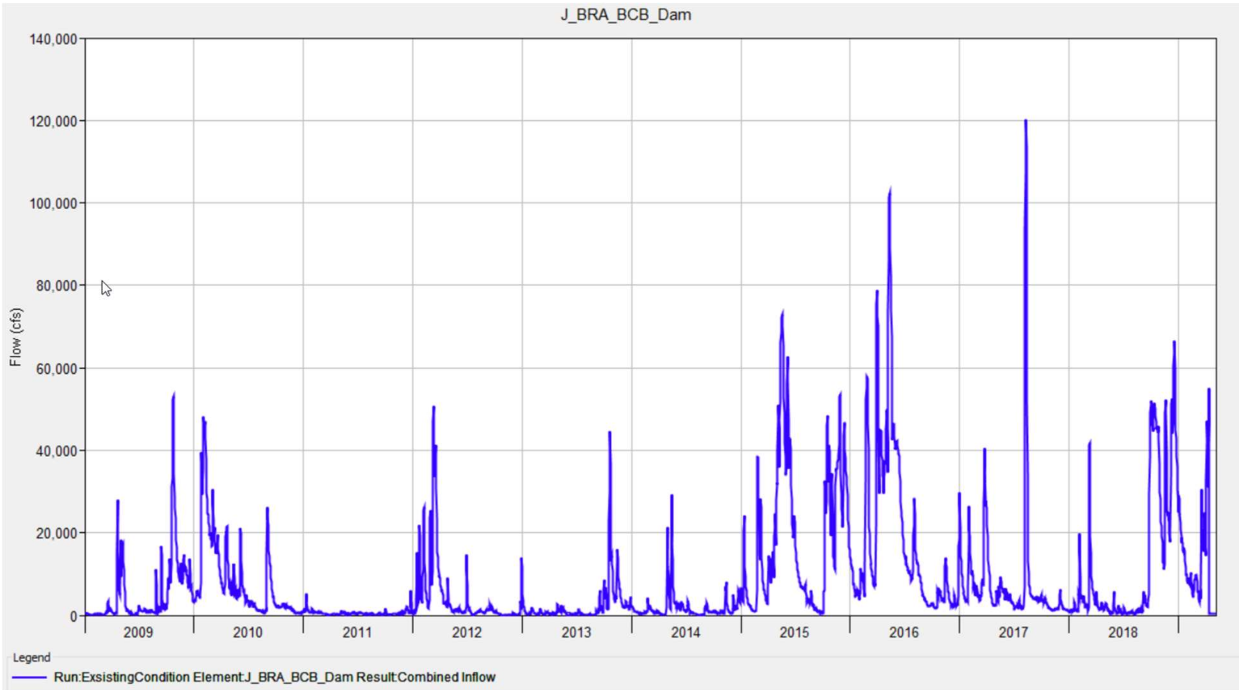


Figure 47: Existing Conditions Flow Hydrograph at Brazoria Discharge/Dow's Water Intake (Brazos River) During 10- ½ -Year Analysis Period

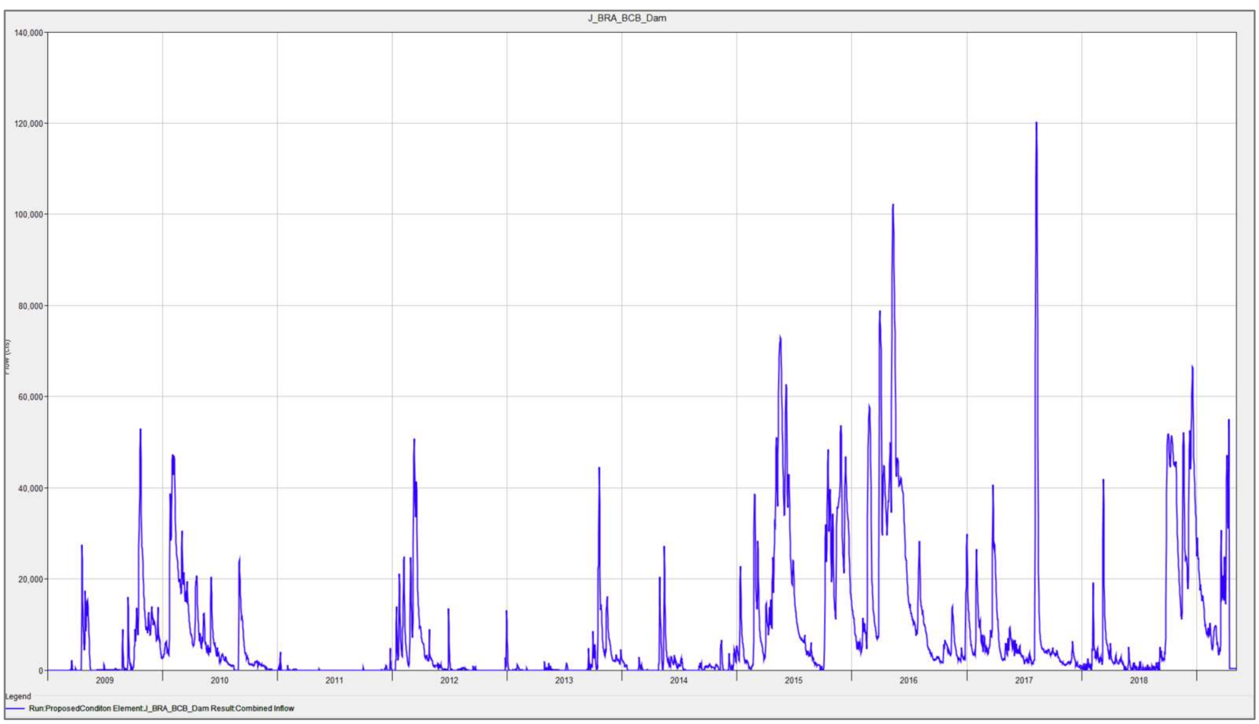


Figure 48: Proposed Conditions Flow Hydrograph at Brazoria Discharge/Dow's Water Intake (Brazos River) During 10- ½ -Year Analysis Period

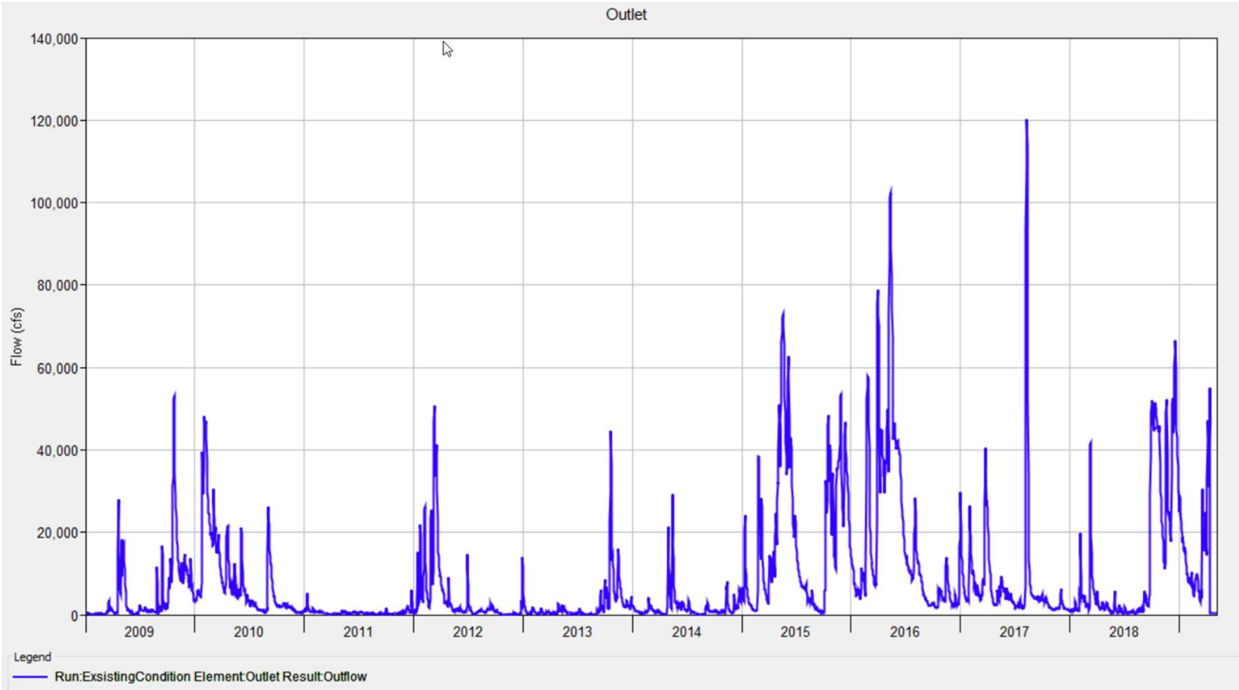


Figure 49: Existing Conditions Flow Hydrograph at Outlet (Brazos River) During 10- ½ -Year Analysis Period

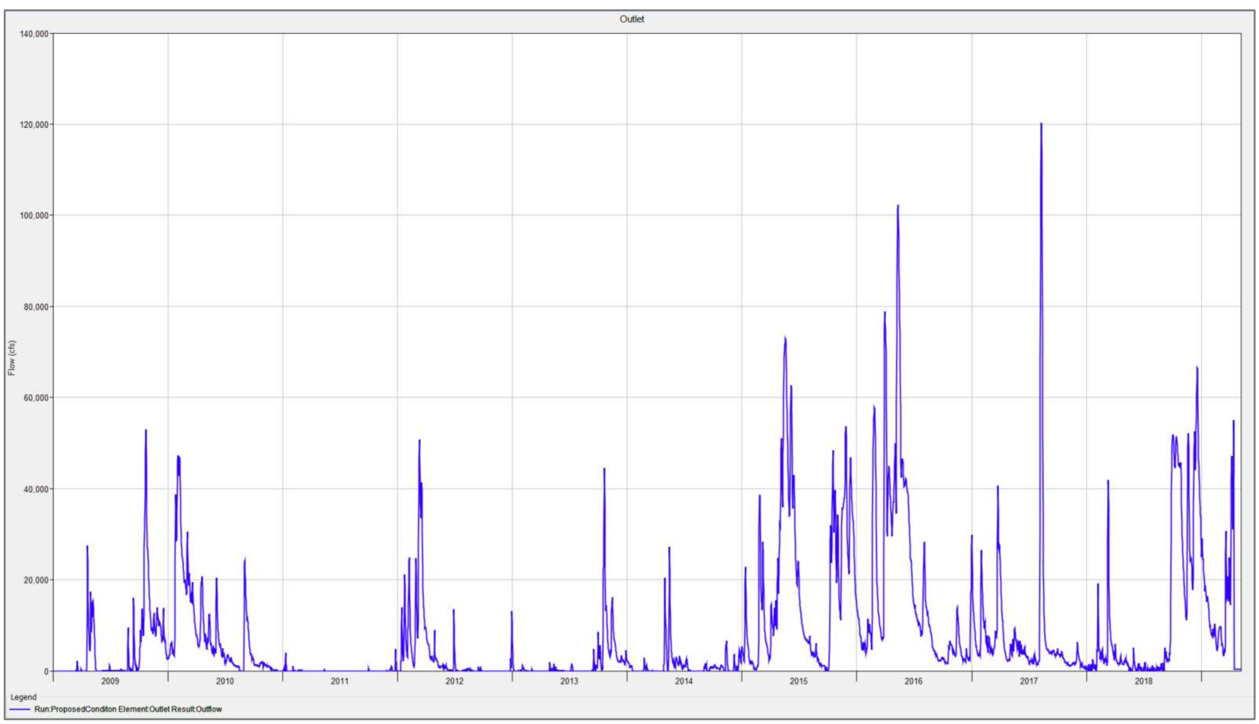


Figure 50: **Existing and Proposed Conditions Flow Hydrograph at Outlet (Brazos River) During 10- ½ -Year Analysis Period**

5.4.2 Riverware™

RiverWare uses **objects** to represent certain natural or man-made systems or structures (e.g., various types of reservoirs, diversions, reaches, stream gages, pumps, power plants, etc.) within a model, much like HEC-HMS does to create the elements within a flow model. However, it differs from HEC-HMS by using what are called **slots** as the primary "storage containers" for data, as well as the actual variables for object operations (e.g., stream inflow/outflow, diversion flow, reservoir stage-storage-discharge values, pump curve and operation information, etc.). RiverWare uses its **slot link** capabilities to couple two or more objects (and specific slots within each respective object) to perform operations within the model (e.g., routing outflow from an object upstream as inflow into a downstream linked object, etc.).

The Existing and Proposed Riverware™ models were built using the Richmond and Rosharon USGS flow gage historical hydrograph data (with a 40-year period of record) extracted from the same BRA FPP Study HEC-HMS model as described above. The Existing Conditions model includes the existing Harris and Brazoria reservoirs, respectively, along with their corresponding diversion elements in order to account for allowed pumping withdrawals along the Brazos River.

5.4.2.1 ***Existing Condition Model*** *(DowHarrisReservoirExisting.mdl.gz)*

The RiverWare model utilized the Existing Condition HEC-HMS Basin Model run's "Inflow" daily flow values from the "Harris_EX_Res_Div" diversion element, which utilized the previously mentioned ten-year period of record flow data from Dow as input, as the starting flow input for the RiverWare "Harris_EX_Res_Div" diversion object "Inflow" slot. Values for "Outflow" from the same HEC-HMS diversion element were likewise used as the input for the "Outflow" slot of the same "Harris_EX_Res_Div" diversion object in RiverWare. A "Diversion" flow data slot was also created to represent pumped outflows which were routed to the "Harris_EX_Res" pumped storage reservoir object, which was used to simulate the existing Harris Reservoir, which receives water from pumped inflows siphoned from the Brazos River at the "Harris_EX_Res_Div".

Historic reservoir plan and operational data received from Dow were used to build the "Harris_EX_Res_" reservoir "Storage", "Elevation Volume Table", and "Pool Elevation" slots. The "Inflow" slot was linked to the "Outflow" slot from the "Harris_EX_Res_Div" object. An "Outflow" slot was created to route discharge flows from the reservoir into the "Harris_EX_Res_Outlet_AP2" control slot, which was used as an analysis point (AP).

This same process was repeated using the flow summary values from the HEC-HMS "Brazoria_Res_Div" element and transferred into the appropriate "Brazoria_Res_Div" diversion object "Inflow" and "Outflow" slots.

Reach objects "R_BRA_410 R_BRA_430" and "R_BRA_440" and confluence object "J_BRA_BCB_Dam" were created to route the discharges from the Brazos River and return flows from the reservoir objects back into the Brazos River system and down to the ultimate outfall, which was the "Outlet_AP1" control object. See the model schematic in Figure 51.

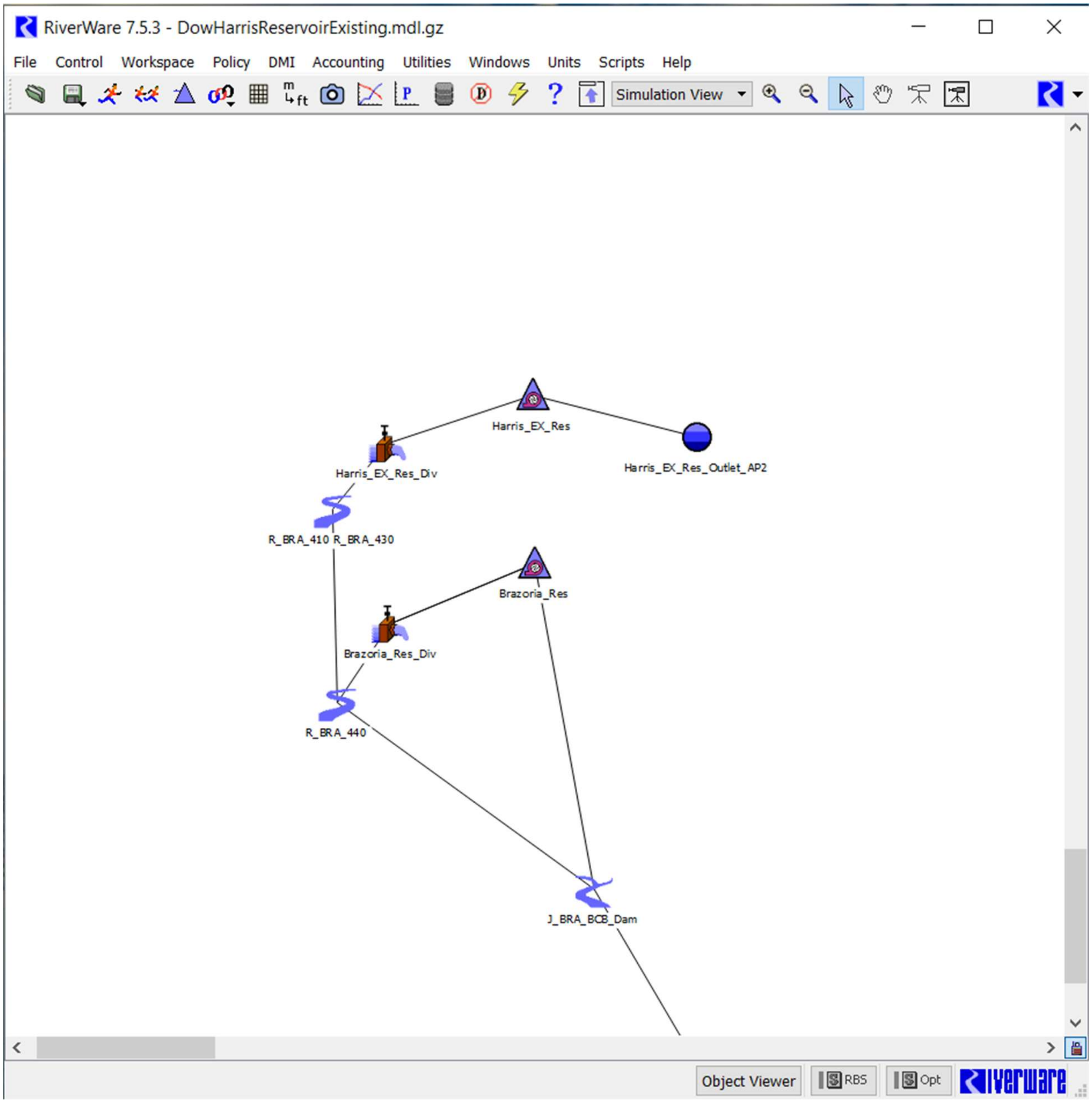


Figure 51: Riverware™ Existing Conditions Schematic

5.4.2.2 ***Proposed Condition Model*** *(DowHarrisReservoirProposed.mdl.gz)*

The Proposed Condition RiverWare model was built upon the Existing Condition model, as explained above. It was modified from the existing condition by the addition of the "Harris_PR_Res_Div" diversion object, the "Harris_PR_Res" pumped storage reservoir object, and the "Harris_PR_Res_Outlet_AP2" control object. The process for building the additional proposed Harris Reservoir and its accompanying diversion was the same as was described above for the Existing Condition Model, except the values were taken from the Proposed Condition Basin Model run of HEC-HMS for the "Harris_PR_Res_Div" and accompanying "Harris_PR_Res" pumped storage reservoir object.

The proposed Harris Reservoir expansion plans and proposed operational data received from Dow and its engineering consultants were used to create the “Harris_PR_Res” reservoir “Storage”, “Elevation Volume Table”, and “Pool Elevation” slots, just as for the Existing Condition model.

As was done previously for the existing Harris Reservoir, an “Outflow” slot was created to route discharge flows from the “Harris_PR_Res” reservoir into the “Harris_PR_Res_Outlet_AP3” control slot, which was used as another AP. A reach object “R_BRA_Harris_PR_Res_Div” was created, along with corresponding “Inflow” “Outflow” slots, to route undiverted flows from the “Harris_PR_Res_Div” back to the Brazos River System. See Figure 52 for the Proposed Project schematic.

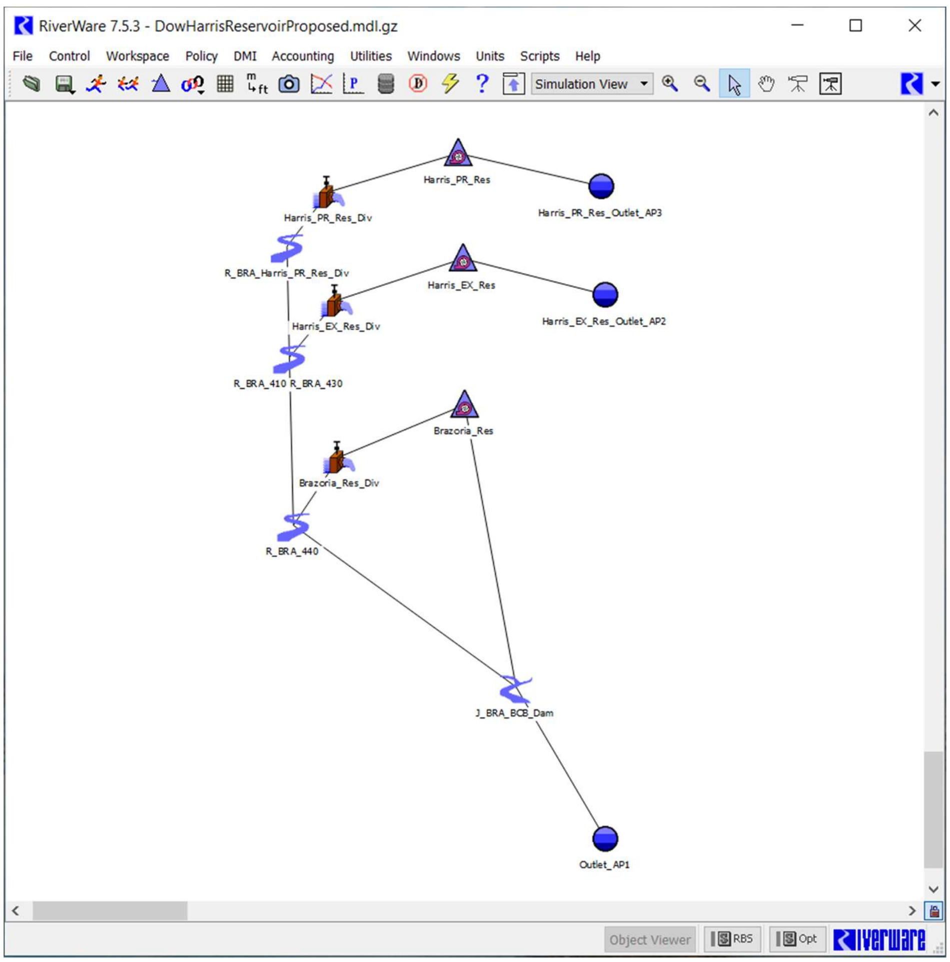
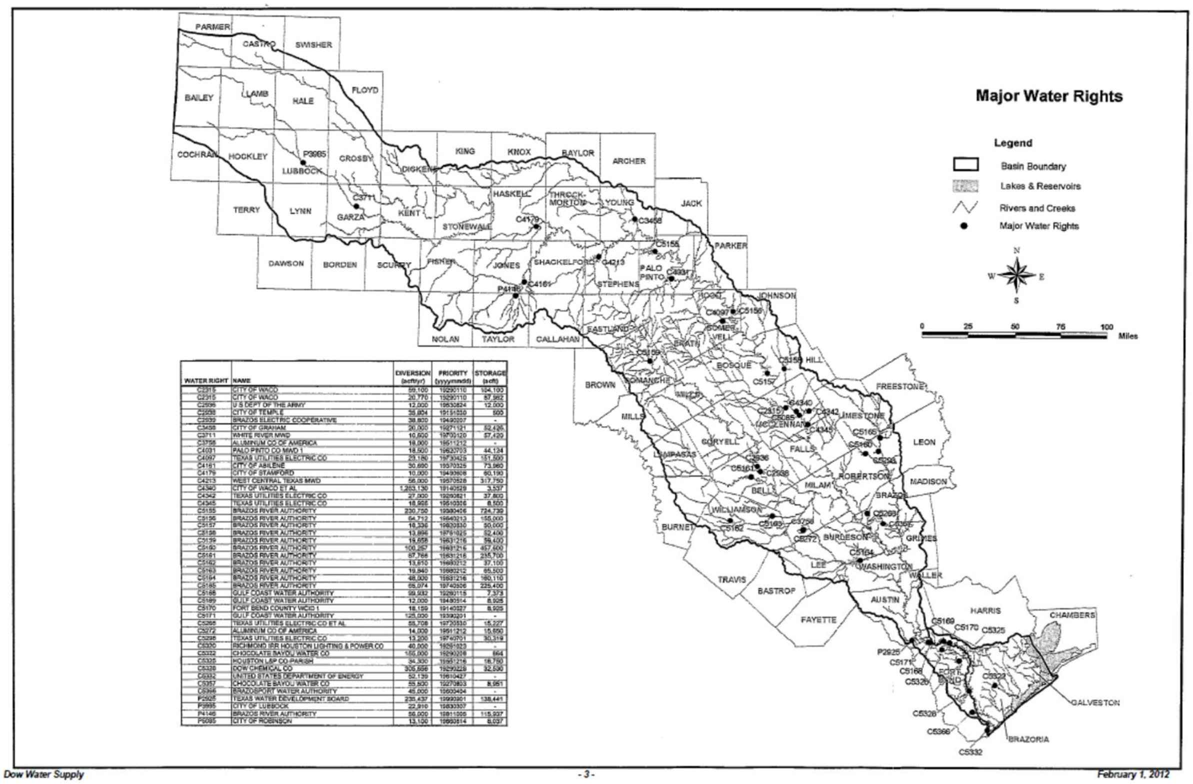


Figure 52: Riverware™ Proposed Conditions Schematic

5.4.2.3 Summary of Water Rights and Inputs to Models

This section provides the prioritization for model inputs for Riverware™. The information is based on documentation provided by Dow regarding their water rights and water supply methods and was confirmed through a review of TCEQ documentation (Texas Water Commission, 1985). Figure 53 provides a summary of the major water rights holders and Figure 54 provides a summary of the adjudicated water rights Dow holds, as confirmed by the Brazos River Watermaster.



WATER RIGHT	NAME	DIVERSION (acft/yr)	PRIORITY (yyyymmdd)	STORAGE (acft)
C2315	CITY OF WACO	59,100	19290110	104,100
C2315	CITY OF WACO	20,770	19290110	87,962
C2936	U S DEPT OF THE ARMY	12,000	19530824	12,000
C2938	CITY OF TEMPLE	35,804	19151030	500
C2939	BRAZOS ELECTRIC COOPERATIVE	38,800	19490207	-
C3458	CITY OF GRAHAM	20,000	19271121	52,426
C3711	WHITE RIVER MWD	10,600	19700120	57,420
C3758	ALUMINUM CO OF AMERICA	18,000	19611212	-
C4031	PALO PINTO CO MWD 1	18,500	19620703	44,124
C4097	TEXAS UTILITIES ELECTRIC CO	23,180	19730426	151,500
C4161	CITY OF ABILENE	30,690	19570325	73,960
C4179	CITY OF STAMFORD	10,000	19490608	60,190
C4213	WEST CENTRAL TEXAS MWD	56,000	19570528	317,750
C4340	CITY OF WACO ET AL	1,253,130	19140529	3,537
C4342	TEXAS UTILITIES ELECTRIC CO	27,000	19260821	37,800
C4345	TEXAS UTILITIES ELECTRIC CO	18,966	19510326	8,500
C5155	BRAZOS RIVER AUTHORITY	230,750	19380406	724,739
C5156	BRAZOS RIVER AUTHORITY	64,712	19640213	155,000
C5157	BRAZOS RIVER AUTHORITY	18,336	19820830	50,000
C5158	BRAZOS RIVER AUTHORITY	13,896	19761025	52,400
C5159	BRAZOS RIVER AUTHORITY	19,658	19631216	59,400
C5160	BRAZOS RIVER AUTHORITY	100,257	19631216	457,600
C5161	BRAZOS RIVER AUTHORITY	67,768	19631216	235,700
C5162	BRAZOS RIVER AUTHORITY	13,610	19680212	37,100
C5163	BRAZOS RIVER AUTHORITY	19,840	19680212	65,500
C5164	BRAZOS RIVER AUTHORITY	48,000	19631216	160,110
C5165	BRAZOS RIVER AUTHORITY	65,074	19740506	225,400
C5168	GULF COAST WATER AUTHORITY	99,932	19260115	7,373
C5169	GULF COAST WATER AUTHORITY	12,000	19480514	8,925
C5170	FORT BEND COUNTY WCID 1	18,159	19140327	8,925
C5171	GULF COAST WATER AUTHORITY	125,000	19390201	-
C5265	TEXAS UTILITIES ELECTRIC CO ET AL	55,708	19720530	15,227
C5272	ALUMINUM CO OF AMERICA	14,000	19611212	15,650
C5298	TEXAS UTILITIES ELECTRIC CO	13,200	19740701	30,319
C5320	RICHMOND IRR HOUSTON LIGHTING & POWER CO	40,000	19261023	-
C5322	CHOCOLATE BAYOU WATER CO	155,000	19290208	664
C5325	HOUSTON L&P CO-PARISH	34,300	19551216	18,750
C5328	DOW CHEMICAL CO	305,656	19290228	32,530
C5332	UNITED STATES DEPARTMENT OF ENERGY	52,139	19610427	-
C5357	CHOCOLATE BAYOU WATER CO	55,500	19270803	8,951
C5366	BRAZOSPORT WATER AUTHORITY	45,000	19600404	-
P2925	TEXAS WATER DEVELOPMENT BOARD	235,437	19990301	138,441
P3995	CITY OF LUBBOCK	22,910	19830307	-
P4146	BRAZOS RIVER AUTHORITY	56,000	19811005	115,937
P5085	CITY OF ROBINSON	13,100	19860514	8,037

Figure 53: Summary of Major Water Rights on the Brazos River in Texas (provided by Dow)

Dow Water Rights Summary

Controlling Legal Documents

Certificate of Adjudication # 12-5328 Granted January 14, 1988; Cover Brazos River, Oyster Creek and Buffalo Camp Bayou Water Rights

Certificate of Adjudication # 12-5328A Granted February 27, 1991; Oyster Creek Adjustment to #12-5328

Certificate of Adjudication # 12-5328B Granted December 4, 1991; Oyster Creek Adjustment to #12-5328

		Period Reliability (Month by Month Basis)	Volume Reliability	Minimum Diverted	Special Consideration
1929	20,000 Acre-ft	98.56 %	98.80%	14,679 Acre-ft	
1942	150,000 Acre-ft	94.25 %	95.78%	76,910 Acre-ft	
1942 OC	58,175 Acre-ft	37.64 %	47.11%	8,626	
1942 OC	1,800 Acre-ft	37.50 %	26.01%	13	
1951BCB	7,500 Acre-ft	55.46 %	67.86 %	1500	
1952	Constructed Brazoria Reservoir and Relocated Right				
1960	65,000 Acre-ft	88.22%	88.75%	18,738 Acre-ft	61,000 Acre-ft of Storage or Contract Water with BRA Req'd
1960	45,000 Acre-ft	BWA Water			
1976	3,136 Acre-ft	84.34 %	88.24%		
				121,205 Acre-ft	

Current TCEQ Water Rights Reliability Assessment
Based on KBR work in Sept, 2002
WAM Model Run 3 (=All Authorized Water Rights at Authorized Amounts, No Return Flows, Original Areas-Capacities)

DOW RESTRICTED - For internal use only

Figure 54: Summary of Dow Water Rights on the Brazos River, Texas DOW RESTRICTED - For Internal Use Only

Dow currently states that it plans to use approximately 100,000 gpm (222.2 cfs) at its plant. This would require a water right of 162,222 AF, which is less than the current Dow water right of approximately 284,000 AF from the Brazos River, Oyster Creek and Buffalo Bayou. If Dow could use all their water right they could increase the water use to 175,000 gpm or 388.9 cfs. The 388.89 cfs would be less than the 630 cfs maximum diversion rate from the water right.

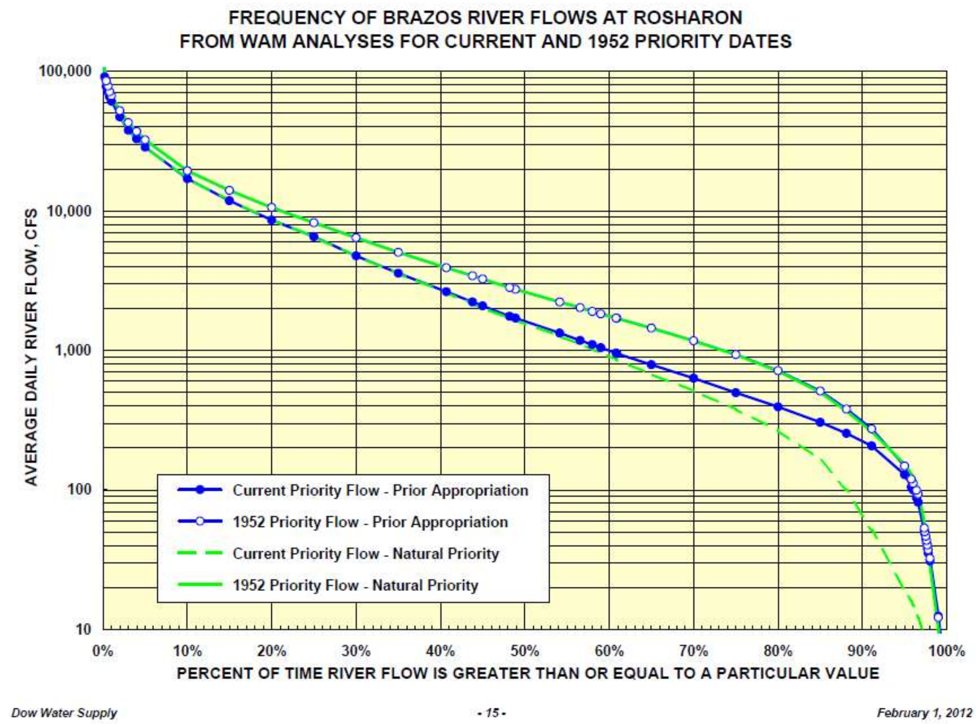


Figure 55: Frequency of Flows for Prior Appropriated and Natural Priority on the Brazos River, Texas

5.4.3 Brazos River HEC-RAS Unsteady Flow

The Brazos River HEC-RAS unsteady flow model used in this study was obtained from the BRA Lower Brazos Flood Protection Planning Study (FPP Study) HEC-RAS hydraulic model that was approved by the BRA in March of 2019 (Halff, 2019). The original model was truncated upstream of the Rosharon USGS gage to reduce extremely long run times and eliminate unnecessary data, as the stream segment and cross-sections upstream of the gage are not part of the area of study for this report. Additionally, any backwater effects associated with the existing and proposed reservoir are expected to be isolated to the area in the closer vicinity to the existing Brazoria and Harris reservoirs and proposed Harris reservoir expansion.

All hydraulic modeling of the Brazos River was performed in HEC-RAS unsteady flow version 5.0.7 following standard modeling procedures for conceptual or planning-level analysis. Model computation time steps of 30 minutes and reporting intervals of one-day were used and were held constant between existing and proposed conditions. Changes to the original model were limited to the following:

1. Truncating the model;
2. Revising the upstream boundary conditions and associated initial flows;
3. Incorporating lateral inflow hydrographs.

5.4.3.1 Geometry Data

With the exception of truncating the HEC-RAS unsteady flow model at cross-section 308,583.5, no changes were made to the geometry data from the original study. As with HEC-HMS, the original FPP Study model did not include either of the existing Harris or Brazoria reservoirs that are operated by Dow. These two reservoirs and their corresponding diversions along the Brazos River were not modeled in the traditional way existing conditions and proposed conditions are modeled in a HEC-RAS unsteady flow model. This usually is done by adding lateral inflow hydrograph along the main river. Diversions (negative flows out of the main river) are not easily modeled in HEC-RAS, as HEC RAS cannot appropriately handle negative flows or flows leaving the system. Negative flows would crash the HEC-RAS simulation. A different approach was used to model the existing Brazos River conditions, which was by inserting a lateral inflow hydrograph of the Proposed Harris reservoir back into the model were the flow was diverted into the Proposed Harris Reservoir. Then, the lateral flow hydrograph was removed and only the boundary conditions were kept in the model. This method gives you the ability to quantify the differences happening at the Brazos River between the existing and proposed project conditions without compromising mode stability.

These three reservoirs were not added to the geometry data as reservoirs. Reservoir routing was performed in HEC-HMS so that hydrographs could be readily imported into both HEC-RAS unsteady flow and Riverware and to avoid creating stability issues in HEC-RAS unsteady flow. Reservoir routing computations are performed using the Modified Puls routing method in both HEC-HMS and HEC-RAS unsteady flow, so results from reservoir routing in either model would be very similar. The two existing and one proposed reservoir were also not included in the cross-section geometry as including them and filling them with blocked obstructions would not significantly change the hydraulic modeling results.

5.4.3.2 Boundary Conditions

The Rosharon gage was input as a flow hydrograph for the upstream boundary condition at the upstream cross-section 308,583.5 (Figure 40). Details on this gage are discussed in Section 5.3. While the original model used a normal depth downstream boundary condition with a slope of 0.0003, this boundary condition did not produce expected backwater effects from the Gulf of Mexico related to mean, high, or low tide or any condition. Since the reach of the Brazoria River modeled for this study has bottom elevation nearly 20 ft below sea level and is tidally influenced, the downstream boundary condition was modified to a fixed WSEL of 0.511 ft, which his consistent with the current MSL reported by USGS (USGS, 2019). While MSL does not capture extreme tidal influence or storm surge, it is reflective of typical levels of tidal influence and backwater effects from the Gulf of Mexico on the study area. As shown in Figure 11, neither the existing Brazoria Reservoir or Harris Reservoir or proposed Harris Reservoir expansion are expected to be inundated from the effects of sea level rise.

5.4.3.3 Lateral Inflow Hydrographs

The rainfall data was omitted from the HMS model, due to the incompleteness of the data set. Therefore, the only river hydrograph utilized in the HEC-RAS model was the upstream boundary condition hydrograph (USGS Rosharon gage). No lateral inflow from drainage area sub-basins were included in the HEC-RAS model. Only the diversion for proposed Harris reservoir was modeled in HEC-RAS.

5.4.3.4 Reservoir Diversions and Discharges

As shown in Figure 56 and Table 12, the only diversion modeled was the proposed Harris Reservoir expansion. The diversion was input into HEC-RAS unsteady flow as a lateral inflow hydrograph at the representative cross-section. As mentioned above, the proposed Harris Reservoir expansion required an additional lateral inflow hydrograph in proposed conditions. There was an attempt to model the diversions in HEC-RAS for both the Existing Harris Reservoir and Brazoria Reservoir as positive discharges(flow entering into the Brazos) and negative discharges(flow exiting the Brazos), except that this methodology brought instability and errors to the model and it was unable to run. A simplified version of the model was the preferred method of analysis which only used one lateral inflow for the proposed Harris Reservoir which was chosen as the best way to represent the system, as the only difference between the existing and proposed conditions in the Brazos river system is the addition of the proposed Harris Reservoir diversion. In Table 12 below the location of the proposed Harris Reservoir Diversion within the HECRAS Model is shown.

Table 12: Reservoir Diversions and Discharges Lateral Inflow Hydrograph Input Locations

Reservoir	HEC-RAS Cross-Section
Existing Harris Discharge	Leaves to Oyster Creek
Proposed Harris Inflow	253,920.7
Proposed Harris Discharge	Leaves to Oyster Creek

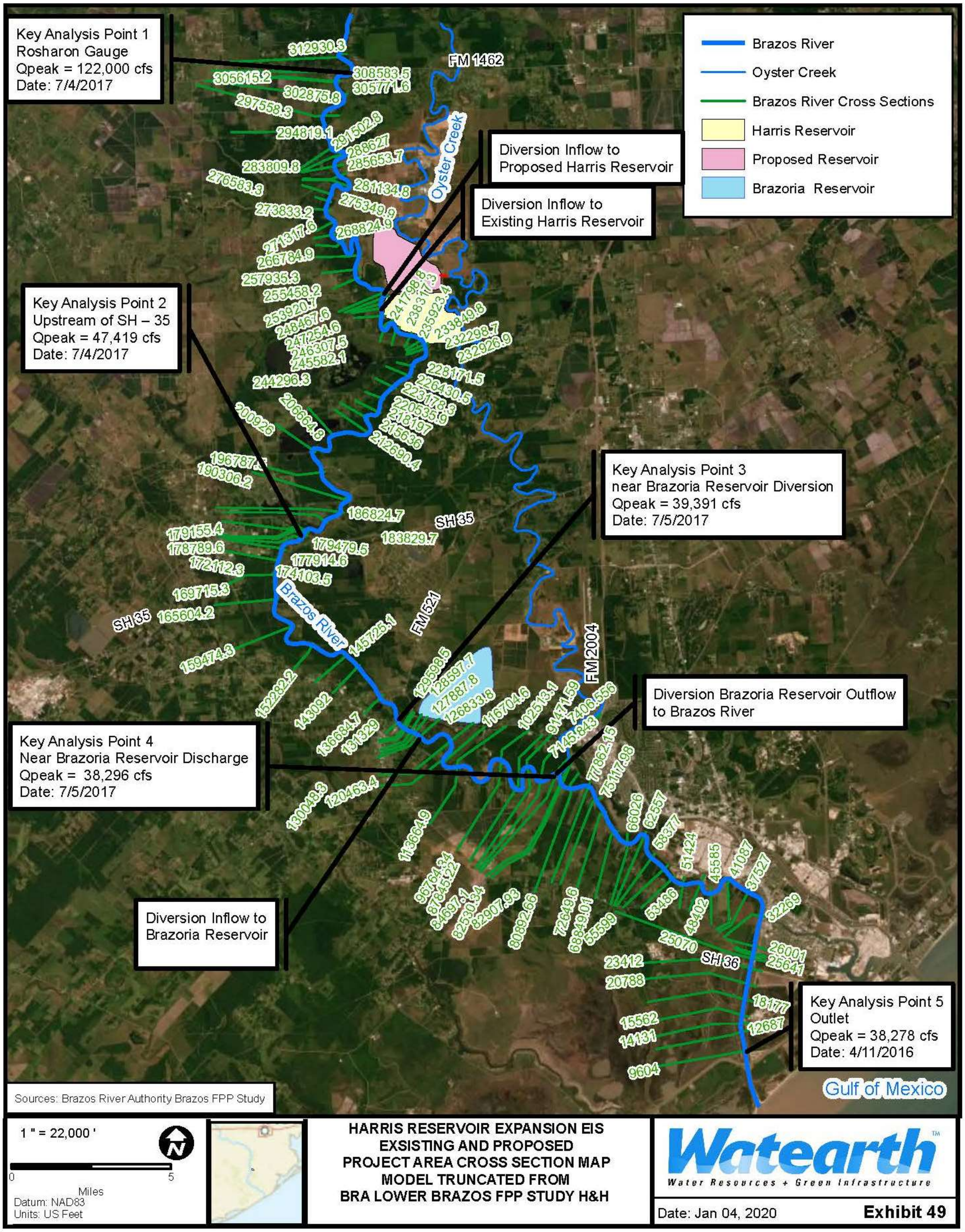


Figure 56: HEC-RAS Cross-Section Layout for Brazos River

5.4.3.5 HEC-RAS Unsteady Flow Results

Table 13 lists existing conditions and proposed conditions Peak Flows at Maximum Water Surface Elevation for the entire 10-1/2-year simulation period and shows the difference in maximum flow through the cross sections at each of the river stations.

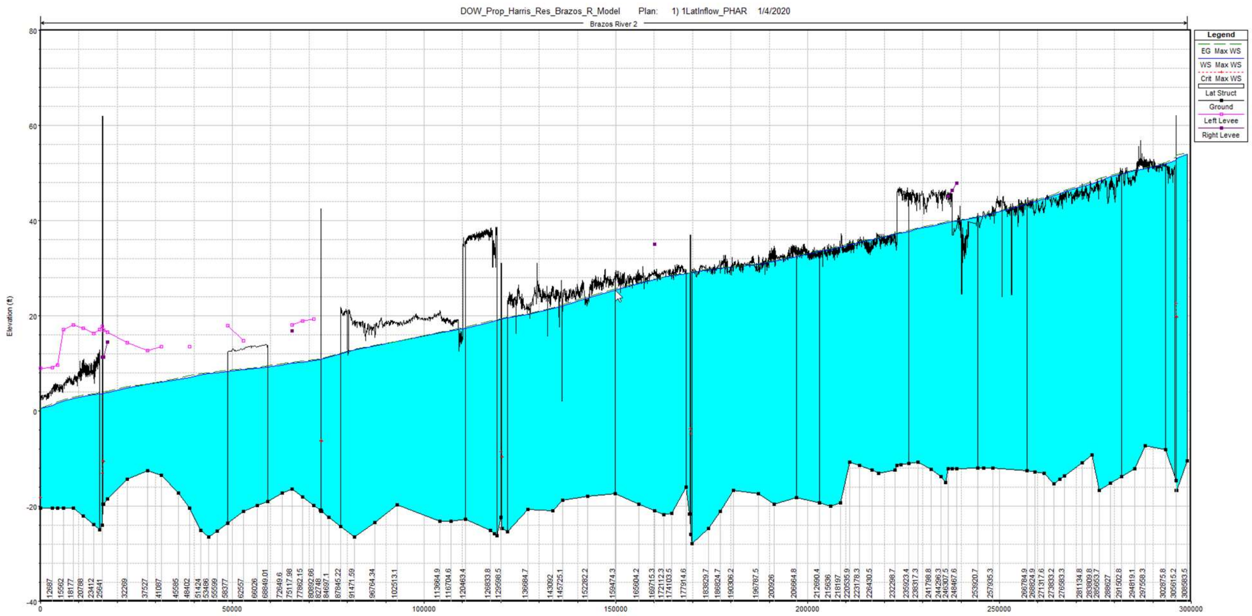


Figure 57 and Figure 58 provides a profile plot of existing and proposed conditions maximum water surface elevation (WSEL) along the Brazos River from the Rosharon gage to the outlet at the Gulf of Mexico. Similarly, Figure 60 through

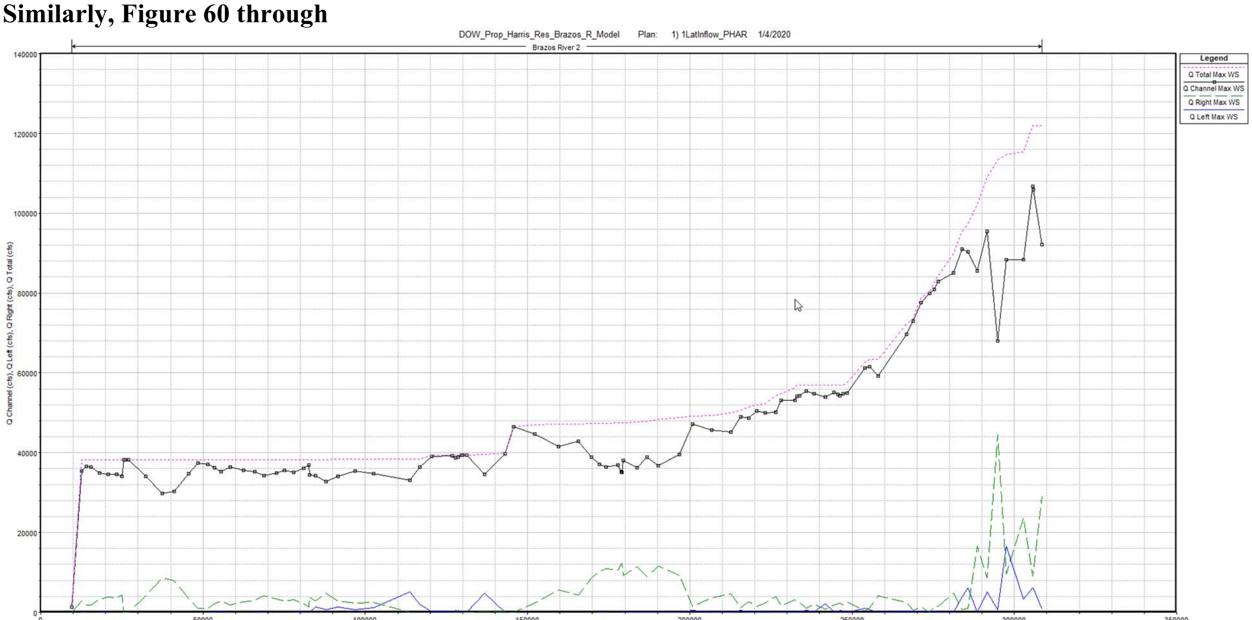


Figure 61 provide a profile plot of existing and proposed conditions maximum velocities and flows along the same analysis reach of the Brazos River, respectively. Most of the results between the existing and proposed conditions varied only slightly from the existing conditions, due to the relatively insignificant change of one diversion added in proposed conditions over a large watershed study area. The change in flow in the Brazos River caused by the Proposed Harris Reservoir Diversion is negligible and the results for both conditions are nearly identical.

Table 13: Comparison of Existing and Proposed Flows at Maximum Water Surface Elevation Over the 10-1/2 Year Simulation Period.

River Station	Existing Conditions Flow Total (cfs)	Proposed Conditions Flow Total (cfs)	Flow Δ (cfs)
308,583.5	122,000	122,000	0
305,771.6	121,974	121,974	0
305,615.2	121,974	121,974	0
302,875.8	115,267	115,267	0
297,558.3	114,603	114,603	0
294,819.1	113,349	113,349	0
291,502.8	109,004	109,004	0.1
288,627.0	102,202	102,202	0
285,653.7	97,362	97,362	-0.02
283,809.8	95,441	95,441	-0.01
281,134.8	89,821	89,821	0.01
276,583.3	84,367	84,367	0.01
275,349.9	82,810	82,810	0.01
273,833.2	80,262	80,262	0.01
271,317.6	79,008	79,008	0
268,824.9	73,715	73,715	0
266,784.9	72,342	72,342	0
257,935.3	63,398	63,398	0
255,458.2	63,302	63,302	-0.01
253,920.7	62,678	62,678	-0.01
248,467.6	57,526	57,526	-0.03
247,254.6	56,999	56,999	-0.02
246,307.5	56,999	56,999	-0.03
245,582.1	56,999	56,999	-0.03
244,296.3	56,999	56,999	-0.03
241,798.8	56,998	56,998	-0.01
238,317.3	56,997	56,997	0
235,923.4	56,995	56,995	-0.02
233,849.8	56,995	56,995	-0.01
232,926.9	56,995	56,995	-0.01

River Station	Existing Conditions Flow Total (cfs)	Proposed Conditions Flow Total (cfs)	Flow Δ (cfs)
232,298.7	56,222	56,222	-0.02
228,171.5	54,743	54,743	0
226,430.5	54,217	54,217	0.01
223,178.3	52,342	52,342	0
220,535.9	51,956	51,956	0.01
218,197.0	51,388	51,388	0.01
215,636.0	50,570	50,570	-0.01
212,690.4	49,959	49,959	0
206,664.8	49,271	49,271	0.01
200,926.0	49,219	49,219	0
196,787.5	48,811	48,811	0.01
190,306.2	48,277	48,280	-3.42
186,824.7	47,827	47,827	0.03
183,829.7	47,681	47,681	0.02
179,479.5	47,417	47,417	-0.01
179,155.4	47,417	47,417	0
178,789.6	47,415	47,415	0.01
177,914.6	47,415	47,415	0.01
174,103.5	47,389	47,389	-0.01
172,112.3	47,361	47,361	0
169,715.3	47,344	47,344	-0.01
165,604.2	47,190	47,190	0
159,474.3	47,167	47,167	0
152,282.2	47,079	47,079	0
145,725.1	46,471	46,471	0.01
143,092.0	39,801	39,801	0
136,684.7	39,498	39,498	0
131,329.0	39,400	39,400	0.01
130,048.3	39,399	39,399	0
129,598.5	39,399	39,399	0
128,597.7	39,399	39,399	0
127,887.8	39,399	39,399	-0.46
126,833.8	39,399	39,399	0
120,463.4	39,397	39,397	-0.01

River Station	Existing Conditions Flow Total (cfs)	Proposed Conditions Flow Total (cfs)	Flow Δ (cfs)
116,704.**6**	38,345	38,345	0
113,664.**9**	38,343	38,343	-0.01
102,513.**1**	38,334	38,334	0
96,764.3	38,329	38,329	0
91,471.6	38,315	38,315	0.18
87,845.2	38,285	38,285	0
84,697.**1**	38,284	38,284	0.01
82,907.9	38,284	38,284	-0.23
82,530.3	38,283	38,283	0
80,892.7	38,283	38,283	0.23
77,862.2	38,283	38,283	-0.2
75,118.0	38,283	38,283	0
72,649.**6**	38,282	38,282	0.01
68,849.0	38,282	38,282	-0.13
66,026.0	38,282	38,282	0.15
62,557.0	38,282	38,282	-0.13
58,377.0	38,282	38,282	0.11
55,599.0	38,282	38,282	0
53,486.0	38,282	38,282	0
51,424.0	38,282	38,282	0
48,402.0	38,282	38,282	0
45,585.0	38,281	38,281	0.01
41,087.0	38,281	38,281	0
37,527.0	38,281	38,281	0
32,269.0	38,281	38,281	0.05
27,098.0	38,281	38,281	0
26,001.0	38,281	38,281	0
25,641.0	38,281	38,281	0.01
25,070.0	38,281	38,281	0
23,412.0	38,281	38,281	0.01
20,788.0	38,281	38,281	0
18,177.0	38,281	38,281	0
15,562.0	38,281	38,281	0
14,131.0	38,281	38,281	0

River Station	Existing Conditions Flow Total (cfs)	Proposed Conditions Flow Total (cfs)	Flow Δ (cfs)
12,687.0	38,281	38,281	0
9,604.0	1,348	730	618

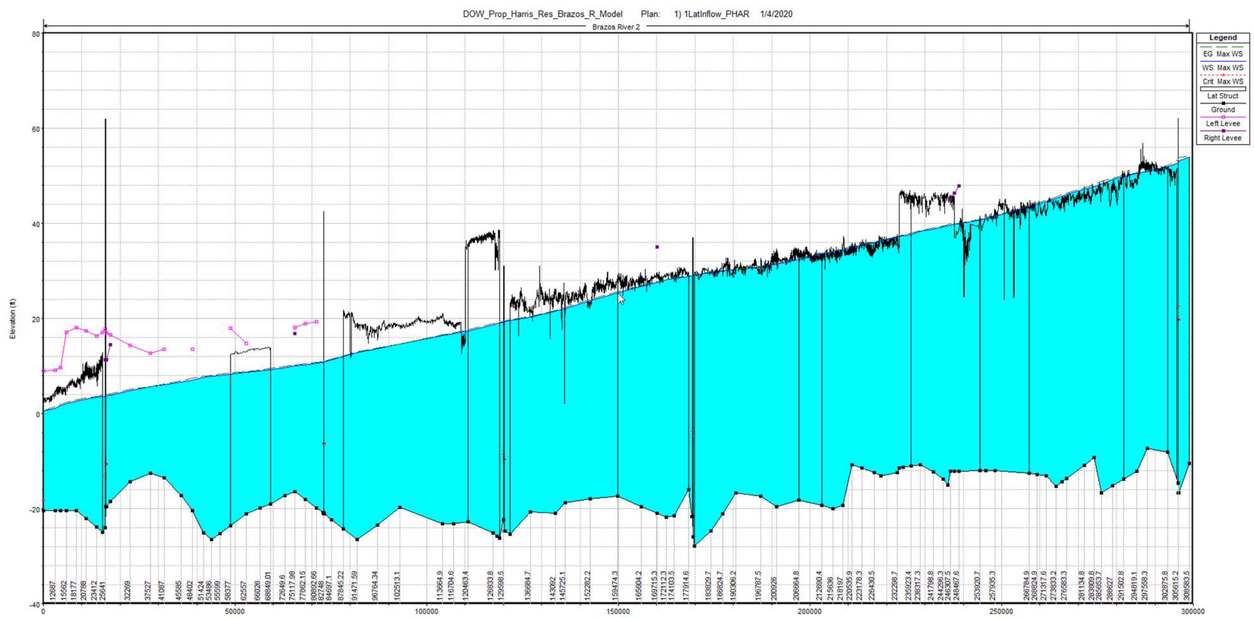


Figure 57 Existing Conditions Maximum WSEL Profile During 10-1/2 - Year Analysis Period Along the Brazos River Between Rosharon Gage and Outlet.

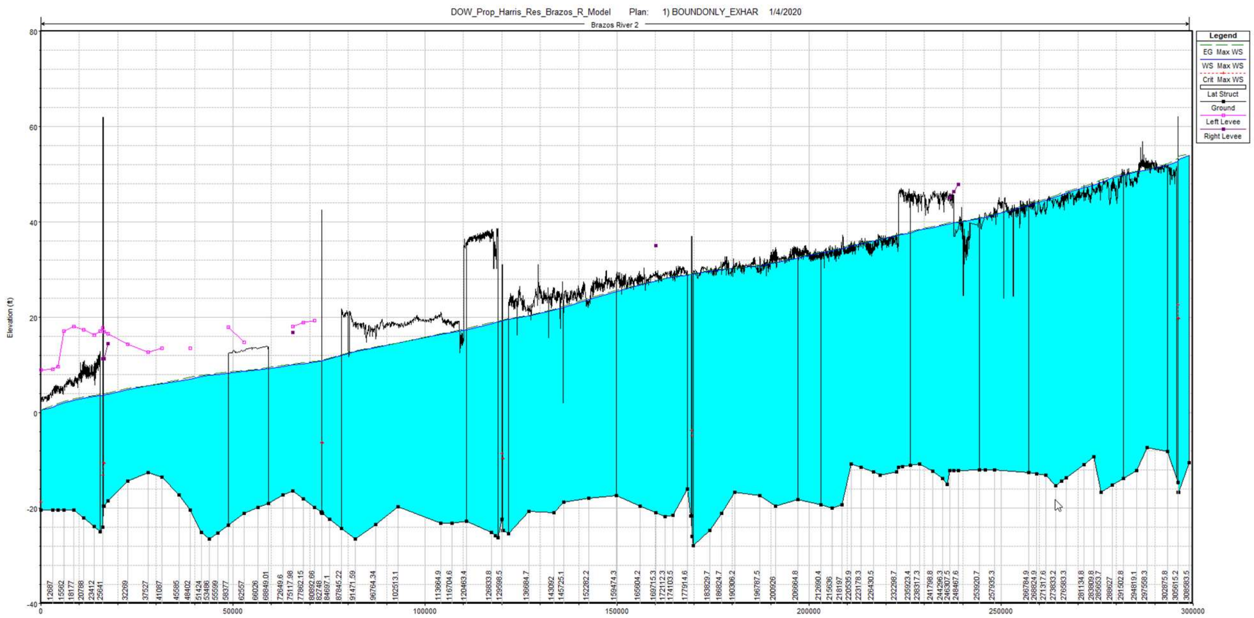


Figure 58 Proposed Conditions Maximum WSEL Profile During 10-1/2 - Year Analysis Period Along the Brazos River Between Rosharon Gage and Outlet.

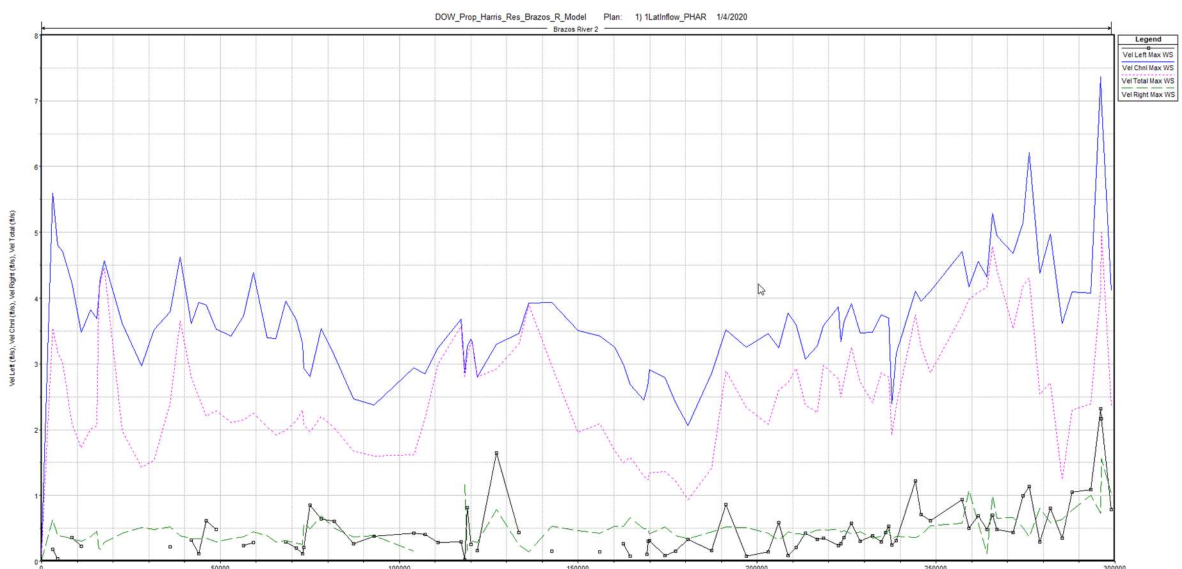


Figure 59: Existing Conditions Channel Flow Velocity, Left and Right Overbank Flow Velocity and Average Flow Velocity for the Peak Maximum WSEL During 10-1/2 - Year Analysis Period Along the Brazos River Between Rosharon Gage and Outlet

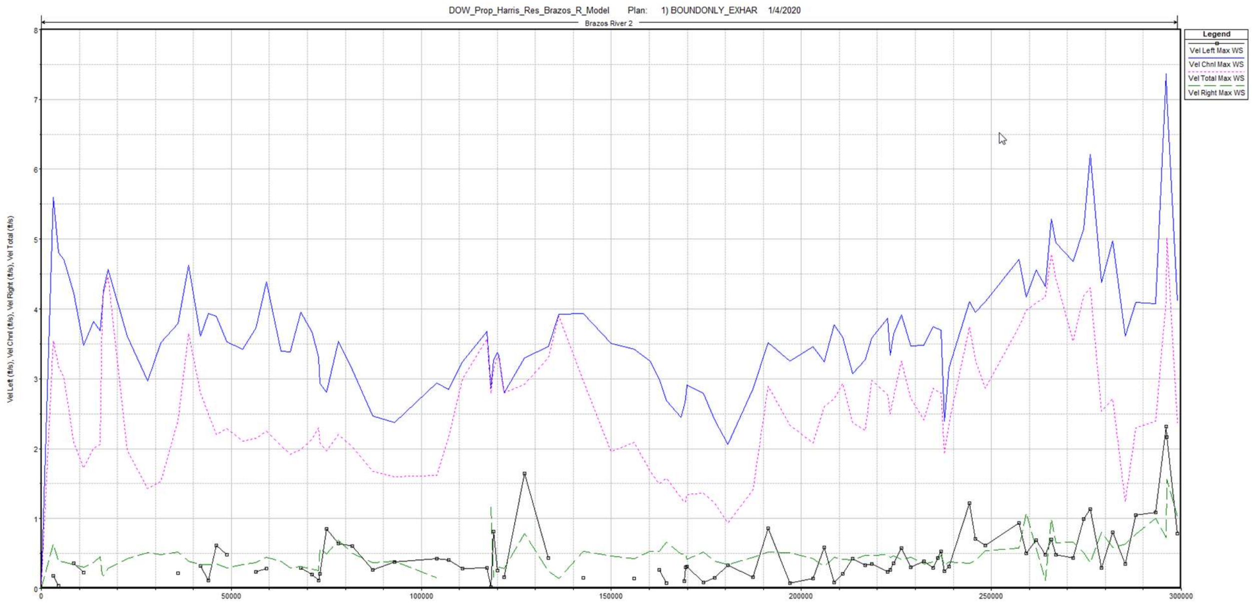


Figure 60: Proposed Conditions Channel Flow Velocity, Left and Right Overbank Flow Velocity and Average Flow Velocity for the Peak Maximum WSEL During 10-1/2 - Year Analysis Period Along the Brazos River Between Rosharon Gage and Outlet

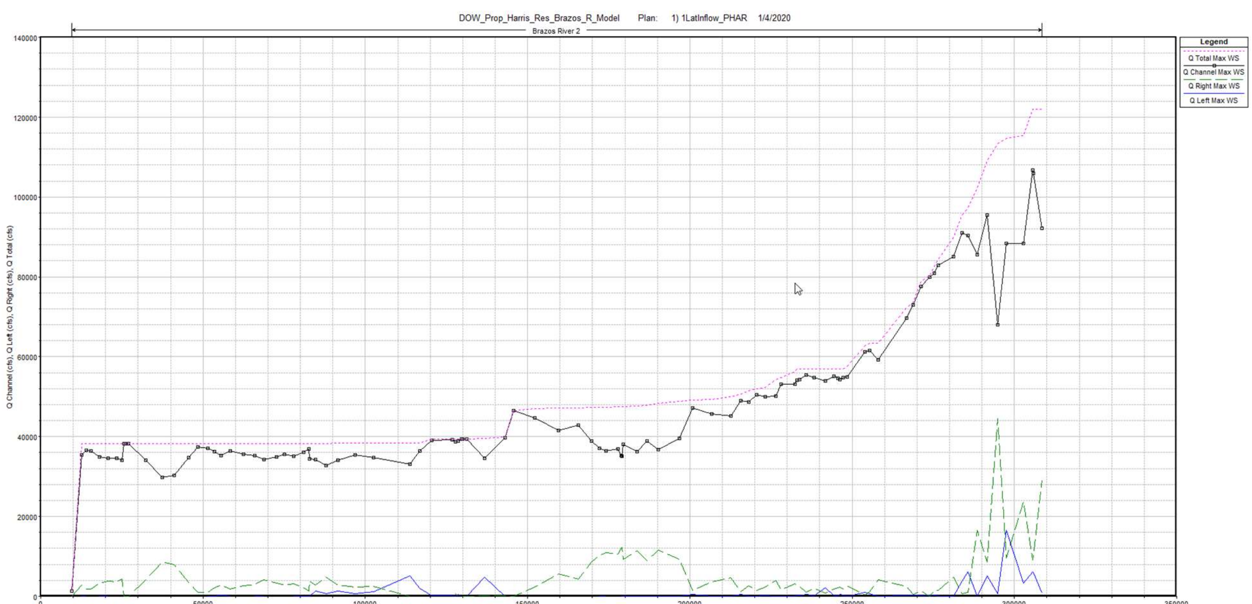


Figure 61: Existing Conditions Channel Flow, Left and Right Overbank Flow and Total Maximum Flow for the Peak Maximum WSEL During 10-1/2 - Year Analysis Period Along the Brazos River Between Rosharon Gage and Outlet

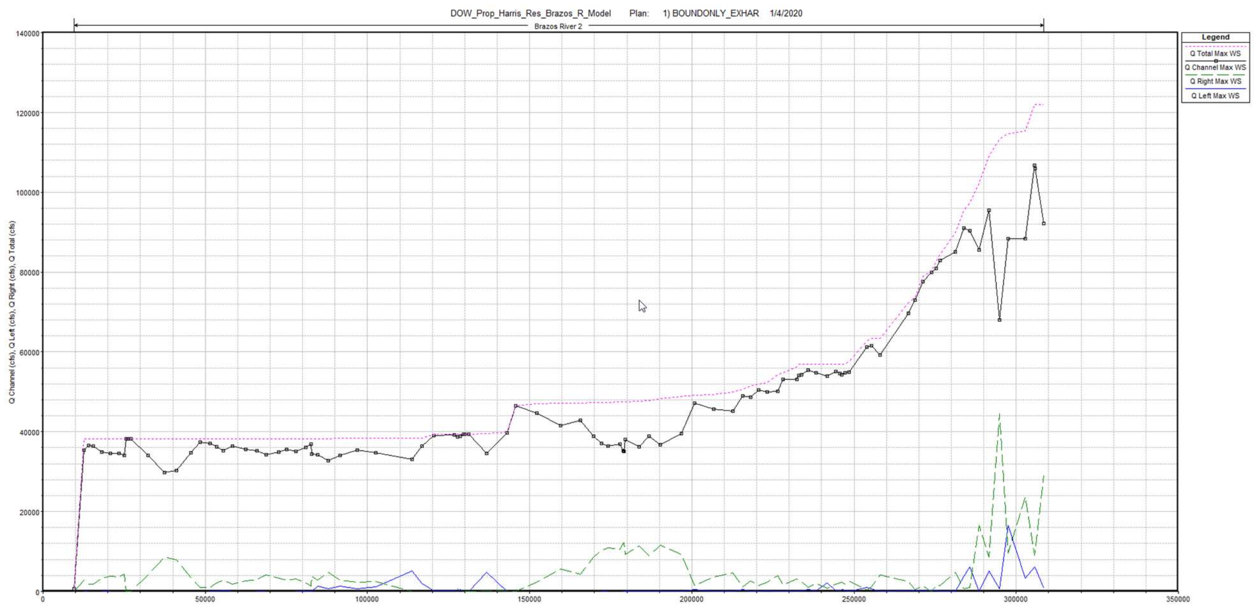


Figure 62: Proposed Conditions Channel Flow, Left and Right Overbank Flow and Total Maximum Flow for the Peak Maximum WSEL During 10-1/2 - Year Analysis Period Along the Brazos River Between Rosharon Gage and Outlet

Figure 65 through Figure 72 depict existing and proposed stage hydrographs and flow hydrographs, at five key analysis points between the Rosharon gage and the outlet at the Gulf of Mexico. Table 14 shows the HEC-RAS results showing the water surface elevations for all the cross sections within existing and proposed conditions model. Table 15 shows the HEC-RAS results showing the maximum channel velocities for all the cross sections within existing and proposed conditions model. The HEC-RAS model results did not show any difference in water surface elevation between the existing and proposed conditions model. The key analysis points are listed in Table 16 and include the Rosharon gage, which is not expected to change between existing and proposed conditions as it is an upstream boundary condition in the model. Most of the results between the existing and proposed conditions varied only slightly from the existing conditions, due to the model having one diversion added over a large watershed study area. Therefore, the change in flow in the Brazos River caused by the Proposed Harris Reservoir Diversion is negligible and the results for both conditions are identical.

Figure 73 and Figure 74 show the flood inundation mapping results of the Brazos HEC-RAS Model which includes cross-sections with maximum existing and proposed WSELs over the 10-1/2-year simulation.

Table 14: Comparison between Existing and Proposed Maximum Water Surface Elevations

River Station	Existing Conditions WSEL (ft.)	Proposed Conditions WSEL (ft.)	Δ WSEL (ft.)
308,583.5	53.95	53.95	0.0
305,771.6	53.06	53.06	0.0
305,615.2	52.65	52.65	0.0
302,875.8	51.88	51.88	0.0
297,558.3	50.96	50.96	0.0
294,819.1	50.5	50.5	0.0
291,502.8	49.74	49.74	0.0
288,627.0	49.21	49.21	0.0
285,653.7	48.21	48.21	0.0
283,809.8	47.73	47.73	0.0
281,134.8	47.18	47.18	0.0
276,583.3	46.02	46.02	0.0
275,349.9	45.59	45.59	0.0
273,833.2	45.25	45.25	0.0
271,317.6	44.57	44.57	0.0
268,824.9	44.02	44.02	0.0
266,784.9	43.43	43.43	0.0
257,935.3	41.47	41.47	0.0
255,458.2	40.94	40.94	0.0
253,920.7	40.63	40.63	0.0
248,467.6	39.91	39.91	0.0
247,254.6	39.84	39.84	0.0
246,307.5	39.64	39.64	0.0
308,583.5	53.95	53.95	0.0
245,582.1	39.51	39.51	0.0
244,296.3	39.28	39.28	0.0
241,798.8	38.81	38.81	0.0
238,317.3	38.32	38.32	0.0
235,923.4	37.67	37.67	0.0
233,849.8	37.33	37.33	0.0
232,926.9	37.21	37.21	0.0
232,298.7	37.06	37.06	0.0

River Station	Existing Conditions WSEL (ft.)	Proposed Conditions WSEL (ft.)	Δ WSEL (ft.)
228,171.5	36.28	36.28	0.0
226,430.5	35.99	35.99	0.0
223,178.3	35.46	35.46	0.0
220,535.9	34.92	34.92	0.0
218,197.0	34.38	34.38	0.0
215,636.0	33.94	33.94	0.0
212,690.4	33.49	33.49	0.0
206,664.8	32.47	32.47	0.0
200,926.0	31.43	31.43	0.0
196,787.5	30.77	30.77	0.0
190,306.2	30.28	30.28	0.0
186,824.7	29.98	29.98	0.0
183,829.7	29.7	29.7	0.0
179,479.5	29.12	29.12	0.0
179,155.4	29.05	29.05	0.0
178,789.6	28.93	28.93	0.0
177,914.6	28.84	28.84	0.0
174,103.5	28.44	28.44	0.0
172,112.3	28.09	28.09	0.0
169,715.3	27.59	27.59	0.0
165,604.2	26.72	26.72	0.0
159,474.3	25.43	25.43	0.0
152,282.2	23.74	23.74	0.0
308,583.5	53.95	53.95	0.0
145,725.1	22.04	22.04	0.0
143,092.0	21.53	21.53	0.0
136,684.7	20.32	20.32	0.0
131,329.0	19.54	19.54	0.0
130,048.3	19.29	19.29	0.0
129,598.5	19.19	19.19	0.0
128,597.7	19.02	19.02	0.0
127,887.8	18.94	18.94	0.0
126,833.8	18.67	18.67	0.0

River Station	Existing Conditions WSEL (ft.)	Proposed Conditions WSEL (ft.)	Δ WSEL (ft.)
120,463.4	17.43	17.43	0.0
116,704.6	16.89	16.89	0.0
113,664.9	16.39	16.39	0.0
102,513.1	14.56	14.56	0.0
96,764.3	13.68	13.68	0.0
91,471.6	12.88	12.88	0.0
87,845.2	12.01	12.01	0.0
84,697.1	11.33	11.33	0.0
82,907.9	10.95	10.95	0.0
82,530.3	10.77	10.77	0.0
80,892.7	10.59	10.59	0.0
77,862.2	10.26	10.26	0.0
75,118.0	10.02	10.02	0.0
72,649.6	9.71	9.71	0.0
68,849.0	9.24	9.24	0.0
66,026.0	8.93	8.93	0.0
62,557.0	8.66	8.66	0.0
58,377.0	8.33	8.33	0.0
55,599.0	8.06	8.06	0.0
53,486.0	7.83	7.83	0.0
51,424.0	7.62	7.62	0.0
48,402.0	7.09	7.09	0.0
45,585.0	6.66	6.66	0.0
41,087.0	6.01	6.01	0.0
37,527.0	5.59	5.59	0.0
32,269.0	4.87	4.87	0.0
27,098.0	3.85	3.85	0.0
26,001.0	3.68	3.68	0.0
25,641.0	3.65	3.65	0.0
25,070.0	3.64	3.64	0.0
23,412.0	3.42	3.42	0.0
20,788.0	3.09	3.09	0.0

River Station	Existing Conditions WSEL (ft.)	Proposed Conditions WSEL (ft.)	Δ WSEL (ft.)
18,177.0	2.65	2.65	0.0
15,562.0	2.02	2.02	0.0
14,131.0	1.61	1.61	0.0
12,687.0	1.11	1.11	0.0
9,604.0	0.51	0.51	0.0

Table 15: Comparison between Existing and Proposed Maximum Velocities

River Station	Existing Conditions Channel Velocity (ft/s)	Proposed Conditions Channel Velocity (ft/s)	Channel Velocity WSEL (ft/s)
308,583.50	4.11	4.11	0.00
305,771.60	7.02	7.02	0.00
305,615.20	7.36	7.36	0.00
302,875.80	4.07	4.07	0.00
297,558.30	4.09	4.09	0.00
294,819.10	3.61	3.61	0.00
291,502.80	4.97	4.97	0.00
288,627.00	4.38	4.38	0.00
281,134.80	4.68	4.68	0.00
276,583.30	4.95	4.95	0.00
275,349.90	5.29	5.29	0.00
273,833.20	4.32	4.32	0.00
271,317.60	4.56	4.56	0.00
268,824.90	4.17	4.17	0.00
266,784.90	4.71	4.71	0.00
257,935.30	4.11	4.11	0.00
255,458.20	3.95	3.95	0.00
253,920.70	4.1	4.1	0.00
248,467.60	3.16	3.16	0.00
247,254.60	2.4	2.4	0.00
246,307.50	3.7	3.7	0.00
245,582.10	3.71	3.71	0.00

River Station	Existing Conditions Channel Velocity (ft/s)	Proposed Conditions Channel Velocity (ft/s)	Channel Velocity WSEL (ft/s)
244,296.30	3.75	3.75	0.00
241,798.80	3.48	3.48	0.00
238,317.30	3.47	3.47	0.00
235,923.40	3.91	3.91	0.00
233,849.80	3.64	3.64	0.00
232,926.90	3.34	3.34	0.00
232,298.70	3.87	3.87	0.00
228,171.50	3.59	3.59	0.00
226,430.50	3.27	3.27	0.00
223,178.30	3.07	3.07	0.00
220,535.90	3.59	3.59	0.00
218,197.00	3.77	3.77	0.00
215,636.00	3.24	3.24	0.00
212,690.40	3.46	3.46	0.00
206,664.80	3.25	3.25	0.00
200,926.00	3.51	3.51	0.00
196,787.50	2.86	2.86	0.00
183,829.70	2.79	2.79	0.00
179,479.50	2.91	2.91	0.00
179,155.40	2.72	2.72	0.00
178,789.60	2.61	2.61	0.00
177,914.60	2.45	2.45	0.00
174,103.50	2.68	2.68	0.00
172,112.30	3	3	0.00
169,715.30	3.25	3.25	0.00
165,604.20	3.43	3.43	0.00
159,474.30	3.5	3.5	0.00
152,282.20	3.94	3.94	0.00
145,725.10	3.92	3.92	0.00
143,092.00	3.46	3.46	0.00
136,684.70	3.3	3.3	0.00
131,329.00	2.8	2.8	0.00

River Station	Existing Conditions Channel Velocity (ft/s)	Proposed Conditions Channel Velocity (ft/s)	Channel Velocity WSEL (ft/s)
130,048.30	3.33	3.33	0.00
129,598.50	3.38	3.38	0.00
128,597.70	3.27	3.27	0.00
127,887.80	2.86	2.86	0.00
126,833.80	3.68	3.68	0.00
120,463.40	3.24	3.24	0.00
116,704.60	2.85	2.85	0.00
113,664.90	2.94	2.94	0.00
102,513.10	2.37	2.37	0.00
96,764.34	2.47	2.47	0.00
91,471.59	3.13	3.13	0.00
87,845.22	3.53	3.53	0.00
84,697.10	2.81	2.81	0.00
82,907.93	2.93	2.93	0.00
82,530.34	3.31	3.31	0.00
80,892.66	3.67	3.67	0.00
72,649.60	3.39	3.39	0.00
68,849.01	4.39	4.39	0.00
66,026.00	3.72	3.72	0.00
62,557.00	3.42	3.42	0.00
58,377.00	3.53	3.53	0.00
55,599.00	3.9	3.9	0.00
53,486.00	3.94	3.94	0.00
51,424.00	3.61	3.61	0.00
48,402.00	4.62	4.62	0.00
45,585.00	3.79	3.79	0.00
41,087.00	3.52	3.52	0.00
37,527.00	2.96	2.96	0.00
32,269.00	3.61	3.61	0.00
27,098.00	4.56	4.56	0.00
26,001.00	4.25	4.25	0.00
25,641.00	4.00	4.00	0.00

River Station	Existing Conditions Channel Velocity (ft/s)	Proposed Conditions Channel Velocity (ft/s)	Channel Velocity WSEL (ft/s)
25,070.00	3.68	3.68	0.00
23,412.00	3.82	3.82	0.00
20,788.00	3.48	3.48	0.00
18,177.00	4.23	4.23	0.00
15,562.00	4.7	4.7	0.00
14,131.00	4.81	4.81	0.00
12,687.00	5.6	5.6	0.00
9,604.00	0.14	0.07	0.07

Table 16: Key Analysis Points for Results Reporting

Key Analysis Point	Location	HEC-RAS Cross-Section
1	Rosharon Gage	308,583.5
2	Upstream of State Road – 35, near West Columbia	179,155.4
3	Downstream of FM-521 (approximately 1,711 ft. upstream of Brazoria Reservoir Diversion [Inflow])	129,598.5
4	Brazoria Discharge upstream of FM-2004	82,907.9
5	Last RAS Cross Section (approximately 9,604 feet from the mouth of the Gulf of Mexico)	9,604.0

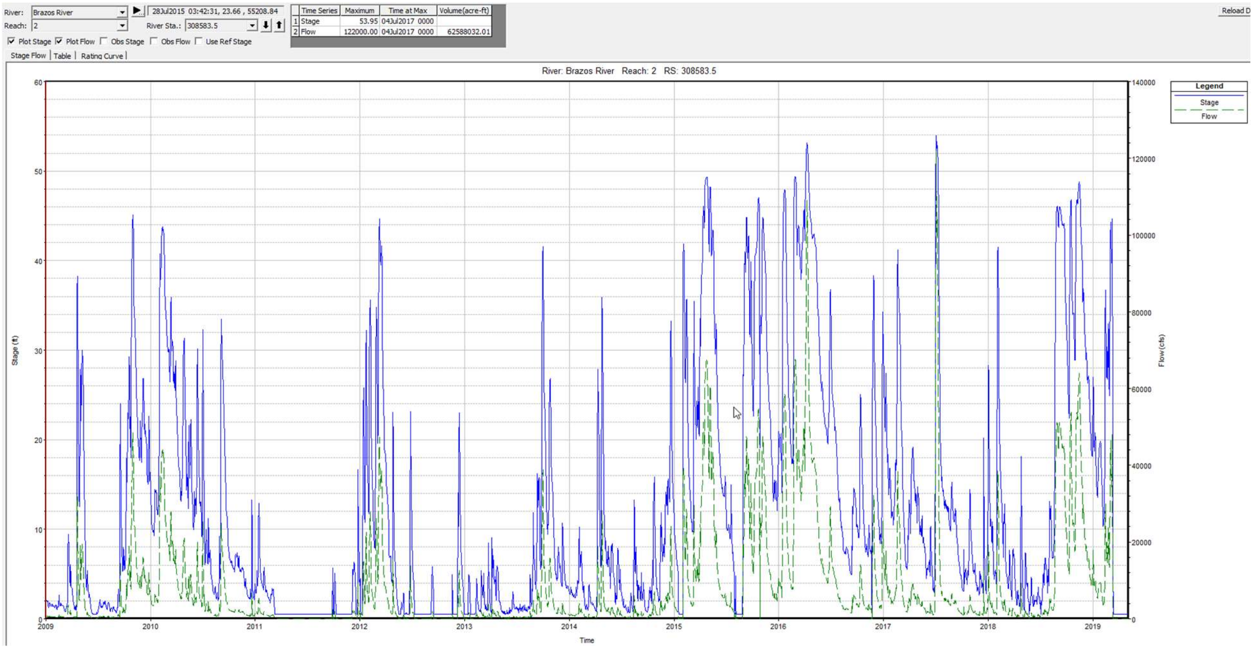


Figure 63 Proposed Stage and Flow Hydrographs at Rosharon Gage During 10-1/2 - Year Analysis Period

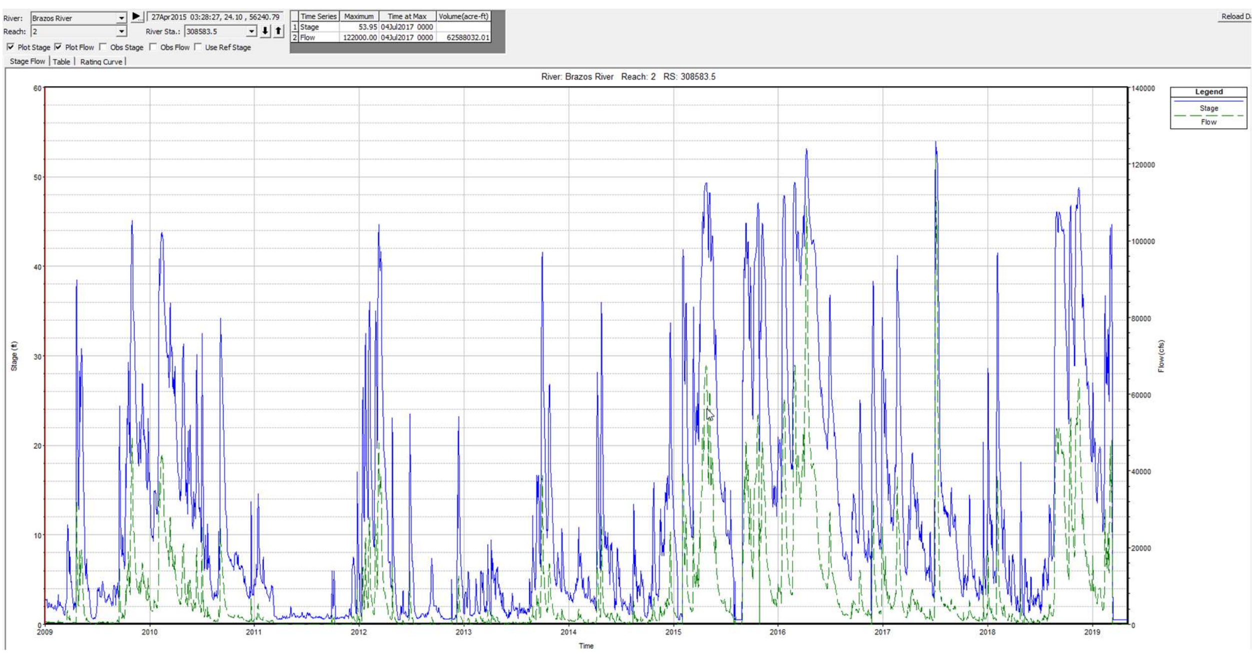


Figure 64 Existing Stage and Flow Hydrographs at Rosharon Gage During 10-1/2 - Year Analysis Period

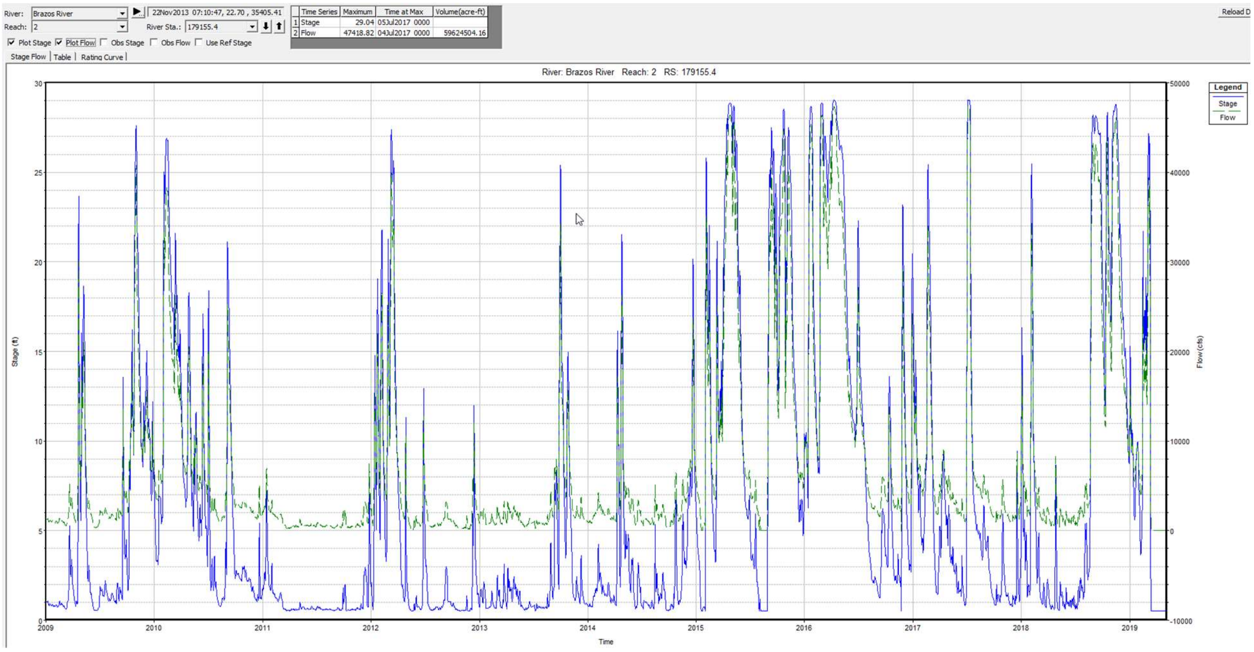


Figure 65: Proposed Stage and Flow Hydrographs upstream of State Road – 35, near West Columbia During 10-1/2 - Year Analysis Period

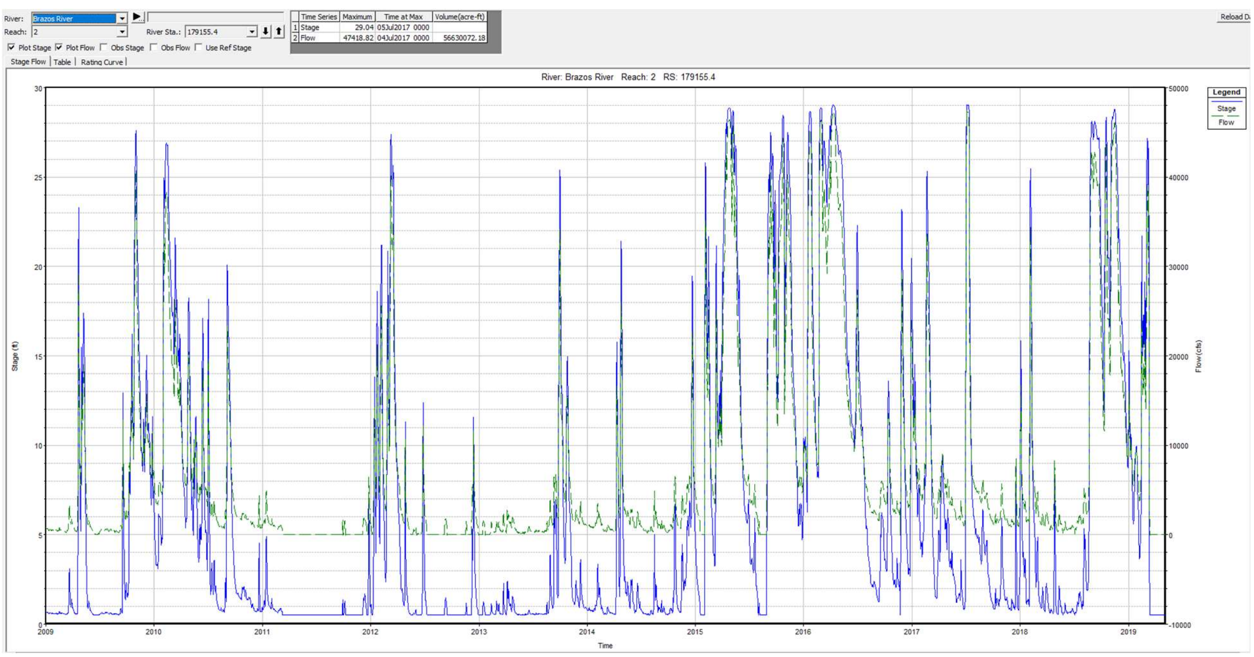


Figure 66: Existing Stage and Flow Hydrographs upstream of State Road – 35, near West Columbia During 10-1/2 - Year Analysis Period

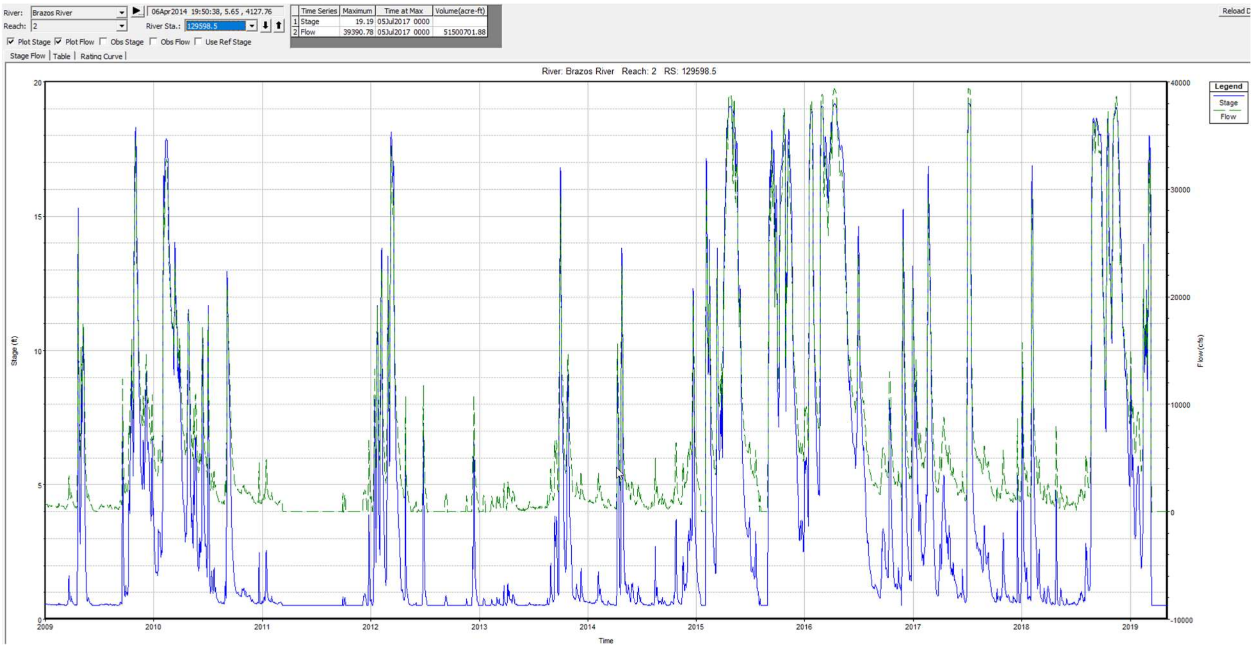


Figure 67 Proposed Stage and Flow Hydrographs Downstream of FM-521, During 10-1/2 - Year Analysis Period

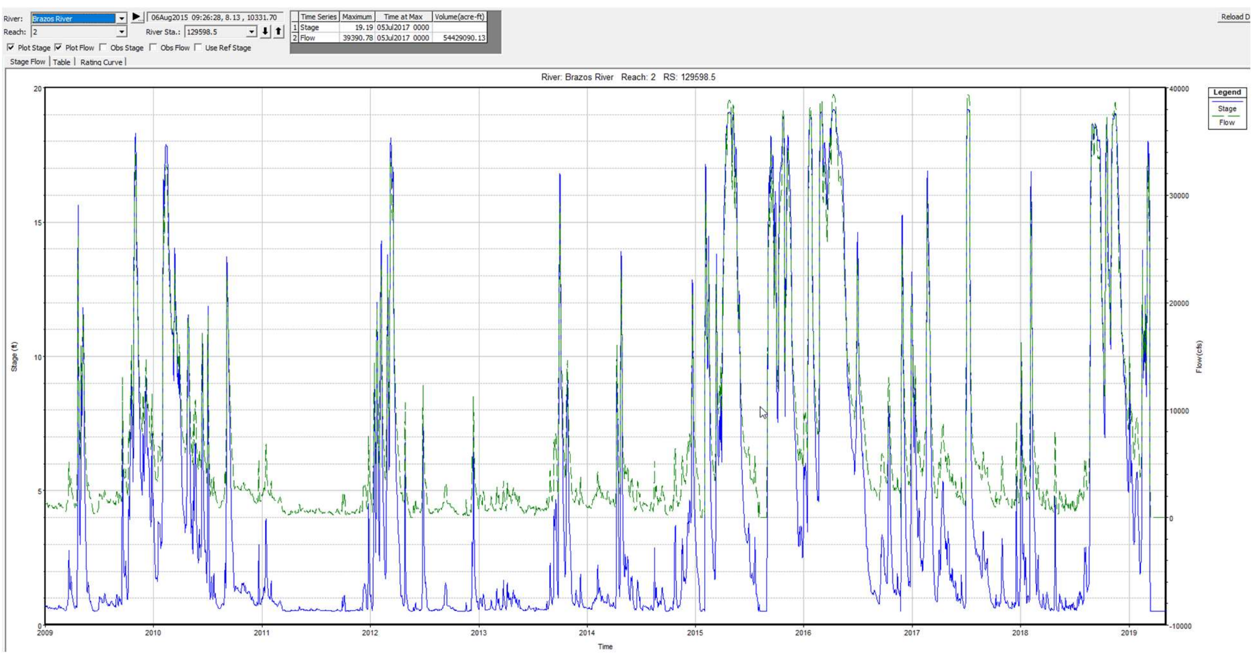


Figure 68: Existing Stage and Flow Hydrographs Downstream of FM-521, During 10-1/2 - Year Analysis Period

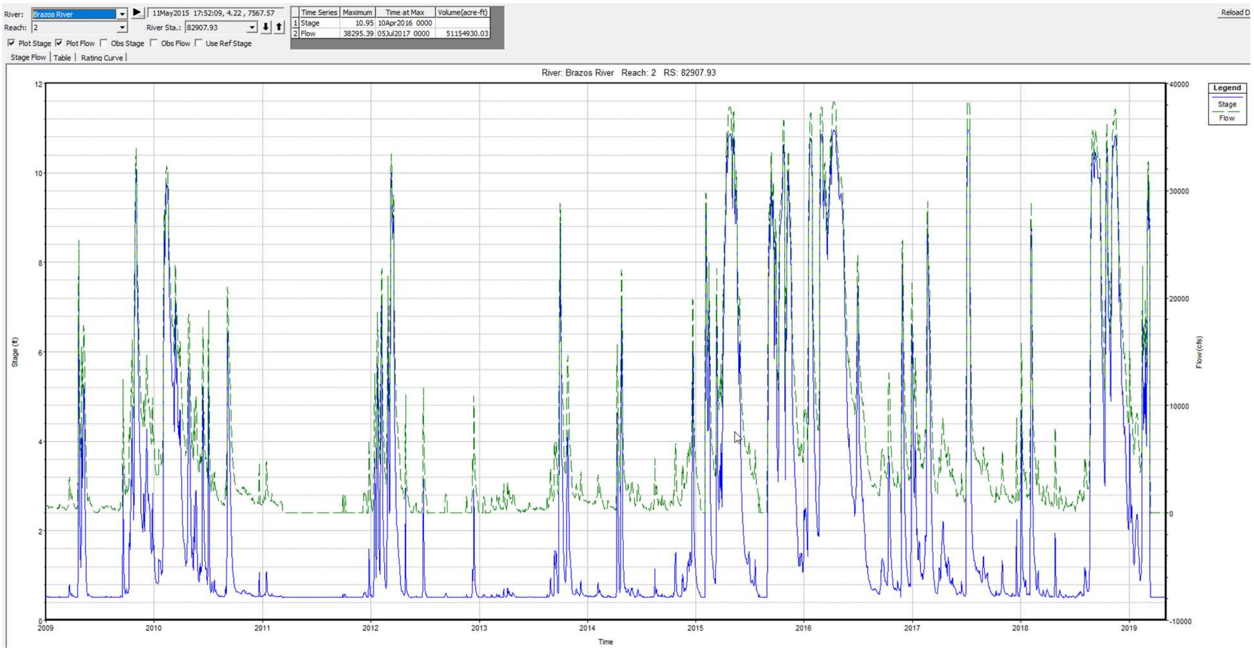


Figure 69: Proposed Stage and Flow Hydrographs Upstream of FM-2004, During 10-1/2 - Year Analysis Period

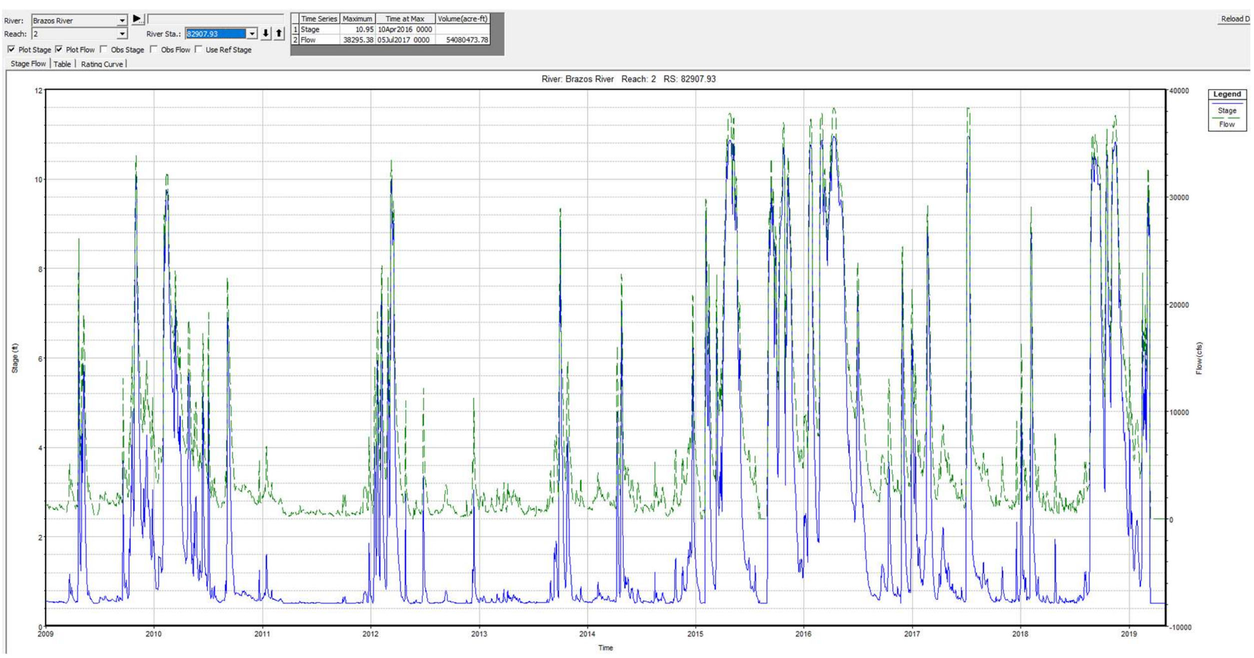


Figure 70: Existing Stage and Flow Hydrographs Upstream of FM-2004, During 10-1/2 - Year Analysis Period

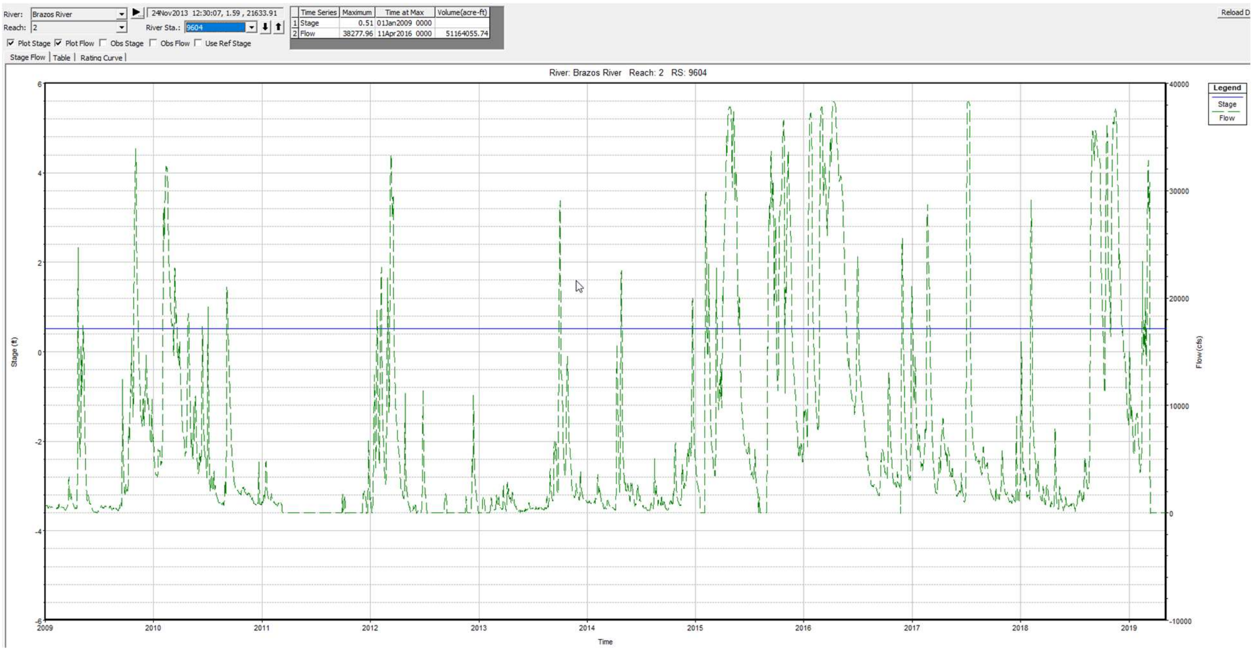


Figure 71: Proposed Stage and Flow Hydrographs at the Last RAS Cross Section approximately 9,604 ft. from the Gulf of Mexico, During 10-1/2 - Year Analysis Period

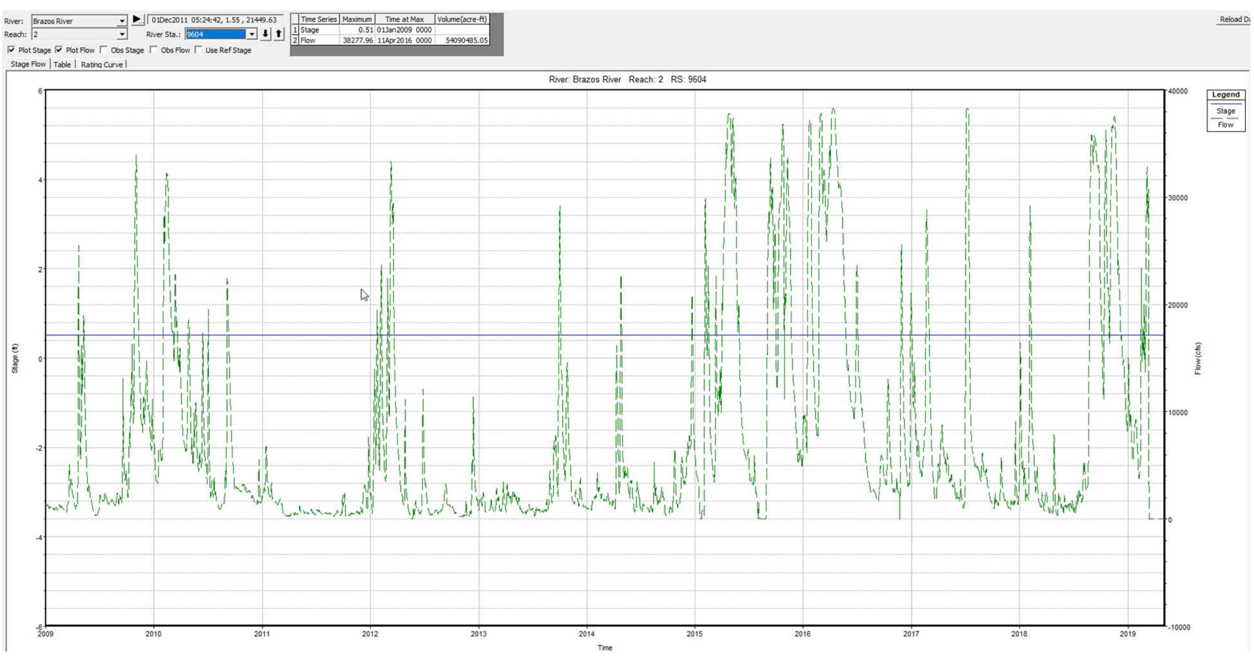


Figure 72: Existing Stage and Flow Hydrographs at the Last RAS Cross Section approximately 9,604 ft. from the Gulf of Mexico, During 10-1/2 - Year Analysis Period

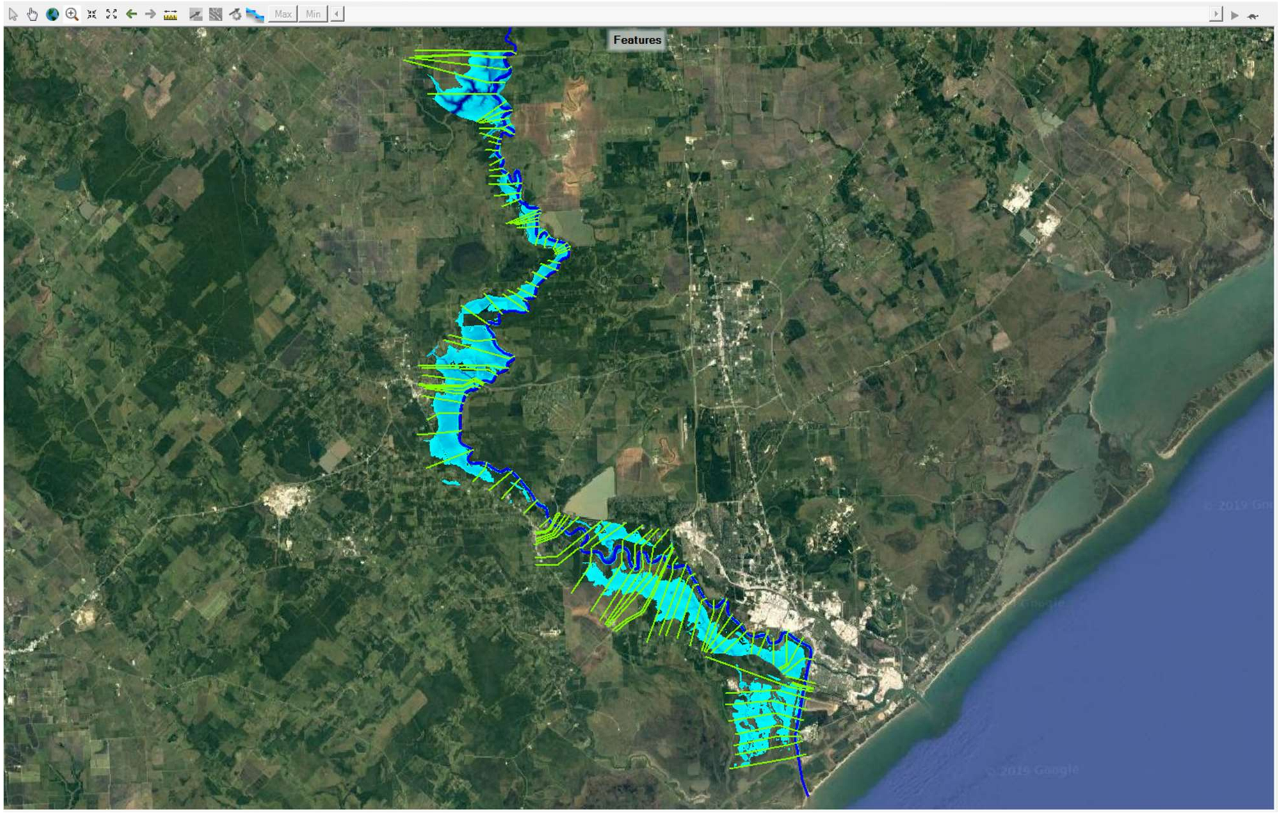


Figure 73: Maximum Flood Inundation Results of Proposed Conditions during the 10-1/2 Year Analysis Period

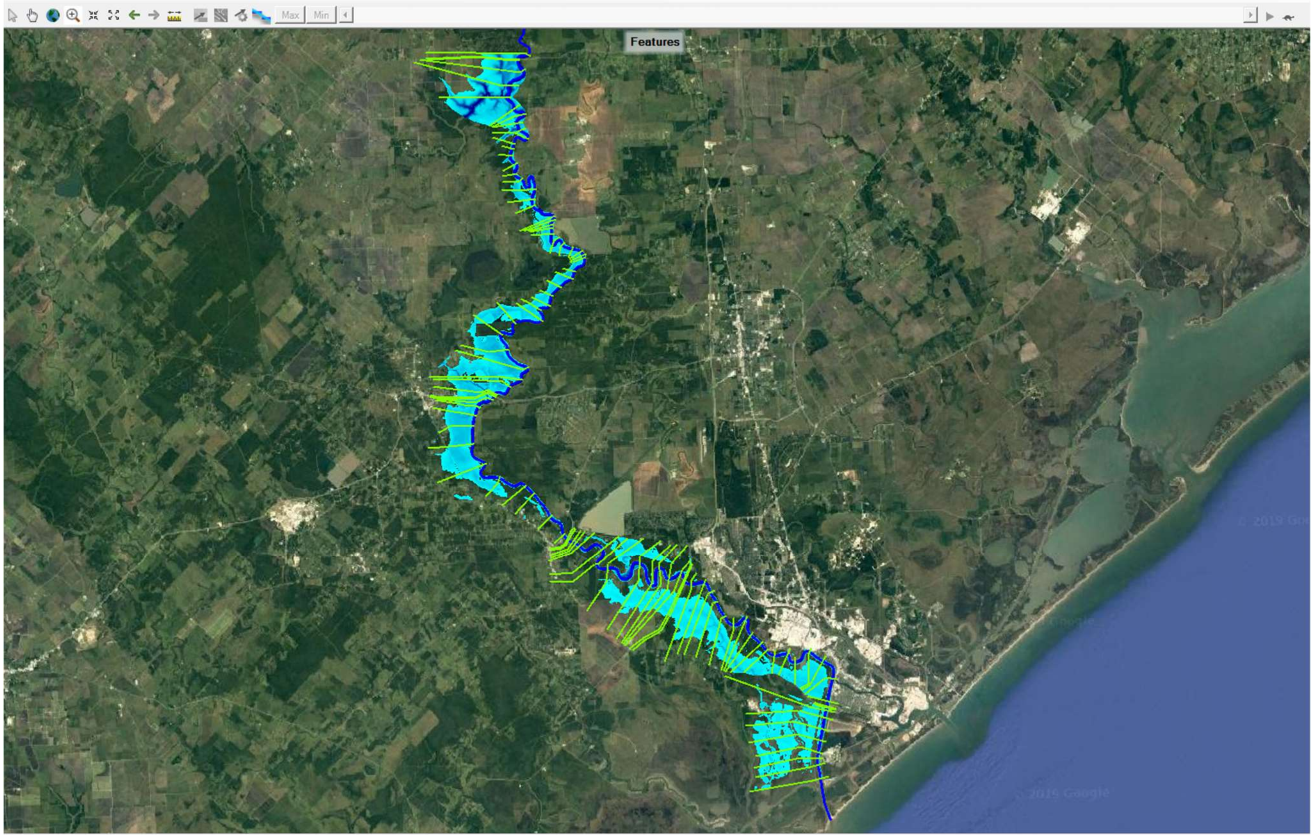


Figure 74: Maximum Flood Inundation Results of Existing Conditions during the 10-1/2 Year Analysis Period

5.4.4 Oyster Creek Hydrology

As shown on Figure 75 depicts the Oyster Creek watershed, which is located directly adjacent to and east of the portion of the Brazos River watershed modeled in this study. Discharges from the Existing Harris Reservoir and Proposed Harris Reservoir Expansion enter Oyster Creek through a series of outfalls discussed further in Section 5.4.5. Discharges from both of these reservoirs enters Oyster Creek near the middle of the watershed or lower portion of the 133.3-square mile Middle Oyster Creek drainage area. The Oyster Creek watershed near the project vicinity is generally flat and undeveloped and similarly to the Brazos River significantly affected by tidal influence and backwater. While an upstream hydrologic model of Oyster Creek was available, hydrologic models of the Oyster Creek watershed were not available for the project study area due to the undeveloped condition of this portion of the watershed.

Figure 29 illustrates historical discharges from the Existing Harris Reservoir, which are expected to remain similar under proposed project conditions, future discharges from the Proposed Harris Reservoir expansion, and the combined total proposed discharges from the Existing Harris Reservoir and Proposed Harris Reservoir expansion. These discharges are based on results of the 10-1/2-year HEC-HMS analysis described in Section 5.4. As shown, total combined discharges into Oyster Creek are expected to increase from a typical range of 0 to 278 cfs under existing conditions to a range of 0 to 2,305 cfs under proposed conditions.

This level of increase in combined flows potentially could create hydromodification issues downstream along Oyster Creek. However, the proposed Oyster Creek bypass/outfall channel/stream restoration segment shown in yellow on Figure 22, will provide buffering storage and partially ameliorate the range of higher peak discharges and associated higher velocities into Oyster Creek associated with the Proposed Harris Reservoir expansion. Additionally, the upstream stream restoration for the portion of Oyster Creek receiving the Existing Harris Reservoir discharge provides additional flood plain storage as compared to existing conditions. The lower velocities and increased storage associated with the upstream stream restoration will further reduce peak flows and velocities downstream on Oyster Creek. Potential for erosion exists at the inlet into the bypass/outfall channel/stream restoration segment shown in yellow on Figure 22 and at the outlet from this segment back into Oyster Creek. Additional stream restoration downstream of the point of discharge into Oyster Creek may be needed for discharges in the range of assumed operational parameters.

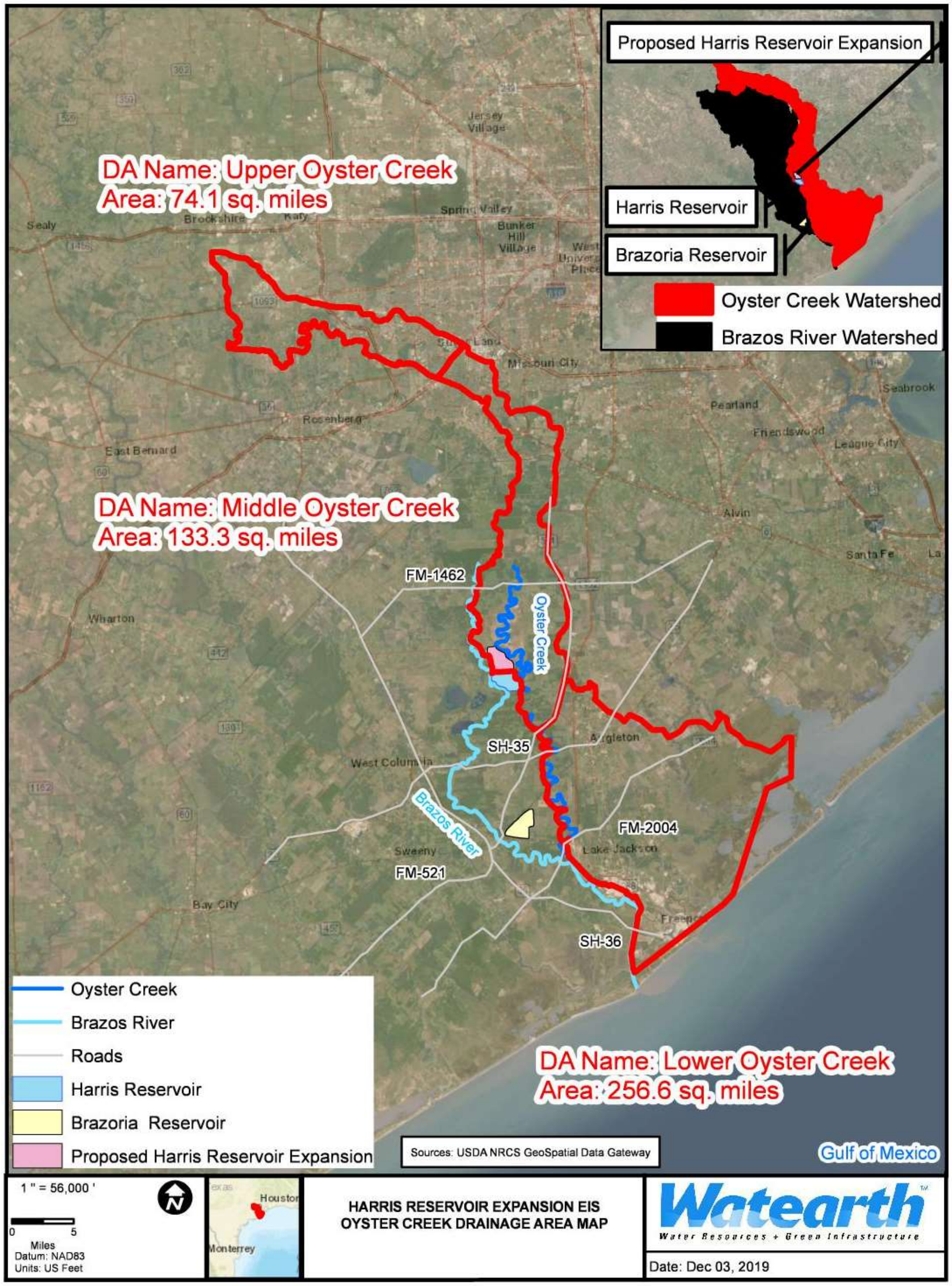


Figure 75 Oyster Creek Drainage Map for HEC-HMS

5.4.5 Oyster Creek Hydraulics

As part of the proposed expansion project, Oyster Creek is planned to be enhanced with three projects (Figure 76). These projects are planned to improve the flood capacity and provide restoration and enrichment to the riparian habitat along the three project lengths. Geomorphic design principles were utilized to provide a bankfull benching creating floodplain storage, riparian habitat, and channel conveyance to accommodate the proposed reservoir outlet flow in to Oyster Creek.

Project 1 is approximately 3,600 feet long from STA 5+00 to STA 41+00 on an unnamed tributary north of the proposed project's northeast corner. It flows into Oyster Creek a short distance north of the northeast corner which is the start of Project 2. Project 2 is approximately 12,860 feet long from STA 41+00 to STA 169+60 and is in the main channel of Oyster Creek. Project 3 is an improved flood overflow channel that flows along the east side of the proposed reservoir until the overflow channel intersects again at approximate STA 254+00 with the main Oyster Creek channel and the proposed reservoir outlet channel. Additional stream restoration downstream of the point of discharge into Oyster Creek may be needed for discharges in the range of assumed operational parameters.

The OCNoRiseUpdate20DEC2019 RAS Model provided by Dow and developed by Jacobs was executed without changes. The model contained two proposed scenarios, one scenario with the Proposed Harris Reservoir Expansion as a blocked obstruction (i.e., affecting conveyance and flood plain storage) and one scenario, which included stream restoration modifications and channel improvements. The corrected effective, the proposed and the proposed with stream restoration modifications conditions-RAS models results yielded the cumulative volume of water between the model cross sections or what is considered loss of flood plain storage between the corrected effective (pre-project, or existing) and proposed conditions. From evaluation of the HEC-RAS model output it was estimated that there is a loss of 316 ac-ft and 263 acre-ft. of floodplain storage for the Oyster Creek Floodplain for the proposed channel improvements and the proposed channel improvements with stream restoration, etc. The results from the HEC-RAS models are summarized below in Table 17. The largest reported loss in floodplain storage column is considered to be the loss of flood plain storage for the project.

Table 17: Comparison Between Change of Floodplain storage between Existing Conditions vs. Proposed Conditions and Existing Conditions vs. Proposed Conditions with Stream Restoration Modifications.

River Station	**Volume (acre/ft)** Existing Conditions	**Volume (acre/ft)** Proposed Conditions	**Volume (acre/ft)** Proposed Conditions + **Stream Restoration Modifications**	**Δ Floodplain Storage (acre/ft)** Existing Conditions vs. Proposed Conditions	**Δ Floodplain Storage (acre/ft)** Existing Conditions vs. Proposed Conditions + **Stream Restoration Modifications**
69.9	103,892	103,577	103,630	-315	-263
69.72	100,529	100,214	100,267	-315	-263
68.56	96,664	96,349	96,402	-315	-262
67.62	92,522	92,210	92,263	-312	-259

River Station	Volume (acre/ft) Existing Conditions	Volume (acre/ft) Proposed Conditions	Volume (acre/ft) Proposed Conditions + **Stream Restoration Modifications**	Δ Floodplain Storage (acre/ft) Existing Conditions vs. Proposed Conditions	Δ Floodplain Storage (acre/ft) Existing Conditions vs. Proposed Conditions + **Stream Restoration Modifications**
66.85	90,347	90,038	90,090	-309	-257
65.35	81,616	81,332	81,380	-284	-236
64.6	79,782	79,506	79,553	-276	-229
63.9	78,106	77,838	77,884	-268	-222
63.19	70,410	70,179	70,220	-231	-190
62.84	67,926	67,708	67,747	-218	-179
61.87	60,216	60,038	60,069	-178	-147
61.43	57,298	57,122	57,150	-176	-149
60.49	51,054	50,937	50,956	-117	-98
60.48	50,939	50,823	50,842	-116	-97
60.47	50,749	50,642	50,661	-107	-87
59.85	49,690	49,629	49,646	-61	-44
59.17	43,547	43,695	43,695	148	148
58.67	39,996	40,235	40,332	239	336
56.05	31,937	32,263	32,573	326	636
55.6	27,689	28,029	28,114	340	425
55.3	25,886	26,181	26,181	295	295
53.49	14,982	14,984	14,984	2	2
53.48	14,794	14,797	14,797	3	3
53.47	14,746	14,745	14,745	-1	-1
53.46	14,586	14,584	14,584	-2	-1
52.75	5,621	5,621	5,621	0	0
50.3					

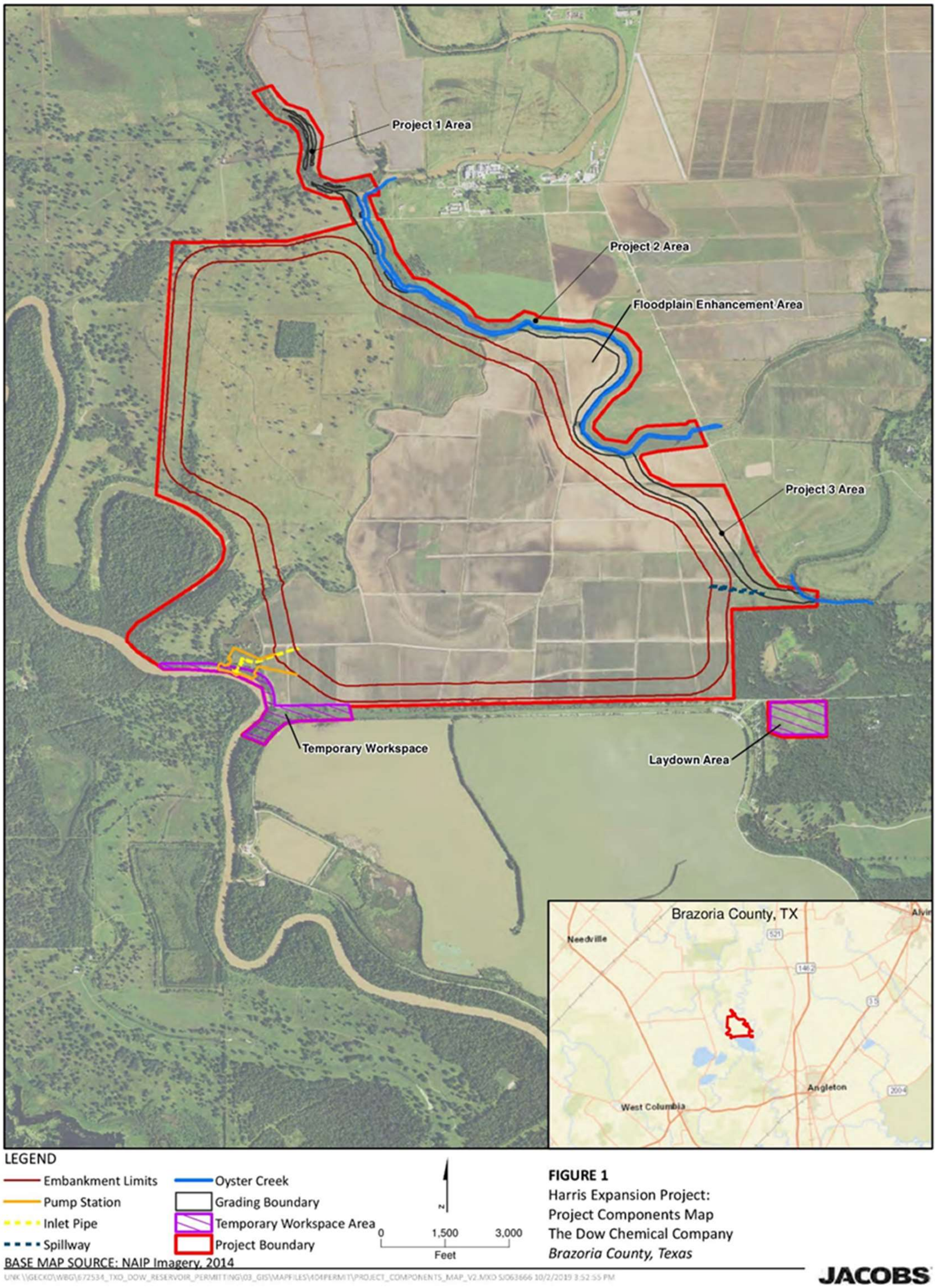


Figure 76 Oyster Creek Floodplain Enhancements

6 Analysis

This section is comprised of quantitative and qualitative analysis of the Proposed Project through the analysis horizon of 50 years (year 2072). The hydrologic, hydraulic, and reservoir operational models provide near term analysis of water supply needs and instream flow alternations. Analysis to long-term changes in the project vicinity to precipitation, temperature, and sea level rise are based on predictive models by agencies such as the USACE, NOAA, and USGS. The combination of these various analysis points is summarized in the Conclusions section below.

6.1 Evaporation Analysis

6.1.1 Introduction

The climatic process where moisture is removed from any water surface and transported as vapor away from the source by wind is called evaporation. Substantial amounts of water can be evaporated from lakes, reservoirs, rivers, streams, bayous, and canals. During wet periods when normal to above normal rainfall, climatic effects minimize evaporation. On the other hand, in dry periods evaporation rates are higher and the amount of evaporation loss becomes a very important item in a water supply analysis.

Evaporation rates in Texas vary during the year with approximately 86% of the evaporation occurring in the six-month period from May through October, which corresponds to lowest rainfall and full sun conditions (TWDB, 2018). Median gross evaporation for the project area is approximately 47.8 inches but can vary from 35 inches to 58 inches (Figure 78). The evaporation from the current and proposed storage reservoirs can present a substantial loss during a dry period.

6.1.2 Data Collection

The TWDB compiles water related data from a number of sources for water managers to estimate evaporation rates, one of the largest sources of water loss from Texas reservoirs (TWDB, 2018). The data in this set is from nearly 4,000 gauging stations and includes precipitation data primarily collected from NOAA's National Weather Service (NWS). In addition, TWDB collects data from pan evaporation sites throughout Texas and from surrounding states from the NOAA-NWS sites as well as other cooperators, which include lake owners and operators, government agencies, research institutions, and other public and private entities.

The Proposed Project generally falls within Quad 812 (Figure 77). Available data includes monthly precipitation from January 1940 through December 2018 and gross evaporation from January 1954 through December 2018 (Figure 78). The graph shows that the trend is towards higher evaporation and precipitation rates, however, the evaporation rate has a steeper trend line than precipitation, which indicates a potential for the evaporation rate to exceed the precipitation rate within the project horizon.

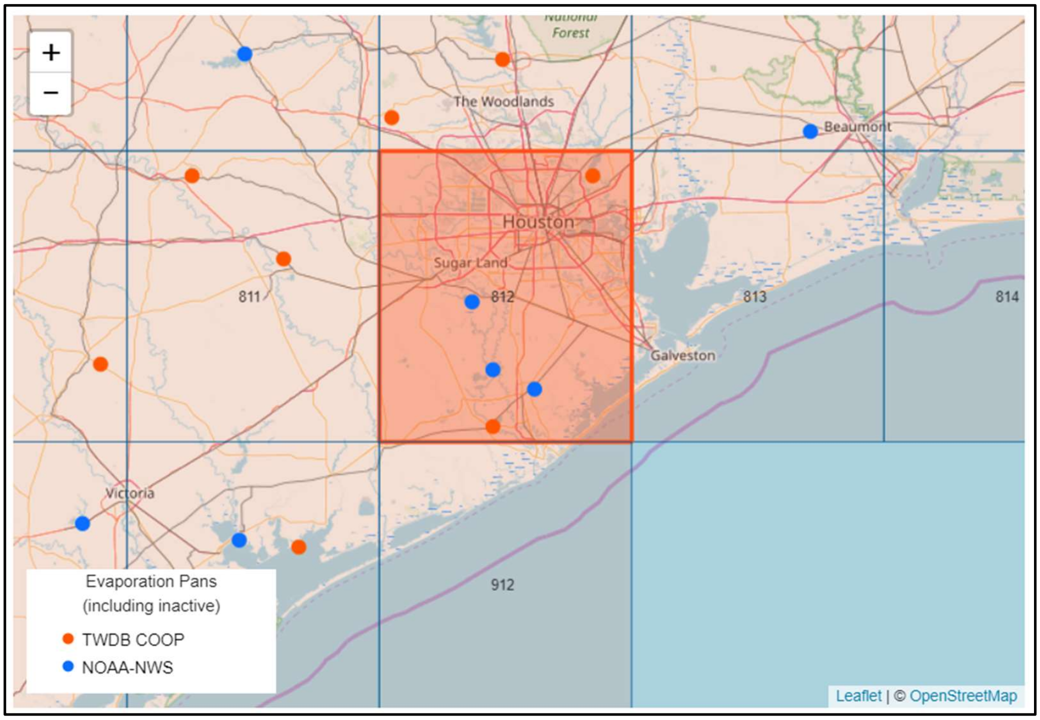


Figure 77: Quad 812 of the Texas Water Development Board Water Data

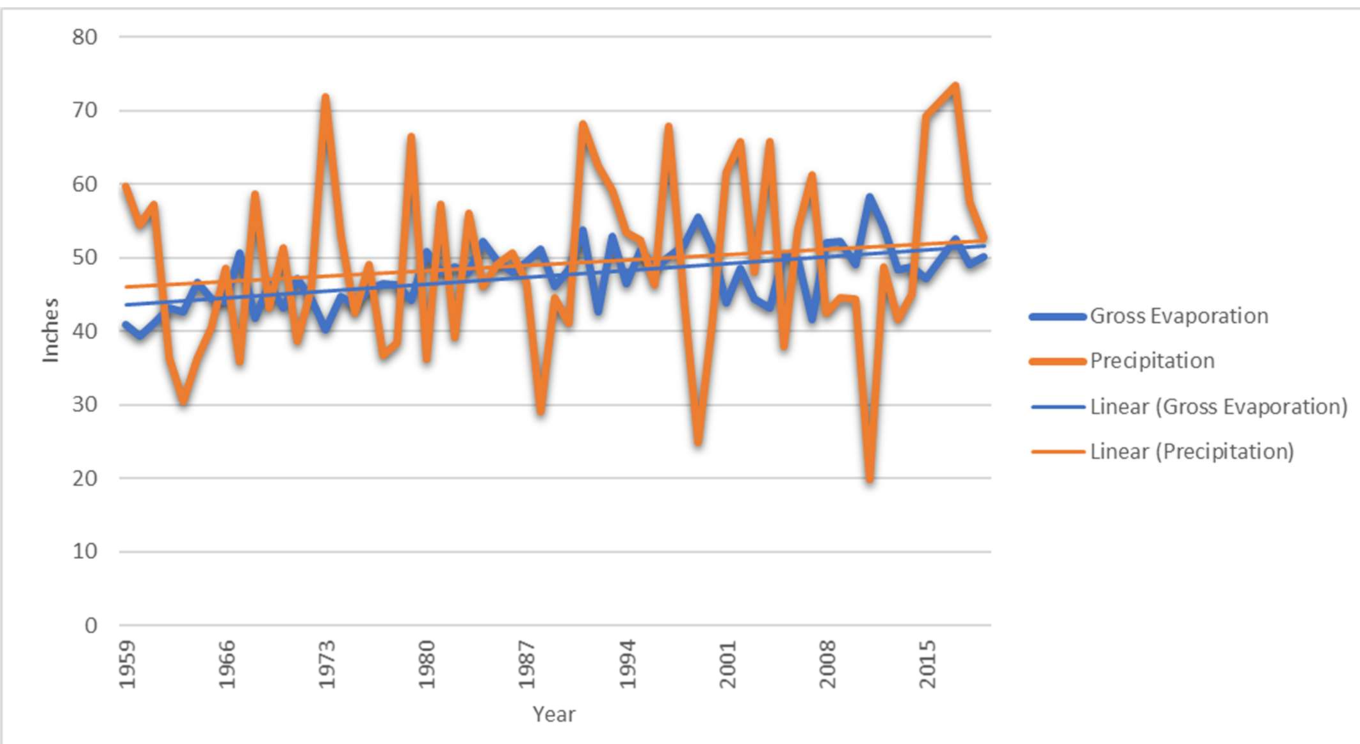


Figure 78: Quad 812 Gross Evaporation Versus Precipitation

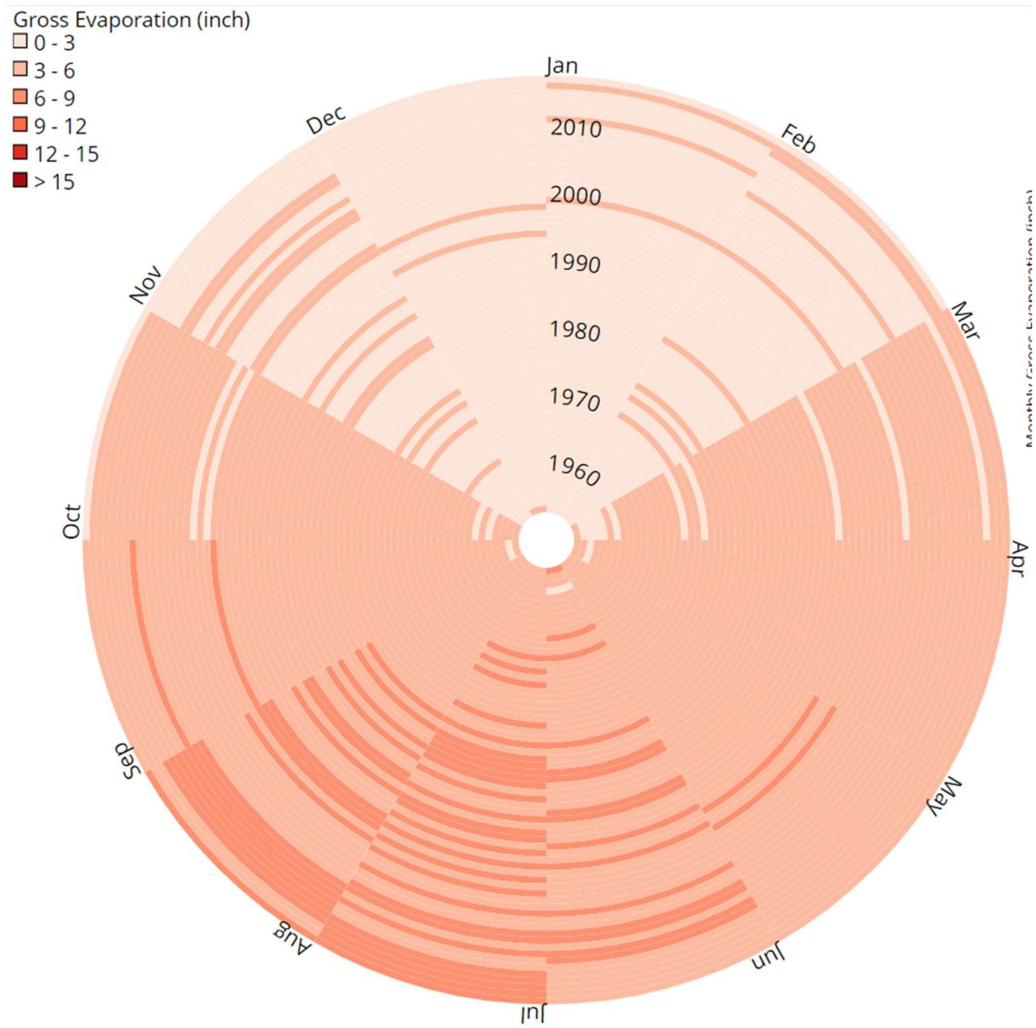


Figure 79: Annual Gross Evaporation Wheel

As shown in Figure 78, net evaporation (trend line) on average is slightly higher than annual precipitation (approximately 1.0 inches more evaporation than rainfall) (TWDB, 2018). In addition, the high variability from month to month and year to year makes long term planning more difficult. For example, the highest net evaporation occurred during August 2017, which corresponds with the majority of rainfall with Hurricane Harvey, when there was 33.5 inches of rain but only 5.3 inches of evaporation. In 1973, the yearly precipitation exceeded evaporation by 31.7 inches compared to in 2011 when there was a net evaporation of 38.4 inches. In 1973, the Freeport, Texas area experienced Tropical Storm Delia, which made landfall twice and dropped significant amounts of rainfall along the coastline during its erratic path in the Gulf of Mexico.

6.1.3 Analysis

Dow currently assumes an approximately 25-percent annual loss due to evaporation in the two-reservoir system. This may be underestimated as the current average annual rainfall for Freeport, TX is 52 inches; evaporation can vary from 35 inches to 58 inches, as described above. During wet conditions, precipitation and high humidity retard evaporation. During drought conditions evaporation rates increase and the lack of rainfall results in less natural make up water. Evaporation rates are a function of surface area versus depth/volume, which results in shallow reservoirs with large surface area being more susceptible to evaporation during drought periods than deep reservoirs with small surface area with the same volume of water.

Dow's existing two-reservoir system are typical of Gulf Coast reservoirs that are relatively shallow compared to surface area. Evaporation rates during normal weather patterns (average annual rainfall and median gross pond evaporation) are almost equal to rainfall rates so there would be negligible water loss during normal years. This is due in part to the natural refill by rainfall capture directly into the reservoir. The normal weather evaporation rate would balance with precipitation for the existing conditions and under the Proposed Project conditions.

Under drought conditions (lower than normal rainfall), the reservoirs would experience maximum evaporation and there would potentially not be makeup water depending on river conditions and precipitation within the watershed. Assuming half the normal precipitation and maximum evaporation, net evaporation (NE=E-R) would be approximately 31 inches. The existing and proposed reservoirs surface area being approximately 5,500 ac. That could result in over a 14,000 AF loss during the most critical periods.

Under wet weather conditions (higher than normal rainfall), the reservoirs would capture precipitation, experience reduced evaporation, and Dow would be able to refill the reservoirs from river pump stations. Capture would be limited to the total effective capacity of each of the reservoirs as well as considerations as discussed below such as sediment loads in the river and wind restrictions for embankment protections.

6.2 Hydromodification of Oyster Creek

Oyster Creek historically had a greater drainage area but 63-percent of the drainage area was diverted by a canal at the Sienna Plantation in Missouri City, Texas to the Brazos River (as measured at the downstream end of Project 2). The analysis of stream system is also limited by the fact that there is a lack of availability of existing hydraulic models for the project reaches but the Geomorphic Assessment approach using Rosgen Level I, II, and III stream assessment that was used to classify the stream is a proven process to establish a stable channel for the long term.

The proposed water storage/floodplain overflow feature near the end of Project 2 and the start of Project 3 is critical to the system. This allows large flows to bypass the oxbow in Oyster Creek and decreasing the velocities which could lead to increased erosion of the agricultural fields in the oxbow area. This and all the features must be maintained for the long-term viability of benefits created by the floodplain storage, riparian habitat and channel conveyance. A maintenance plan should be developed and implemented by Dow for the project reaches.

In coordination with SWCA, the following information and analysis is provided regarding geomorphic impacts of the reservoir operations on Oyster Creek from the Proposed Project (Forbes, 2020).

SWCA reviewed the referenced report with a focus on fluvial geomorphology and hydromodification. SWCA has concerns that the operational discharge from the new reservoir may have significant impacts to the stability and ecological integrity of the receiving and downstream reach of Oyster Creek. As stated in Section 5.4.4 of the Watearth report, "total combined discharges into Oyster Creek are expected to increase from a typical range of 0 to 278 cubic feet per second (cfs) under existing conditions to a range of 0 to 2,305 cfs under proposed conditions." According to Jacobs' Memorandum, the drainage area to Oyster Creek at the point of discharge from the proposed new reservoir expansion is 42.55 square miles (mi^2). According to the regional hydraulic geometry curves developed for the Texas Gulf Coastal Plains by the Harris County Flood Control District (AMEC, 2011), bankfull (channel-forming) discharge can be estimated from the drainage area using the following equation:

$$Q_{BKF} = 45.76 \times DA^{0.65}$$

where Q_{BKF} = bankfull discharge (cfs)

DA = drainage area (mi2)

A drainage area of 42.44 mi2 corresponds to a bankfull discharge of 524 cfs, which means that the maximum discharge from the reservoir would be approximately 4.4 times larger than the bankfull discharge. Sustained discharges to Oyster Creek at flows near or above than bankfull discharge are now known to increase the erosion of the receiving stream, as described below.

A study by (Bledsoe, 2002) suggests that sustained discharges from standard, peak-control (limiting discharge rates to pre-development peak flow – optimizes flood control) and erosion-control (much lower maximum detention discharges – supposedly optimizes erosion protection of downstream receiving streams) managed detention basins typically result in channel instability due to the an increase in frequency and duration of critical shear stress exceedance. Other studies examined the channel erosion from two-year (which is just slightly higher than bankfull discharge) control detention discharge management, which is the most common form of erosion-control detention discharge method currently in use (McCuen & Moglen, 1988; MacRae, 1993; MacRae, 1997). These studies similarly suggest that two-year control detention discharges does not reduce channel erosion and actually increases the amount of time the channel is exposed to erosive flows. The cause of this excessive channel erosion is described as follows: Two-year control often releases water above the critical discharge for effective work (Qcrt) for a longer period of time, which results in greater transport of sediment and bedload. MacRae also documented that two-year control causes channel expansion by as much as three times the predevelopment condition. In addition, many communities have provided anecdotal evidence that two-year control has failed to protect downstream channels from erosion. The primary reason is that while the magnitude of the peak discharge is unchanged from pre to post development under two-year control, the duration and frequency of erosive flows sharply increases. As a result, "effective work" on the channel is shifted to smaller runoff events that range from the half-year event up to the 1.5-year runoff event (MacRae, An alternative design approach for the control of stream erosion potential in urbanizing watersheds, 1993).

In conclusion, any traditional, sustained discharge from the proposed new reservoir will likely result in significant downstream erosion of Oyster Creek. SWCA recommends that a discharge operation plan be developed for the new reservoir that minimizes the potential for downstream erosion of Oyster Creek.

MacRae ((1993; 1997)) presented a promising framework for achieving receiving stream channel stability and water quality objectives in conjunction with reservoir discharge operations that might be appropriate for the proposed new reservoir. The framework, termed Distributed Runoff Control, includes designing detention discharge to emulate both the shape and magnitude of the pre-development hydrograph over a range of geomorphically important flows. It involves complex field assessments and modeling to determine the hydraulic stress and erosion potential of bank materials. The criteria states that channel erosion is minimized if the erosion potential of the channel boundary materials is maintained constant to predevelopment conditions over the range of available flows, such that the channel is just able to move the dominant particle size of the bedload. This Canadian method holds great promise but would require considerable field work at the site and it has yet to be tested on streams in the Texas Gulf Coastal region.

6.3 Sedimentation Analysis for Reservoirs, Brazos River, and Oyster Creek

6.3.1 Existing Reservoirs and Brazos River

Sediment loads and corresponding impacts on existing reservoir effective storage volumes is discussed in Section 3.5. Effective storage volumes for Harris and Brazoria Reservoirs is based on the Dow USACE application of 7,000 AF and 21,000 AF, respectively, for a combined existing effective water storage volume of 28,000 AF. This is at least a 4,000 AF loss of storage due to sedimentation during the nearly 60 years of operation of the two reservoirs. Based on a linear calculation of original design volume and surveyed volume in 1990, the effective combined existing storage could be as low as 18,250 AF. Dow reported periodic sediment removal by dewatering the existing Harris reservoir and removing sediment by a bulldozer however the frequency of past sediment removal and future maintenance at the two current reservoirs was not provided. They also reported in their reply to questions concerning the "Dow Water Rights and Supply – Fast Facts and Information" document that Dow has a permit authorizing dredging of solids from the reservoirs with specified, limited releases to the Brazos River under certain river flow conditions.

Dow also indicated they have concerns with embankment stability if dredging was performed. But there is a possibility to dredge these reservoirs back to their original authorized capacity with the modern equipment that could be used with global positioning systems (GPS) that would control location and depth of dredging. Dredging to original or deeper contours could increase available water but would not increase reservoir surface area where the evaporation occurs.

Without a more recent survey of the existing reservoirs, the actual effective storage volume could range from 18,000 AF to 28,000 AF, as described above for different sedimentation rate calculations. Due to the relatively high sands and fine sediment loads in the Brazos River, storage volume loss due to sedimentation for the Proposed Project as well as the existing reservoirs could be a significant issue during the 50-year planning horizon if not addressed by operation and maintenance plans and potentially results in less than the 180-day water storage volume which is the project purpose. Currently provided documentation does not indicate if there is an operational restriction on pumping high sediment load water from the Brazos River into any of the reservoirs and/or plans to remove accumulated sediments on a regular basis to maintain authorized reservoir volumes. A requirement to develop an O&M plan for these reservoirs could be a condition of the permit.

6.3.2 Proposed Project

The Proposed Project would be subject to the same sedimentation rates experienced by the existing Harris and Brazoria Reservoirs. Operational restrictions for pumping for high sediment load periods and regular removal of accumulated sediments on a regular basis are the most reasonable methods for maintaining authorized reservoir volumes. The O&M plan can be a condition of the permit.

6.3.3 Oyster Creek

Oyster Creek's natural flow has been significantly curtailed by a flood control project near Sienna Plantation, which has resulted in very low to no flow conditions throughout the project area. In addition, the channel is highly incised, which has disconnected the creek from it's floodplain and may at least be in part a result of the flood control project and farming practices creating hydromodification and erosion. Repeated wet and dry conditions are more likely to create a hydromodification condition due to breaking down the soil structure. The section of Oyster Creek between the proposed reservoir outfall through the overflow channel and the existing Harris Reservoir outfall are at highest near-term risk for hydromodification due to the current nearly dry conditions except during high rain events.

6.4 Watershed Vulnerability and Floodplain Storage

As addressed above in Section 3, previous floodplain impacts were addressed by analyzing water surface elevation (WSEL) changes in the Brazos River and Oyster Creek. While Dow found there was no rise in either system directly downstream of the proposed project, they did not address the loss of floodplain storage due to the 2,000-ac off-channel impoundment facility located between Brazos River and Oyster Creek and across the shared 100-year floodplain. It does not appear Dow previously completed calculations for floodplain storage loss for the reservoir and/or the channel revisions.

The proposed reservoir embankment will be built to elevation 72.88 ft. from the natural ground elevation of approximately 40 ft. The natural ground east of the Brazos River and west of Oyster Creek is relatively flat, so the water from high flows from either the Brazos River and Oyster Creek would have been able to flow across that area (shared 100-year floodplain) and be stored until the Brazos River or Oyster Creek receded to allow the flood plain storage to safely flow downstream.

Also, to be considered is the planned three phased Oyster Creek enhancement project to improve the flood capacity and provide restoration and enrichment to the riparian habitat. Although the enhancement is planned to revegetate and stabilize the main Oyster Creek channel as part of Phase 2, it will not totally make up the flood plain storage diminished by the proposed reservoir.

Phase 3 is an overflow channel that flows along the east side of the proposed reservoir which shortens the water flow path by cutting off an Oyster Creek main channel ox bow. The channel overflow weir is set at the 25-year discharge elevation. This will allow the higher peak discharges to flow into Phase 3, thus shorting the discharge travel distance (cutting off flow through the ox bow channel to the east) and timing of the water getting downstream.

6.4.1 Floodplain Storage Volume Loss Analysis

The volume of storage above natural ground eliminated by the originally proposed reservoir is 315 AF across the shared 100-year floodplain for both Brazos River and Oyster Creek. The revised proposed stream restoration and overflow channel results in 263 AF loss of floodplain storage across the shared 100-year floodplain. This loss of flood plain storage volume is due to volume taken up by reservoir and slight decreases in 100-year WSEL. This loss of flood plain storage volume could lead to increased peak flows downstream of the project. For purposes of this analysis, the revised proposed design is used with the 263 AF loss of floodplain storage.

The loss of this floodplain storage may or may not change the water elevations downstream of the reservoir (because of the relative flat floodplain) but will change the timing of that water arriving at downstream locations. Because the water cannot be stored in the proposed reservoir location, it will be forced to flow downstream arriving at the downstream locations earlier than it would have if the proposed reservoir had not been built. Additional analysis of the change in timing and impacts to Oyster Creek downstream of the proposed project are underway but not completed as part of this report.

6.5 Relative Sea Level Rise Analysis

An increase in the sea level water surface can have the same effect as the saltwater wedge moving upstream during a drought that is discussed in next section. As the sea level rises the river flow will have to be greater that the current 1,750 cfs now required to allow Dow to pump the fresh water from the river into Brazoria Reservoir at the maximum pump capacity. The sea level rise would also require a greater river flow than currently required at the existing Harris and proposed expansion. This could greatly limit the availability of Dow to get fresh water with their water rights.

6.6 Salinity Analysis

6.6.1 Introduction

Dow's Brazoria Reservoir intake pumps (river mile 25) cannot be operated when the water in Brazos River chloride concentration reaches or exceeds 500 mg/l. The interface between the fresh river water and the saltwater is referred to as the saltwater wedge and denotes the extent of the Brazos River estuary, which ranges from river mile 15 to 43 and potentially up to river mile 49 depending on river flow and tides. Dow reported efforts to correlate river flows at the USGS Rosharon gage with location of the salt wedge, which determines if withdrawals are restricted at the Brazoria Reservoir. They found that when river flows are greater than 1700 cfs at the USGS Rosharon gage, the salt wedge is downstream of the Brazoria Reservoirs pumps and there are no restrictions to filling the reservoir. River flow between 1700 cfs to 600 cfs at Rosharon gage may allow limited pumping at the Brazoria Reservoir intake. Below 600 cfs, the intakes cannot be used at all because of the saltwater wedge.

Dow's existing Harris Reservoir intake pumps (river mile 46) can be impacted by the salt wedge, which can extend up to river mile 49. Dow found they can operate the existing Harris Reservoir intake pumps at full capacity (approximately 290 cfs) as long as there is 400 cfs river flow at the Rosharon gage.

6.6.2 Saltwater Discharges

The inter-coastal barge canal crosses the Brazos River approximately 1.4 miles upstream of the current mouth of the River. The inter-coastal barge canal introduces saltwater into the Brazos River at that location.

Intermittent discharge of brine into the Brazos River from the Strategic Oil Reserve occurs at a location that is approximately 2.7 miles upstream of the mouth of the Brazos River.

Multiple discharges, containing elevated salts or seawater, are discharged to the Brazos River in an area are that is approximately 7 to 8 miles upstream of the mouth of the Brazos River. These discharge flows include:

- Discharge from the Dow Plant A storm water/wastewater canal at a location that is 7 miles upstream of the mouth of the Brazos River
- A Dow chemical discharge of approximately 40 MGD (61.7 cfs) of 7 to 8 % TDS wastewater at a location 8 miles upstream of the mouth of the Brazos River,
- Discharge of approximately 400,000 (888.9 cfs) to 500,000 (1,111.1 cfs) gpm of seawater used for one pass cooling at a location 8 miles upstream of the mouth of the Brazos River

Compared to the discharge of the Brazos River, 20,055 cfs as shown in Figure 6 and with tidal flows, the above process water discharges are unlikely to material impact the location of the salt wedge. The above volumes may contribute to increasing the localized salinity but not likely to materially impact the location of the salt wedge.

6.6.3 RSLR Salinity Analysis

The rising relative sea level is likely to result in long term viability of the Proposed Project due to low lying topography of the Gulf Coast. Due to variability of climate models, as shown in Figure 8 and Figure 9, the relative sea level is expected to rise from one to three feet over the next 50 years. With anticipated decreases in annual precipitation levels (Figure 4), although storm events are anticipated to be more frequent and higher intensity, natural stream flows could decrease and result in the regular position of the leading edge of the estuary being farther upstream compared to today.

6.7 Storm Surge Analysis

An increase in the local water surface and tide levels from tropical storms and hurricanes, referred to as storm surge, can have the same effect as the saltwater wedge moving upstream during a drought. Due to the estuary and associated salt wedge potentially reaching up to river mile 48, these storms could result in reduced water quality that exceeds the 500 mg/l of salts that Dow determined is in excess of the allowable for pumping into the plant near Freeport as well as pumping make up water into the existing Brazoria and Harris Reservoirs and the Proposed Project.

A recent example is during Hurricane Harvey the storm surge caused the water and tide levels over most of the Texas Coast to rise, with the highest storm tides observed at the Aransas National Wildlife Refuge where the storm surge levels were more than 12 feet above ground level. Storm surge in Port Lavaca was also more than 10 feet. Elsewhere across South Texas, storm tide levels ranged from near three to six feet above ground level at Seadrift, Port

O'Connor, Holiday Beach, Copano Bay, Port Aransas, and Bob Hall Pier (National Weather Service 2017).

Although storm surge may impede in Dow's ability to pump during the storm event, these storms are usually short in duration and Dow should be able to start utilizing their river water rights again as the storm surge recedes.

7 Conclusions

The purpose and need of the project is to provide 180 days of water storage for drought conditions as recommended by TCEQ for near term (assume 2022 for when Proposed Project reservoir could come online) and the long-term planning horizon (assumed to be 50 years, or year 2072). Dow currently needs 430 AF/day to meet their water supply needs, including the water supplied to others. Dow estimated the existing Harris and Brazoria Reservoirs as 28,000 AF. However, the estimate appears to be based on a survey conducted in 1990 and extrapolated with unknown assumptions. Dow reported that solids removal has occurred but the extent and frequency were unclear so under a worse-case scenario the existing reservoir capacity could be as low as 18,000 AF. When the proposed reservoir comes online in the near-term (e.g. 2022), the total storage capacity could meet the TCEQ recommendation for 180 days of storage is Dow's existing reservoirs do have a combined effective capacity of 28,000 AF per Dow's calculations.

Watearth has the following recommendations to confirm the project meets the Purpose and Need, as stated by Dow, for the near-term.

1. A survey of the existing reservoirs should be conducted to confirm capacity.
2. An Operation and Maintenance Plan should be required for the existing reservoirs, which have lost capacity due to sedimentation. The O&M Plan should require scheduled solids removal, which can be based on a number of different indicators such as a depth gage or probing.

Downstream of the Rosharon gage, no significant changes in flow are shown in the Brazos River despite assumed increased diversions at peak river flows/stages to maintain the additional storage associated with the Proposed Harris Reservoir Expansion.

These results and modeling assumptions show no significant changes to diversions into or discharges out of the Brazoria Reservoir into the Brazos River. Similarly, modeling assumptions and results show no significant changes to diversions into or discharges out of the Existing Harris Reservoir into Oyster Creek. The proposed diversion into the Proposed Harris Reservoir and associated discharge into Oyster Creek significantly increase peak flows out of the combined Harris Reservoir into Oyster Creek from an existing range of 0 to 278 cfs to a proposed range of 0 to 2,305 cfs.

Under the Proposed Project, Dow will conduct stream restoration of two segments upstream of the Proposed reservoir plus an overflow channel to receive the discharge. Watearth has the following recommendations.

1. Sustained discharge from the proposed new reservoir will likely result in significant downstream erosion of Oyster Creek. To address this, we recommend that a discharge operation plan (can be included in the overall O&M Plan) be developed for the new reservoir that minimizes the potential for downstream erosion of Oyster Creek.
2. Dow should note that FEMA may require a floodplain amendment due to the changes in the Oyster Creek and floodplain from the restoration project. This determination would be made by the local Flood Plain Administrator.

3. Erosion control is recommended at the inlet and outlet to the stream restoration section, especially for the Project 3 Overflow segment.
4. Additional stream restoration on Oyster Creek downstream of the point of discharge is recommended based on the assumed operational parameters of the Proposed Harris Reservoir Expansion.
5. Repeated filling and draining to create wet then dry conditions over the short term can result in hydromodification to the reservoirs and the receiving waters, which is specifically a concern for Oyster Creek due to the low natural flow. The repeated wet/dry conditions can break down the soil structure and lead to erosion. Oyster Creek between the Proposed Project discharge point and the existing Harris Reservoir discharge point are at highest near-term risk due to the changed conditions and regular inspection should be required along with a management plan to minimize erosion.

As mentioned above, Dow should consider additional water storage as the proposed project likely does not meet the 180-day storage recommendation by TCEQ.

1. This could include maintenance dredging to original or deepening the existing reservoirs, assuming dam safety concerns can be addressed.
2. Another option is to contract storage in an upstream reservoir.
3. Other water saving and conservation measures at the Dow plant could be considered, including water reuse through systems such as reverse osmosis. However, these systems tend to have a high energy requirement.

This analysis assumes 100,000 gpm discharge rates. If Dow does increase their discharge to 175,000 gpm, which is possible if Dow exercises their full water right, the water storage would be insufficient to meet the 180 days of water storage.

1. Of note is that the Proposed Project shifts the current discharge rate into Oyster Creek upstream of the adjacent existing Harris Reservoir. This is a minor change that did not result in a changed condition for Oyster Creek. However, nearly doubling the discharge could have an impact on Oyster Creek for both the existing Harris Reservoir as well as the Proposed Project. This would represent a significant increase in flows in Oyster Creek and the periodic nature could make Oyster Creek more susceptible to hydromodification and erosion.
2. A change in withdrawal rate from Brazos River to 175,000 gpm, expect possibly at the lowest of river flows during drought, would not be anticipated to cause a change to the river due to the large natural flows through the project vicinity.

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APPENDIX B

Brazos River Hydrology and Hydraulics Final Report

Note: The Section 508 amendment of the Rehabilitation Act of 1973 requires that the information in federal documents be accessible to individuals with disabilities. The U.S. Army Corps of Engineers (Corps) has made every effort to ensure that the information in this appendix is accessible. However, this appendix is not fully compliant with Section 508, and readers with disabilities are encouraged to contact Mr. Jayson Hudson at the Corps at (409) 766-3108 or at SWG201601027@usace.army.mil if they would like access to the information.

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Brazos River Hydrology and Hydraulics Final Report

DCC Harris Reservoir Expansion EIS

October 2021

Prepared for:

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DRAFT MEMORANDUM RELEASED UNDER THE AUTHORITY OF **JENNIFER J. WALKER PE (85619), DWRE, CFM** ON 2021-10-08 AND SHOULD NOT BE USED FOR DESIGN OR CONSTRUCTION.

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ES-1.0 Executive Summary

The Dow Chemical Company (Dow) and Regional Water Planning Group identified at least as early as 2011 the need for Dow to undertake steps to ensure reliable water supply to their plant located in Freeport, Texas. For purposes of this analysis, the time horizon was at least 50 years into the future for resiliency and water supply needs. This Watearth report supersedes past reports, and details cited and referenced are the most recent information concerning the proposed Harris Reservoir expansion and the Brazos River. This report supplants all previous reports concerning the Brazos River.

ES-1.1 Project Summary

A full description of the project purpose is provided in the Dow Individual Permit application to the U.S. Army Corps of Engineers (USACE). Dow currently operates the existing Harris and Brazoria Reservoirs with a total effective storage of approximately 27,343 acre-feet (ac-ft), which is no more than 68 days of storage based on current water use. The Texas Commission on Environmental Quality (TCEQ) recommends water suppliers have at least 180 days of water storage or they are at risk of shortages during drought conditions.

Dow proposes to construct an approximate 50,968 ac-ft off-channel impoundment reservoir adjacent and upstream of the existing Harris Reservoir, referred to in the permit application as the Harris Reservoir expansion (proposed project). The proposed impoundment is located directly upstream and adjacent to the existing Harris Reservoir but will work independently. The proposed Harris Reservoir expansion would cover approximately 2,000 acres (ac). It includes a pumped intake station on the Brazos River and gravity outfall to Oyster Creek via a new bypass channel.

Dow proposes to operate the three reservoirs in a manner similar to current operations with the proposed project increasing available storage from 68 days to 180 days. During periods of drought, the proposed Harris Reservoir would be exhausted first, followed by the existing Harris Reservoir and then the Brazoria Reservoir. The decision for emergency releases due to severe weather, such as tropical storms and hurricanes with wind speeds that can overtop the embankments, would remain unchanged.

ES-1.2 Environmental Setting

The Brazos River is a major river system within Texas with headwaters located near Blackwater Draw, New Mexico, and its mouth near Freeport, Texas. The river is highly managed through a series of dams and off-channel storage reservoirs throughout its length. This is due to the high variability of flows as the primary water source is rainfall to store water for dry season use but also for flood control. The proposed project is located within segment 1201, which is tidally influenced.

The general climate for the project area includes high potential rainfall events from tropical storms and hurricanes with long periods of drought. Future rainfall is predicted to trend toward lower rainfall levels and higher temperatures. Sea level is expected to rise by 1 to 2 feet in the next 50 years, which will tend to push the estuary farther upstream (referred to as the salt wedge). Storm surge could reach farther upstream from current conditions. The historic sediment load of the Brazos River has decreased for particles larger than sand but has increased overall for sand and smaller size particles.

Harris Reservoir is located at River Mile 46 with an effective storage capacity of 9,136 ac-ft. Brazoria Reservoir is at River Mile 25 with an effective storage capacity of 18,207 ac-ft. The reservoirs provide potable water to the Dow chemical plant and other users. Dow has reported periodic but not regularly scheduled maintenance dredging on the existing reservoirs, which has resulted in loss of storage by up to half of the original design volume. During drought conditions, Dow estimates the two-reservoir system provides 68 days or less of necessary water supplies. TCEQ has determined that facilities with less than 180 days of water storage are at risk during droughts.

ES-1.3 Summary of Modeling and Analysis

Modeling included Hydrologic Engineering Center-Hydrologic Modeling System (HEC-HMS), RiverWare, and Hydraulic Engineering Center- River Analysis System (HEC-RAS). HEC-HMS provides hydrologic modeling, RiverWare provides reservoir operational modeling, and HEC-RAS provides hydraulic modeling. Using data provided by Dow and supplemented by various local, state, and federal data and reports, the modeling and analysis were focused on drought conditions during the life of the project. The assumed project life is 50 years for analysis purposes although the current Dow plant has been in operation for more than 60 years. The assumed project life is not an indication of maximal life for the project and only used for modeling purposes.

ES-1.4 Analysis of Potential Impacts

ES-1.4.1 Floodplain Storage Loss

The proposed project site is approximately 2,000 ac in the shared Brazos River and Oyster Creek 100-year floodplain. The loss of floodplain storage for the Brazos River is negligible under current development conditions. There would be a net loss of 1,028 ac-ft Oyster Creek floodplain storage when the proposed Harris Reservoir is constructed, as documented in the Jacobs HEC-RAS model dated May 27, 2020, between FM-1462 (cross-section 69.9) and Harris Reservoir Road (cross-section 50.3).

Dow presented modeling results that meet Federal Emergency Management Agency (FEMA) No Rise requirements, meaning that there will be no water surface elevation increases associated with the project. Nonetheless, there is a concern that loss of floodplain storage will cause flow, velocity, and water surface elevation increases downstream, particularly for a 100-year flood event (1.0% chance of occurring in any given year).

A more detailed analysis of the floodplain storage loss and effects are contained in the *Oyster Creek Downstream Hydrologic and Hydraulic Impacts Final Report (October 2021)*.

ES-1.4.2 Hydromodification of Oyster Creek

Hydromodification will occur on 21,300 feet (ft) of Oyster Creek (i.e., channel size increased) from 3,600 ft northeast of the proposed reservoir (Project 1) to the proposed reservoir outlet channel. Project 1 widens the existing unnamed tributary channel north of the confluence of Oyster Creek and FM 655. Project 2 starts immediately downstream of Project 1, 12,000 ft downstream from the confluence until the original channel flows east into an old oxbow before meeting the proposed reservoir outlet channel downstream. Project 3 is an overflow channel up to 15 ft deep with a 100-foot bottom width and 4H:1V side slopes starting downstream of Project 2, which is represented between cross-sections 56.05 and 55.3 in the HEC-RAS model. A complete description of the hydromodification of Oyster Creek is provided in section 5.2, Oyster Creek Enhancements.

The hydromodification of Oyster Creek does not alleviate the floodplain storage loss caused by the construction of the proposed Harris Reservoir embankment. Construction of the embankment west of Oyster Creek will block floodplain storage that was previously provided. The proposed Harris Reservoir will also block interbasin flows from entering Oyster Creek at current locations. These interbasin flows will be either transferred to Oyster Creek above the proposed reservoir or transferred downstream stream of the current entry location.

An aquatic assessment was completed on Oyster Creek to determine potential impacts on the biological resources of Oyster Creek. More details pertaining to these effects are found in the *Oyster Creek Downstream Hydrologic and Hydraulic Impacts Final Report (October 2021)*.

ES-1.5 Conclusions

ES-1.5.1 Near Term

Dow estimates that the current two-reservoir system can provide only 68days of water supply to Dow's Freeport plant and other users that Dow is under contract to supply with potable water. Based on TCEQ water storage recommendations, recent drought events, and loss of contract water availability, Dow estimates that it needs at least 180 days of storage to provide the necessary water to users during an extended drought.

The modeling and analysis support Dow's findings that the current two-reservoir system provides less than 68days of potable water to their Freeport plant and other water supply users. Due to sedimentation, the effective storage capacity of the existing reservoirs is 27,343 ac-ft based on a 2020 survey conducted by Doyle and Wachtsetter. This is slightly lower than the previous Dow estimate of 28,000 acre-ft. Modeling shows that the proposed Harris Reservoir expansion volume of 50,968 ac-ft, combined with existing reservoir effective storage of 27,343 ac-ft, will provide 180 days of storage at 78,311 ac-ft.

The proposed design meets current reservoir standards for dam safety, including wind and wave conditions, which are likely to increase due to more frequent and severe tropical storm events.

ES-1.5.2 Long-Term

Changes in rainfall patterns, anticipated increases to average air temperatures (resulting in increased evaporation), rising sea levels, and high fine sediment loads in the Brazos River are all considerations for a long-term outlook on the project. The existing reservoirs have been in operation for more than 50 years and have shown a nearly 30% loss in storage capacity due to sedimentation. Using a similar projection of approximately 50 years, sedimentation presents the highest risk for long-term viability of the 180 days of total combined water storage. This is further put at risk as Dow proposes to capture high flow events to refill the proposed and existing reservoirs as part of its normal operations. Without planned and regularly executed maintenance removal of solids from all three reservoirs, the proposed project purpose and need of 180 days of storage cannot be maintained and will fall below that level.

ES-1.5.3 Recommendations

1. Watearth recommends Dow proceeds with design and construction of the proposed Harris Reservoir to provide the required 180 days of water storage for drought conditions. An operation and maintenance (O&M) plan should be developed and implemented for the existing reservoirs and the proposed Harris Reservoir. The O&M Plan should require regularly scheduled solids removal based on radar surveys, depth gages, or probing.

2. Sustained discharge from the proposed Harris Reservoir will likely result in significant downstream erosion of Oyster Creek. To address this, we recommend that a discharge operation plan (can be included in the overall O&M plan) be developed for the new reservoir that minimizes the potential for downstream erosion of Oyster Creek.
    a. Dow should note that FEMA may require a floodplain amendment due to the changes in Oyster Creek and the floodplain from the restoration project. This determination would be made by the local Flood Plain Administrator.
    b. Erosion control is recommended at the inlet and outlet to the stream restoration section, especially for the Project 3 Overflow segment.
3. Repeated filling and draining to create wet, then dry conditions over the short term can result in hydromodification to the reservoirs and the receiving waters, which is specifically a concern for Oyster Creek due to the low natural flow. The repeated wet/dry conditions can break down the soil structure and lead to erosion. Oyster Creek between the proposed project discharge point and the existing Harris Reservoir discharge point are at highest near-term risk due to the changed conditions and regular inspection should be required along with a management plan to minimize erosion. The O&M plan that will be developed by Dow will address periodic inspections reservoir outlet work into Oyster Creek and the channel down to Lake Jackson.
4. Dow should consider additional water storage as the proposed project currently meets the 180-day storage recommendation by TCEQ but can incrementally lose storage over time due to sedimentation of the reservoirs.
    a. This could include maintenance dredging to the original or deepening the existing reservoirs, assuming dam safety concerns can be addressed.
    b. Another option is to contract storage in an upstream reservoir.
    c. Other water-saving and conservation measures at the Dow plant could be considered, including water reuse through systems such as reverse osmosis. However, these systems tend to have a high energy requirement.
5. If Dow discharges at 175,000 gpm, the equivalent of their full water right, the water storage would be insufficient to meet the 180 days of water storage.
    a. The proposed Harris Reservoir would shift the current discharge rate into Oyster Creek upstream of the adjacent existing Harris Reservoir. This is a minor change that did not result in a changed condition for Oyster Creek. However, nearly doubling the discharge could have an impact on Oyster Creek for both the existing Harris Reservoir and the proposed project. The impact of the proposed Harris Reservoir on Oyster Creek is analyzed in detail in the *Oyster Creek Downstream Hydrology and Hydraulic Impact Final Report (October 2021)*.
    b. A change in withdrawal rate from Brazos River to 175,000 gpm, except possibly at the lowest of river flows during drought, would not be anticipated to cause a change to the river due to the large natural flows through the project vicinity.

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Acronyms and Abbreviations

Acronym/Abbreviation	Full Form
ac	acre
ac-ft	acre-feet
AP	analysis point
BFE	Base Flood Elevation
BRA	Brazos River Authority
BWA	Brazosport Water Authority
cfs	cubic feet per second
DCC	Dow Chemical Company
Dow	Dow Chemical Company
EIS	environmental impact statement
FEMA	Federal Emergency Management Agency
FIS	Flood Insurance Study
FM	Farm to Market Road
FPP	Floodplain Protection Planning Study
ft	feet
gpm	gallons per minute
HEC-HMS	Hydraulic Engineering Center-Hydrologic Modeling System, USACE
HEC-RAS	Hydraulic Engineering Center-River Analysis System, USACE
HMG	Hydrologic Modeling Guidelines, USACE
hrs	hours

HUC	Hydrologic Unit Code
MGD	million gallons per day
mi^2	miles squared
mph	miles per hour
MSL	mean sea level
NAVD88	North American Vertical Datum of 1988
NCDC	National Climatic Data Center, NOAA
NGVD29	National Geodetic Vertical Datum of 1929
NOAA	National Oceanic and Atmospheric Agency
NWS	National Weather Service, NOAA
O&M	Operations and maintenance
RiverWare	River and Reservoir Modeling Software, University of Colorado Boulder
sq-mi	square miles
SSC	suspended sediment concentration
TCEQ	Texas Commission on Environmental Quality
Tc	time of concentration
TWDB	Texas Water Development Board
TX	Texas
TxRR	Texas Rainfall-Runoff Model
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
WAM	Water Availability Model

HUC	Hydrologic Unit Code
WSEL	water surface elevation

Appendices

Appendix A – Brazos River HEC-HMS Model

1.0 Introduction

This report describes the hydrologic and hydraulic analysis conducted to inform the USACE determination if the proposed Dow Harris Reservoir Expansion project meets hydrology requirements in Section 404 of the Clean Water Act. The analysis followed the guidance provided in the USACE Hydrology Modeling Guidelines (HMG) for conducting the hydrologic and hydraulic modeling. The USACE developed HMG to assign project managers and applicants in determining how to address hydrology and specifically how to approach hydrologic modeling for primary and secondary effects.

The purpose of the proposed project is to expand Dow's water storage capacity at or near the existing Harris Reservoir to improve the long-term reliability of water supply during drought for the Texas Operations facilities in Freeport, Texas, as well as other industrial, community and potable water users that rely on Dow's water supply. It is also planned to allow more efficient use of Dow's existing Brazos River surface water rights.

Dow currently manages the Brazoria and Harris reservoirs for water supply and water quality (at the Dow intake for industrial water supply), which has a reported combined effective storage capacity of 27,343 ac-ft, providing approximately 63 days of stored water. The TCEQ recommendation for storage to meet drought preparedness and response standards is 180 days. This recommendation is based on the Texas Administrative Code Title 30, Part 1, Chapter 290, Subchapter D, Rule §290.41, which under b.1 states that retail public utilities should report when they have less than 180 days of water supply storage and therefore develop a drought contingency plan (State of Texas, Revised 2013).

The proposed Harris Reservoir will include a 2,000-ac off-channel impoundment facility that will increase Dow's storage capacity by 50,968 ac-ft. The facility will include an auxiliary spillway outlet from the reservoir and an intake and pump station to divert Brazos River water within Dow's existing water rights. The proposed project, in conjunction with the existing two reservoirs, will provide 78,311 ac-ft of effective capacity and have 180 days of water storage.

This report includes analysis of the impacts of proposed Harris Reservoir on the Brazos River. A thorough assessment of local hydrology, climate, existing site conditions, and hydrological and hydraulic modeling analysis are reported. An unsteady one-dimensional hydraulic model was used to determine if there is a floodplain storage loss, and a hydrologic model was used to determine if there is a change in peak flowrates in the Brazos River.

2.0 Environmental Setting

This section describes the general environmental conditions that define the setting of the proposed project. This includes the physical setting and other hazards that are considered when analyzing the proposed project.

2.1 Watershed

The proposed project is located along the Brazos River, one of the largest watersheds by area in Texas (

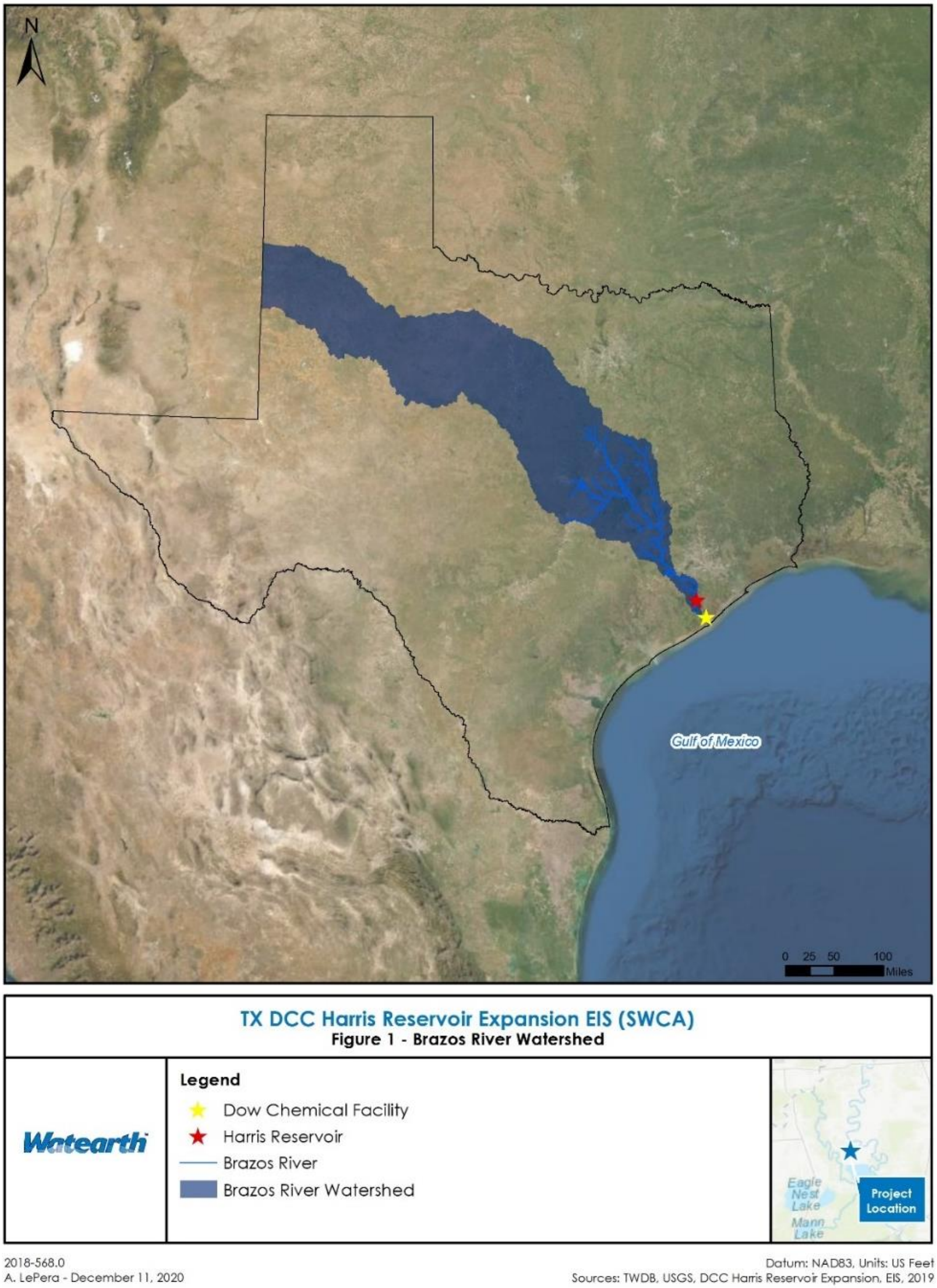


Figure 1) (TWDB, 2019). The watershed generally runs northwest to southeast with the headwaters in New Mexico and discharges to the Gulf of Mexico near Freeport, Texas. The Brazos River has the largest average annual flow of any river in the state.

The Brazos River flow is primarily supplied through precipitation with many creeks and streams along the main stem. The upper basin was historically underutilized for withdrawals for irrigation, livestock water, and other agricultural purposes until recently with the decline in groundwater supplies, in particular the overuse of the Ogallala Aquifer (TWDB, 2019). This has led to decreasing supplies farther downstream in the more populated areas of the basin, especially during low rainfall and drought years.

The Brazos River is a highly managed and regulated river system with three Brazos River Authority (BRA) reservoirs, eight USACE flood control dams, and numerous other large-to-small impoundments (**Figure 2**). There are over 1,200 adjudicated water rights in the Lower Brazos River alone. In addition, Dow is also a potable water supplier for industries and municipal users near its plant in Freeport, Texas.

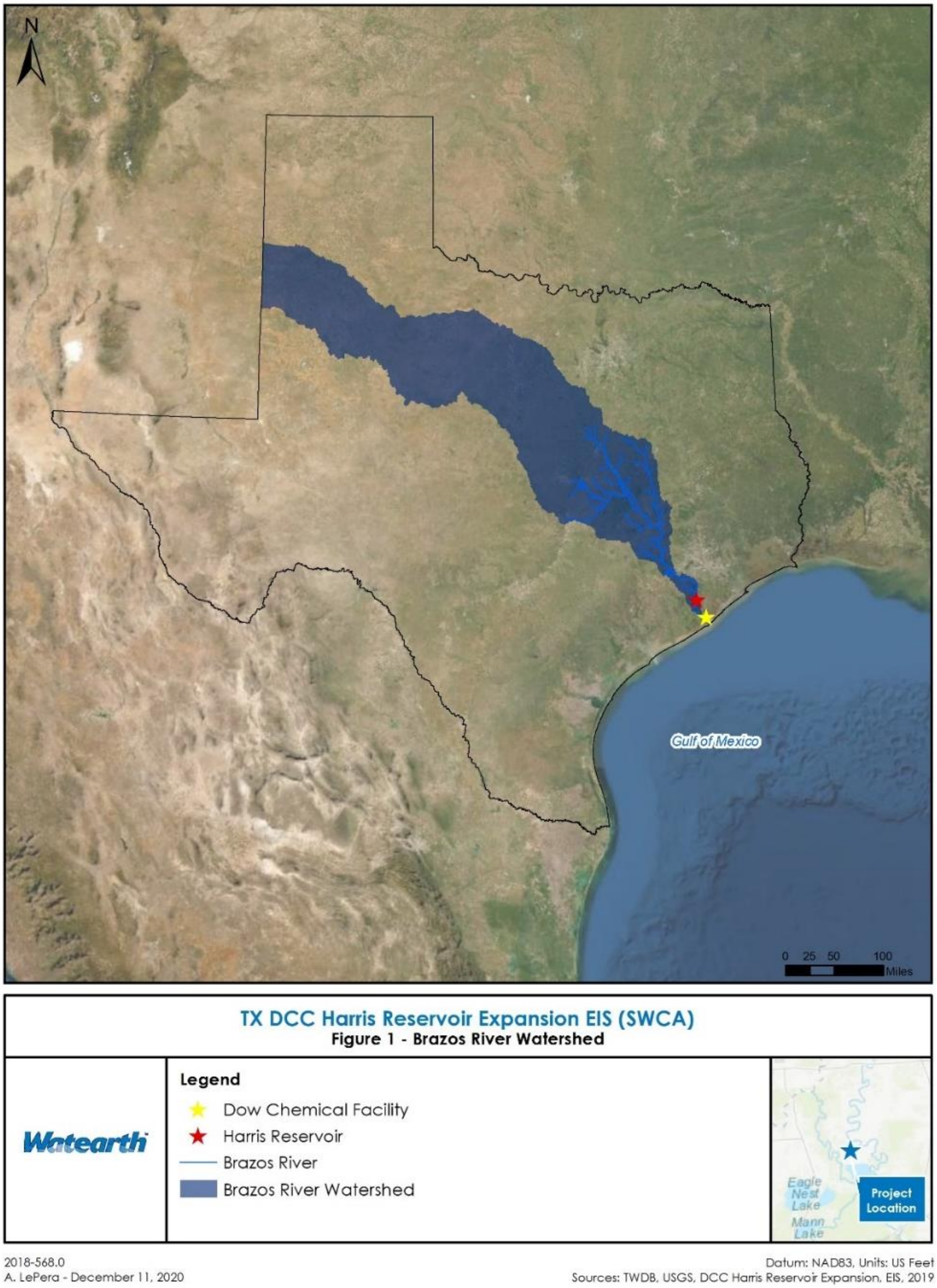


Figure 1: *Brazos River watershed.*

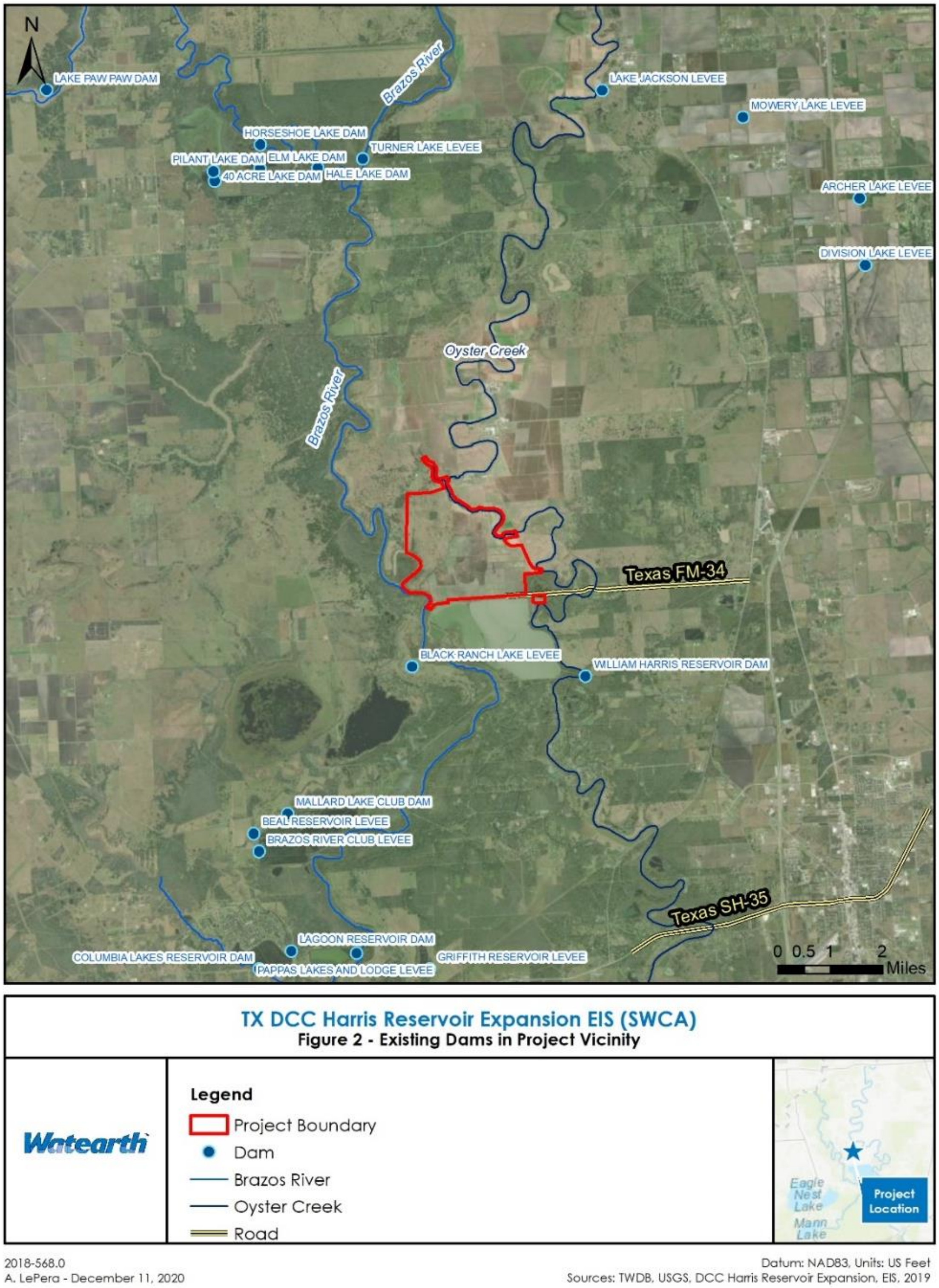


***Figure 2**: Dam inventory for Lower Brazos River (segment 1201).*

2.2 Surface Waters and Local Hydrology

The Brazos River Basin is more than 820 miles long and crosses nearly every physiographic region in Texas (TWDB, 2019; BRA, 2019). The watershed is approximately 42,000 square miles (sq-mi) and descends at a rate of 3 ft to 0.5 foot per river mile.

The Lower Brazos River sub-basin includes the area from Waco, Texas, to the Gulf of Mexico (Halff, 2019). The focus of this report is the lowest portion of the Lower Brazos River and is limited to Brazoria and Fort Bend Counties. Figure 3 shows the project area drainage areas in the Lower Brazos River sub-basin.

The topography in this area is level with minimal rise as shown by the height of the gages along the Brazos River in **Table 1** (USGS, 2019; USGS, 2019). The gages along the Brazos River are reported in National Geodetic Vertical Datum of 1929 (NGVD29) and North American Vertical Datum of 1988 (NAVD88). The conversion factor for vertical datums in the project area is NAVD88 is equal to U.S. Geological Survey (USGS) gage elevation in NGVD29 minus 0.975 ft (Heitmuller & Greene, 2009). As **Table 1** shows, there is minimal elevation change between the Freeport gage and the Rosharon gage. The thalweg of the Brazos River does not rise above mean sea level (MSL) until above the Rosharon gage.

Table 1: Gage Elevations

Location	Brazos River Mile	Elevation (NAVD88)
Freeport Gage (08772440)	6	-4.51ft
Rosharaon Gage (08116650)	57	-0.98 ft
Richmond Gage (08114000)	92	+27.02 ft

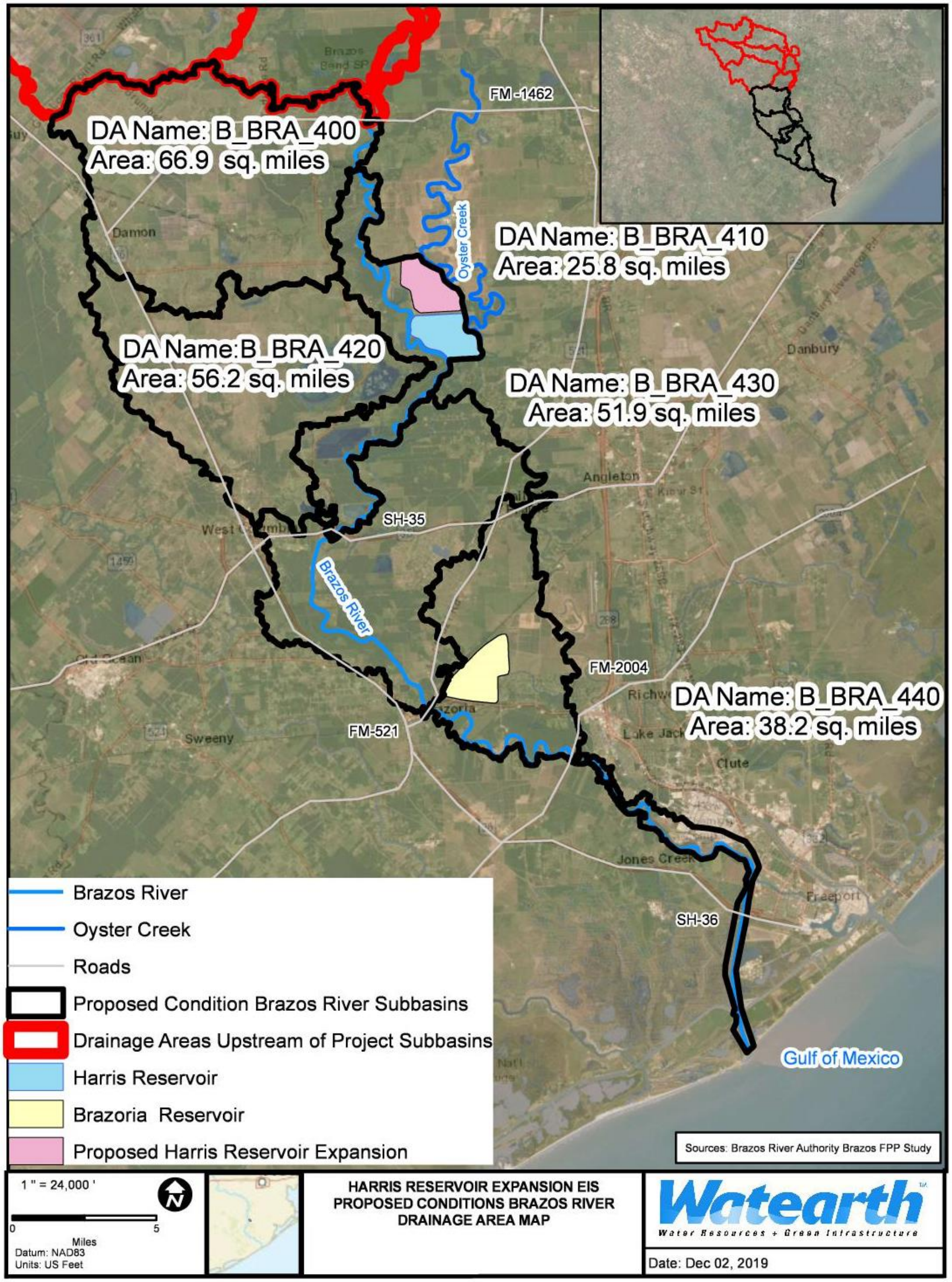


***Figure 3**: Lower Brazos River and Oyster Creek sub-basins in project vicinity.*

2.3 Rainfall and Temperature Change

The USACE developed predictive models for changes in rainfall and temperature, among other climate predictors. The USACE Region 12 (Texas-Gulf Region) report summarizes current climate and hydrology literature for the general project area. Seasonal precipitation is expected to decrease slightly with warmer annual temperatures, although intense rainfall events may increase in frequency. Consequently, the mean annual rainfall may decrease while the variance from year-to-year increases. **Figure 4** shows projected seasonal precipitation changes in 2085 (USACE, 2015).

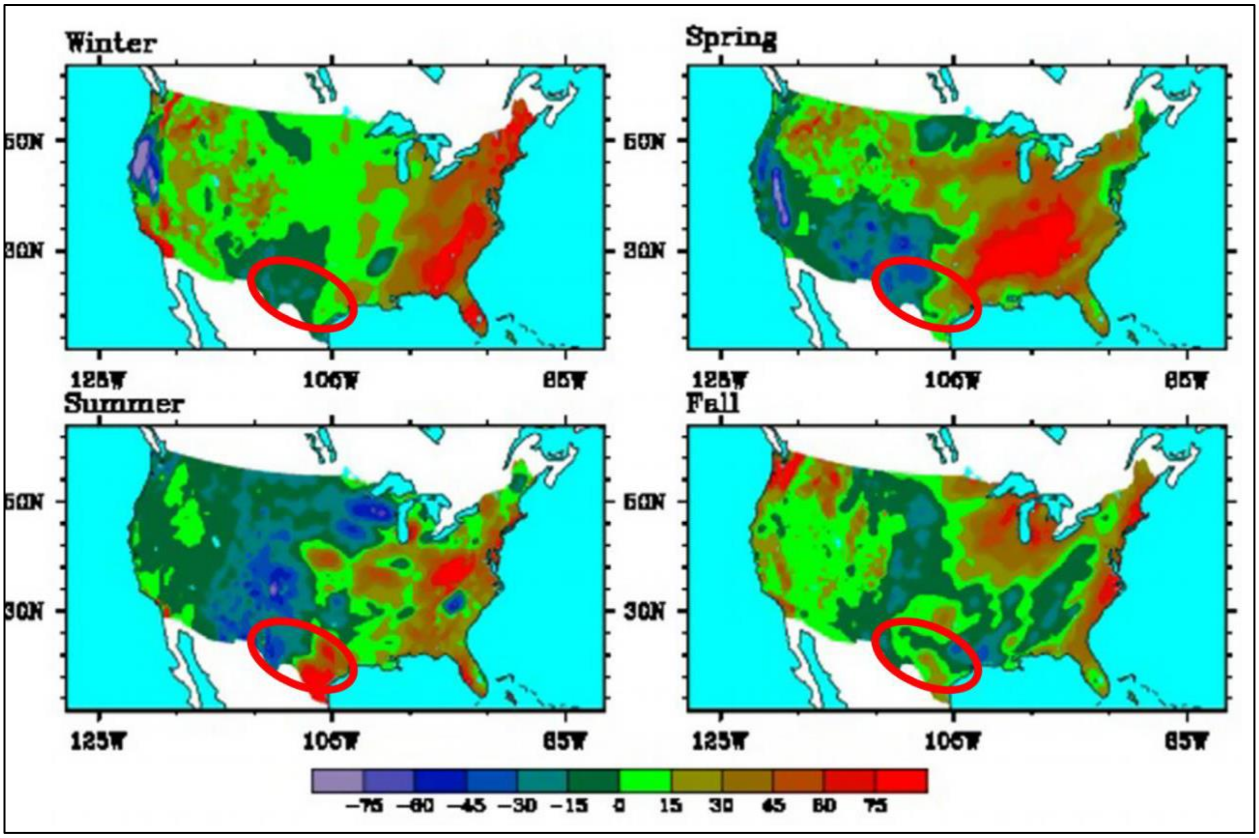


Figure 4: *Projected changes in seasonal precipitation, 2085 vs. 1985 mm (from (USACE, 2015)) Note: Texas region circled in red.*

Although **Figure 4** shows a slight decrease in precipitation in southern Texas, projections of future precipitation change are especially uncertain in this region because it is in a transition zone between projected drier conditions to the south and projected wetter conditions to the north, which could have mixed effects on river flows at the project site. Due to these uncertainties, the assumption that future precipitation in the project area will be roughly similar to past precipitation appears to be justified.

2.4 Watershed Vulnerability and Hydrology Assessment

The project proponent, Dow, developed a Hydrology and Floodplain Analysis (Attachment J of the USACE Individual Permit Application) with a focus on the flooding risk and high flow events. That full analysis is not repeated in this report. The USACE watershed vulnerability tool was used to screen the vulnerability of the project area to flooding under future conditions (USACE, 2019b). For the Brazos River watershed (HUC 1207), the projected future risk is expected to be low for the dry scenario and moderate for the wet scenario. **Figure 5** shows the vulnerability of the Brazos River watershed for 2050 and 2085 conditions.

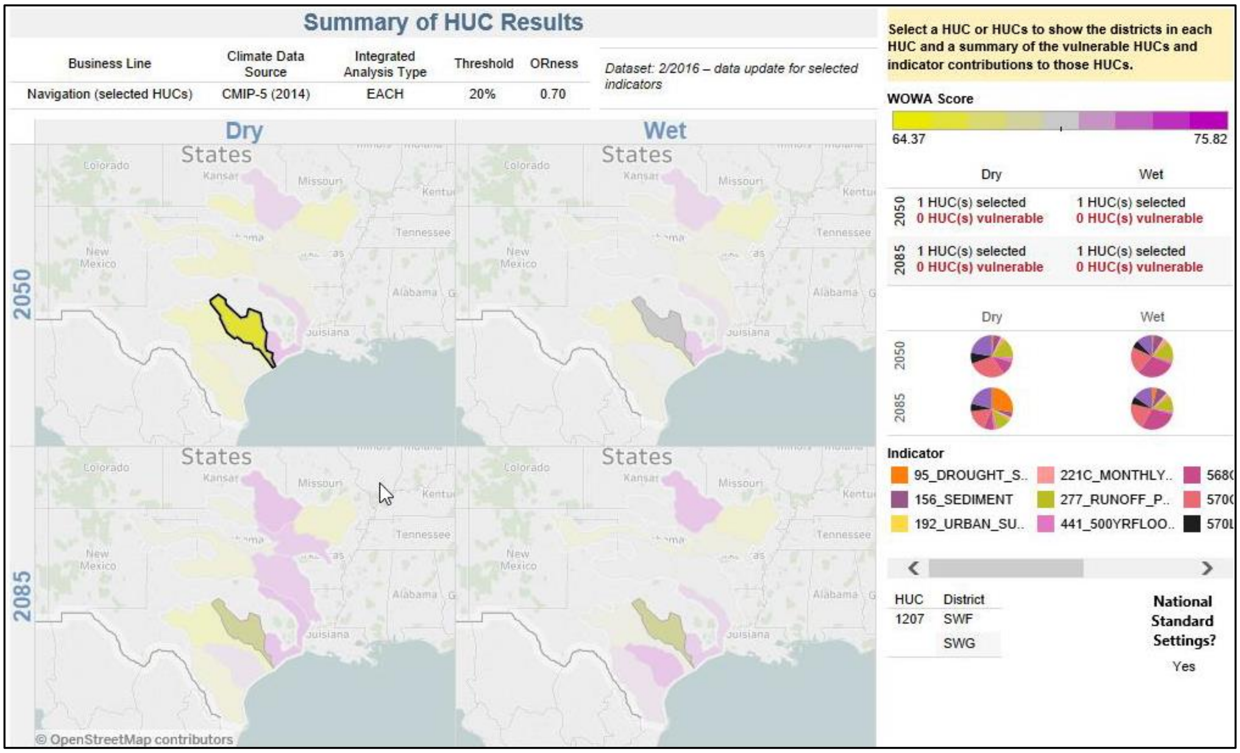


Figure 5: Watershed vulnerability for the Brazos River watershed (HUC 1207) from the USACE watershed vulnerability tool.

The climate hydrology assessment tool was also used to assess the predicted trends of the peak annual discharge for the Brazos River (USACE, 2019a). **Figure 6** shows the trends in projected peak annual flowrate, which represent the mean of 93 projected future hydrology models for the Brazos River watershed (HUC-1207). The projected annual maximum monthly streamflow for the Brazos River is expected to remain relatively constant, with the potential for a very small increase in flow rates in the future based on the climate hydrology model results shown in **Figure 6.** However, there is considerable uncertainty in making such specific predictions of future peak annual discharges. It is important to note that this data should not be used for quantitative analysis.

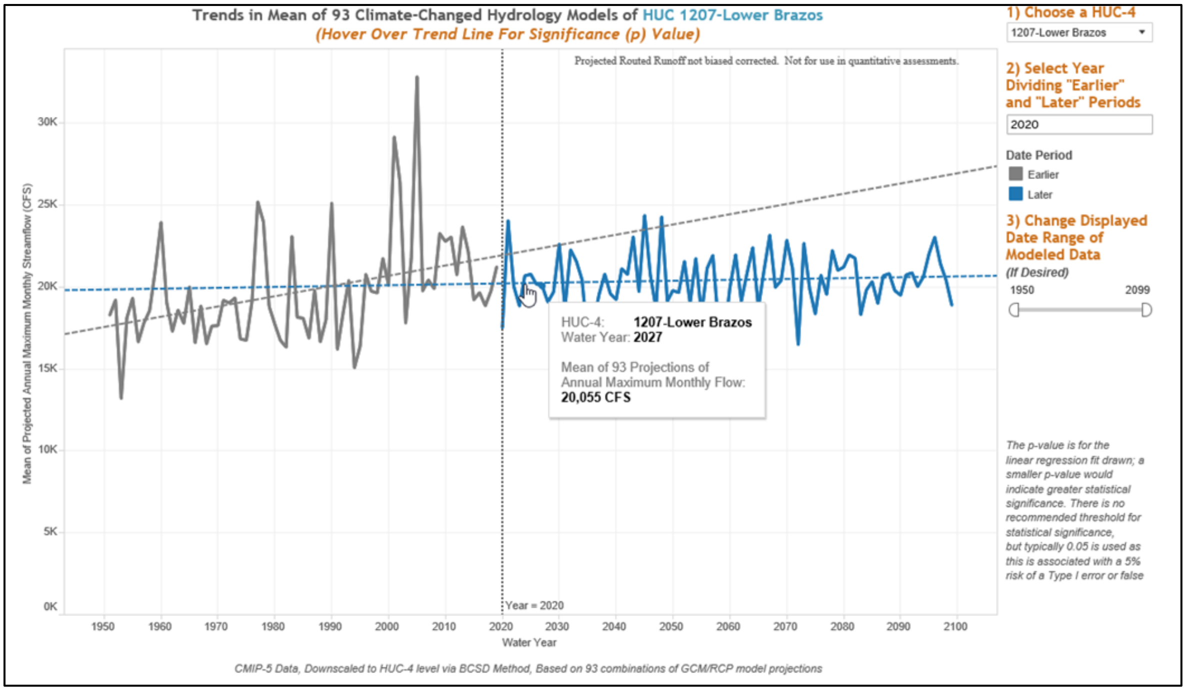


***Figure 6**: Trends in mean modeled annual maximum streamflow. The mean (dotted blue line) is the average of 93 climate-change hydrology models of HUC 1207.*

The consensus in recent literature points toward mild increases in annual precipitation and streamflow in the Texas-Gulf Region over the past century. In some studies and some locations, statistically significant trends have been quantified; however, the trends at the Brazos project site remain insignificant or unclear. The information in this section should be used for qualitative analysis of the hydrology, precipitation, and temperature impacts for the proposed project.

2.5 Storm Surge

The Gulf Coast shoreline is susceptible to storm surge, which is an abnormal rise in seawater level during a storm as a result of onshore high winds. Storm surge is measured as the height above the normal predicted astronomical tide. The distance onshore that storm surge travels can be compounded if associated with high tides, especially unusually high tides called king tides. The increased sea level height indicates that the tidal influence area is extended upstream from normal conditions temporarily. Storm surge and associated winds can damage human development and infrastructure farther upstream than under normal conditions. FEMA calibrates and validates storm surge using historical recorded storms in development of the Flood Insurance Study (FIS) for Texas coastal counties (FEMA, 1999). FEMA selected Carla (1961), Claudette (2003), Rita (2005), and Ike (2008) as potential validation storms due to their intensity and proximity to the project site (**Figure 7**). Due to the flat topography in the project area, inundation of brackish and saline water will reach farther upstream than under normal conditions. Based on sampling data provided by Dow, the salt wedge ranged between River Miles 15 and 43 and could potentially reach River Mile 49.

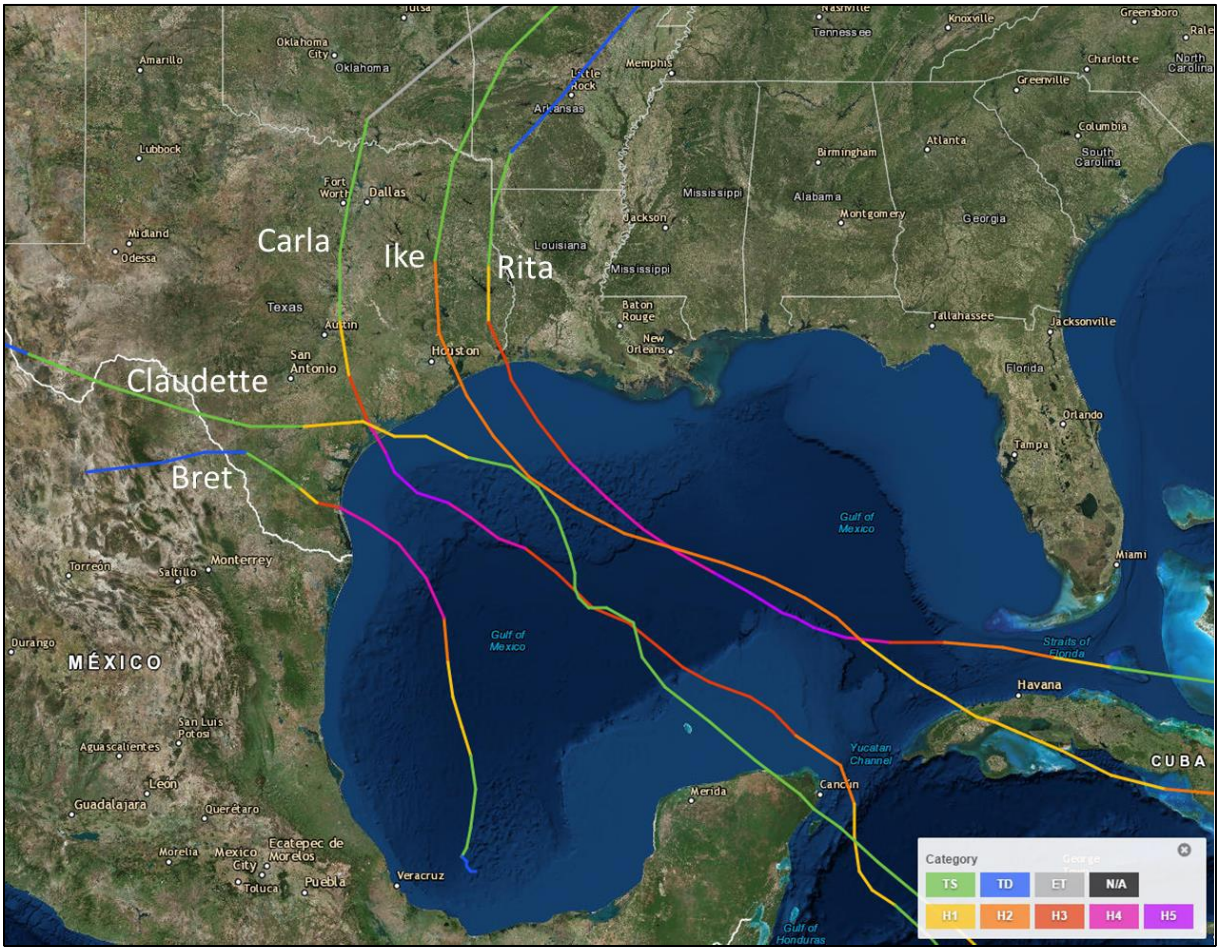


__Figure 7__: Historical storm tracks near the project site (FEMA, 1999).

2.6 Relative Sea Level Rise

The global sea level has been rising over the past century and current prediction models indicate sea level rise will accelerate over the next century. Low-lying and flat topography areas such as the project area are more likely to experience direct effects including inundation and extension of the brackish water upstream compared to past conditions. The Brazos River estuary extends above the Brazoria Reservoir located at River Mile 25 periodically throughout the year. Dow monitors and tracks the location of the salt wedge, which is defined as greater than 500 milligrams/liter of chloride. As discussed earlier, Dow provided the salt wedge position tracking data and found the salt wedge fluctuates between River Miles 15 and 43 and could potentially reach River Mile 49. The existing Harris Reservoir is located at River Mile 46.

The USACE developed a relative sea level rise calculation and mapping tool (USACE, 2014). The tool uses USGS gage data, National Oceanic and Atmospheric Agency (NOAA) Atlas 14 rainfall rates, and other data to provide three scenarios for relative sea level change, which reflects different rates of sea level rise based on the scientific literature.

The assumed project start date (substantial completion of the proposed project) is 2022 with the planning horizon of 2072 (50 years). Data were obtained using the web tool from the closest available gage, 8772440 at Freeport, Texas, which is located approximately 6 miles from the

Brazos River mouth. Tool assumptions include a base flood elevation (BFE) of 12 feet (FEMA, 1999). Model predictions range from approximately 1 foot to 4 feet in 2070 and 2 feet to over 8 feet in 2122.

Figure 8 shows the resulting relative sea level change over the planning horizon (until 2075) and 100 years from the project start date (2122). **Figure 9** shows the century of the resulting inundation from the USACE high sea level change scenario in 2122.

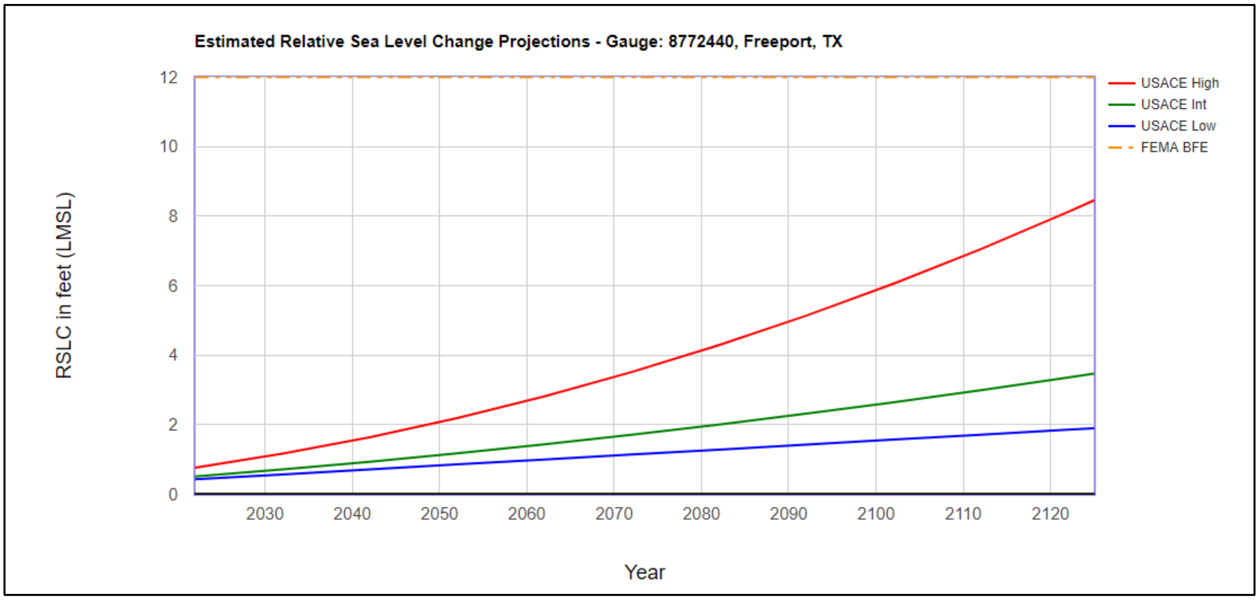


***Figure 8**: USACE projected RSLR, at NOAA gage 8772440, Freeport, Texas, over 100-year period of analysis (2022 base year, 2075 end-of-50-year project planning horizon, 2122 end-of-100-year).*

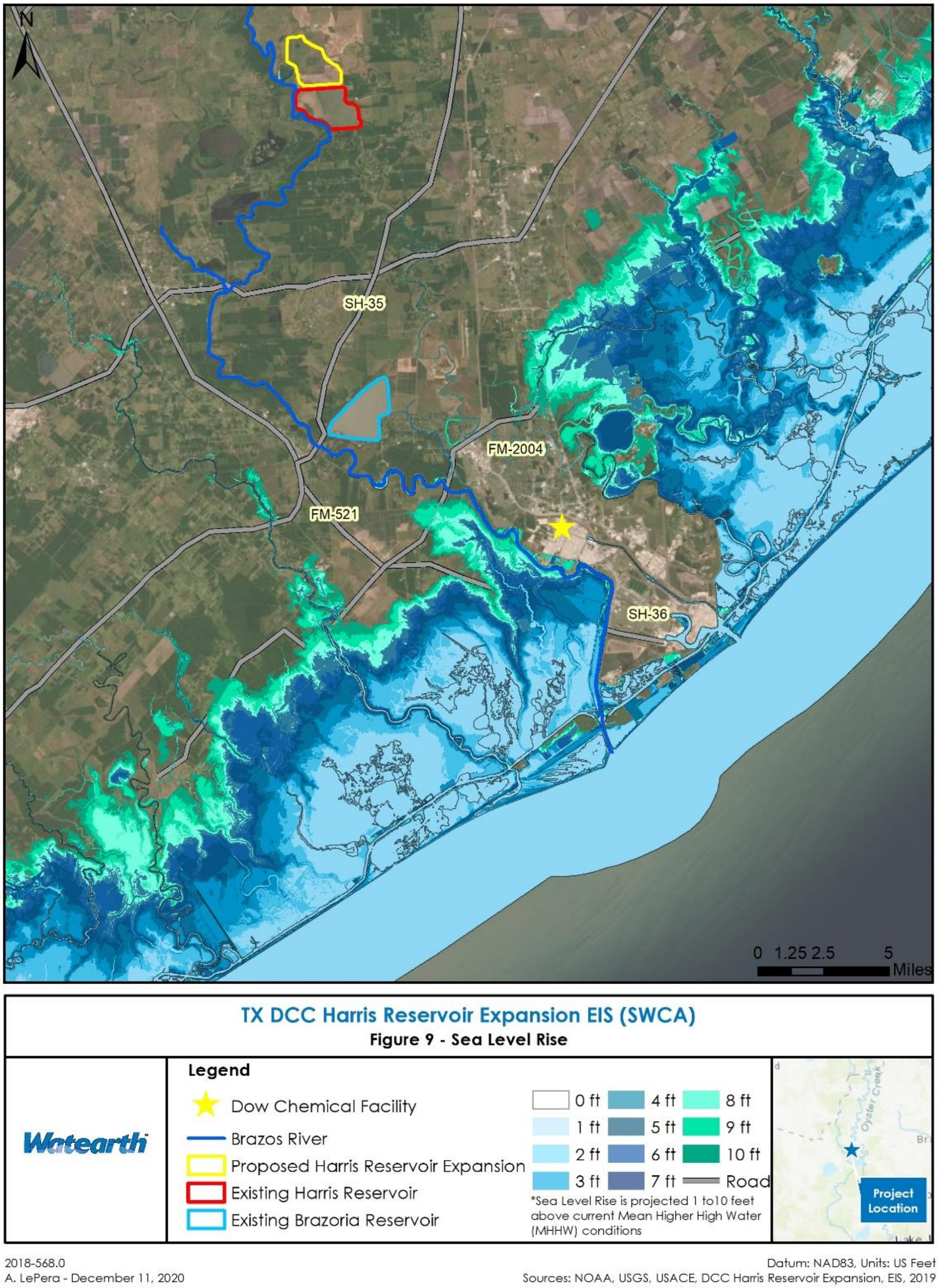


Figure 9*: Gulf Coast inundation map for mean sea level in the year 2122 under the high sea level rise scenario.*

3.0 Existing Site Conditions

This project has a unique set of existing site conditions such as a water supply system spanning nearly 40 river miles of the Brazos River, cross basin interactions between the Brazos River and Oyster Creek, a series of canals, and multiple reservoirs.

3.1 Proposed Project Boundaries

The proposed project is development of a 50,968 ac-ft reservoir directly upstream from the existing Harris Reservoir. The proposed Harris Reservoir site is currently being used for agriculture. According to project information provided by Dow, the proposed Harris Reservoir site has wetlands and acts as the floodplain for both the Brazos River and Oyster Creek.

The proposed project must be considered in the context of the system it will contribute to, specifically the water supply system that serves the Dow plant and other users in Freeport, Texas. For modeling purposes, the project boundaries include the Brazos River from the Rosharon USGS stream gage to the mouth of the Brazos River at the Gulf of Mexico and portions of Oyster Creek used for inter-basin transfers of water through the existing Harris and Brazoria Reservoirs.

As shown in **Figure 10**, Dow operates two off-channel impoundments (information provided by Dow). The existing Harris Reservoir, located at River Mile 46, lies between the Brazos River and Oyster Creek in their shared floodplain. The Brazoria Reservoir, located at River Mile 25, is deeper than the existing Harris Reservoir and designed for three times the storage.

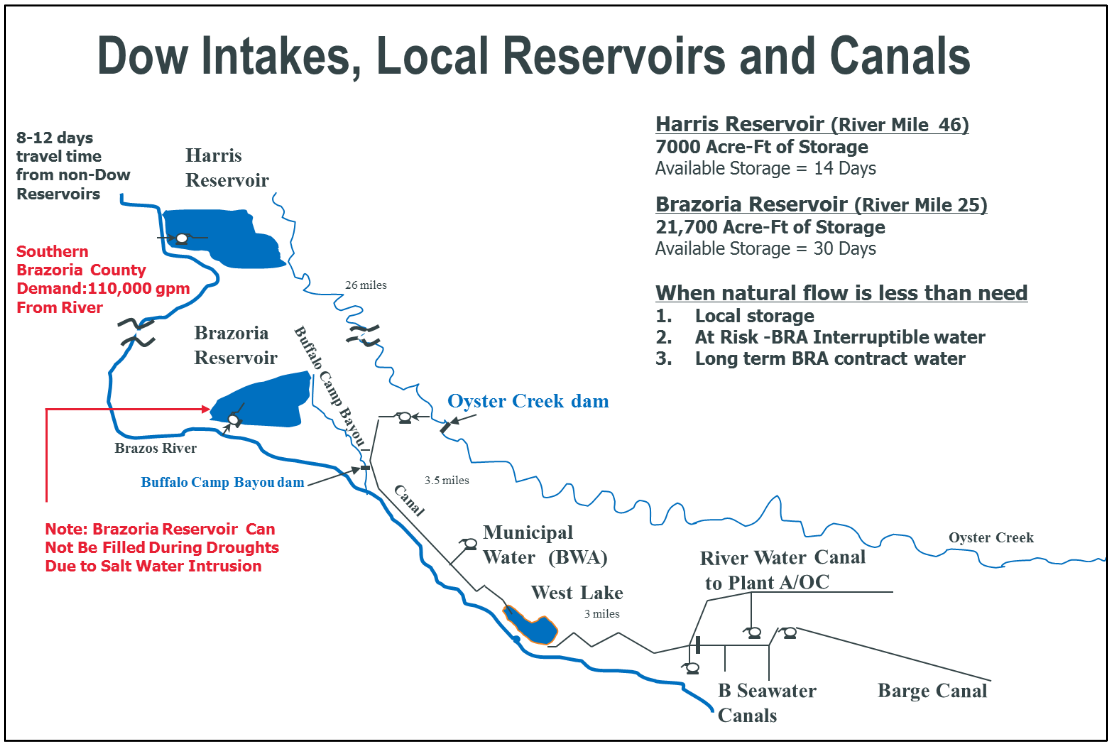


Figure 10: Dow Reservoir water supply map (provided by Dow).

3.2 Dow Managed Water Storage

Dow's existing surface water intakes for the Brazoria and Harris Reservoirs are located in segment 1201 of the Brazos River, which is tidally influenced. During low flow conditions in the Brazos River, saline water moves up from the Gulf of Mexico to upstream locations on the river (saltwater wedge), ranging between River Miles 15 and 43, per data provided by Dow on chloride sampling. When flow conditions at the Brazos River pump station (River Mile 25) are reduced to approximately 1,730 cubic feet per second (cfs) or lower, Dow is unable to divert water into the Brazoria Reservoir due to saltwater intrusion from the Gulf and must rely on water delivered from the existing Harris Reservoir. When river flows are sufficient at the existing Harris pump station intake on the Brazos River, river water is transferred through the reservoir to Oyster Creek by pumping from the river into the reservoir and then discharging into the creek through a siphon system. When flow conditions limit pumping to the existing Harris Reservoir, water supply needs of Dow and others are met by withdrawing water stored in the Harris and Brazoria Reservoirs.

3.2.1 Dow's Brazos River Water Rights

Dow has a Brazos River water right of 238,156 ac-ft per year for industrial, municipal, domestic, and livestock uses. In addition, it has an Oyster Creek water right for 60,000 ac-ft per year for industrial and municipal uses, and a Buffalo Bayou water right of 7,560 ac-ft per year for industrial and municipal uses. There are no water rights holders with more senior rights compared to Dow in the river segment between the Rosharon USGS gage and the Gulf of Mexico. Dow's combined water rights allows a maximum diversion rate of 630 cfs from the Brazos River.

3.3 Water Supply Needs

As discussed in the Local Drought **Section 2.4**, the Freeport area, like much of Texas, experienced drought conditions that reduced the flows in many local rivers and streams. During the drought there was significant population growth and corresponding demands for additional potable water. Portions of the Brazos River watershed also saw significant development.

In response, Dow undertook efforts to reduce potable water needs. Even with demand reduction measures in place, the raw water use rate for Dow and water customers was about 3,000 ac-ft per week (approximately 430 ac-ft per day or 97,000 gpm). At this rate, and without any additional storage, the existing two reservoirs (when full) would provide a storage reserve of approximately 63 days or less, assuming all stored water could be accessed. The TCEQ considers water systems with 180 days or fewer of available water supply at risk during drought. A storage reserve of only 63 days is significantly below the drought preparedness and response standards established by the state.

3.3 Recent Drought Conditions

In 2005, a multi-year drought started in Texas. The year 2011 was the driest year on record and by that October, 97% of the state was in extreme or exceptional drought conditions. During the drought period, flows in the river were significantly lower than during average conditions. Had the severe drought conditions continued, Dow would have faced the possibility of reducing essential functions at its facility and curtailing use for the industries and municipal users that rely on its water supply system.

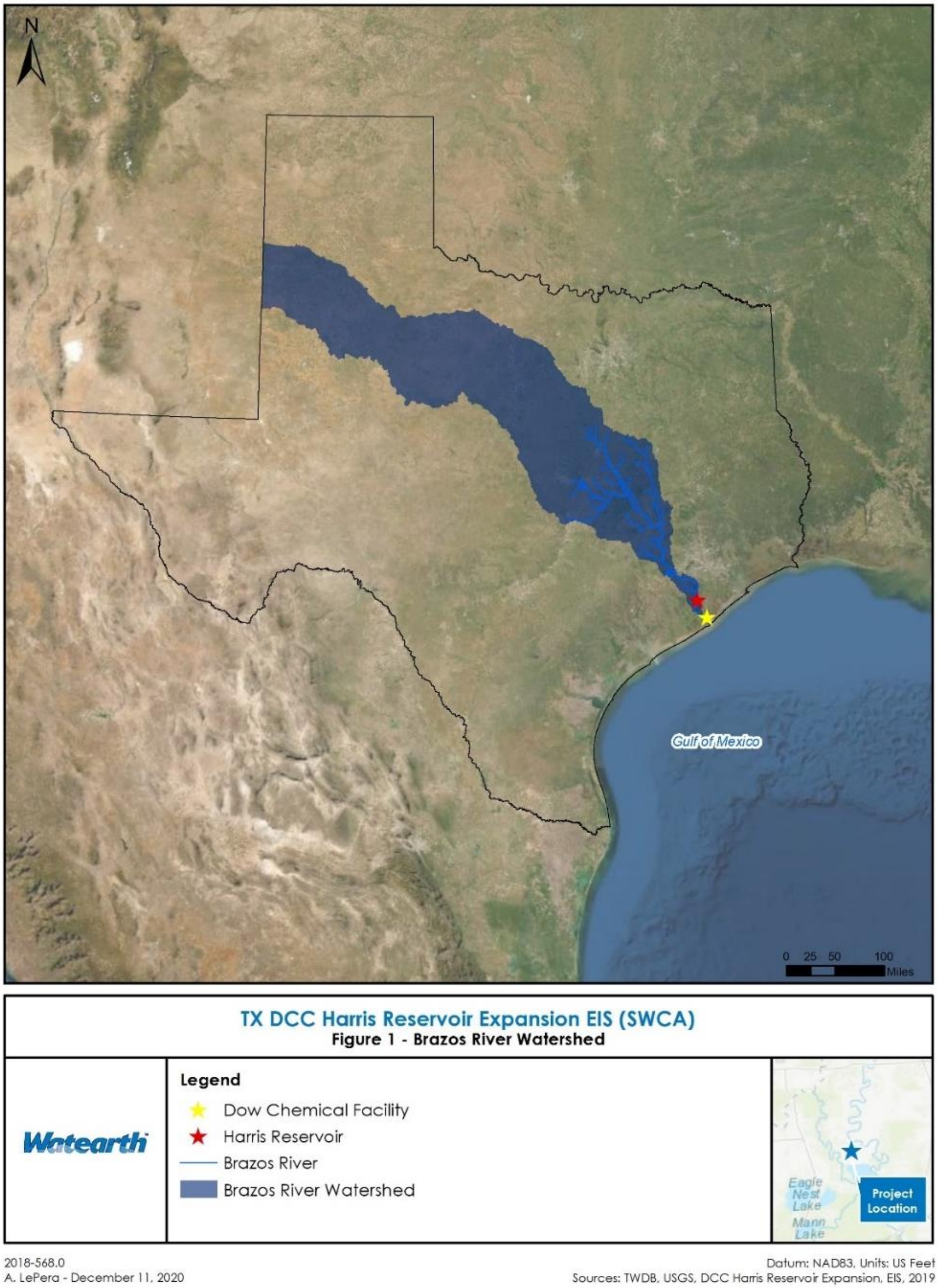
Additionally, the Water Availability Model (WAM) provided by Dow indicates there are significant multi-month periods when water from the Brazos River would not be available during a repeat of the drought of record. Modeling indicates if upstream junior water rights holders divert their full authorization, availability for diversion will be decreased.

During recent years, Dow has successfully reduced its freshwater consumption from the Brazos River by more than 20,000 ac-ft per year at its Texas Operations through on-site recycling and water efficiency practices. Additional water conservation/water use efficiency measures are planned for implementation as technology and cost-effective approaches are developed. It is projected that with future water savings and with savings already achieved, future water demands associated with operations and production growth during most climate conditions could be met. However, investments in water conservation do not provide the additional storage capacity required to sustain operations during extended drought.

3.4 Lower Brazos River Watershed

The drainage area of the entire Brazos River is approximately 45,560 sq-mi (TWDB, 2011). The drainage area starts 50 miles west of the Texas–New Mexico border and runs approximately

1,050 miles to the Gulf of Mexico (see



TX DCC Harris Reservoir Expansion EIS (SWCA)
Figure 1 - Brazos River Watershed

Figure **1**). The Lower Brazos River drainage basin that includes the proposed project is approximately 9,766 sq-mi and has no major structures that control the river flow. The Lower Brazos River affects the southern Texas counties of Falls, Limestone, Robertson, Milam, Lee, Burleson, Grimes, Washington, Waller, Austin, Fort Bend, and Brazoria. This area is one of the fastest-growing areas in the country and has experienced substantial flooding over the last 4 years including the Memorial Day Flood (2015), Tax Day Flood (2016), and Hurricane Harvey (2017).

3.4.1 Basin Hydrology

The following hydrologic data corresponds to the hydrologic studies completed by the Texas Water Development Board (TWDB) for Brazos River (TWDB, 2011). The Brazos River Estuary Hydrology Study covers the period of record from 1977 to 2009.

Hydrologic analysis results provided a volumetric runoff balance in ac-ft, which includes the following contributions:

Balance = gaged + modeled - diversion + return - evaporation + precipitation

Note that there is no gaged data at the coastal sub-watershed (below the Rosharon gage) that is not subject to tidal influences. Therefore, a rainfall-runoff hydrologic model is needed; where gaged flows are obtained from USGS gages, modeled are rainfall-runoff values estimated using the Texas Rainfall-Runoff Model (TxRR), diversions and returns are flows associated with water rights and holders of discharge permits, and evaporation and precipitation include a contribution from each process on the surface area exclusively (TWDB, 2011). Note that the TxRR model results were obtained from the TWDB. The TxRR model is conceptually similar to the United States Department of Agriculture (USDA) Natural Resources Conservation Service; formerly the Soil Conservation Service curve number method, which was developed by research conducted by the USDA Agricultural Research Service.

Gaged inflow from the USGS station on the Brazos River near Rosharon accounted for approximately 86% of combined inflow, while modeled flows (rainfall-runoff) accounted for almost 3% of the balance over the study period as shown in **Figure 11**. Indicating the river discharge on the Brazos River is significantly dominated by upstream riverine processes rather than precipitation-induced discharges in the coastal plain. Therefore, precipitation processes can be ignored in the analysis. Such behavior is expected due to a large drainage area. It is possible that heavy local rainfall between the Rosharon gage and the Harris Reservoir project intersection could influence hydrodynamics at the project site. However, long-term trends indicate it is an infrequent event, which would not likely alter the long-term hydrodynamics.

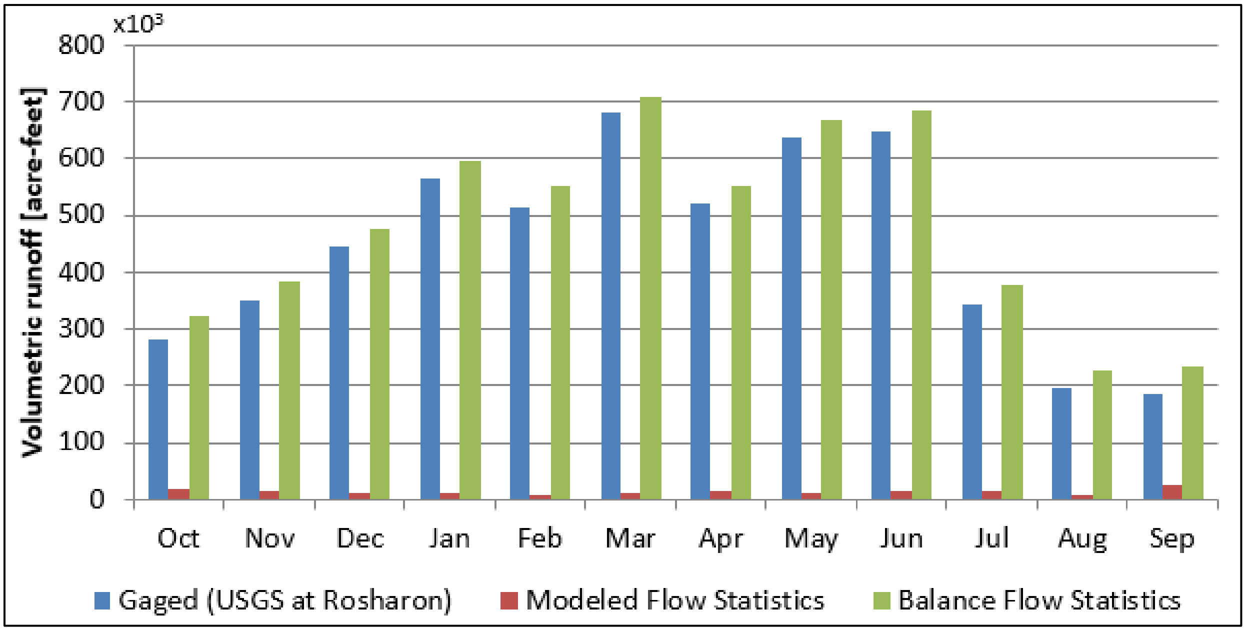


Figure 11: Brazos River long-term monthly mean freshwater inflow hydrology data over the period from 1977 to 2009. Data are shown in water year from October 1 to September 30 (TWDB, 2011).

3.4.2 Analysis of Flow Gage Data Trends

USGS maintains stream gages throughout the project watershed including on the mainstem Brazos River as well as tributaries (**Figure 12**). The nearest upstream gage to the project is located near Rosharon, Texas. For purposes of modeling, this was selected as the upper limit of the project area for analysis. The Richmond, Texas gage was used to confirm stream flow conditions. The West Columbia gage is subject to tidal and estuary conditions.

To evaluate the long-term trends of precipitation on river discharge, a trend analysis was conducted on the annual peak discharges at the Rosharon, Texas and Richmond, Texas USGS gages for the Brazos River. **Figures 13** and **14** show the peak annual discharges for the Brazos Rosharon gage and Brazos Richmond gage, respectively.

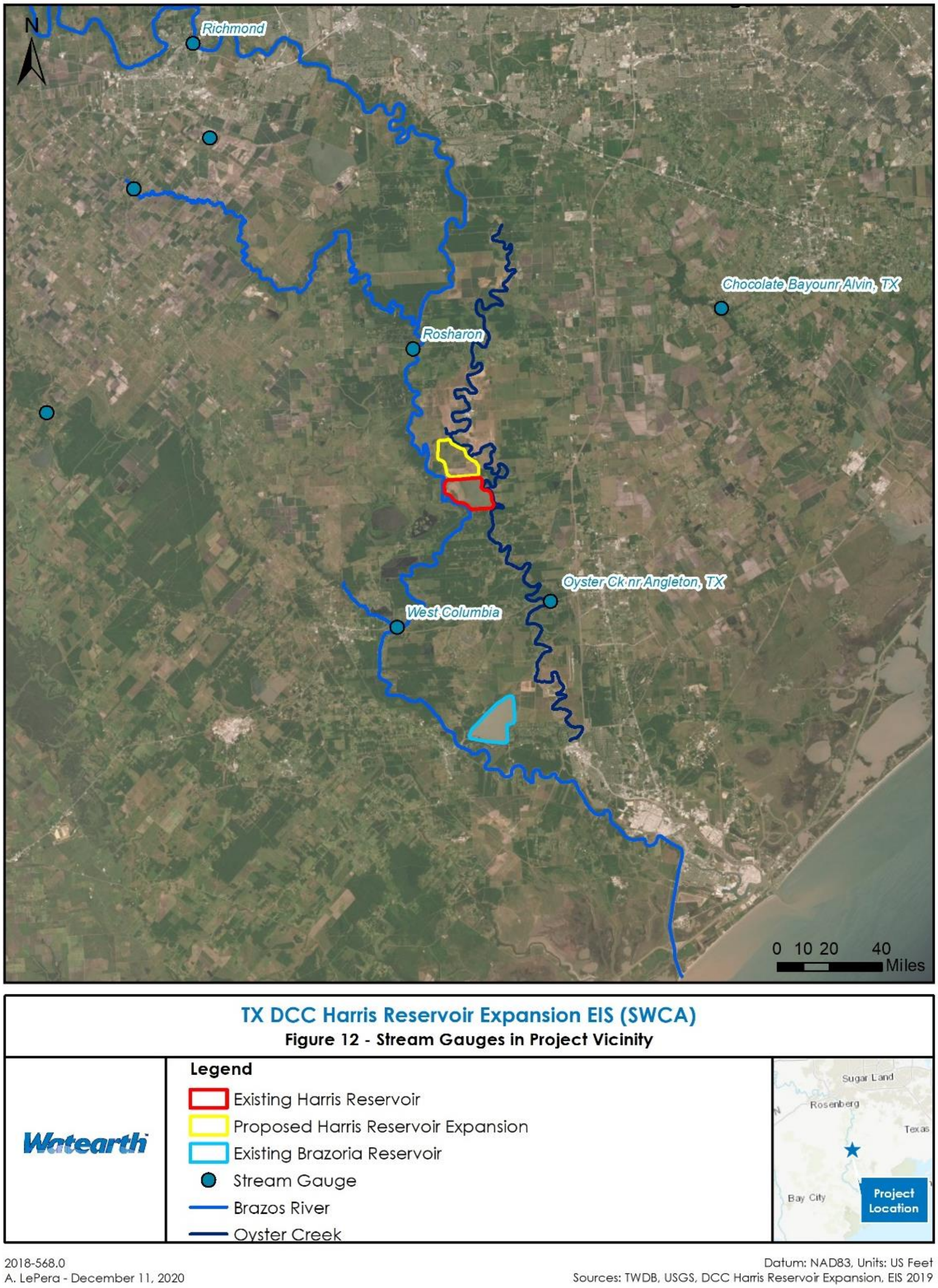


***Figure 12**: Stream gauges in vicinity of proposed project.*

A USGS gauge upstream of the project site at Brazos River (USGS 08116650 Brazos River near Rosharon, Texas) shows the flow time series fluctuates significantly in a relatively short period of time. Historical records show that daily flows within 1 month can go from 800 cfs to more than 100,000 cfs and back to low flows again within the next month.

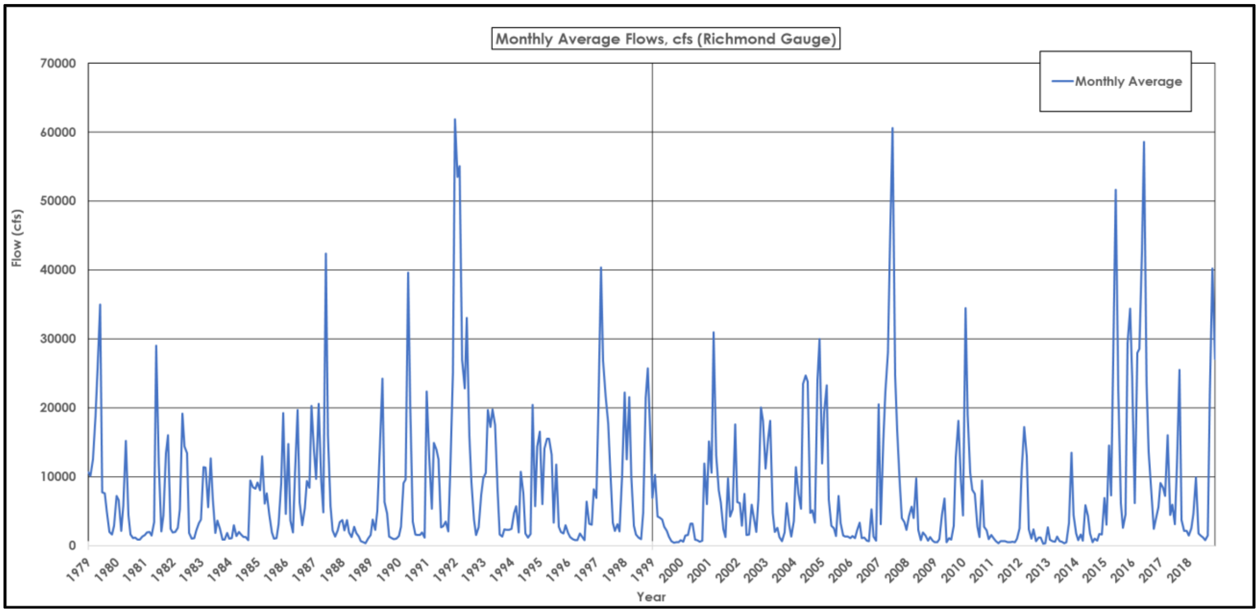


Figure 13*: Monthly average flows, Richmond, Texas, gage.*

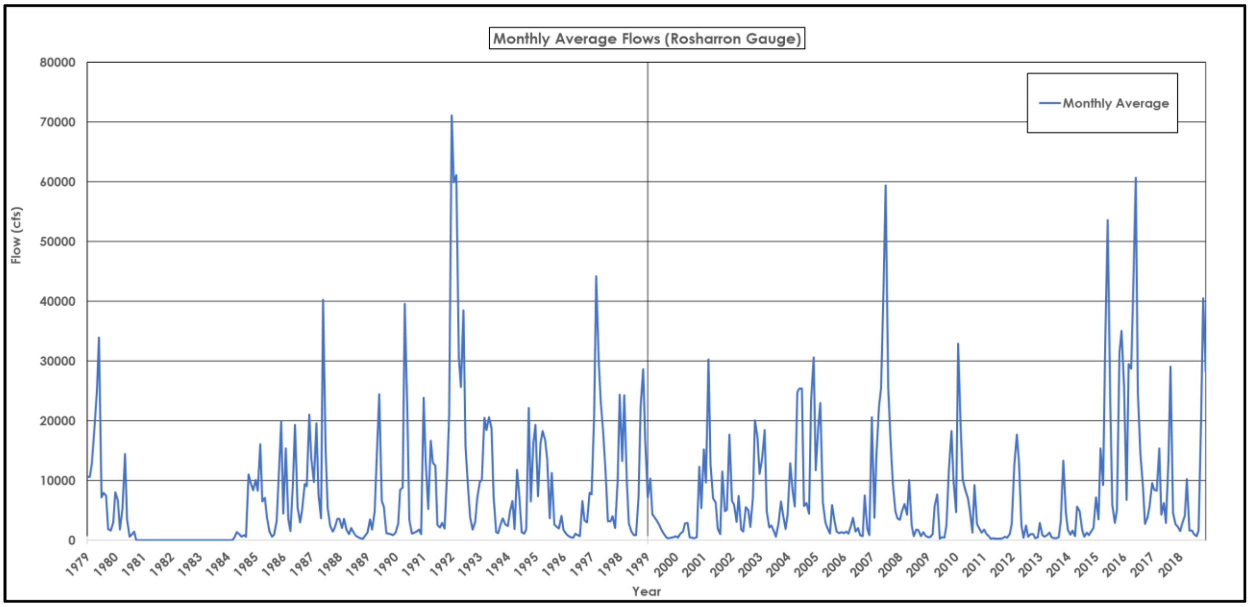


Figure 14*: Monthly average flows, Rosharon, Texas, gage.*

The comparison of the data shows over the entire period of record, the monthly mean peak discharge attenuates in the downstream direction. The maximum monthly mean discharge drops from 14,200 cfs to 12,400 cfs in May. Such attenuation is expected in the lower sections of the Brazos River, "as elevated flows enter storage in the low elevation terrain and are released over longer time periods" (USGS, undated). Conversely, the lower flows seen during November, December, January, February, March, April, June, July, August, and September increase in the downstream reach. The highest monthly average discharge in the Brazos River occurs in June as shown in **Figure 15**.

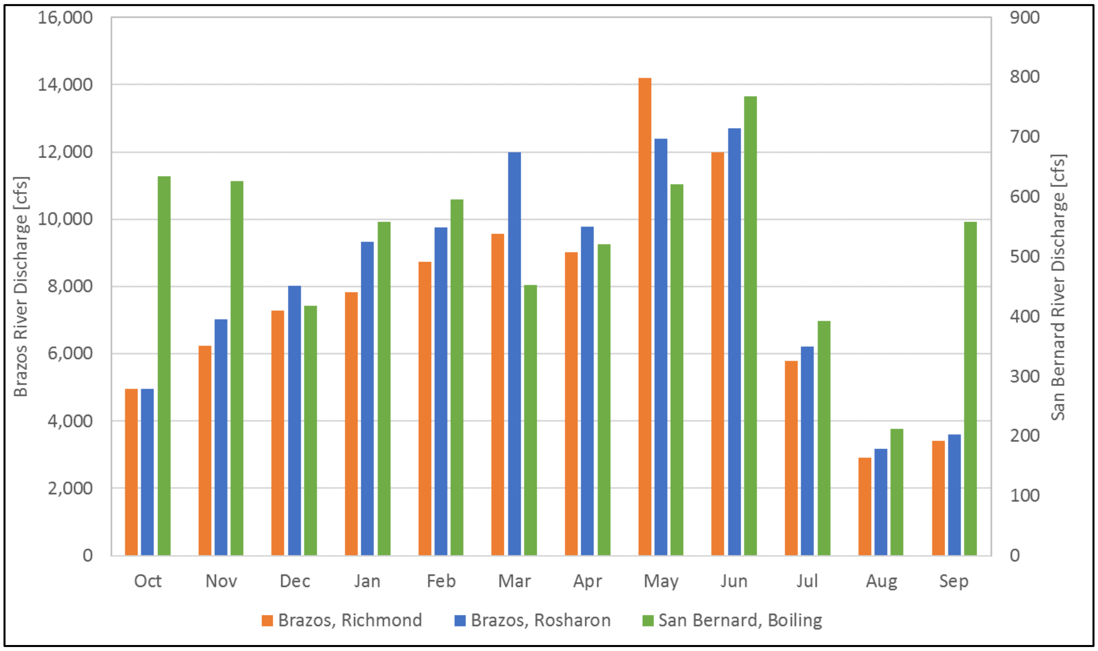


***Figure 15**: Long-Term monthly mean streamflow discharge at USGS Stations Brazos River near Richmond (upstream in blue), Brazos River near Rosharon (downstream in red) and San Bernard River near Boling. Data are shown in water year from October 1 to September 30.*

3.5 Sedimentation Loads in Brazos River

3.5.1 Introduction

Sediment transport is a function of riverine systems. The velocity of flow determines sediment load and gradation size as higher velocities carry larger particle sizes and resist settling. Increases in velocities can also resuspend larger particle size sediment.

3.5.2 Brazos River Sediment Load

Sand-sized sediment transport has decreased since measurements were taken starting in 1969. The decrease is at least partially attributable to the effects of the operation of new reservoirs during the time period (USGS, 2001). The reservoirs reduce high peak flows, which can transport larger particles for longer distances, and trap sediment within their boundaries. The scatter plot in **Figure 16** shows the relationship to discharge rates and concentration of sand particles with a Locally Weighted Scatterplot Smoothing (LOWESS) line. The plot provides a graphical comparison between the two time periods shown without assigning a statistical significance to the difference (USGS, 2001). At similar discharge rates, the suspended-sand load is reduced during the latter period. Tables 2 and 3 show the change in Brazos River based on surveys taken in 1990 and 2020.

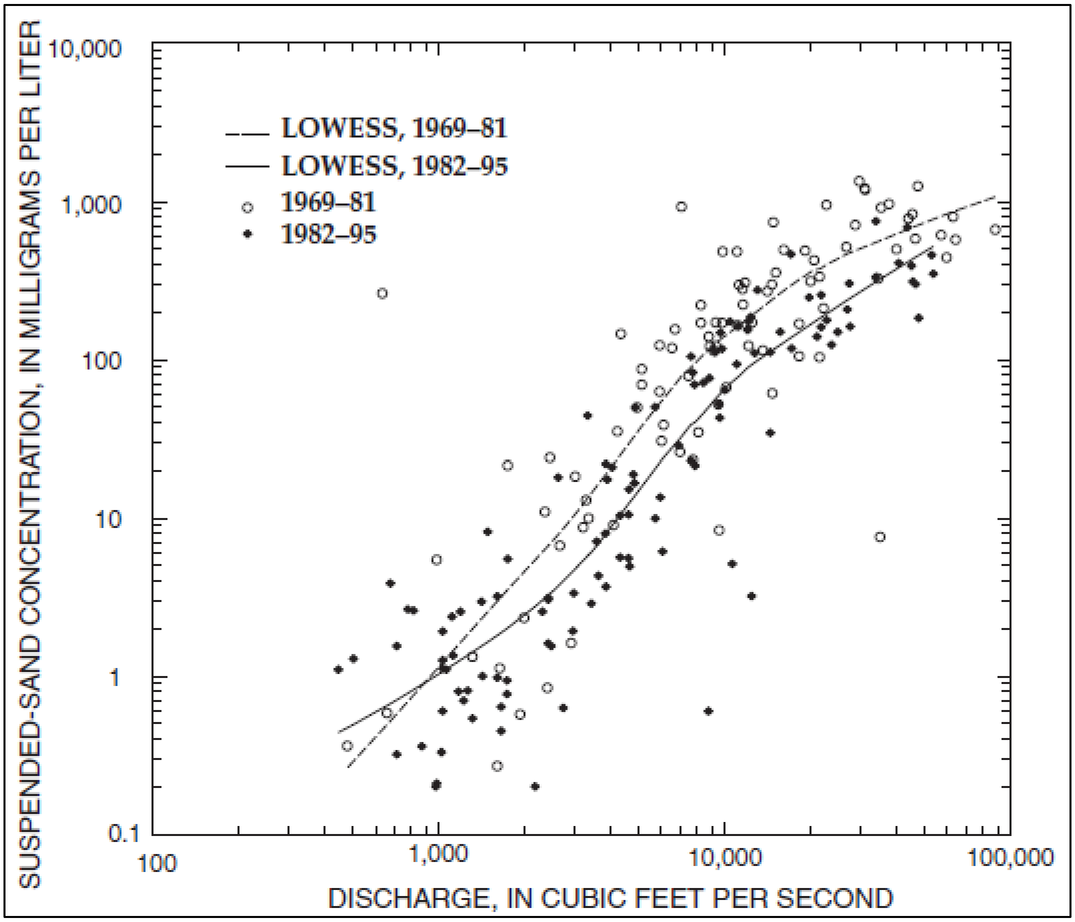


***Figure 16**: Relation of suspended sand concentration to discharge at Streamflow-Gaging Station 08114000 Brazos River at Richmond, Texas, 1969–1995 (USGS, 2001).*

Table 2: Brazoria Reservoir

Authorized			1990 Survey			Adjusted 1990 Survey			2020 Survey		
Volume-Area-Depth			Volume-Area-Depth			Volume-Area-Depth			Volume-Area-Depth		
Volume (ac-ft)	Area (acres)	Elevation (ft)	Volume (ac-ft)	Area (acres)	Elevation (ft)	Volume (ac-ft)	Area (acres)	Elevation ft)	Volume (ac-ft)	Area (acres)	Elevation (ft)
0	0	13.6	0	0	16.0	0	0	16.0	0.2	1	13.0
160	200	15.2	90	300	17.6	160	200	17.6	70	72	17.5
900	400	17.6	900	800	20.0	900	400	20.0	992	727	20.0
2,257	830	19.6	2,000	1,300	22.0	2,257	830	22.0	2,884	1,142	22.0
4,587	1,500	21.6	4,650	1,830	24.0	4,587	1,500	24.0	5,615	1,549	24.0
6,262	1,850	22.6	6,000	1,850	25.0	6,262	1,850	25.0	7,248	1,700	25.0
9,103	1,860	24.2	8,500	1,860,	26.6	9,103	1,860	26.6	9,875	1,787	26.5
21,710	1,870	31.0	17,300	1,870	31.0	17,309	1,870	31.0	18,115	1,851	31.0
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	18,207	1,851	31.05
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	21,883	1,858	33.0
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	25,546	1,865	35.0
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	29,283	1,872	37.0
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	31,156	1,873	38.0
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	32,092	1,873	38.5

Table 3: Existing Harris Reservoir

Authorized			1990 Survey			Adjusted 1990 Survey			2020 Survey		
Volume-Area-Depth			Volume-Area-Depth			Volume-Area-Depth			Volume-Area-Depth		
Volume (ac-ft)	Area (acres)	Elevation (ft)	Volume (ac-ft)	Area (acres)	Elevation (ft)	Volume (ac-ft)	Area (acres)	Elevation (ft)	Volume (ac-ft)	Area (acres)	Elevation (ft)
0	0	29.8	0	0	32.0	0	0	32.0	N/A	N/A	N/A
13	50	30.3	20	200	32.5	13	50	32.5	0.3	3	33.0
88	100	31.3	50	480	33.5	88	100	33.5	3.3	9	33.5
493	170	34.3	200	1,220	35.5	493	170	36.5	668.8	672	36.5
728	300	35.3	400	1,450	36.5	728	300	37.5	1,539.4	1,148	37.5
813	550	35.5	1,000	1,600	37.7	813	550	37.7	2,158.3	1,345	38.0
1,593	1,400	63.3	1,500	1,655	38.5	1,593	1,400	38.5	2,861.2	1,466	38.5
2,355	1,650	36.8	3,000	1,660	39.9	2,355	1,650	39.0	3,613.2	1,531	39.0
5,173	1,665	38.5	4,500	1,665	40.7	5,173	1,665	40.7	5,962.3	1,580	40.5
10,199	1,675	41.5	6,500	1,675	41.5	6,509	1,675	41.5	7,546.1	1,586	41.5
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	13,102.5	1,605	45.0
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	16,323.6	1,615	47.0
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	17,131.6	1,616	47.5

The amount and gradation of the sediment carried by the Brazos River is highly dependent on the velocity of the river. High flows carry sand, silt, and clay, but low flows carry mostly clay. The intake pump inlets for both existing reservoirs are below the natural stream bed, which likely results in sediment intake at all flow conditions. The proposed project intake has a similar location compared to the natural stream bed.

Historical suspended sediment concentration (SSC) was recorded in the Brazos River at USGS Station 08116650 (Rosharon gage) monthly between 1973 and 1981, and again between 2008 and 2015 (**Figure 17**).

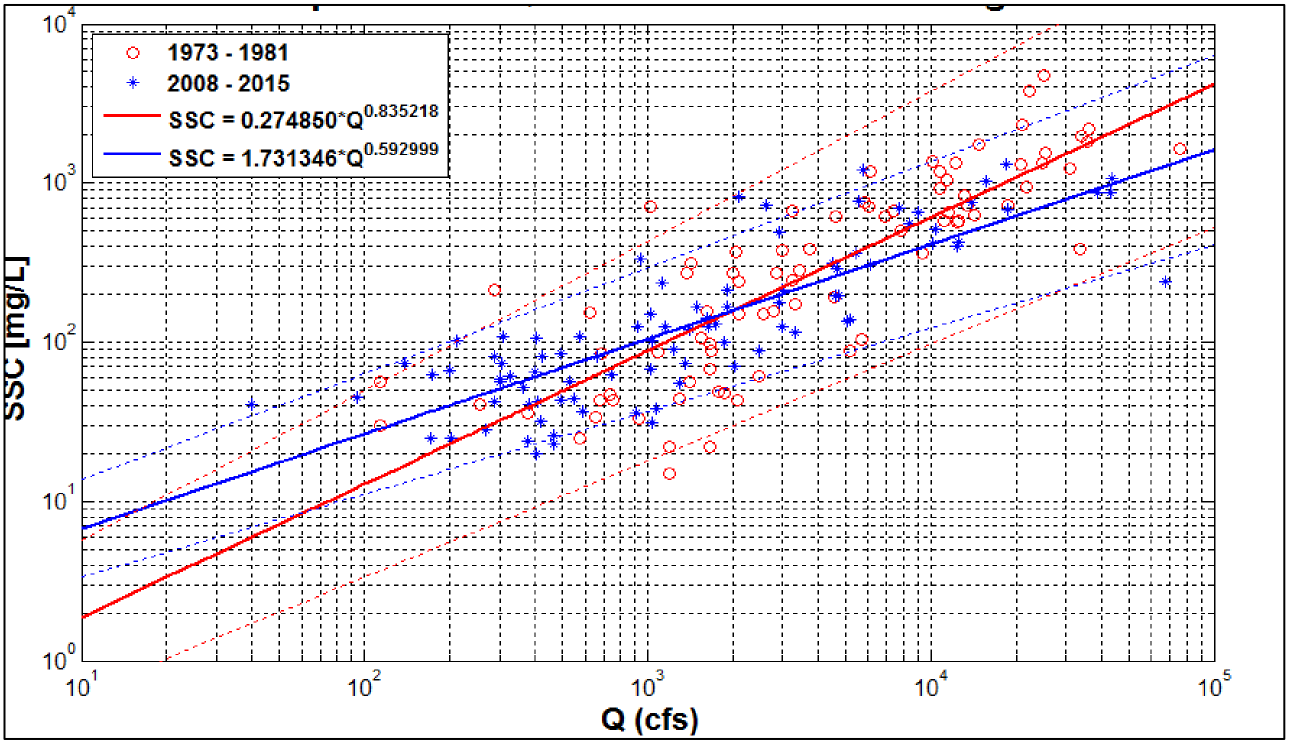


***Figure 17**: Sediment load curve at Brazos River, Rosharon gage, based on measured data.*

Dow reported periodic sediment removal of the existing Harris Reservoir through dewatering and bulldozer excavation, but documented frequency was not provided. Further, there is no current schedule of future maintenance for the existing reservoirs. Dow also reported in its *Dow Water Rights and Supply – Fast Facts and Information (June 2020)* document an existing permit authorizing dredging of solids from the reservoirs with specified, limited releases to the Brazos River under certain river flow conditions but indicated concerns with embankment stability. It is possible to dredge these reservoirs back to their original authorized capacity with modern equipment in conjunction with radar surveys or global positioning systems (GPS) that would control the location and depth of dredging. Dredging to original or deeper contours could increase available water but would not increase reservoir surface area where evaporation occurs.

The historical reservoir capacity loss for Brazoria Reservoir was 111 ac-ft per year (ac-ft/yr) from 1954 to 1990. The straight-line projection of 111 ac-ft /yr storage loss by sediment forecast the 2020 Brazoria Reservoir storage volume at approximately 14,877 ac-ft (**Table 4**). Survey data from 2020 show actual storage capacity of 18,207 ac-ft.

The historical reservoir capacity loss for Harris Reservoir was 81 ac-ft/yr from 1947 to 1990 (**Table 4**). The straight-line projection of 81 ac-ft/yr storage loss by sediment forecast the 2020 Harris Reservoir storage volume to approximately 6,706 ft. 2020 survey data show actual storage capacity of 9136 ac-ft.

Table 4: Effective Storage Capacity for Existing Harris and Brazoria Reservoirs

Year (Estimate by)	Harris Reservoir (ac-ft)	Brazoria Reservoir (ac-ft)	Total Effective Storage (ac-ft)
1947	10,200	-	10,200
1954	-	22,000	22,200
1990 (Dow by survey)	6,500	17,300	23,800
2018 (Dow USACE Application)*	7,000	21,000	28,000
2020 (by Doyle and Wachtstetter)	9,136	18,207	27,343

* Dow USACE application and 2020 Doyle and Wachtstetter storage values are used for purposes of analysis and modeling.

3.6 Other Hazards Considered

3.6.1 Wind

The proposed Harris Reservoir location is close to the Gulf of Mexico and can be subject to high winds from tropical storms and hurricanes. The preliminary design report supplied by CH2M was reviewed concerning their design approach and how wind may affect the proposed Harris Reservoir design. The design report indicates that in 2017, a wind speed of 185 miles per hour (mph) was reported from Hurricane Harvey.

The high winds traveling across open water in the reservoir (the fetch) generate waves that could damage the embankment or even overtop the embankment. The preliminary design indicates that these concerns were taken into consideration and addressed by elements such as the soil-cement embankment protection, the wave wall at the intersection of the top and interior slope, and the operational drawdown prior to the forecasted storm events.

3.6.2 Wave

The preliminary proposed embankment design addresses the embankment slope protection from wave action with the placement of 8-inch stair-stepped soil-cement lifts on the interior slope above elevation 60.93. Dow also prepares for large storm events by drawing down the reservoir pool elevation whenever a hurricane alert is issued for any substantial hurricane that may make landfall near the reservoirs, allowing for more freeboard below the top of the embankment.

The preliminary design also addresses overtopping, which is the most common cause of an embankment breach and uncontrolled release of water. A 3-foot tall bullnose (or parapet) wall at the interior edge of the embankment top would be anchored into the soil-cement to reduce overtopping of the embankment. Using the U.S. Bureau of Reclamation breach equation, Watearth estimates approximately 12,500 cfs of water could be released into the Brazos River or Oyster Creek in the event of a breach. While this is a significant quantity of water, the downstream floodplain would quickly dissipate this volume and little to no long-term effects would be anticipated under current land use conditions.

3.6.3 Tidal Elevations

The lowest extent of the project is the confluence of Brazos River with the Gulf of Mexico near Freeport, Texas. In addition, nearly the entire project area is subject to estuarine conditions with one of the factors being tides. Tides are determined by the lunar cycle, distance, and position of the moon in comparison to the sun, and gravitational forces. The lunar day is 24 hours and 50 minutes, resulting in two high tides per lunar day every 12 hours and 25 minutes, with the accompanying low tide occurring six hours and 12.5 minutes after the high tide. Due to the relationship between the moon and the position on Earth experiencing a tide, there will be a higher and lower high tide during the lunar day. With other influences, such as the position of the sun, higher than normal tides can occur (sometimes referred to as king tides).

The Gulf of Mexico is tidally influenced with tidal conditions similar to an inland sea due to a large coastal shelf and relatively narrow entrance blocked by Cuba and other Caribbean islands. As such, tides can be highly influenced by storm conditions.

The tidal gauge at Freeport, Texas (gauge 8772447), located 6 miles northeast of the mouth of the Brazos River, measures tidal conditions near the project area (**Figure18**) (NOAA, 2019). The average monthly high tide fluctuation is 1.67 ft (MSL) with the largest recorded fluctuation of 5.4 ft (MSL). The average fluctuation between the monthly lowest low tide and the highest high tide is 3.65 ft (MSL) with a largest recorded fluctuation of 7.25 ft (MSL). This is a relatively narrow band of water surface elevation changes related to tides, but when taken in consideration with the low nearshore topography, it can present design and inundation risks, especially during storm surge. The flat topography carries relatively far inland as the bottom of the Rosharon gauge is below MSL.

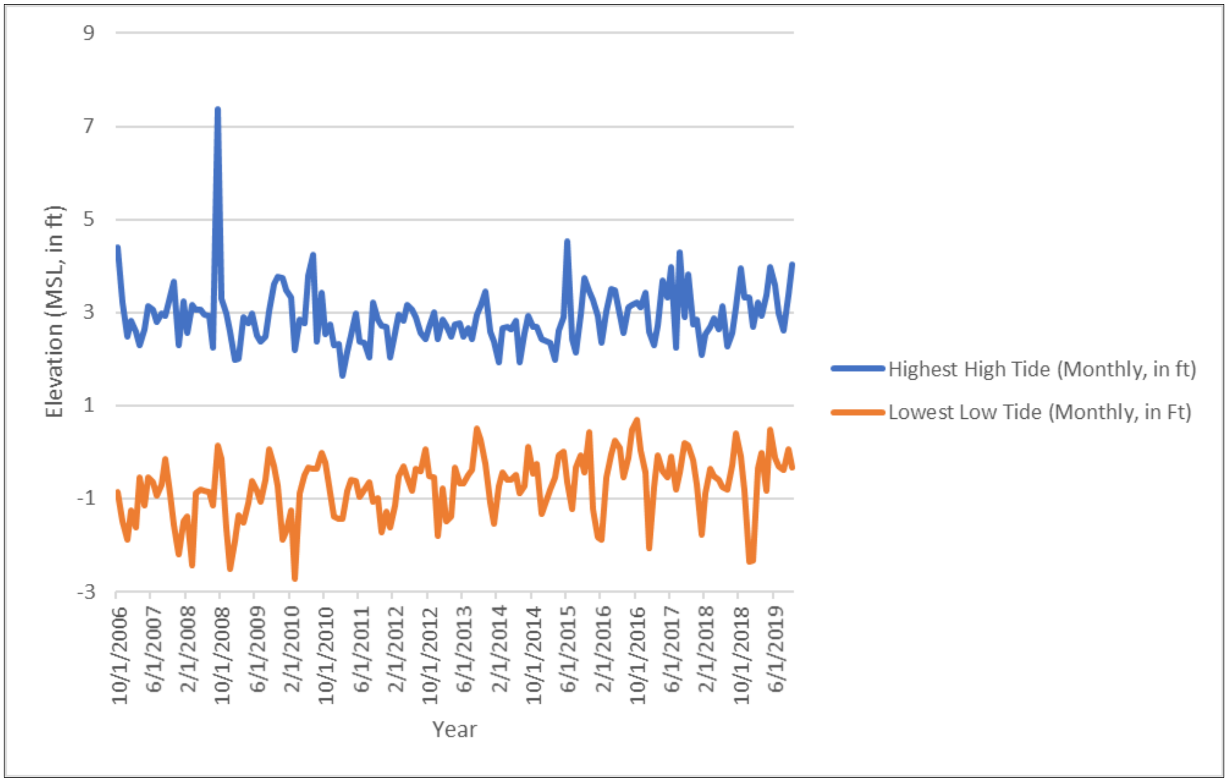


Figure18: Highest high tide and lowest low tide (monthly, in ft) for Freeport, Texas, gauge 877244.

4.0 Proposed Project

The proposed project, referred to as Harris Reservoir expansion in the permit application to USACE Regulatory, is located immediately north of the existing Harris Reservoir (**Figure 19**). The proposed project includes a 2,000-ac impoundment with a nominal storage capacity of 50,968 ac-ft, an intake and pump station to divert Dow's existing surface water rights from the Brazos River, an outlet to Oyster Creek, and an auxiliary spillway. The proposed project will change the current interbasin flows from the Brazos River to Oyster Creek and the amount of floodplain storage. Recommendations will be added to the proposed O&M plan for the proposed project and operational flows in Oyster Creek. The project also includes floodplain enhancements to Oyster Creek, stream restoration, and temporary construction staging and laydown areas.

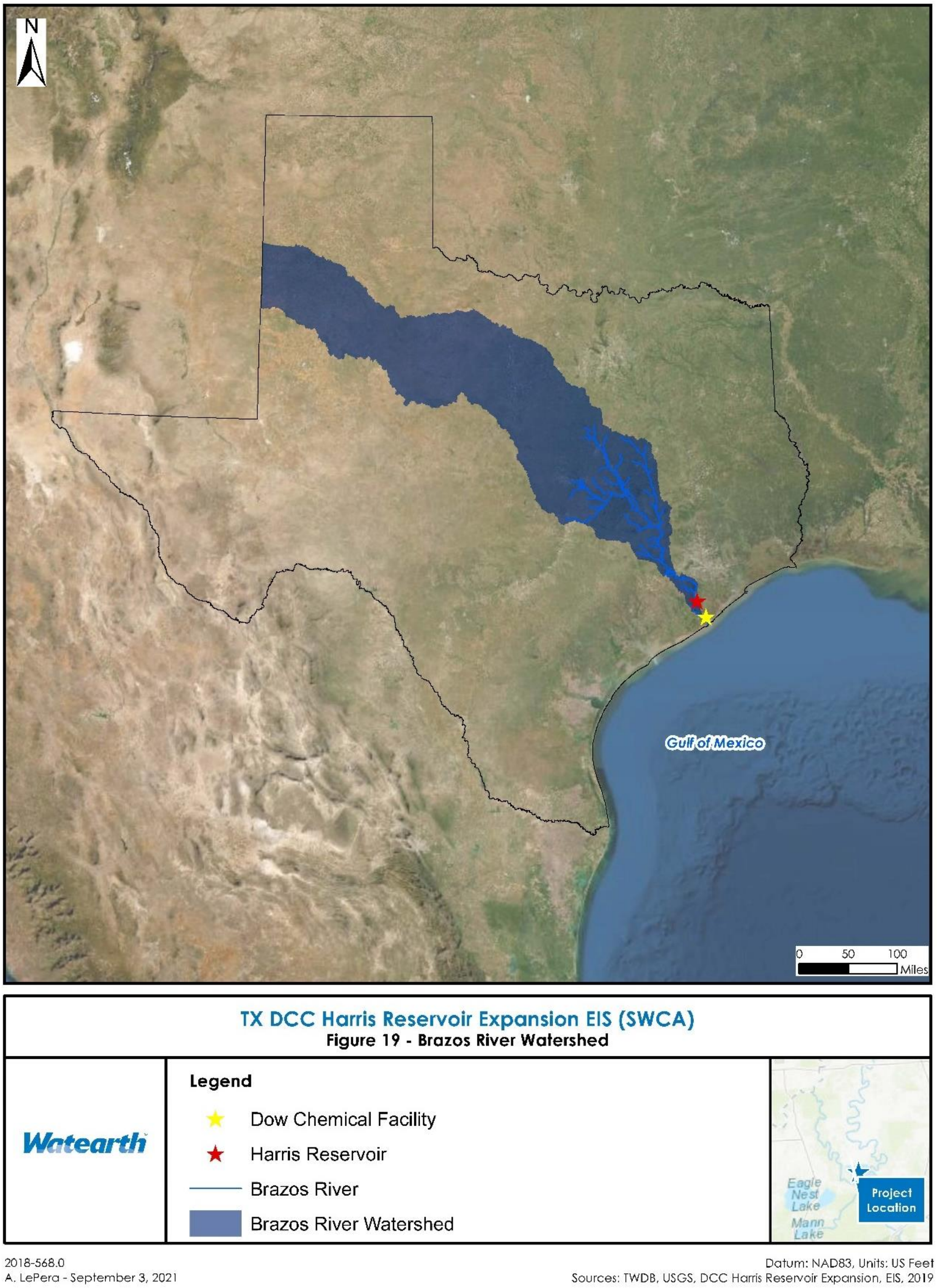


Figure 19*: Project elements for hydrologic analysis.*

4.1 Harris Reservoir Expansion

The embankment will be constructed to a nominal elevation of 72.7 ft with borrow material from the reservoir interior, leaving 400 feet of no borrow zone from the embankment toe (**Figure 20**). The embankment will have a 3-foot-wide vertical chimney drain located 5 feet downstream of the embankment center line. Drainage will continue into a horizontal blanket drain, which will exit into the embankment tow drain. The interior will have a sacrificial lower slope with a stepped soil-cement upper slope for wave protection. A 3-feet tall (top of wall is El. 75.7 ft) precast concrete wave wall will be anchored into the soil-cement at the intersection of the interior embankment slope and top of embankment.

A 2.5-foot-wide vertical seepage barrier wall will be constructed 35 ft upstream from the embankment centerline. The seepage barrier is under the entire embankment length of 36,059 ft. The depth of the seepage barrier wall varies from 17 ft below natural ground to 55 ft below natural ground.

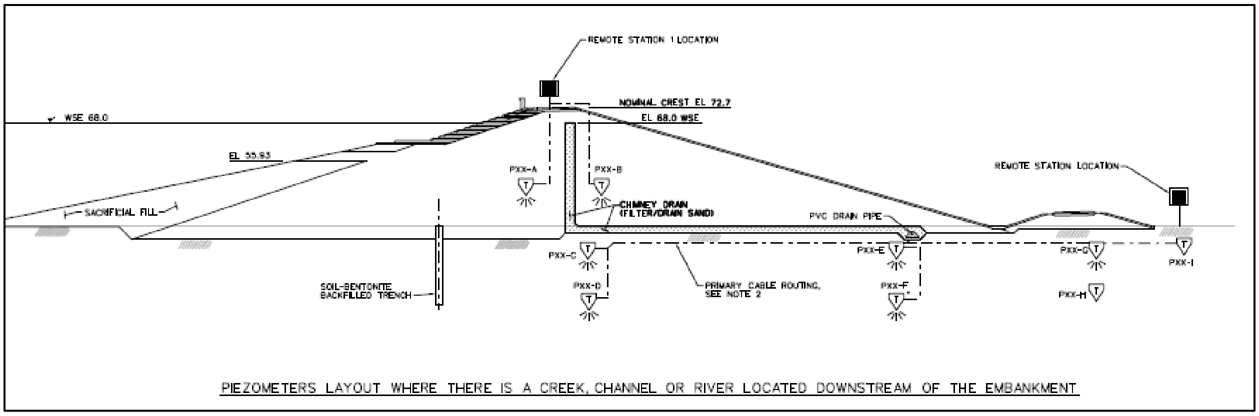


***Figure 20**: Embankment cross-section.*

The proposed pump station is located near the southwest corner of the proposed project at embankment STA 113+89 and has a capacity of 150,000 gpm (334 cfs). The water is pumped from the Brazos River intake through the pump house up and over the embankment in a 72-inch pipe into the project intake structure. The suction centerline elevation is set at 8.5 ft, which will require a vacuum priming system to fill the pump suction lines. The pumps can be isolated for maintenance regardless of the river level. The 72-inch pipe will have a gooseneck air vent at the top of the embankment for gravity flow down the interior of the reservoir embankment to an energy dissipation structure inside the reservoir at the end of the pipe. The combined gated outlet and auxiliary spillway structures are located on the southeast side of the reservoir at STA 227+29.88. The outlet structure has two 36-inch-wide × 48-inch-high sluice gates that allow water to flow in an outlet conduit through the embankment into a stilling basin at rates from 60 cfs to 1,000 cfs. The baffled drop inlet auxiliary spillway structure also flows into the outlet conduit. The baffled outlet structure is designed to allow the reservoir to be lowered 3 ft from normal maximum water surface elevation prior to storm events. A 1-foot per day draw down requires slightly more than a 900 cfs release rate. The stilling basin outlets into the constructed Oyster Creek flood channel.

The northeastern part of the proposed project includes enhancement of the Oyster Creek flood capacity and provides riparian restoration. The enhancement starts on an unnamed tributary, which flows into Oyster Creek where riparian restoration and flood plain benching is planned. A weir will be constructed that allows large discharges to flow down the flood channel, which parallels the project embankment along the north side until it flows back into Oyster Creek below the gated outlet and auxiliary spillway outlet.

There will also be a temporary staging area and temporary workspace located southeast of the project and due north of the existing Harris Reservoir. This area will be restored back to natural conditions after the project is completed.

4.2 Oyster Creek Enhancements

As part of the proposed expansion project, Oyster Creek will be enhanced with three projects. These projects are planned to improve the flood capacity and provide restoration and enrichment to the riparian habitat along the three project lengths. Geomorphic design principles were used to provide a bankfull benching creating floodplain storage, riparian habitat, and channel conveyance to accommodate the proposed Harris Reservoir outlet flow into Oyster Creek.

Project 1 is approximately 3,516 ft long from STA 5+15.90 to STA 40+00 on an unnamed tributary north of the proposed project's northeast corner. Project 1 widens the existing unnamed tributary channel to Oyster Creek north of the confluence of Oyster Creek and the unnamed tributary north of FM 655. The changes include providing a 70-foot bottom-width channel with 4H:1V side slopes and a widened floodplain bench, which are represented between cross-sections 61.87 and 61.43 of the HEC-RAS model. The channel flows into Oyster Creek a short distance north of the northeast corner, which is the start of Project 2.

Project 2 is approximately 12,960 ft long from STA 40+00 to STA 169+60 and is in the main channel of Oyster Creek. Widening of the Oyster Creek channel through this section will be predominantly on the western side of Oyster Creek and include an 80-foot bottom width channel with 4H:1V side slopes followed by a 150-foot flat buffer and channel with 4H:1V side slopes until tying to existing ground. This provides a 310-foot-wide top width for the section of channel represented between cross-sections 60.47 and 58.67 of the HEC-RAS model. Project 2 is intended to restore the natural function of the channel by planting riparian vegetation and providing a riparian buffer in conjunction with channel widening.

Project 3 is an improved flood overflow channel that flows along the east side of the proposed Harris Reservoir until the channel intersects downstream with the main Oyster Creek channel at STA 254+00, and also the proposed Harris Reservoir outlet channel. The Project 3 channel will extend 4,300 feet south, rejoining Oyster Creek 12,000 feet upstream of CR 34 (Harris Reservoir Road). A weir would prevent flows from the Oyster Creek main channel from spilling into the overflow channel until the existing Oyster Creek main channel exceeds its 25-year water surface elevation (WSEL); however, backwater flows will inundate the downstream end of the Project 3 channel at lower rates. Project 3 provides additional channel capacity for Oyster Creek during high flow events. A typical cross-section of the Project 1 through Project 3 stream restoration to recreate the multiple level channel morphology is shown in **Figure 21**.

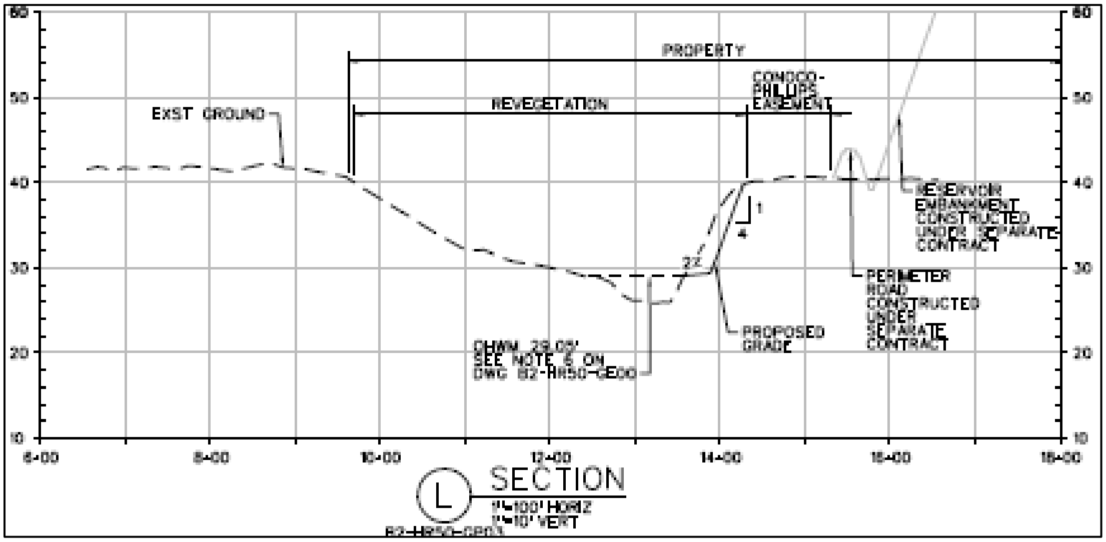


Figure 21: Cross-section of Oyster Creek restoration in area adjacent to the reservoir embankment.

4.3 Water Supply Needs

Modeling results show that 78,311 ac-ft of reservoir storage is needed to supply Dow's Texas Operations for 180 days during an extended drought using existing water rights. Dow needs 430 ac-ft per day of water supply to meet its daily water supply obligations, which include the Brazosport Water Authority (BWA), which supplies approximately 16,000 ac-ft per year to its customers through the Dow water pumping and reservoir facilities. The effective combined storage capacity in the existing Brazoria and Harris Reservoirs is approximately 27,343 ac-ft. Therefore, Dow will need to develop additional storage capacity of 50,968 ac-ft from a new reservoir to provide a reliable water supply during drought, which cannot be achieved by maintenance dredging or deepening Dow's existing reservoirs.

Use of Dow's existing water rights and storage facilities, existing pumping and conveyance system through Oyster Creek and Buffalo Camp Bayou, and existing industrial plant canal system supplemented with expanded storage at the Harris Reservoir site provides a cost-effective and financially viable means of meeting the storage requirements and increasing drought resilience for Dow's Texas Operations, industries, and the BWA. Without additional storage capacity that would allow more efficient use of Dow's existing surface water rights from the Brazos River, production at Dow's Texas Operations and reliable public water supplies for BWA customers would be at risk during extended drought conditions. Reduction of production would result in severe economic hardship for the local economy—potentially affecting approximately 6,700 direct jobs at Dow's Texas Operations and the health and safety of the seven cities in Brazoria and Fort Bend Counties that currently obtain approximately 16,000 ac-ft per year of drinking water from Dow's water supply system through the BWA. Furthermore, interruption of production would impact material supply across the state and the nation.

The recent drought conditions demonstrated the urgency for implementation of a project to provide additional storage and increase the reliability of water supply during drought in an environmentally responsible and financially viable manner. Without additional water storage to increase Dow's resilience to drought, essential functions at the Texas Operations site would be at risk during times of water shortage. The proposed project is intended to reduce the risk of water shortage during drought.

5.0 Hydrology, Operational, and Hydraulic Modeling

The purpose of this section is to describe the three models used to analyze the existing and proposed project and for compliance with the Hydrologic Modeling Guidelines (HMG). The models discussed in this section include Hydraulic Engineering Center-Hydrologic Modeling System (HEC-HMS), RiverWare, and Hydraulic Engineering Center-River Analysis System (HEC-RAS).

5.1 Hydrologic Modeling Guidelines

The USACE developed the HMGs checklist for use by USACE Regulatory project managers and applicants to guide their daily data analysis and modeling process. Required information is presented as a series of questions, grouped into three tiers of increasing complexity. Per the HMGs, the USACE permit decision is based on whether enough information have been provided so all required aspects of the project are appropriately addressed. From a modeling perspective, this documentation presents a general summary of three models selected for the project in terms of their capabilities to address related items in the HMGs checklist.

The models provide answers to the following items:

1. Flow extent and water depth under both existing and post-project condition
2. Peak and low flow impacts on aquatic resources under both wet and dry hydrology periods

The USACE Regulatory uses the HMGs checklist in determining sufficiency for hydrologic evaluation but does not require the use of specific modeling software, which allows for flexibility in determining which suites of software to use based on the proposed project's potential impacts. In general, any project that includes an existing and/or proposed Harris Reservoir will require the use of the RiverWare modeling software due to its unique capabilities to model complex reservoir operations including input of water rights and water supply. As more fully discussed in the *Hydrology and Hydraulic Modeling White Paper (2019)* and the *Environmental Modeling Approach (2019)* prepared for this project, HEC-HMS has reservoir modeling capabilities, but these are limited compared to RiverWare in that HEC-HMS uses a science-based hydrologic model while RiverWare models the type and ownership of the water in the system to identify the owner of water based on water rights priority at any location. RiverWare also allows for prioritizing of different objectives, such as water diversion, flood control, environmental flow compliance, etc., making it possible to solve very complex water resources problems.

In addition to RiverWare, the USACE-developed HEC-HMS and HEC-RAS models are necessary to fully address the HMGs checklist. The three models have different strengths in responding to the questions posed in the HMGs and need to be used collaboratively as none of them individually provide the full picture of potential impacts caused by proposed project conditions.

5.2 Model Descriptions

This section describes several different models used in the analysis of the project with specific attention to the three models developed as part of this analysis: HEC-HMS, RiverWare, and HEC-RAS.

1. **USACE-developed HEC-HMS** is designed to simulate the complete hydrologic processes of dendritic watershed systems. It can be applied to a wide range of geographic areas in solving a wide range of problems, including large river basin water supply, water withdrawal, flood hydrology, and small urban or natural watershed runoff. Flow time series produced by the model can be used in conjunction with other software for studies of water availability, urban drainage, flow forecasting, future urbanization impact, reservoir spillway design, flood damage reduction, floodplain regulation, and systems operation. The software includes many traditional hydrologic analysis procedures such as event infiltration including evapotranspiration, snowmelt, and soil moisture accounting (USACE, 2018).

   The primary purpose of the model for this analysis is to identify and process hydrologic data including instream flows and precipitation. Rainfall-runoff modeling with HEC-HMS based on gauged precipitation and upstream inflows provided results of river flows into and downstream of the proposed project. The results from HEC-HMS are flow hydrographs at points in the watershed where flows are not controlled by the proposed project operations.
2. **RiverWare** is a reservoir and river basin modeling software decision support tool. Users can model the topology, physical processes, and operating policies of river and reservoir systems to make decisions on how to operate these systems by understanding and evaluating the trade-offs among the various basin operation and management objectives, in both simulation and forecast modes. The model's wide variety of applications range from short-term operations to long-term water resources planning, which includes hydropower optimization, reservoir operation optimization, water accounting, water quality, environmental flows, and climate change assessments. The Bureau of Reclamation, the Tennessee Valley Authority, and the USACE sponsor ongoing RiverWare research and development. It is an ideal platform for operational decision-making, responsive forecasting, operational policy evaluation, system optimization, water accounting, water rights administration, and long-term resource planning (University of Colorado at Boulder, 2019).

   For this analysis, the primary purpose of this analysis is the prioritization tools for water rights and instream flows. Using outputs from HEC-HMS combined with user defined operating rules and scheduled withdrawals and releases, RiverWare simulated reservoir operations for the pre-defined 50-year analysis horizon.
3. **USACE HEC-RAS** is a computer program that models hydraulics of water flow through natural rivers, man-made channels, lakes, and reservoirs. The model can perform one-dimensional steady flow, one- and two-dimensional unsteady flow, sediment transport, and water temperature/water quality modeling. The HEC-RAS model is being developed as a part of the Hydrologic Engineering Center's "Next Generation" (NexGen) of hydrologic engineering software, which will encompass several aspects of hydrologic engineering, including rainfall-runoff analysis, river hydraulics, reservoir system simulation, flood damage analysis, and real-time river forecasting for reservoir operations (USACE, 2018).

For this project, river hydraulics were performed with HEC-RAS using unsteady flow modeling for selected drought, average, and storm events from the hydrographs produced by HEC-HMS, HEC-RAS–computed water surface profiles, velocity, and stage hydrographs. When used in conjunction with Habitat Suitability Criteria, weighted usable area for certain species habitat were calculated.

5.2.1 Water Availability Model

The TCEQ WAM is a computer-based simulation predicting the amount of water in a river or stream under a specified set of conditions. The model is used in evaluating water rights applications to help determine if water would be available for a newly requested water right or amendment, or if an amendment might affect other water rights. The WAM model is used by Dow and the TCEQ in predicting available flows for water rights in the Brazos River. However, the model cannot be calibrated against gauge records and therefore is insufficient for modeling and analysis needs for the proposed project.

5.3 Modeling Assumptions

Due to the conceptual, planning-level nature of the modeling performed for this study, several assumptions were made based on available data, synthesis of multiple data sources provided by Dow, and engineering judgement. Primary assumptions are noted below, and where relevant, further details are provided in **Section 5.4 Modeling Methodology**.

1. All elevations and project survey are based on vertical datum NAVD88.
2. Modeling was performed in HEC-HMS version 4.3, HEC-RAS unsteady flow version 5.0.7, HEC-RAS steady flow version 5.0.7, and RiverWare version 7.5.3.
3. HEC-RAS unsteady flow was used for routing flows along the Brazos River, whereas HEC-HMS was used to generate flow hydrographs for use in RiverWare and HEC-RAS unsteady flow and was not used for hydrologic routing along the Brazos River in this study.
4. HEC-HMS and HEC-RAS models were not available downstream of the portion of the Oyster Creek watershed where existing and future discharges will occur from the existing Harris Reservoir and proposed Harris Reservoir. Therefore, this analysis is based on analysis of available data and modeling results related to discharges from the Harris Reservoirs presently.
5. The following models were used as a basis for the modeling performed for this study:
    a. FPP HEC-HMS provided by Brazos River Authority
    b. FPP HEC-RAS unsteady flow provided by Brazos River Authority
    c. HEC-RAS steady flow Oyster Creek model by Baker and Lawson and provided by Dow as a HEC-2 model
    d. HEC-HMS hydrologic model of Oyster Creek by Jacobs
    e. HEC-RAS steady flow model of Oyster Creek by Jacobs
6. In its USACE application, Dow estimated the existing reservoir storage capacity at 7,000 ac-ft for the existing Harris Reservoir and 21,000 ac-ft for Brazoria Reservoir, providing a combined 28,000 ac-ft of existing water storage. A 2020 survey from Doyle and Wachtstetter provided an updated value of 27,343 ac-ft for effective storage that supersedes the application values presented by Dow. It is assumed that future, routine sediment removal maintenance operations will be performed to increase existing reservoir storage capacities.

7. During initial HEC-HMS modeling, existing conditions operations were simulated with numerical relationships rather than with physical structures and pumps due to the manual adjustments regularly made by Dow's operators that override set operational parameters. While this type of manual operation provides "real time" operational control to Dow, it is impractical to capture each detailed nuance within static modeling relationships and conceptual operational protocols for the reservoir modeling and routing. During the initial modeling, the diversions into the existing Harris Reservoir and Brazoria Reservoir are simulated with an inflow-diversion relationship (i.e., flow diverted into the reservoirs is based on flow in the Brazos River).

   Discharge from the existing Harris Reservoir and Brazoria Reservoir was based on storage-discharge relationships (i.e., discharge from the reservoir into Oyster Creek and the Brazos River, respectively, based on storage in the reservoir at a given time step). Operations of the proposed Harris Reservoir were similarly simulated. However, modeling results with this conceptual approach were not reflective of the actual reservoir operation, inflows, discharges, and water levels.

   As such, the modeling approach was changed to use historical operational data for the existing Brazoria and existing Harris Reservoirs, including diversions into the reservoirs and discharges out of the reservoirs. The proposed Harris Reservoir was simulated with similar, but scaled up, operational parameters as the existing Harris Reservoir.

8. Since detailed operational protocol and parameters were not available for the proposed Harris Reservoir, the historical operation data (i.e., inflows from the Brazos River and discharges to Oyster Creek) for the existing Harris Reservoir were scaled up proportionately based on the proposed storage volume versus the existing storage volume.

9. The elevation-volume relationship for the proposed Harris Reservoir was estimated from available design details using the conic approximation method and did not account for detailed bottom grading, if any. It was then adjusted to match the total volume provided by Dow. Small changes to the total estimated volume or the elevation-volume relationship will not have a significant effect on results of this study.

10. Rainfall gage data were not available for the entire period of record for the analysis based on historical operational parameters. As such, precipitation in the lower reach of the Brazos River below the Rosharon gage was neglected for part of the analysis as watershed processes in the Brazos River are driven by the large upstream watershed effects rather than by local rainfall.

11. HEC-RAS unsteady flow of the Brazos River was not stable with the negative (flow leaving) diversions into the existing and proposed Harris Reservoir. To stabilize the model and provide a basis of comparison, the diversions into the Harris Reservoir and diversions into and discharges from the Brazoria Reservoir were excluded. The increased diversion into the proposed Harris Reservoir was simulated by adding the diverted flows in existing conditions and removing them in proposed conditions.

12. Consistent with the project description, it was assumed that the entire Harris Reservoir expansion would be constructed at once and not phased.

13. The objective of the analysis was to evaluate the operation and potential water resources impacts of the proposed Harris Reservoir as designed. As such, the effects of changes in location, volume, or operations were not evaluated.

A detailed modeling was performed to determine the potential impacts of proposed Harris Reservoir on Oyster Creek. *Oyster Creek Downstream Hydrologic and Hydraulic Impacts Final Report (October 2021)* provides this study and its results.

5.4 Modeling Methodology

This section describes the site-specific model development for the hydrologic, hydraulic, and reservoir operational models.

5.4.1 Brazos River HEC-HMS

The Brazos River HEC-HMS model used in this study was taken from the BRA Lower Brazos Flood Protection Planning Study (FPP) HEC-HMS hydrologic model that was approved by the BRA in March 2019 (Halff, 2019). The original model was truncated upstream of the Richmond USGS gage to reduce run times and eliminate unnecessary data, as none of the sub-basins upstream of the gage are part of the area of study for this report (see **Figure 22** and **Figure 23**). While the study area extends from the Rosharon gage to the outlet of the Brazos River at the Gulf of Mexico, the reach upstream was extended to the Richmond gage to provide a more comprehensive model in the project vicinity.

The original FPP study model did not include either the existing Harris or Brazoria Reservoirs that are operated by Dow. These two reservoirs and their corresponding diversions along the Brazos River were added to the existing conditions model along with applicable routing reaches to connect back downstream to the Brazos River and to account for discharge of flows from the existing and proposed Harris Reservoir into Oyster Creek. The proposed/expansion condition model included all the aforementioned model elements, but a diversion was added upstream of the existing Harris Reservoir to tie into the proposed Harris Reservoir, which was also added to the HEC-HMS model based on the current CH2MHill design (**Figure 24**).

All hydrologic modeling was performed in HEC-HMS version 4.3 following standard modeling procedures for conceptual or planning-level analysis. The modeling simulations were run on daily time steps, which is appropriate for continuous simulation modeling covering this timeframe, and consistent with the original HEC-HMS model. Summarized HEC-HMS basin model names are in **Table 5,** and the models are included in **Appendix A**.

Figure 22 shows a visual representations of the drainage areas, reservoirs, and sub-basins involved with the exsisting conditions project modeling. The polygons shown in green are part of the Brazos River watershed and are upstream of the project area. The area highlighted in yellow is the original drainage area for B_BRA_410 called B_BRA_410_original. Next to B_BRA_410_original is BRA_410, which is the area used within the existing condition model and includes the area within the existing Harris Reservoir.

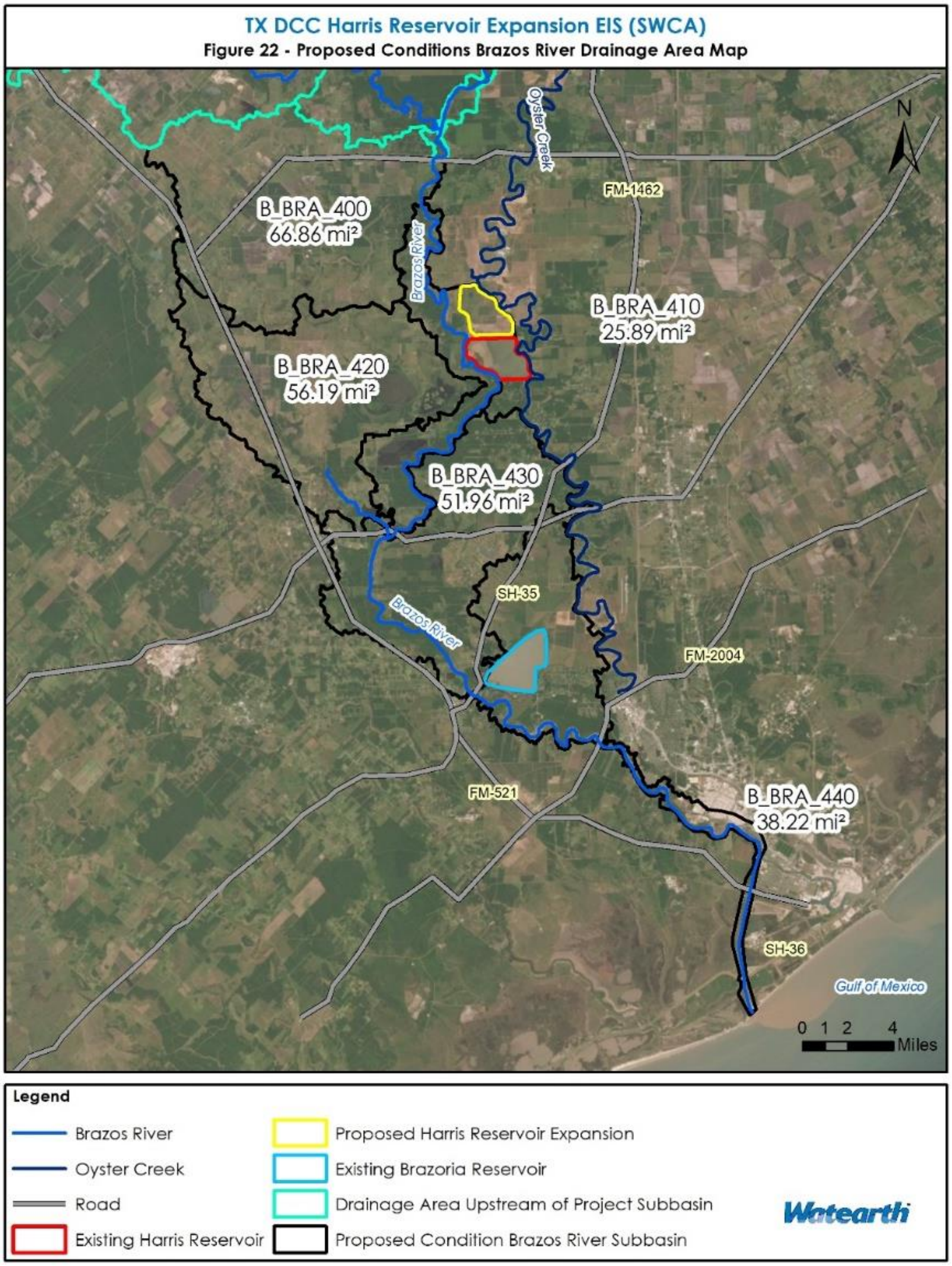


***Figure 22**: Brazos River existing conditions for HEC-HMS model.*

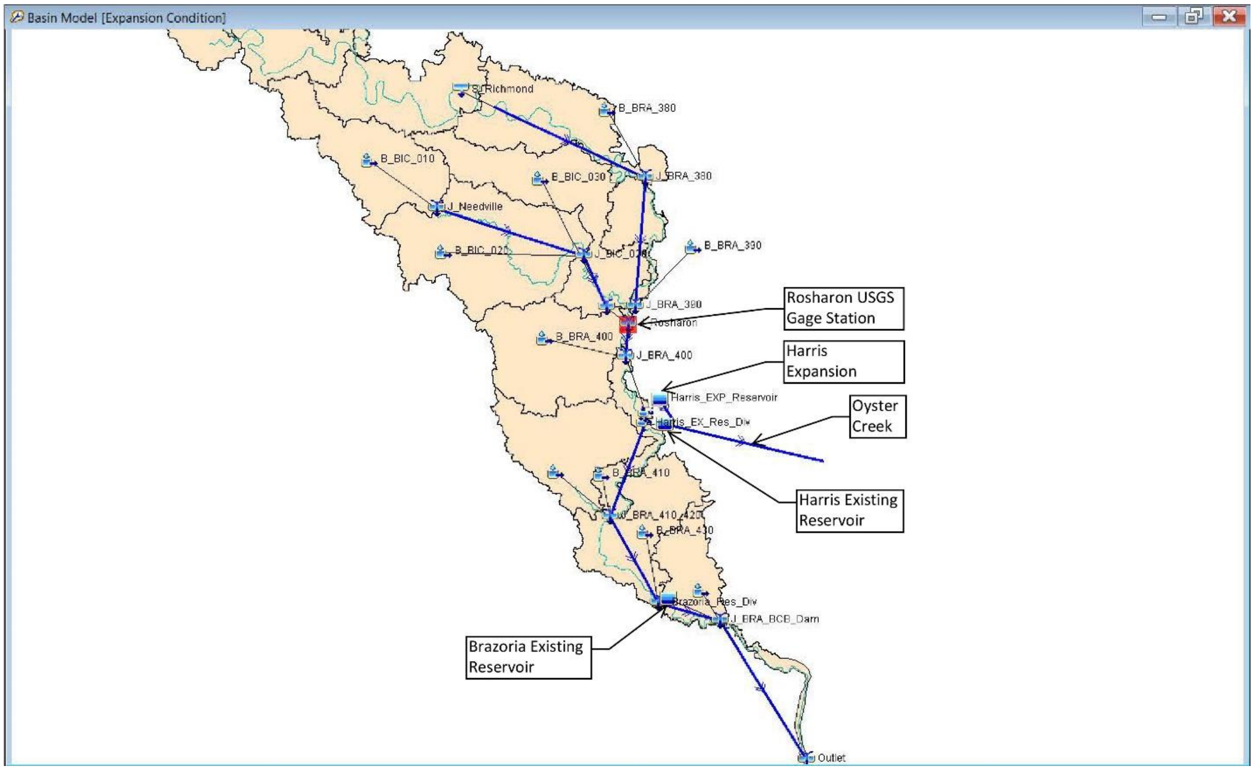


***Figure 23**: HEC-HMS model for Harris Reservoir Expansion Project.*

Table 5: HEC-HMS Basin Model Names

Analysis Conditions	Model Name
Base Conditions[1]	HMS v4.0 B_BRA_410_original
Existing Conditions[2]	Harris_Reservoir_HMS_v4.3 BRA_410 Brazos_Model_Harris_Res_1_6.hms
Proposed Conditions[3]	Harris_Reservoir_HMS_v4.3 Brazos_Model_Harris_Res_1_6.hms

[1]Base conditions are the original model obtained from Brazos River Authority.
[2]The existing conditions model adds the existing Brazoria and Harris Reservoirs to the original model.
[3]The proposed conditions model adds the proposed Harris Reservoir to the existing model.

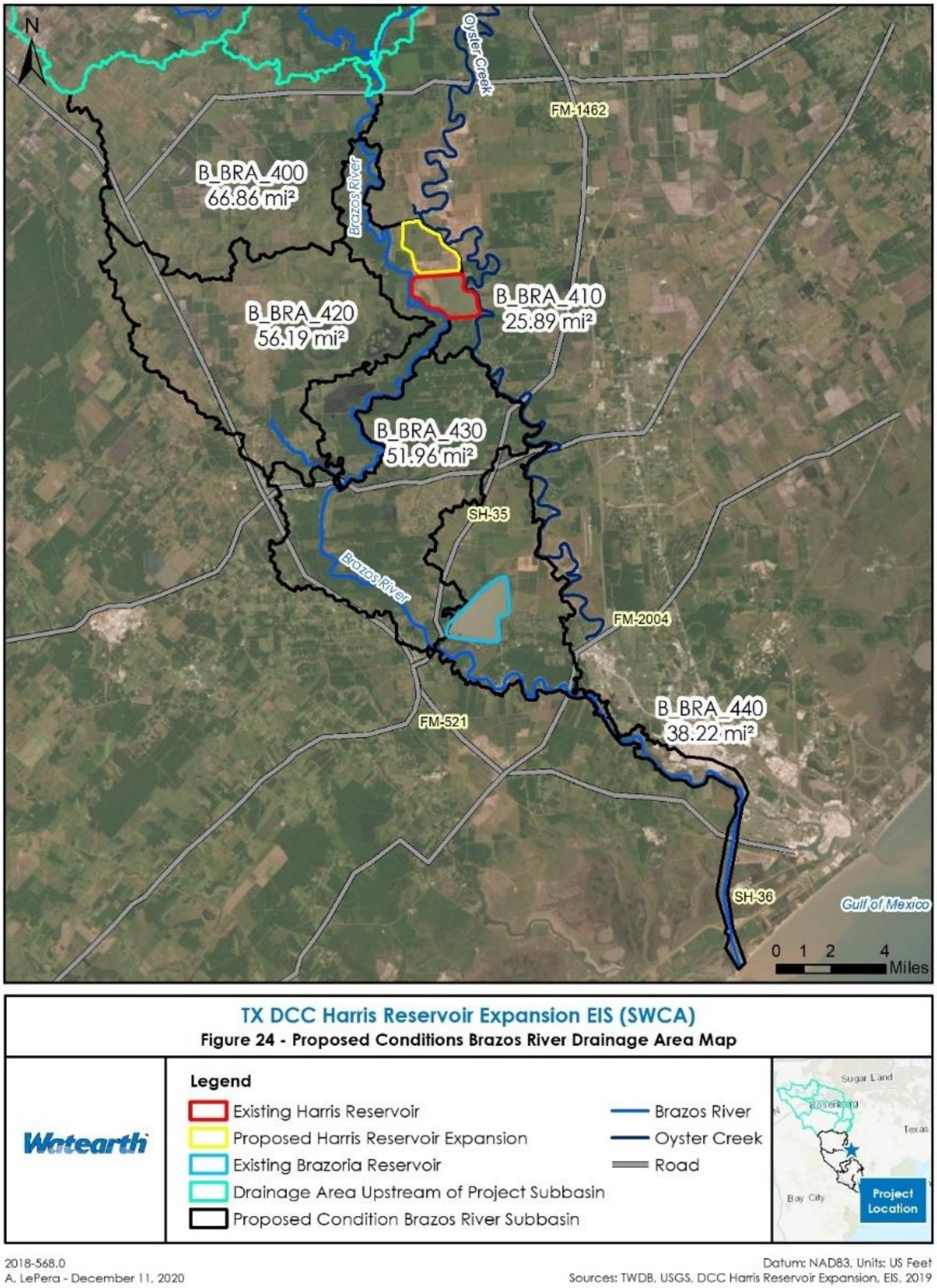


__Figure 24__: Brazos River proposed conditions in HEC-HMS model.

5.4.1.1 Meteorological and Rainfall Data

The meteorological and rainfall data used in the original FPP HEC-HMS model were not maintained for this study. The NOAA National Climatic Data Center (NCDC) Richmond and Thompson rainfall gages were used to capture hourly rainfall data and rainfall patterns for the 42-year period of record from January 1, 1979, through December 31, 2010. The 42-year record captures historical drought and high rainfall years. For the purposes of this analysis, the simulation was run for the period of record from January 1, 2009, through May 6, 2019, due to the availability of measured inflows and outflows from the existing reservoirs. New gage data were acquired for the study; however, the data could not be used in the model because there was missing data from the new set of acquired data. The meteorological model with missing data prevented the HMS model from running stable, so the data for the Richmond and Thompson gages were omitted from the model. Since the rainfall data have little effect on the Brazos River, it was appropriate to exclude the meteorological data in the model for the entire simulation period.

Consistent with the original HEC-HMS model, the gage weights method was used to assign one gage for time weighting for each drainage sub-basin and percentages of each of the two gages for depth weighting for each drainage sub-basin. While a continuous simulation model, neither tree canopy interception nor evaporation were considered in the original HEC-HMS hydrology model, or the existing or proposed conditions models modified for this study.

5.4.1.2 Gage Data

Historical USGS daily maximum flows at the Richmond and Rosharon gages from January 1, 2009, through May 6, 2019, were used in the hydraulic analysis (see **Figure 13** and **Figure 14**). The Richmond gage was input at HEC-RAS junction J_BRA_380 to represent discharge from the entire Brazos River watershed upstream of this junction. The Rosharon gage was placed at HEC-RAS junction J_Rosharon as an observed flow gage. The gage data in the original HEC-RAS model did not cover the new analysis period. Furthermore, the data for the Rosharon gage extended through the full simulation period but contained data gaps. Gage data for the Richmond and Rosharon gages are provided in **Figure 25** and **Figure 26.**

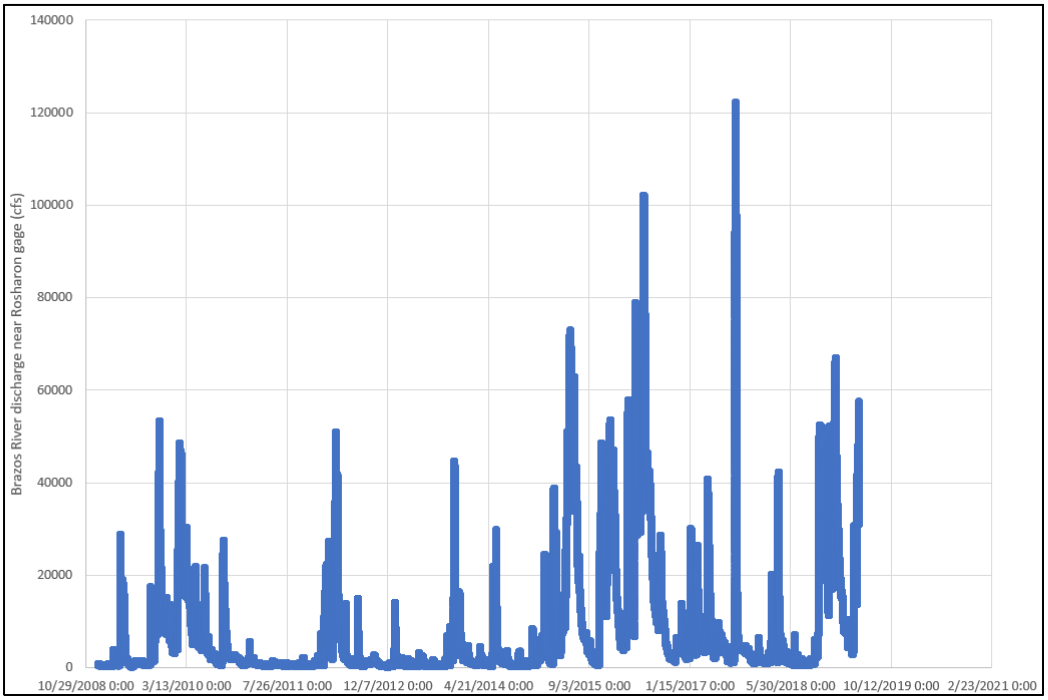


***Figure 25**: Flow for Brazos River for the USGS Richmond gage from January 1, 2009, through May 6, 2019*

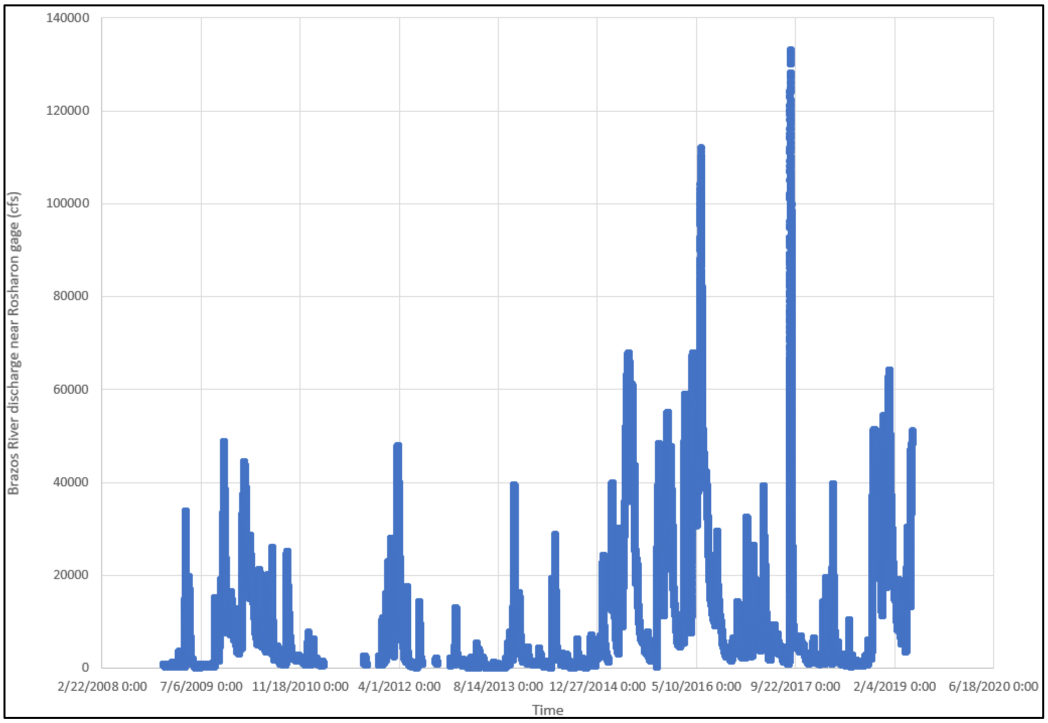


***Figure 26**: Flow for the Brazos River for the USGS Rosharon gage from January 1, 2009, through May 6, 2019.*

5.4.1.3 Drainage Sub-Basins

The portions of the Brazos River watershed included in the HEC-HMS model are depicted in **Figure 22** and **Figure 24**. As stated previously, both the Richmond and Rosharon gages are included in the model, although results reporting are focused from the Rosharon gage to the outlet at the Gulf of Mexico.

The existing approximately 1,873-ac (2.93-sq mi) Brazoria Reservoir is located in the B_BRA_440 drainage sub-basin. The approximately 1,616-ac (2.53-sq mi) existing Harris Reservoir and approximately 1,776-ac (2.78-sq mi) proposed Harris Reservoir are located adjacent to the B_BRA_410 drainage sub-basin but are outside the drainage sub-basin boundary in the original model. For existing conditions, the B_BRA_410 drainage sub-basin boundary was expanded to include the existing Harris Reservoir, and for proposed conditions, the boundary was further expanded to include the proposed Harris Reservoir. As shown in **Table 6**, the B_BRA_410 drainage sub-basin area was increased from the original 20.3 sq-mi to 22.8 sq-mi and 25.6 sq-mi in existing and proposed conditions, respectively. Due to the planning level nature of this analysis, sub-watersheds were not further subdivided.

Table 6: Original, Existing, and Proposed Brazos River Sub-Basin Area Parameters Downstream of Rosharon Gage, Texas

Drainage Sub-Basin Name	Original Area (mi^2)	Exist. Area (mi^2)	Prop. Area (mi^2)
B_BRA_400	66.9	66.9	66.9
B_BRA_410	20.3	22.8	25.6
B_BRA_420	56.2	56.2	56.2
B_BRA_430	52.0	52.0	52.0
B_BRA_440	38.2	38.2	38.2

5.4.1.4 Hydrologic Parameters

The FPP models use the Clark Unit Hydrograph Method, which is a commonly used method in the region, to generate unit hydrographs and transform them into runoff hydrographs. The specific unit hydrograph transformation parameters are the time of concentration (Tc) in hours (hrs) and the Clark's Storage Coefficient (R value) in hours. The Exponential Loss Method is used to account for soil losses (i.e., infiltration) and is an appropriate loss method for continuous simulation analyses. Due to the planning-level nature of this analysis, all existing conditions hydrologic parameters were left unchanged with the exception of impervious cover.

Impervious cover is used to reflect the percent of each drainage sub-basin occupied by impervious cover that does not allow infiltration of rainfall (or create losses). Areas not occupied by impervious cover are referred to as pervious cover and include all permeable surfaces (i.e., lawns, fields, landscaped areas, etc.). Drainage sub-basins with lower impervious cover, such as the project area, are less developed and have higher potential for infiltration. More developed areas with higher impervious cover have less potential for infiltration and higher runoff from a given rainfall event.

Due to the underlying clay soils, infiltration from the existing Brazoria and Harris Reservoirs and proposed Harris Reservoir is expected to be minimal, especially in saturated and prolonged rainfall conditions. As such, the reservoir surface areas were assumed to be 100% impervious consistent with local hydrology practices and the existing and proposed impervious cover values associated with the drainage areas. The drainage areas containing the reservoirs were adjusted as these areas were not included as impervious cover in the original study.

The existing Harris Reservoir and proposed Harris Reservoir are generally located within drainage sub-basin B_BRA_410, which was expanded to include the proposed Harris Reservoir. Accounting for the approximately 1,616-acre (2.53 sq-mi) existing Harris Reservoir the expansion increases the existing conditions impervious cover in the 22.8 sq-mi existing B_BRA_410 drainage sub-basin from 2.4% to 11.1%. The approximately 1,776-acre (2.78 sq-mi) reservoir expansion increases the total impervious cover in B_BRA_410 in proposed conditions to 5.31 sq-mi, resulting in an overall 20.7% impervious cover in the 25.6 sq-mi drainage sub-basin in proposed conditions. The Tc and storage coefficient for proposed sub-basin B_BRA_410 was left unchanged in the model because the reservoirs are not located within the largest flow path in the drainage area, resulting in minimal impacts to modeling.

The existing approximately 1,873-acre (2.93-sq mi) Brazoria Reservoir is located in the B_BRA_440 drainage sub-basin. Accounting for the reservoir surface area in the impervious cover increases the existing impervious cover in B_BRA_440 from the 7.7% reported in the original study to 5.56 sq-mi, or 14.6% impervious cover. This value remains constant between existing and proposed conditions. Hydrologic parameters for the drainage sub-basins located between the Rosharon gauge and the downstream end of the HEC-HMS model or outlet into the Gulf of Mexico are summarized in **Table 7**. The drainage sub-basins located between the Richmond and Rosharon gages are not included in **Table 7** for brevity.

Table 7: Original, Existing, and Proposed Brazos River Hydrologic Parameters Downstream of Rosharon Gage, Texas

Drainage Sub-Basin Name	Original Area (mi^2)	Exist. Area (mi^2)	Prop. Area (mi^2)	Tc (hr)	Storage Co-efficient (R-Value)	Original Impervious Cover	Existing Impervious Cover	Proposed Impervious Cover
B_BRA_400	66.9	66.9	66.9	9.13	31.74	3.4	3.4	3.4
B_BRA_410	20.3	22.8	25.6	13.62	837.35	2.4	14.7	23.8
B_BRA_420	56.2	56.2	56.2	13.25	31.25	3.8	3.8	3.8
B_BRA_430	52.0	52.0	52.0	6.83	51.87	6.0	6.0	6.0
B_BRA_440	38.2	38.2	38.2	3.19	54.65	7.7	14.6	14.6

5.4.1.5 Routing Reaches

Reach routing methods were not used in HEC-HMS for the reaches along the Brazos River as all hydrograph routing is performed in the HEC-RAS unsteady flow model for both this study and the original models. Hydrographs were computed in HEC-HMS and the reaches are used to orient the model spatially and geographically and to translate the hydrographs from an upstream junction to a downstream junction. While the hydrographs are translated, there is no real attenuation (dampening of flows) or lag (delay to account for travel time) as these effects of routing or accounted for in the dynamic, or unsteady flow hydraulic routing performed in HEC-RAS unsteady flow. Consistent with the original HEC-HMS model, the Muskingum Cunge reach routing method was maintained for the remaining tributary in the truncated model between the Richmond gage and the Rosharon gage (from Junction J_Needville to Junction J_Rosharon).

Routing reaches (without routing methodology) were added from the existing Harris Reservoir and the proposed Harris Reservoir to simulate flows leaving the system and entering the Oyster Creek system and are named R_OC_Harris_EX and R_OC_Harris_PRO, respectively.

5.4.1.6 Reservoir Data

The elevation-volume relationship for the existing Harris and Brazoria Reservoirs are displayed in **Table 8** and **Table 9.** As previously discussed, total effective storage of 27,343 ac-ft is based on the 2020 Doyle and Wachtstetter survey, which is composed of existing Harris and Brazoria Reservoir volumes of 9,136 ac-ft and 18,207 ac-ft, respectively. The HEC-RAS modeling elevation-volume relationships were developed using the conic approximation method. For the Harris Reservoir, a surface area of 1,591 ac was used at top of overflow weir elevation 42.50 ft, and zero ac at the reservoir bottom 33 ft elevation. For the Brazoria Reservoir, a surface area of 1,850.7 ac was used at top of overflow weir elevation 31.05 ft, and zero ac at the reservoir bottom 13.0 ft elevation.

The 2020 Doyle and Wachtstetter survey reports that reservoir water surface elevations and volumes are higher than the top of the overflow weirs, which are summertime reservoir elevation target levels following Dow’s freeboard management practices.

The proposed Harris Reservoir storage volume was estimated at 51,796 ac-ft using the conic approximation method. This volume and associated elevation-volume relationship were adjusted downward by applying a 98.4% factor to match the volume of 50,968 ac-ft reported by Dow (**Table 10**).

Table 8: Existing Harris Reservoir Elevation-Volume Relationship

Stage (ft)	Area (sq-ft)	Area (ac)	Incremental Storage Volume (ac-ft)	Cumulative Storage Volume (ac-ft)
33.00	113,256	2.6	0	0.3
33.50	387,684	8.9	3	3.3
34.00	675,180	15.5	5.9	9.2
34.50	1,454,904	33.4	11.6	20.8
35.00	5,566,968	127.8	34.2	55.0
35.50	13,895,640	319.0	112.9	167.9
36.00	21,993,444	504.9	205.8	373.7
36.50	29,276,676	672.1	295.1	668.8
37.00	36,908,388	847.3	377.6	1,046.4
37.50	50,011,236	1,148.1	493	1,539.4
38.00	58,570,776	1,344.6	618.9	2,158.3
38.50	63,867,672	1,466.2	702.9	2,861.2
39.00	66,694,716	1,531.1	752.0	3,613.2
39.50	68,092,992	1563.2	774.6	4,387.8
40.00	68,615,712	1575.2	785.4	5,173.2
40.50	68,829,156	1580.1	789.1	5,962.3
41.00	68,972,904	1583.4	791.1	6,753.4
41.50	69,099,228	1586.3	792.7	7,546.1
42.00	69,221,196	1589.1	794.1	8,340.2
42.50	69,312,672	1591.2	795.3	9,135.5
43.00	69,421,572	1593.7	768.2	9,903.7
43.50	69,547,896	1596.6	797.6	10,701.3

Stage (ft)	Area (sq-ft)	Area (ac)	Incremental Storage Volume (ac-ft)	Cumulative Storage Volume (ac-ft)
44.00	69,669,864	1599.4	799.0	11,500.3
44.50	69,783,120	1602	800.4	12,300.7
45.00	69,896,376	1604.6	801.8	13,102.5
45.50	70,009,632	1607.2	802.9	13,905.4
46.00	70,118,532	1609.7	804.3	14,709.7
46.50	70,310,196	1614.1	806.5	15,516.2
47.00	70,371,180	1615.5	807.4	16,323.6
47.50	70,410,384	1616.4	808.0	17,131.6

Table 9: Brazoria Reservoir Elevation-Volume Relationship

Stage (ft)	Areas (sq-ft)	Area (ac)	Incremental Storage Volume (ac-ft)	Cumulative Storage Volume (ac-ft)
13.0	30,492	0.7	0	0.2
13.5	69,696	1.6	0.60	0.8
14.0	08,900	2.5	1.10	1.9
14.5	12,460	3.5	1.40	3.3
15.0	248,292	5.7	2.20	5.5
15.5	422,532	9.7	3.80	9.3
16.0	701,316	16.1	6.40	5.7
16.5	1,075,932	24.7	10.00	25.7
17.0	1,794,672	41.2	16.00	41.7
17.5	3,145,032	72.2	27.80	69.5
18.0	5,841,396	134.1	49.20	118.7

Stage (ft)	Areas (sq-ft)	Area (ac)	Incremental Storage Volume (ac-ft)	Cumulative Storage Volume (ac-ft)
18.5	12,109,680	278.0	102.00	220.7
19.0	19,209,960	441.0	178.70	399.4
19.5	26,179,560	601.0	259.60	659.0
20.0	31,655,052	726.7	332.60	991.6
20.5	36,951,948	848.3	395.60	1,387.2
21.0	41,416,848	950.8	449.60	1,836.8
21.5	45,568,116	1,046.1	500.80	2,337.6
22.0	49,728,096	1,141.6	546.60	2,884.2
22.5	54,968,364	1,261.9	601.00	3,485.2
23.0	59,807,880	1,373.0	659.00	4,144.2
23.5	64,194,372	1,473.7	713.60	4,857.8
24.0	67,470,084	1,548.9	756.90	5,614.7
24.5	71,368,704	1,638.4	796.50	6,411.2
25.0	74,052,000	1,700.0	836.50	7,247.7
25.5	75,794,400	1,740.0	860.80	8,108.5
26.0	76,966,164	1,766.9	877.50	8,986.0
26.5	77,837,364	1,786.9	888.90	9,874.9
27.0	78,543,036	1,803.1	897.90	10,772.8
27.5	79,131,096	1,816.6	905.20	11,678.0
28.0	79,579,764	1,826.9	911.30	12,589.3
28.5	79,858,548	1,833.3	915.40	13,504.7
29.0	80,071,992	1,838.2	918.20	14,422.9

Stage (ft)	Areas (sq-ft)	Area (ac)	Incremental Storage Volume (ac-ft)	Cumulative Storage Volume (ac-ft)
29.5	80,241,876	1,842.1	920.30	15,343.2
30.0	80,411,760	1,846.0	922.30	16,265.5
30.5	80,538,084	1,848.9	924.10	17,189.6
31.0	80,607,780	1,850.5	925.10	18,114.7
31.05	80,616,492	1,850.7	92.50	18,207.2
31.5	80,694,900	1,852.5	833.40	19,040.6
32.0	80,760,240	1,854.0	926.60	19,967.2
32.5	80,829,936	1,855.6	927.40	20,894.6
33.0	80,912,700	1,857.5	988.30	21,882.9
33.5	80,995,464	1,859.4	869.20	22,752.1
34.0	81,082,584	1,861.4	930.30	23,682.4
34.5	81,160,992	1,863.2	931.10	24,613.5
35.0	81,252,468	1,865.3	932.10	25,545.6
35.5	81,252,468	1,865.3	933.20	26,478.8
36.0	81,417,996	1,869.1	934.10	27,412.9
36.5	81,483,336	1,870.6	935.00	28,347.9
37.0	81,526,896	1,871.6	935.50	29,283.4
37.5	81,557,388	1,872.3	935.90	30,219.3
38.0	81,570,456	1,872.6	937.30	31,156.6
38.5	81,579,168	1,872.8	935.4	32,092.0

Table 10: Proposed Harris Reservoir Elevation-Volume Relationship

Conic Approximation Method							
Stage (ft)	Embankment Slope (1H:1V)	Area (sq-ft)	Area (ac)	Incremental Storage Volume (ac-ft)	Incremental Storage Volume (ac-ft)	Cumulative Storage Volume (ac-ft)	Adjusted Storage Volume (ac-ft)
32.00	3.5	68,479,108	1572	0.00	0	0	0
40.00	3.5	70,419,590	1617	12,754	4311	4311	4,242
45.00	3.5	71,642,397	1645	8,153	8153	12464	12,265
50.00	3.5	72,872,901	1673	8,294	8294	20758	20,426
55.00	3.5	74,111,101	1701	8,436	8436	29194	28,727
60.00	3.5	75,356,999	1730	8,578	8578	37772	37,168
65.00	3.5	76,610,594	1759	8,722	8722	46494	45,751
68.00	3.5	77,366,445	1776	5,302	5302	51796	50,968
				60,239	51,796	51,796	50,968

As discussed earlier, existing conditions operations were simulated using detailed operational data provided by Dow, including diversions into the reservoirs and discharges out of the reservoirs. The proposed Harris Reservoir was simulated with similar operational parameters provided by Dow as the existing Harris Reservoir given the adjacent location in the watershed and similar diversion locations from the Brazos River and discharge locations into Oyster Creek. The proposed 50,968 ac-ft Harris Reservoir expansion is 5.58 times the existing Harris Reservoir capacity of 9,136 ac-ft. The maximum discharge capacity for the proposed Harris Reservoir is 978 cfs, and the maximum diversion from the Brazos River pump station into the proposed Harris Reservoir is 334 cfs, thus the diversion flows into the dataset were scaled up by a factor of 1.15 and reservoir discharges were scaled up by a factor of 3.51 to estimate the future diversions and discharges into and out of the proposed Harris Reservoir.

Diversions from the Brazos River into the Brazoria Reservoir were simulated by HEC-HMS model diversion Brazoria_Res_Div; diversions from the Brazos River into the existing and proposed Harris Reservoir were simulated by diversions placed at Harris_Ex_Res_Div and Harris_Pro_Res_Div, respectively. Brazoria Reservoir discharges back into the Brazos River were simulated at HEC-HMS node J_BRA_BCB_Dam, and discharges from the existing and proposed Harris Reservoirs were simulated to leave the Brazos River and enter Oyster Creek through reaches R_OC_Harris_EX and R_OC_Harris_PR, respectively. Discharges from all three reservoirs were modeled with the specified discharge outflow structure method. See **Table 11, Figure 27,** and **Figure 28** for illustrations of the diversions into and discharges out of the reservoirs.

Table 11: Existing Brazoria Reservoir and Harris Reservoir Diversion and Discharges

Reservoir Name	Flow	
Brazoria Reservoir	Diversion (Max Flow)	468 cfs
	Reservoir (Max Discharge)	263 cfs
Harris Reservoir	Diversion (Max Flow)	290 cfs
	Reservoir (Max Discharge)	278 cfs
Proposed Harris Reservoir	Diversion (Max Flow)	334 cfs
	Reservoir (Max Discharge)	978 cfs

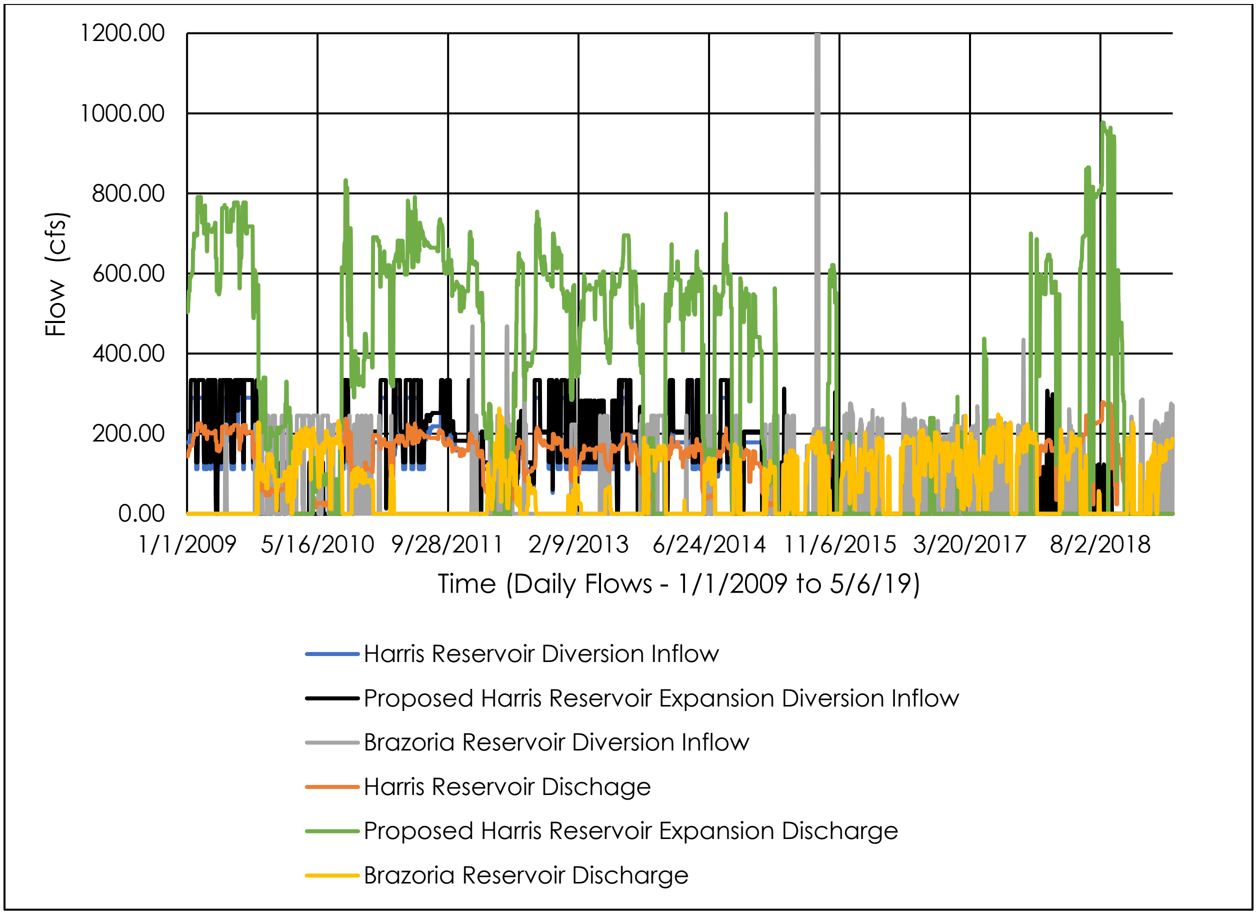


***Figure 27**: Existing Harris Reservoir, proposed Harris Reservoir, and Brazoria Reservoir diversions and discharges.*

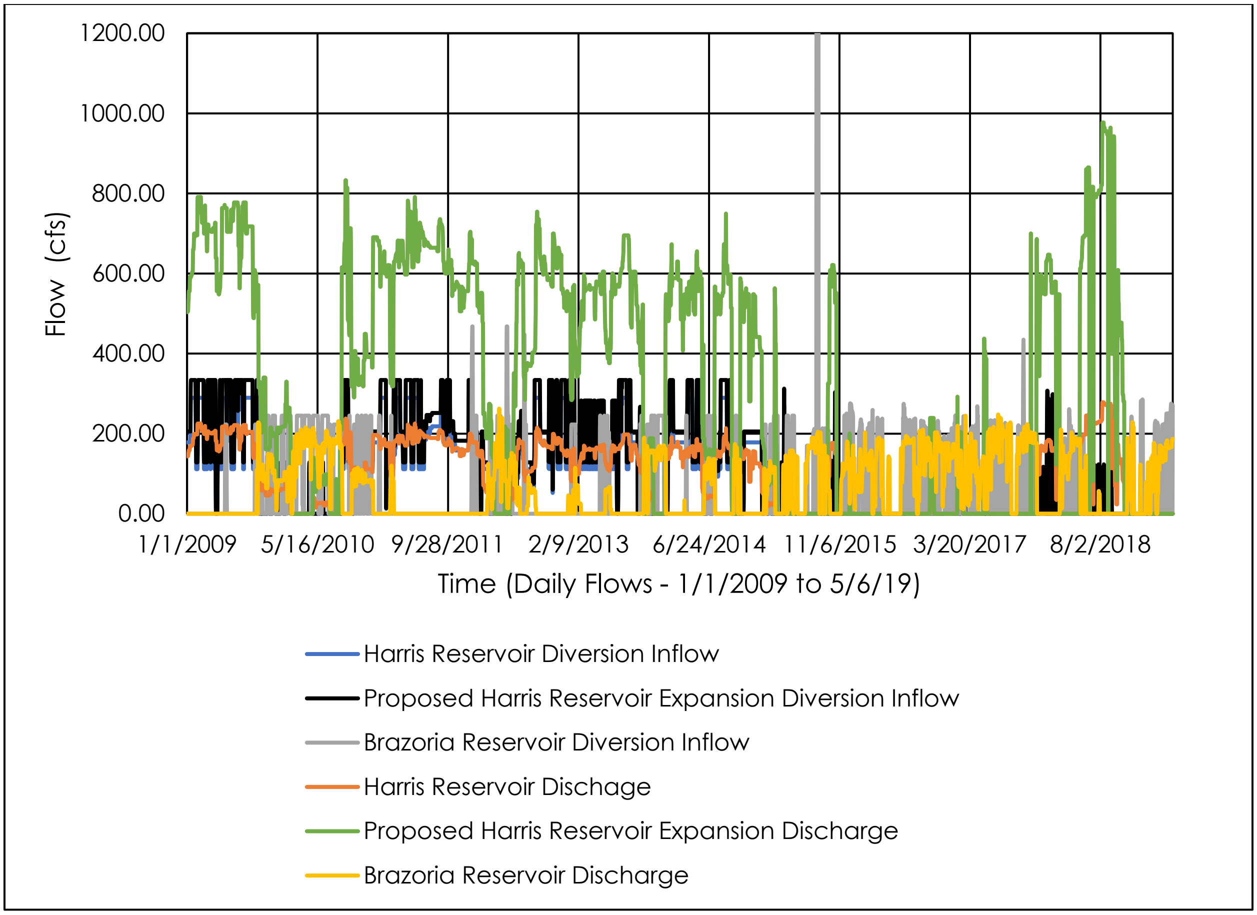


***Figure 28**: Combined flows for Harris Reservoir and proposed Harris Reservoir compared to existing Harris Reservoir diversions and discharges.*

5.4.1.7 HEC-HMS Results

Maximum flows over the 10.5-year simulation for each of the drainage sub-basins and junctions to the outlet of the Brazos River at the Gulf of Mexico based on Rosharan USGS gage data (HEC-RAS junction J_Rosharon) are listed in **Table 12**. Diversions into each of the reservoirs and discharges out of the reservoirs over the 10.5-year simulation period are shown in **Figures 29** through **49**. It should be noted that some outliers were found in the Harris Reservoir flow data (**Figure 27**, **Figure 28**, and **Figure 36** through **Figure 38**), which were normalized to the rest of the values on May 25, 2014, and September 24, 2018.

These results and modeling assumptions show no significant changes to diversions into or discharges out of the Brazoria Reservoir into the Brazos River. Similarly, modeling assumptions and results show no significant changes to diversions into or discharges out of the existing Harris Reservoir into Oyster Creek. The proposed diversion into the proposed Harris Reservoir and associated discharge into Oyster Creek significantly increase peak flows out of the combined Harris Reservoirs (existing and proposed Reservoirs) into Oyster Creek from an existing maximum of 278 cfs to a proposed maximum of 1,256 cfs.

Table 12: Table of Existing and Proposed Maximum Flows over the 10.5-Year Simulation Period

HEC HMS NODES	Existing Conditions Maximum Flows (cfs)	Proposed Conditions Maximum Flows (cfs)	Difference Between Both Conditions (cfs)
J_ROSHARON	120,000	120,000	0
HARRIS_PR_RES_DIV	-	334	N/A
HARRIS_PR_RES	-	334	N/A
R_OC_HAR_PR	-	334	N/A
HARRIS_EX_RES_DIV	290	290	0
HARRIS_EX_RES	278	278	0
R_OC_HAR_EX	278	278	0
BRAZORIA_RES_DIV	468	468	0
BRAZORIA_EX RES	263	263	0
J_BRA_BCB_DAM	119,892	119,892	0
OUTLET	119,892	119,882	0

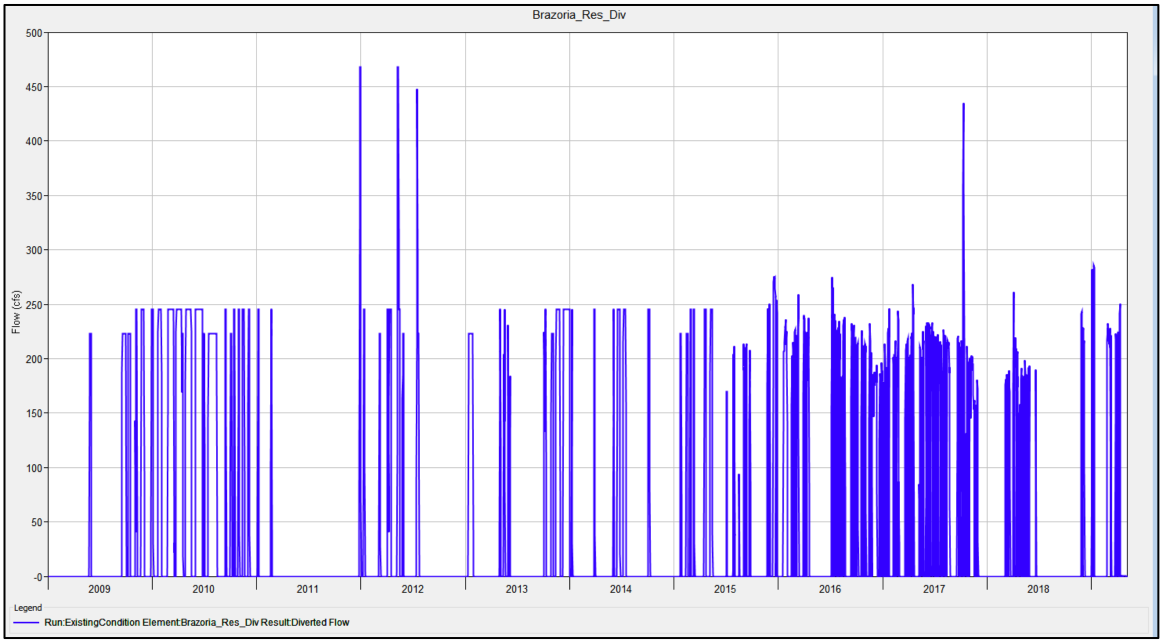


Figure 29: *Existing conditions diversion into existing Brazoria Reservoir over 10.5-year simulation period.*

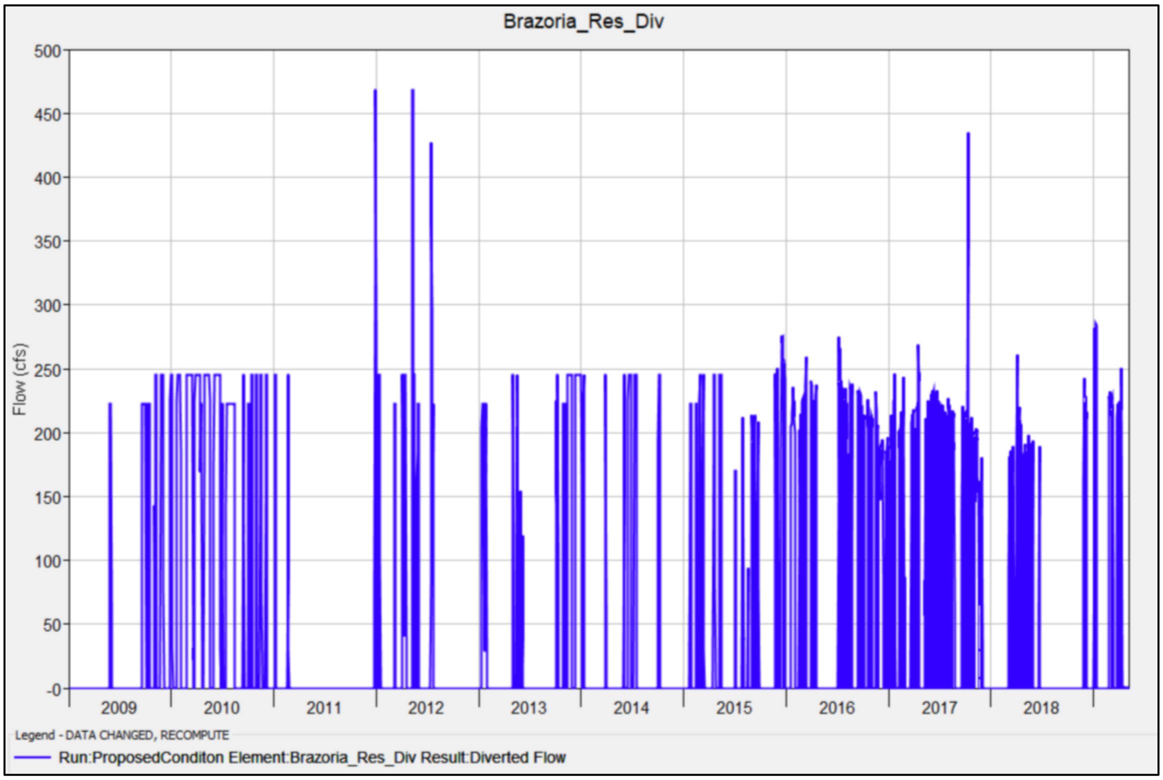


Figure 30: *Proposed conditions diversion into existing Brazoria Reservoir over 10.5-year simulation period.*

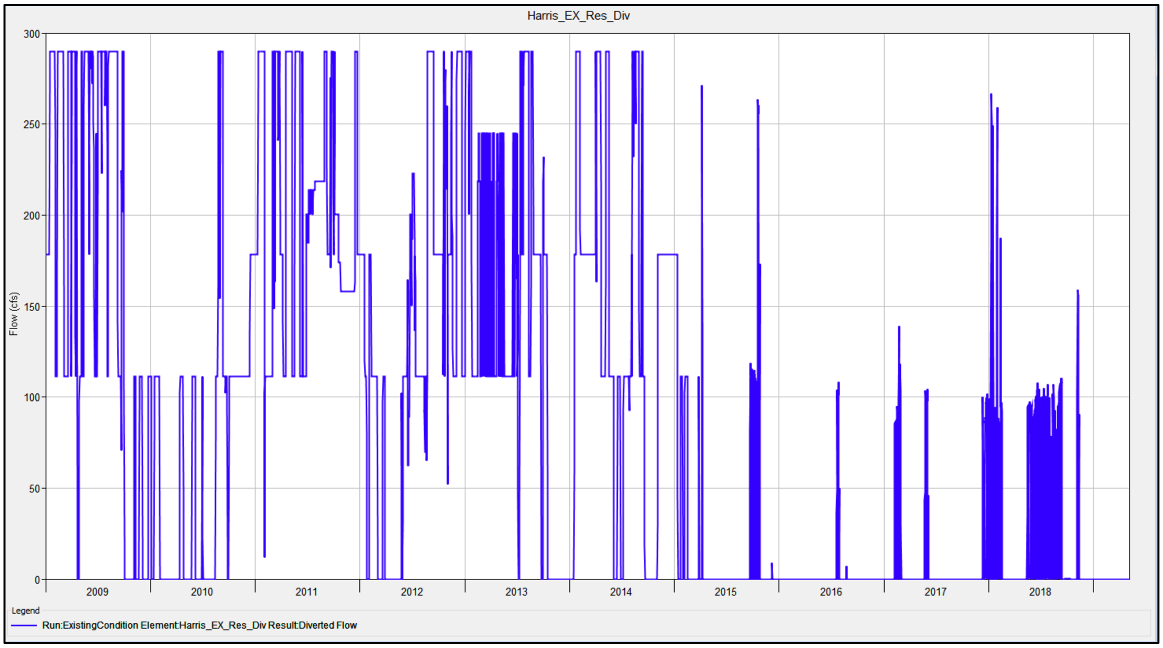


***Figure 31**: Existing conditions diversion into existing Harris Reservoir over 10.5-year simulation period.*

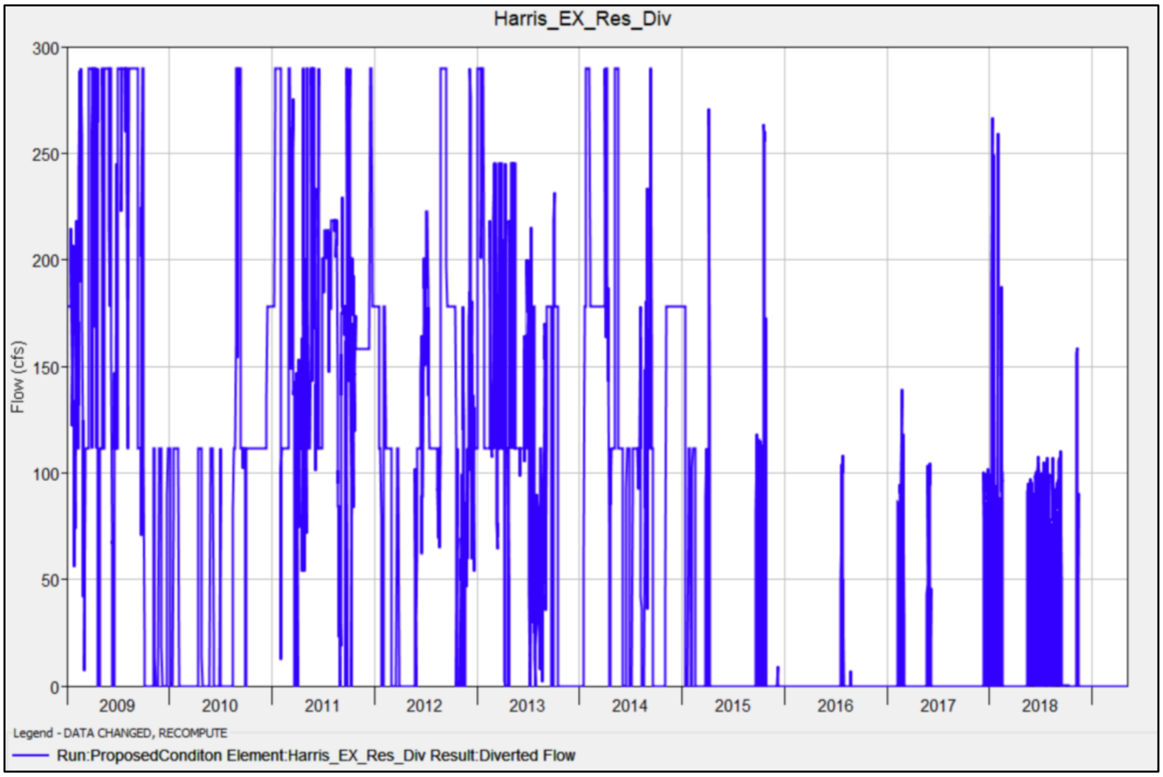


***Figure 32**: Proposed conditions diversion into existing Harris Reservoir over 10.5-year simulation period.*

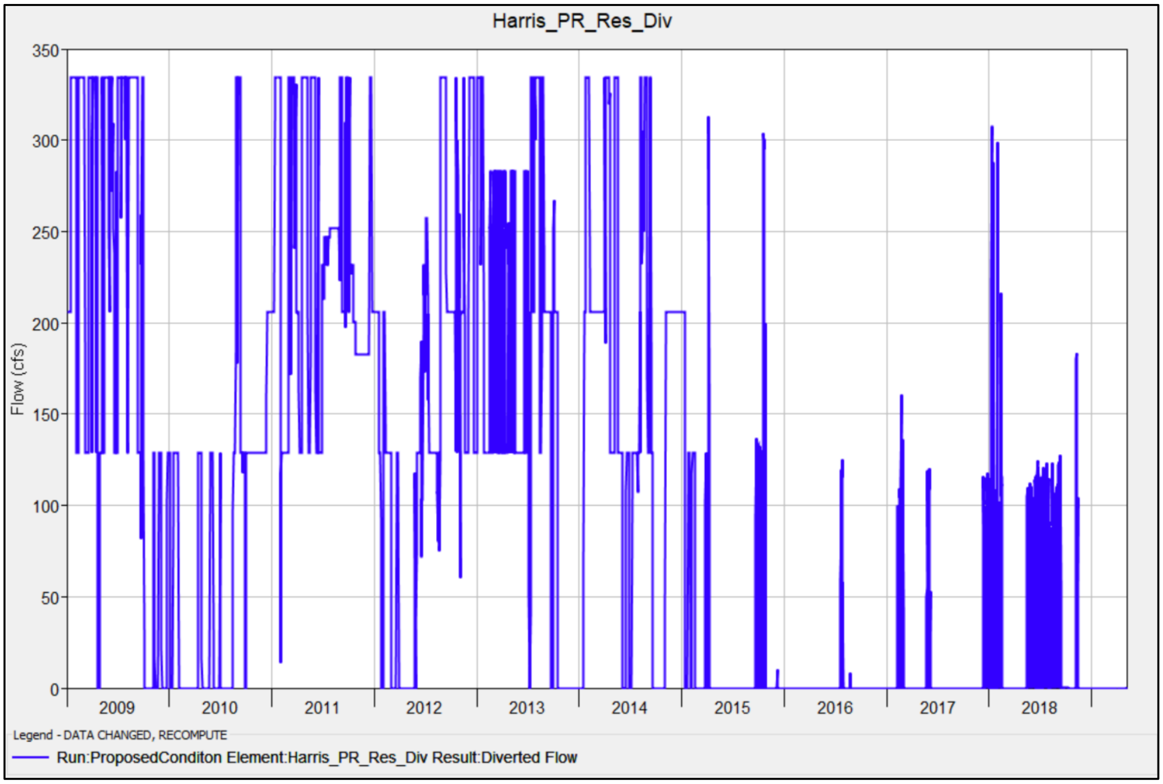


***Figure 33**: Proposed conditions diversion into proposed Harris Reservoir over 10.5-year simulation period.*

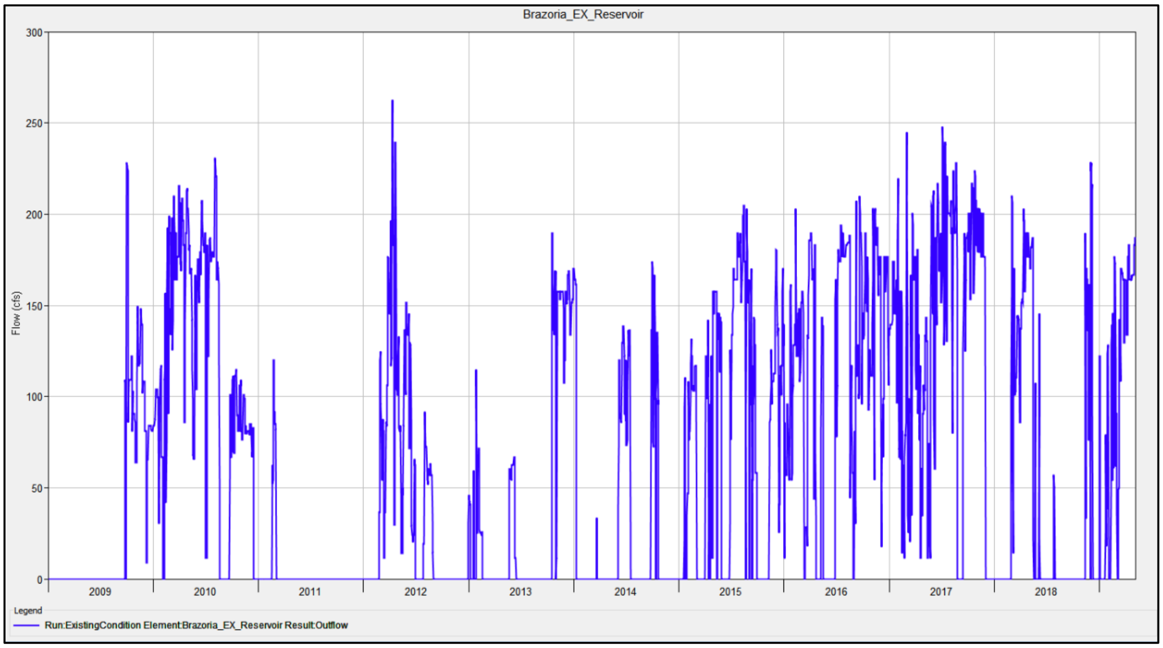


***Figure 34**: Existing conditions discharges from existing Brazoria Reservoir over 10.5-year simulation period.*

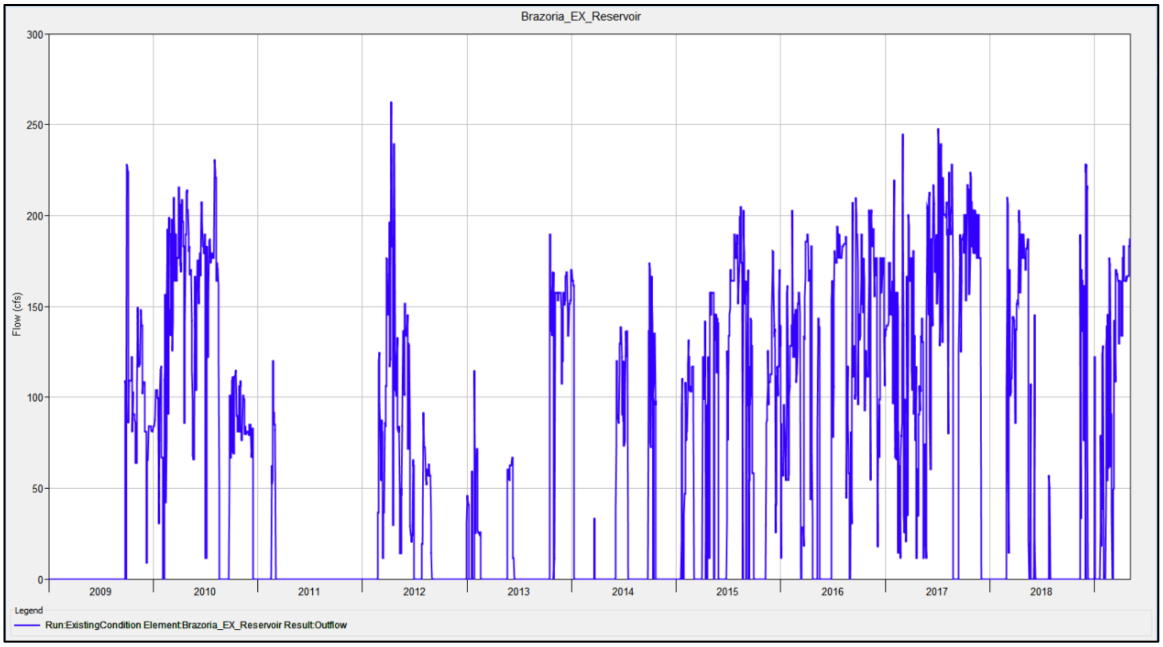


Figure 35*: Proposed conditions discharges from existing Brazoria Reservoir over 10.5-year simulation period.*

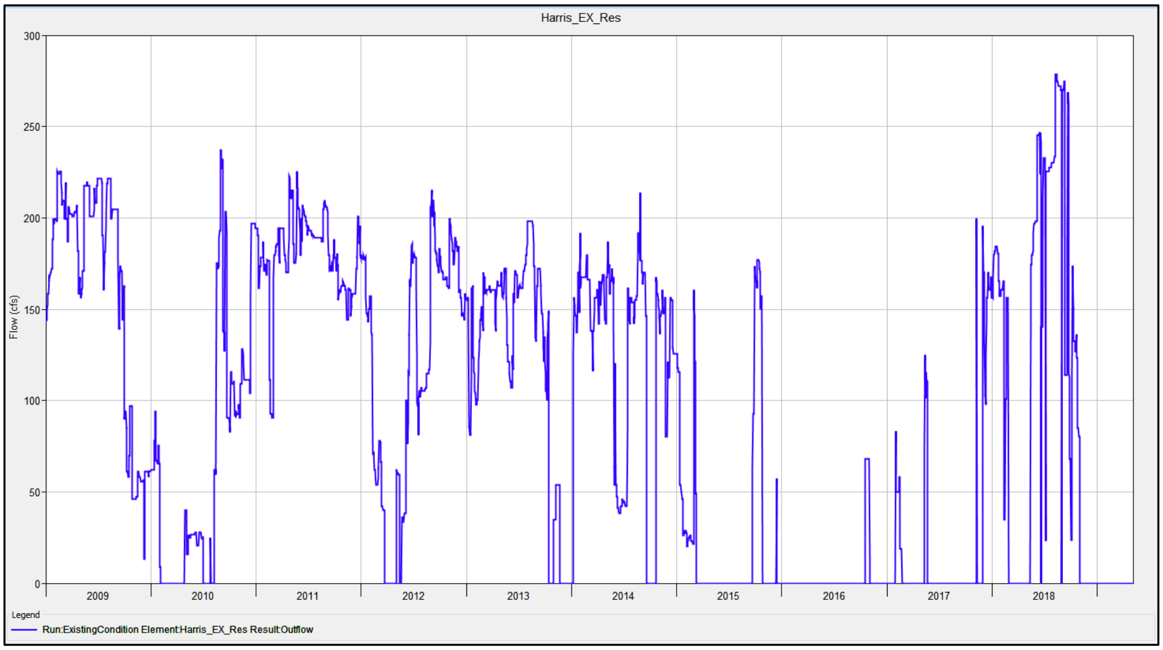


Figure 36*: Existing conditions discharges from existing Harris Reservoir over 10.5-year simulation period. Note: Large spikes were noted in the May 25, 2014, and September 24, 2018, flow data (not shown in the hydrograph,) which appeared to be outliers. The flows on those dates were normalized to the rest of the data.*

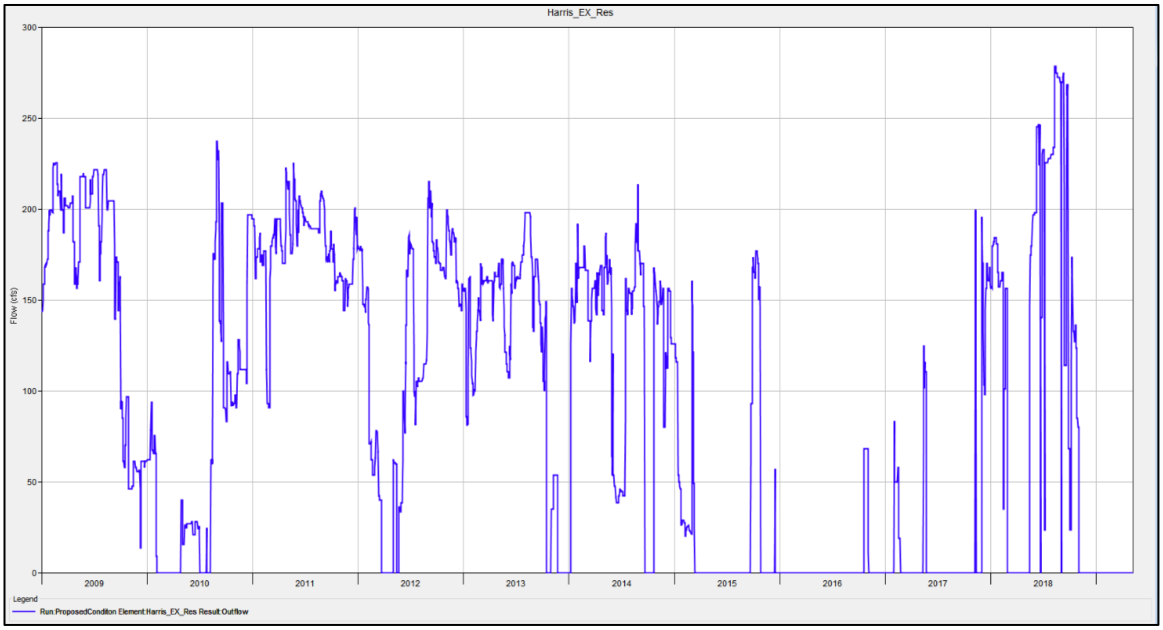


Figure 37*: Proposed conditions discharges from existing Harris Reservoir over the 10.5-year simulation period. Note: Large spikes were noted in the May 25, 2014, and September 24, 2018, flow data (not shown in the hydrograph), which appeared to be outliers. The flows on those dates were normalized to the rest of the data.*

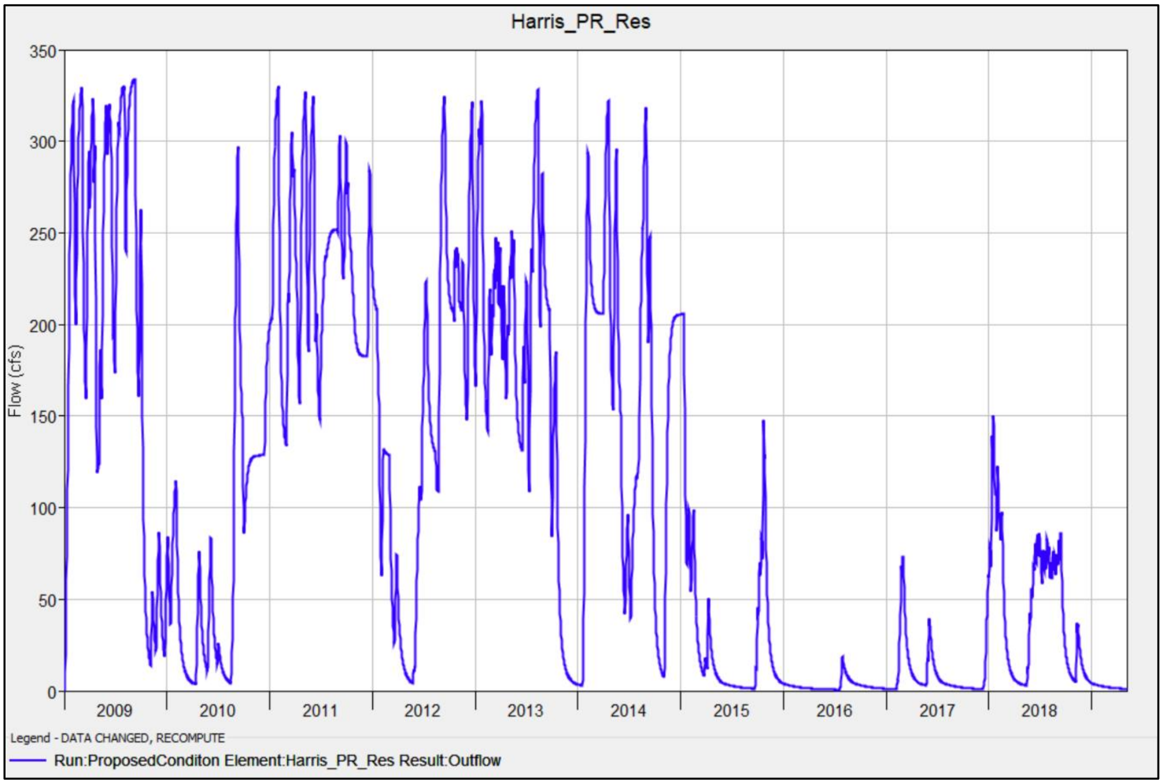


Figure 38*: Proposed conditions discharges outflow from proposed Harris Reservoir over the 10.5-year simulation period.*

Shown in **Figures 39** through **49** are the existing and proposed flow hydrographs at six key analysis points between the Rosharon gage and the outlet at the Gulf of Mexico. The key analysis points are listed in **Table 13** and include the Rosharon gage, which is not expected to change between existing and proposed conditions as it is an observed flow condition in the model. While routing along the Brazos River is performed in HEC-RAS unsteady flow rather than HEC-HMS, this is a useful comparison at the outlet as hydrographs are combined along the Brazos River without attenuation or lagging. Downstream of the Rosharon gage, no significant changes in flow are shown in the Brazos River despite assumed increased diversions at peak river flows/stages to maintain the additional storage associated with the proposed Harris Reservoir.

Since detailed design and operational inflow or discharge rating curves were not available, multiple scenarios were modeled within HEC-HMS to estimate the proposed Harris Reservoir inflow and outflow through the spillway. Several multipliers were applied to the known existing Harris Reservoir daily peak flows provided by Dow to estimate possible peak flows that the proposed Harris Reservoir could discharge while in operation to develop a range of possible operating scenarios. Multipliers of 2.98, 5.57 (described in this report), and 7.28 (described in the January 8, 2020, report) were applied to the existing Harris Reservoir peak outflows and Brazos River diversion to the existing Harris Reservoir, which was used to forecast the diversion and outflow occurring in the proposed Harris Reservoir system. It was determined after observing several of these results with the different ranges of peak flows that the diversion occurring at the proposed Harris Reservoir had no change in the water surface elevation or peak flows in Brazos River based on the range of scenarios that were modeled. If actual operations result in significantly different inflows and discharges, then results may vary.

Table 13: Key Analysis Points for Results Reporting

Key Analysis Point	Location	HEC-HMS Name
1	Rosharon Gage	J_Rosharon
2	Proposed Harris Reservoir Diversion (Brazos River)	Harris_PR_Res_Div
3	Existing Harris Reservoir Diversion (Brazos River)	Harris_EX_Res_Div
4	Brazoria Reservoir Diversion (Brazos River)	Brazoria_Res_Div
5	Brazoria Discharge/Dow's Water Intake	J_BRA_BCB_Dam
6	Outlet (Mouth)	Outlet

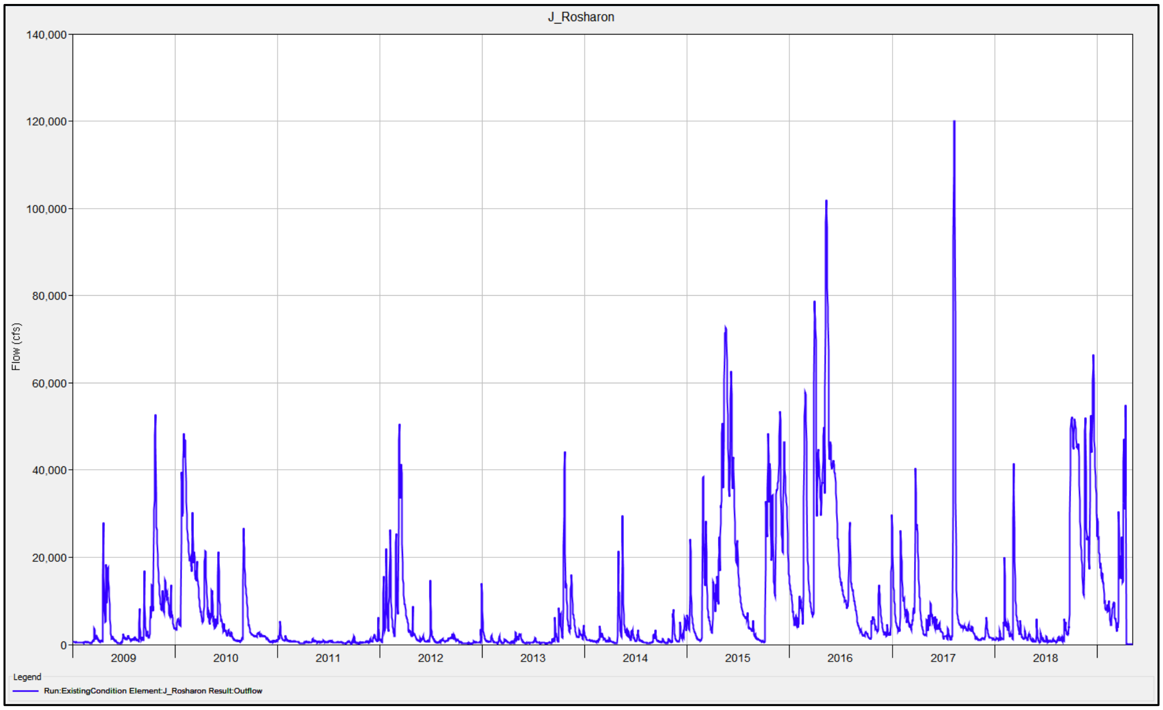


Figure 39: *Existing conditions flow hydrograph at Rosharon gage over the 10.5-year simulation period.*

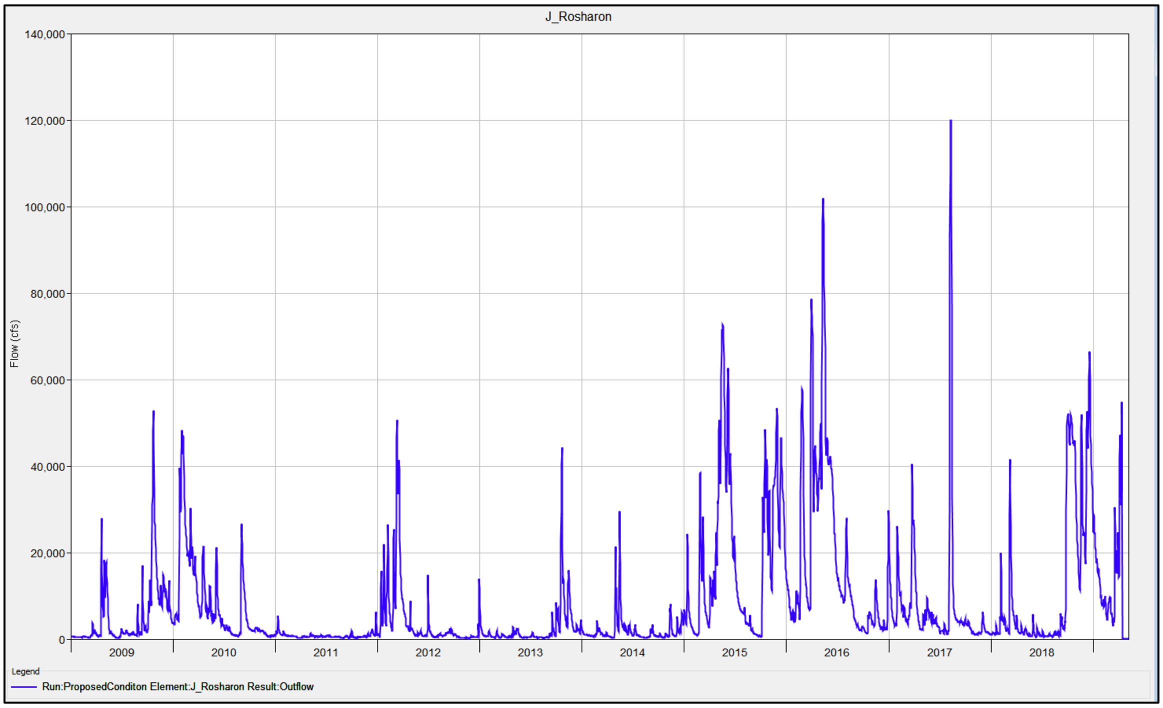


Figure 40: *Proposed conditions flow hydrograph at Rosharon gage over the 10.5-year simulation period.*

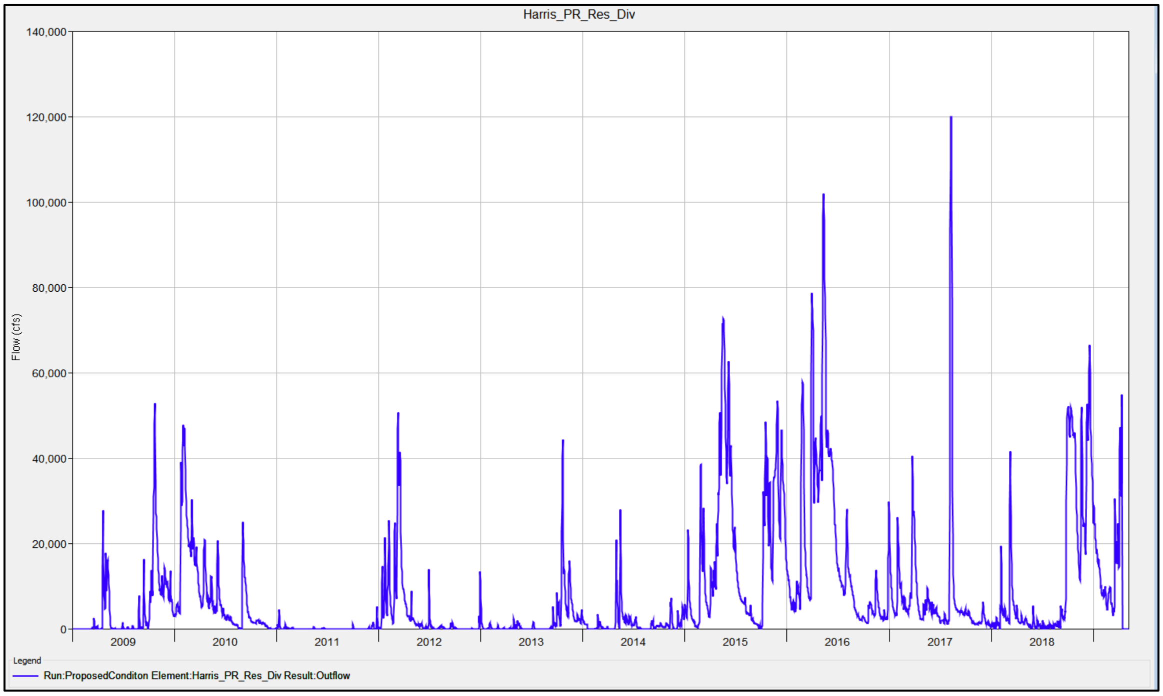


Figure 41: *Proposed conditions flow hydrograph at proposed Harris Reservoir diversion (Brazos River) over the 10.5-year simulation period.*

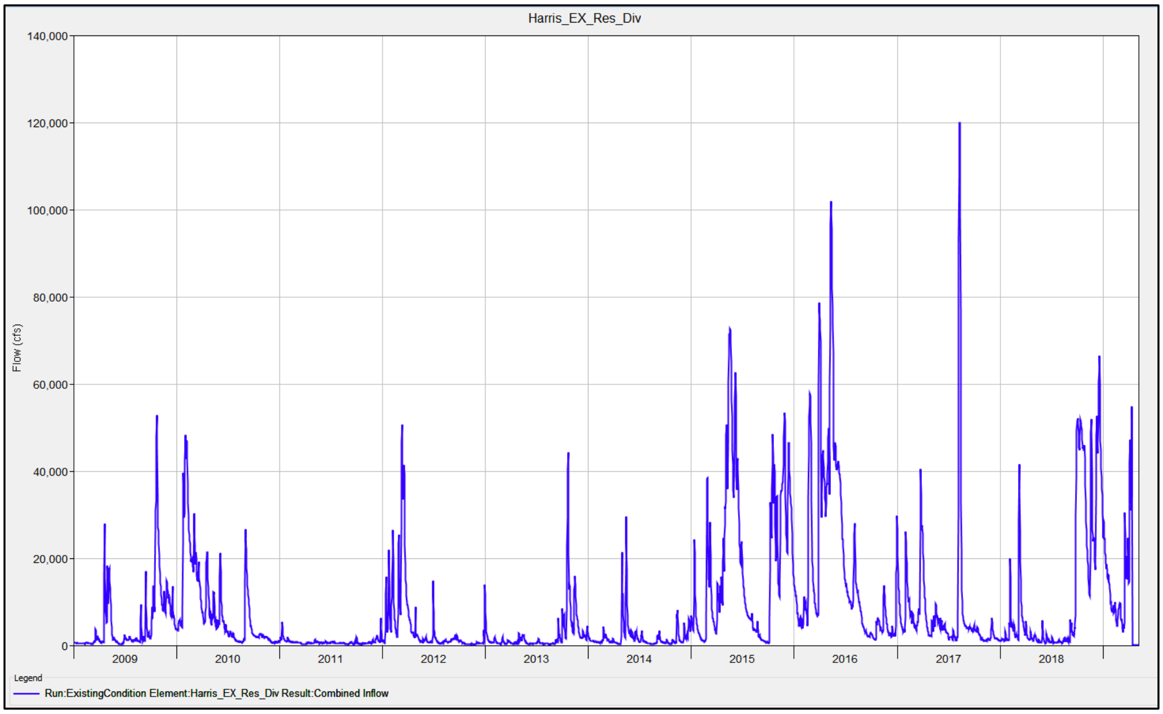


Figure 42: *Existing conditions flow hydrograph at existing Harris Reservoir diversion (Brazos River) over the 10.5-year simulation period.*

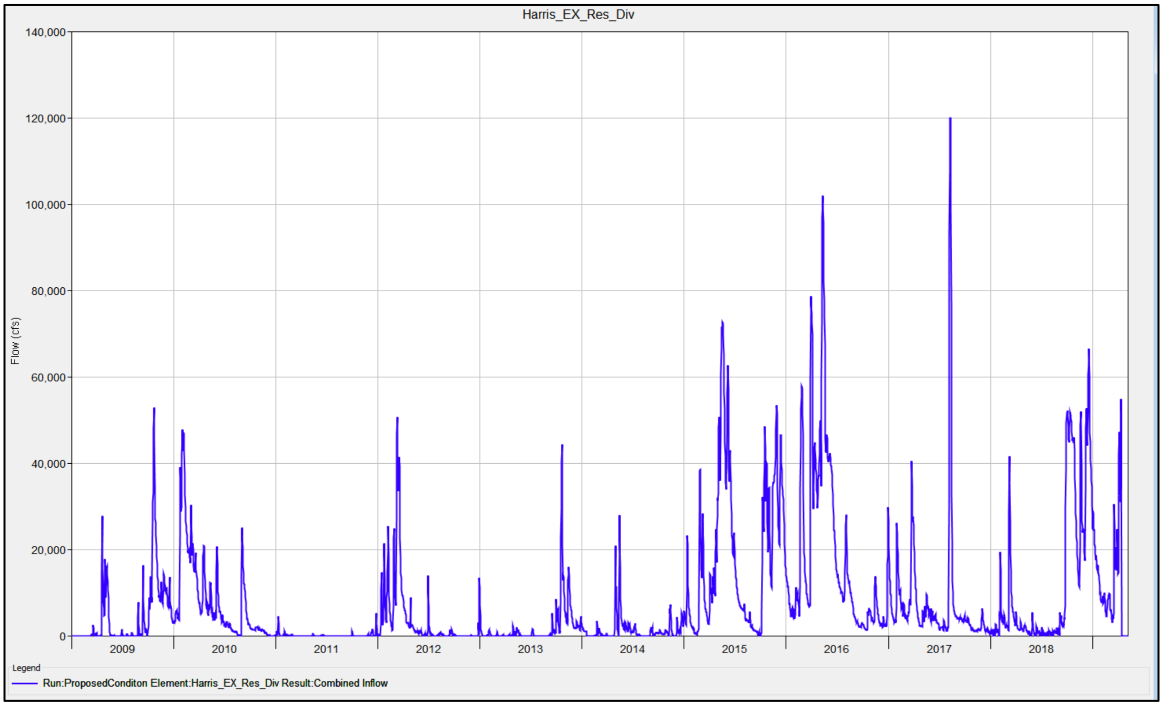


***Figure 43:** Proposed conditions flow hydrograph at existing Harris Reservoir diversion (Brazos River) over the 10.5-year simulation period.*

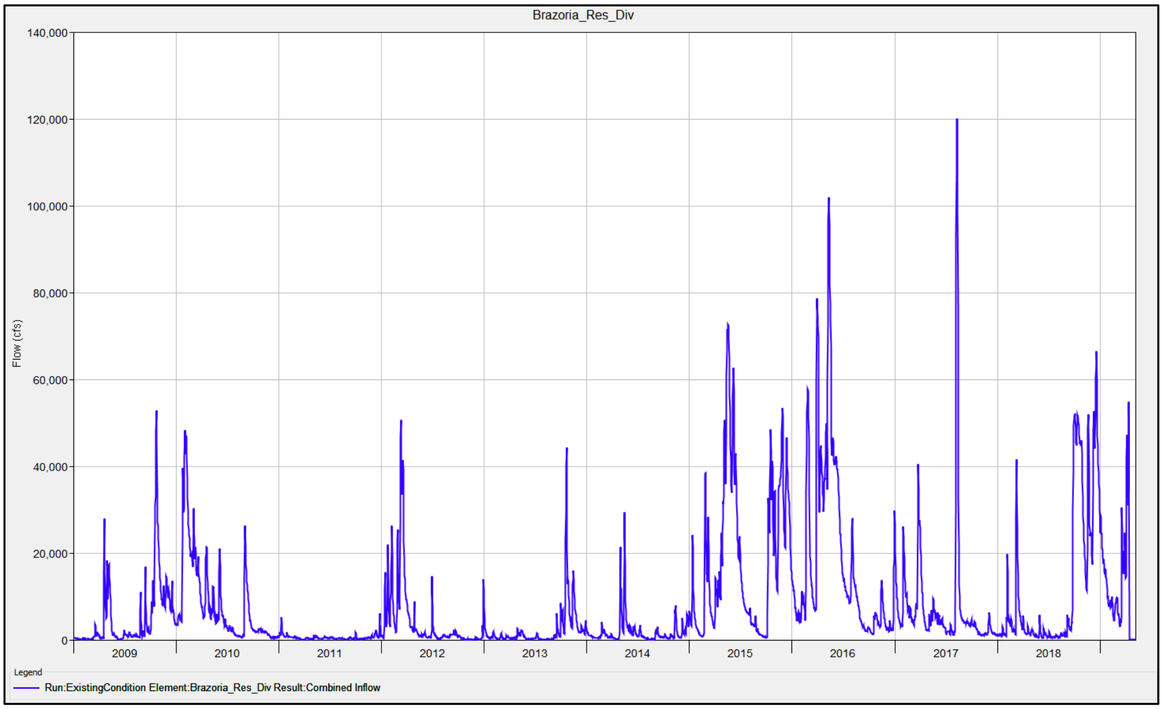


***Figure 44**: Existing conditions flow hydrograph at existing Brazoria Reservoir diversion (Brazos River) over the 10.5-year simulation period.*

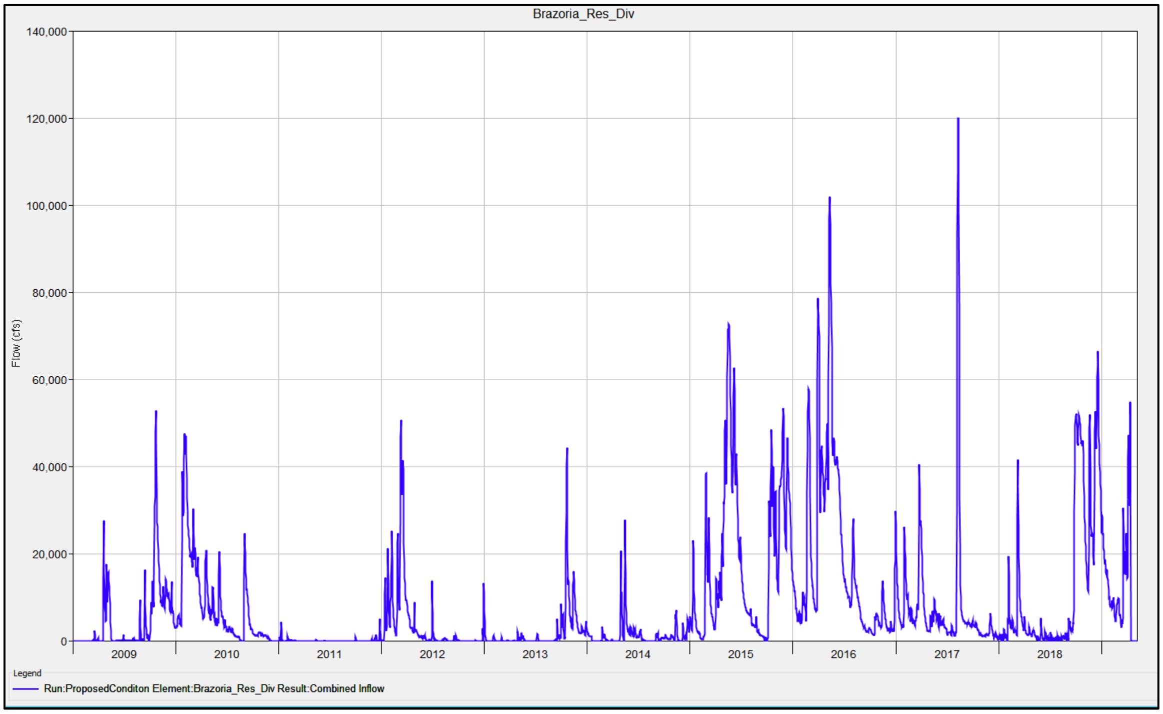


***Figure 45**: Proposed conditions flow hydrograph at existing Brazoria Reservoir diversion (Brazos River) over the 10.5-year simulation period.*

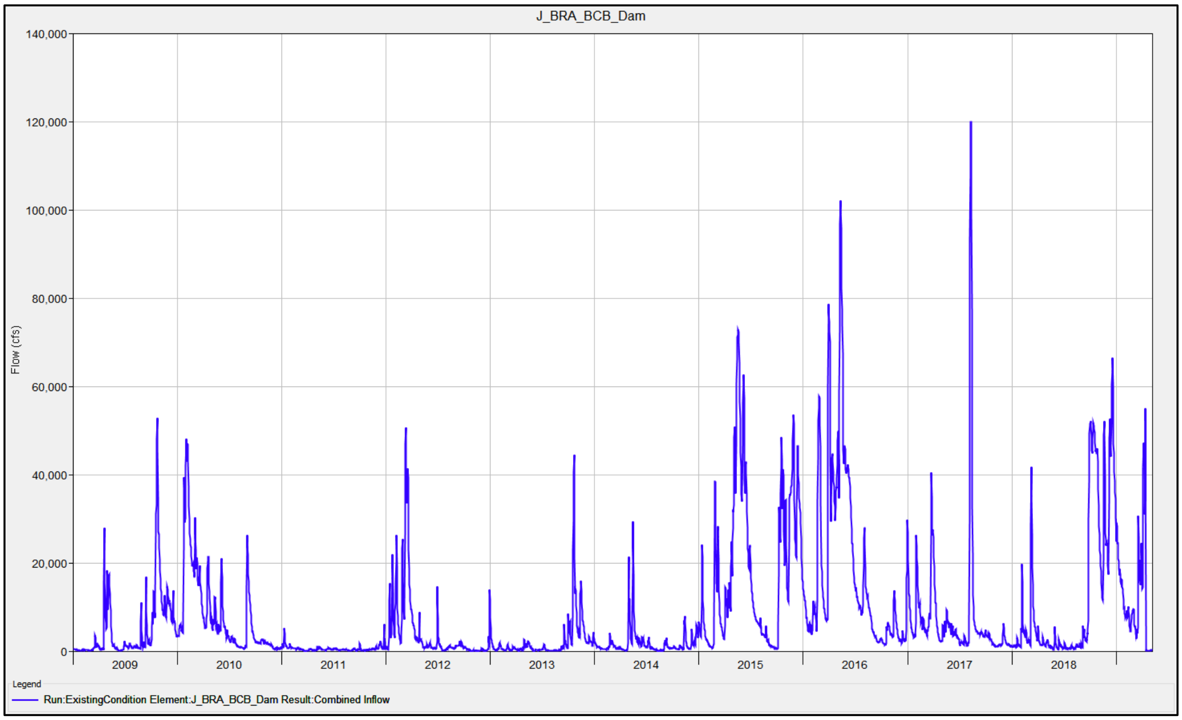


***Figure 46**: Existing conditions flow hydrograph at Brazoria discharge/Dow's water intake (Brazos River) over the 10.5-year simulation period.*

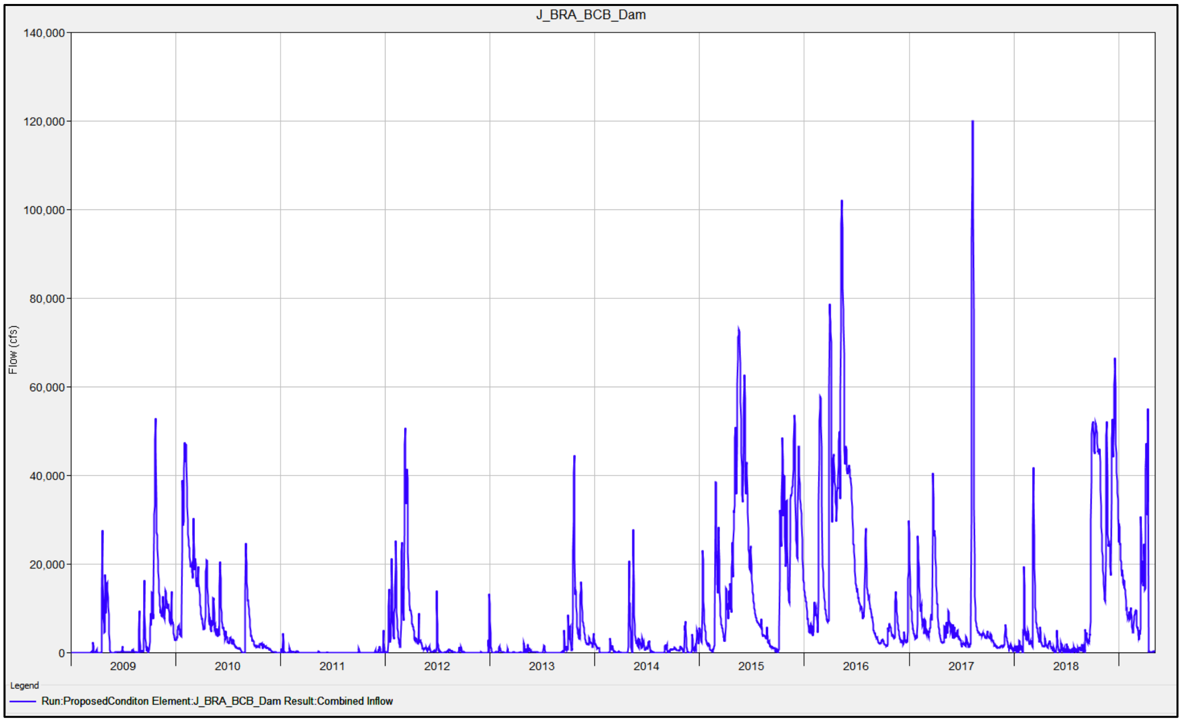


Figure 47*: Proposed conditions flow hydrograph at Brazoria discharge/Dow's water intake (Brazos River) over the 10.5-year simulation period.*

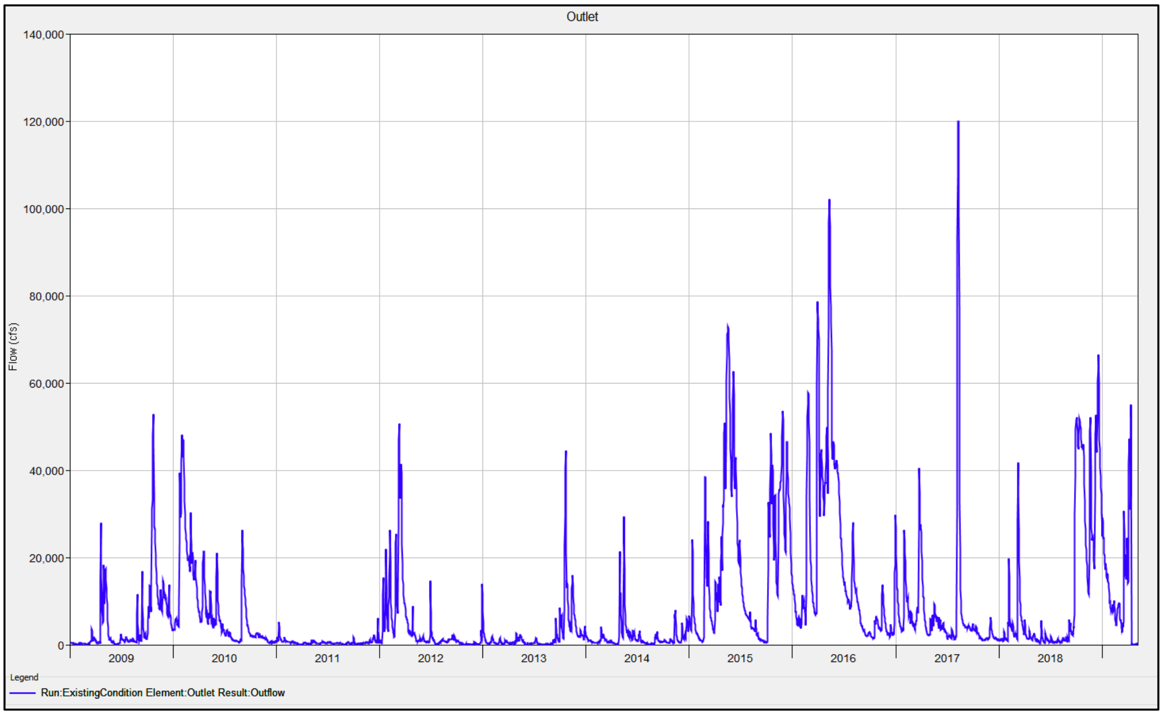


Figure 48*: Existing conditions flow hydrograph at outlet (Brazos River) over the 10.5-year simulation period.*

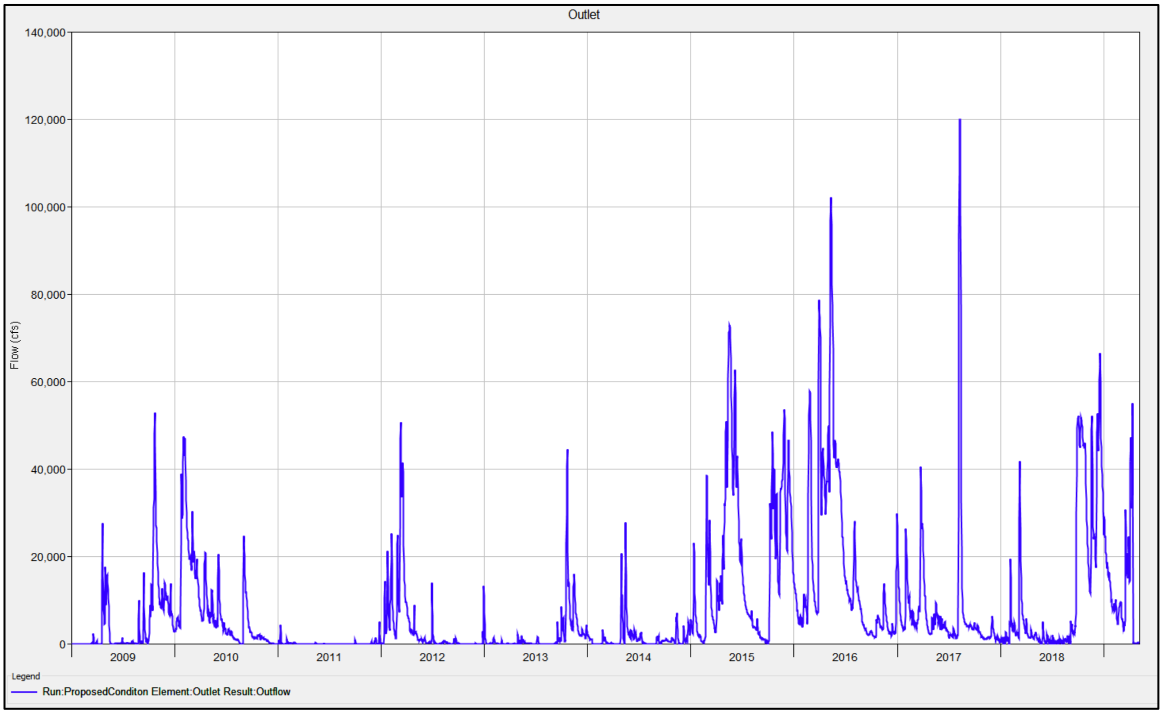


***Figure 49**: Proposed conditions flow hydrograph at outlet (Brazos River) over the 10.5-year simulation period.*

5.4.2 RiverWare

RiverWare uses objects to represent certain natural or man-made systems or structures (e.g., various types of reservoirs, diversions, reaches, stream gages, pumps, power plants, etc.) within a model, much like HEC-HMS does to create the elements within a flow model. However, it differs from HEC-HMS by using slots as the primary "storage containers" for data, as well as the actual variables for object operations (e.g., stream inflow/outflow, diversion flow, reservoir stage-storage-discharge values, pump curve and operation information, etc.). RiverWare uses its slot link capabilities to couple two or more objects (and specific slots within each respective object) to perform operations within the model (e.g., routing outflow from an object upstream as inflow into a downstream linked object, etc.).

The existing and proposed RiverWare models were built using the Richmond and Rosharon USGS flow gage historical hydrograph data (with a 40-year period of record) extracted from the same BRA FPP Study HEC-HMS model as described previously. The existing conditions model includes the existing Harris and Brazoria Reservoirs, respectively, along with their corresponding diversion elements in order to account for allowed pumping withdrawals along the Brazos River.

5.4.2.1 Existing Condition Model

The RiverWare model utilized the existing condition HEC-HMS basin model run's "Inflow" daily flow values from the "Harris_EX_Res_Div" diversion element, which utilized the previously mentioned 10-year period of record flow data from Dow as input, as the starting flow input for the RiverWare "Harris_EX_Res_Div" diversion object "Inflow" slot. Values for "Outflow" from the same HEC-HMS diversion element were likewise used as the input for the "Outflow" slot of the same "Harris_EX_Res_Div" diversion object in RiverWare. A "Diversion" flow data slot was also created to represent pumped outflows which were routed to the "Harris_EX_Res" pumped storage reservoir object, which was used to simulate the existing Harris Reservoir, which receives water from pumped inflows siphoned from the Brazos River at the "Harris_EX_Res_Div."

Historical reservoir plan and operational data received from Dow were used to build the "Harris_EX_Res_" reservoir "Storage," "Elevation Volume Table," and "Pool Elevation" slots. The "Inflow" slot was linked to the "Outflow" slot from the "Harris_EX_Res_Div" object. An "Outflow" slot was created to route discharge flows from the reservoir into the "Harris_EX_Res_Outlet_AP2" control slot, which was used as an analysis point (AP). This same process was repeated using the flow summary values from the HEC-HMS "Brazoria_Res_Div" element and transferred into the appropriate "Brazoria_Res_Div" diversion object "Inflow" and "Outflow" slots.

Reach objects "R_BRA_410 R_BRA_430" and "R_BRA_440" and confluence object "J_BRA_BCB_Dam" were created to route the discharges from the Brazos River and return flows from the reservoir objects back into the Brazos River system and down to the ultimate outfall, which was the "Outlet_AP1" control object. See the model schematic in **Figure 50**.

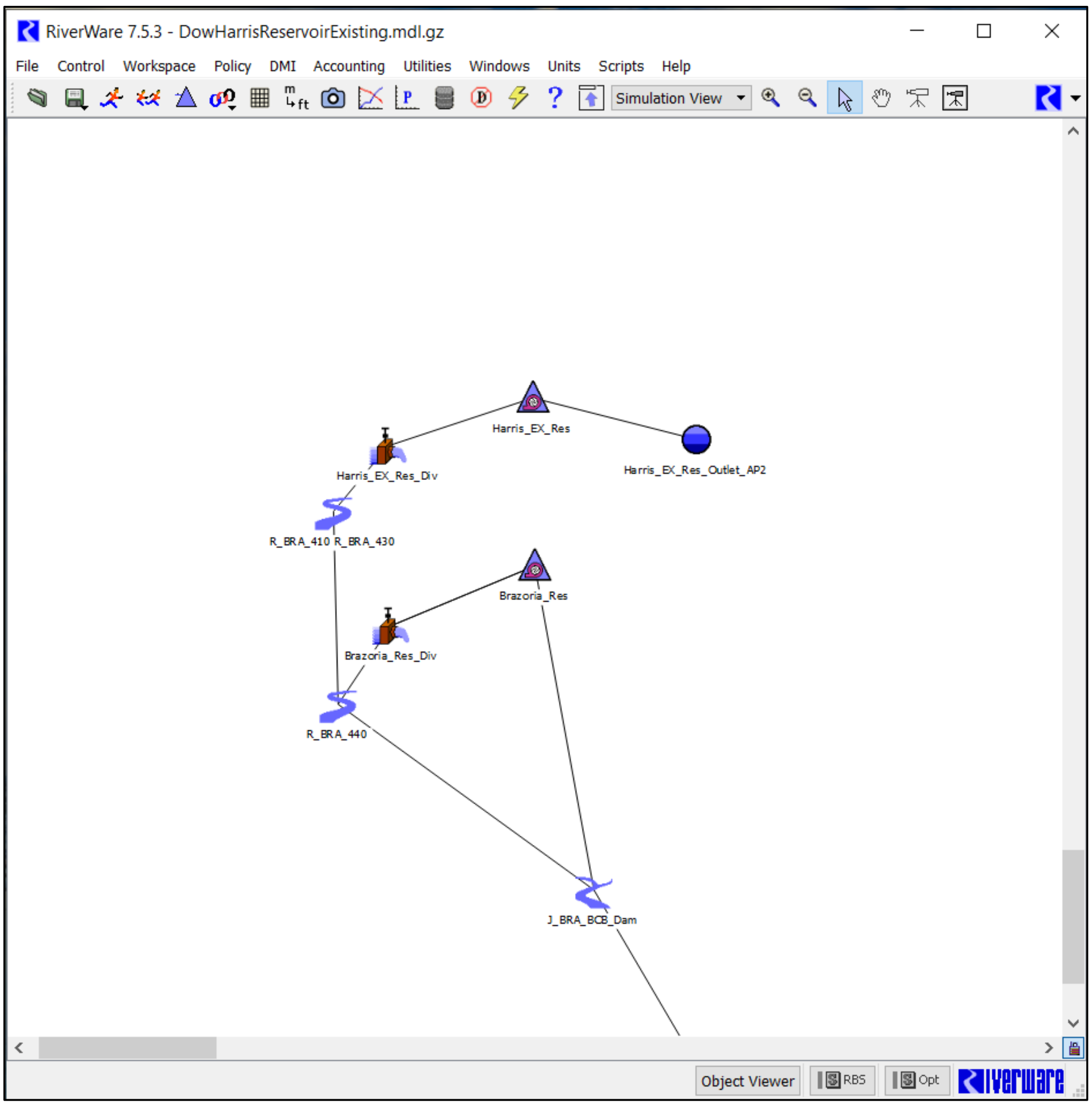


Figure 50: RiverWare existing conditions schematic.

5.4.2.2 Proposed Condition Model

The proposed condition RiverWare model was built upon the existing condition model, as explained previously. It was modified from the existing condition by the addition of the "Harris_PR_Res_Div" diversion object, the "Harris_PR_Res" pumped storage reservoir object, and the "Harris_PR_Res_Outlet_AP2" control object. The process for building the additional proposed Harris Reservoir and its accompanying diversion was the same as was described above for the Existing Condition Model, except the values were taken from the Proposed Condition Basin Model run of HEC-HMS for the "Harris_PR_Res_Div" and accompanying "Harris_PR_Res" pumped storage reservoir object. The proposed Harris Reservoir expansion plans and proposed operational data received from Dow and its engineering consultants were used to create the "Harris_PR_Res" reservoir "Storage," "Elevation Volume Table, and "Pool Elevation" slots, just as for the existing condition model.

As was done previously for the existing Harris Reservoir, an "Outflow" slot was created to route discharge flows from the "Harris_PR_Res" reservoir into the "Harris_PR_Res_Outlet_AP3" control slot, which was used as another AP. A reach object "R_BRA_Harris_PR_Res_Div" was created, along with corresponding "Inflow" "Outflow" slots, to route undiverted flows from the "Harris_PR_Res_Div" back to the Brazos River System. See **Figure 51** for the proposed project schematic.

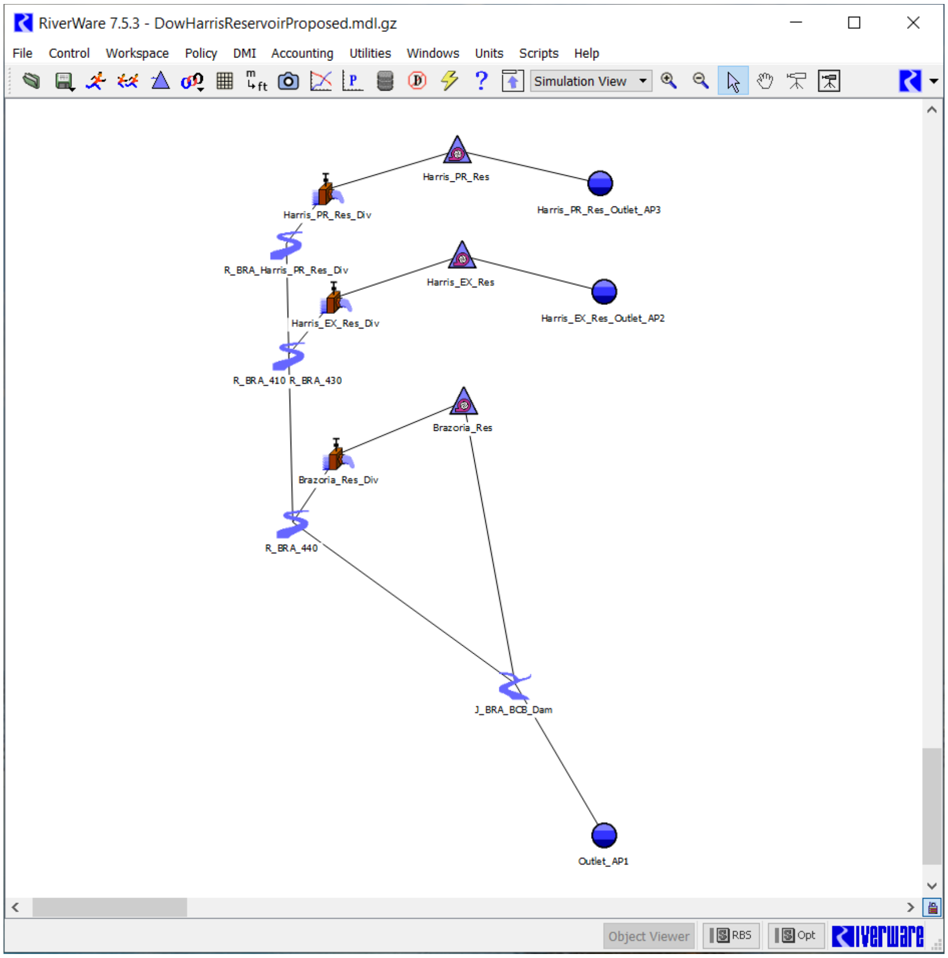
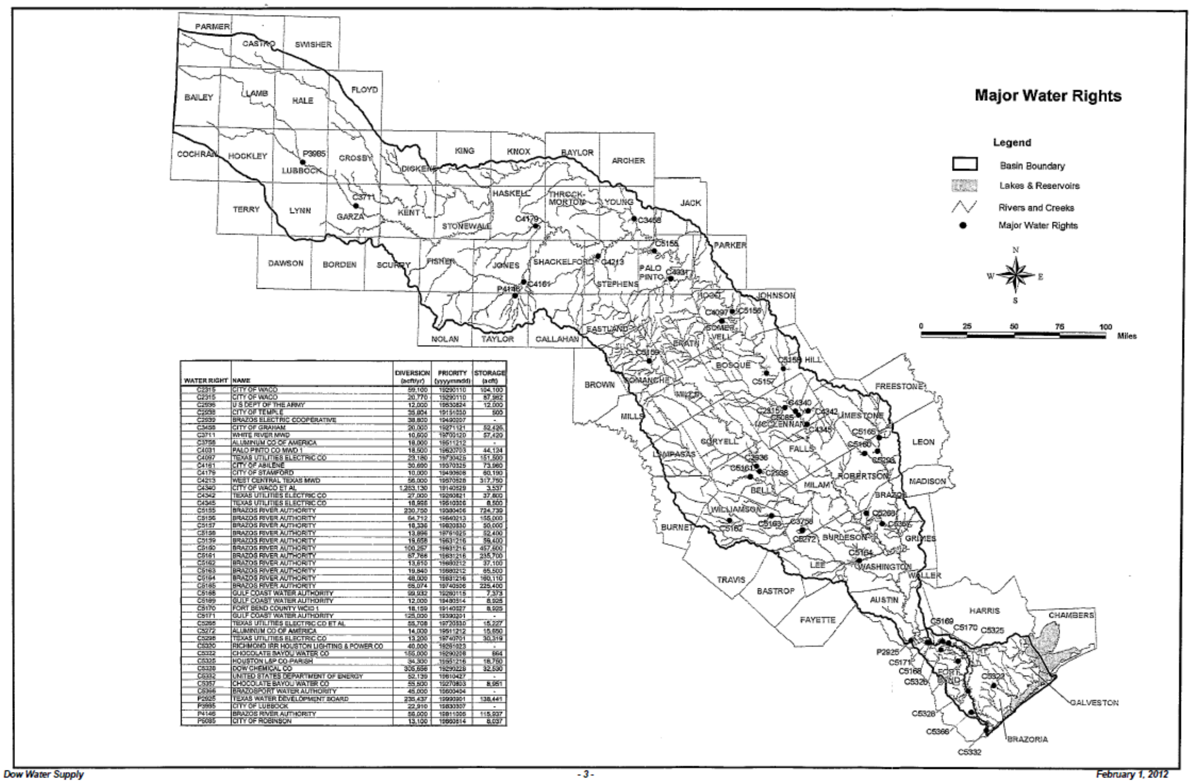


***Figure 51**: RiverWare proposed conditions schematic.*

5.4.2.3 Summary of Water Rights and Inputs to Models

This section provides the prioritization for model inputs for RiverWare. The information is based on documentation provided by Dow regarding its water rights and water supply methods and was confirmed through a review of TCEQ documentation (Texas Water Commission, 1985). A summary of the major water rights holders is provided in **Figure 52. Figure 53** provides a summary of the adjudicated water rights Dow holds, as confirmed by the Brazos River Watermaster. Figure 54 shows the frequency of flows for prior appropriated and natural priority on the Brazos River.



WATER RIGHT	NAME	DIVERSION (acft/yr)	PRIORITY (yyyymmdd)	STORAGE (acft)
C2315	CITY OF WACO	59,100	19290110	104,100
C2315	CITY OF WACO	20,770	19290110	87,962
C2936	U S DEPT OF THE ARMY	12,000	19530824	12,000
C2938	CITY OF TEMPLE	35,804	19151230	500
C2939	BRAZOS ELECTRIC COOPERATIVE	38,800	19490207	-
C3458	CITY OF GRAHAM	20,000	19271121	52,425
C3711	WHITE RIVER MWD	10,600	19700120	37,420
C3758	ALUMINUM CO OF AMERICA	18,000	19511212	-
C4031	PALO PINTO CO MWD 1	18,500	19620703	44,124
C4097	TEXAS UTILITIES ELECTRIC CO	23,180	19730425	151,500
C4161	CITY OF ABILENE	30,690	19370325	73,960
C4179	CITY OF STAMFORD	10,000	19490608	60,190
C4213	WEST CENTRAL TEXAS MWD	56,000	19570528	317,750
C4340	CITY OF WACO ET AL	1,253,130	19140529	3,537
C4342	TEXAS UTILITIES ELECTRIC CO	27,000	19260821	37,800
C4345	TEXAS UTILITIES ELECTRIC CO	18,966	19510326	8,500
C5155	BRAZOS RIVER AUTHORITY	230,750	19380406	724,739
C5156	BRAZOS RIVER AUTHORITY	64,712	19640213	155,000
C5157	BRAZOS RIVER AUTHORITY	18,336	19820830	50,000
C5158	BRAZOS RIVER AUTHORITY	13,896	19761025	52,400
C5159	BRAZOS RIVER AUTHORITY	19,658	19631216	59,400
C5160	BRAZOS RIVER AUTHORITY	100,257	19631216	457,600
C5161	BRAZOS RIVER AUTHORITY	67,768	19631216	235,700
C5162	BRAZOS RIVER AUTHORITY	13,610	19680212	37,100
C5163	BRAZOS RIVER AUTHORITY	19,840	19680212	65,500
C5164	BRAZOS RIVER AUTHORITY	48,000	19631216	160,110
C5165	BRAZOS RIVER AUTHORITY	65,074	19740506	225,400
C5168	GULF COAST WATER AUTHORITY	99,932	19260115	7,373
C5169	GULF COAST WATER AUTHORITY	12,000	19480514	8,925
C5170	FORT BEND COUNTY WCID 1	18,159	19140327	8,925
C5171	GULF COAST WATER AUTHORITY	125,000	19390201	-
C5266	TEXAS UTILITIES ELECTRIC CO ET AL	55,708	19720530	15,227
C5272	ALUMINUM CO OF AMERICA	14,000	19511212	15,650
C5298	TEXAS UTILITIES ELECTRIC CO	13,200	19740701	30,319
C5320	RICHMOND IRR HOUSTON LIGHTING & POWER CO	40,000	19261023	-
C5322	CHOCOLATE BAYOU WATER CO	155,000	19290208	664
C5325	HOUSTON L&P CO-PARISH	34,300	19551216	18,750
C5328	DOW CHEMICAL CO	305,656	19290228	32,530
C5332	UNITED STATES DEPARTMENT OF ENERGY	52,139	19610427	-
C5357	CHOCOLATE BAYOU WATER CO	55,500	19270803	8,951
C5366	BRAZOSPORT WATER AUTHORITY	45,000	19600404	-
P2925	TEXAS WATER DEVELOPMENT BOARD	235,437	19990901	138,441
P3985	CITY OF LUBBOCK	22,910	19830307	-
P4146	BRAZOS RIVER AUTHORITY	56,000	19811005	115,937
P5085	CITY OF ROBINSON	13,100	19860814	8,037

Figure 52: Summary of major water rights on the Brazos River in Texas (provided by Dow).

Dow Water Rights Summary

Controlling Legal Documents

Certificate of Adjudication # 12-5328 Granted January 14, 1988; Cover Brazos River, Oyster Creek and Buffalo Camp Bayou Water Rights

Certificate of Adjudication # 12-5328A Granted February 27, 1991; Oyster Creek Adjustment to #12-5328

Certificate of Adjudication # 12-5328B Granted December 4, 1991; Oyster Creek Adjustment to #12-5328

		Period Reliability (Month by Month Basis)	Volume Reliability	Minimum Diverted	Special Consideration
1929	20,000 Acre-ft	98.56 %	98.80%	14,679 Acre-ft	
1942	150,000 Acre-ft	94.25 %	95.78%	76,910 Acre-ft	
1942 OC	58,175 Acre-ft	37.64 %	47.11%	8,626	
1942 OC	1,800 Acre-ft	37.50 %	26.01%	13	
1951BCB	7,500 Acre-ft	55.46 %	67.86 %	1500	
1952	Constructed Brazoria Reservoir and Relocated Right				
1960	65,000 Acre-ft	88.22%	88.75%	18,738 Acre-ft	61,000 Acre-ft of Storage or Contract Water with BRA Req'd
1960	45,000 Acre-ft	BWA Water			
1976	3,136 Acre-ft	84.34 %	88.24%		
				121,205 Acre-ft	

Current TCEQ Water Rights Reliability Assessment
Based on KBR work in Sept, 2002
WAM Model Run 3 (=All Authorized Water Rights at Authorized Amounts, No Return Flows, Original Areas-Capacities)

DOW RESTRICTED - For internal use only

***Figure 53**: Summary of Dow water rights on the Brazos River, Texas. DOW RESTRICTED - For Internal Use Only.*

Dow has a water right up to 175,000 gpm (388.9 cfs), of which it plans to use about 100,000 gpm (222.2 cfs). Even if it uses all its water right, the water use would still be less than the maximum diversion rate of 630 cfs.

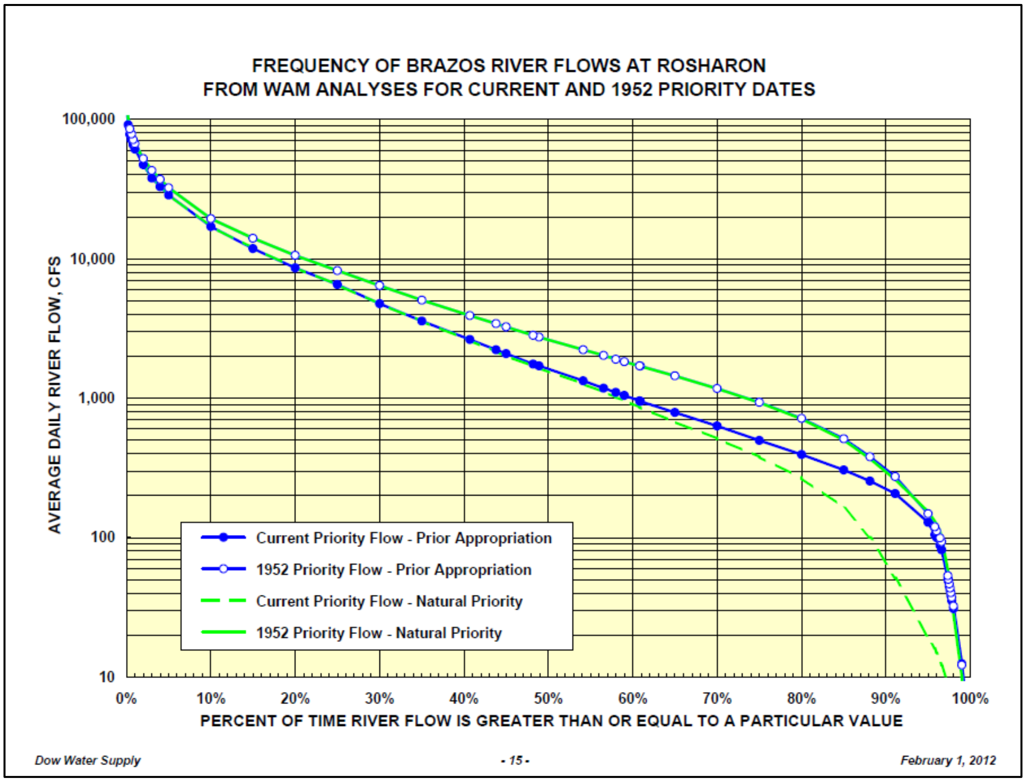


Figure 54: Frequency of flows for prior appropriated and natural priority on the Brazos River, Texas.

5.4.3 Brazos River HEC-RAS Unsteady Flow

The Brazos River HEC-RAS unsteady flow model used in this study was obtained from the BRA Lower Brazos Flood Protection Planning Study (FPP Study) HEC-RAS hydraulic model approved by the BRA in March of 2019 (Halff, 2019). The original model was truncated upstream of the Rosharon USGS gage to reduce extremely long run times and eliminate unnecessary data; the stream segment and cross-sections upstream of the gage are not part of the area of study for this report. Additionally, any backwater effects associated with the existing and proposed Harris Reservoir are expected to be isolated to the area in the closer vicinity to the existing Brazoria and Harris Reservoirs and proposed Harris Reservoir.

All hydraulic modeling of the Brazos River was performed in HEC-RAS unsteady flow version 5.0.7(DOW_Prop_Harris_Res_Brazos.prj) following standard modeling procedures for conceptual or planning-level analysis. Model computation time steps of 30 minutes and reporting intervals of 1 day were used and were held constant between existing and proposed conditions. Changes to the original model were limited to the following:

1. Truncating the model
2. Revising the upstream boundary conditions and associated initial flows
3. Incorporating lateral inflow hydrographs

5.4.3.1 Geometry Data

The geometry data from the original HEC-RAS unsteady flow model were used with the only modification at cross-section 308,583.5. The original FPP study model did not include either of the existing Harris and Brazoria Reservoirs, which are operated by Dow. These reservoirs were not added to the HEC-RAS model; however, they were modeled in HEC-HMS using the reservoir routing method. The resulting hydrographs were then imported into both HEC-RAS and RiverWare models. The Modified Puls Routing Method was used in HEC-HMS reservoir routing.

5.4.3.2 Boundary Conditions

The Rosharon gage was input as a flow hydrograph for the upstream boundary condition at the upstream cross-section 308,583.5 (see **Figure 39**). Details on this gage are discussed in **Section 4.3.5** While the original model used a normal depth downstream boundary condition with a slope of 0.0003, this boundary condition did not produce expected backwater effects from the Gulf of Mexico related to mean, high, or low tide or any condition. Since the reach of the Brazoria River modeled for this study has bottom elevation nearly 20 ft below sea level and is tidally influenced, the downstream boundary condition was modified to a fixed WSEL of 0.511 ft, which is consistent with the current MSL reported by USGS (USGS, 2019). While MSL does not capture extreme tidal influence or storm surge, it is reflective of typical levels of tidal influence and backwater effects from the Gulf of Mexico on the study area. As shown in **Figure 11**, neither the Brazoria Reservoir, the existing Harris Reservoir, or the proposed Harris Reservoir are expected to be inundated from the effects of sea level rise.

5.4.3.3 Lateral Inflow Hydrographs

The only river hydrograph used in the HEC-RAS model was the upstream boundary condition hydrograph (USGS Rosharon gage). No lateral inflow from drainage area sub-basins were included in the HEC-RAS model. Only the diversion for proposed Harris reservoir was modeled in HEC-RAS.

5.4.3.4 Reservoir Diversions and Discharges

Figure 55 and **Table 14** show the only diversion which was modeled in HEC-RAS. This HEC-RAS model includes only Brazos River, not Oyster Creek. The modeling conventions do not allow for crossing cross-sections within the same floodplain. A detailed modeling analysis of Oyster Creek is located in the *Oyster Creek Downstream Hydrology and Hydraulic Impacts Final Report*. This diversion was added to the existing conditions model to represent the amount of water that would be removed from Brazos River when the proposed Harris Reservoir was added. This way, existing and proposed conditions can be compared to each other.

Table 12: Reservoir Diversions and Discharges Lateral Inflow Hydrograph Input Locations

Reservoir	HEC-RAS Cross-Section
Existing Harris Discharge	Leaves to Oyster Creek
Proposed Harris Inflow	253,920.7
Proposed Harris Discharge	Leaves to Oyster Creek

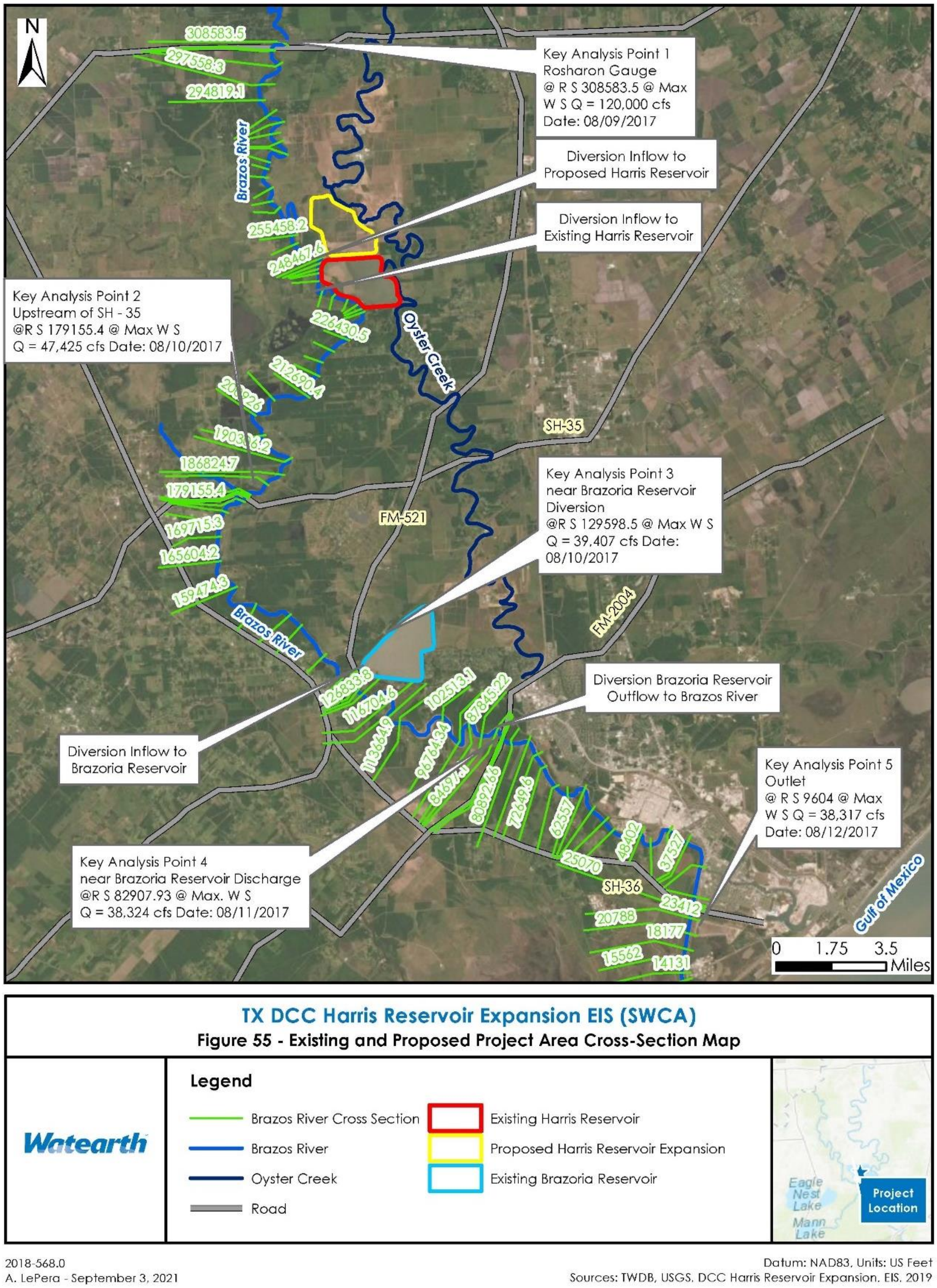


Figure 55: *HEC-RAS cross-section layout for Brazos River.*

5.4.3.5 HEC-RAS Unsteady Flow Results

Listed in **Table 15** are the existing and proposed condition peak flows at maximum WSELs for the entire 10.5-year simulation period showing the difference in maximum flow through the cross-sections at each of the river stations. Provided in **Figure 56** and **Figure 57** are a profile plot of existing and proposed conditions maximum WSELs along the Brazos River from the Rosharon gage to the outlet at the Gulf of Mexico.

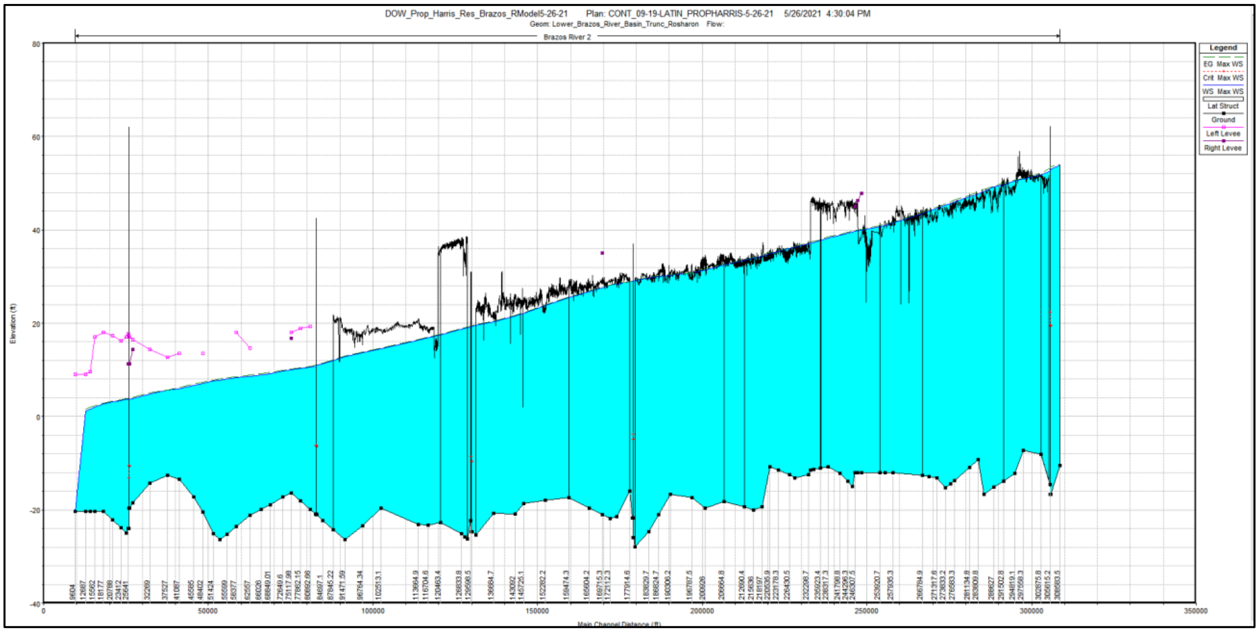


__Figure 56__: Existing conditions profile plot showing maximum water surface elevations along the Brazos River from the Rosharon gage to the outlet at the Gulf of Mexico.

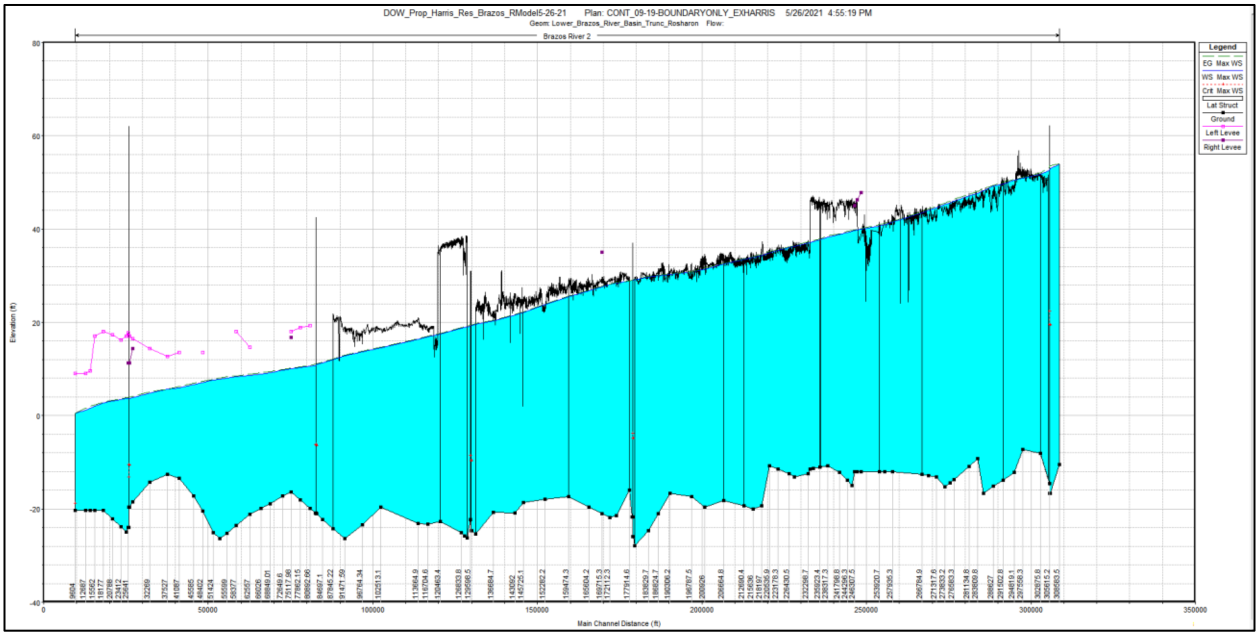


Figure 57: Proposed conditions profile plot showing maximum water surface elevations along the Brazos River from the Rosharon gage to the outlet at the Gulf of Mexico.

Similarly, **Figure 58** through **Figure 61** provide a profile plot of existing and proposed conditions maximum flows and velocities. Most of the proposed results varied only slightly from the existing conditions due to relatively insignificant diversion impacts compared to the large watershed study area. Accordingly, the change in flow in the Brazos River caused by the proposed Harris Reservoir diversion is negligible and the results for both conditions are nearly identical.

Table 15: Comparison of Existing and Proposed Flows at Maximum Water Surface Elevation Over the 10.5-Year Simulation Period

River Station	Existing Conditions Flow Total (cfs)	Proposed Conditions Flow Total (cfs)	Flow Δ (cfs)
308,583.50	120,000	120,000	0
305,771.60	120,000	120,000	0
305,615.20	120,000	120,000	0
302,875.80	113,694	113,694	0
297,558.30	113,184	113,184	0
294,819.10	112,072	112,072	0
291,502.80	107,921	107,921	0
288,627.00	101,320	101,320	0
285,653.70	96,609	96,609	0
283,809.80	94,770	94,770	0

River Station	Existing Conditions Flow Total (cfs)	Proposed Conditions Flow Total (cfs)	Flow Δ (cfs)
281,134.80	89,298	89,298	0
276,583.30	84,011	84,011	0
275,349.90	82,492	82,492	0
273,833.20	79,991	79,991	0
271,317.60	78,770	78,770	0
268,824.90	73,545	73,545	0
266,784.90	72,194	72,194	0
257,935.30	63,290	63,290	0
255,458.20	63,199	63,199	0
253,920.70	62,582	62,582	0
248,467.60	57,453	57,453	0
247,254.60	56,930	56,930	0
246,307.50	56,930	56,930	0
245,582.10	56,930	56,930	0
244,296.30	56,930	56,930	0
241,798.80	56,930	56,930	0
238,317.30	56,930	56,930	0
235,923.40	56,930	56,930	0
233,849.80	56,930	56,930	0
232,926.90	56,930	56,930	0
232,298.70	56,160	56,160	0
228,171.50	54,692	54,692	0
226,430.50	54,169	54,169	0
223,178.30	52,301	52,301	0
220,535.90	51,918	51,918	0
218,197.00	51,353	51,353	0
215,636.00	50,540	50,540	0
212,690.40	49,932	49,932	0
206,664.80	49,250	49,250	0
200,926.00	49,208	49,208	0

River Station	Existing Conditions Flow Total (cfs)	Proposed Conditions Flow Total (cfs)	Flow Δ (cfs)
196,787.50	48,811	48,811	0
190,306.20	48,284	48,284	0
186,824.70	47,835	47,835	0
183,829.70	47,687	47,687	0
179,479.50	47,425	47,425	0
179,155.40	47,425	47,425	0
178,789.60	47,425	47,425	0
177,914.60	47,425	47,425	0
174,103.50	47,400	47,400	0
172,112.30	47,373	47,373	0
169,715.30	47,358	47,358	0
165,604.20	47,203	47,204	0
159,474.30	47,183	47,183	0
152,282.20	47,095	47,095	0
145,725.10	46,484	46,484	0
143,092.00	39,811	39,811	0
136,684.70	39,508	39,508	0
131,329.00	39,410	39,410	0
130,048.30	39,410	39,410	0
129,598.50	39,410	39,410	0
128,597.70	39,410	39,410	0
127,887.80	39,410	39,410	0
126,833.80	39,410	39,410	0
120,463.40	39,410	39,410	0
116,704.60	38,357	38,357	0
113,664.90	38,357	38,357	0
102,513.10	38,356	38,356	0
96,764.34	38,356	38,356	0
91,471.59	38,355	38,355	0
87,845.22	38,324	38,324	0

River Station	Existing Conditions Flow Total (cfs)	Proposed Conditions Flow Total (cfs)	Flow Δ (cfs)
84,697.10	38,323	38,323	0
82,907.93	38,323	38,323	0
82,530.34	38,323	38,323	0
80,892.66	38,322	38,322	0
77,862.15	38,322	38,322	0
75,117.98	38,322	38,322	0
72,649.60	38,322	38,322	0
68,849.01	38,322	38,322	0
66,026.00	38,321	38,321	0
62,557.00	38,321	38,321	0
58,377.00	38,321	38,321	0
55,599.00	38,321	38,321	0
53,486.00	38,321	38,321	0
51,424.00	38,321	38,321	0
48,402.00	38,321	38,321	0
45,585.00	38,321	38,321	0
41,087.00	38,321	38,321	0
37,527.00	38,321	38,321	0
32,269.00	38,320	38,321	0
27,098.00	38,320	38,320	0
26,001.00	38,320	38,320	0
25,641.00	38,320	38,320	0
25,070.00	38,320	38,320	0
23,412.00	38,320	38,320	0
20,788.00	38,320	38,320	0
18,177.00	38,320	38,320	0
15,562.00	38,320	38,320	0
14,131.00	38,320	38,320	0
12,687.00	38,320	38,320	0
9,604.00	618	0	618

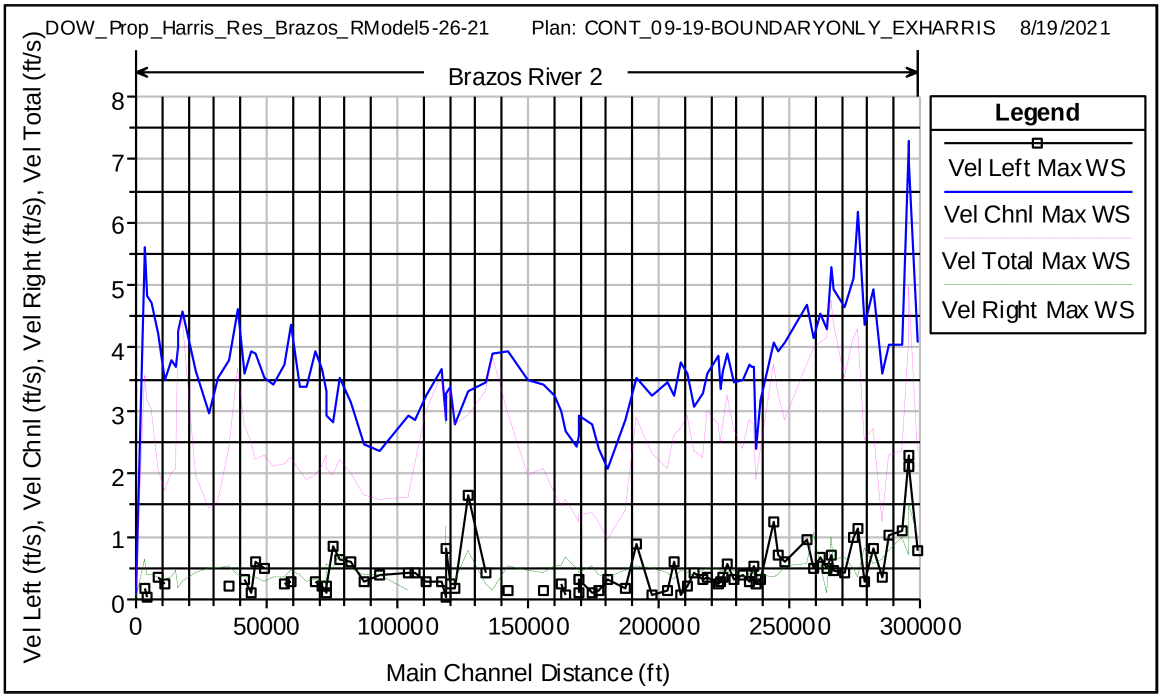


***Figure 58**: Existing conditions channel flow velocity, left and right overbank flow velocity, and average flow velocity for the peak maximum WSEL over the 10.5-year simulation period along the Brazos River between Rosharon gage and outlet.*

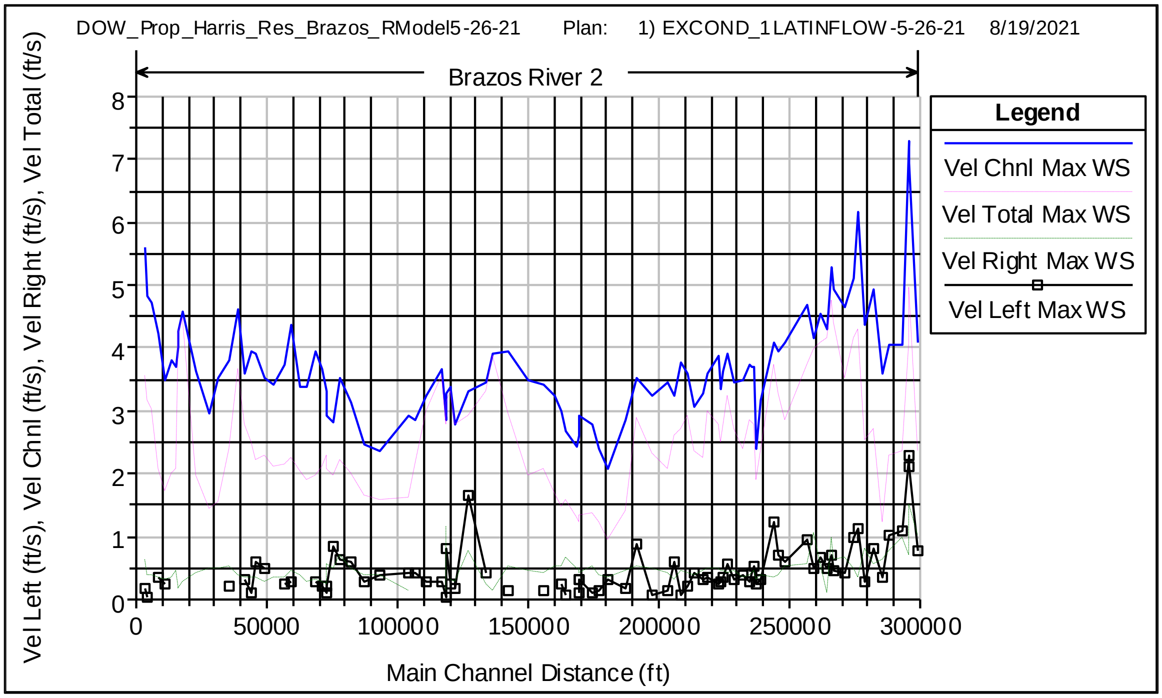


***Figure 59**: Proposed conditions channel flow velocity, left and right overbank flow velocity, and average flow velocity for the peak maximum WSEL over 10.5-year simulation period along the Brazos River between Rosharon gage and outlet.*

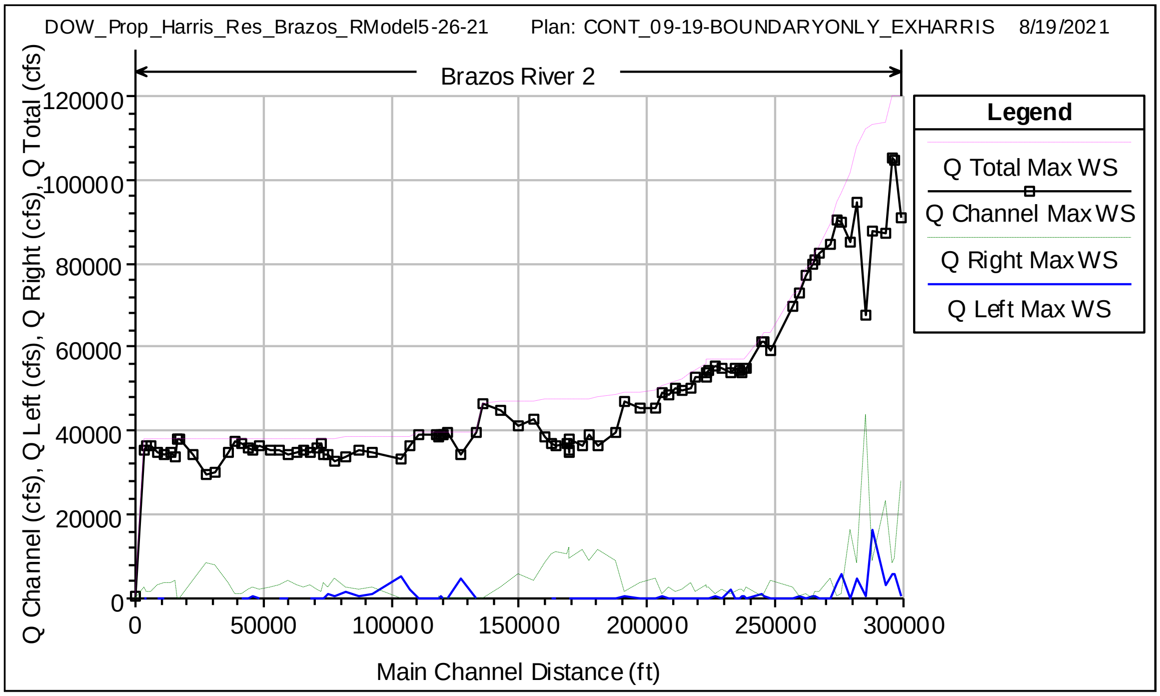


***Figure 60**: Existing conditions channel flow, left and right overbank flow, and total maximum flow for the peak maximum WSEL over the 10.5-year simulation period along the Brazos River between Rosharon gage and outlet.*

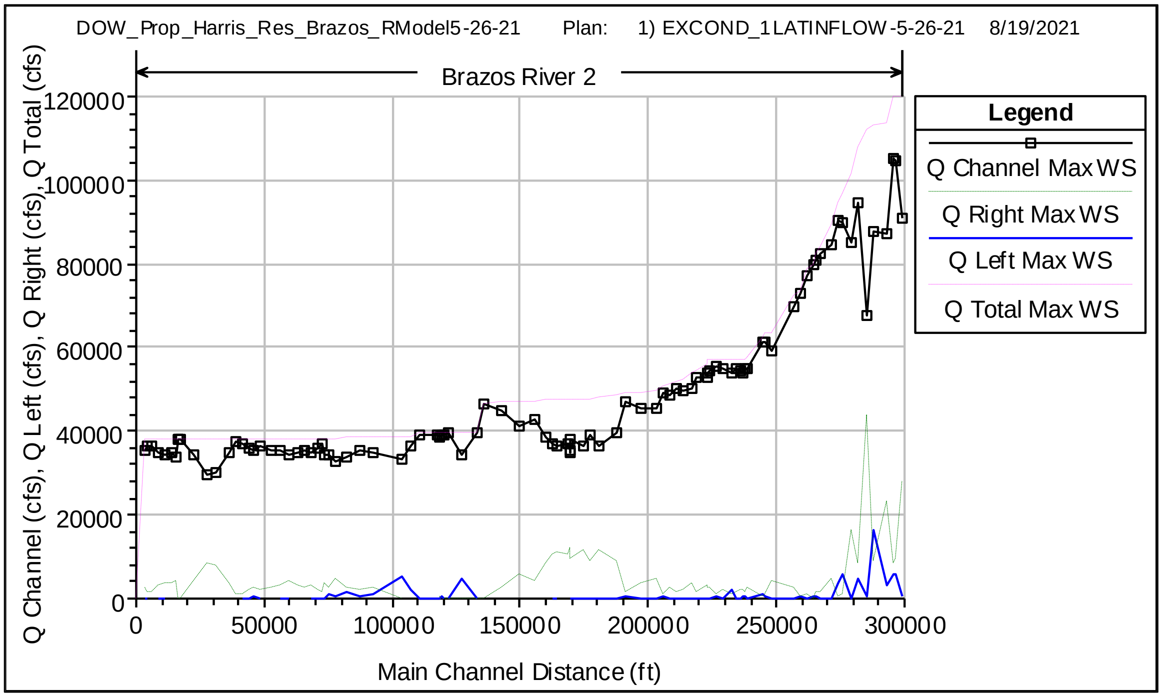


***Figure 61**: Proposed conditions channel flow, left and right overbank flow, and total maximum flow for the peak maximum WSEL during the 10.5-year simulation period along the Brazos River between Rosharon gage and outlet.*

Depicted in **Figure 62** through **Figure 71** are the existing and proposed stage hydrographs and flow hydrographs at five key analysis points between the Rosharon gage and the outlet at the Gulf of Mexico. **Table 16** shows the existing and proposed HEC-RAS unsteady flow water surface elevations for all cross-sections. **Table 17** shows the HEC-RAS existing and proposed unsteady flow maximum channel velocities for all cross-sections. The key analysis points are listed in **Table 18** and include the Rosharon gage, which is not expected to change between existing and proposed conditions as it is input as an upstream boundary condition in the model. Most of the results between the existing and proposed conditions varied only slightly from the existing conditions due to the model having one diversion added over a large watershed study area. Therefore, the change in flow in the Brazos River caused by the proposed Harris Reservoir diversion is negligible and the results for both conditions are identical.

Figure 72 shows the flood inundation mapping results of the Brazos HEC-RAS model, which includes cross-sections with maximum existing and proposed WSELs over the 10.5-year simulation. The red shade is used for proposed conditions model results and the blue shade is used for existing conditions model results. As there is no change in WSEL, when overlaid, the flood inundation map looks purple. **Figure 73** shows a close-up of the flood inundation map around the proposed Harris Reservoir.

Table 16: Comparison between Existing and Proposed Maximum Water Surface Elevations

River Station	Existing Conditions WSEL (ft)	Proposed Conditions WSEL (ft)	Change in WSEL (ft)
308,583.5	53.84	53.84	0.00
305,771.6	52.96	52.96	0.00
305,615.2	52.57	52.57	0.00
302,875.8	51.81	51.81	0.00
297,558.3	50.90	50.90	0.00
294,819.1	50.44	50.44	0.00
291,502.8	49.69	49.69	0.00
288,627.0	49.17	49.17	0.00
285,653.7	48.18	48.18	0.00
283,809.8	47.70	47.70	0.00
281,134.8	47.15	47.15	0.00
276,583.3	46.00	46.00	0.00
275,349.9	45.57	45.57	0.00
273,833.2	45.23	45.23	0.00
271,317.6	44.55	44.55	0.00
268,824.9	44.01	44.01	0.00
266,784.9	43.42	43.42	0.00

River Station	Existing Conditions WSEL (ft)	Proposed Conditions WSEL (ft)	Change in WSEL (ft)
257,935.3	41.45	41.45	0.00
255,458.2	40.93	40.93	0.00
253,920.7	40.62	40.62	0.00
248,467.6	39.90	39.90	0.00
247,254.6	39.83	39.83	0.00
246,307.5	39.63	39.63	0.00
245,582.1	39.50	39.50	0.00
244,296.3	39.27	39.27	0.00
241,798.8	38.81	38.81	0.00
238,317.3	38.31	38.31	0.00
235,923.4	37.67	37.67	0.00
233,849.8	37.32	37.32	0.00
232,926.9	37.20	37.20	0.00
232,298.7	37.06	37.06	0.00
228,171.5	36.28	36.28	0.00
226,430.5	35.99	35.99	0.00
223,178.3	35.46	35.46	0.00
220,535.9	34.92	34.92	0.00
218,197.0	34.38	34.38	0.00
215,636.0	33.94	33.94	0.00
212,690.4	33.49	33.49	0.00
206,664.8	32.47	32.47	0.00
200,926.0	31.44	31.44	0.00
196,787.5	30.77	30.77	0.00
190,306.2	30.28	30.28	0.00
186,824.7	29.98	29.98	0.00
183,829.7	29.70	29.70	0.00
179,479.5	29.13	29.13	0.00
179,155.4	29.05	29.05	0.00
178,789.6	28.94	28.94	0.00

River Station	Existing Conditions WSEL (ft)	Proposed Conditions WSEL (ft)	Change in WSEL (ft)
177,914.6	28.84	28.84	0.00
174,103.5	28.45	28.45	0.00
172,112.3	28.09	28.09	0.00
169,715.3	27.60	27.60	0.00
165,604.2	26.72	26.72	0.00
159,474.3	25.43	25.43	0.00
152,282.2	23.75	23.75	0.00
145,725.1	22.05	22.05	0.00
143,092.0	21.53	21.53	0.00
136,684.7	20.32	20.32	0.00
131,329.0	19.55	19.55	0.00
130,048.3	19.29	19.29	0.00
129,598.5	19.19	19.19	0.00
128,597.7	19.02	19.02	0.00
127,887.8	18.94	18.94	0.00
126,833.8	18.67	18.67	0.00
120,463.4	17.43	17.43	0.00
116,704.6	16.90	16.90	0.00
113,664.9	16.39	16.39	0.00
102,513.1	14.57	14.57	0.00
96,764.3	13.69	13.69	0.00
91,471.6	12.88	12.88	0.00
87,845.2	12.02	12.02	0.00
84,697.1	11.34	11.34	0.00
82,907.9	10.96	10.96	0.00
82,530.3	10.78	10.78	0.00
80,892.7	10.59	10.59	0.00
77,862.2	10.27	10.27	0.00
75,118.0	10.03	10.03	0.00
72,649.6	9.72	9.72	0.00

River Station	Existing Conditions WSEL (ft)	Proposed Conditions WSEL (ft)	Change in WSEL (ft)
68,849.0	9.25	9.25	0.00
66,026.0	8.93	8.93	0.00
62,557.0	8.66	8.66	0.00
58,377.0	8.33	8.33	0.00
55,599.0	8.07	8.07	0.00
53,486.0	7.84	7.84	0.00
51,424.0	7.63	7.63	0.00
48,402.0	7.09	7.09	0.00
45,585.0	6.67	6.67	0.00
41,087.0	6.02	6.02	0.00
37,527.0	5.60	5.60	0.00
32,269.0	4.87	4.87	0.00
27,098.0	3.85	3.85	0.00
26,001.0	3.69	3.69	0.00
25,641.0	3.66	3.66	0.00
25,070.0	3.64	3.64	0.00
23,412.0	3.42	3.42	0.00
20,788.0	3.10	3.10	0.00
18,177.0	2.66	2.66	0.00
15,562.0	2.02	2.02	0.00
14,131.0	1.62	1.62	0.00
12,687.0	1.11	1.11	0.00
9,604.0	0.51	-	0.51

Table 17: Comparison Between Existing and Proposed Maximum Velocities

River Station	Existing Conditions Channel Velocity (ft/s)	Proposed Conditions Channel Velocity (ft/s)	Change in Channel Velocity (ft/s)
308,583.5	4.08	4.08	0.00
305,771.6	6.95	6.95	0.00
305,615.2	7.28	7.28	0.00
302,875.8	4.04	4.04	0.00
297,558.3	4.07	4.07	0.00
294,819.1	3.60	3.60	0.00
291,502.8	4.94	4.94	0.00
288,627.0	4.36	4.36	0.00
285,653.7	6.18	6.18	0.00
283,809.8	5.11	5.11	0.00
281,134.8	4.66	4.66	0.00
276,583.3	4.93	4.93	0.00
275,349.9	5.27	5.27	0.00
273,833.2	4.31	4.31	0.00
271,317.6	4.55	4.55	0.00
268,824.9	4.16	4.16	0.00
266,784.9	4.70	4.70	0.00
257,935.3	4.10	4.10	0.00
255,458.2	3.95	3.95	0.00
253,920.7	4.10	4.10	0.00
248,467.6	3.15	3.15	0.00
247,254.6	2.39	2.39	0.00
246,307.5	3.70	3.70	0.00
245,582.1	3.71	3.71	0.00
244,296.3	3.74	3.74	0.00

River Station	Existing Conditions Channel Velocity (ft/s)	Proposed Conditions Channel Velocity (ft/s)	Change in Channel Velocity (ft/s)
241,798.8	3.48	3.48	0.00
238,317.3	3.47	3.47	0.00
235,923.4	3.91	3.91	0.00
233,849.8	3.63	3.63	0.00
232,926.9	3.34	3.34	0.00
232,298.7	3.87	3.87	0.00
228,171.5	3.58	3.58	0.00
226,430.5	3.27	3.27	0.00
223,178.3	3.07	3.07	0.00
220,535.9	3.59	3.59	0.00
218,197.0	3.77	3.77	0.00
215,636.0	3.24	3.24	0.00
212,690.4	3.46	3.46	0.00
206,664.8	3.25	3.25	0.00
200,926.0	3.51	3.51	0.00
196,787.5	2.85	2.85	0.00
190,306.2	2.07	2.07	0.00
186,824.7	2.41	2.41	0.00
183,829.7	2.79	2.79	0.00
179,479.5	2.91	2.91	0.00
179,155.4	2.71	2.71	0.00
178,789.6	2.61	2.61	0.00
177,914.6	2.45	2.45	0.00
174,103.5	2.68	2.68	0.00
172,112.3	3.00	3.00	0.00
169,715.3	3.25	3.25	0.00

River Station	Existing Conditions Channel Velocity (ft/s)	Proposed Conditions Channel Velocity (ft/s)	Change in Channel Velocity (ft/s)
165,604.2	3.43	3.43	0.00
159,474.3	3.50	3.50	0.00
152,282.2	3.94	3.94	0.00
145,725.1	3.92	3.92	0.00
143,092.0	3.46	3.46	0.00
136,684.7	3.30	3.30	0.00
131,329.0	2.80	2.80	0.00
130,048.3	3.33	3.33	0.00
129,598.5	3.38	3.38	0.00
128,597.7	3.27	3.27	0.00
127,887.8	2.86	2.86	0.00
126,833.8	3.68	3.68	0.00
120,463.4	3.24	3.24	0.00
116,704.6	2.85	2.85	0.00
113,664.9	2.94	2.94	0.00
102,513.1	2.37	2.37	0.00
96,764.3	2.47	2.47	0.00
91,471.6	3.13	3.13	0.00
87,845.2	3.53	3.53	0.00
84,697.1	2.81	2.81	0.00
82,907.9	2.93	2.93	0.00
82,530.3	3.31	3.31	0.00
80,892.7	3.67	3.67	0.00
77,862.2	3.95	3.95	0.00
75,118.0	3.39	3.39	0.00
72,649.6	3.39	3.39	0.00

River Station	Existing Conditions Channel Velocity (ft/s)	Proposed Conditions Channel Velocity (ft/s)	Change in Channel Velocity (ft/s)
68,849.0	4.39	4.39	0.00
66,026.0	3.72	3.72	0.00
62,557.0	3.42	3.42	0.00
58,377.0	3.53	3.53	0.00
55,599.0	3.90	3.90	0.00
53,486.0	3.94	3.94	0.00
51,424.0	3.61	3.61	0.00
48,402.0	4.63	4.63	0.00
45,585.0	3.79	3.79	0.00
41,087.0	3.52	3.52	0.00
37,527.0	2.97	2.97	0.00
32,269.0	3.61	3.61	0.00
27,098.0	4.57	4.57	0.00
26,001.0	4.26	4.26	0.00
25,641.0	4.01	4.01	0.00
25,070.0	3.69	3.69	0.00
23,412.0	3.82	3.82	0.00
20,788.0	3.48	3.48	0.00
18,177.0	4.23	4.23	0.00
15,562.0	4.71	4.71	0.00
14,131.0	4.81	4.81	0.00
12,687.0	5.60	5.60	0.00
9,604.0	0.06	-	0.10

Table 18: Key Analysis Points for Results Reporting

Key Analysis Point	Location	HEC-RAS Cross-Section
1	Rosharon Gage	308,583.5
2	Upstream of State Road – 35, near West Columbia	179,155.4
3	Downstream of FM-521 (approximately 1,711 ft. upstream of Brazoria Reservoir Diversion [Inflow])	129,598.5
4	Brazoria Discharge upstream of FM-2004	82,907.9
5	Last RAS Cross Section (approximately 9,604 feet from the mouth of the Gulf of Mexico)	9,604.0

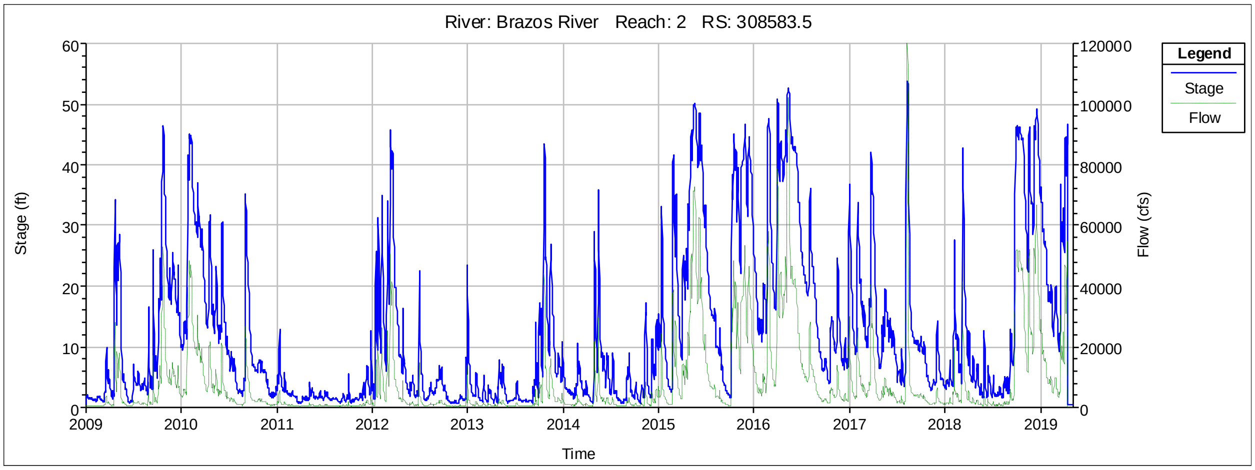


***Figure 62**: Proposed stage and flow hydrographs at Rosharon gage over the 10.5-year simulation period.*

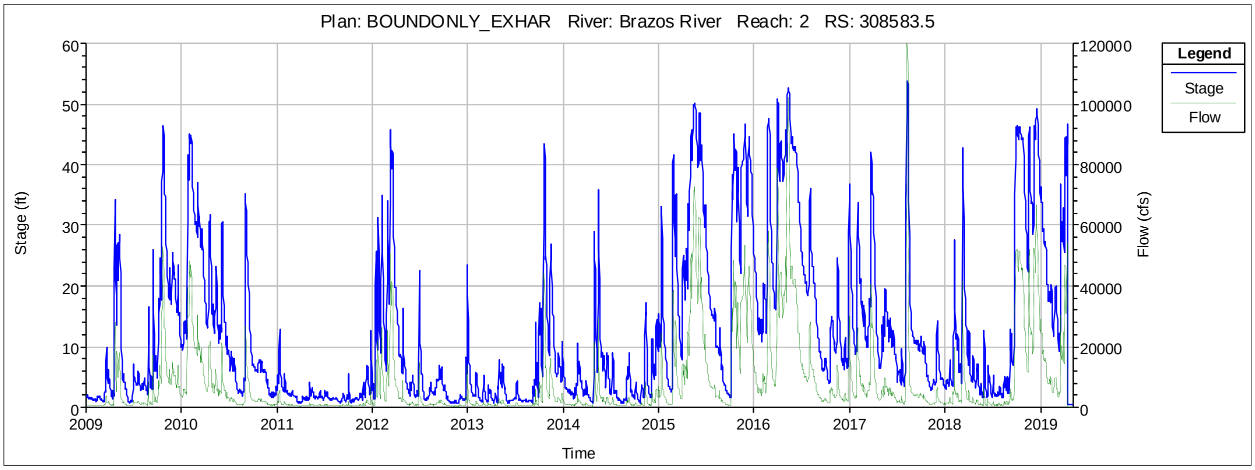


***Figure 63**: Existing stage and flow hydrographs at Rosharon gage over the 10.5-year simulation period.*

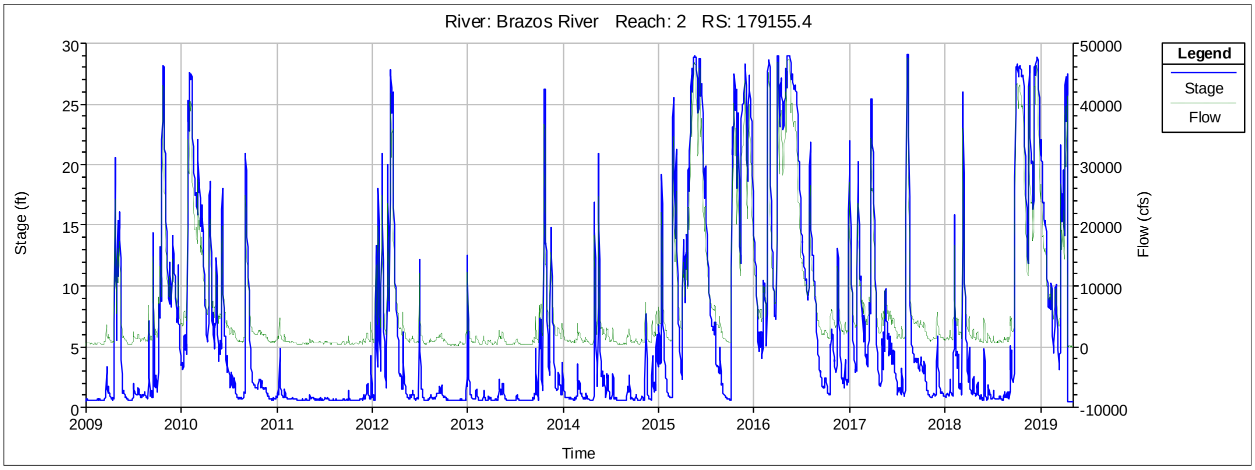


***Figure 64**: Proposed stage and flow hydrographs upstream of State Road – 35, near West Columbia, over the 10.5-year simulation period.*

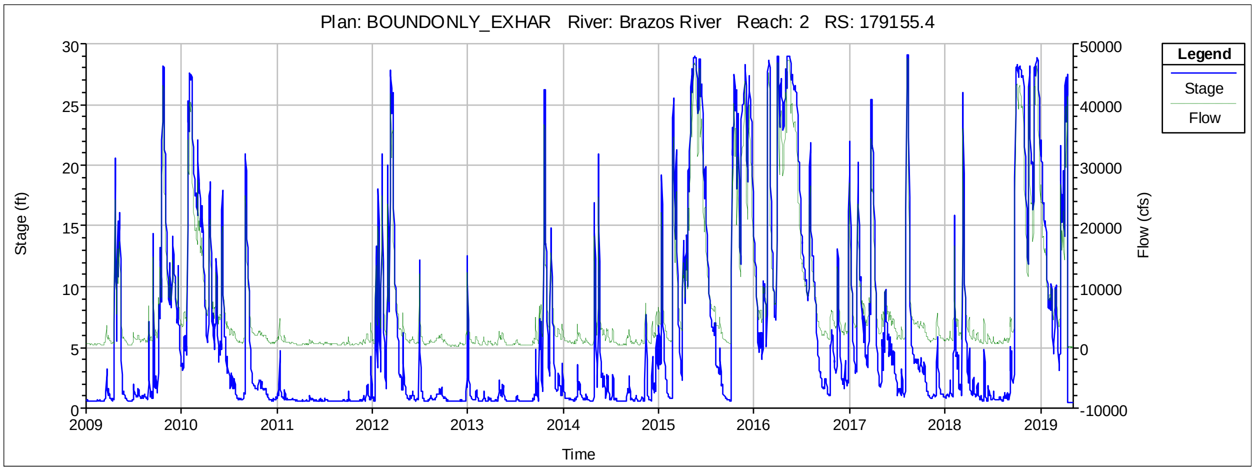


***Figure 65**: Existing stage and flow hydrographs upstream of State Road – 35, near West Columbia, over the 10.5-year simulation period.*

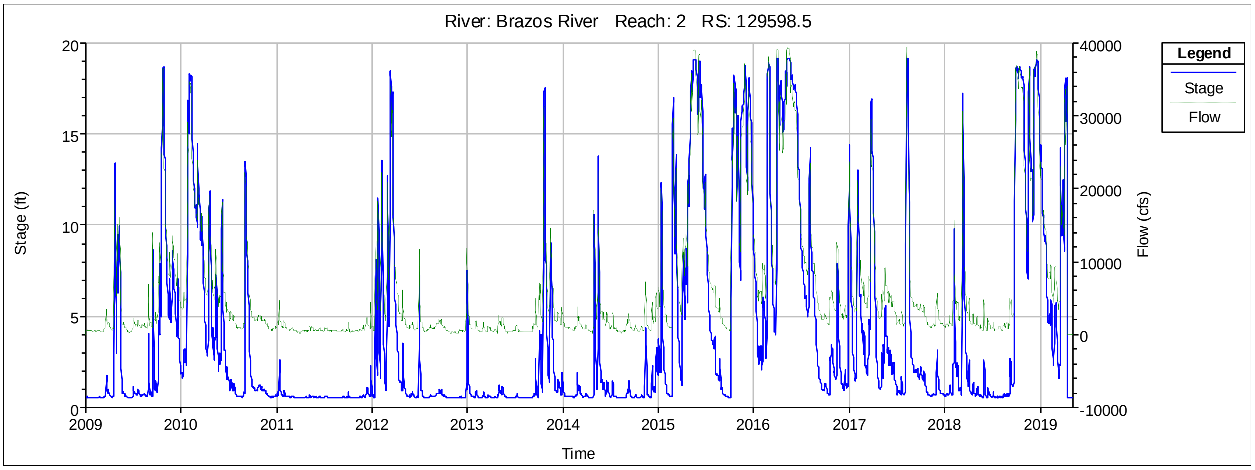


Figure 66: *Proposed stage and flow hydrographs downstream of FM-521 over the 10.5-year simulation period.*

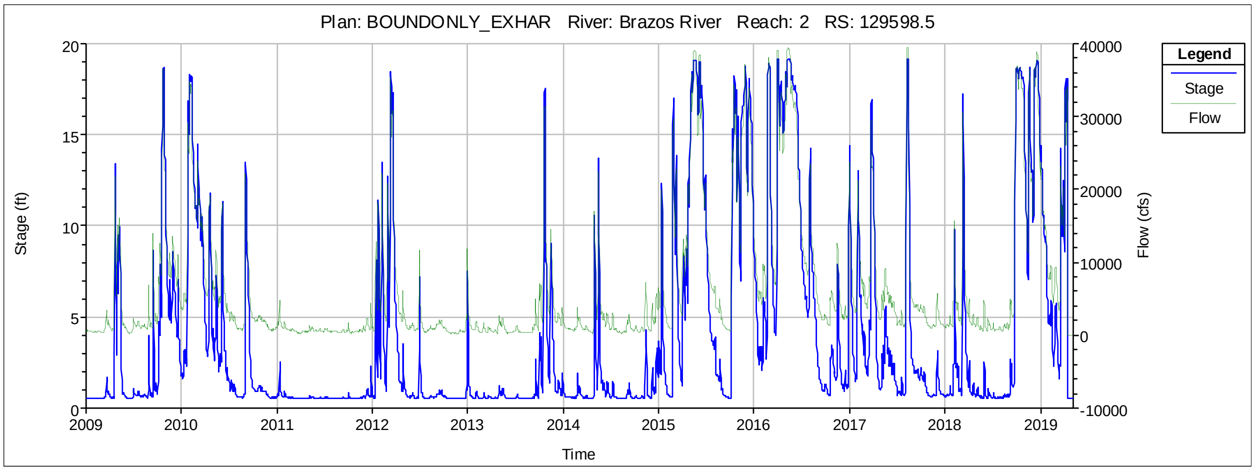


Figure 67: *Existing stage and flow hydrographs downstream of FM-521over the 10.5-year simulation period.*

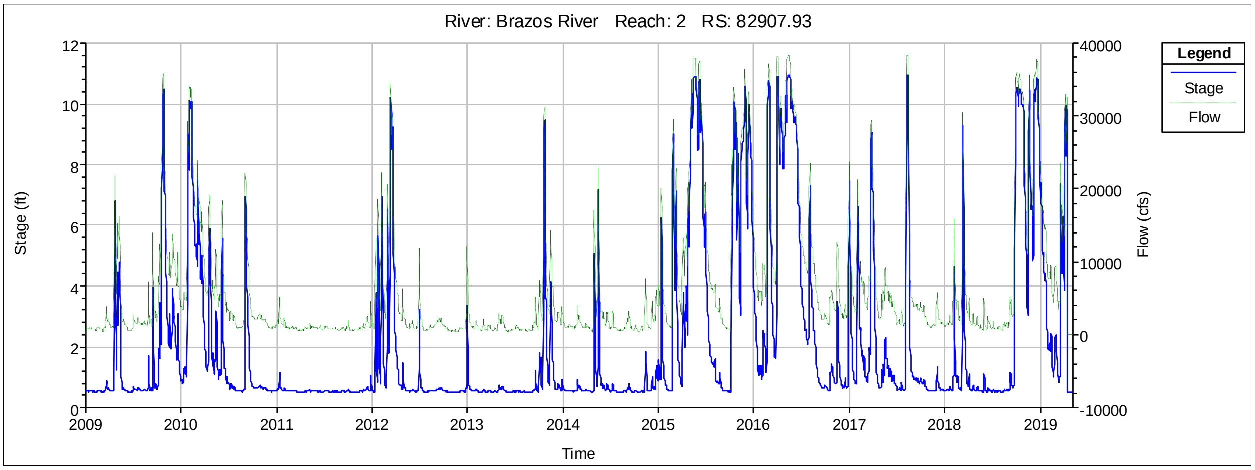


***Figure 68**: Proposed stage and flow hydrographs upstream of FM-2004 over the 10.5-year simulation period.*

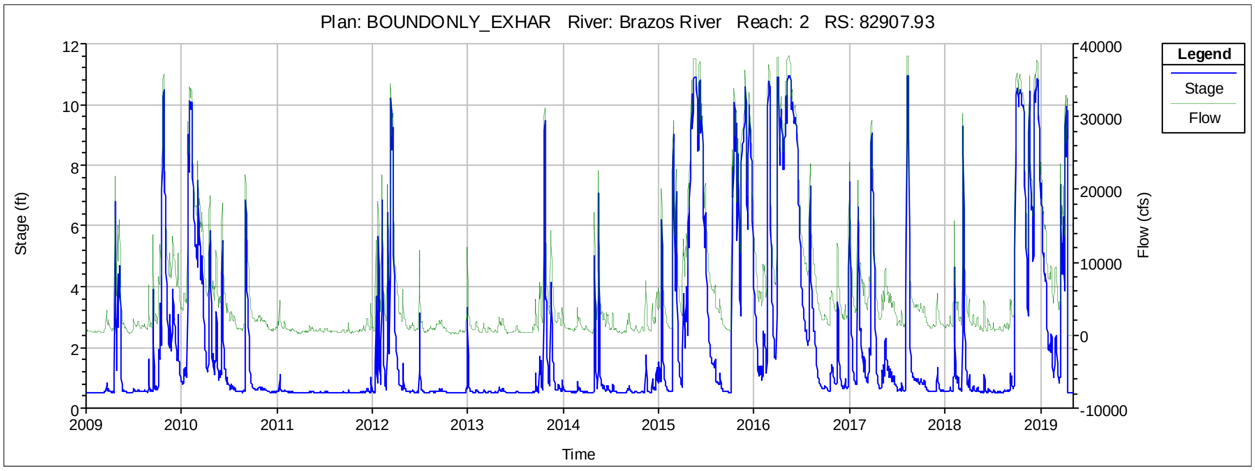


***Figure 69**: Existing stage and flow hydrographs upstream of FM-2004 over the 10.5-year simulation period.*

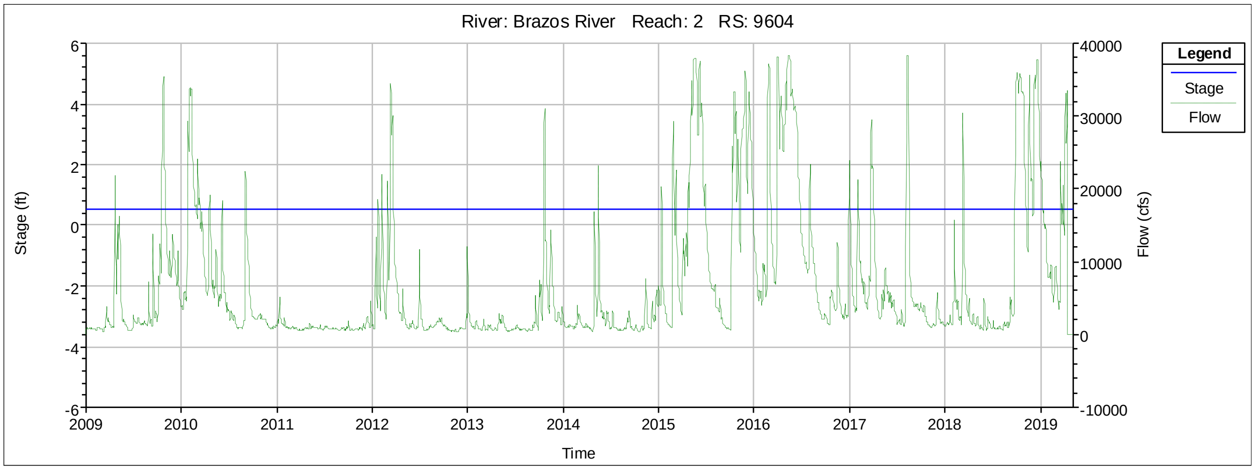


Figure 70: *Proposed stage and flow hydrographs at the last RAS cross-section approximately 9,604 ft from the Gulf of Mexico over the 10.5-year simulation period.*

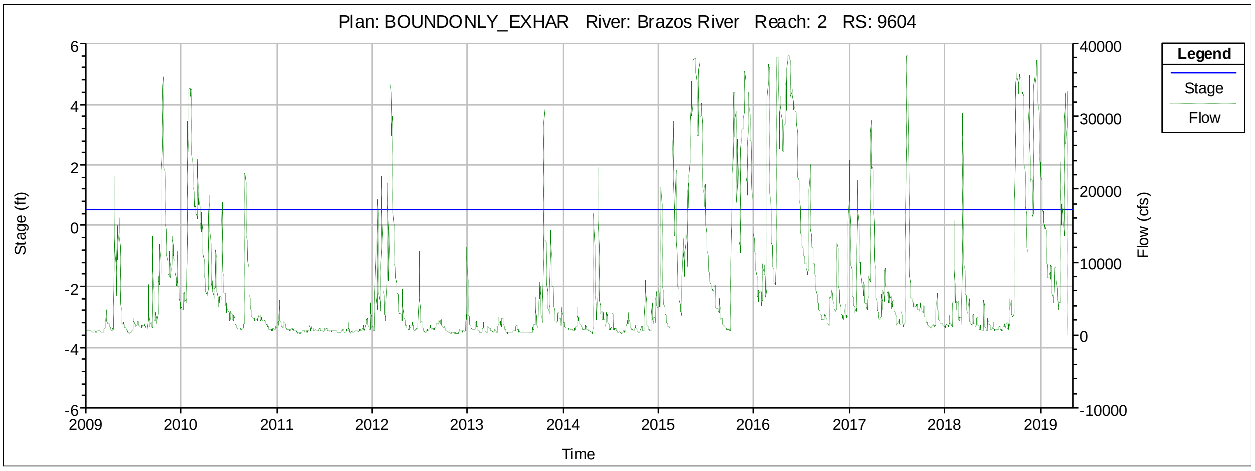


Figure 71*: Existing stage and flow hydrographs at the last RAS cross-section approximately 9,604 ft from the Gulf of Mexico over the 10.5-year simulation period.*

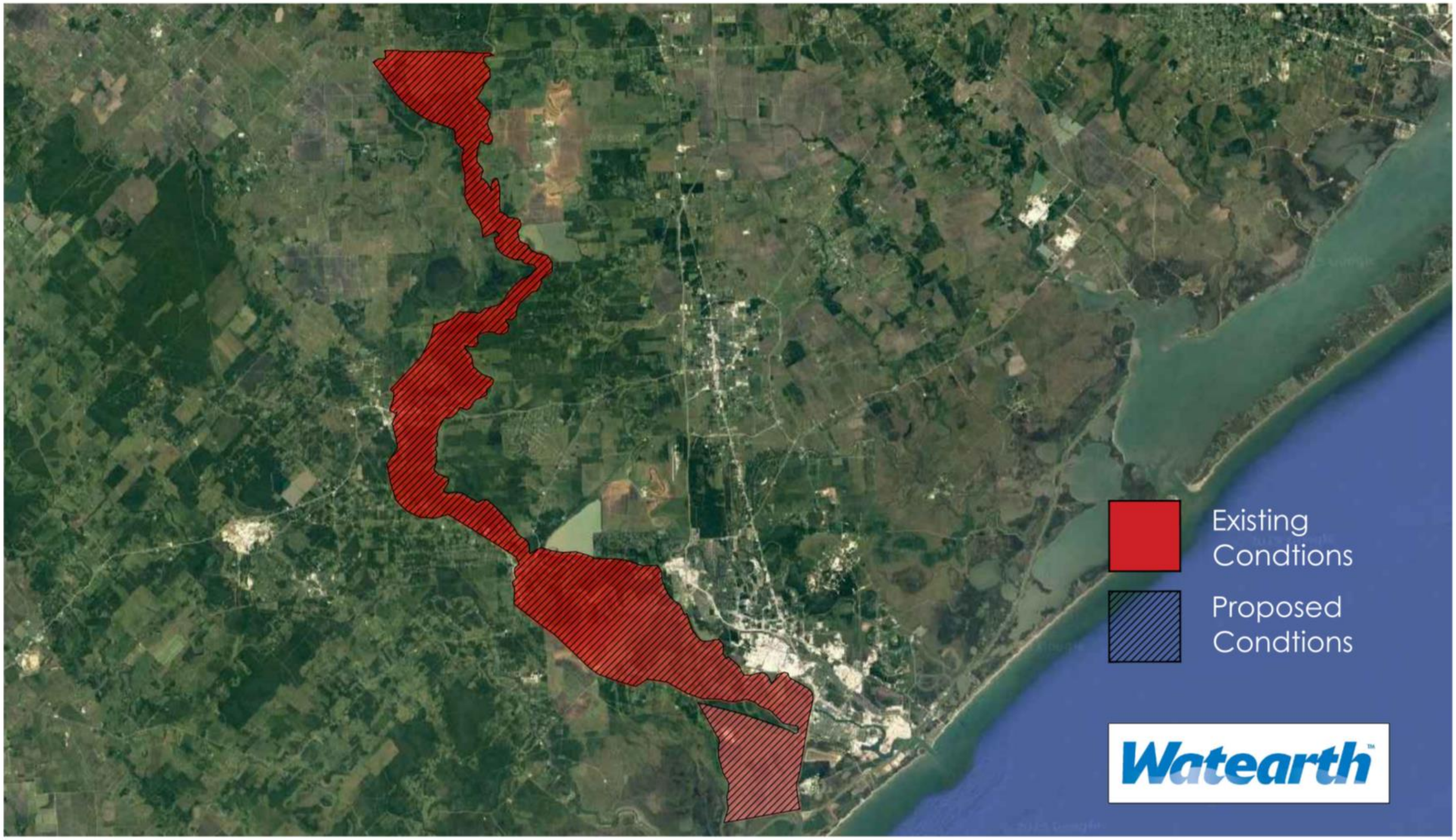


Figure 72: Maximum flood inundation results of both existing and proposed conditions over the 10.5-year simulation period.

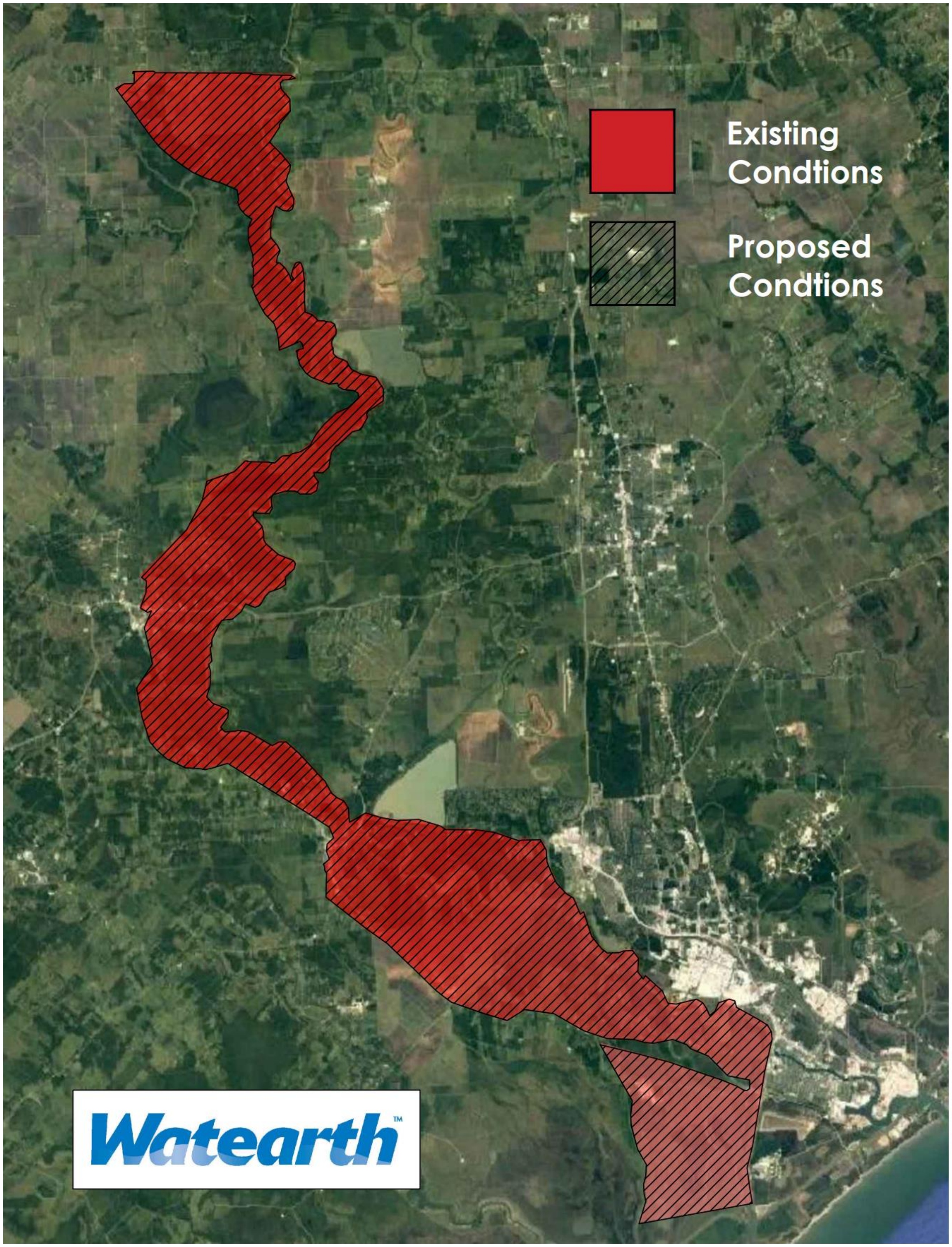


Figure 73: Close-up of proposed Harris Reservoir on maximum flood inundation results of existing and proposed conditions over the 10.5-year simulation period.

5.4.4 Oyster Creek Hydrology

The Oyster Creek watershed located adjacent to and east of the Brazos River watershed modeled in this study is depicted in **Figure 74**. Discharges from the existing Harris Reservoir and proposed Harris Reservoir enter Oyster Creek through a series of outfalls as discussed in **Section 5.4.5**. Discharges from both reservoirs enter Oyster Creek near the middle of the watershed or lower portion of the 133.3 sq-mi Middle Oyster Creek drainage area. The drainage area of the proposed Harris Reservoir is in the Brazos River watershed; however, as the proposed Harris Reservoir discharges into Oyster Creek, it was also modified and moved into the Oyster Creek watershed for the hydrologic and hydraulic models for Oyster Creek, which are explained in detail in the *Oyster Creek Downstream Hydrologic and Hydraulic Impacts Final Report (October 2021)*.

The Oyster Creek watershed near the project vicinity is generally flat and undeveloped and, similar to the Brazos River, is significantly affected by tidal influence and backwater. While an upstream hydrologic model of Oyster Creek was available, hydrologic models of the Oyster Creek watershed were not available for the project study area due to the undeveloped condition of this portion of the watershed.

The historical discharges from the existing Harris Reservoir and the future discharges from the proposed Harris Reservoir are illustrated in **Figure 28.** This level of increase in combined flows potentially could create downstream hydromodification issues on Oyster Creek. These potential impacts are explained in detail in the *Oyster Creek Downstream Hydrologic and Hydraulic Impacts Final Report (October 2021)*.

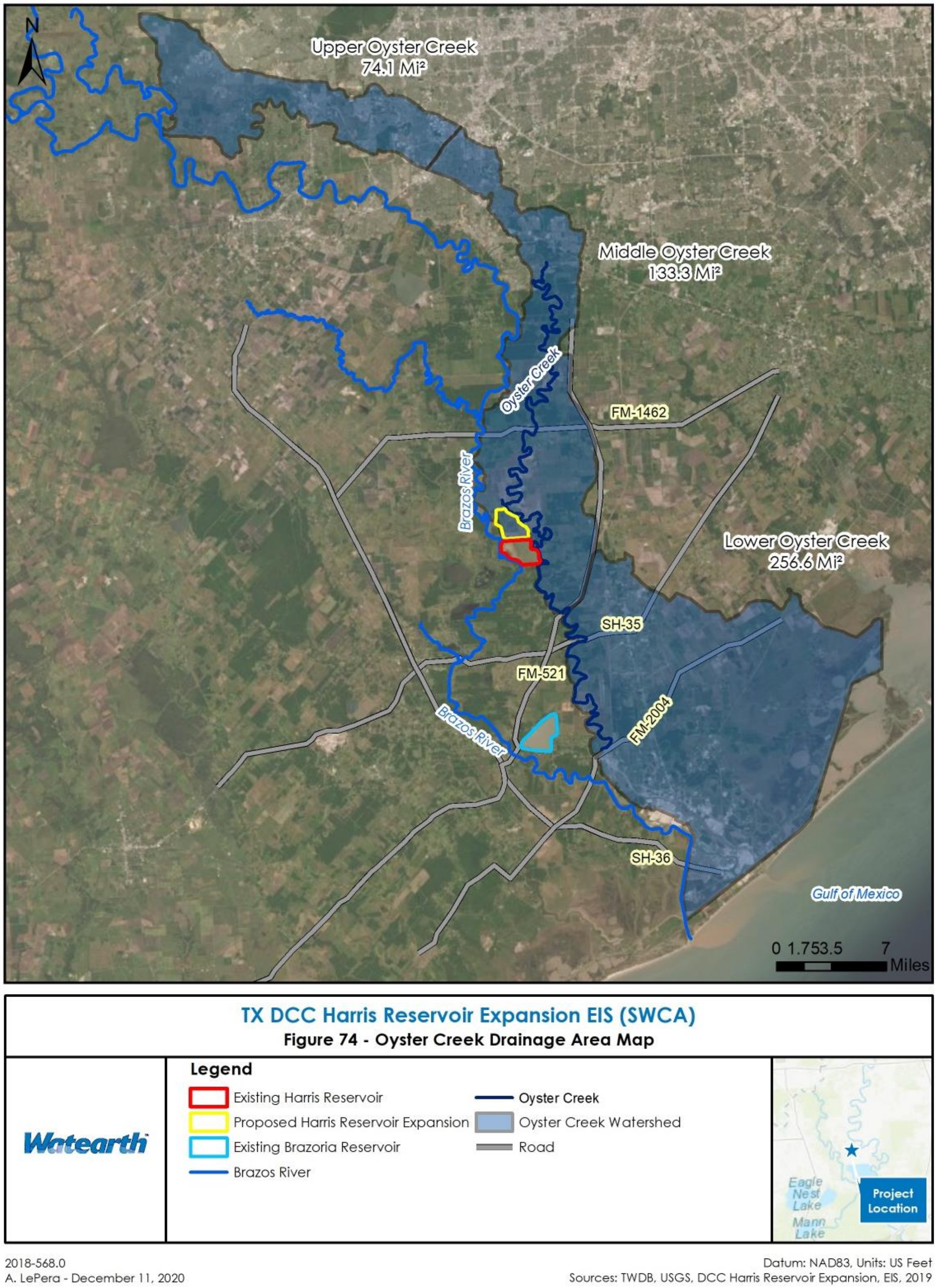


***Figure 74**: Oyster Creek drainage map for HEC-HMS.*

5.4.5 Oyster Creek Hydraulics

As part of the proposed expansion project, Oyster Creek will be enhanced with three projects to improve flood capacity and provide restoration and enrichment to the riparian habitat (**Figure 75**). Geomorphic design principles were used to provide bankfull benching creating floodplain storage, riparian habitat, and channel conveyance to accommodate the proposed Harris Reservoir outlet flow in to Oyster Creek.

A comparative analysis of the floodplain storage between existing and proposed conditions using the Brazos River HEC-RAS model is summarized in **Table 19A** and **Table19B**. A more detailed analysis of Oyster Creek hydraulics can be found in *Oyster Creek Downstream Hydrologic and Hydraulic Impacts Final Report (October 2021)*.

Table 19A: Comparison of Floodplain Storage Between Existing Conditions vs. Proposed Conditions

River Station	10-Year Flood			50-Year Flood		
	Existing (ac-ft)	Proposed (ac-ft)	Δ (ac-ft)	Existing (ac-ft)	Proposed (ac-ft)	Δ (ac-ft)
69.90	13,692	12,565	-1,127	75,207	74,682	-525
69.72	13,230	12,103	-1,127	73,160	72,635	-525
68.56	12,871	11,743	-1,127	70,772	70,247	-525
67.62	12,007	10,876	-1,131	67,643	67,118	-525
66.85	11,611	10,478	-1,133	65,990	65,465	-525
65.35	10,543	9,443	-1,100	59,684	59,199	-484
64.60	10,364	9,280	-1,084	58,377	57,910	-468
63.90	10,201	9,139	-1,061	57,149	56,697	-452
63.19	8,988	8,083	-905	51,336	50,958	-377
62.84	8,585	7,730	-855	49,463	49,115	-349
61.87	7,640	7,001	-640	43,753	43,542	-210
61.43	7,182	6,673	-508	41,539	41,384	-155
60.49	6,036	5,825	-211	36,715	36,694	-20
60.48	6,018	5,811	-207	36,627	36,608	-19
60.47	5,990	5,789	-201	36,483	36,472	-11
59.85	5,859	5,699	-160	35,694	35,731	37
59.17	4,960	5,022	62	31,066	31,349	283
58.67	4,407	4,583	176	28,497	28,944	447
56.05	3,249	3,518	269	22,931	23,458	527

River Station	10-Year Flood			50-Year Flood		
	Existing (ac-ft)	Proposed (ac-ft)	Δ (ac-ft)	Existing (ac-ft)	Proposed (ac-ft)	Δ (ac-ft)
55.60	2,649	2,757	108	19,917	20,185	268
55.30	2,395	2,442	47	18,619	18,813	194
53.49	846	847	0	10,629	10,638	9
53.48	825	825	0	10,494	10,497	3
53.47	822	821	0	10,465	10,464	-1
53.46	812	812	0	10,351	10,351	-1
52.75	232	232	0	4,149	4,149	0
50.30	0	0	0	0	0	0

Table 19B: Comparison of Floodplain Storage Between Existing Conditions vs. Proposed Conditions

River Station	100-Year Flood			500-Year Flood		
	Existing (ac-ft)	Proposed (ac-ft)	Δ (ac-ft)	Existing (ac-ft)	Proposed (ac-ft)	Δ (ac-ft)
69.90	103,892	102,865	-1,028	199,464	196,468	-2,996
69.72	100,529	99,502	-1,028	193,665	190,661	-3,004
68.56	96,664	95,637	-1,028	186,522	183,488	-3,034
67.62	92,522	91,494	-1,027	180,233	177,078	-3,145
66.85	90,347	89,320	-1,027	177,001	173,767	-3,235
65.35	81,616	80,589	-1,026	163,525	159,728	-3,797
64.60	79,782	78,756	-1,026	160,672	156,722	-3,950
63.90	78,106	77,081	-1,026	158,108	154,021	-4,087
63.19	70,410	69,387	-1,023	146,624	141,926	-4,698
62.84	67,926	66,903	-1,022	142,906	137,997	-4,909
61.87	60,216	59,239	-977	131,137	125,538	-5,598
61.43	57,298	56,337	-961	126,722	120,844	-5,878
60.49	51,054	50,173	-882	117,094	110,795	-6,299
60.48	50,939	50,059	-881	116,911	110,607	-6,304
60.47	50,749	49,879	-870	116,593	110,305	-6,287

River Station	100-Year Flood			500-Year Flood		
	Existing (ac-ft)	Proposed (ac-ft)	Δ (ac-ft)	Existing (ac-ft)	Proposed (ac-ft)	Δ (ac-ft)
59.85	49,690	48,867	-824	114,811	108,575	-6,236
59.17	43,547	42,891	-656	104,193	98,217	-5,976
58.67	39,996	93,489	-507	97,213	91,661	-5,552
56.05	31,937	31,736	-201	78,192	74,806	-3,386
55.60	27,689	27,443	-246	68,027	65,859	2,168
55.30	25,886	25,663	-223	63,777	62,135	-1,642
53.49	14,982	14,985	3	38,177	38,175	-1
53.48	14,794	14,797	3	37,724	37,722	-2
53.47	14,746	14,745	-1	37,563	37,556	-7
53.46	14,586	14,584	-1	37,143	37,136	-7
52.75	5,621	5,621	0	13,016	13,015	0
50.30	0	0	0	0	0	0

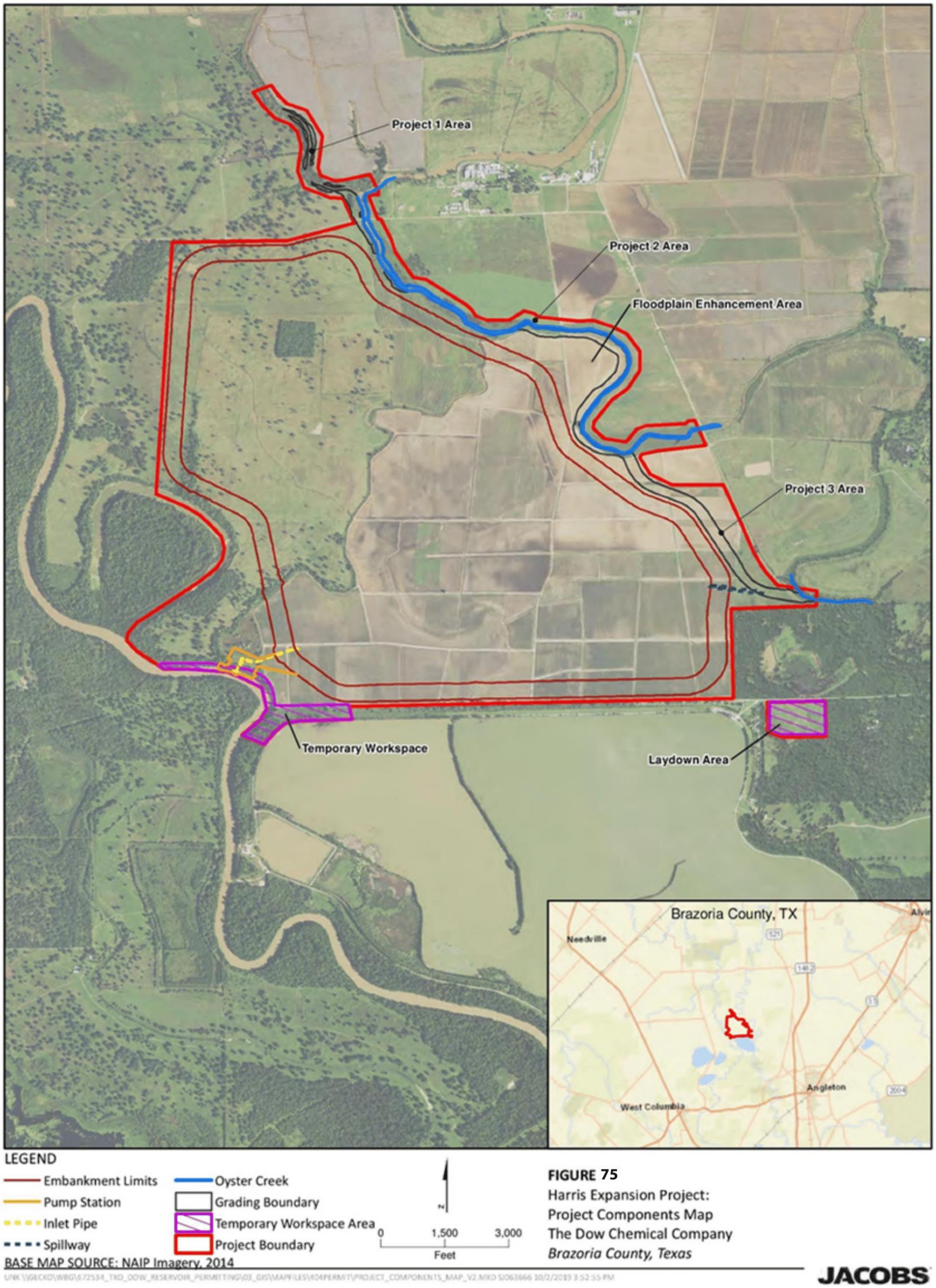


***Figure 75**: Oyster Creek floodplain enhancements.*

6.0 Analysis

This section is comprised of quantitative and qualitative analysis of the proposed project through the analysis horizon of 50 years (year 2072). The hydrologic, hydraulic, and reservoir operational models provide near-term analysis of water supply needs and instream flow alternations. Analysis to long-term changes in the project vicinity such as precipitation, temperature, and sea level rise are based on predictive models by agencies such as the USACE, NOAA, and USGS. The combination of these various analysis points is summarized in the Conclusions and Recommendations section, **Section 7**.

6.1 Evaporation Analysis

6.1.1 Introduction

The climatic process, where moisture is removed from any water surface and transported as vapor away from the source by wind, is called evaporation. Substantial amounts of water can evaporate from lakes, reservoirs, rivers, streams, bayous, and canals. During wet periods with normal to above normal rainfall, climatic effects minimize evaporation. On the other hand, in dry periods, evaporation rates are higher and the amount of evaporation loss becomes a very important element in a water supply analysis.

Evaporation rates in Texas vary during the year with approximately 86% of the evaporation occurring in the 6-month period from May through October, which corresponds to the lowest rainfall and full sun conditions (TWDB, 2018). Median gross evaporation for the project area is approximately 47.8 inches but can vary from 35 inches to 58 inches (**Figure 76**). The evaporation from the current and proposed storage reservoirs can present a substantial loss during a dry period.

6.1.2 Data Collection

The TWDB compiles water related data from a number of sources for water managers to estimate evaporation rates because evaporation is one of the largest sources of water loss from Texas reservoirs (TWDB, 2018). The data in this set are from nearly 4,000 gauging stations and includes precipitation data primarily collected from NOAA's National Weather Service (NWS). In addition, TWDB collects data from pan evaporation sites throughout Texas and from surrounding states from the NOAA-NWS sites, as well as other cooperators, which include lake owners and operators, government agencies, research institutions, and other public and private entities.

The proposed project generally falls within Quad 812 (**Figure 76**). Available data include monthly precipitation from January 1940 through December 2018 and gross evaporation from January 1954 through December 2018 (**Figure 77 and Figure 78**). The graph shows the trend is toward higher evaporation and precipitation rates; however, the evaporation rate has a steeper trend line than precipitation, which indicates a potential for the evaporation rate to exceed the precipitation rate within the project horizon.

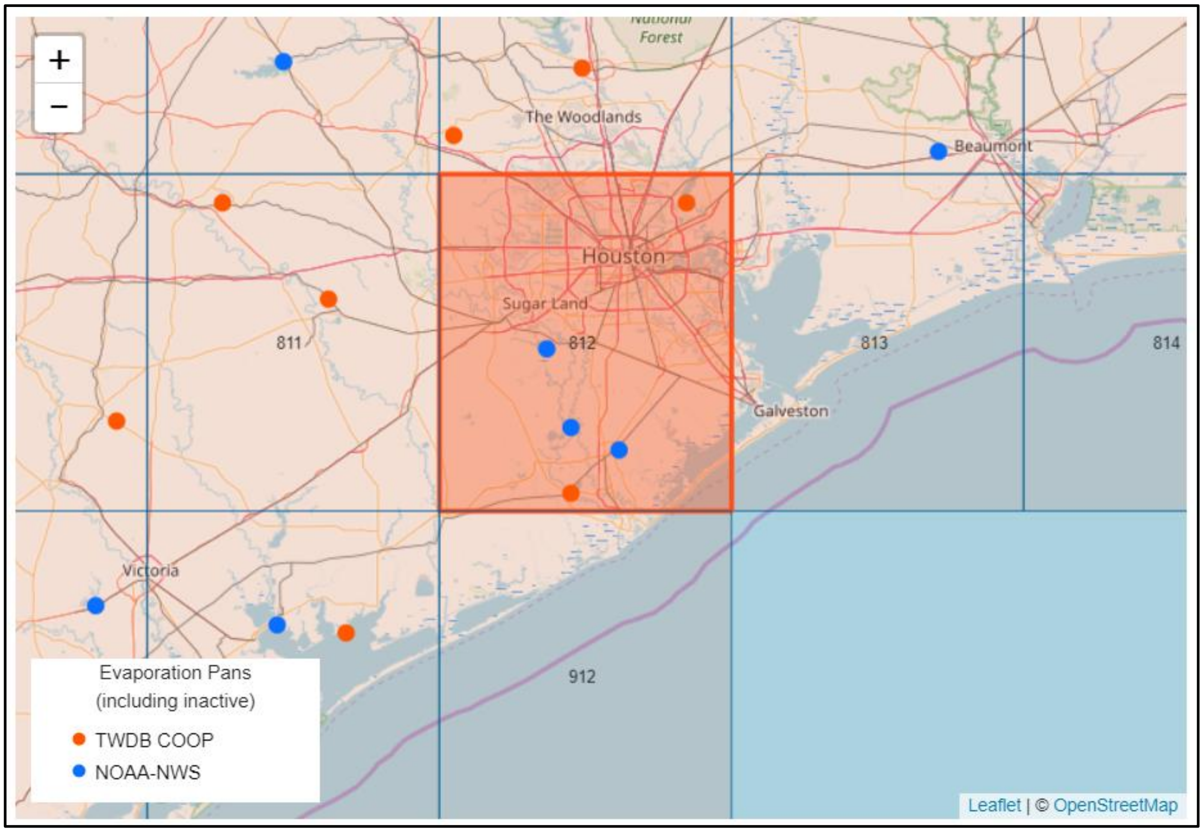


Figure 76: Quad 812 of the Texas Water Development Board water data.

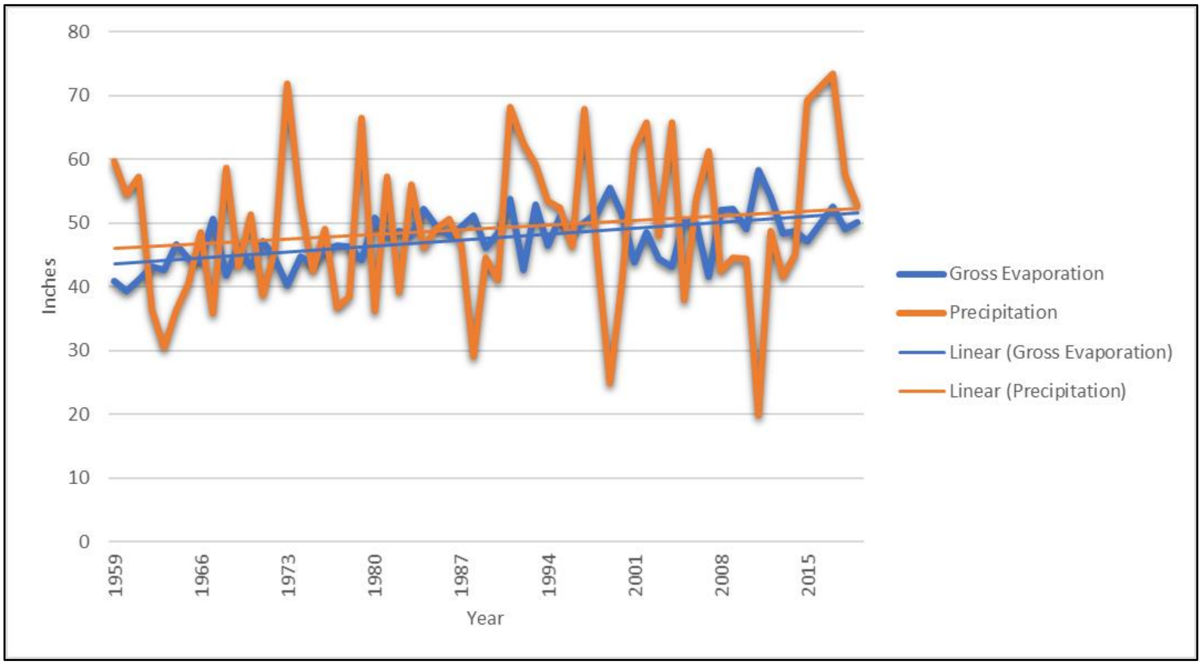


Figure 77: Quad 812 gross evaporation versus precipitation.

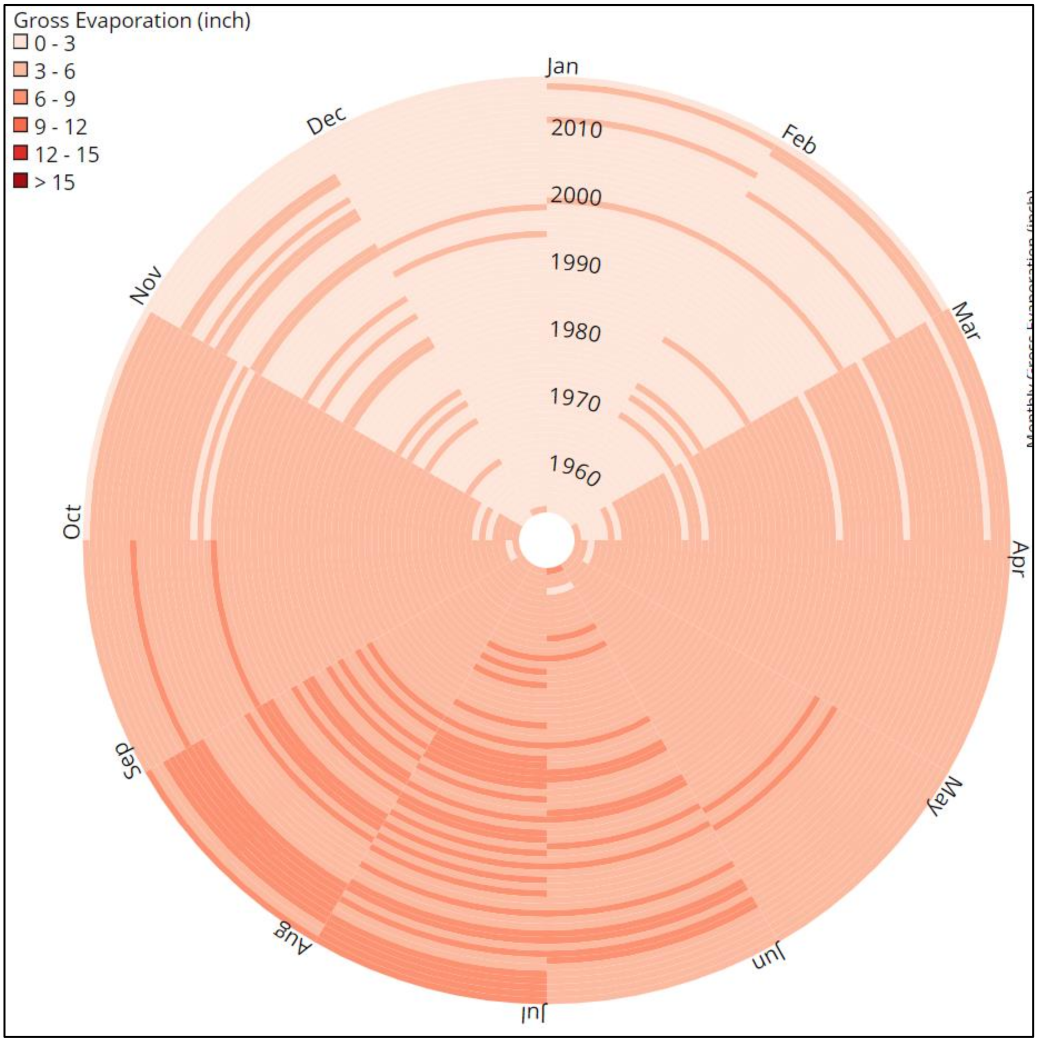


***Figure 78**: Annual gross evaporation wheel.*

The net evaporation (trend line), as depicted in **Figure 77**, is on average slightly higher than annual precipitation (approximately 1 inch more evaporation than rainfall) (TWDB, 2018). In addition, the high variability from month-to-month and year-to-year makes long-term planning more difficult. For example, the highest net evaporation occurred during August 2017, which corresponds with the majority of rainfall from Hurricane Harvey, when there was 33.5 inches of rain but only 5.3 inches of evaporation. In 1973, the yearly precipitation exceeded evaporation by 31.7 inches compared to 2011 when there was a net evaporation of 38.4 inches. In 1973, the Freeport, Texas, area experienced Tropical Storm Delia, which made landfall twice and dropped significant amounts of rainfall along the coastline during its erratic path in the Gulf of Mexico.

6.1.3 Analysis

Dow currently assumes an approximately 25% annual loss due to evaporation in the two-reservoir system. This may be underestimated as the current average annual rainfall for Freeport, Texas, is 52 inches; evaporation can vary from 35 inches to 58 inches, as described previously. During wet conditions, precipitation and high humidity retard evaporation. During drought conditions, evaporation rates increase and the lack of rainfall results in less natural makeup water. Evaporation rates are a function of surface area versus depth/volume, which results in shallow reservoirs with large surface area being more susceptible to evaporation during drought periods than deep reservoirs with small surface area with the same volume of water.

Dow's existing two-reservoir system is typical of Gulf Coast reservoirs that are relatively shallow compared to surface area. Evaporation rates during normal weather patterns (average annual rainfall and median gross pond evaporation) are almost equal to rainfall rates so there would be negligible water loss during normal years. This is due in part to the natural refill by rainfall capture directly into the reservoir. The normal weather evaporation rate would balance with precipitation for the existing conditions and under the proposed project conditions.

Under drought conditions (lower than normal rainfall), the reservoirs would experience maximum evaporation and there would potentially not be makeup water depending on river conditions and precipitation within the watershed. Assuming half the normal precipitation and maximum evaporation, annual net evaporation (NE=E-R) would be approximately 31 inches. The existing and proposed Harris Reservoirs surface area is approximately 5,500 ac. That could result in a loss of over 14,000 ac-ft during the most critical periods.

Under wet weather conditions (higher than normal rainfall), the reservoirs would capture precipitation, experience reduced evaporation, and Dow would refill the reservoirs from river pump stations. Capture would be limited to the total effective capacity of each of the reservoirs, as well as considerations as discussed in the following section, such as sediment loads in the river and wind restrictions for embankment protections.

6.2 Hydromodification of Oyster Creek

Oyster Creek historically had a greater drainage area but 63% of the drainage area was diverted by a canal at the Sienna Plantation in Missouri City, Texas, to the Brazos River (as measured at the downstream end of Project 2). The analysis of the stream system is also limited because there is a lack of availability of existing hydraulic models for the project reaches but the geomorphic assessment approach using Rosgen Level I, II, and III stream assessment used to classify the stream is a proven process to establish a stable channel for the long term.

There is a proposed water storage/floodplain overflow feature near the end of Project 2 and the start of Project 3, which is critical to the system. This storage/floodplain overflow allows large flows to bypass the oxbow in Oyster Creek and avoid increased velocities in Oyster Creek. Increased velocities could lead to increased erosion of the agricultural fields in the oxbow area. All features of this overflow must be maintained for the long-term viability of benefits created by the floodplain storage, riparian habitat, and channel conveyance. A maintenance plan should be developed and implemented by Dow for the project reaches.

The hydromodification impacts of the proposed Harris Reservoir on Oyster Creek has been examined in detail and can be found in *Oyster Creek Downstream Hydrologic and Hydraulic Impacts Final Report (October 2021)*.

6.3 Sedimentation Analysis for Reservoirs, Brazos River, and Oyster Creek

6.3.1 Existing Reservoirs and Brazos River

Sediment loads and corresponding impacts on existing reservoir effective storage volumes were discussed in **Section 3.5.2**.

Due to the relatively high sands and fine sediment loads in the Brazos River, storage volume loss due to sedimentation for the proposed project and the existing reservoirs could be a significant issue during the 50-year planning horizon and will likely result in less than the required 180-day reservoir storage. Current information does not indicate if there is an operational restriction on pumping high sediment load water from the Brazos River into any of the reservoirs. As previously discussed, it is recommended that Dow develop and implement an O&M plan to provide regular reservoir sediment removal to ensure maintenance of required storage capacity.

6.3.2 Proposed Project

The proposed project would be subject to the same sedimentation rates experienced by the existing Harris and Brazoria Reservoirs. Operational restrictions for pumping for high sediment load periods and regular removal of accumulated sediments on a regular basis are the most reasonable methods for maintaining authorized reservoir volumes. The O&M plan can be a condition of the permit. A BASINS/HSPF model was used to analyze the sediment transport in Oyster Creek as a result of the construction of proposed Harris Reservoir and can be found in *Oyster Creek Downstream Hydrologic and Hydraulic Impacts Final Report (October 2021)*.

6.3.3 Oyster Creek

Oyster Creek's natural flow has been significantly curtailed by a flood control project near Sienna Plantation, which has resulted in very low to no flow conditions throughout the project area. In addition, the channel is highly incised, which has disconnected the creek from its floodplain and may at least be in part a result of the flood control project and farming practices creating hydromodification and erosion.

To examine the hydromodification process in Oyster Creek, Better Assessment Science Integrating Point and Nonpoint sources (BASINS) model is used together with Hydrologic Simulation Program Fortran (HSPF). The methodology and results are described in detail in the *Oyster Creek Downstream Hydrology and Hydraulics Impacts Final Report*. The results of the BASINS/HSPF model shows an increase in the erosion within Oyster Creek downstream of the proposed Harris Reservoir outflow and a slight increase in velocity in the channel.

6.4 Watershed Vulnerability and Floodplain Storage

As discussed in **Section 5.4**, floodplain flow, velocity, and WSEL changes were analyzed for the Brazos River and storage effects on Oyster Creek for the proposed Harris Reservoir project. While Dow found there was no rise in either system directly downstream of the proposed project, Dow did not address the loss of Oyster Creek floodplain storage due to the proposed Harris Reservoir between the Brazos River and Oyster Creek.

The proposed Harris reservoir embankment will be built to elevation 72.7 ft from the existing 40 ft natural ground elevation. The natural ground east of the Brazos River and west of Oyster Creek is relatively flat, so current flood flows from the shared 100-year floodplain are stored and peak flows are attenuated downstream.

The proposed three-phased Oyster Creek enhancement project will improve flood storage capacity and provide restoration and enrichment to the riparian habitat. Nonetheless, as previously discussed, there will be a net 1,028 acre-ft (1%) loss in floodplain storage as a result of the proposed Harris reservoir embankment encroaching the Oyster Creek 100-year floodplain.

Table 20A and **Table 20B** show the Jacobs HEC-RAS 5.07 (OCNoRiseUpdateMay2020) existing and proposed Oyster Creek WSELs upstream of the proposed flood channel projects to downstream of the proposed Harris Reservoir. **Table 20A** shows the HEC-RAS generated WSEL comparisons between existing and proposed conditions for the Oyster Creek floodplain between FM-1462 (cross-section 69.90) and Harris Reservoir Road (cross-section 50.30) during the 10- and 50-year flood events; **Table 20B** shows the HEC-RAS generated WSEL comparisons between existing and proposed conditions for the Oyster Creek floodplain between FM-1462 (cross-section 69.90) and Harris Reservoir Road (cross-section 50.30) during the 100- and 500-year flood events.

Table 20A: Comparison of Water Surface Elevations Between Existing Conditions vs. Proposed Conditions for Oyster Creek

River Station	10-Year Flood			50-Year Flood		
	Existing (ft)	Proposed (ft)	Δ	Existing (ft)	Proposed (ft)	Δ
69.90	41.05	41.05	0.00	44.13	44.13	0.00
69.72	40.93	40.93	0.00	43.78	43.78	0.00
68.56	40.12	40.13	0.01	42.07	42.07	0.00
67.62	39.87	39.88	0.01	41.58	41.58	0.00
66.85	39.78	39.78	0.00	41.44	41.44	0.00
65.35	38.49	38.44	-0.05	40.50	40.52	0.02
64.60	38.15	38.06	-0.09	40.39	40.41	0.02
63.90	38.02	37.89	-0.13	40.33	40.36	0.03
63.19	37.82	37.64	-0.18	40.16	40.19	0.03
62.84	37.75	37.55	-0.20	40.09	40.12	0.03
61.87	37.44	37.07	-0.37	39.82	39.86	0.04
61.43	37.37	36.97	-0.40	39.70	39.75	0.05
60.49	37.21	36.72	-0.49	39.38	39.46	0.08
60.48	37.20	36.71	-0.49	39.37	39.45	0.08
60.47	37.17	36.69	-0.48	39.35	39.43	0.08
59.85	37.09	36.60	-0.49	39.26	39.34	0.08
59.17	36.63	36.17	-0.46	38.73	38.84	0.11
58.67	36.13	35.77	-0.36	38.22	38.34	0.12
56.05	33.53	33.39	-0.14	36.39	36.39	0.00
55.60	33.14	33.19	0.05	36.14	36.10	-0.04
55.30	33.06	33.13	0.07	36.09	36.04	-0.05
53.49	32.23	32.24	0.01	35.53	35.44	-0.09
53.48	32.16	32.17	0.01	35.51	35.42	-0.09

River Station	10-Year Flood			50-Year Flood		
	Existing (ft)	Proposed (ft)	Δ	Existing (ft)	Proposed (ft)	Δ
53.47	32.02	32.02	0.00	35.40	35.40	0.00
53.46	31.99	31.99	0.00	35.38	35.38	0.00
52.75	29.59	29.58	-0.01	34.50	34.50	0.00
50.30	24.65	24.65	0.00	34.24	34.24	0.00

Table 20B: Comparison of Water Surface Elevations Between Existing Conditions vs. Proposed Conditions for Oyster Creek

River Station	100-Year Flood			500-Year Flood		
	Existing (ft)	Proposed (ft)	Δ	Existing (ft)	Proposed (ft)	Δ
69.90	44.70	44.70	0.00	45.54	45.55	0.01
69.72	44.39	44.39	0.00	45.25	45.25	0.00
68.56	42.70	42.70	0.00	43.71	43.74	0.03
67.62	42.11	42.11	0.00	43.02	43.08	0.06
66.85	41.95	41.95	0.00	42.86	42.93	0.07
65.35	41.15	41.15	0.00	42.22	42.37	0.15
64.60	41.06	41.06	0.00	42.16	42.32	0.16
63.90	41.02	41.02	0.00	42.13	42.29	0.16
63.19	40.85	40.85	0.00	41.99	42.17	0.18
62.84	40.78	40.78	0.00	41.94	42.13	0.19
61.87	40.54	40.54	0.00	41.76	41.97	0.21
61.43	40.41	40.41	0.00	41.65	41.88	0.23
60.49	40.07	40.07	0.00	41.38	41.64	0.26
60.48	40.06	40.06	0.00	41.37	41.63	0.26
60.47	40.05	40.04	-0.01	41.36	41.62	0.26
59.85	39.96	39.96	0.00	41.30	41.57	0.27
59.17	39.45	39.44	-0.01	41.00	41.27	0.27
58.67	38.95	38.94	-0.01	40.76	41.02	0.26
56.05	37.21	37.21	0.00	40.12	40.22	0.10
55.60	36.93	36.93	0.00	39.96	40.00	0.04

River Station	100-Year Flood			500-Year Flood		
	Existing (ft)	Proposed (ft)	Δ	Existing (ft)	Proposed (ft)	Δ
55.30	36.86	36.86	0.00	39.91	39.94	0.03
53.49	36.23	36.23	0.00	39.38	39.38	0.00
53.48	36.21	36.20	-0.01	39.36	39.36	0.00
53.47	36.13	36.13	0.00	39.34	39.34	0.00
53.46	36.12	36.12	0.00	39.33	39.33	0.00
52.75	35.29	35.29	0.00	38.81	38.81	0.00
50.30	35.05	35.05	0.00	38.69	38.69	0.00

6.4.1 Floodplain Storage Volume Loss Analysis

Per Watearth's analysis on January 23, 2020, titled *Preliminary Hydrology and Hydraulics Report DCC Harris Reservoir Expansion EIS (January, 2020)* the volume of storage above natural ground eliminated by the originally proposed Harris Reservoir across the shared Brazos River and Oyster Creek 100-year floodplain and the proposed Oyster Creek stream restoration and overflow channel results in 1,028 ac-ft (1%) loss of floodplain storage. This loss of flood plain storage volume could lead to increased peak flows downstream of the project.

The loss of this floodplain storage may change the timing of flood flows arriving downstream and increase WSELs. Additional analysis of downstream impacts to Oyster Creek are explained in detail in the *Oyster Creek Downstream Hydrologic and Hydraulics Impacts Final Report*.

6.5 Relative Sea Level Rise Analysis

An increase in the sea level water surface has the same effect as the saltwater wedge moving upstream during a drought that is discussed in next section. As the sea level rises, the river flow will have to be greater that the current 1,750 cfs now required to allow Dow to pump the fresh water from the river into Brazoria Reservoir at the maximum pump capacity. The sea level rise also requires a greater river flow than currently required at the existing Harris Reservoir and the proposed Harris Reservoir. This could greatly limit the availability of Dow to get fresh water with its water rights.

6.6 Salinity Analysis

6.6.1 Introduction

Dow's Brazoria Reservoir intake pumps (River Mile 25) cannot be operated when the chloride concentration in the Brazos River water reaches or exceeds 500 mg/l. The interface between the fresh river water and the saltwater is referred to as the saltwater wedge and denotes the extent of the Brazos River estuary, which ranges between River Miles 15 and 43 and potentially up to River Mile 49 depending on river flow and tides. Dow reported efforts to correlate river flows at the USGS Rosharon gage with location of the salt wedge, which determines if withdrawals are restricted at the Brazoria Reservoir. They found when river flows are greater than 1,700 cfs at the USGS Rosharon gage, the salt wedge is downstream of the Brazoria Reservoirs pumps and there are no restrictions to filling the reservoir. River flow between 1,700 cfs to 600 cfs at Rosharon gage may allow limited pumping at the Brazoria Reservoir intake. Below 600 cfs, the intakes cannot be used at all because of the saltwater wedge.

Dow's existing Harris Reservoir intake pumps (River Mile 46) can be impacted by the salt wedge, which can extend up to River Mile 49. Dow found it can operate the existing Harris Reservoir intake pumps at full capacity (approximately 290 cfs) as long as there is 400 cfs river flow at the Rosharon gage.

6.6.2 Saltwater Discharges

The inter-coastal barge canal crosses the Brazos River approximately 1.4 miles upstream of the current mouth of the river. The inter-coastal barge canal introduces saltwater into the Brazos River at that location. Intermittent discharge of brine into the Brazos River from the Strategic Oil Reserve occurs at a location that is approximately 2.7 miles upstream of the mouth of the Brazos River. Multiple discharges, containing elevated salts or seawater, are discharged to the Brazos River in an area are that is approximately 7 to 8 miles upstream of the mouth of the Brazos River. These discharge flows include the following:

1. Discharge from the Dow plant: A stormwater/wastewater canal at a location that is 7 miles upstream of the mouth of the Brazos River
2. A Dow chemical discharge of approximately 40 MGD (61.7 cfs) of 7% to 8% total dissolved solids wastewater at a location 8 miles upstream of the mouth of the Brazos River
3. Discharge of approximately 400,000 (888.9 cfs) to 500,000 (1,111.1 cfs) gpm of seawater used for one pass cooling at a location 8 miles upstream of the mouth of the Brazos River.

Compared to the discharge of the Brazos River, 20,055 cfs as shown in **Figure 6** and with tidal flows, the above process water discharges are unlikely to materially impact the location of the salt wedge. The above volumes may contribute to increasing the localized salinity but are not likely to materially impact the location of the salt wedge.

6.6.3 RSLR Salinity Analysis

The rising relative sea level is likely to result in long-term viability of the proposed project due to low lying topography of the Gulf Coast. Due to variability of climate models, (see **Figure 8** and **Figure 9**), the relative sea level is expected to rise from 1 to 3 feet over the next 50 years. Although storm events are anticipated to be more frequent and higher intensity, anticipated annual precipitation levels are expected to decline (see **Figure 4**). Natural stream flows could decrease and result in the regular position of the leading edge of the estuary being farther upstream compared to today.

6.7 Storm Surge Analysis

An increase in the local water surface and tide levels from tropical storms and hurricanes, referred to as storm surge, can have the same effect as the saltwater wedge moving upstream during a drought. Due to the estuary and associated salt wedge potentially reaching up to River Mile 48, these storms could result in reduced water quality that exceeds the 500 mg/l of salts that Dow determined is in excess of the allowable for pumping into the plant near Freeport, as well as pumping makeup water into the existing Brazoria and Harris Reservoirs and the proposed project.

A recent example is when the Hurricane Harvey storm surge caused the water and tide levels along most of the Texas Coast to rise. The highest storm tides were observed at the Aransas National Wildlife Refuge, where the storm surge levels were more than 12 feet above ground level. Storm surge in Port Lavaca was more than 10 feet. Elsewhere across southern Texas, storm tide levels ranged from near 3 to 6 feet above ground level at Seadrift, Port O'Connor, Holiday Beach, Copano Bay, Port Aransas, and Bob Hall Pier (National Weather Service 2017).

Although storm surge may impede Dow's ability to pump during the storm event, these storms are usually short and Dow should be able to start using its river water rights again as the storm surge recedes.

7.0 Conclusions and Recommendations

The purpose of the proposed Harris Reservoir project is to provide 180 days of water storage for drought conditions as recommended by TCEQ guidelines. The 2020 survey (by Doyle and Wachtstetter) estimated the existing Harris and Brazoria Reservoirs has 27,343 ac-ft acre feet of storage. The proposed Harris Reservoir would provide 50,968 ac-ft of storage, resulting in a combined effective capacity of 78,311 ac-ft and 180 days of storage. The potential impact of the proposed Harris Reservoir on Oyster Creek is examined using a long-term, 180-day, BASINS model. The results of this BASINS model is used to determine potential impacts on the biological resources of Oyster Creek. The details of the BASINS modeling methodology and results, together with the aquatic assessment report, are found in the *Oyster Creek Downstream Hydrologic and Hydraulic Impacts Final Report (October 2021)*.

The following conclusions and recommendations for the Brazos River are presented below.

Conclusions

1. **Discharge Rates**: This analysis assumes 100,000 gpm (222.8 cfs) reservoir discharge rates. If Dow does increase its discharges to 175,000 gpm (389.9 cfs), which is possible if Dow exercises its full water right, the water storage would be insufficient to meet the 180 days of water storage.

   A change in withdrawal rate from Brazos River to 175,000 gpm, except possibly at the lowest of river flows during drought, would not be anticipated to cause a change to the river due to the large natural flows through the project vicinity. The proposed project shifts the current discharge rate into Oyster Creek upstream of the adjacent existing Harris Reservoir and there will be additional discharges from the proposed Harris Reservoir. The potential impact from the increased discharges into Oyster Creek for 180 days of dry conditions is modeled using EPA BASINS model and the results are analyzed in the *Oyster Creek Downstream Hydrologic and Hydraulic Impacts Final Report (October 2021)* BASINS model results indicate that Oyster Creek will be more susceptible to hydromodification and erosion with increased discharges from the proposed Harris Reservoir.

2. **Modeling Results and Assumptions**: Based on the unsteady one-dimensional HEC-RAS hydraulic model described in Section 5.4.3, the addition of the proposed Harris Reservoir does not result in any changes in flow, velocities, and WSELs in the Brazos River downstream of the Rosharon gage despite increased diversions at peak river flows to maintain the additional storage associated with the proposed Harris Reservoir. The results from the unsteady one-dimensional hydraulic model presented in Section 5.4.3.5 exhibit no significant changes in diversions into or discharges out of the Brazoria Reservoir into the Brazos River. Similarly, modeling assumptions and results described in Sections 5.3 and 6.4 for the unsteady one-dimensional HEC-RAS model show no significant changes in diversions into or discharges out of the existing Harris Reservoir into Oyster Creek.

3. **Proposed Diversion**: The proposed diversion into the proposed Harris Reservoir and associated discharge into Oyster Creek significantly increase peak flows. The most significant increase occurs when both the existing and the proposed Harris Reservoirs discharge at the same time. The discharge out of the existing and proposed Harris Reservoirs into Oyster Creek increase from an existing maximum of 278 cfs to a maximum of 1,256 cfs.

4. **Stream Restoration**: Under the proposed project, Dow will conduct stream restoration of Oyster Creek on two segments upstream of the proposed Harris Reservoir plus an overflow channel to receive the discharge. The improvements will increase flood storage capacity and riparian habitat.
5. **Floodplain Storage**: Oyster Creek floodplain storage will decrease by a net 1,028 acre-feet (1%) for the 100-year event as a result of the proposed Harris Reservoir berm and Oyster Creek channel improvements. To counter the loss of floodplain storage, Dow plans to operate the reservoir to drawdown the proposed Harris Reservoir prior to 50-year and 100-year storm events and tropical storms and hold the rainfall falling on the proposed Harris Reservoir and any initial diverted flows from the Brazos River as floodplain storage prior to discharge. In the *Oyster Creek Downstream Hydrologic and Hydraulic Impacts Final Report*, a detailed analysis of this operational measure is included. For a 100-year design storm, with 18 inches of drawdown before a 100-year storm event, the proposed Harris Reservoir will store 807 ac-ft for 6 inches of depth, 1,309 ac-ft of gain for 9 inches of depth and a gain 0f 1,632 ac-ft for 12 inches of depth. Using 18 inches of drawdown before a 100-year storm event and storing various depths within the proposed Harris Reservoir before releasing flows into Oyster Creek results in a net loss of 221 ac-ft floodplain storage for 6 inches of storage depth while gaining a net floodplain storage of 281 ac-ft for 9 inches of storage depth and 604 ac-ft of floodplain storage for 12 inches of storage depth. The details of this analysis are in the *Oyster Creek Downstream Hydrologic and Hydraulic Impacts Final Report (October 2021)*.
6. **Interbasin Flows**: Due to the flat nature of their watersheds, a significant amount of water transfers between the Brazos River and Oyster Creek. These interbasin flows are modeled into Oyster Creek HEC-HMS model as sources and sinks. The proposed Harris Reservoir blocks some of the interbasin flows into Oyster Creek so that they enter Oyster Creek downstream of the proposed Harris Reservoir, increasing the magnitude and timing of peaks. The details of this modeling and its results are included in the *Oyster Creek Downstream Hydrologic and Hydraulic Impacts Final Report (October 2021)*.
7. **Aquatic Impacts on Oyster Creek**: A long-term, 180 days, BASINS/HSPF model is simulated for four separate constant discharge values from the proposed Harris Reservoir to examine the impacts of the proposed Harris Reservoir on Oyster Creek. The details of this model and analysis are included in the *Oyster Creek Downstream Hydrologic and Hydraulic Impacts Final Report (October 2021)*. The BASINS/HSPF model results indicate an increase in velocity and erosion in Oyster Creek downstream of the proposed Harris Reservoir, as well as a decrease in water temperatures.

   The increase in velocity could affect populations of fish that prefer stagnant or slow-moving water. In addition, the increase of velocity could cause increased sedimentation and turbidity downstream, as well as erosion and scour along the banks of Oyster Creek. The outflows from the proposed Harris Reservoir will cause an increase in sedimentation and turbidity in Oyster Creek downstream of the proposed Harris Reservoir due to increased erosion and scour. This increase in sedimentation could cause water quality issues and decrease clarity downstream. The sediment increases could potentially clog fish gills, bury eggs, cover food sources, kill off vegetation, and shade out the sun needed for aquatic life.

   The decrease in temperature could affect vegetative growth, decrease spawning and reproduction of some fish species, cause die-off of fish species, or cause species to move to other warmer waters. The decrease in temperature could cause extended overwintering for benthic species and could slow down reproduction. A detailed analysis of the aquatic impact of the proposed Harris Reservoir on the Oyster Creek is included in the *Oyster Creek Downstream Hydrologic and Hydraulic Impacts Final Report (October 2021)*.

Recommendations

1. **Additional Maintenance Measures**: Dow should consider additional measures to ensure maintenance of the 180-day storage recommendation by TCEQ.
    a. Develop and adopt an O&M plan for regular maintenance dredging of existing reservoirs and the proposed Harris Reservoir.
    b. Consider contract storage in an upstream reservoir.
    c. Consider plant water re-use through treatment systems such as reverse osmosis. However, note that these systems tend to have a high energy requirement.
2. **Discharge Optional Plan**: Sustained discharge from the proposed Harris Reservoir will likely result in significant downstream erosion of Oyster Creek. To address this concern, a discharge operation plan is recommended for the new reservoir.
    a. Erosion control is recommended at the inlet and outlet to the stream restoration section, especially for the Project 3 overflow segment.
    b. Additional stream restoration and erosion reduction measures on Oyster Creek downstream of the point of discharge are recommended based on the assumed increase in flows and velocities resulting from loss of floodplain storage.
    c. Repeated filling and draining to create wet then dry conditions over the short term can result in hydromodification to the reservoirs and the receiving waters, which is specifically a concern for Oyster Creek due to the low natural flow. The repeated wet/dry conditions can break down the soil structure and lead to erosion. Oyster Creek between the proposed project discharge point and the existing Harris Reservoir discharge point are at highest near-term risk due to the changed conditions. Accordingly, regular inspections should be performed along this section of Oyster Creek to address potential erosion.
3. **Letter of Map Revision**: Dow should note that FEMA may require a Letter of Map Revision due to the changes in the Oyster Creek floodplain from the restoration project. This determination would be made by the local Flood Plain Administrator.
4. **Operation and Maintenance Plan.** A comprehensive O&M plan should be developed that encompasses the water storage reservoirs and water delivery to Dow.

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Appendix A

Brazos River HEC-HMS Model

APPENDIX C

Oyster Creek Downstream Hydrologic and Hydraulic Impacts Final Report

Note: The Section 508 amendment of the Rehabilitation Act of 1973 requires that the information in federal documents be accessible to individuals with disabilities. The U.S. Army Corps of Engineers (Corps) has made every effort to ensure that the information in this appendix is accessible. However, this appendix is not fully compliant with Section 508, and readers with disabilities are encouraged to contact Mr. Jayson Hudson at the Corps at (409) 766-3108 or at SWG201601027@usace.army.mil if they would like access to the information.

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Oyster Creek Downstream Hydrologic and Hydraulic Impacts Final Report

DCC Harris Reservoir Expansion EIS

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ES-1.0 Executive Summary

The purpose of this technical report is to supplement Watearth, Inc.'s (Watearth's) *Preliminary Hydrology and Hydraulics Report for the DCC Harris Reservoir Expansion Environmental Impact Statement (EIS)* dated August 2021 (Watearth, Inc., 2021). The report details cited and referenced are the most recent information concerning the proposed Harris Reservoir expansion concerning the proposed Harris Reservoir expansion and the impacts to Oyster Creek. This report supplants all previous reports concerning Oyster Creek.

Specifically, this memorandum addresses hydrologic and hydraulic downstream impacts at a planning-level review for the proposed Harris Reservoir expansion as identified in the report in Section 6.2 *Hydromodification of Oyster Creek* and Section 6.4 *Watershed Vulnerability and Floodplain Storage*. This technical report provides a summary of the environmental setting, existing conditions, and proposed project conditions necessary for the planning-level analysis conducted in support of the EIS for Oyster Creek while further details for the entire project area and detailed models for Brazos River are described in the *Preliminary Hydrology and Hydraulics Report* for the DCC Harris Reservoir Expansion EIS (Watearth, Inc., 2020).

ES-1.1 Project Setting

The proposed project is located in south central Texas on the Gulf Coastal Plain near the town of Rosharon, Texas. The general climate for the project area includes high potential rainfall events from tropical storms and hurricanes with long periods of drought (Watearth, Inc., 2020). Future rainfall is predicted to trend toward lower rainfall levels and higher temperatures. Sea level is expected to rise by 1 to 2 feet in the next 50 years, which will tend to push the estuary farther upstream (referred to as the salt wedge). In addition, the storm surge could reach farther upstream from current conditions.

ES-1.2 Proposed Project

Dow Chemical (Dow) currently operates two reservoirs: Harris Reservoir, located at Brazos River Mile 46 with reported effective summer storage capacity of 9,135.5 acre-feet (ac-ft), and Brazoria Reservoir, located at Brazos River Mile 25 with reported effective summer storage capacity of 18,207.2 ac-ft, to provide potable water to the Dow Chemical plant and other users. Dow has reported periodic but not regularly scheduled maintenance dredging on the existing reservoirs, which has resulted in loss of storage by up to half of the original design volume. Storage will continue to be lost or water will be blocked from getting to the lowest outlet elevations, which can reduce the available water storage further.

During drought conditions, Dow estimates that the two-reservoir system provides 68 days or less of necessary water supplies. The Texas Commission on Environmental Quality (TCEQ) identified facilities with less than 180 days of water storage as being at risk during droughts. Dow's purpose and need statement identifies the minimum of 180 days of water storage as a primary project feature and justification.

The proposed project, called the Harris Reservoir Expansion project in the Clean Water Act Section 404 permit application, includes a 50,968 ac-ft reservoir adjacent and upstream of the existing Harris Reservoir. The proposed Harris Reservoir lies between the Brazos River and Oyster Creek on their shared floodplain. The hydromodification of Oyster Creek is displayed in **Figure 1**. The proposed Harris Reservoir discharges to a constructed overflow and conveyance channel, referred to as Project 3. In addition, Dow proposes to conduct stream restoration projects adjacent to the proposed Harris Reservoir, referred to as Projects 1 and 2.

ES-1.3 Summary of Modeling and Analysis

Modeling of Oyster Creek includes Hydrologic Engineering Center-Hydrologic Modeling System (HEC-HMS) for hydrology and Hydraulic Engineering Center-River Analysis System (HEC-RAS) for hydrologic flow routing (Modified Puls Method) to determine peak flows downstream of the proposed Harris Reservoir. The HEC-HMS hydrology model computes peak flows. The HEC-RAS steady state model (Watearth model) routes the peak flows determined by the HEC-HMS model through the reaches set in the hydrologic model. The upstream boundary includes the entire Oyster Creek watershed (headwaters), and the downstream boundary is the inlet to Lake Jackson. Overflow hydrographs from the Lower Brazos Flood Protection Planning Study were used in the HEC-HMS modeling of Oyster Creek because the Flood Insurance Study (FIS) for Brazoria County, Texas, (revised December 2020) and the Lower Brazos Flood Protection Planning Study (March 2019) demonstrated that interbasin flows are occurring between the Brazos River and Oyster Creek watersheds and should be represented in the current hydrologic model.

The Brazos/Oyster interbasin flows are represented in the HEC-HMS model as sources and sinks. The sources are considered positive inflows entering Oyster Creek and the sinks are considered negative outflows leaving Oyster Creek, which return to the Brazos River. After a thorough review of the Lower Brazos Flood Protection Planning Study, the flow hydrographs were adjusted to generate peak flow results at the same nodes/river mile stations similar to the Brazoria County FIS study. The lateral structure hydrographs from the Lower Brazos Flood Protection Planning Study were used to represent the interbasin flows; however the flow hydrographs were decreased by 75% to 80% to better match the results found in the Brazoria County FIS study.

The lateral structure hydrographs from the Lower Brazos Flood Protection Planning Study HEC-RAS model were entered at the centroid of the lateral structure weir length and transferred across to Oyster Creek. This method was used to place the interbasin flow sources and sinks into the appropriate locations in the HEC-HMS node diagram.

The proposed Harris Reservoir and the existing Harris Reservoir were both modeled as detention basins with inflows from the Brazos River pump stations. Small sub-basins were included for each reservoir, which represent the drainage area associated with rainfall occurring over the reservoirs. Current elevation-storage data and operational data for the proposed Harris Reservoir and the other reservoirs in the system were used in the HMS reservoir model. The 50-year and 100-year, 24-hour design storm events were modeled for both the existing and the proposed conditions. Several proposed conditions scenarios were modeled to simulate proposed Harris Reservoir operations before a tropical storm or extreme rainfall event. For the proposed condition models, 18 inches of pre-release design storm drawdown coupled with 6 inches, then 9 inches, and lastly 12 inches of floodplain storage was modeled along with a no-drawdown scenario. The post-project HEC-HMS hydrologic modeling consists of a total of four proposed conditions scenarios for each design storm event.

The construction of the proposed Harris Reservoir would affect the flow path of interbasin flows occurring in the area north of the existing Harris Reservoir where the proposed reservoir is located. There are several differences between the existing and proposed conditions HEC-HMS models. The existing conditions model only has the existing Harris Reservoir modeled while the proposed conditions model has both the existing and proposed Harris Reservoir modeled. The existing conditions model has additional sources and sinks added to represent interbasin flow where the proposed reservoir is located. The proposed conditions HEC-HMS model has a few interbasin flows that have been shifted downstream due to blocked flows from the proposed reservoir's embankment and were added to a downstream node below the existing Harris Reservoir.

The proposed conditions HEC-RAS geometry includes the stream restoration projects (revised Projects 1, 2, and 3 revised in May 2020) and the floodplain storage volume displacement by the proposed Harris Reservoir. The HEC-RAS hydraulic model calculates the 50- and 100-year design storage/discharge relationship for the reaches within the project area sub-basins. The upstream boundary starts near the town of Otey, Texas, (approximately 3,500 feet [(ft] downstream of Otey), and the downstream boundary ends approximately 1,000 ft downstream of the Lake Jackson inlet to allow the model to equalize. The HEC-RAS model includes the proposed stream restoration projects and the floodplain storage volume displacement by the proposed Harris Reservoir. The HEC-HMS model provides the peak flows to be hydraulically routed in the HEC-RAS model. The HEC-RAS model returns the amount of storage in a reach for the HEC-HMS calculated flowrate. The HEC-RAS model provides the storage/discharge parameters to conduct the Modified Puls hydrologic routing in HEC-HMS. Once the peak flows are within a 5% difference between what is entered in HEC-RAS and calculated in HEC-HMS, the peak flows determined in HEC-HMS are accurate for the storage/discharge capacity of the modeled reaches.

The Modified Puls Reservoir Routing Method was used as the hydrologic routing method for critical downstream reaches in HEC-HMS and is a commonly used method for flat watersheds within the Gulf Coast of Texas.

Hydrologic Simulation Program Fortran (HSPF) was used to examine the effects of the proposed reservoir during drought conditions. HSPF is a plug-in program within the U.S. Environmental Protection Agency's (EPA) BASINS (Better Assessment Science Integrating Point and Nonpoint Sources) model. BASINS is a multipurpose environmental analysis system developed by the EPA to assist in watershed management. A geographic information system (GIS) provides the integrating framework for BASINS by allowing users to efficiently access national environmental information. The BASINS model provides a core framework with various EPA- and third-party–supported model plug-ins. HSPF is an EPA-supported watershed model for estimating in stream concentrations of point and nonpoint sources.

Land use and meteorological data were accessed through BASINS framework, and HSPF has the capability to calculate sediment transport in overland runoff and streams, as well as water temperature in the streams based on heat exchange equations. By using BASINS and HSPF, Watearth was able to analyze the effects of the proposed Harris Reservoir under drought conditions and compare the results to the existing conditions.

ES-1.4 Analysis of Potential Impacts

The drainage area for the Oyster Creek watershed upstream of the proposed Harris Reservoir is 80.53 square miles (sq-mi), with a peak flow of 25,602 cubic feet per second (cfs) and a runoff volume of 544,834 ac-ft at Junction O-6 for the 100-year design storm event, this includes four interbasin flow locations upstream of the proposed Harris Reservoir.

As identified in Watearth's *Preliminary Hydrology and Hydraulics Report for the DCC Harris Reservoir Expansion EIS* (2020), the proposed project results in a floodplain storage loss. Under the originally submitted application, this was 309 ac-ft, but the revised stream restoration and improvements, provided in May 2020 (by Jacobs), result in a 1,028 ac-ft floodplain storage loss.

The 1,028 ac-ft floodplain storage loss is less than 1% of the volume of flow for the watershed above the proposed project.

Review of the flood peak flow hydrographs show the peak flows in the hydrologic model (HEC-HMS) for Oyster Creek are driven by a combination of the watershed runoff and the Brazos River interbasin flows.

The HEC-HMS model results for both 50- and 100- year 24-hour design storm events show two peak flow events. A smaller magnitude peak flow associated with the design storm rainfall (peak one) and a larger peak flow associated with the arrival of the interbasin flows to Oyster Creek (peak two). Model results point to an increase in the peak flows associated with the arrival of interbasin flows from Brazos River into Oyster Creek for the proposed conditions. This increase is especially pronounced in the locations just downstream of the proposed Harris Reservoir.

The increases in the peak flows of the proposed conditions hydrograph show the potential for erosion and hydromodification during larger events. While there are increases to peak flows downstream of the proposed Harris Reservoir during both the 50-year and 100-year, 24-hour design storm events, models for lesser storms do not contain interbasin flows and thus do not have peak flow increases. The 10-year storm event generally remains within the banks of Oyster Creek.

Both HEC-RAS and HEC-HMS models analyzed conditions during design storm events. To examine the impacts of the proposed Harris Reservoir on Oyster Creek during dry conditions, a BASINS/HSPF model was used. Four different constant outflows from the proposed Harris Reservoir into Oyster Creek during 180 days of drought conditions (spring and summer months) are modeled and compared to existing conditions. Using the HSPF model, the average velocity in Oyster Creek, sediment transport, and heat exchange between Oyster Creek and the atmosphere are modeled. Based on the HSPF model results, the velocity in Oyster Creek increases as the outflows from the proposed Harris Reservoir increases. The average velocity in Oyster Creek increases about 30% for the highest modeled outflow from the proposed Harris Reservoir, which is 334 cfs. For the environmental flows (Scenario Four, 22 cfs constant outflow), the increase in average velocity is 1.75%.

There is a very slight increase in shear velocity and bed shear stress in Oyster Creek with an increase in outflows from the proposed Harris Reservoir. The increase in velocity, shear velocity, and bed shear stress causes increased scouring in Oyster Creek, which results in higher erosion and sediment discharge downstream of the proposed Harris Reservoir. With more erosion and scouring, more sediment discharges from Oyster Creek downstream of the proposed Harris Reservoir. The outflow of sediment causes a decrease in total suspended sediment concentration in Oyster Creek immediately downstream of the proposed Harris Reservoir. The average total suspended sediment concentration decreases around 10% as the eroded sediments are transported farther downstream with increased velocities in Oyster Creek.

HSPF model results also indicate a decrease in water temperatures as more outflow from the proposed Harris Reservoir enters Oyster Creek. The HSPF model is run through spring and summer months to represent dry conditions. The water temperature is between 55 and 78 degrees Fahrenheit for existing conditions. However, with outflows from the proposed Harris Reservoir, the range of water temperature decreases to 41 to 62 degrees Fahrenheit for the highest outflow (334 cfs). Oyster Creek usually has low flows, based on U.S. Geological Survey (USGS) Gage 0807900 Oyster Creek Discharge Gage near Angleton, Texas. A baseflow of 2 cfs flows in the model for dry conditions. When the proposed Harris Reservoir discharges 334 cfs (in the highest discharge scenario), there is a significant increase in the amount of water in Oyster Creek. The heat exchange equation used in the HSPF model uses a simple heat balance between atmosphere and water. As the water volume increases, the time for all the volume of water to warm up to the atmospheric temperature also increases, causing a drop in water temperature.

The BASINS/HSPF model results, transect data for Oyster Creek collected in May and June of 2021, and the following reports have been evaluated to analyze the potential impacts of the proposed Harris Reservoir on the aquatic life in Oyster Creek:

1. Fisheries Use Attainability Study for Oyster Creek (Segment 1110). Written by Gordon W. Linam and Leroy J. Kleinsasser. July 1987.
2. Macroinvertebrate Assessment of Allens Creek and the Brazos River, Austin County, Texas. Written by Charles R. Wood, Thomas L. Arsuffi, and M. Katherine Cauble. Data collection in 1993. December 1994.
3. Fish Assemblage Changes in Three Western Gulf Slope Drainages. Written by Dr. Timothy Bonner and Dennis T. Runyan. July 2007.
4. Stream Condition Assessment Report for the Dow Harris Reservoir Expansion Project in Brazoria County, Texas. Written by SWCA Environmental Consultants. November 2019.

A detailed aquatic assessment of Oyster Creek was prepared by SWCA Environmental Consultants and is attached here to as Appendix A. Effects to aquatic species including fish and macroinvertebrates are discussed in that report..

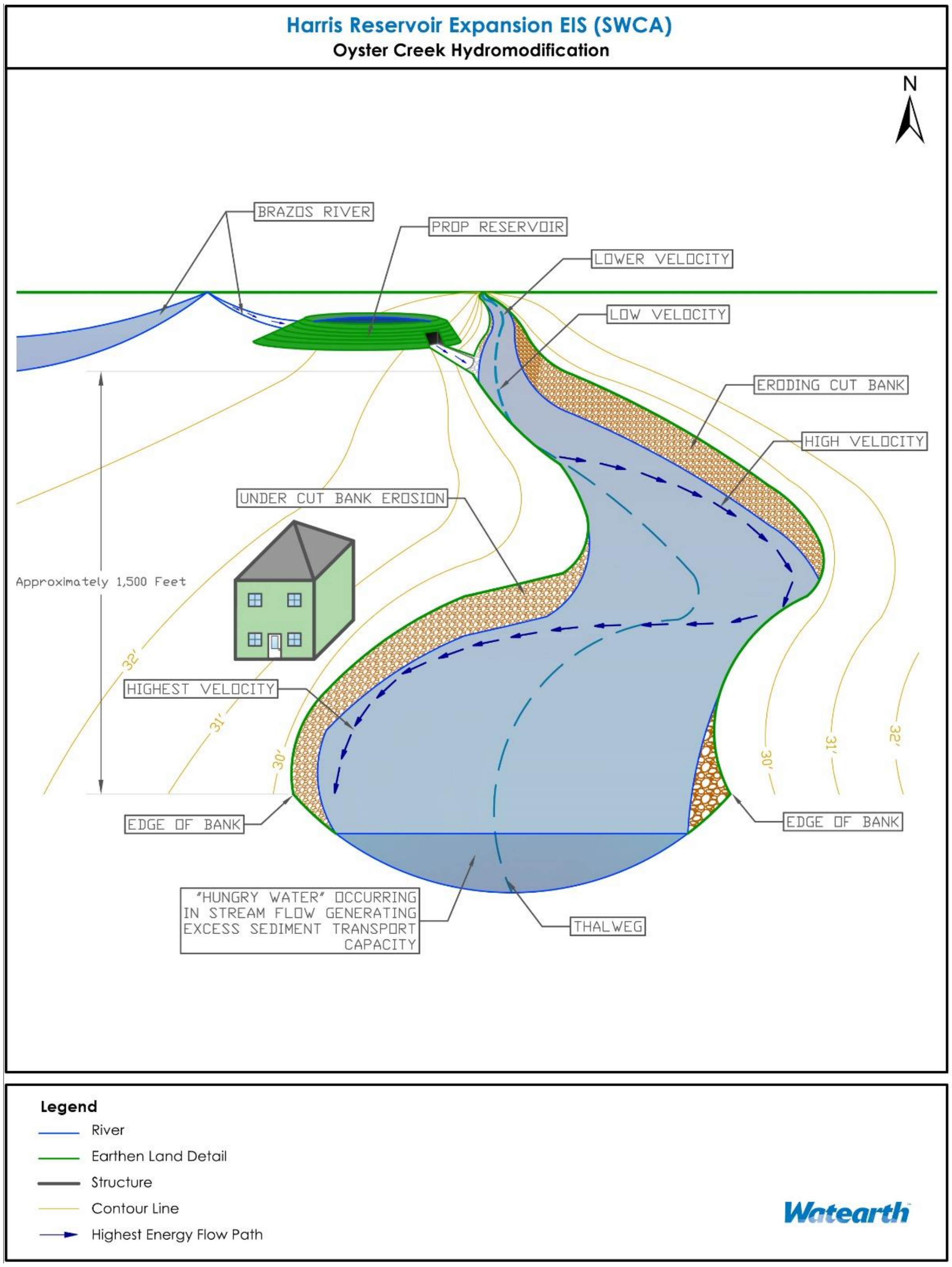

Figure 1: *Example of hydromodification occurring in Oyster Creek.*

ES-1.5 Conclusions

The purpose of this report was to identify if there were potential impacts to Oyster Creek downstream of the proposed Harris Reservoir. The analysis includes planning-level modeling and literature research to establish likely downstream impacts as a result of the project, specifically if there are impacts resulting from the loss of floodplain storage due to the proposed construction of a 2,000-acre (ac) reservoir in the shared Oyster Creek and Brazos River floodplain at the project site in conjunction with the proposed stream restoration (Projects 1 and 2) and overflow/conveyance channel (Project 3). Under the original in-stream design, there was an estimated 309 ac-ft loss of floodplain storage. Under the revised in-stream design, there was an estimated 1,028 ac-ft loss of floodplain storage.

In order to address the 1,028 ac-ft loss of floodplain storage, the proposed Harris Reservoir would be operated to counter the effects due to the loss of floodplain storage.

Several operational scenarios are modeled to analyze the possible floodplain gain or loss through operational measures. The scenarios modeled using a combination of HEC-HMS and HEC-RAS are as follows:

1. Existing conditions for 50-year, 24-hour design storm (no proposed Harris Reservoir expansion).
2. Proposed conditions and no drawdown prior to a storm event for 50-year, 24-hour design storm event.
3. Proposed conditions, 18 inches drawdown prior to a storm event, and holding 6 inches of floodplain storage in the reservoir before spillway discharge for 50-year, 24-hour design storm event.
4. Proposed conditions, 18 inches drawdown prior to a storm event, and holding 9 inches of floodplain storage in the reservoir before spillway discharge for 50-year 24-hour design storm event.
5. Proposed conditions, 18 inches drawdown prior to a storm event, and holding 12 inches of floodplain storage in the reservoir before spillway discharge for 50-year, 24-hour design storm event.
6. Existing conditions for 100-year, 24-hour design storm (no proposed Harris Reservoir expansion).
7. Proposed conditions and no drawdown prior to a storm event for 100-year, 24-hour design storm event.
8. Proposed conditions, 18 inches drawdown prior to a storm event, and holding 6 inches of floodplain storage in the reservoir before spillway discharge for 100-year, 24-hour design storm event.
9. Proposed conditions, 18 inches drawdown prior to a storm event, and holding 9 inches of floodplain storage in the reservoir before spillway discharge for 100-year, 24-hour design storm event.
10. Proposed conditions, 18 inches drawdown prior to a storm event, and holding 12 inches of floodplain storage in the reservoir before spillway discharge for 100-year, 24-hour design storm event.

These scenarios are depicted in **Figure 2**. **Table 1** shows a summary of model results for floodplain storage gain and loss.

Table 1: Operational Plan Scenarios to Offset Floodplain Storage Loss

	Loss of Floodplain Storage	50-Year Design Storm				100-Year Design Storm			
		Floodplain Storage (ac-ft)							
		Proposed No Drawdown	Proposed 18" Drawdown and 6" Floodplain Storage	Proposed 18" Drawdown and 9" Floodplain Storage	Proposed 18" Drawdown and 12" Floodplain Storage	Proposed No Drawdown	Proposed 18" Drawdown and 6" Floodplain Storage	Proposed 18" Drawdown and 9" Floodplain Storage	Proposed 18" Drawdown and 12" Floodplain Storage
50-year	-525	-525	+993	+1,371	+1,715	N/A	N/A	N/A	N/A
100-year	-1,028	N/A	N/A	N/A	N/A	-1,028	+807	+1,309	+1,632
Total		-525	+468	+846	+1,190	-1,028	-221	+281	+604

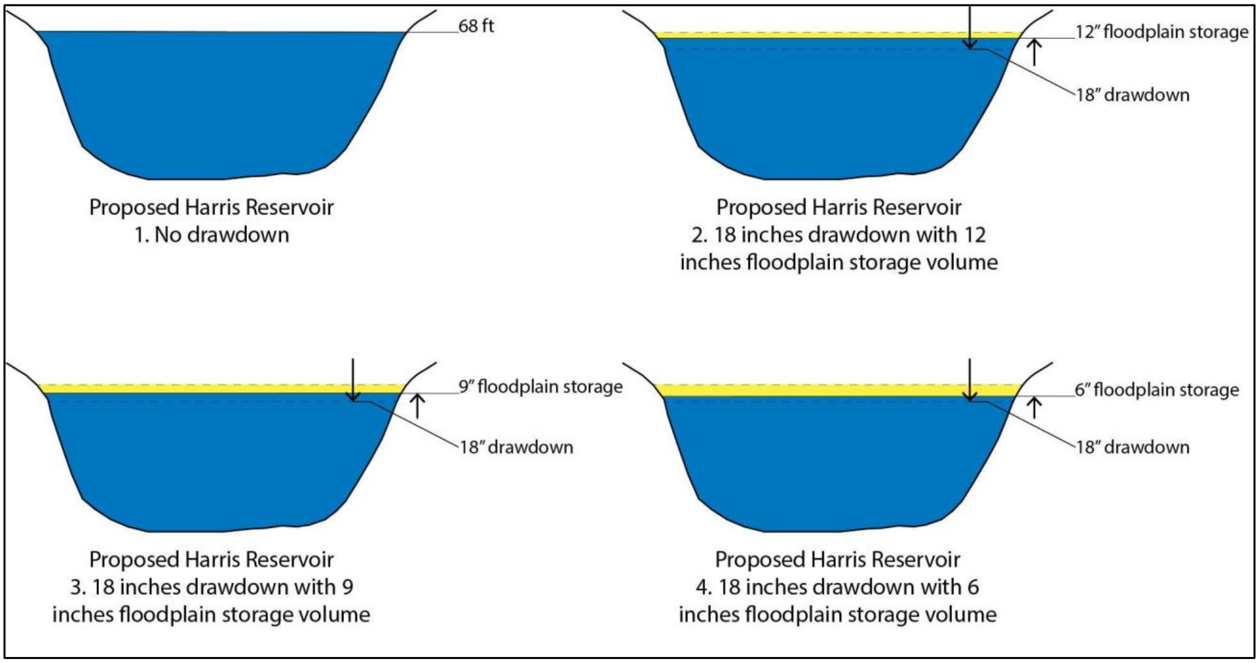

Figure 2: Operational measures for floodplain storage gain.

The hydrologic and hydraulic model results also indicate a peak flow increase downstream of the proposed Harris Reservoir due to interbasin flows occurring between the Brazos River and Oyster Creek during 50- and 100-year design storms. The proposed Harris Reservoir blocks some of the interbasin flows into Oyster Creek, which causes the interbasin flows to enter Oyster Creek downstream of the proposed Harris Reservoir.

The HSPF model, which was applied to examine the impact of the proposed Harris Reservoir during long-term drought conditions, produced results indicating an increase in average channel velocity, shear velocity, and bed shear stress in Oyster Creek. These increases cause erosion, scouring, and an increase in sediment outflow downstream of the proposed Harris Reservoir.

HSPF model results also indicate a decrease in water temperatures as more outflow from the proposed Harris Reservoir enters Oyster Creek during spring and summer months simulation. The average water temperature decreases from 78 degrees Fahrenheit to 62 degrees Fahrenheit on the warmest end for the highest outflow (334 cfs). More water takes longer to warm, which might have an adverse effect on temperature-sensitive aquatic life.

The results of the models demonstrate that the higher flows in conjunction with the low-sediment reservoir discharge is highly likely to result in erosion downstream of the proposed Harris Reservoir. As stated above, the peak flows and water surface elevation (WSEL) increase; this is due to the large, flat nature of the Oyster Creek watershed. The increase in flows along with loss of sediment is likely to increase Oyster Creek erosion if operations and maintenance (O&M) of the three-reservoir water supply system does not follow a well-reasoned and updated O&M Plan.

The erosion and scour will increase the concentration of suspended sediments in Oyster Creek downstream of the proposed Harris Reservoir. The average velocity in Oyster Creek will also increase slightly. Model results indicate a decrease in water temperatures with outflows from the proposed Harris Reservoir into Oyster Creek, as well. These changes in velocity, temperature, sediment concentration, and scour will also have aquatic impacts, which are explained in more detail in the aquatic assessment in **Appendix A**.

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Acronyms and Abbreviations

Acronym/Abbreviation	Full Form
ac	acre
ac-ft	acre feet
ACE	Annual Chance Exceedance
BASINS	Better Assessment Science Integrating Point and Nonpoint Sources
BRA	Brazos River Authority
CF3R	Comprehensive Flood Risk Resources and Response
cfs	cubic feet per second
DEM	Digital Elevation Model
Dow	Dow Chemical
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FIS	Flood Insurance Study
FM	Farm to Market
ft	feet
GIS	geographic information system
H&H	hydrology and hydraulics
HEC-HMS	Hydraulic Engineering Center – Hydrologic Modeling System
HEC-RAS	Hydraulic Engineering Center – River Analysis System
HSPF	Hydraulic Engineering Center – River Analysis System
LBFPPS	Lower Brazos Flood Protection Planning Study
NHD	National Hydrography Dataset

NLCD	National Land Cover Database
NLDAS	North American Land Data Assimilation System
O&M	Operations and maintenance
sq-mi	square mile
TC	time of concentration
TCEQ	Texas Commission on Environmental Quality
TSARP	Tropical Storm Allison Recovery Project
TWDB	Texas Water Development Board
USACE	U.S. Army Corps of Engineers
USBR	U.S. Bureau of Reclamation
USGS	U.S. Geological Survey
WSEL	water surface elevation

Appendices

1.0 Project Setting

The general climate for the project area includes high potential rainfall events from tropical storms and hurricanes with long periods of drought (Watearth, Inc., 2020). Future rainfall is predicted to trend toward lower rainfall levels and higher temperatures. Sea level is expected to rise by 1 to 2 ft in the next 50 years, which will tend to push the estuary farther upstream (referred to as the salt wedge). Storm surge could reach farther upstream from current conditions.

Dow currently operates two reservoirs: Harris Reservoir, located at Brazos River Mile 46 with reported effective storage capacity of 9,135.5 ac-ft, and Brazoria Reservoir, located at Brazos River Mile 25 with reported effective storage capacity of 18,207 ac-ft, to provide portable water to the Dow Chemical plant and other users. Dow has reported periodic but not regularly scheduled maintenance dredging on the existing reservoirs, which has resulted in loss of storage by up to half of the original design volume. Storage will continue to be lost or water will be blocked from getting to the lowest outlet elevations, which can reduce the available water storage further.

During drought conditions, Dow estimates that the two-reservoir system provides 68 days or less of necessary water supplies. TCEQ has identified facilities with less than 180 days of water storage as being at risk during droughts.

2.0 Proposed Project

The analysis in this report focuses on Oyster Creek modifications as fully described in (Watearth, Inc., 2020) Section 4.2. As part of the proposed Harris Reservoir expansion project, three projects are planned to enhance Oyster Creek. These projects are planned to improve the flood capacity and provide restoration and enrichment to the riparian habitat along the three project lengths. Geomorphic design principles were used to provide a bankfull benching creating floodplain storage, riparian habitat, and channel conveyance to accommodate the proposed Harris Reservoir outlet flow into Oyster Creek. For this analysis, the proposed project elements analyzed are described in detail below:

1. Proposed project (Harris Reservoir expansion) embankment, which restricts flows into the existing shared 100-year floodplain for Oyster Creek and the Brazos River (**Figure 3**).
2. Project 1 is approximately 3,600 ft long from STA 5+00 to STA 41+00 on an unnamed tributary north of the proposed project's northeast corner **Figure 3**. It flows into Oyster Creek a short distance north of the northeast corner, which is the start of Project 2.
3. Project 2 is approximately 12,860 ft long from STA 41+00 to STA 169+60 and is in the main channel of Oyster Creek running mostly parallel to the proposed Harris Reservoir embankment on the northeast side. Oyster Creek then turns east and enters an oxbow, which is approximately 15,550 ft long (almost 3 miles).
4. Project 3 is an improved flood overflow channel that flows along the east side of the proposed Harris Reservoir until the overflow channel intersects again at approximate STA 254+00 with the main Oyster Creek channel and the proposed Harris Reservoir outlet channel. It starts as Oyster Creek enters the oxbow. This project allows water flow greater than the 25-year storm to bypass the oxbow and flow along the east side of the proposed Harris Reservoir until the overflow channel intersects again with the main Oyster Creek channel and the proposed Harris Reservoir outlet channel.

   The overflow weir will take runoff discharge greater than the 25-year runoff discharge and allow the difference between the 25-year and the 100-year runoff discharge to flow a shorter distance of approximately 8,440 ft until it rejoins the main channel. This could affect the time to peak water surface elevation downstream; the loss of floodplain storage in the oxbow could affect the amount of water downstream at that peak water surface elevation. **Figure 4** shows a typical cross-section of the Project 1 and 2 stream restorations to recreate the multiple-level channel morphology. Additional details on Project 3 are explained in **Section 3.1**.

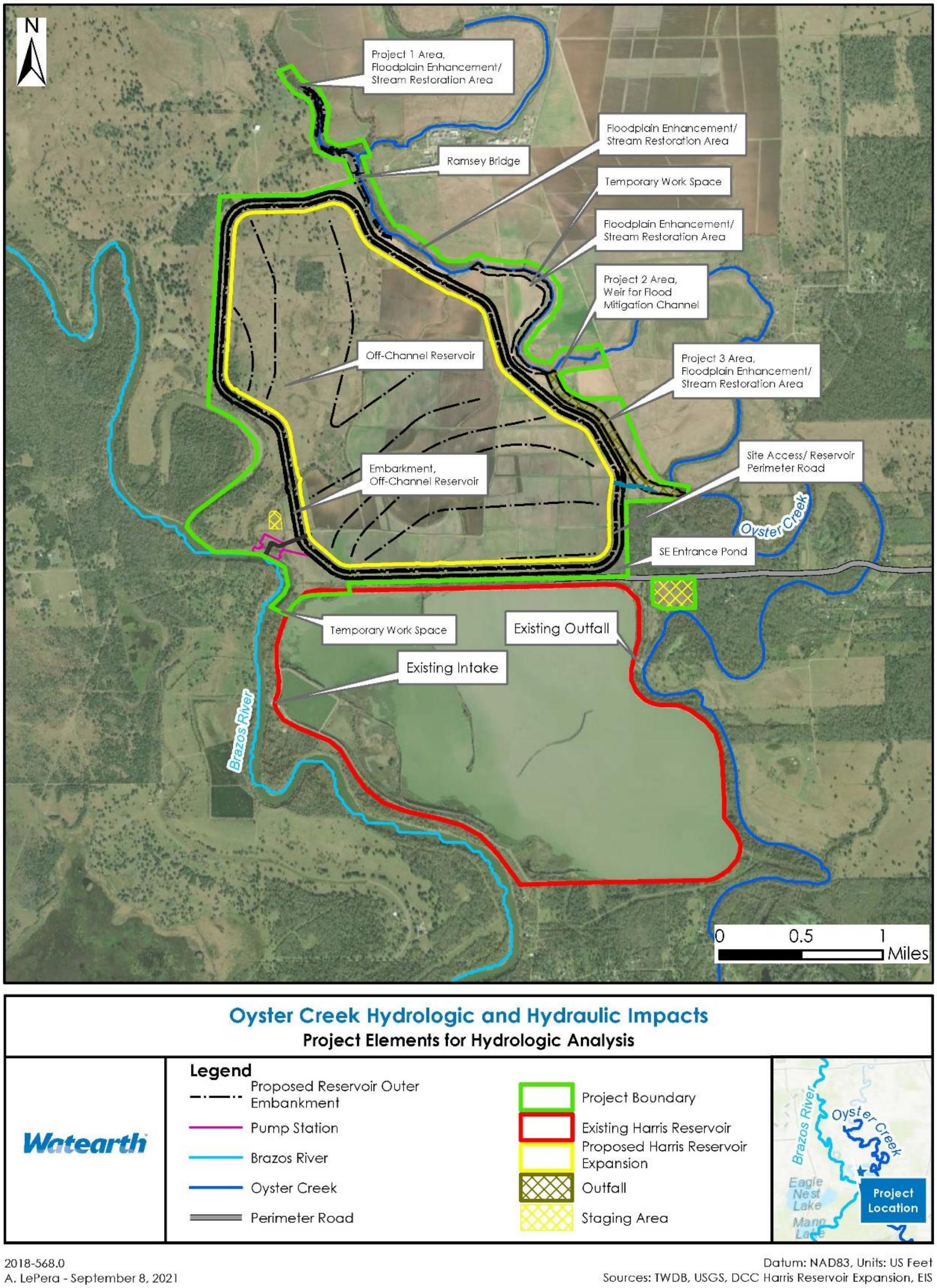


***Figure3**: Project elements for hydrologic analysis.*

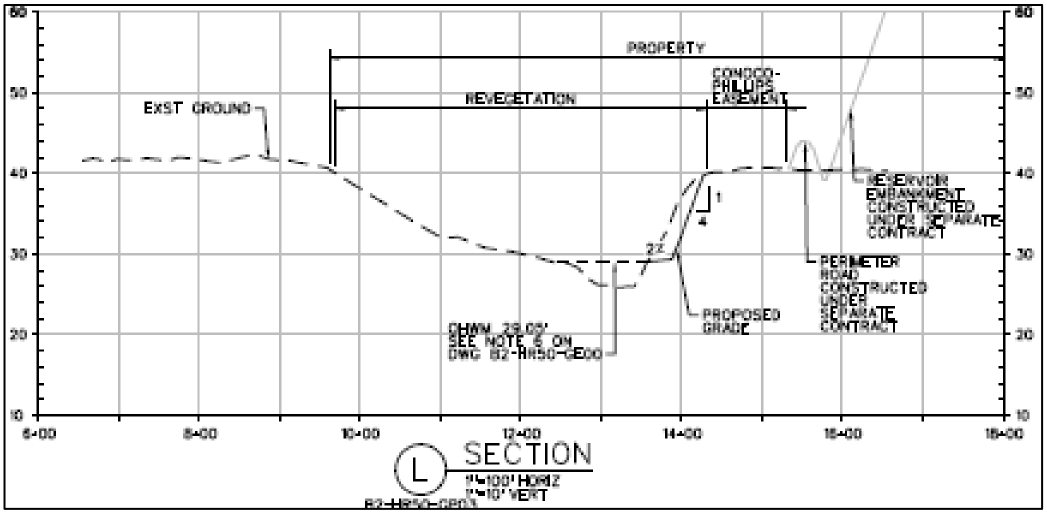


__Figure 4__: Cross section of Oyster Creek restoration in area adjacent to the reservoir embankment (Projects 1 and 2 only).

2.1 Overflow and Conveyance Channel (Project 3)

The proposed Harris Reservoir has a rectangular concrete riser structure in the reservoir, which serves as the gated outlet and auxiliary (emergency) spillway (ch2m, 2018). The gated outlet has two sluice gates to provide a low-level flow release. Both sluice gates are 36 inches wide × 48 inches tall and are attached on the downstream side of the headwall.

The hydraulic capacity required of the gates varies from 60 cfs to slightly over 1,000 cfs. For normal operations, the maximum flow capacity is 300 cfs for the majority of water levels in the reservoir. A maximum of 450 cfs capacity is desired for the upper range of the pool elevations. For emergency flow releases at full or near full pool, the performance requirements determined for the 36-hour drawdown before a tropical storm might affect the reservoir and would need to be 978 cfs. This would allow a reservoir drawdown of approximately 1 foot per day so the reservoir would be ready for the tropical storm. The proposed gated outlet will provide the desired performance with the gates fully opened.

The rectangular concrete outlet riser structure can function effectively over a wide range of stream flows. There is no compromise in energy dissipation performance at flows less than the design flow. The structure can operate at any downstream tailwater level as submergence or no submergence is not a concern.

The 10-ft-wide × 5-ft-tall concrete outlet conduit conveys the released water through the embankment, which exits near where the flood overflow channel (Project 3) comes back into Oyster Creek. Before reaching Oyster Creek, the flow goes through different types of flow elements. The first transition increases the width from 10 ft to 20 ft to reduce the unit discharge entering the U.S. Bureau of Reclamation (USBR) Type III stilling basin where a hydraulic jump occurs, reducing the velocity. Then the flow is equalized by a wave suppressor before entering a rectangle flume below the stilling basin for the purpose of measuring the normal flow releases (less than 400 cfs). Normal flow releases from the gated outlet will occur only when flows in Oyster Creek are low or when the only flows in Oyster Creek are from the reservoir.

3.0 Summary of Modeling and Analysis

This section of the report shows details about prior studies used to develop the basis for the models in this report. It focuses on describing the methods and procedures used to develop the models associated with this report. All parameters and modeling extents used to set up the three different models used in this analysis are documented in this section of the report.

3.1 Prior Studies

Dow, the applicant, provided a revised conceptual design in May 2020 to increase hydraulic storage and hydraulic capacity for Oyster Creek (Jacobs, 2019). There were changes to the profile of the stream restoration projects (Projects 1 and 2), as well as a significant change to Project 3, the storage and conveyance channel that receives the proposed project discharge and flows higher than the 10-year event. The northern extent includes a weir that will split flow from Oyster Creek prior to the oxbow during the 25-year and higher event flows.

As part of the Individual Permit application to the U.S. Army Corps of Engineers (USACE), the applicant prepared a no-rise analysis of Oyster Creek to demonstrate that the project would not cause any rise in WSEL in Oyster Creek (Jacobs, 2018). Jacobs modeled elevated embankments by simulating the reservoir as a blocked obstruction, as is standard and appropriate. This model included all three channel projects (Projects 1, 2, and 3). The oxbow was included in their model and is shown in cross-section 53.49. The model and documentation did not calculate the loss of floodplain storage. Watearth reviewed both the original model with the original design submitted in February 2018 and the updated model with the updated restoration design provided in May 2020.

The Digital FIRM Update for Fort Bend County, Texas Part 1, Task 42 – Hydrology Oyster Creek and Lower Oyster Creek was prepared by Comprehensive Flood Risk Resources and Response (CF3R) (revised February 2007). The CF3R study was carried out to calculate the peak discharges for the 0.2%, 1%, 2%, and 10% annual chance events for Oyster Creek.

CF3R modeled three sections of Oyster Creek. The Lower Oyster Creek Model associated with their report was the most relevant item to review. The limits of the study for the Lower Oyster Creek Model started near the Flat Bank diversion channel to the Sienna Plantation levee diversion channel at McKeever Road. CF3R described the topography of Oyster Creek as gently sloping to flat with ground elevations at about 60 ft in the Lower Oyster Creek area. CF3R described the ground slopes in the watershed to be less than 10 ft per mile. The soils in the watershed were described as typically clayey or silt-loamy, which results in a high runoff potential. The land use varies from residential, commercial, to undeveloped areas. Most of the development consists of single-family, residential communities with curb-and-gutter streets and underground storm sewer drainage systems.

The CF3R report stated their parameters for the hydrologic analysis in their report as follows:

- Rainfall data were from the 1999 Fort Bend County *Drainage Criteria Manual*
- Land use data were developed based on county GIS data and 2005 aerial imagery
- Green-Ampt loss function was used to compute infiltration loss

- Clark Unit Hydrograph was used to calculate runoff volume with the time of concentration (TC) and storage coefficient R computed using the methodology from the Fort Bend *Drainage Criteria Manual*
- The Modified Puls Routing Method was used to route the hydrographs between model nodes

The Brazos River Authority (BRA) was awarded a Texas Water Development Board (TWDB) flood protection grant for the development of the Lower Brazos Flood Protection Planning Study that was completed in March 2019. Hydrology and hydraulics (H&H) of the lower basin were conducted with the goal of updating discharge rates and WSELs in the Brazos River for the 10%, 2%, 1%, and 0.2% Annual Chance Exceedance (ACE) storm events, a 1-D unsteady hydraulic model was developed from the Waller/Grimes County line to the Gulf of Mexico for the BRA study. The H&H analyses in the BRA study determined the peak discharges in the Brazos 1% ACE were generally lower than the discharges published in the current effective Federal Emergency Management Agency (FEMA) FIS.

For the Rosharon USGS gauge, the difference in WSEL between the BRA study versus the FEMA FIS study was 0.2 ft lower in the BRA study. This demonstrates that the BRA study and the FIS study have similar results due to the similar WSELs stated in the BRA study executive summary.

The Brazos 1-D unsteady state model was the newest hydraulic model that modeled interbasin flows entering the Oyster Creek watershed. The lateral outflow hydrographs for the Brazos River found in the BRA study's 1-D unsteady state model were used to quantify the Brazos basin overflows entering the Oyster Creek watershed. The hydrographs from the 1-D model were applied to the Lower Oyster Creek HMS model and inserted as sources and sinks to accurately represent the interbasin flows that occur in the Lower Oyster/Brazos watersheds.

The Brazoria County, Texas, and incorporated areas FIS (revised in 9-22-1999) was reviewed for this analysis. The discharges found in Oyster Creek (near the project area) were used as reference to calibrate the flows found in Oyster Creek for the 50- and 100-year events, which include the combination of Oyster Creek watershed peak discharges and the inclusion of interbasin flows that enter Oyster Creek from the Brazos River inundation events. The FIS mentions that a FLOW SIM 10 and a USACE 2-D model was used in analyzing the interbasin flows in low-lying areas. A combined 1D/2D approach was used in the FLOW SIM 10 model with the discharges entered into a HEC-2 model. The summary of flows for the discharges mentioned in this section is shown in Table 2 of the FIS report.

3.2 Modeling Methodology

H&H modeling conducted for this analysis included HEC-HMS unsteady flow hydrologic analysis and computation of peak flows of Oyster Creek to assess downstream impacts and HEC-RAS hydraulic analysis including computation of WSEL profiles, velocities, and storage. The Modified Puls Reservoir Routing Method was used because it is the best method for assessing flat watersheds, such as those in the Gulf Coast of Texas, and because it uses storage in the routing reach data. This method allows for the subtraction of lost floodplain storage, as well.

BASINS with HPSF plug-in was used to model the velocity and sediment erosion in the Oyster Creek under drought conditions to examine the hydromodification impact of the proposed reservoir. The HSPF model was also used to model the water temperature in Oyster Creek during drought conditions to determine any impact on aquatic life. The HSPF model has been successfully used to determine hydromodification effects in previous studies (EPA, 2009).

3.2.1 Existing Model Selection

After reviewing the CF3R HEC-HMS model and supporting documentation, it was determined that the previous model could be used as a basis for the Watearth model. However, the CF3R HEC-HMS model ends approximately 20.5 miles (linearly estimated) upstream of the Oyster Creek Project 1 restoration site. Two sub-basins and 10 reaches were delineated and inserted into the new model in order to close the gap between the CF3R model and the Watearth model. In addition, there were several references to paired data errors in the existing model that were resolved. The existing model was run to obtain the peak flows happening at the existing model's outlet. **Figure 5** contains the 1% annual reoccurrence run with the outflow hydrograph displayed in the lower left corner of the figure. **Figure 6** shows the results summary table for the model seen in **Figure 5**.

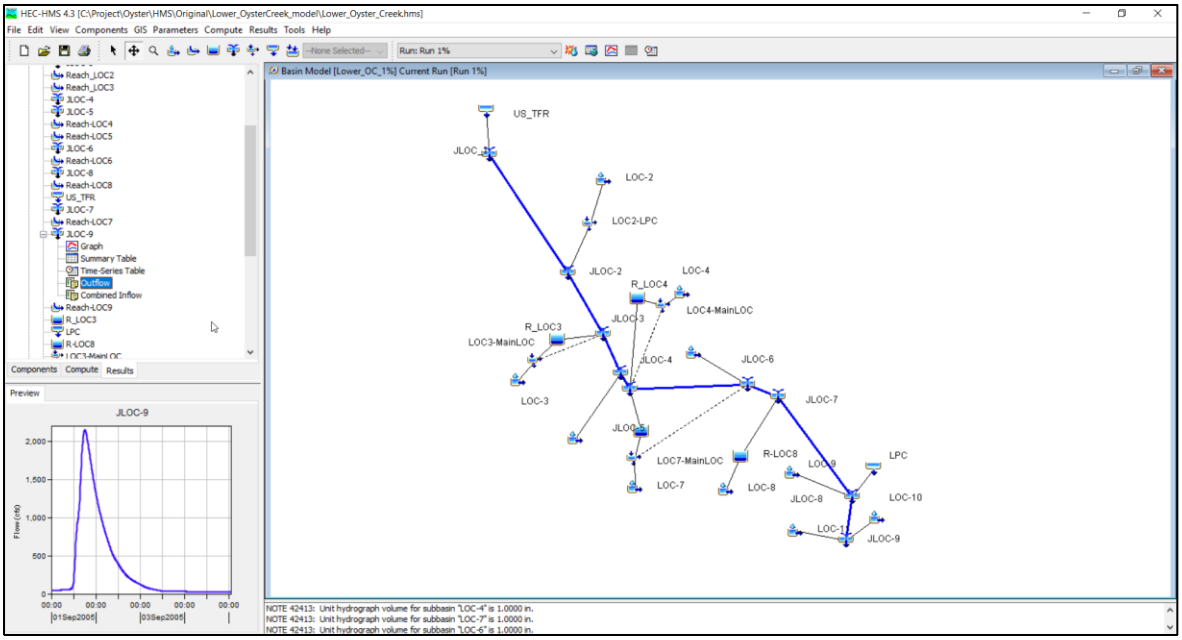


***Figure 5**: CF3R's existing model was ran to obtain peak flows for the Lower Oyster Creek Model as referenced by CF3R. The peak flow at the end of the model (JLOC-9) is 2,144 cfs.*

Global Summary Results for Run "Run 1%"

Project: Lower_Oyster Creek Simulation Run: Run 1%

Start of Run: 01Sep2005, 00:00 Basin Model: Lower_OC_1%
End of Run: 05Sep2005, 01:00 Meteorologic Model: 1%
Compute Time: 21Jan2020, 09:47:34 Control Specifications: Control 1

Show Elements: All Elements Volume Units: IN AC-FT Sorting: Alphabetic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
JLOC-2	5.78	219.5	01Sep2005, 15:20	278.3
JLOC-3	6.19	295.0	01Sep2005, 15:40	484.7
JLOC-4	6.30	349.7	01Sep2005, 15:00	528.9
JLOC-5	6.97	433.6	01Sep2005, 14:50	695.2
JLOC-6	7.11	622.4	01Sep2005, 15:10	828.2
JLOC-7	7.24	627.1	01Sep2005, 15:30	864.6
JLOC-8	14.46	2126.4	01Sep2005, 18:00	2619.2
JLOC-9	14.66	2144.2	01Sep2005, 18:10	2689.0
JLOC_1	5.32	69.4	02Sep2005, 03:20	124.1
LOC-10	0.11	138.5	01Sep2005, 13:40	38.7
LOC-11	0.09	161.6	01Sep2005, 13:00	30.8
LOC-2	0.46	303.6	01Sep2005, 15:20	175.5
LOC-3	0.41	428.7	01Sep2005, 13:40	169.3
LOC-4	0.30	307.7	01Sep2005, 13:40	112.0
LOC-5	0.11	155.7	01Sep2005, 13:10	42.0
LOC-6	0.14	156.3	01Sep2005, 13:40	54.1
LOC-7	0.37	402.7	01Sep2005, 13:40	149.7
LOC-8	0.13	161.6	01Sep2005, 13:40	46.6
LOC-9	0.16	200.4	01Sep2005, 13:30	56.8
LOC2-LPC	0.46	215.8	01Sep2005, 15:20	156.1
LOC3-MainLOC	0.41	278.7	01Sep2005, 13:40	110.0
LOC4-MainLOC	0.30	215.4	01Sep2005, 13:40	78.4
LOC7-MainLOC	0.37	201.4	01Sep2005, 13:40	74.9
LPC	7.06	1628.0	01Sep2005, 18:20	1696.7
Reach-LOC4	6.19	295.0	01Sep2005, 16:30	487.0
Reach-LOC5	6.30	349.7	01Sep2005, 15:10	529.7
Reach-LOC6	6.97	413.3	01Sep2005, 15:50	699.3
Reach-LOC7	7.11	621.9	01Sep2005, 15:30	828.8
Reach-LOC8	7.24	619.0	01Sep2005, 15:50	865.7
Reach-LOC9	14.46	2126.1	01Sep2005, 18:10	2619.5
Reach_LOC2	5.32	57.8	02Sep2005, 08:20	122.1
Reach_LOC3	5.78	183.0	01Sep2005, 18:10	277.6
R-LOC8	0.13	5.3	01Sep2005, 20:40	35.7
R_LOC3	0.41	56.1	01Sep2005, 18:50	147.8
R_LOC4	0.30	8.8	01Sep2005, 13:20	61.9
R_LOC7	0.37	8.8	01Sep2005, 00:00	70.0
US_TFR	5.32	69.4	02Sep2005, 03:20	124.1

***Figure 6**: CF3R's existing model summary table. The peak flow at the end of the model (JLOC-9) is 2,144 cfs.*

3.2.2 Lake Jackson Reservoir as Downstream Analysis Ending Point

The contributing drainage area for Oyster Creek has been altered by the Sienna Plantation Subdivision canal project, which rerouted the northern portion of Oyster Creek (north of the proposed Harris Reservoir) to the Brazos River. The contributing drainage area was reduced by 63%.

Oyster Creek continues to flow downstream approximately 26 miles without any further channel modification until it arrives near Lake Jackson, Texas, which is where the reservoir discharge or any natural stream flow is diverted into Dow's canal. The water from the Oyster Creek Dam (Keyway) is pumped into Dow's canal (Dow Chemical Company, 2019, p. 9). The canal takes the water to the Dow's plants for use.

Oyster Creek Dam near Lake Jackson, Texas, was selected as the end point of the modeling because it is where the water is diverted by Dow and any impacts due to the proposed project would naturally end due to the weir and Lake Jackson operations. Additionally, this distance downstream of the proposed project would allow changes in flows to attenuate back into natural conditions. The Oyster Creek Dam is approximately 12 miles linear distance from the Gulf of Mexico.

3.2.3 Reservoir Discharge Assumptions During a 50- and 100-Year Design Event for Oyster Creek Modeling

Dow has a 1942 water right that allows it to divert up to 60,000 ac-ft per year from Oyster Creek. Dow's operational philosophy is to maximize the use of storm flows in Oyster Creek so that it does not have not pump water into and release water from the existing and proposed reservoirs (Dow Chemical Company, 2019). This allows Dow to save pumping costs, which is one of its primary objectives according to their operation philosophy (Dow Chemical Company, 2019).

The current and proposed reservoirs can only be filled by water pumping from the Brazos River and natural rainfall on the reservoir surface. The reservoirs are operated at such a level that a localized 50- and 100-year storm event is contained in the reservoir without discharge. For larger storm events from tropical storms, Dow monitors tropical storm activity in the Gulf of Mexico and uses a site shutdown sequence that typically starts 96 hours or more ahead of landfall for larger tropical storms or hurricanes. This storm monitoring protocol needs to continue.

This would mean that if Dow is diverting Oyster Creek stream flow from storm events whenever possible, there would not be any water discharge from the existing or proposed Harris Reservoirs during the 50- and 100-year storm event. So only natural rainfall and runoff from the contributing drainage area will have to be considered in the modeling of the 50- and 100-year storm event on Oyster Creek.

3.2.4 Considerations for Proposed Oyster Creek Improvements and Oxbow Storage

The proposed project reservoir berm will prevent Oyster Creek overflow into the west floodplain of Oyster Creek for approximately 12,000 ft of the creek. The Dow proposed Oyster Creek improvement projects do not fully mitigate this floodplain storage loss, which was 309 ac-ft of loss under the original application and 1,028 ac-ft under the revised Project 3 design. Under the revised Project 3 design, all flows through the 25-year flow event will continue to enter the oxbow as it currently does. However, for events above the 25-year flow, the flow volume between the 25-year and 100-year storm flow will be diverted into the (Project 3) overflow channel. The Jacobs model contains one cross-section through this oxbow, which could better be represented with additional cross-sections in the existing and proposed conditions models. This would better simulate floodplain storage losses between the 25-year and 100-year design storm event. Watearth did not scope to add cross-sections or other modifications to the Jacobs model for this effort.

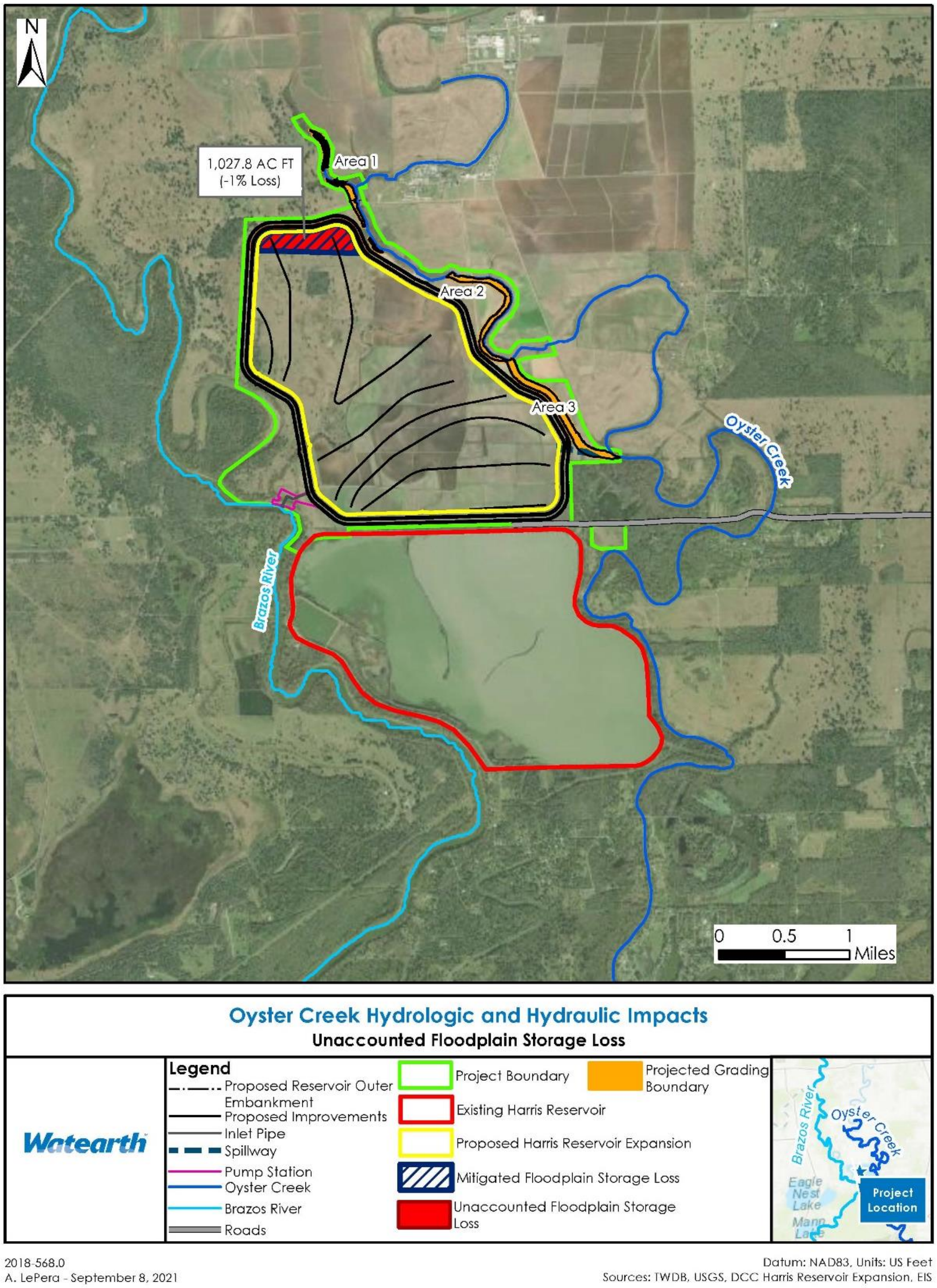


Figure 7: *Oyster Creek figure showing loss of floodplain storage due to the construction of the proposed Harris Reservoir expansion and stream restoration projects.*

3.2.5 Assumptions for Hydrologic and Hydraulic Models and Analysis

As described above, the model end points were established to include the proposed improvements and to assess the downstream impacts due to the proposed Harris Reservoir. Upstream impacts were not reviewed. The H&H model developed by Watearth starts junction JLOC-9 to the same location were the unnamed tributary being improved in stream restoration Project 1(Area 1 in the **Figure 7** above) converges with Oyster Creek near Otey, Texas, as seen in **Figure 8**. This will bridge the gap between the two models. The model ends at the Oyster Creek Dam, which serves as the Dow water supply diversion near Lake Jackson as seen in **Figure 8**.

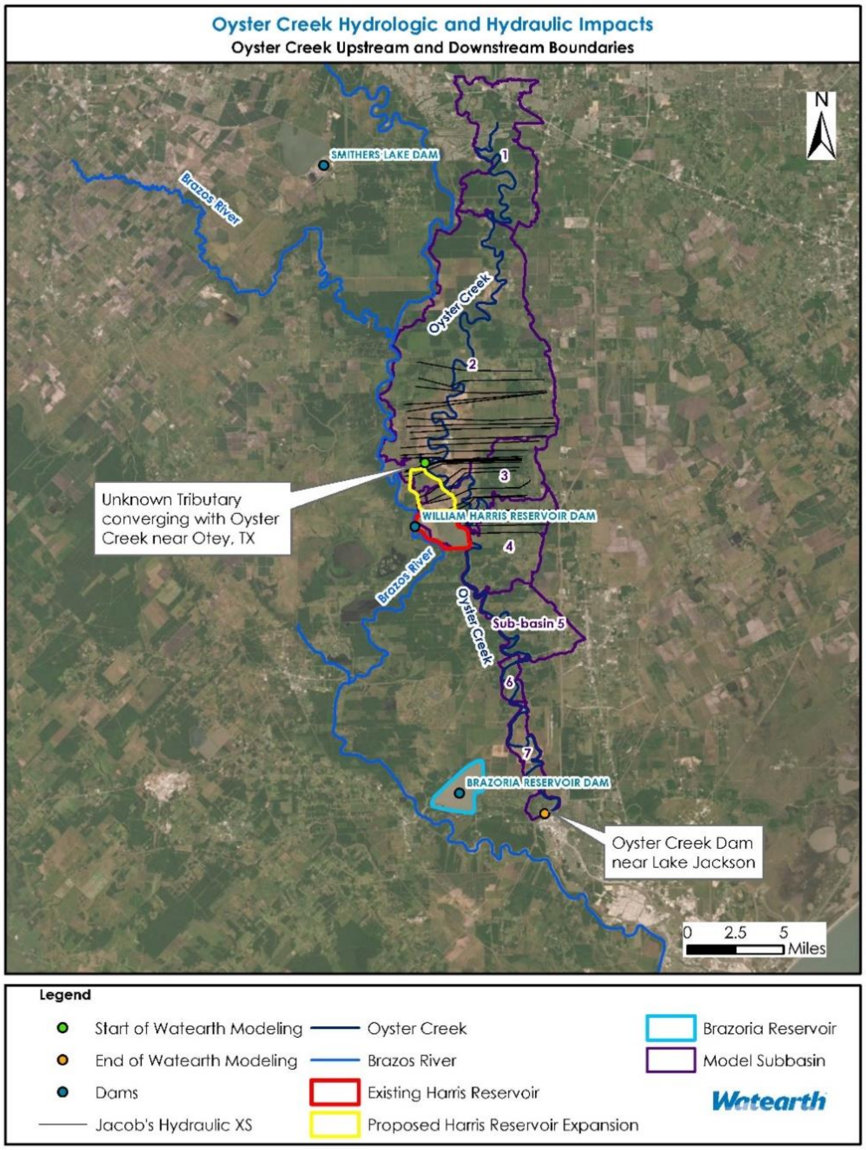


__Figure 8__: Modeling boundaries for the Watearth H&H model for Oyster Creek.

As mentioned in previous sections, there is a gap between the existing model and Watearth's model. The first two sub-basins (O-1 and O-2) and the part of Oyster Creek drawn in dark blue (between O-1 and O-2) represented in the HEC-HMS model in the following reaches: R-O1, R-1.29, R-1.54, R-1.59, R-O1.61, R-1.65, R-1.70, R-1.72, R-1.73, R-1.75, and R-02. The reaches located in **Figure 9** was used to bridge the gap between the models.

The sub-basins for Oyster Creek were delineated using the Arc-Hydro 10.6 extension within Arc-GIS 10.6.1. First, the Digital Elevation Model (DEM) was obtained from the USGS TNM Download application for the project area. The DEM was obtained with the precision of one-third arc-second in ArcGrid format. The elevations for the DEM are in meters and were converted to feet by multiplying the values in the DEM by the conversion factor of 3.281 (meters to feet). The DEM was then clipped to a smaller area to lower the terrain preprocessing time.

After the catchments were created, the point delineation feature in Arc-Hydro 10.6 was used to assist in determining the extents of the watershed (area that includes all the sub-basins). The point delineation could not be used at the outlet point because there was not enough stream definition in that location. However, the point delineation was used at the sub-basin boundary for Sub-basin O6. Sub-basin O-7 is directly downstream of Sub-basin O-6 and was just added to the watershed. The watershed was divided into small catchments, then the hydrologic modeler merged the sub-basins by visual inspection into seven larger sub-basins for the watershed. The divisions were set so that one sub-basin would flow into the subsequent sub-basins until the flows reached the outlet point or end of the model. The first two sub-basins were created to close the gap between the existing model and Watearth's model. The subsequent sub-basins were created to model the watershed within the Watearth project area shown in **Figure 10**.

The hydrography for the rivers/streams in the area were also obtained within the National Hydrography Dataset (NHD) layer. This layer was clipped to obtain the Oyster_US_model shape file and the ClipNHD_STP shapefile.

An adjustment was made to the C3FR side of the model to run the model to completion due to the addition of new elements to the model downstream of the C3FR model, as well as having to extend the run time of the model to approximately 30 days instead of 7 days in the original version. This was done to see the effects of interbasin peak flow and sub-basin peak flow hydrographs in the HEC-HMS model. The model would not run to completion in its original version, and after troubleshooting the error messages within the RAS model, a couple changes were made to a few of the nodes in the C3FR side of the model (model upstream of J-LOC9).

Error messages popped up regarding reservoir R-LOC7 possibly running dry and having no outflow; this would cause the model to fail. R-LOC7 receives flow from sub-basin LOC-7, which is a small sub-basin of 0.37 square miles that feeds flow into R-LOC7. The issue was resolved by disconnecting the sub-basin LOC-7 and adding and connecting a source node (STEADYFLOW LOC-7) with a constant flow of 10 cfs in its place. This adjustment eliminated the errors caused by the empty reservoir. A flow of 10 cfs upstream in the model should have minimal effects to the results, especially because the Oyster Creek model is subject to large volume interbasin flows.

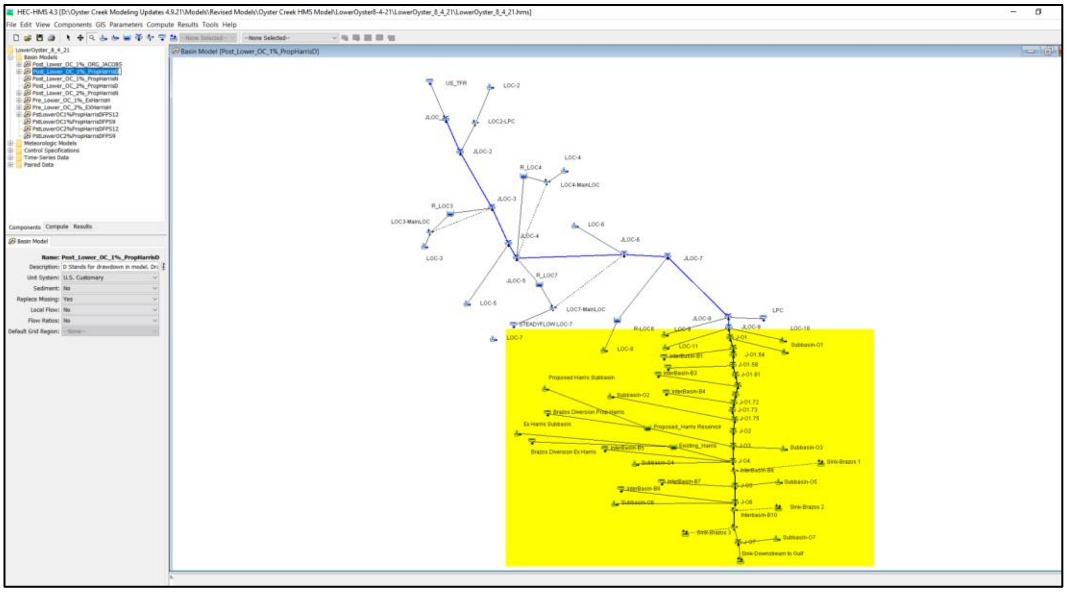


Figure 9: *Watearth's hydrologic model including a portion added to fill gap in existing models.*

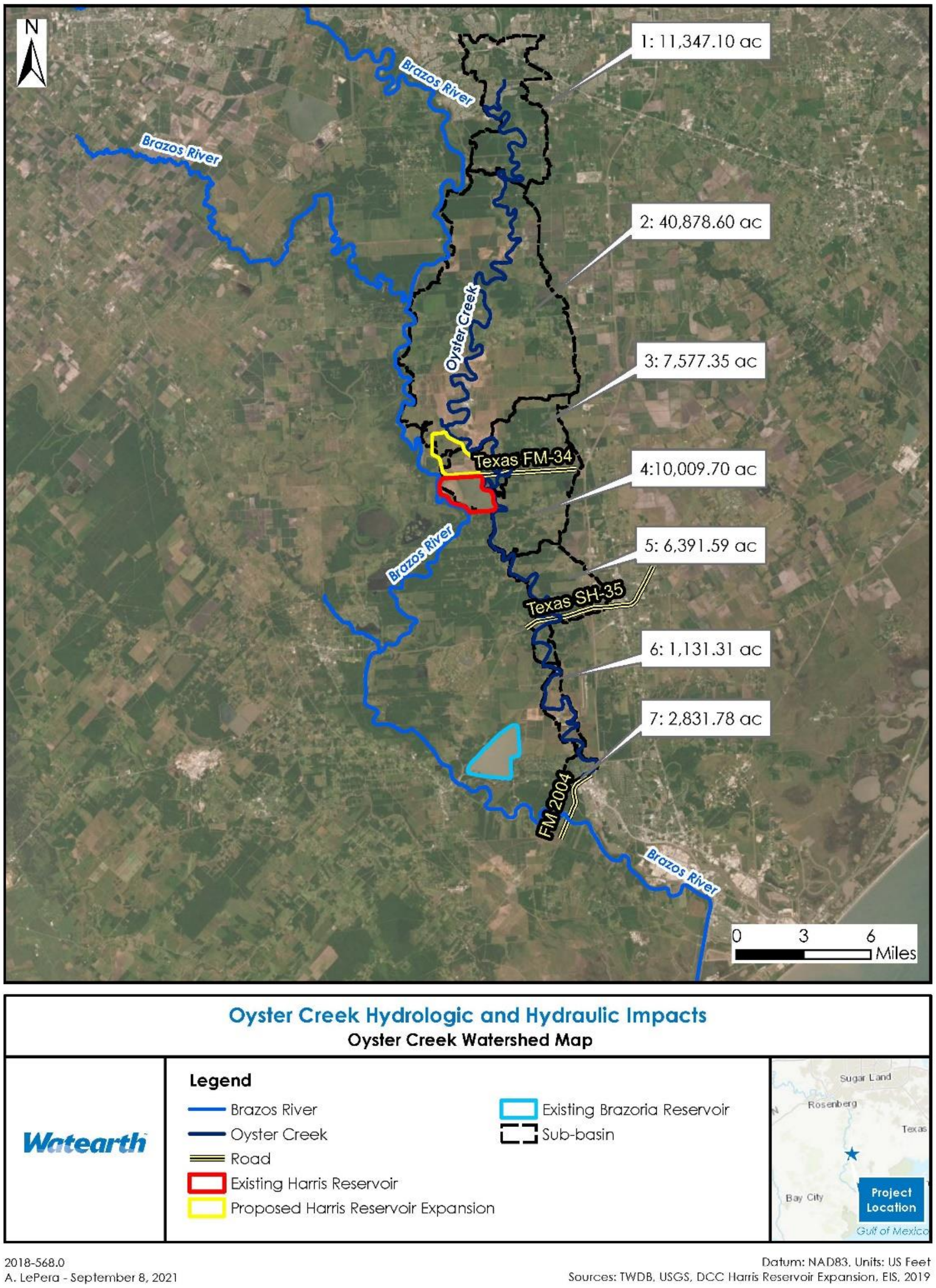


***Figure 10**: Oyster Creek watershed delineated in ARC-HYDRO 10.6. Watearth Oyster Creek modeling begins approximately where the blue stream begins and consists of Sub-basins O3 through O7.*

The next step in the construction of the hydrologic model was to include the sub-basins, reaches, and junctions established in ArcGIS into the existing HEC-HMS model. HEC-HMS version 4.3 was used to model Oyster Creek from the model boundary points seen in **Figure 8**. The items mentioned above were added to C3FR's model seen in **Figure 9,** which includes the sub-basins delineated and connected downstream by reaches and junctions down to the outlet point, Dow's intake diversion (a freshwater canal) at J-07, shown in yellow. Later, the interbasin flows were added to the model. **Figure 11** provides a closer look at all the nodes in Lower Oyster Creek hydrologic model as the **Figure 9** node diagram does not show all the nodes.

The hydrologic model was set up with the sub-basins, reaches, and junctions established in ArcGIS for the Lower Oyster Creek watershed and was combined into the existing HEC-HMS model. This model setup was not enough to model the effects of interbasin flows and the operation of the existing and proposed Harris Reservoirs during the storm events for Oyster Creek. Additional improvements had to be made for the HEC-HMS model to accurately model the interbasin flows entering and exiting the Oyster Creek watershed because of the flat slopes and interbasin flooding that occur in the Oyster/Brazos watershed during the 50- and 100-year storm events.

The existing and proposed Harris Reservoirs modeled in the HEC-HMS model included a sub-basin for each reservoir, which was added to account for rainfall occurring over the reservoir area, and a source node that was used to include the diversion inflows from the pumps that draw water from the Brazos River and fill up the reservoirs when necessary. Various operational scenarios were modeled for the proposed Harris Reservoir to determine whether impacts occur downstream and/or if overtopping of the dam's embankment could occur. These scenarios include the following:

1. 50-year and 100-year 24-hour design storms with no drawdown.
2. 50-year and 100-year 24-hour design storms with 18 inches of drawdown prior to the design storm event at a rate of 978 cfs for 6 hours prior to design storm rainfall and 6 inches of floodplain storage held during the design storm event within the reservoir prior to spillway discharge.
3. The same scenario as No. 2 above but with 9 inches of floodplain storage held during the design storm events.
4. The same scenario as Nos. 2 and 3, but with 12 inches of floodplain storage held in the reservoir during the storm event.

After the design storm rainfall concludes, the flow out of the proposed Harris Reservoir spillway is modeled as 11 cfs (half the environmental flow required in Oyster Creek). The other half or 11 cfs to complete the environmental flow required for Oyster Creek is provided by a release from the existing Harris Reservoir.

Interbasin flows B1 though B4 are modeled as sources in the HEC-HMS model. They occur upstream of the proposed Harris Reservoir within the O2 sub-basin. The incoming hydrographs used to represent the interbasin flows were obtained from the Lower Brazos Flood Protection Planning Study Hydraulic Analysis HEC-RAS model. The Lower Brazos Flood Protection Planning Study (LBFPPS) Hydraulic Analysis HEC-RAS model spans from Washington County to Brazoria County ending at the Gulf of Mexico, which includes the modeled area.

The LBFPPS has the Brazos River and Oyster Creek modeled side by side with lateral structure weirs set up between the Brazos River and Oyster Creek to transfer flow between the Brazos/Oyster watershed. **Figure 10** shows a lateral structure circled in magenta, which was used to represent Interbasin flow B1 in the HEC-HMS model. The flow hydrograph highlighted in red shown in the same figure represents the interbasin flow leaving the Brazos River and entering Oyster Creek.

The interbasin flow hydrograph is distributed through a long weir to Oyster Creek in the HEC-RAS model; however, HEC-HMS does not have the same capability as HEC-RAS to distribute flow along a weir length. HEC-HMS uses point sources or point diversions/sinks along the reaches to add or subtract flow from the modeled reaches. To resolve the different ways that the two models handle lateral inflows, the centroid of the lateral structure weir was measured in GIS and a junction node was placed in that location. A lateral structure hydrograph then was inserted in the lateral structure's centroid to best represent the most accurate location of where the flow hydrograph should enter Oyster Creek in the HEC-HMS model.

The reaches between J-O1 and J-O2 were broken up into smaller reaches where a junction node was added at the start, center, and end of each lateral structure section shown in the HEC-RAS model. This was done to accurately place the interbasin flows in the correct locations within the Oyster Creek reach in the HEC-HMS model. For example, for interbasin flow B1, a junction node was placed in J-O1 representing the start of the lateral flow weir location. Another node was then added at J-O1.29 where interbasin flow hydrograph B1 was applied to Oyster Creek, and then another junction node was entered at J-O1.54 representing the end of the lateral structure location. This same process was used for Interbasins-B2 through B4.

There are additional interbasin flows occurring downstream of the existing Harris Reservoir; these are labeled interbasin flow B5 through B10. Interbasin flow B7 is a source node with flow entering Oyster Creek. Interbasin flow B10 is a diversion/sink where flow is leaving Oyster Creek to return to the Brazos River. Interbasin flows B5-B6 and B8-B9 were represented slightly differently in the HMS model compared to B1 through B4. The reason is because below the existing Harris Reservoir, there are some areas where there is a combination of flows leaving Oyster Creek into the Brazos River. Flows entering Oyster Creek from the Brazos River at different sections of the hydrograph must be handled differently in the HEC-HMS model as shown in LBFPPS HEC-RAS model screenshot in **Figure 12**.

For example, there are flows entering and exiting Oyster Creek just downstream of the existing Harris Reservoir near Junction O4. The positive flows in the hydrograph are represented as flows entering Oyster Creek as a source node (InterBasin-B5) just upstream of J-O4. The negative flows in the hydrograph are represented as flow leaving Oyster Creek using a diversion and a sink node (Interbasin-B6/Sink Brazos 1) just downstream of J-O4.

All the interbasin flows seen in the in LBFPPS HEC-RAS model and the flows generated within the Oyster Creek watershed sub-basins are represented in the HEC-HMS model. The model results were reviewed and were compared to the peak flows reported in the Brazoria County FIS. The results in the HEC-HMS model appeared to be significantly higher than the peak discharges reported in the Brazoria County FIS. This prompted the calibration of the interbasin flow hydrographs that appeared to be too high of magnitude and were reduced in magnitude by multiplying the flows to a factor, so peak flow results match up better with the peak flow results reported in the FIS for Oyster Creek from that previous study.

A factor of 0.25 was multiplied to all the interbasin flows hydrographs in the 100-year model so the peak flows in the HMS model would be more realistic and correlate better to the values reported in the FIS. For the 50-year, interbasin flow hydrographs were multiplied by a factor of 0.21 for the same reason.

The hydrograph adjustments to the data yielded results similar to those reported in the FIS for peak flows, which included interbasin flows in the modeling approach.

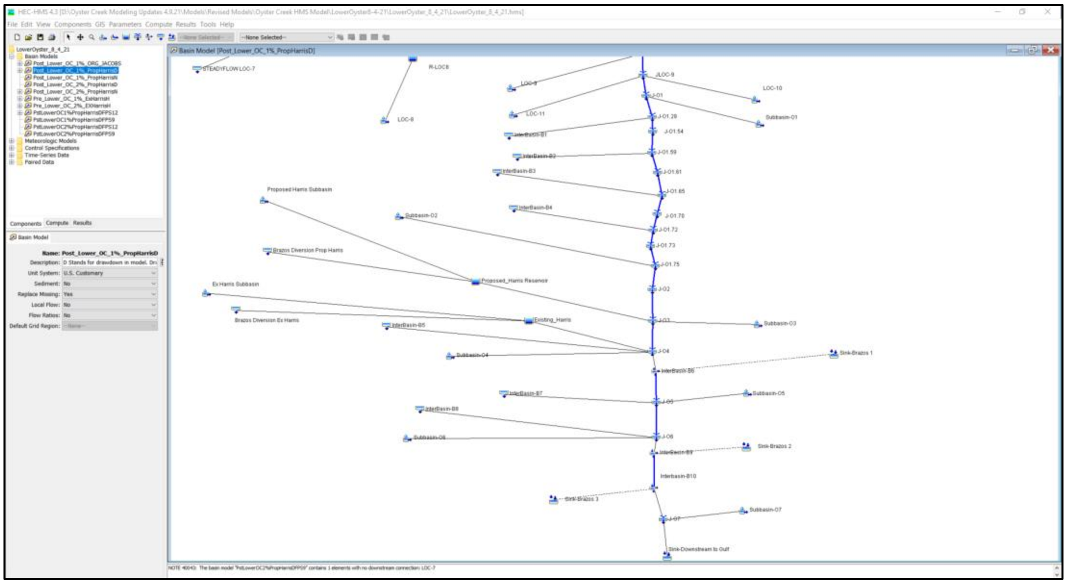


Figure 11: *Watearth's hydrologic model zoomed in showing all the nodes within the Lower Oyster Creek HMS model.*

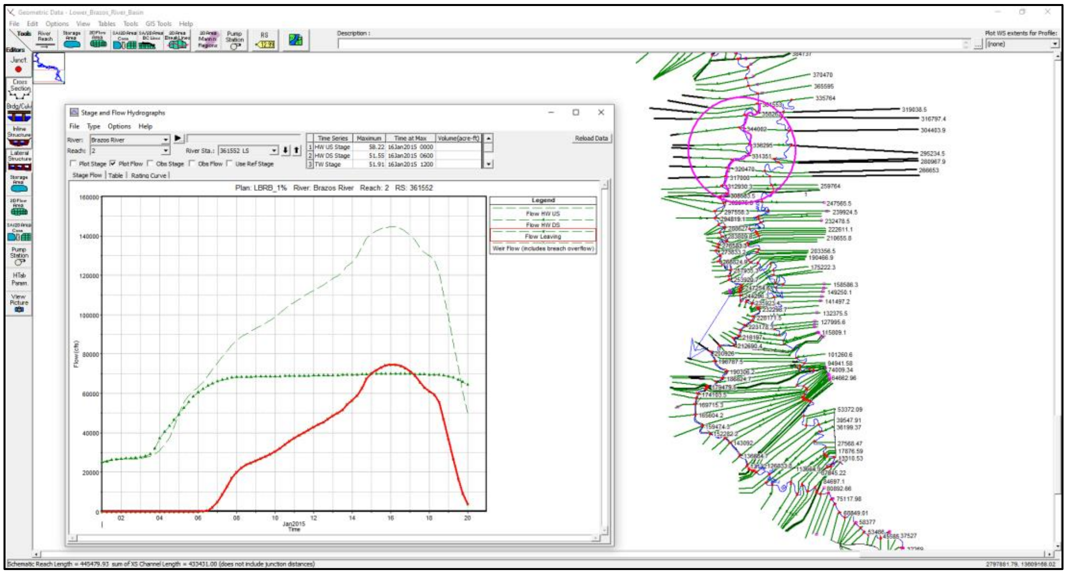


Figure 12: *Lower Brazos Flood Protection Planning Study Hydraulic Analysis HEC-RAS model showing a lateral inflow location (circled in magenta) and lateral inflow hydrograph (highlighted in red to the left of the cross section diagram,) which was entered into the HEC-HMS model as Interbasin flow-B1.*

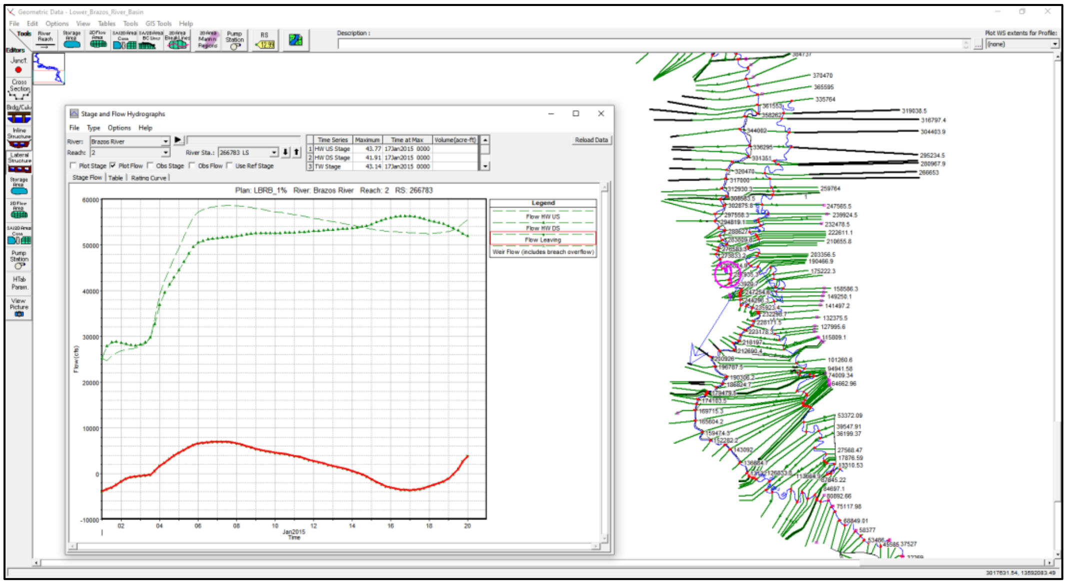


Figure 13: *Lower Brazos Flood Protection Planning Study Hydraulic Analysis HEC-RAS model showing a lateral inflow location (circled in magenta) and lateral inflow hydrograph (highlighted in red to the left of the cross section diagram) which was entered into the HEC-HMS model as Interbasin flow-B5(positive flows) and B6 (negative flows).*

3.2.6 Rainfall Data

The previous model used criteria established in the Fort Bend County *Drainage Criteria Manual*. However, the majority of the model is located in Brazoria County, therefore the methods established for determining hydrologic parameters used the 2003 Brazoria County *Drainage Criteria Manual* (Brazoria County, TX, 2003). The 1% Frequency Storm (100-year) was changed from what is shown in **Table 2** to the values stated to be used for Brazoria County found in the 2003 *Drainage Criteria Manual* as shown in **Table 3.** The same approach was applied to the 2% Frequency Storm (50-year) shown in **Table 3** through **Table 5.**

Table 2: Existing Conditions Model Frequency Storm Data for Fort Bend County

100-Year Storm Frequency Storm Data	
Met Name	1%
Annual-Partial Conversion	None
Annual-Partial Ratio	1.0000
Storm Duration	1 Day
Intensity Duration	5 Minutes
Intensity Position	50%

Area Reduction	TP40
Storm Area	0.01
Curve	Uniform for All Sub-basins
Depth/Duration Data	
Duration	Depth (Inches)
5 Minutes	0.91
15 Minutes	2.01
1 Hour	4.55
2 Hours	6.05
3 Hours	6.85
6 Hours	8.40
12 Hours	10.45
1 Day	12.50

Table 3: Proposed Conditions Revised Frequency Storm Data for Brazoria County as Required from *Drainage Criteria Manual*

100-Year Storm Frequency Storm Data	
Met Name	1%
Annual-Partial Conversion	None
Annual-Partial Ratio	1.0000
Storm Duration	1 Day
Intensity Duration	5 Minutes
Intensity Position	50%
Area Reduction	TP40
Storm Area	0.01
Curve	Uniform for All Sub-basins

100-Year Storm Frequency Storm Data	
Depth/Duration Data	
Duration	Depth (Inches)
5 Minutes	0.91
15 Minutes	2.02
1 Hour	4.62
2 Hours	6.20
3 Hours	7.15
6 Hours	8.75
12 Hours	10.75
1 Day	13.00

Table 4: Existing Conditions Model Frequency Storm Data for Fort Bend County

50-Year Storm Frequency Storm Data	
Met Name	2%
Annual-Partial Conversion	None
Annual-Partial Ratio	1.0000
Storm Duration	1 Day
Intensity Duration	5 Minutes
Intensity Position	50%
Area Reduction	TP40
Storm Area	0.01
Curve	Uniform for All Sub-basins
Depth/Duration Data	
Duration	Depth (Inches)
5 Minutes	0.83
15 Minutes	1.85
1 Hour	4.14

50-Year Storm Frequency Storm Data	
2 Hours	5.45
3 Hours	6.10
6 Hours	7.55
12 Hours	9.25
1 Day	11.00

Table 5: Proposed Conditions Model Frequency Storm Data for Brazoria County as Required from Drainage Criteria Manual

50-Year Storm Frequency Storm Data	
Met Name	2%
Annual-Partial Conversion	None
Annual-Partial Ratio	1.0000
Storm Duration	1 Day
Intensity Duration	5 Minutes
Intensity Position	50%
Area Reduction	TP40
Storm Area	0.01
Curve	Uniform for All Sub-basins
Depth/Duration Data	
Duration	Depth (Inches)
5 Minutes	0.84
15 Minutes	1.86
1 Hour	4.20
2 Hours	5.60
3 Hours	6.30

50-Year Storm Frequency Storm Data	
6 Hours	7.80
12 Hours	9.60
1 Day	11.50

3.2.7 Land Use Data and Soils Data

Land use data were obtained from the 2016 National Land Cover Database (NLCD 2016) and was used to estimate the percentage of impervious cover used in the Green Ampt Loss Method as reported in **Table 6**. The percentage of impervious cover was estimated visually using **Figure 14** and reported in **Table 7**. The soil classifications for the project area were similar to the existing model and the same parameters were kept for the use of Watearth's Hydrologic Model (**Figures 15–17**).

Table 6: Green Ampt Soil Characteristics

Green Ampt Soil Characteristics	HEC-HMS inputs (All Sub-basins)
Initial Content	0.075
Saturated Content	0.46
Suction (in.)	12.45
Conductivity (in/hr)	0.15

Table 7: Percent Impervious Values Used in Green Ampt Method within the HEC-HMS Model

Sub-basin Name	Percent Impervious (%)
O1	10.0
O2	5.0
O3	0.0
O4	5.0
O5	5.0
O6	0.0
O7	5.0

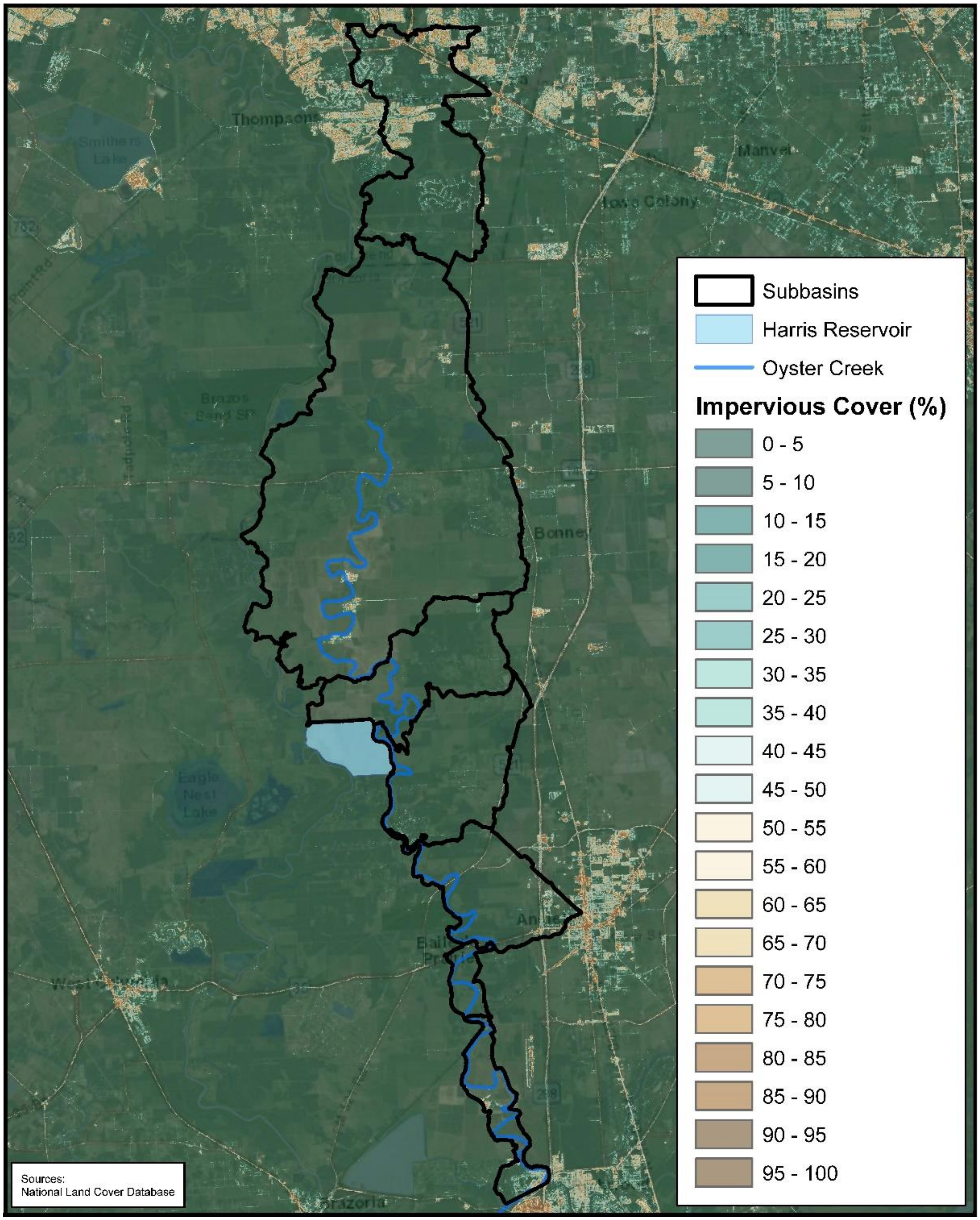


Figure 14: *Impervious cover for the Oyster Creek watershed.*

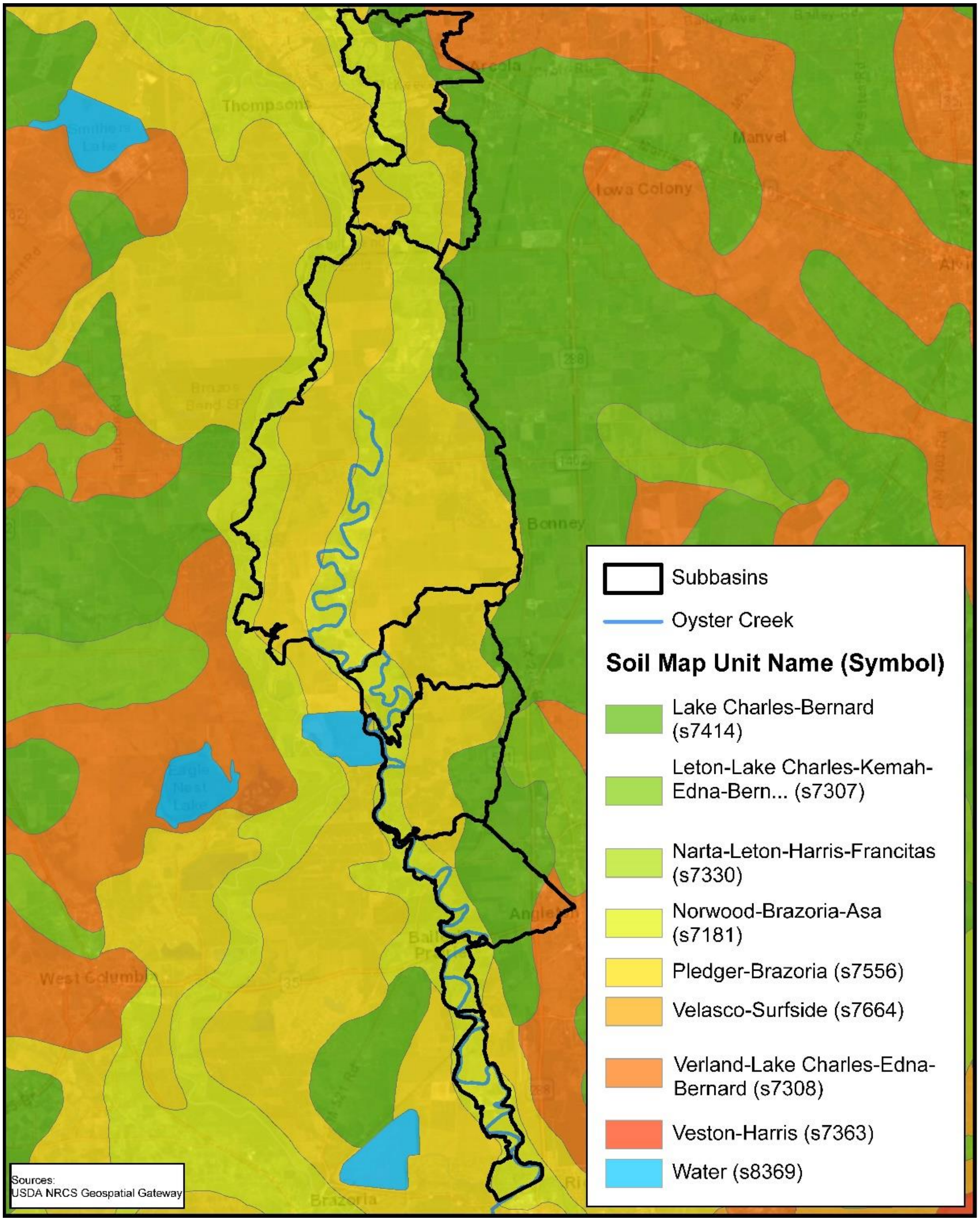


Figure 15: Soils series for project study area.

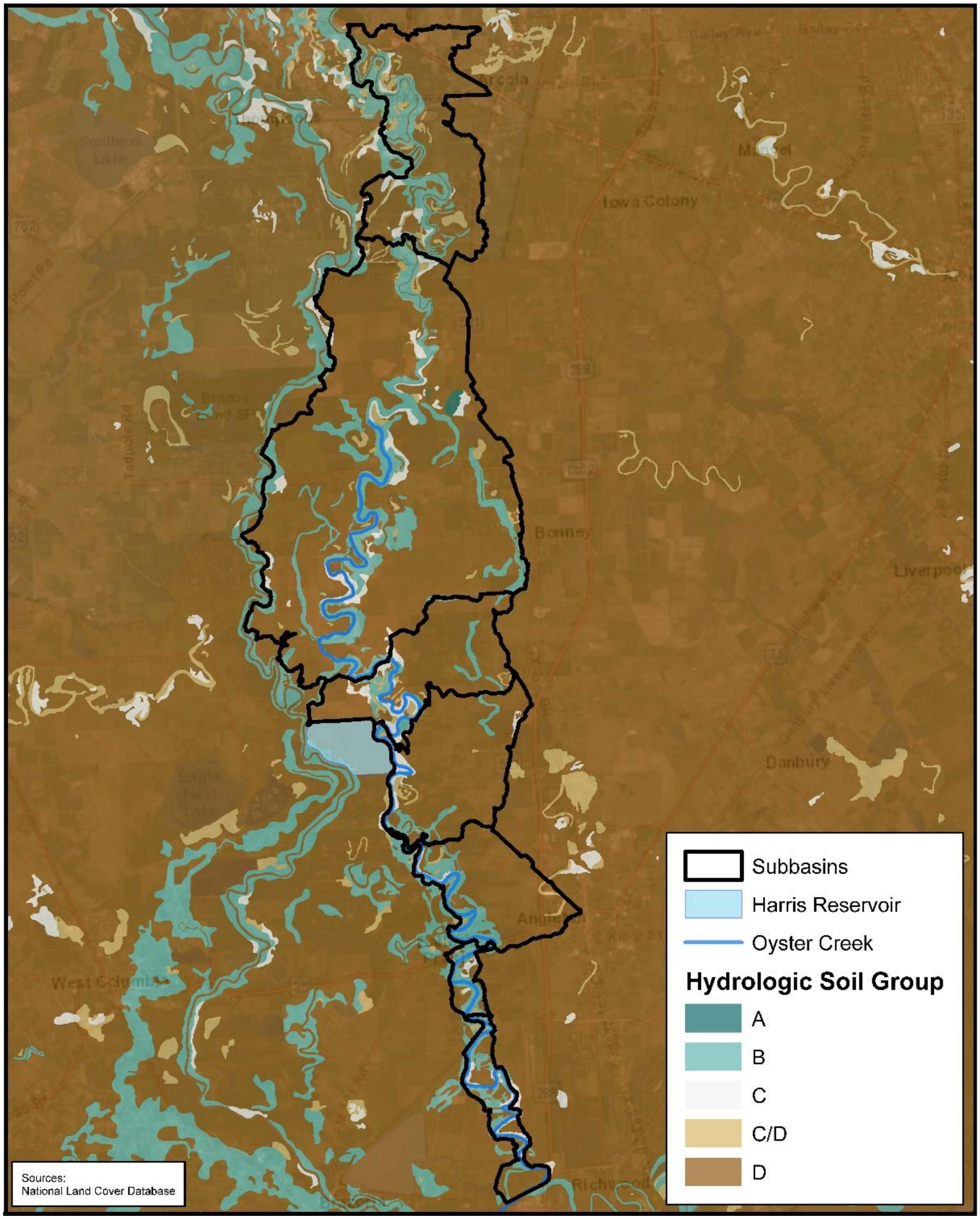


Figure 16: *Hydrologic soil group map for the Oyster Creek modeling sub-watershed.*

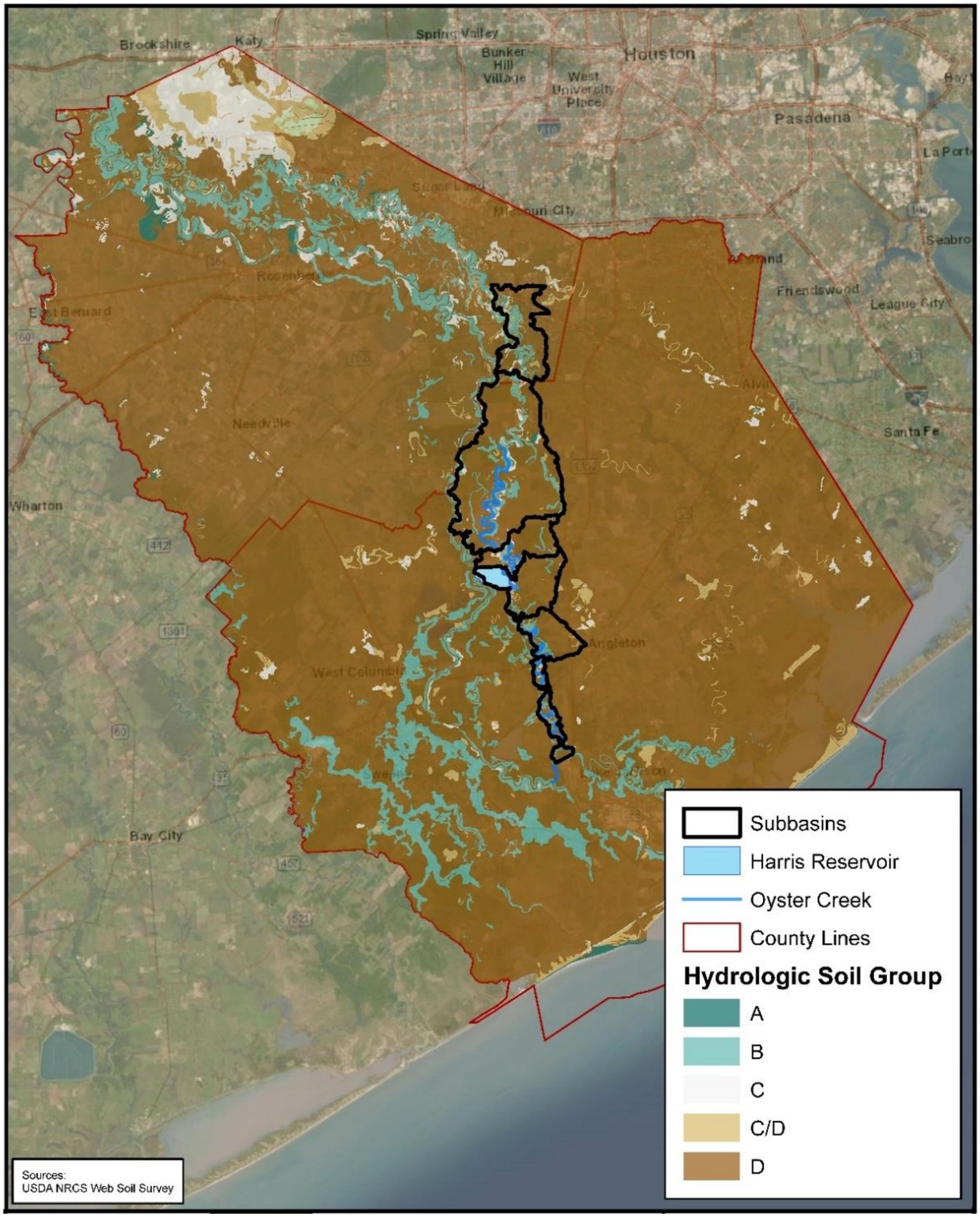


__Figure 17:__ Watershed view of the hydrologic soil group map for the Oyster Creek watershed.

3.3 Hydrologic Model Methodology

The Clark Unit Hydrograph Method was selected to determine the design storm runoff in HEC-HMS. The Brazoria County Drainage Criteria determined that the equations from the *Harris County Hydrology Manual* dated March 1988 should be used to determine the variables to be used in the Clark Method (Brazoria County, TX, 2003). The process to obtain T_c (Time of Concentration) and R (Clark's Storage Coefficient) is to calculate T_c using Equation 1 and to calculate T_c + R by using Equation 2, then subtract Equation 1 from Equation 2 to obtain Clark's Storage Coefficient (R). Watearth determined that instead of using Equation 1, the Kerby-Kirpich Method would be applicable for calculating T_c for this planning level study. However, the T_c calculated by the Kerby-Kirpich Method was subtracted from Equation 2 to obtain the R.

T_c and R found in the Brazoria County *Drainage Manual* is calculated by using the following equations found in **Appendix B.** The Kerby-Kirpich Method was used to obtain T_c for this study. This method is applicable for estimating watershed time of concentration for drainage areas of 0.25 sq-mi up to watersheds less than 150 sq-mi. The T_c for this method is broken up into two components: an overland flow component (Kerby Method) and a channel flow component (Kirpich Method).

The results for the Kerby-Kirpich Method to determine T_c for all the sub-basins is located in **Appendix B**. Using the method described in the text above with the equations and T_c for each sub-basin in hours presented in **Appendix B**, the R coefficient for the Clark Method was obtained for each sub-basin and summarized in **Table 8**.

Table 8: Summary Calculations Used to Obtain Clark's Storage Coefficient (R)

Sub-basin Name	L (miles)	S (ft/mile)	Tc + R	Tc (Kirpich)	R
O3	5.8	1.55	21.43	5.77	15.66
O4	3.5	2.31	12.96	3.64	9.32
O5	5.2	1.14	22.29	5.57	16.72
O6	3.3	1.82	13.66	3.66	10.00
O7	8.6	0.47	43.14	8.74	34.40

3.3.1 Reach Routing

The flow through the sub-basins was routed using Muskingum-Cunge (O1 and O2) and Modified Puls Reservoir Routing Methods (O3 through O7).

3.3.2 Muskingum-Cunge Routing

O1(R-O1) through O2 (R-O1.75) was routed using the Muskingum-Cunge Method. Arc-GIS and Google Street View were used to assist in estimating the characteristics of the channels mentioned for the sub-basins where Muskingum-Cunge routing was used. The slope was obtained from the T_c calculations in the section above. The length of the reaches was obtained by tracing Oyster Creek in Arc-GIS between drainage area boundaries and junctions when necessary. Manning's n values were estimated from Chow's 1959 Manning's n for channels table. The main channel appeared to be winding; was mostly clean; contained pools, and shoals; weeds, and had a very shallow slope. Manning's n values range from 0.045 to 0.055 for these types of reaches. This was more typical for the reaches R-O1 through R-O1.75. The index flows used for R-O1 through R-O1.75 were obtained from the Harris County Flood Control District's Hydrology and Hydraulics Guidance Manual – Exhibit II.3-18 – Conveyance Discharge Curve for S = 1 foot/mile (which is very similar to Brazoria Counties Drainage Criteria). The graphical interpolation for the flows is in **Appendix C.**

The other reach parameters were estimated by cutting cross-sections in GIS and by using a USGS DEM as terrain background to assist in determining the channel width and depth. Google Street View images near relevant bridge crossings were also used to develop the average cross-section for the reaches. The Index Flow parameters were set in an early version of the HMS model where interbasin flows were not included in the modeling and only the sub-basin peak flows were expected in the Muskingum-Cunge reaches. A higher index flow was tested with the values elevated to the peak flow range expected with interbasin flows included.

Those modeling results were reviewed, and a higher index flow did not affect the model results. Therefore, the index flows set in the model shown in **Appendix C** were used in the model. Ten reaches and junctions were set in this location of the model to include interbasin flows in the hydrologic model. The reason for including all the reaches and junctions was to accurately place the interbasin flows entering along Oyster Creek in the correct locations in the HEC-HMS model. The locations and reach lengths of the interbasin flows were measured in ArcGIS and placed at the centroid of the lateral flow structure as described in Section 3.2.5 Assumptions for Hydrologic and Hydraulic Models and Analysis. The parameters used the Muskingum-Cunge routing are the same between existing and proposed conditions. **Table 9** and **Table 10** are a few examples of the Muskingum-Cunge reaches found in the model with many found in the HEC-HMS model.

3.3.3 Modified Puls Reservoir Routing

Part of the Jacobs HEC-RAS model was used as a basis for Watearth's HEC-RAS model, which was used to calculate the volume of the reaches for Modified Puls reservoir routing. Jacobs created a HEC-RAS model with cross sections representing the stream restoration channel improvements. The Watearth model contained Jacobs' model cross sections and HEC-2 effective model cross sections to show the effects of the stream restoration improvements downstream of the existing Harris Reservoir. The cross sections capture the upstream end of the proposed Harris Reservoir embankment and stream restoration Project 2 and end near the Lake Jackson diversion Dow freshwater canal. Watearth chose to use the Modified Puls reservoir routing method because it provides the best method for flat watersheds, such as along the Gulf Coast of Texas, and because it uses storage volume in the routing reach data.

First, initial peak flows were obtained by extracting the peak flow results from the Lower Oyster Creek HEC-HMS model. Interbasin flows from the Oyster/Brazos river watershed were included as sources and sinks that connect to junctions going along Oyster Creek. The 50- and 100-year peak flows found in the Modified Puls reaches (RO2 through RO7) are entered into the Watearth HEC-RAS model. The flow change locations/cross-sections within the steady flow data window match up with the reaches found within the Oyster Creek HEC-HMS sub-basins. In the HEC-RAS model, River Stations 147 through 142 correspond to reach (R-O2). In the HEC-HMS model, River Stations 142 through 134 correspond to reach (R-O3), River Stations 134 through 128 correspond to reach (R-O4), River Stations 128 through 111 correspond to reach (R-O5), River Stations 111 through 102 correspond to reach (R-O6), and River Station 102 through 72 correspond to reach (R-O7).

The Harris County Flood Control District *Hydrology and Hydraulics Guidance Manual* (Harris County Flood Control District, 2009) contains a procedure to determine the Modified Puls storage-outflow relationship for each reach. The procedure was used in this analysis and is summarized in the following paragraph.

The procedure states to hold the flows constant between routing reaches which were held constant until the last cross section where the flow change occurs for the next reach downstream. The interbasin flows exiting and entering the Oyster Creek system were added to the end of the reach in order to not affect the requirement of the Modified Puls procedure of keeping the flows between reaches constant.

The initial peak flows for the Modified Puls reaches determined in the HEC-HMS model were multiplied by several factors and entered into the HEC-RAS model. A downstream boundary condition of S = 0.00006 represented the slope at the downstream boundary of the model. The average reach travel time and the average flood wave travel time are calculated according to the procedure using results generated from the HEC-RAS model. The storage/discharge data for each reach were obtained from the HEC-RAS model results for areas between the reaches. Then, using the average flood wave travel time and the HEC-HMS model time step, the number of sub-reaches was calculated for each peak flow factor and the average sub-reach was entered as a parameter in the HEC-HMS model.

The average number of subreaches and the storage discharge data for each reach were then entered into the HMS model as Modified Puls parameters. All the hydrologic parameters for each drainage area were entered in the HEC-HMS model and routed through all the reaches. Peak flows were generated for each junction/reach, which represent a drainage area boundary in the HEC-HMS model or flow change location in the HEC-RAS model.

The HEC-HMS model results yielded the 50-year and 100-year design storm peak flows for each sub-basin, which were then reinserted into the HEC-RAS model. The HEC-RAS model yielded new storage/discharge data for the reaches dependent on the new peak flows, which were then entered into HEC-HMS, which resulted in an adjusted flow value for the 100-year storm. After seven iterations of the process described above, the difference in peak flow between the reaches (R-O2 through R-O7) was less than 3% when compared to the peak flows calculated for each reach in HEC-HMS and compared to the flows entered into the HEC-RAS model. Since the peak flows are similar between the HEC-RAS and HEC-HMS models, the storage/volume relationship for each reach has been determined by using the iterative method described above. The Modified Puls parameters are shown for each of the sub-basins in **Table 9** through **Table 16** for existing conditions and proposed conditions.

Table 9: Pre-Project Muskingum-Cunge Parameters for R-O1

Basin Name: Pre_Lower_OC_1%_ExHarrisH	
Element Name: R-O1	
Initial Type	Discharge = Inflow
Length (FT)	55,782
Slope (FT/FT)	0.0006
Manning's n	0.045
Space-Time Method	Auto DX Auto DT

Basin Name: Pre_Lower_OC_1%_ExHarrisH	
Index Method	Flow
Index Flow (CFS)	3,000
Shape	Triangle
Side Slope (xH: 1V)	3
Invert (FT)	1.5

Table 10: Post Project Muskingum-Cunge Parameters for R-O1.75

Basin Name: Post_Lower_OC_1%_PropHarrisD	
Element Name: R-O1.75	
Initial Type	Discharge = Inflow
Length (FT)	5,325
Slope (FT/FT)	0.006
Manning's n	0.055
Space-Time Method	Auto DX Auto DT
Index Method	Flow
Index Flow (CFS)	8,000
Shape	Trapezoid
Bottom Width (FT)	10
Side Slope (xH: 1V)	4
Invert (FT)	1.5

Table 11: Existing Conditions and Proposed Conditions Modified Puls Parameters for R-O2

Basin Name: Pre_Lower_OC_1%_ExHarrisH		Basin Name: Post_Lower_OC_1%_PropHarrisD	
Element Name: R-O2		Element Name: R-O2	
Initial Type	Discharge = Inflow	Initial Type	Discharge = Inflow
Stor-Dis Function	100YR R-O2 PreMod.Puls R4	Stor-Dis Function	100YR R-O2 PostMod.Puls R4
Subreaches	25	Subreaches	70
Elev-Dis Function	None	Elev-Dis Function	None
Invert (FT)	-	Invert (FT)	-
Basin Name: Pre_Lower_OC_1%_ExHarrisH		Basin Name: Post_Lower_OC_1%__PropHarrisN	
Element Name: R-2		Element Name: R-2	
Storage (ac-ft)	Discharge (cfs)	Storage (ac-ft)	Discharge (CFS)
0	0	0	0
2,478	4,568	2,094	4,569
5,090	9,136	4,705	9,137
7,287	13,704	7,030	13,706
9,201	18,272	9,068	18,275
10,934	22,840	10,904	22,844
12,691	27,409	12,657	27,412
15,072	34,259	15,159	34,265

Table 12: Existing Conditions and Proposed Conditions Modified Puls Parameters for R-O3

Basin Name: Pre_Lower_OC_1%_ExHarrisH		Basin Name: Post_Lower_OC_1%_PropHarrisD	
Element Name: R-O3		Element Name: R-O3	
Initial Type	Discharge = Inflow	Initial Type	Discharge = Inflow
Stor-Dis Function	100YR R-O3 PreMod.Puls R4	Stor-Dis Function	100YR R-O3 PostMod.Puls R4
Subreaches	70	Subreaches	70
Elev-Dis Function	None	Elev-Dis Function	None
Invert (FT)	-	Invert (FT)	-
Element Name: R-O3		Element Name: R-O3	
Storage (ac-ft)	Discharge (cfs)	Storage (ac-ft)	Discharge (cfs)
0	0	0	0
5,595	4,388	6,349	4,568
14,102	8,776	15,372	9,136
22,391	13,165	23,866	13,703
29,858	17,553	30,633	18,271
35,067	21,941	35,558	22,839
39,994	26,329	40,138	27,407
48,000	32,912	48,687	34,258

Table 13: Existing Conditions and Proposed Conditions Modified Puls Parameters for R-O4

Basin Name: Pre_Lower_OC_1%_ExHarrisH		Basin Name: Post_Lower_OC_1%_PropHarrisD	
Element Name: R-O4		Element Name: R-O4	
Initial Type	Discharge = Inflow	Initial Type	Discharge = Inflow
Stor-Dis Function	100YR R-O4 PreMod.Puls R4	Stor-Dis Function	100YR R-O4 PostMod.Puls R4
Subreaches	65	Subreaches	65
Elev-Dis Function	None	Elev-Dis Function	None
Invert (FT)	-	Invert (FT)	-
Basin Name: Pre_Lower_OC_1%_ExHarrisH		**Basin Name: Post_Lower_OC_1%__PropHarrisD**	
Element Name: R-O4		**Element Name: R-O4**	
Storage (ac-ft)	**Discharge (cfs)**	**Storage (ac-ft)**	**Discharge (cfs)**
0	0	0	0
3,505	4,227	3,772	4,568
10,778	8,455	11,294	9,136
17,410	12,682	18,278	13,705
25,393	16,910	26,411	18,273
31,474	21,137	32,743	22,841
36,843	25,365	38,546	27,409
46,931	31,706	51,167	34,261

Table 14: Existing Conditions and Proposed Conditions Modified Puls Parameters for R-O5

Basin Name: Pre_Lower_OC_1%_ExHarrisH		Basin Name: Post_Lower_OC_1%_PropHarrisD	
Element Name: R-O5		Element Name: R-O5	
Initial Type	Discharge = Inflow	Initial Type	Discharge = Inflow
Stor-Dis Function	100YR R-O5 PreMod.Puls R4	Stor-Dis Function	100YR R-O5 PostMod.Puls R4
Subreaches	65	Subreaches	65
Elev-Dis Function	None	Elev-Dis Function	None
Invert (FT)	-	Invert (FT)	-
Basin Name: Pre_Lower_OC_1%_ExHarrisH		Basin Name: Post_Lower_OC_1%__PropHarrisD	
Element Name: R-O5		Element Name: R-O5	
Storage (ac-ft)	Discharge (cfs)	Storage (ac-ft)	Discharge (cfs)
0	0	0	0
3,657	4,581	3,786	4,664
12,533	9,161	12,977	9,329
21,554	13,742	22,506	13,993
32,074	18,323	33,638	18,657
42,304	22,904	44,739	23,321
52,733	27,484	56,574	27,986
70,984	34,355	77,868	34,982

Table 15: Existing Conditions and Proposed Conditions Modified Puls Parameters for R-O6

Basin Name: Pre_Lower_OC_1%_ExHarrisH		Basin Name: Post_Lower_OC_1%_PropHarrisD	
Element Name: R-O6		Element Name: R-O6	
Initial Type	Discharge = Inflow	Initial Type	Discharge = Inflow
Stor-Dis Function	100YR R-O6 PreMod.Puls R4	Stor-Dis Function	100YR R-O6 PostMod.Puls R4
Subreaches	33	Subreaches	33
Elev-Dis Function	None	Elev-Dis Function	None
Invert (FT)	-	Invert (FT)	-
Basin Name: Pre_Lower_OC_1%_ExHarrisH		Basin Name: Post_Lower_OC_1%__PropHarrisD	
Element Name: R-O6		Element Name: R-O6	
Storage (ac-ft)	Discharge (cfs)	Storage (ac-ft)	Discharge (cfs)
0	0	0	0
780	4,932	818	5,078
3,524	9,863	4,384	10,157
11,191	14,795	12,880	15,235
19,099	19,727	21,352	20,313
26,787	24,659	29,629	25,392
34,301	29,590	37,663	30,470
45,184	36,988	49,219	38,088

Table 16: Existing Conditions and Proposed Conditions Modified Puls Parameters for R-O7

Basin Name: Pre_Lower_OC_1%_ExHarrisH		Basin Name: Post_Lower_OC_1%_PropHarrisD	
Element Name: R-O7		Element Name: R-O7	
Initial Type	Discharge = Inflow	Initial Type	Discharge = Inflow
Stor-Dis Function	100YR R-O7 PreMod.Puls R4	Stor-Dis Function	100YR R-O7 PostMod.Puls R4
Subreaches	30	Subreaches	30
Elev-Dis Function	None	Elev-Dis Function	None
Invert (FT)	-	Invert (FT)	-
Basin Name: Pre_Lower_OC_1%_ExHarrisH		Basin Name: Post_Lower_OC_1%__PropHarrisD	
Element Name: R-O7		Element Name: R-O7	
Storage (ac-ft)	Discharge (cfs)	Storage (ac-ft)	Discharge (cfs)
0	0	0	0
1,903	2,876	2,088	3,100
3,524	5,752	3,762	6,200
5,201	8,628	5,727	9,299
7,537	11,503	8,255	12,399
9,785	14,379	10,617	15,499
11,877	17,255	12,807	18,599
14,775	21,569	15,834	23,248

3.4 Hydraulic Methodology

The Oyster Creek FEMA effective model consisted of HEC-2 cross section data, which were imported into HEC RAS 5.0.7 along with the Jacobs model cross sections. A steady flow model was created for the affected reaches of Oyster Creek (FEMA, 1992). A QA/QC check was performed on the model and errors corrected accordingly as noted below in Section 3.4.1 Existing Model QA/QC Check. Further, in HEC-RAS version 5.0.7, a steady flow model was used to perform a floodplain storage analysis for Oyster Creek using the Modified Puls Routing Method (described above). All elevations presented in this report are based on the Tropical Storm Allison Recovery Project (TSARP) datum (NAVD88, 2001 adj.)

The HEC-RAS model upstream extent is just upstream of a bridge along Farm to Market (FM) Road 655 (Jacobs cross section 60.49/Watearth cross section 147) with a downstream extent at approximately 8,000 ft downstream of FM Road 2004 (Watearth cross section 65) as shown below in **Figure 18** and **Figure 19**. The modeling end point is at the Lake Jackson diversion Dow freshwater canal (Watearth cross section 72).

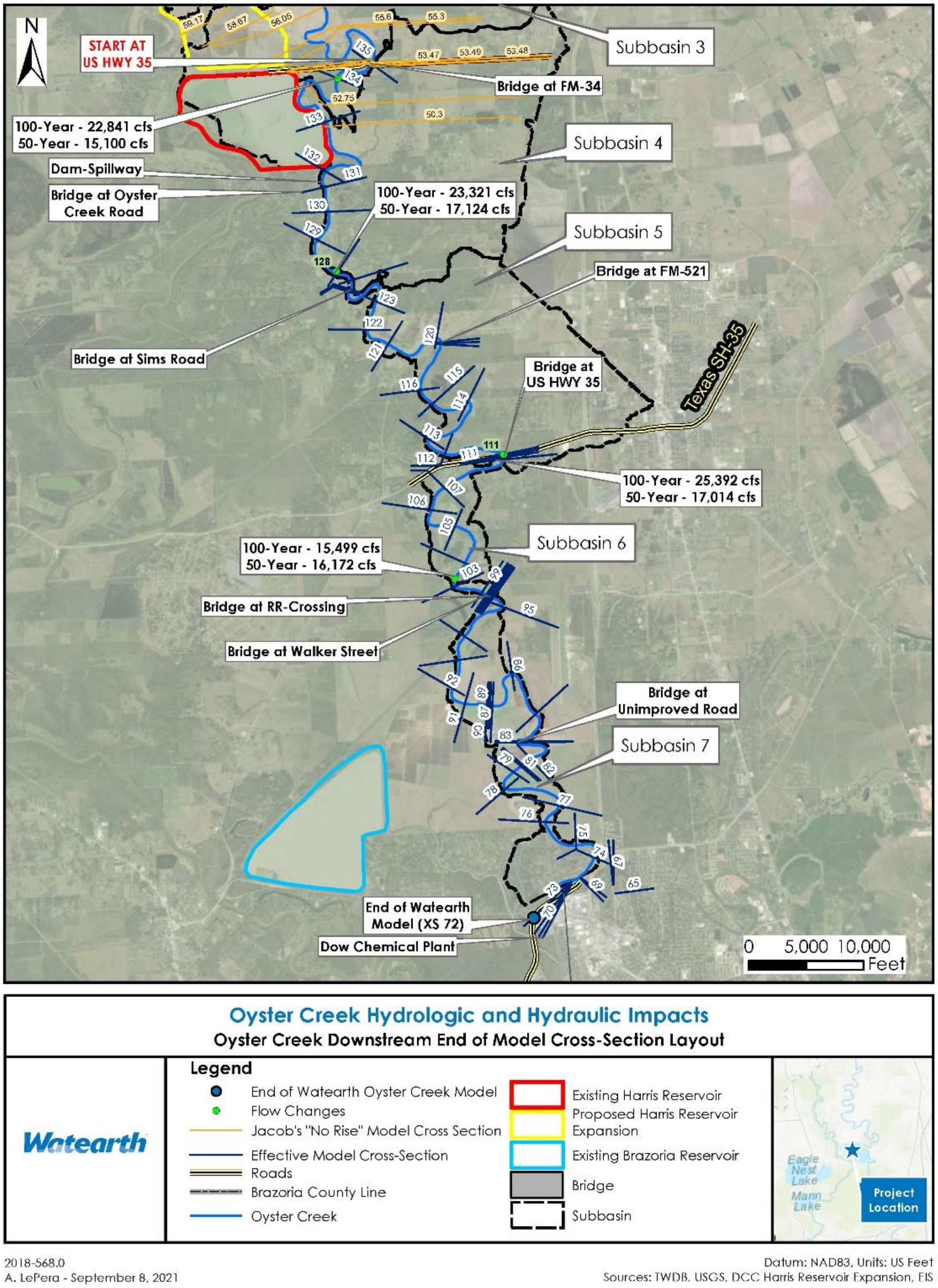


***Figure 18**: HEC-RAS model boundaries for Oyster Creek Including cross sections.*

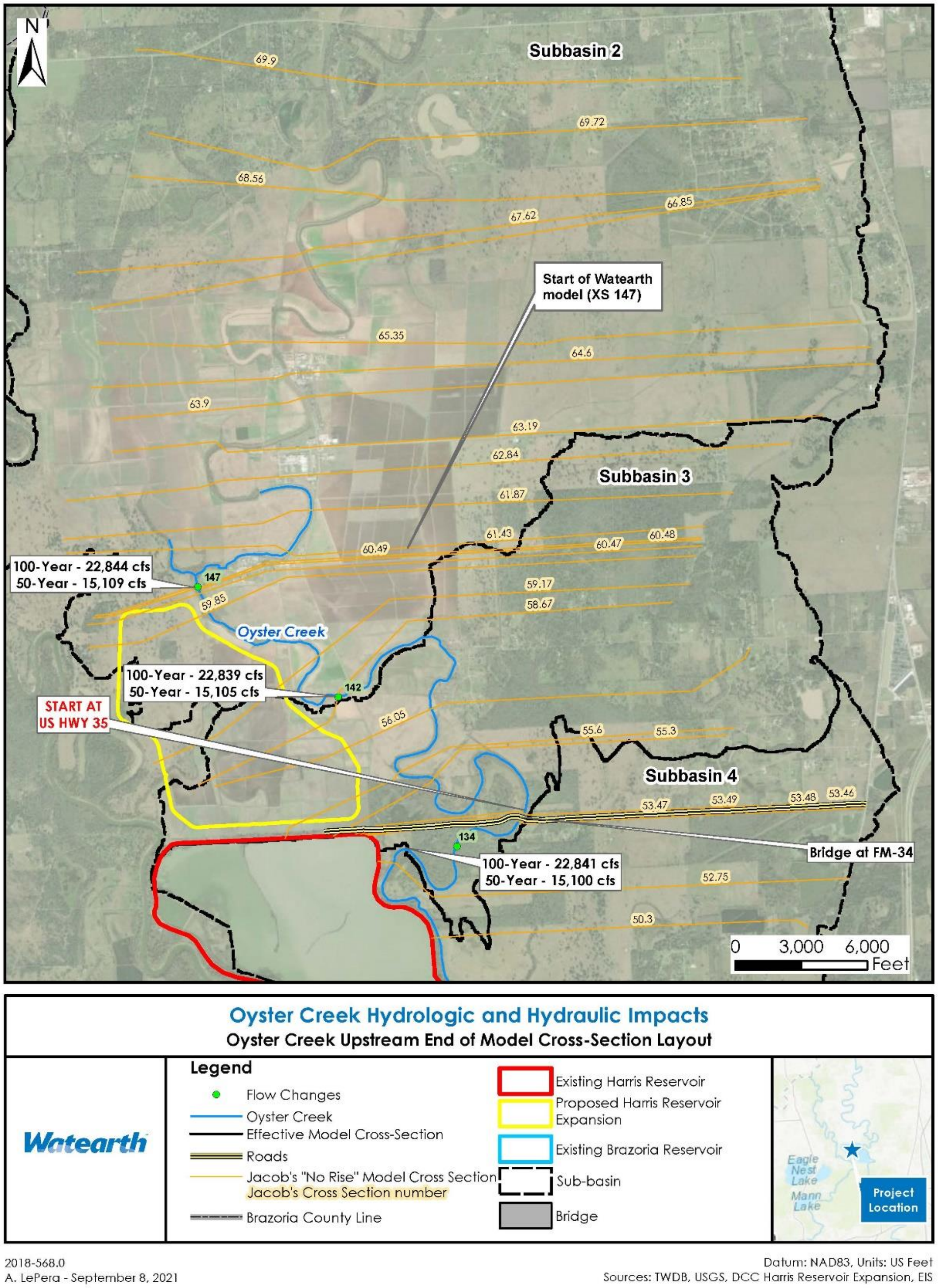


Figure 19: HEC-RAS model boundaries for Oyster Creek Including cross sections.

3.4.1 Existing Model QA/QC Check

The conversion of the HEC-2 model to run in the HEC-RAS software often results in errors that require correction. The most common errors were "No upstream or downstream cross sections" bridges. A review showed that several bridge decks were not attached to the piers within the model. To resolve this error, the bridge decks were deleted, re-input with upper and lower chords, and reattached to the piers. There were duplicate points in the cross sections, which were deleted to remove errors. There was one bottom-of-channel elevation input error that resulted in the channel being significantly below other data points. This data point was also corrected. All corrections made ensured model stability and accuracy. The following is the list of errors in the model and the corrections made, including a list of the cross sections and points.

Duplicate Points – Deleted duplicate points

1. CS: 178 At point(s): 35
2. CS: 173 At point(s): 33, 38
3. CS: 172 At point(s): 29, 34
4. CS: 171 At point(s): 25, 30
5. CS: 170 At point(s): 40, 45
6. CS: 169 At point(s): 30, 35
7. CS: 162 At point(s): 37, 43
8. CS: 157 At point(s): 5, 41, 46
9. CS: 155 At point(s): 33, 39
10. CS: 154 At point(s): 33, 38
11. CS: 153 At point(s): 29, 34
12. CS: 152 At point(s): 29, 34
13. CS: 151 At point(s): 33, 38
14. CS: 145 At point(s): 31
15. CS: 139 At point(s): 33
16. CS: 138 At point(s): 7, 10, 14, 16, 21
17. CS: 127 At point(s): 5
18. CS: 125 At point(s): 5

Bridge and/or crossing that had upstream distance of zero. The bridge was shortened by 2 feet, and then 1 foot was added to the upstream distance.

1. CS: 164.5
2. CS: 159.5
3. CS: 136.5
4. CS: 125.5
5. CS: 118.5
6. CS: 109.5
7. CS: 100.5
8. CS: 88.5
9. CS: 81.5
10. CS: 71.5
11. CS: 67.5
12. CS: 62.5
13. CS: 56.5
14. CS: 52.5
15. CS: 49.5
16. CS: 45.5
17. CS: 38.5
18. CS: 32.5
19. CS: 28.5
20. CS: 20.5
21. CS: 16.5
22. CS: 6.5

Bridge and/or crossing did not contain an opening on the upstream and/or downstream side. The bridge deck was moved to be over the stream opening. This assumed a 10-foot deck thickness.

1. CS: 136.5
2. CS: 125.5
3. CS: 118.5
4. CS: 109.5

Additional items modified (see notes below).

1. CS: 177 - Updated top of left bank
2. CS: 176 - Updated top of left bank
3. CS: 174 - Updated top of left and right bank
4. CS: 172 - Corrected Section 172 for low creek elevation point. See **Figure 20** below.

Appendix D illustrates the locations of effective cross-sections in the model, including the cross sections identified above with errors.

3.5 Methodology for BASINS/HSPF Modeling

HSPF model version 3.1 is used to examine the impact of the proposed Harris Reservoir during drought conditions. HSPF is a plug-in watershed quality model within the BASINS framework. BASINS version 4.5 is used to create the HSPF model. Oyster Creek is located within the Austin-Oyster watershed (HUC 12040205). The NHD, North American Land Data Assimilation System (NLDAS) land use data set, USGS gages, and meteorological data were downloaded for the selected HUC8 watershed using BASINS framework. To keep consistency between all modeling studies, the same watershed delineations used in HMS models were used in the BASINS model framework. **Figure 20** shows the four sub-basins in Oyster Creek. The shapefile for the same four sub-basins was imported into the BASINS model to create the background information for the HSPF model. **Figure 20** shows the watershed delineation used in the BASINS model. It must be noted that the model boundaries for the BASINS/HSPF models are slightly different than the HEC-HMS and HEC-RAS models. The downstream boundary ends sooner for the BASINS model. The upstream boundary is Reach 1 (R-O1 in the HMS model), which is the same in other models, but the downstream boundary is Reach 4 (R-O4), which ends at the downstream drainage basin boundary south of the existing Harris Reservoir.

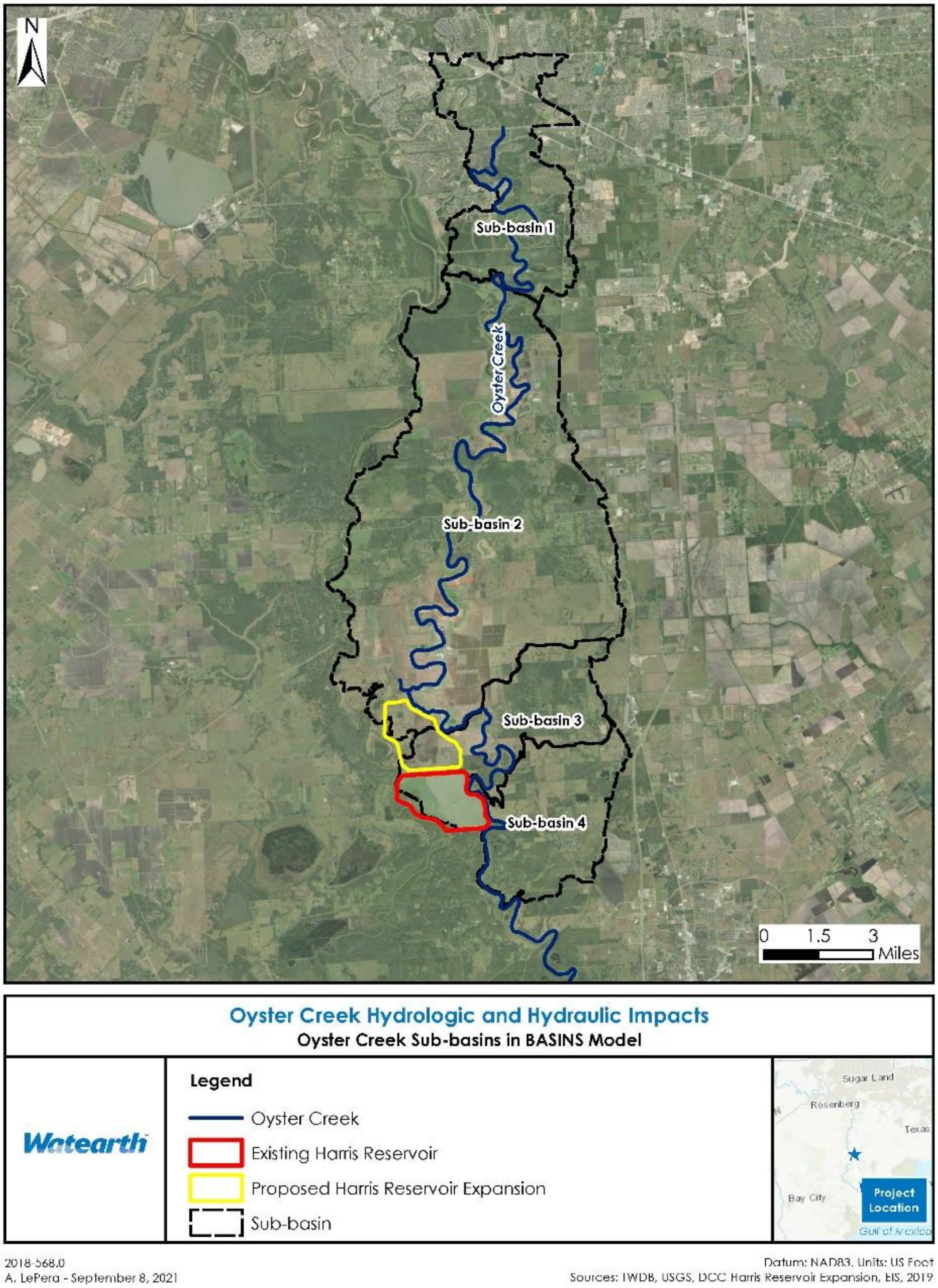
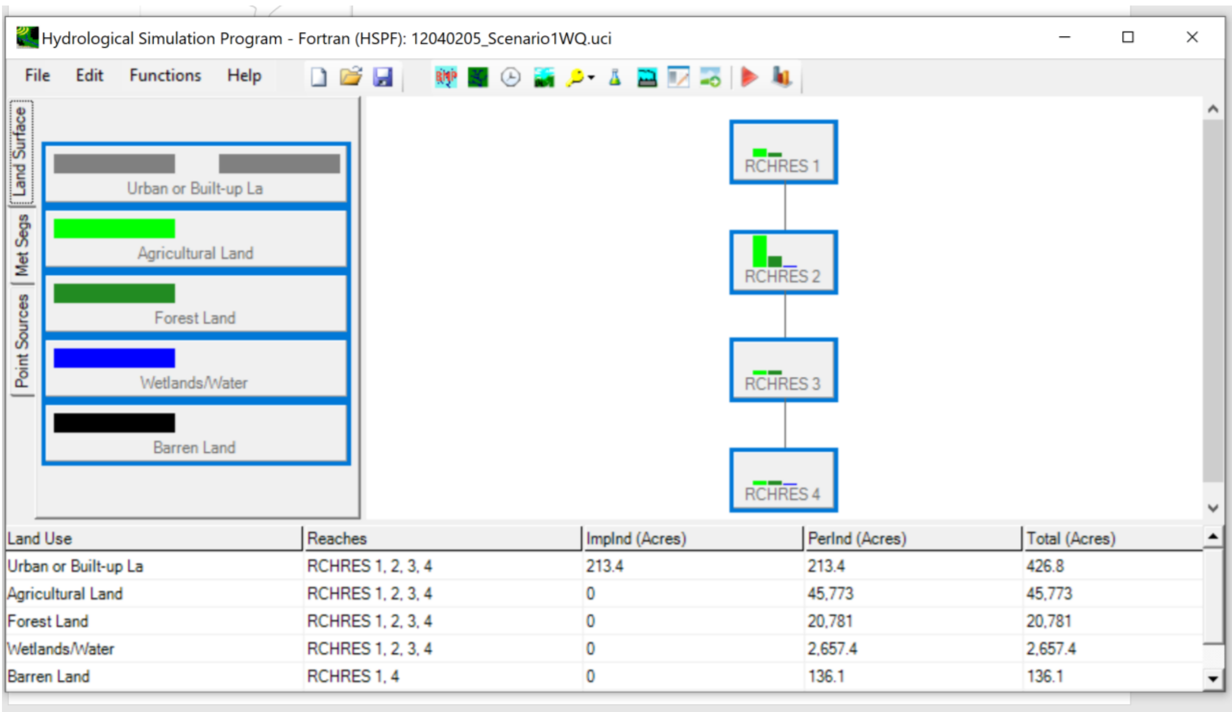


Figure 20: *Oyster Creek sub-basins in BASINS model.*

There are four sub-basins and four stream reaches in the Oyster Creek BASINS and HSPF models. HSPF treats the whole watershed as three components: pervious land, impervious land, and waterbodies (reaches and reservoirs). It has algorithms to calculate runoff from both pervious and impervious land, as well as one-directional water flow in streams. It uses water budget calculations to account for precipitation, evapotranspiration, infiltration, and runoff.

Land use information for both pervious and impervious land was downloaded within the BASINS framework. There are five land uses defined in the study area: urban (also called the build-up land in BASINS), agricultural land, forest land, wetlands/water, and barren land. The HSPF model uses different algorithms when calculating overland flow for each type of land use. **Figure 21** shows the land use information in the HSPF model for the four sub-basins of Oyster Creek.



Land Use	Reaches	ImpInd (Acres)	PerInd (Acres)	Total (Acres)
Urban or Built-up La	RCHRES 1, 2, 3, 4	213.4	213.4	426.8
Agricultural Land	RCHRES 1, 2, 3, 4	0	45,773	45,773
Forest Land	RCHRES 1, 2, 3, 4	0	20,781	20,781
Wetlands/Water	RCHRES 1, 2, 3, 4	0	2,657.4	2,657.4
Barren Land	RCHRES 1, 4	0	136.1	136.1

Figure 21: *The four sub-basins and five types of land use information in HPSF model.*

Data from the closest meteorological station to the study area, TX 418996, were downloaded. TX 418996 station has timeseries data for the duration of May 1, 1957, to March 31, 2006. The scenarios to be modeled required dry conditions where there was no precipitation at all. A dummy gage was created with no rain data but has air temperature and potential evaporation from meteorological gage TX 418996. However, this meteorological station did not record the parameters required to model heat exchange to obtain water temperature results such as solar radiation, cloud cover, dew point temperature, and wind speed. Another meteorological station, TX 722527, recorded all those parameters, so these parameters were imported into the same dummy gage, as well. **Appendix E** has the values used for the heat exchange calculations from station TX 722527. The locations of both meteorological stations are shown in **Figure 22** below.

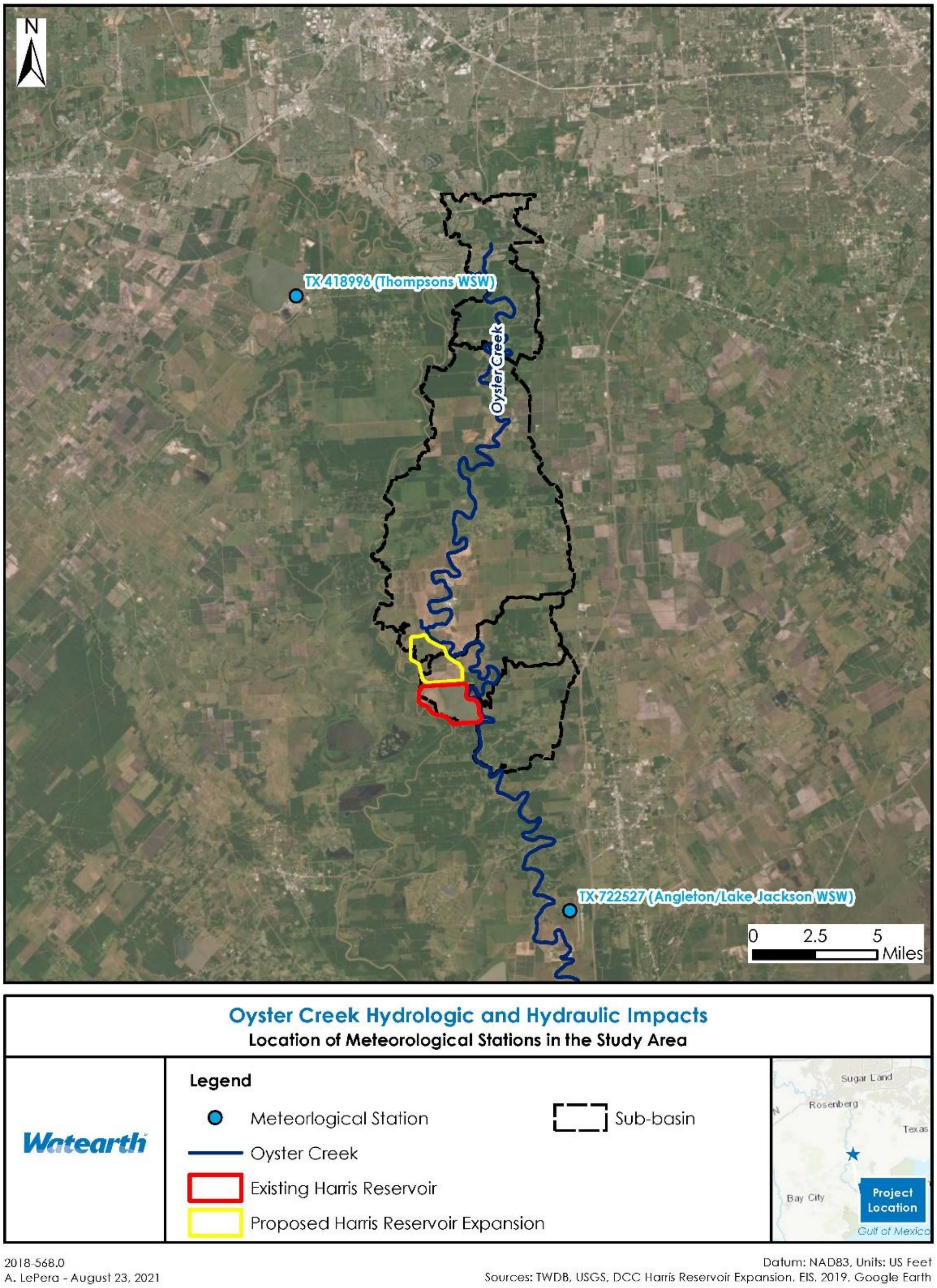


Figure 22: *Location of meteorological stations in the study area.*

Using HSPF, existing conditions without the proposed Harris Reservoir and proposed conditions (with the proposed Harris Reservoir) were compared under dry conditions. Four scenarios were modeled with the proposed conditions. These four scenarios were run continously for 180 days of simulation with no precipitation (total drought conditions). The four scenarios are:

1. Scenario 1: 334 cfs constant discharge for 180 days with no rain
2. Scenario 2: 216 cfs constant dischrage for 180 days with no rain
3. Scenario 3: 133 cfs constant discharge for 180 days with no rain
4. Scenario 4: 22 cfs constant discharge for 180 days with no rain

All these outflows from the proposed Harris Reservoir enter Oyster Creek in Sub-basin 3, which is downstream of the proposed reservoir.

As there was no precipitation during the simulation period, a baseflow was added to Oyster Creek to keep the model stable. USGS Gage 0807900 – Oyster Creek near Angleton shows discharge data for Oyster Creek. After a thorough examination of the discharge at this gage, a constant flow of 2 cfs was used as an upstream boundary condition in the model. The historical flowrates in Oyster Creek from USGS Gage 0807900 are in **Appendix F**. Both the 2 cfs baseflow and the outflows from the proposed reservoir were entered as external point sources into the HSPF model.

The areas of each sub-basin, flow lengths, Manning's n values, overland slope, and the length of each reach were calculated by BASINS framework and used in HSPF model. These values are given in **Table 17** below. The land use information created through BASINS and used in the HSPF model are given in **Table 18** below.

Table 17: Parameters Used in HSPF Model

Sub-basin Name	Area of Basin (Acres)	Overland Slope (ft/ft)	Length of Reach (mi)	Reach Slope (ft/ft)	Manning's N in Reach
Sub-basin-1	11,347.1	0.1899	10.54	0.00000329	0.04
Sub-basin-2	40,878.6	0.0957	27.34	0.0001566	0.04
Sub-basin-3	7,577.35	0.0892	5.55	0.00031	0.05
Sub-basin-4	10,009.7	0.0923	4.45	0.0004	0.05

Table 18: Land Use Areas in Sub-basins Used in HSPF Model

Sub-basin Name	Impervious Land (ac)	Pervious Land – Urban (ac)	Pervious Land – Agricultural (ac)	Pervious Land – Forest (ac)	Pervious Land – Wetland (ac)	Pervious Land – Barren (ac)
Sub-basin-1	0	0	7,714.2	3,416	156.9	62.2
Sub-basin-2	53.4	53.4	30,073.2	9,980.5	722	-
Sub-basin-3	14.3	14.3	3,851.7	3,636.4	54.9	-
Sub-basin-4	145.7	145.7	4,134.3	3,747.6	1,723.6	73.9

The model uses monthly average evapotranspiration values for the water budget calculations. The EPA Stormwater Calculator was used to get the evapotranspiration values; these values are shown in **Table 19**. The evaporation data downloaded from the EPA Stormwater Calculator are located in **Appendix G**. A constant value for monthly interception value of 0.1 was used for both the existing and the proposed models.

Table 19: Monthly Average Evapotranspiration Values

Month	Evapotranspiration (in)
January	0.12
February	0.15
March	0.23
April	0.27
May	0.30
June	0.33
July	0.33
August	0.32
September	0.26
October	0.21
November	0.19
December	0.12

HSPF calculates the flowrate in streams based on some depth-area-volume-discharge relationships called FTables. HSPF calculates those automatically using BASINS land use information. BASINS created some FTables using GIS-based land information when the HSPF model was created. The FTables generated by the BASINS model were less accurate than the data obtained in the latest survey transects. Therefore, the FTables were updated using the latest survey transects. Transect 1 was used to determine the FTable for Reach 1. Transect 1 is far away from Reach 1 but was used because it was the most accurate representation of an upstream reach currently available. Transects 2 and 3 were averaged to determine the FTable for Reach 2. Transects 2 and 3 fall within Reach 2 boundaries. Transects 4, 5, and 6 were averaged and then used to determine the FTable for Reach 3. Transects 4, 5, and 6 are with the Reach 3 boundary. Lastly, Transects 8, 9, and 10 were averaged and then used to determine the FTable for Reach 4. Transects 8, 9, and 10 fall within the Reach 4 boundaries. These transects are located in **Figure 23**. The updated FTables for each reach are given in **Table 20** through **Table 23.**

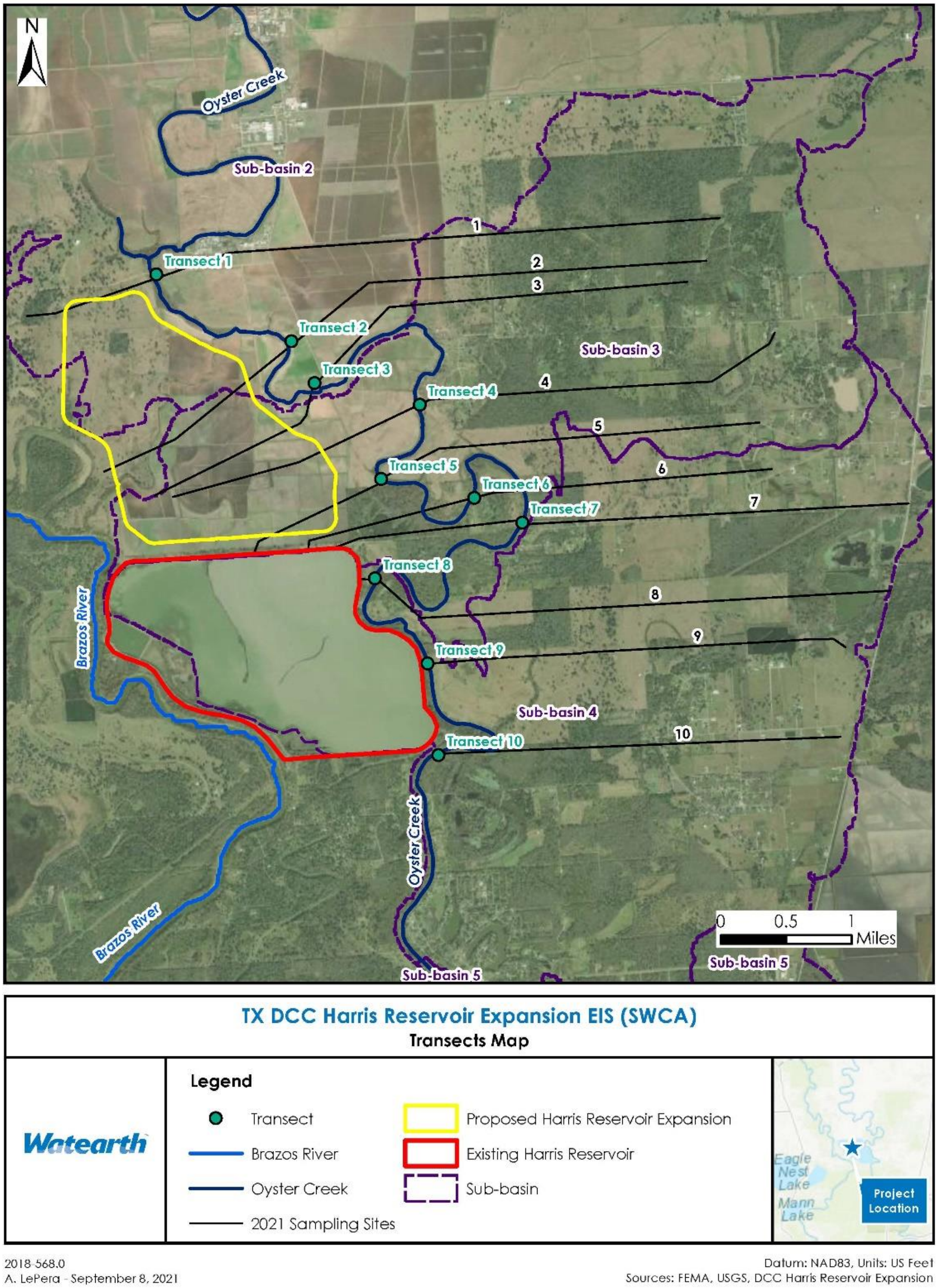


Figure 23: *Surveyed transects along Oyster Creek.*

Table 20: FTable for Reach 1 in Oyster Creek

Depth (ft)	Area (ac)	Volume (ac-ft)	Outflow (cfs)
0.5	44.5	57	30
2	178	22	120
4	408	521	301
6	675	862	532
8	974	1,244	809
10	1304	1,666	1,133
12	1714	2,190	1,583
14	2205	2,817	2,173
16	2836	3,623	3,024
30	7253	9,266	9,513
50	13563	17,328	19,207

Table 21: FTable for Reach 2 in Oyster Creek

Depth (ft)	Area (ac)	Volume (ac-ft)	Outflow (cfs)
0.5	5.8	19	7
2	23	76	27
4	68	225	105
6	157	520	323
8	307	1,017	814
10	556	1,843	1,888
12	994	3,294	4,402
14	1634	5,415	9,096
14.9	1995	6,611	12,170

Depth (ft)	Area (ac)	Volume (ac-ft)	Outflow (cfs)
15.7	2392	7,927	15,904
30	9,488.4	31,444	102,660
50	19,413.4	64,335	240,815

Table 22: FTable for Reach 3 in Oyster Creek

Depth (ft)	Area (ac)	Volume (ac-ft)	Outflow (cfs)
0.5	8.1	5	14
2	32.3	22	54
4	88	59	181
6	164.7	111	393
8	300	202	882
10	563.3	379	2,172
12	1,048	705	5,412
14	1,639.7	1,103	10,297
16	2,291.7	1,542	16,458
17.6	2,473	1,664	17,535
18	3,248	2,185	27,209
18.3	4,805	3,233	51,688
30	65,528	44,083	2,893,995
50	169,328	113,912	10,017,709

Table 23: FTable for Reach 4 in Oyster Creek

Depth (ft)	Area (ac)	Volume (ac-ft)	Outflow (cfs)
0.5	11.8	6	29
2	47.3	6	116
4	132	71	404
6	234.3	126	801
8	364	196	1,378
10	531.67	287	2,233
12	743	401	3,455
14	1,009.3	544	5,194
16	1,345.7	726	7,674
18	1,739.3	938	10,881
20	2,184.7	1,178	14,831
22	2,702.7	1,458	19,842
24	3,454.3	1,863	28,184
26	4,630	2,497	43,537
28	5,727.5	3,089	59,071
30	7,876	4,248	95,933
32	9,126	4,923	117,464
34	10,391	5,605	140,060
35.1	11,195	6,039	155,253
50	22,085.6	11,913	380,544

After the hydrology calculations were completed successfully, sediment erosion calculations were added. As in water budget calculations, HSPF again uses three separate algorithms to calculate sediment erosion and transportation for pervious land, impervious land, and water bodies. On pervious and impervious land, sediment particles get detached from the soil matrix during rainfall events and carried with surface runoff whereas in reaches, sediment is transported with the bulk movement of water in the stream (Briknell et al., 2001).

The sediment particles are modeled in three categories: sand, silt, and clay. A power function is used for sediment transport. The coefficient of the power function is 0.1 and the exponent of the power function is 2 (Briknell et al., 2001). Other parameters required for sediment transport are the physical properties of sand, silt, and clay, which are found in literature (Donigian and Crawford, 1976). Other parameters are TAUCD (critical bed shear stress for deposition) and TAUCS (critical bed shear stress for scour), which determine above which no deposition occurs and below which no scour occurs, respectively. **Table 24** below is a summary of the parameters used for sediment transport in the model.

Table 24: Sediment Physical Properties

Parameter	Sand	Silt	Clay
Diameter (in)	0.005	0.0004	0.0001
Fall velocity in still water (in/sec)	0.02	0.0003	0.00001
Density (gm/cm^3)	2.5	2.2	2.0
TAUCD (lb/ft^2) Critical bed shear stress for deposition	0.1	0.1	0.1
TAUCS (lb/ft^2) Critical bed shear stress for scour	0.3	0.3	0.3

After the sediment erosion/transportation portion of the modeling was successfully conducted, heat exchange calculations were completed to account for the effects of the proposed reservoir on the water temperature within Oyster Creek downstream of the outflows from the proposed reservoir. The results of the HSPF model and their potential implications are discussed in Section 5.3.

4.0 Analysis of Potential Impacts

Hydrologic, hydraulic, and environmental water quality analyses for Oyster Creek were conducted using three modeling software programs: HEC-HMS, HEC-RAS, and EPA-BASIN/HSPF. The results for the different models are presented in this section of the report and shown in various tables and graphs.

4.1 Analysis of Modeling Results

Modeling of Oyster Creek includes HEC-HMS for hydrology and HEC-RAS for hydrologic flow routing (Modified Puls Method) to determine peak flows downstream of the proposed Harris Reservoir. The HEC-HMS hydrology model computes peak flows. The HEC-RAS steady state model (Watearth model) routes the peak flows determined by the HEC-HMS model through the reaches set in the hydrologic model. The BASINS model was used to determine sediment transport and possible hydromodification of the proposed Harris Reservoir stepped spillway flows during drought conditions in the area between the proposed and existing Harris Reservoirs. The HEC-HMS hydrology model assessed peak flows. The upstream boundary includes the entire Oyster Creek watershed (headwaters). The downstream boundary was the Dow freshwater canal near Lake Jackson. The proposed site conditions included the stream restoration projects (revised Projects 1, 2, and 3 revised in May 2020) and the floodplain storage volume displacement by the proposed Harris Reservoir expansion.

Watearth modeled 10 scenarios in HEC-HMS to determine peak flows in Oyster Creek and quantify potential impacts. The HEC-HMS hydrology model contained 10 models which incorporated the current elevation-storage and operational data of the proposed Harris Reservoir. The proposed conditions modeling consisted of eight proposed conditions models: six proposed conditions models with drawdown containing different volumes of floodplain storage and two proposed conditions models without drawdown. The existing condition modeling consisted of two models.

The proposed conditions 50-year and 100-year events reservoir models both included 18 inches of drawdown. All models had a starting water surface elevation of 68 ft, which was drawn down at a flow rate of 978 cfs to an elevation of 66.5 ft, 6 hours prior to the design storm event's arrival. After the design storm arrives, the discharges were held in the reservoir to simulate 6 inches of floodplain storage volume before spillway discharges occur. The 9-inch and 12-inch floodplain storage volume scenarios were modeled for the 50-year and 100-year drawdown events, as well, to determine whether impacts were minimized with a higher floodplain storage volume retained prior to spillway discharge.

A no-drawdown scenario was developed for the 50-year and 100-year proposed conditions design storm events. The starting water surface elevation for the no-drawdown scenarios was 68 ft, and after the design storm rainfall event, it was concluded that the proposed Harris Reservoir rose to a water surface elevation of 69.1 ft (100-year rainfall event) and 68.9 ft (50-year rainfall event), which is lower than the proposed reservoir's nominal crest of 72.7 ft.

The Jacobs HEC-RAS hydraulic model assessed the 50-year and 100-year design storm WSEL changes downstream of the proposed Harris Reservoir. The upstream boundary starts 6.5 miles upstream of the town of Otey, Texas, and the downstream boundary ends approximately 1.0 mile upstream of the existing Harris Reservoir spillway channel at Oyster Creek. The model includes the stream restoration projects (revised Projects 1, 2, and 3) and the floodplain storage volume displacement by the proposed Harris Reservoir expansion.

The Modified Puls Reservoir Routing Method was used as the hydrologic routing method for critical downstream reaches in HEC-HMS and is a commonly used method for flat watersheds within the Gulf Coast.

BASINS and HSPF models together were used to examine the sediment erosion in Oyster Creek during drought conditions with and without the proposed Harris Reservoir. Four different constant outflows from the proposed Harris Reservoir were modeled and compared with the existing conditions, where there is no reservoir outflow into Oyster Creek. The modeled four scenarios represent Lake Jackson pump station capacity, normal river use, 180 days drawdown, and Dow's environmental flows. All models were run for 180 days with no precipitation (total drought). The same models were also used to model the water temperature in the Oyster Creek.

4.1.2 Peak Flows

Peak flows were calculated using HEC-HMS. HEC-HMS and HEC-RAS models were used in an iterative analysis to determine the peak flows for the modeled reaches. HEC-RAS was also used to determine the hydrologic routing for each reach (see next section). The peak flow for reach R-O1 was dependent on the flow incoming from the upstream watershed in Fort Bend County and the flows arriving from sub-basin O-1. The peak flows downstream of O-1 were subject to interbasin flows entering Oyster Creek, as well as flows arriving from the Lower Oyster Creek watershed sub-basins and flows entering Oyster Creek from the existing and proposed reservoirs that are located along Oyster Creek. The interbasin flows are the primary reason for the peak flows that elevate drastically between reach R-O1 and R-O2 and stay elevated until the lower portion of reach R-O7 where the interbasin flow stops. The Lower Oyster Creek model includes the interbasin flows that overflow from the Brazos River in the 50-year and 100-year events. **Table 25** and **Table 26** provide the results for the 50-year and 100-year existing peak flows. The purpose of the iterations was to converge on a peak flow using the HEC-HMS and HEC-RAS models for the existing and proposed conditions for the 50-year and 100-year design storm. This was achieved when the percent difference, as shown in **Table 27** through **Table 29**, was less than 5% between both models.

Table 25: Peak Flow Results for Existing Conditions (50-year event) HEC-HMS Reaches

Existing Conditions 50-year Event	HMS MODEL	RAS MODEL	Percent Difference (%)
Hydrologic Element	Peak Flow (cfs)		
R-O1	1,818	N/A	N/A
R-O2	15,109	15,109	0.00%
R-O3	15,003	15,003	0.00%
R-O4	14,588	14,588	0.00%
R-O5	16,029	16,024	0.00%
R-O6	17,027	16,909	0.70%
R-O7	13,732	14,026	2.10%

Table 26: Peak Flow Results for Existing Conditions (100-year event) HEC-HMS Reaches

Existing Conditions 100-year Event	HMS MODEL	RAS MODEL	Percent Difference (%)
Hydrologic Element	Peak Flow (cfs)		
R-O1	1,888	N/A	N/A
R-O2	22,844	22,839	0.02%
R-O3	21,970	21,941	0.13%
R-O4	21,183	21,137	0.22%
R-O5	23,184	22,904	1.22%
R-O6	25,364	24,659	2.82%
R-O7	14,277	14,379	0.71%

The existing model was modified to develop the proposed condition HEC-HMS model. The proposed conditions HEC-HMS model simulates the effect of interbasin flows becoming obstructed by the proposed reservoir embankment, and this effect results in interbasin flows being shifted farther downstream. The interbasin flows from the Brazos River enter downstream of the existing Harris Reservoir where the flows are unobstructed. This effect was modeled in HEC-HMS by moving the hydrograph connection downstream of the original entrance locations where the proposed Harris Reservoir expansion would be constructed and shifting the hydrograph connection downstream of the existing Harris Reservoir where the obstructed flows can enter the Oyster Creek watershed freely.

In the existing conditions model, interbasin source nodes B11 and B12 were added to the model linked to Junction J-O2 and J-O3 to represent flows entering Oyster Creek from the Brazos River at the locations where the proposed Harris Reservoir expansion would be constructed. In that same area, flows exit Oyster Creek and return to the Brazos River which is represented in interbasin sink flows B13 and B14. The location of interbasin flows is shown in **Figure 24.**

In the proposed conditions model, the interbasin flow hydrographs B11 through B14 were summed up and added to the flows entering Oyster Creek as interbasin B5 (or Junction J-O4). This represents the flow being obstructed by the proposed Harris Reservoir embankment and results in the flow being shifted downstream entering Oyster Creek where the flows are unobstructed by the floodplain's topography.

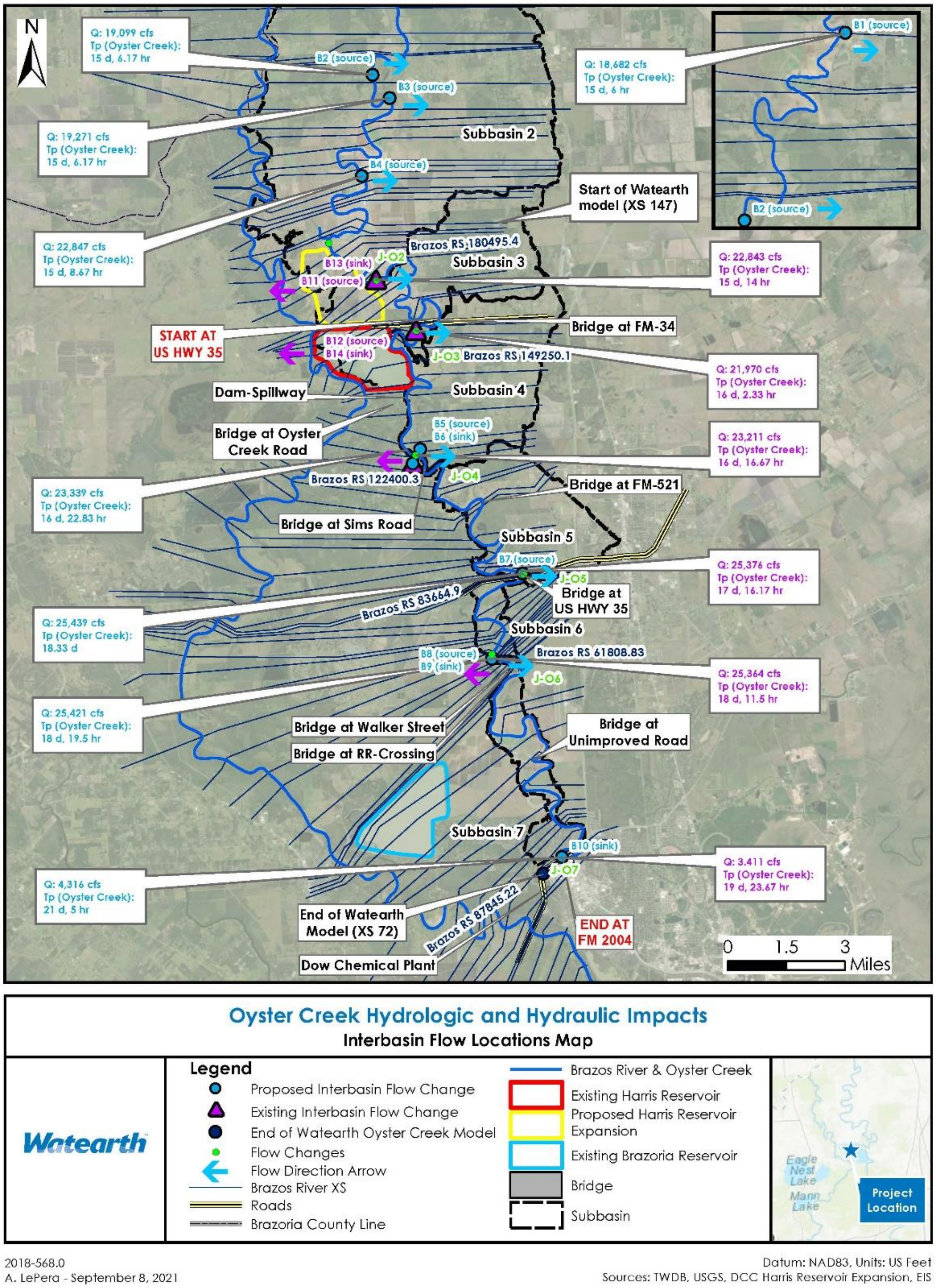


Figure 24: *Interbasin flow location map.*

Table 27: Peak Flow Results for Proposed Conditions (50-year event) HEC-HMS Reaches

Proposed Conditions 100-year Event	HMS MODEL	RAS MODEL	Percent Difference (%)
Hydrologic Element	Peak Flow (cfs)		
R-O1	1,818	N/A	N/A
R-O2	15,109	15,109	0.00%
R-O3	15,102	15,105	0.02%
R-O4	15,100	15,100	0.00%
R-O5	17,213	17,124	0.52%
R-O6	17,223	17,014	1.22%
R-O7	16,180	16,172	0.05%

Table 28: Peak Flow Results for Proposed Conditions (100-year event) HEC-HMS Reaches

Proposed Conditions 100-year Event	HMS MODEL	RAS MODEL	Percent Difference (%)
Hydrologic Element	Peak Flow (cfs)		
R-O1	1,888	N/A	N/A
R-O2	22,844	22,844	0.00%
R-O3	22,839	22,839	0.00%
R-O4	22,841	22,841	0.00%
R-O5	23,318	23,321	0.01%
R-O6	25,422	25,392	0.23%
R-O7	15,198	15,499	1.96%

For the proposed project conditions, the loss of floodplain storage was subtracted from Reaches R-O2 and R-O3 (within the Modified Puls model parameters) in order to display modeled results that factored the loss of floodplain storage within the HMS models. Reaches R-O2 and R-O3 were selected because the proposed Harris Reservoir expansion and the channel improvements occur within that sub-basin/reach location. The loss of floodplain storage was subtracted from the 60% of 100-year event in the storage volume/storage flow data within the Modified Puls Method level and above. This methodology was used because the 50-year event in the Jacobs model is visually where the loss in floodplain storage occurs, and the 50-year flow is 67% of the 100-year flow. This occurs for Jacobs' cross sections 60.49 (Watearth Model RS 147) through 55.3 (Watearth Model RS 134) and provide the results of subtraction of the floodplain storage in Reaches R-O2 and R-O3.

Table 29: Peak Flow Comparison Results Between Existing and Proposed Conditions for the 50-Year and 100-Year Design Storm Events Located in the HEC-HMS Model Reaches

Hydrologic Element	50-Year 24-Hour Storm			100-Year 24-Hour Storm		
	Existing Conditions	Proposed Conditions	Δ (Proposed – Existing Conditions)	Existing Conditions	Proposed Conditions	Δ (Proposed – Existing Conditions)
	Peak Flow (cfs)			Peak Flow (cfs)		
R-O1	1,818	1,818	0	1,888	1,888	0
R-O2	15,109	15,109	0	22,844	22,844	0
R-O3	15,003	15,102	+99	21,970	22,839	+869
R-O4	14,588	15,100	+512	21,183	22,841	+1,658
R-O5	16,029	17,213	+1,184	23,184	23,318	+134
R-O6	17,027	17,223	+196	25,364	25,422	+58
R-O7	13,732	16,180	+2,448	14,277	15,198	+921

In a previous version of this report, the maximum proposed conditions peak flow for the 100-year design storm event was reported to be 6,883 cfs occurring in Junction J-O1.75. The previous report showed proposed conditions with stream restoration improvements and proposed conditions without stream restoration improvements. The stream restoration improvements approximately decreased the peak flow by 52 cfs in comparison to the proposed conditions without the stream restoration improvements between J-03 and J-O4. The previous model and analysis were simpler than the current analysis. The existing and proposed Harris Reservoirs were not modeled in the previous version of the model. This analysis only included the flows being introduced to Oyster Creek from the sub-basins in the watershed.

In this report, interbasin flows were included in the analysis and the existing and proposed reservoirs were modeled, which greatly increased the flows occurring in Oyster Creek. The construction of the proposed Harris Reservoir also shifts flows farther downstream, which increases the peak flow occurring downstream at Junction J-O4. There are interbasin flows entering and exiting upstream and downstream of the existing and proposed reservoirs, which ultimately added flows into Oyster Creek. The hydrographs entering at J-O4 are combined with the hydrographs that would enter where the proposed Harris Reservoir is located. The results for the two conditions are seen in **Tables 29.**

The blockage of interbasin flows between the Brazos River and Oyster Creek changes both the magnitude and the timing of the peak flows in Oyster Creek between existing and proposed conditions models. The proposed Harris Reservoir blocks the interbasin flows from the Brazos River into Oyster Creek. These interbasin flows were modeled as lateral hydrographs in the unsteady HEC-RAS model, and as sources/sinks in HEC-HMS model. These hydrographs were not adjusted to account for routing or lagging in the watershed but assumed to have the same timing and shape as overflows from Brazos River.

The overflows blocked by the proposed Harris Reservoir were entered into the Oyster Creek downstream of the proposed reservoir (Junction J-O4), causing an increase in peak flowrate at this point in Oyster Creek; prior to this junction, peak flows in Oyster Creek were similar for both the proposed and existing conditions.

In the existing conditions model, there are 12 interbasin flows between the Brazos River and Oyster Creek. The addition of the proposed Harris Reservoir blocks three of these interbasin flows. As there is a higher elevation road between the existing and the proposed Harris Reservoirs, the interbasin flows enter Oyster Creek at a junction farther downstream. Two of these interbasin flows were modeled as sources (one entering the model at Junction J-O2, and one entering the model at Junction J-O3), and one was modeled as a sink (exiting the model at Junction J-O3).

The sources were added, and the sink was subtracted from the interbasin flow entering the proposed model at the junction downstream of the proposed Harris Reservoir (J-O4). When the three interbasin flows forming the existing conditions model were combined, time lag was not considered. **Figure 25** shows a plot of the existing interbasin flows into J-O4 (blue line) and proposed interbasin flows into J_O4 (orange line), which is the combination of the interbasin flows B11+B12-B6. The same interbasin flows enter the model in both cases, just at earlier junctions for existing conditions and as a combination for proposed conditions farther downstream. If the proposed Harris Reservoir was not blocking the interbasin flows from Brazos River into Oyster Creek, there would not be such a significant increase in the peak flows in Oyster Creek.

Table 30 shows the location, magnitude, and arrival time of peak flows for the 100-year design storm. **Table 31** and **Tabel 32** show the peak flows for all the interbasin flows for the 50- and 100-year design storms, respectively for various scenarios simulated.

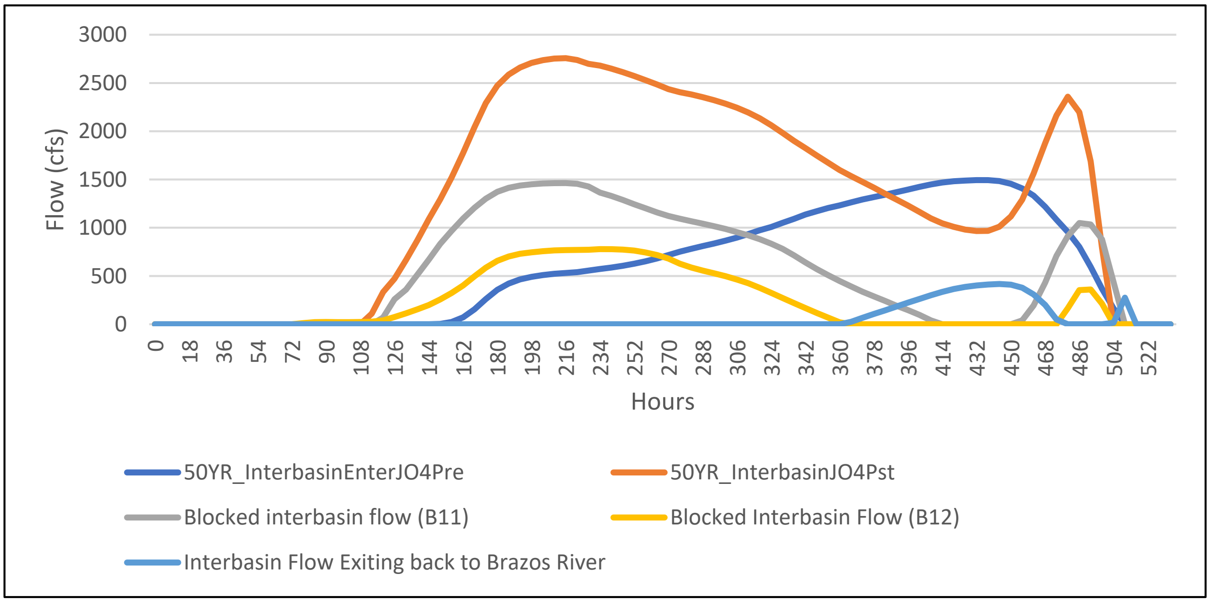


***Figure 25**: The interbasin FLOWS at the Junction (J-O4 downstream of the proposed Harris Reservoir for existing and proposed models).*

Table 30: Interbasin Peak Flows and Time to Peak Flow in Oyster Creek for the Existing and Proposed Conditions at Significant Junctions for the 100-Year Design Storm Event

Hydrologic Element	Peak Flows [Q_p] (cfs) and Time to Peak [T_p] (days)							
	Q_p Existing Conditions (cfs)	T_p Existing Conditions (days)	Q_p Proposed Conditions 18" Drawdown and 6" Floodplain Storage (cfs)	T_p Proposed Conditions 18" Drawdown and 6" Floodplain Storage (days)	Q_p Proposed Conditions 18" Drawdown and 12" Floodplain Storage (cfs)	T_p Proposed Conditions 18" Drawdown and 12" Floodplain Storage (days)	Q_p Proposed Conditions 18" No Drawdown (cfs)	T_p Proposed Conditions 18" No Drawdown (days)
J-O1	3,113	0.98	3,113	0.98	3,113	0.98	3,113	0.98
J-O1.29	18,682	15.25	18,682	15.25	18,682	15.25	18,682	15.25
J-O1.59	19,099	15.26	19,099	15.26	19,099	15.26	19,099	15.26
J-O1.72	22,847	15.26	22,847	15.26	22,847	15.26	22,847	15.26
J-O1.75	22,846	15.36	22,846	15.36	22,846	15.36	22,846	15.36
J-O2	22,844	15.58	22,844	15.58	22,844	15.58	22,844	15.58
J-O3	21,970	16.10	22,850	16.13	22,850	16.13	22,851	16.13
J-O4	23,211	16.69	23,339	16.95	23,303	16.80	22,339	16.95
J-O5	25,376	17.67	25,439	18.01	25,623	17.39	25,441	18.01
J-O6	25,364	18.48	25,421	18.81	25,602	18.19	25,423	18.81
J-O7	3,411	19.99	4,316	21.21	3,375	20.88	4,316	21.21

Table 31: HEC-HMS Model Results for the Existing and Proposed Conditions at Significant Junctions for the 50-Year Storm Event

Hydrologic Element	Peak Flows (cfs)								
	Existing Conditions (cfs)	Proposed Conditions No Drawdown (cfs)	Δ Proposed No Drawdown vs Existing Conditions	Proposed 18" Drawdown and 6" Floodplain Storage (cfs)	Δ Proposed 18" Drawdown and 6" Floodplain Storage vs Existing Conditions (cfs)	Proposed Conditions 18" Drawdown and 9" Floodplain Storage	Δ Proposed 18" Drawdown and 9" Floodplain Storage vs Existing Conditions	Proposed Conditions Outflow 18" Drawdown and 12" Floodplain Storage	Δ Proposed 18" Drawdown and 12" Floodplain Storage vs Existing Conditions
J-O1	2,822	2,822	0	2,822	0	2,822	0	2,822	0
J-O2	15,109	15,109	0	15,109	0	15,109	0	15,109	0
J-O3	15,003	15,118	+115	15,113	+110	15,113	+110	15,113	+110
J-O4	16,050	17,448	+1,398	17,445	+1,395	17,445	+1,395	17,445	+1,395
J-O5	17,070	17,266	+196	17,263	+193	17,263	+193	17,263	+193
J-O6	17,027	17,226	+199	17,223	+196	17,223	+196	17,223	+196
J-O7	6,312	8,053	+1,741	8,048	+1,736	8,048	+1,736	8,048	+1,736

Table 32: HEC-HMS Model Results for the Existing and Proposed Conditions at Significant Junctions for the 100-Year Storm Event

Hydrologic Element	Peak Flows (cfs)								
	Existing Conditions (cfs)	Proposed Conditions No Drawdown (cfs)	Δ Proposed No Drawdown vs Existing Conditions	Proposed Conditions 18" Drawdown and 6" Floodplain Storage (cfs)	Δ Proposed 18" Drawdown and 6" Floodplain Storage vs Existing Conditions (cfs)	Proposed Conditions 18" Drawdown and 9" Floodplain Storage (cfs)	Δ Proposed 18" Drawdown and 9" Floodplain Storage vs Existing Conditions (cfs)	Proposed Conditions 18" Drawdown and 12" Floodplain Storage (cfs)	Δ Proposed 18" Drawdown and 12" Floodplain Storage vs Existing Conditions (cfs
J-O1	3,133	3,133	0	3,133	0	3,133	0	3,133	0
J-O2	22,844	22,844	0	22,844	0	22,844	0	22,844	0
J-O3	21,970	22,851	+881	22,850	+880	22,850	+880	22,850	+880
J-O4	23,211	23,339	+128	23,338	+127	23,338	+127	23,303	+92
J-O5	25,376	25,441	+65	25,439	+63	25,439	+63	25,623	+247
J-O6	25,364	24,423	-941	25,422	+58	25,422	+58	25,602	+238
J-O7	3,411	4,316	+905	4,316	+905	4,316	+905	3,375	-36

The loss in floodplain storage has some effect in increasing peak flow impacts. In this model, there are two peak flow events: a smaller-magnitude peak flow associated with the design storm rainfall (peak one) and a larger peak flow associated with the arrival of the interbasin flows to Oyster Creek (peak two). In this brief analysis, the hydrographs for locations J-O3 and J-O4 were analyzed due to their proximity to the proposed Harris Reservoir project area. For the proposed conditions,100-year design storm event, the peak one flow occurs 3 days after the beginning of the design storm rainfall at a peak flow of 6,072 cfs at Junction J-O3. Arriving 21 hours later at Junction J-O4, the peak one flow increases to 7,137 cfs arriving at day 4. The second larger peak flow (peak two) resulting from the entrance of the large interbasin flows arrives at Junction J-O3 on day 17 at 22,850 cfs and travels downstream to Junction J-O4, arriving 14 hours later. The peak two flow at J-O4 increases from 22,850 to 23,338 cfs.

Due to the large, flat nature of the Oyster Creek watershed, there generally is an increase in peak flow occurring in the proposed conditions model when comparing it to the existing conditions scenarios.

The 100-year design storm flow event proposed conditions flows are generally higher (50 to 260 cfs) than the existing conditions flows on the rising limb of the peak one section of the hydrograph. The proposed conditions 100-year design storm peak flow is 6,072 cfs, which is 487 cfs higher than the existing conditions 100-year design storm peak flow of 5,584 cfs, related to the 100-year design storm event. The proposed conditions peak flow arrives 10 minutes sooner than the existing conditions peak flow.

The same hydrograph behavior occurs during the 50-year design storm event where two peak flow events occur: peak flow one, which related to the design storm event, and peak flow two, which is related to the interbasin flows arriving to Oyster Creek.

The 100-year proposed conditions results hydrograph shows there is a rise in peak flow in comparison to the existing condition hydrograph on the extremities of the hydrograph. For the middle portion of the hydrograph, the existing conditions flow is higher than the proposed conditions flow.

The 50-year results hydrograph shows there is a rise in peak flow for the proposed conditions after the second peak flow occurs and in the falling limb of the second peak flow in the hydrograph. Generally for the 50-year event, the existing conditions flow are higher than the proposed conditions flow for the majority of the hydrograph.

4.1.3 Loss of Floodplain Storage

In a prior version of the HEC-RAS model, an additional run of the model with proposed conditions was created to determine the proposed conditions for Oyster Creek without proposed channel improvements. The loss of floodplain storage estimated for this condition without the proposed channel improvements was 309 ac-ft, which corresponds with the original stream restoration design provided by Dow in their application. A second model run was set up to show the loss of floodplain storage with the revised stream restoration design, which had an estimated 263 ac-ft loss of floodplain storage. After reviewing the most up-to-date Jacobs HEC-RAS model, the results for the loss of floodplain storage for the 50-year and 100-year events demonstrate a loss of 525 ac-ft and 1,028 ac-ft in floodplain storage.

Oyster Creek floodplain storage will decrease by a net 1,028 acre-feet (1%) for the 100-year event as a result of the proposed Harris Reservoir berm and Oyster Creek channel improvements. To counter the loss of floodplain storage, Dow plans to operate the reservoir to draw down the proposed Harris Reservoir prior to 50-year and 100-year storm events and tropical storms and hold the rainfall falling on the proposed Harris Reservoir and any initial diverted flows from the

Brazos River as floodplain storage prior to discharge. In the *Oyster Creek Downstream Hydrologic and Hydraulic Impacts Draft Report*, a detailed analysis of this operational measure is included. For a 100-year design storm, with 18 inches of drawdown before a 100-year storm event, the proposed Harris Reservoir would store 807 ac-ft for 6 inches of depth, 1,309 ac-ft of gain for 9 inches of depth, and a gain of 1,632 ac-ft for 12 inches of depth. Using 18 inches of drawdown before a 100-year storm event and storing various depths within the proposed Harris Reservoir before releasing flows into Oyster Creek would result in a net loss of 221 ac-ft floodplain storage for 6 inches of storage depth while gaining a net floodplain storage of 281 ac-ft for 9 inches of storage depth and 604 ac-ft of floodplain storage for 12 inches of storage depth. **Table 33** below shows the gross and net floodplain storage gain with this operational measure.

Table 33: Operational Plan to Offset Floodplain Storage Loss

	50-Year Design Storm				100-Year Design Storm		
	Floodplain Storage (ac-ft)						
	Loss of Floodplain Storage	Proposed 18" Drawdown and 6" Floodplain Storage	Proposed 18" Drawdown and 9" Floodplain Storage	Proposed 18" Drawdown and 12" Floodplain Storage	Proposed 18" Drawdown and 6" Floodplain Storage	Proposed 18" Drawdown and 9" Floodplain Storage	Proposed 18" Drawdown and 12" Floodplain Storage
50-year	-525	+993	+1,371	+1,715	N/A	N/A	N/A
100-year	-1,028	N/A	N/A	N/A	+807	+1,309	+1,632
Total		+468	+846	+1,190	-221	+281	+604

4.1.4 Existing and Proposed Conditions Hydrographs

Below are the hydrographs for key junctions within the model for the two project conditions (existing and conditions) for the 50-year and 100-year design storm events, which include Brazos/Oyster interbasin flows as seen in **Figure 26** through **Figure 37.**

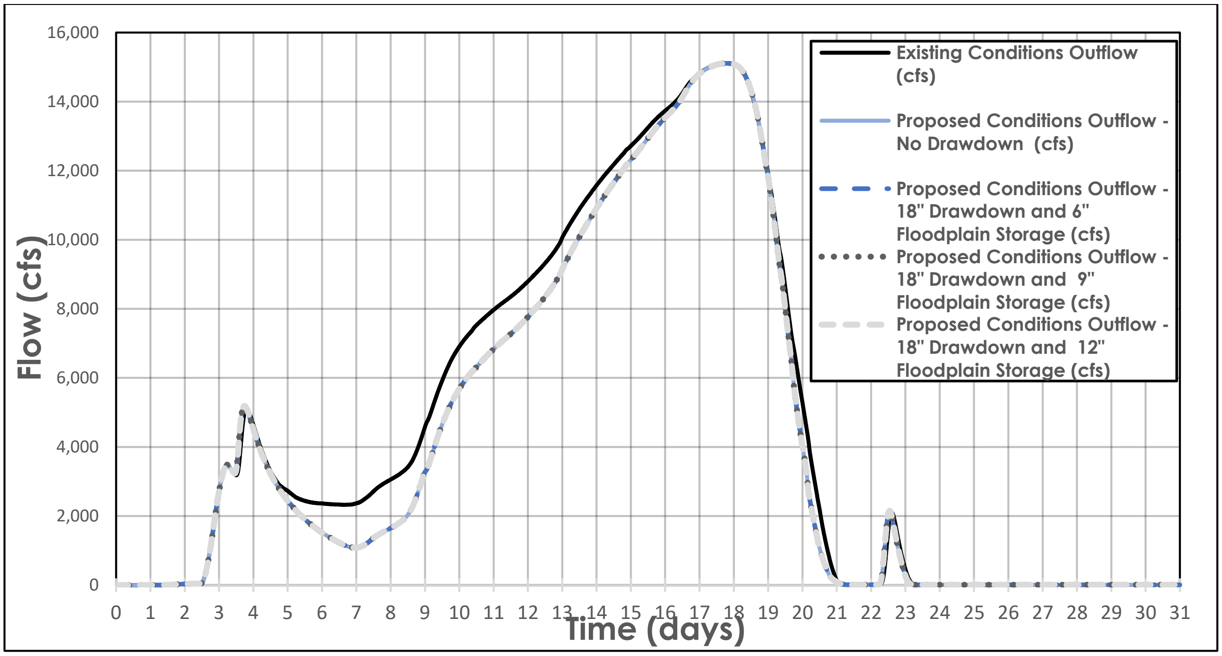


Figure 26: *50-Year existing and proposed conditions design storm hydrographs at Junction J-O2.*

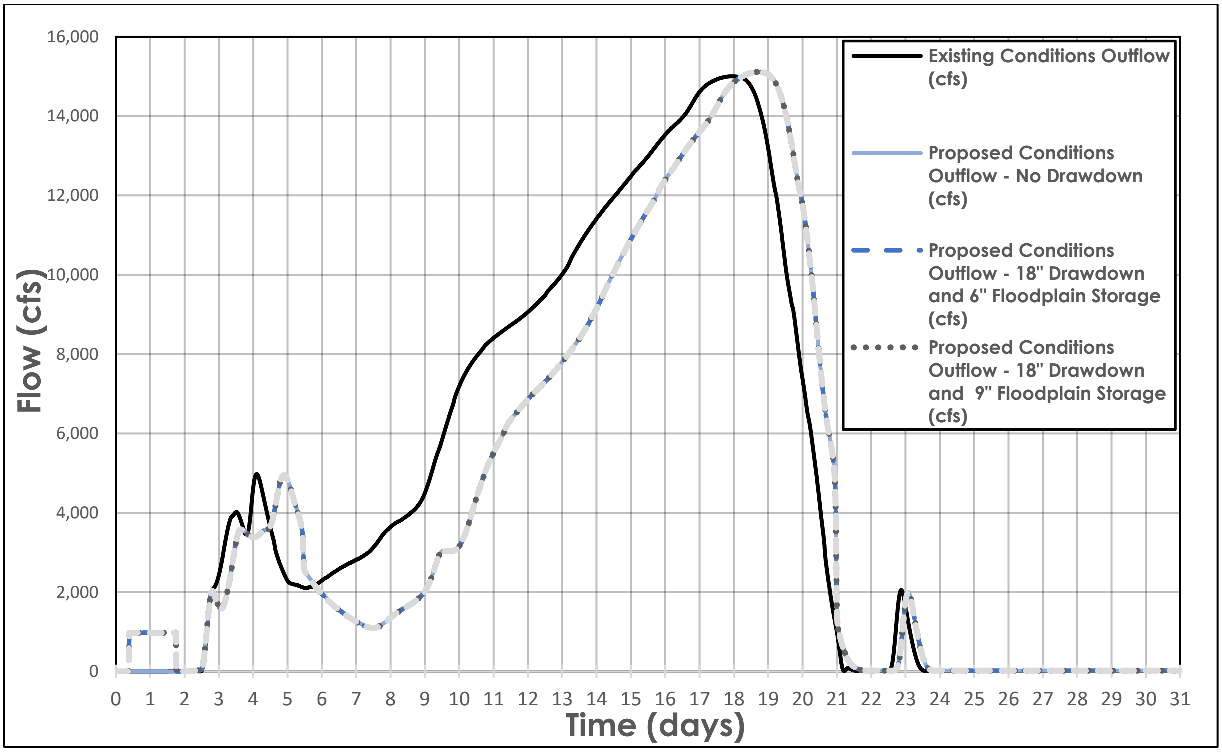


Figure 27*: 50-year existing and proposed conditions design storm hydrographs at Junction J-O3.*

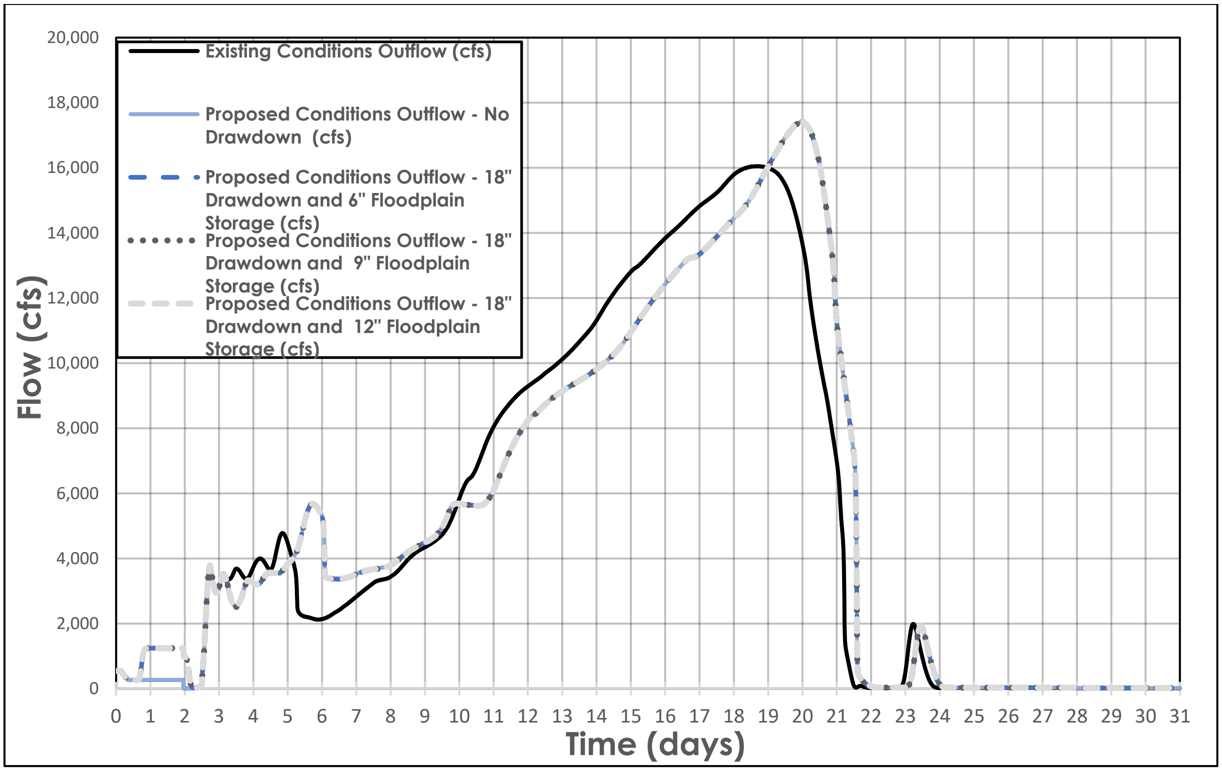


Figure 28*: 50-year existing and proposed conditions design storm hydrographs at Junction J-O4.*

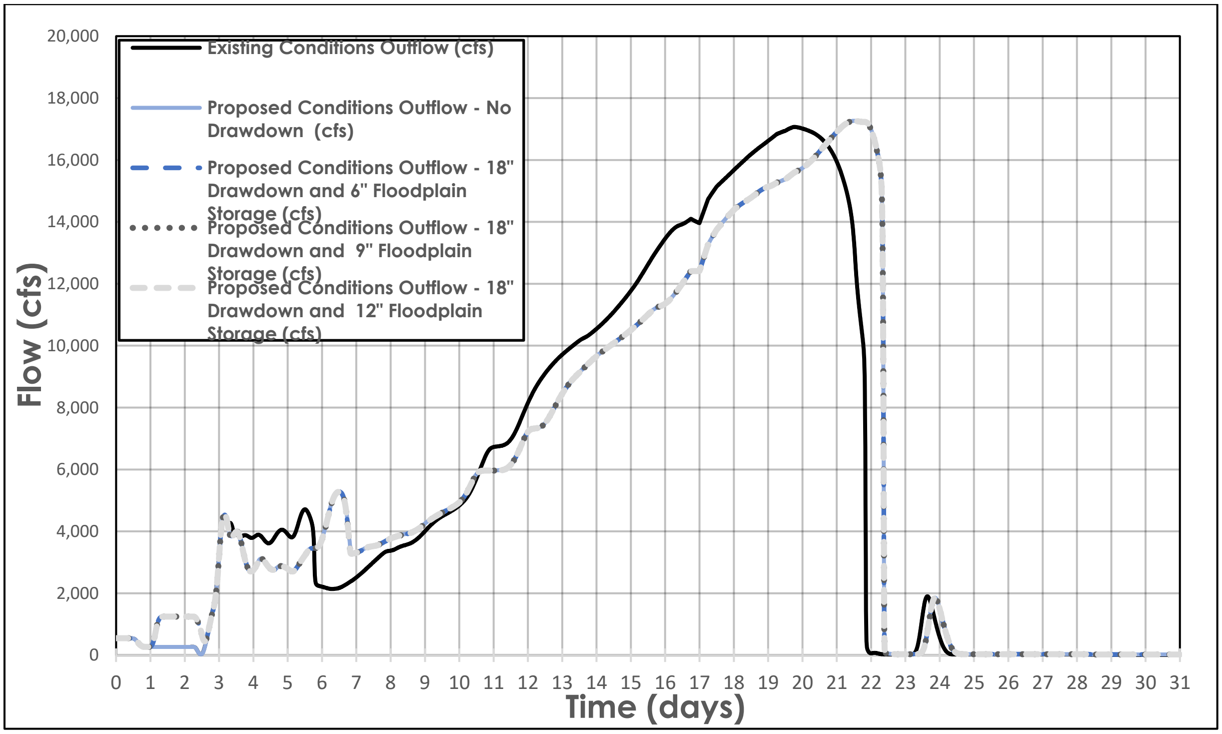


Figure 29: *50-year existing and proposed conditions design storm hydrographs at Junction J-O5.*

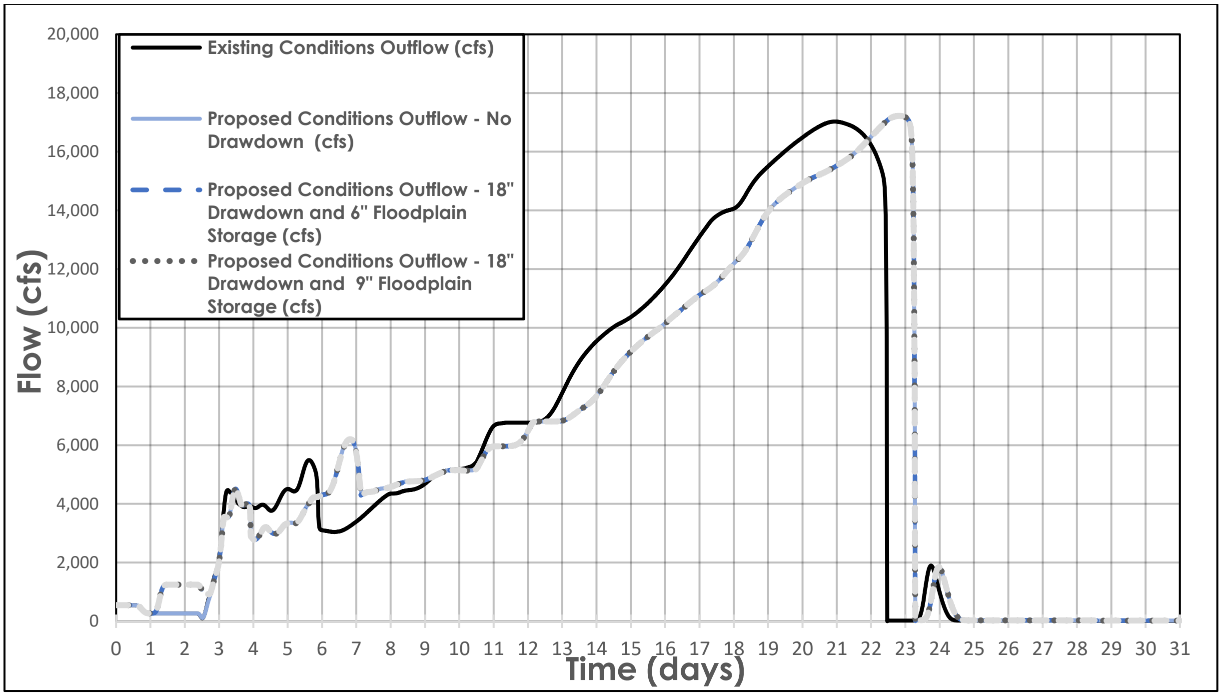


Figure 30: *50-year existing and proposed conditions design storm hydrographs at Junction J-O6.*

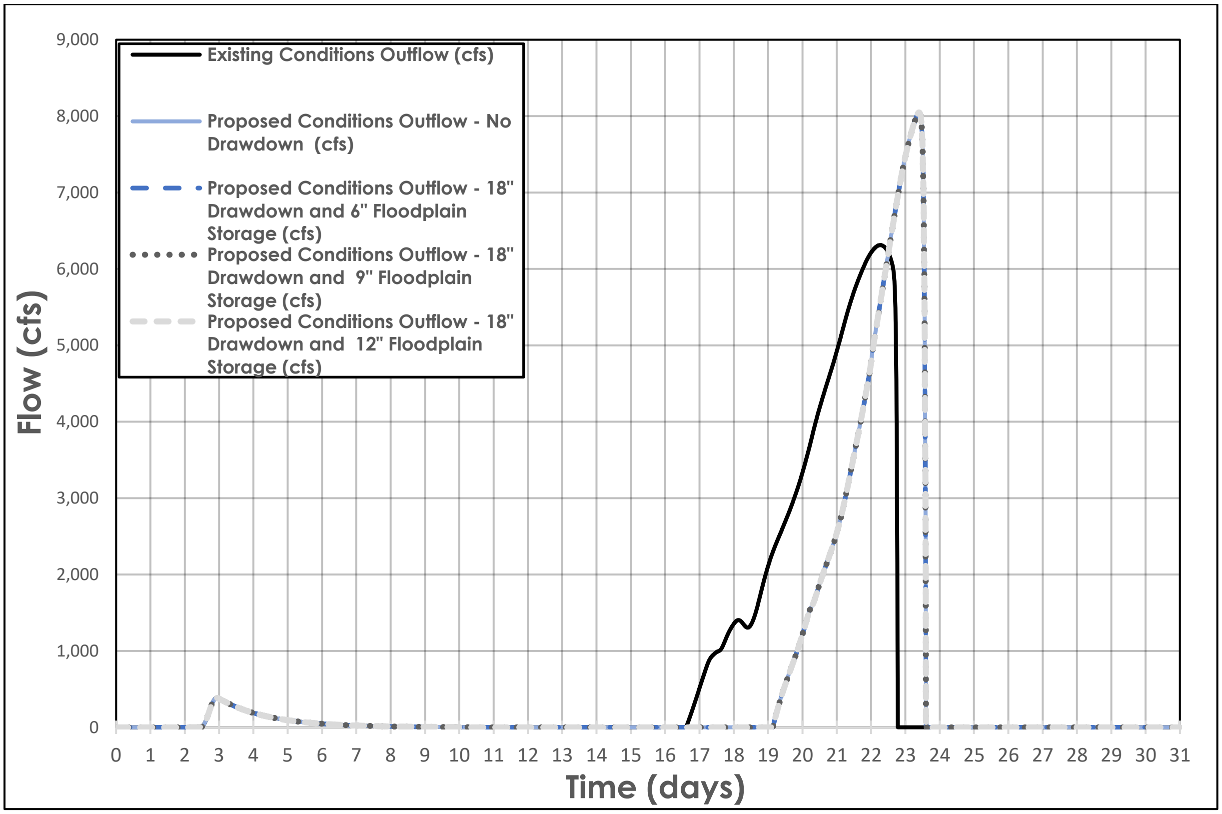


Figure 31: *50-year existing and proposed conditions design storm hydrographs at Junction J-O7.*

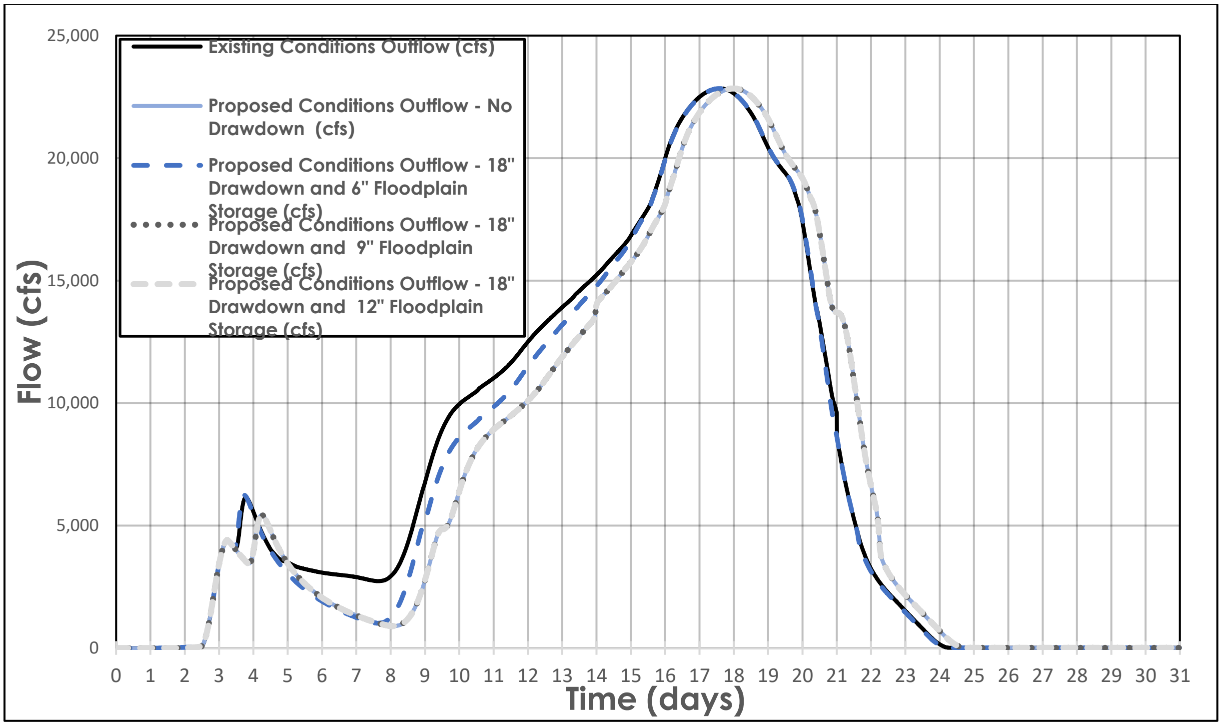


***Figure 32**: 100-year existing and proposed conditions design storm hydrographs at Junction J-O2.*

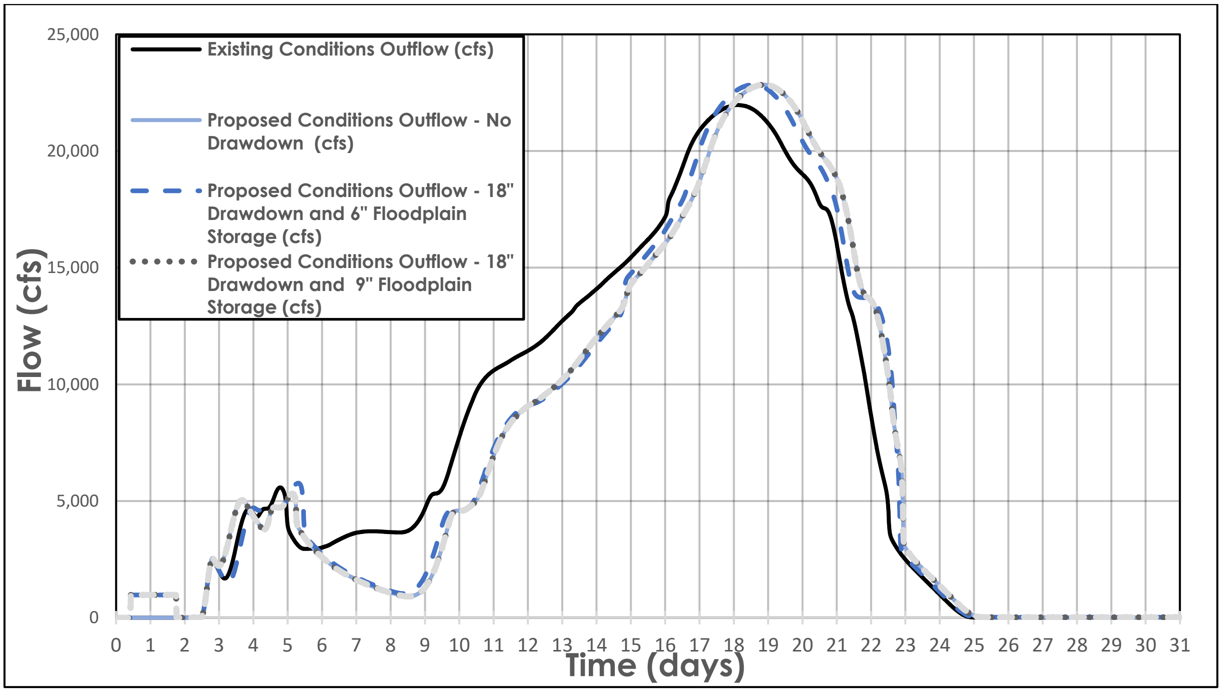


***Figure 33**: 100-year existing and proposed conditions design storm hydrographs at Junction J-O3.*

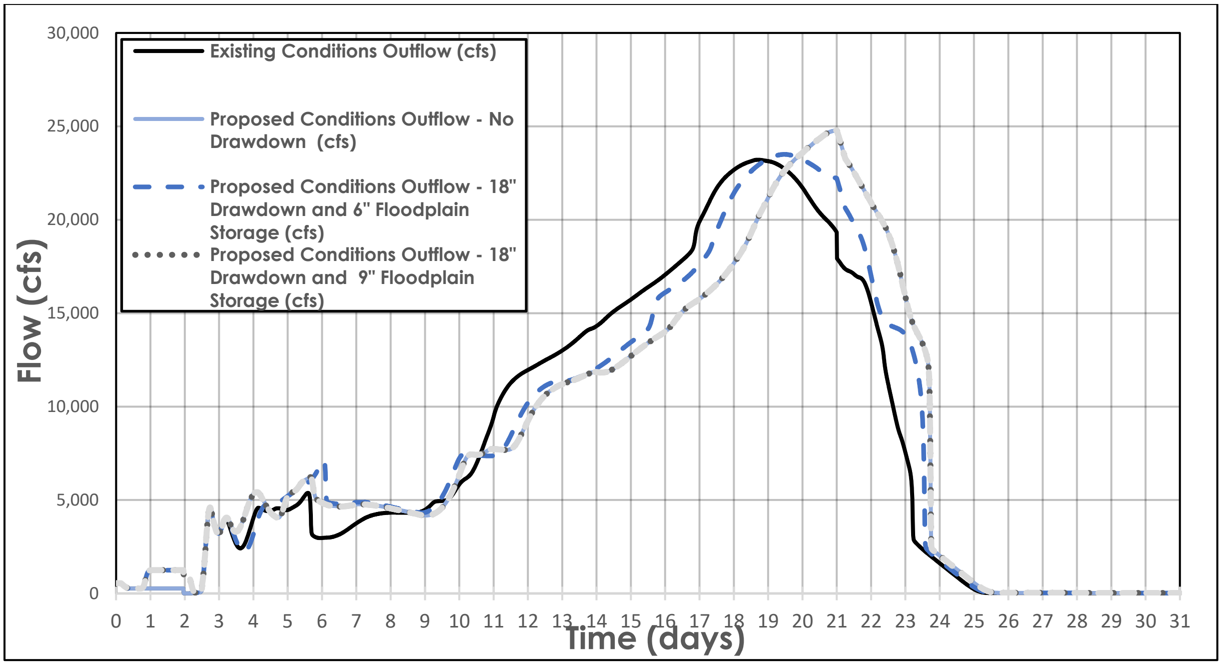


Figure 34: *100-year existing and proposed conditions design storm hydrographs at Junction J-O4.*

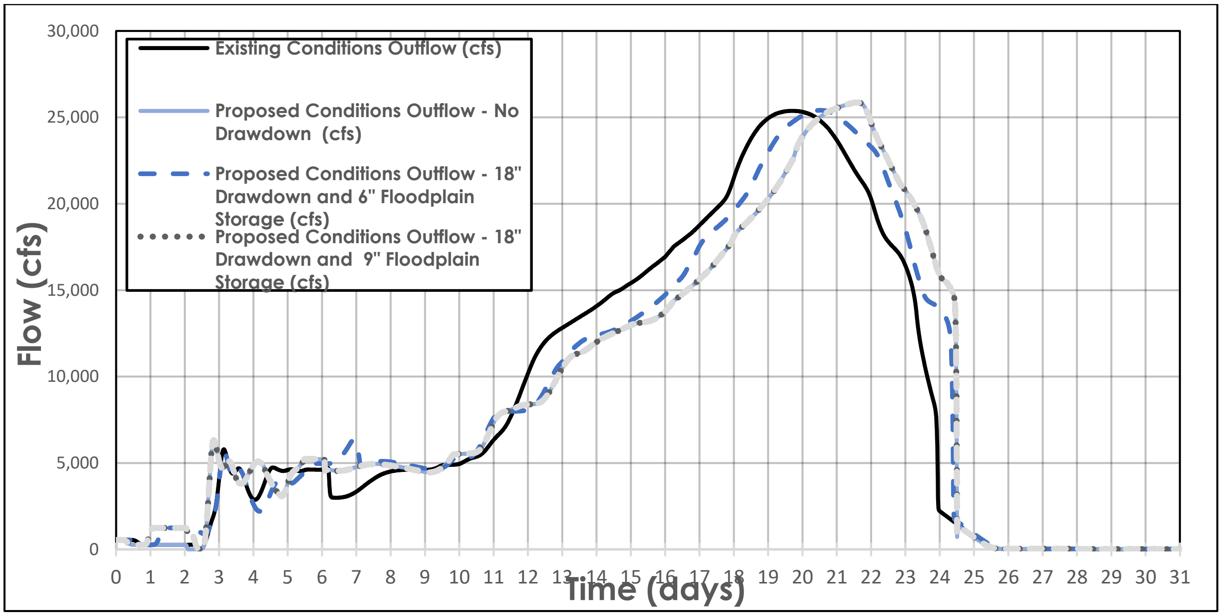


Figure 35: 100-year existing and proposed conditions design storm hydrographs at Junction J-O5.

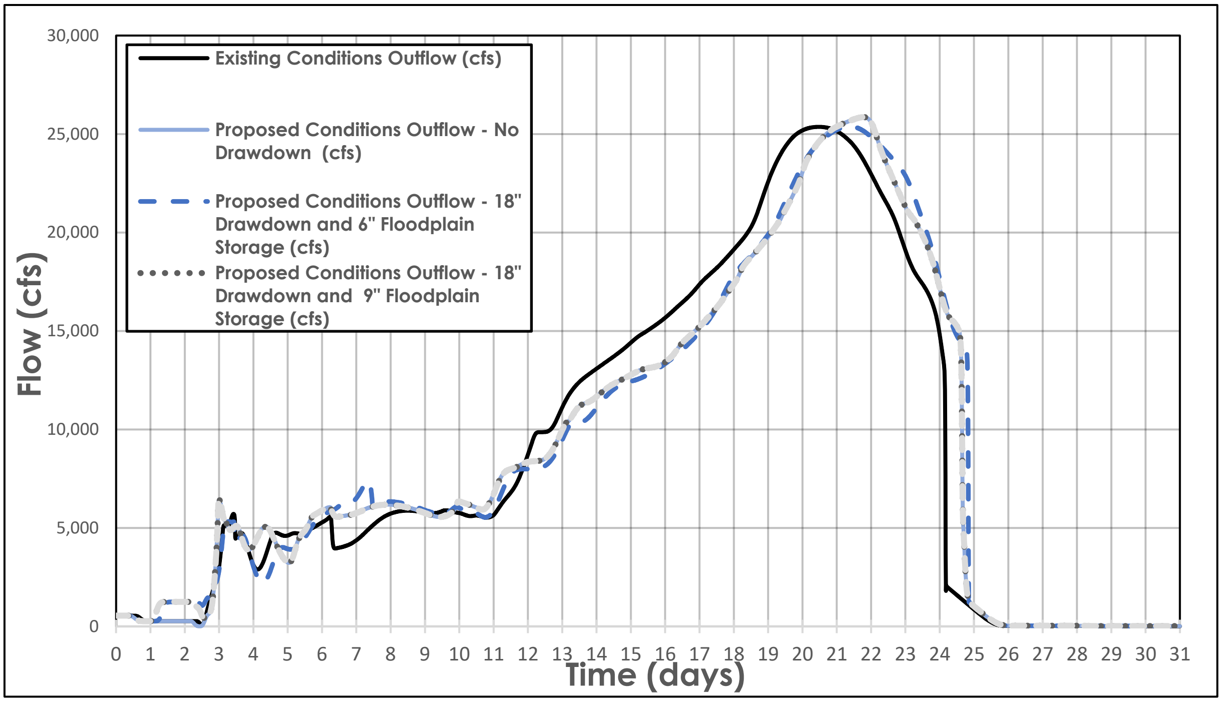


Figure 36: 100-Year Existing and Proposed Conditions Design Storm Hydrographs at Junction J-O6.

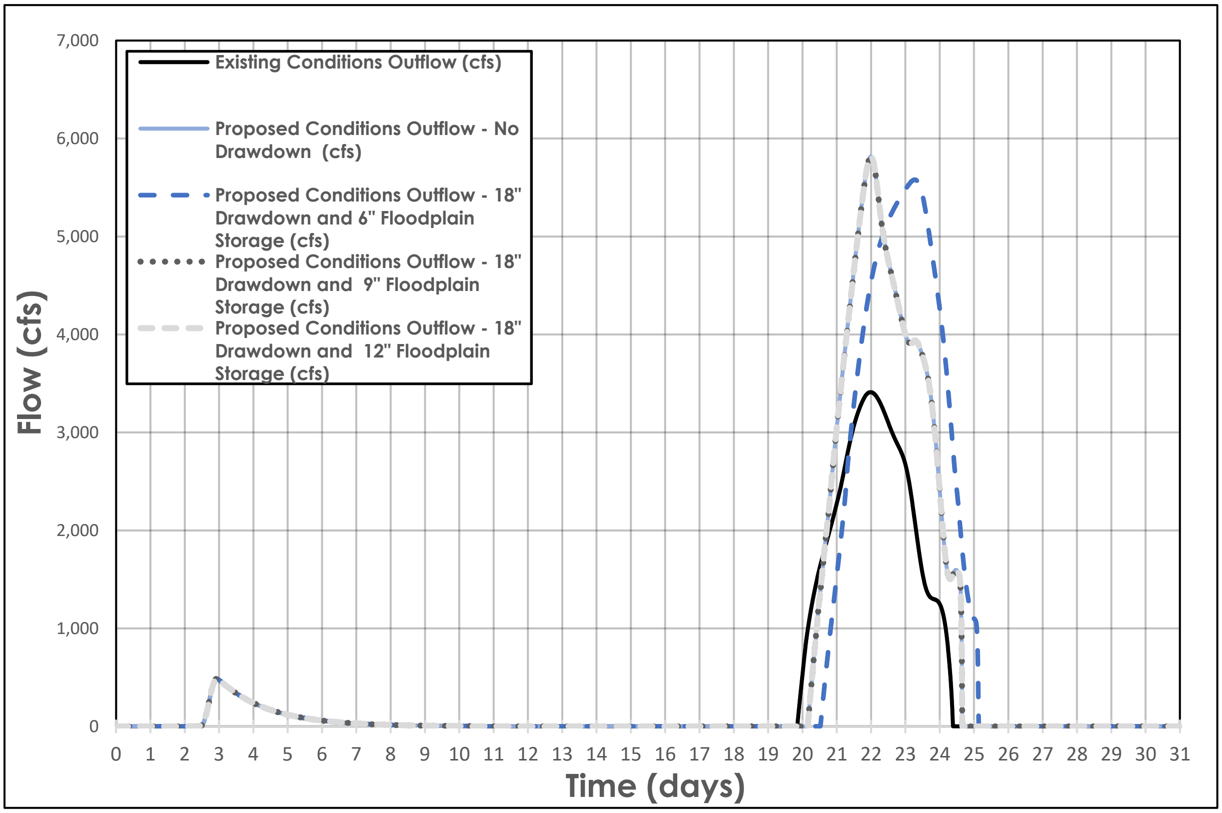


***Figure 37**: 100-Year Existing and Proposed Conditions Design Storm Hydrographs at Junction J-O7.*

4.1.5 Water Surface Elevation

Using HEC-RAS, WSELs were modeled for existing and proposed conditions for the revised channel improvements design as shown in **Table 34.** The results shown here were deterimined in the May 2020 Oyster Creek No Rise Model developed by Jacobs.

Table 34: Water Surface Elevations for Oyster Creek for the 50-Year and 100-Year Design Event

River Station	50-Year Design Storm WSEL (ft)			100-Year Design Storm WSEL (ft)		
	Existing Conditions	Proposed Conditions	Δ Existing Conditions vs Proposed Conditions	Existing Conditions	Proposed Conditions	Δ Existing Conditions vs Proposed Conditions
69.9	44.13	44.13	0.00	44.7	44.7	0.00
69.72	43.78	43.78	0.00	44.39	44.39	0.00
68.56	42.07	42.07	0.00	42.7	42.7	0.00
67.62	41.58	41.58	0.00	42.11	42.11	0.00
66.85	41.44	41.44	0.00	41.95	41.95	0.00
65.35	40.52	40.5	-0.02	41.15	41.15	0.00
64.6	40.41	40.39	-0.02	41.06	41.06	0.00
63.9	40.36	40.33	-0.03	41.02	41.02	0.00
63.19	40.19	40.16	-0.03	40.85	40.85	0.00
62.84	40.12	40.09	-0.03	40.78	40.78	0.00
61.87	39.86	39.82	-0.04	40.54	40.54	0.00
61.43	39.75	39.7	-0.05	40.41	40.41	0.00
60.49	39.46	39.38	-0.08	40.07	40.07	0.00
60.48	39.45	39.37	-0.08	40.06	40.06	0.00
60.47	39.43	39.35	-0.08	40.05	40.04	-0.01
59.85	39.34	39.26	-0.08	39.96	39.96	0.00
59.17	38.84	38.73	-0.11	39.45	39.44	-0.01
58.67	38.34	38.22	-0.12	38.95	38.94	-0.01
56.05	36.39	36.39	0.00	37.21	37.21	0.00
55.6	36.1	36.14	0.04	36.93	36.93	0.00
55.3	36.04	36.09	0.05	36.86	36.86	0.00
53.49	35.44	35.53	0.09	36.23	36.23	0.00
53.48	35.42	35.51	0.09	36.21	36.2	-0.01

River Station	50-Year Design Storm WSEL (ft)			100-Year Design Storm WSEL (ft)		
	Existing Conditions	Proposed Conditions	Δ Existing Conditions vs Proposed Conditions	Existing Conditions	Proposed Conditions	Δ Existing Conditions vs Proposed Conditions
53.47	35.4	35.4	0.00	36.13	36.13	0.00
53.46	35.38	35.38	0.00	36.12	36.12	0.00
52.75	34.5	34.5	0.00	35.29	35.29	0.00
50.3	34.24	34.24	0.00	35.05	35.05	0.00

4.2 Normal Flow Releases and Sediment Loss in Oyster Creek

Normal flow releases from the proposed Harris Reservoir only occur when flow in Oyster Creek is low or not flowing at all. Dow is currently using around 100 cfs but has a water right to use up to 176 cfs in its operation, which it could release from the proposed Harris Reservoir when built. These releases would flow downstream in Oyster Creek approximately 29 stream miles to the Oyster Creek Dam at Lake Jackson, Texas, where the water is pumped into a canal to be conveyed to the plants for use.

The normal release of reservoir water into Oyster Creek can become the source of erosion even though the flow is low (100 cfs to 176 cfs) compared to the bankfull stream flow of 476 cfs in Project 2 mentioned above. This erosion is caused because the reservoir water is deprived of sediment (Kondolf, 1997; Subcommittee on Sedimentation, 2017).

The approximate 900 cfs flow for lowering the reservoir for a tropical storm would equate to less than the 1.5-year storm in Project 2, which would make it part of the regular storm flow from the contributing watershed.

The sediment that was part of the Brazos River flow when it was pumped from the Brazos River into the reservoir has settled out. This is substantiated by looking at the change in available storage in the Brazoria Reservoir and the existing Harris Reservoir, which have lost substantial storage capacity to water-pumped sediment settling out in the reservoirs. This will continue to occur unless a regular scheduled operation and maintenance program is started to maintain storage capacity in all reservoirs.

Since the proposed Harris Reservoir will not be continually releasing water, there will also be a wetting and drying cycle that can increase the bed and bank erosion when the sediment-deprived reservoir water is released. This can cause channel incision and widening thus increasing the sediment load farther downstream.

The proposed reservoir is an off-channel storage structure, thus allowing storm events to flow downstream from the upstream Oyster Creek watershed as it has in the past. Although these flow events are being altered by the upstream projects, some of the sediment that was carried by Oyster Creek will still be feeding the stream, but it may not be enough to make up for the erosion caused by deprived water released from the reservoir.

Inspection of the downstream channel for erosion should be part of the proposed project O&M plan. If any excessive erosion is observed in the stream channel or banks, it should be restored.

4.3 Analysis BASINS/HSPF Modeling Results

The velocity, sediment transport, and water temperature were modeled using the BASINS framework and HSPF watershed model during 180 days of continuous simulation under drought conditions. Five scenarios were modeled: no reservoir, 334 cfs constant outflow, 216 cfs constant outflow, 133 cfs constant outflow, and 22 cfs constant outflow. The results are used to compare the existing conditions with proposed conditions (addition of proposed Harris Reservoir) under the four constant outflow conditions.

The drawdown time for the proposed reservoir was analyzed to have a better understanding of how long it would take to empty for each of the four scenarios modeled. For this analysis, the elevation-storage table for the proposed reservoir was used. The elevation-storage relationship for the proposed reservoir is given in **Appendix H**. According to this analysis, the proposed reservoir would empty as follows:

- Scenario 1 – 334 cfs outflow from proposed reservoir: reservoir would be empty at simulation day 72
- Scenario 2 – 216 cfs outflow from proposed reservoir: reservoir would be empty at simulation day 111
- Scenario 3 – 133 cfs outflow from proposed reservoir: reservoir would be empty at simulation day 180
- Scenario 4 – 22 cfs outflow from proposed reservoir: reservoir would still be between 60 ft and 65 ft at the end of 180 days of simulation

Using BASINS and HSPF, average velocity, shear velocity, bed shear stress, deposition/scour, sediment inflow and outfow, and water temperature at Reach 3 of Oyster Creek, which is immediately downstream of the proposed reservoir, are modeled and compared with the existing conditions. The tables showing all the results for the duration of 180 days are in **Appendix I. Table 35** below shows a summary of these results.

Table 35: Summary of HSPF Model Results

	No Reservoir	Scenario 1 (334 cfs discharge from proposed reservoir)	Scenario 2 (216 cfs discharge from proposed reservoir)	Scenario 3 (133 cfs discharge from proposed reservoir)	Scenario 4 (22 cfs discharge from proposed reservoir)
Average Velocity (ft/s)	1.68	2.36	2.20	2.03	1.71
Maximum Velocity (ft/s)	1.75	2.40	2.26	2.10	1.86
Average Shear Velocity (ft/s)	0.04	0.05	0.05	0.05	0.04

	No Reservoir	Scenario 1 (334 cfs discharge from proposed reservoir)	Scenario 2 (216 cfs discharge from proposed reservoir)	Scenario 3 (133 cfs discharge from proposed reservoir)	Scenario 4 (22 cfs discharge from proposed reservoir)
Maximum Shear Velocity (ft/s)	0.05	0.05	0.05	0.05	0.05
Average Bed Shear Stress (lb/ft²)	0.0032	0.0042	0.0041	0.0041	0.0032
Maximum Bed Shear Stress (lb/ft²)	0.0041	0.0043	0.0041	0.0042	0.0041
Average Deposition/scour	-0.0001	-0.0219	-0.0125	-0.0067	-0.0008
Maximum Deposition/Scour	0.0175	-0.0107	0.0004	0.0073	0.0162
Average Sediment Outflow Concentration (ton/ac-ft)	0.0021	0.0239	0.0145	0.0087	0.0029
Maximum Sediment Outflow Concentration (ton/ac-ft)	0.0508	0.0821	0.0706	0.0630	0.0530
Average Sediment Inflow Concentration (ton/ac-ft)	0.0020	0.0020	0.0020	0.0020	0.0020
Maximum Sediment Inflow Concentration (ton/ac-ft)	0.0808	0.0808	0.0808	0.0808	0.0808
Average Total Suspended Sediment Concentration (mg/L)	0.6466	0.5864	0.5279	0.4775	0.4784
Maximum Total Suspended Sediment Concentration (mg/L)	11.075	1.9078	2.38	3.1306	7.1945

	No Reservoir	Scenario 1 (334 cfs discharge from proposed reservoir)	Scenario 2 (216 cfs discharge from proposed reservoir)	Scenario 3 (133 cfs discharge from proposed reservoir)	Scenario 4 (22 cfs discharge from proposed reservoir)
Average Water Temperature (deg F)	71.86	52.00	53.78	55.52	63.56
Maximum Water Temperature (deg F)	78.29	62.25	64.36	65.88	73.40

The average velocity in Oyster Creek for each modeled scenario is plotted in **Figure 38** below. As observed in the plot, and based on the model results, the average velocity in Oyster Creek increases proportional to the amount of outflow from the proposed reservoir. The more outflow from the proposed reservoir, the higher the average velocity in Oyster Creek.

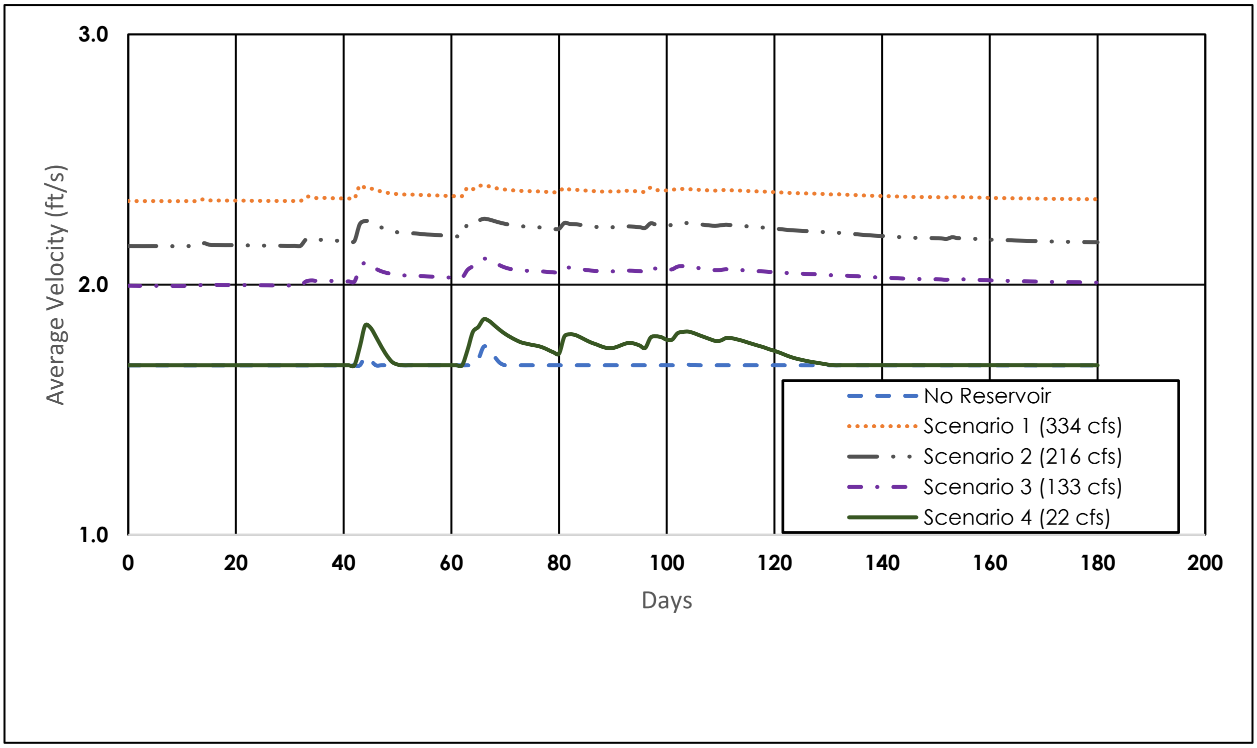


***Figure 38:** Average velocities in Oyster Creek downstream of proposed dam.*

As the modeling aims to examine if there is any potential for hydromodification, shear velocity and bed shear stress are two other parameters used to compare the proposed conditions with the existing conditions. With constant outflows from the proposed Harris Reservoir, the results show a very slight increase in shear velocity in Oyster Creek compared to existing conditions. **Figure 39** below shows the difference in shear velocity between all modeled scenarios.

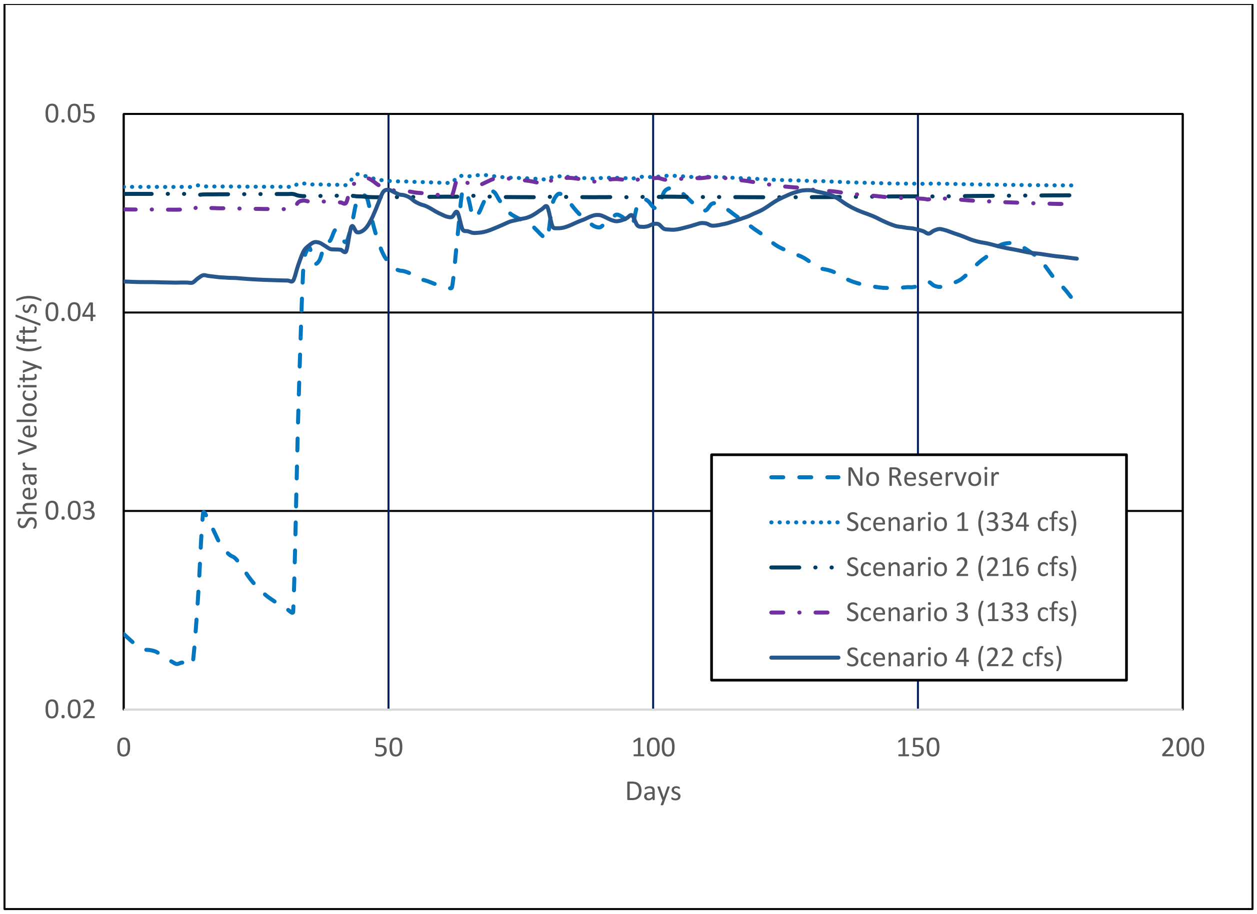


Figure 39: *Shear velocity comparison in Oyster Creek downstream of the proposed reservoir.*

Bed shear stress in Oyster Creek becomes more stable as there is consistently higher flow in the creek as a result of proposed Harris Reservoir outflows. The value of the bed shear stress increases very slightly with higher velocities. **Figure 40** below shows the model results for bed shear stress.

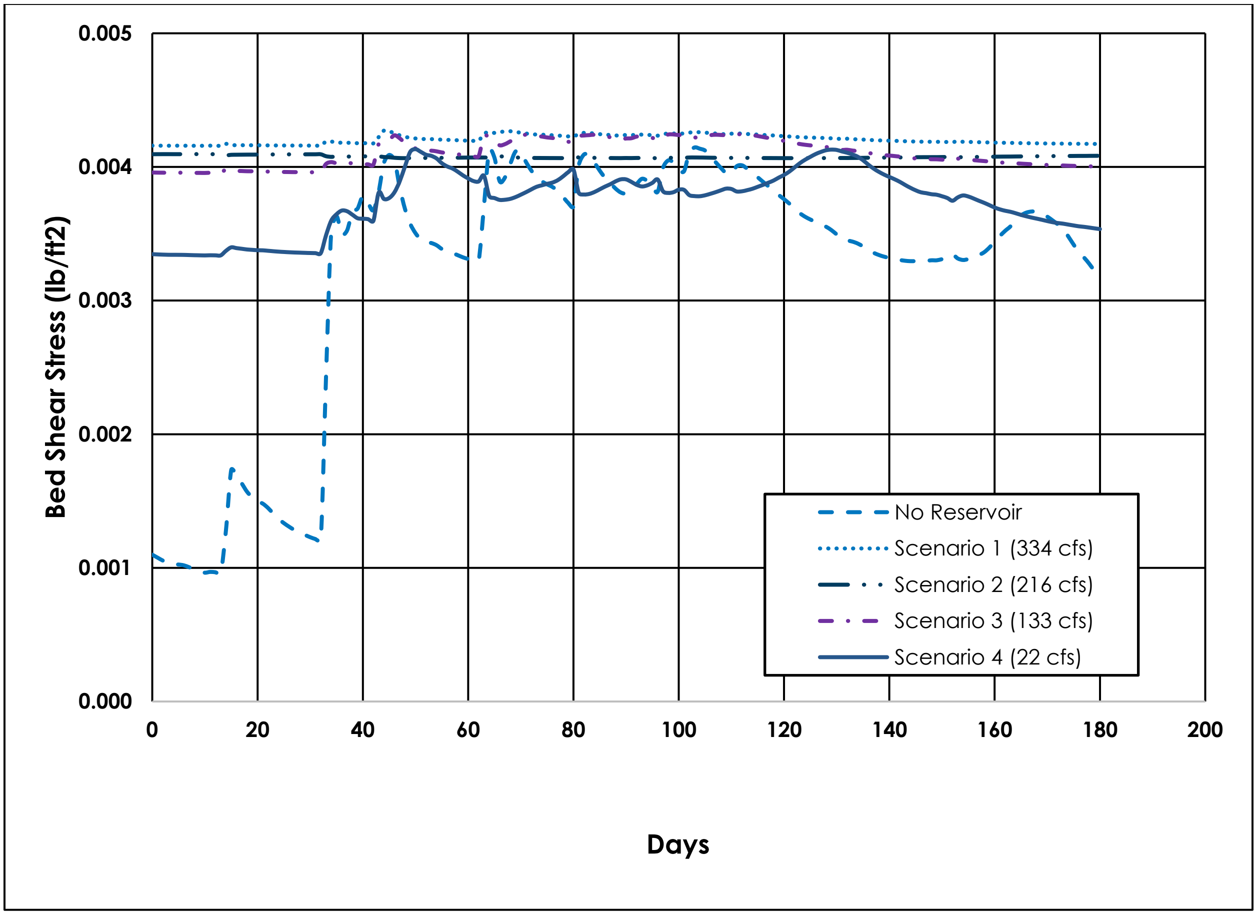


Figure 40: *Bed shear stress in Oyster Creek downstream of proposed reservoir.*

Another parameter used to examine the hydromodification in Oyster Creek is the deposition/scour term. If positive, this parameter indicates the occurrence of deposition in the channel, whereas a negative value indicates occurrence of scour in the channel. As expected with the major source of flow being the outflows from the proposed Harris Reservoir, scouring will be observed more than deposition with the construction of the proposed Harris Reservoir. **Figure 41** shows the change in deposition and scour terms for all modeled scenarios. The occurrence and amount of deposition decreases as the flow increases in Oyster Creek.

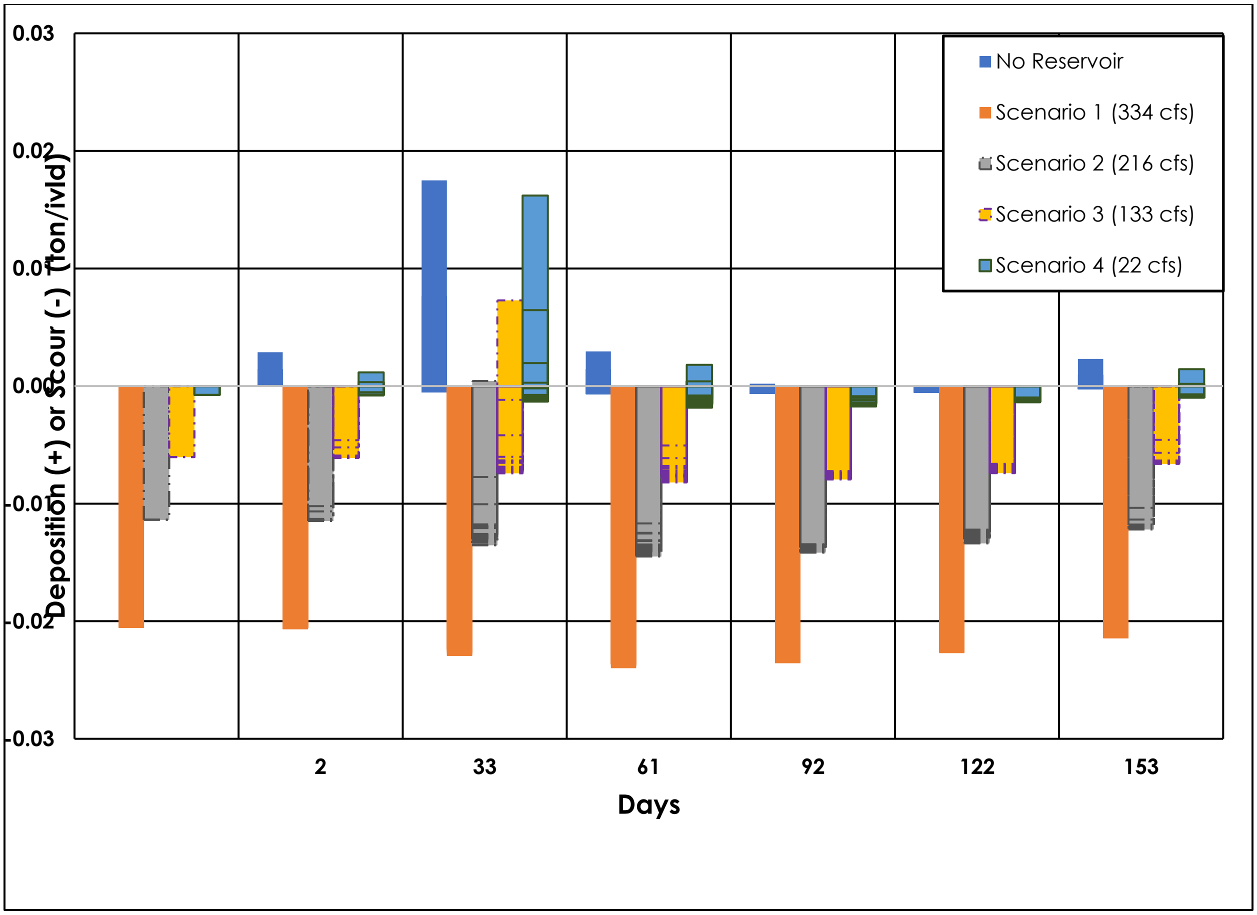


Figure 41: Deposition/scour in Oyster Creek downstream of proposed reservoir.

With more water flowing in Oyster Creek, more sediment outflow is expected. The model agrees with this expectation. The increases in scour and velocity indicate more suspended sediment concentration in Oyster Creek. As the outflow from the proposed Harris Reservoir increases, the sediment outflow from Reach 3 in Oyster Creek also increases. The results are shown in **Figure 42**.

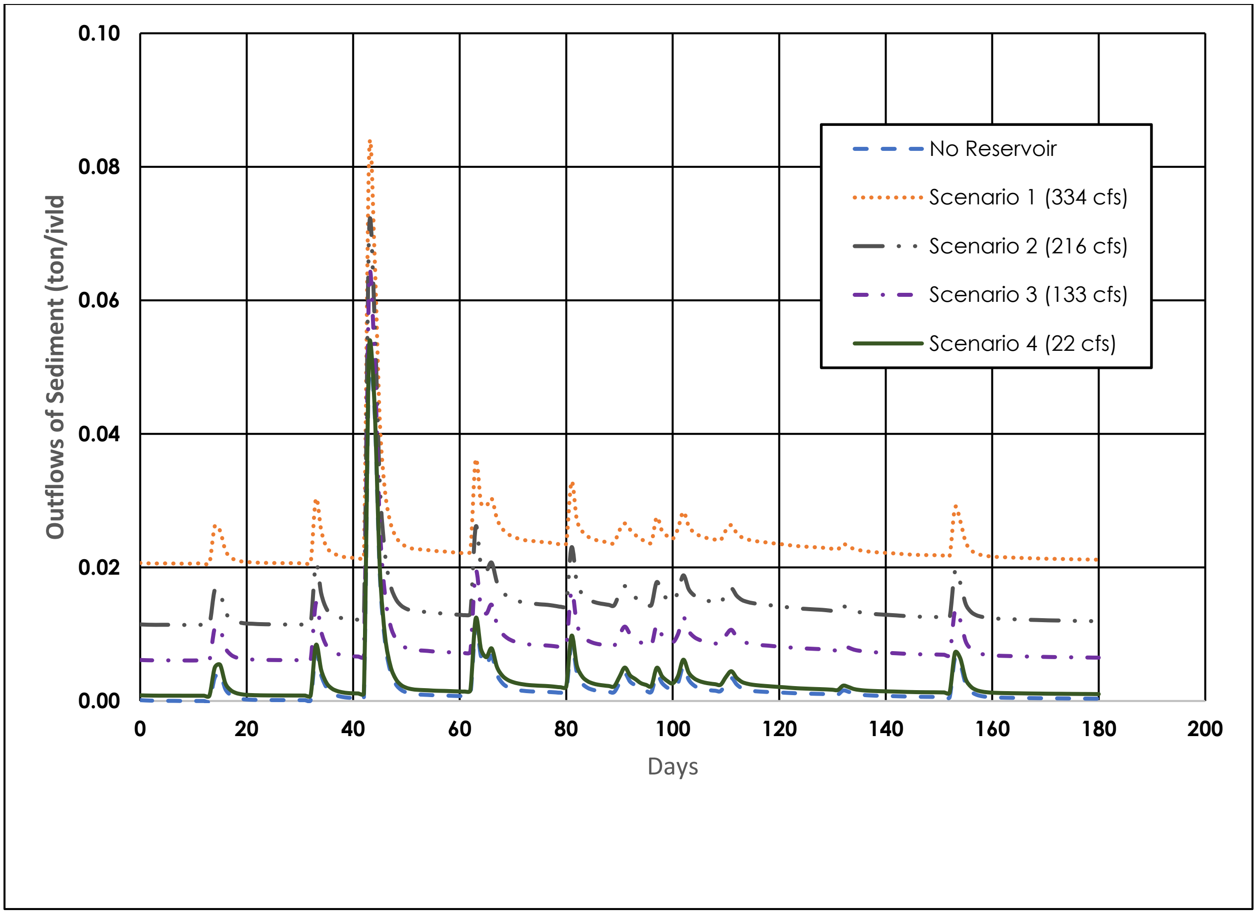


***Figure 42**: Sediment outflow from Oyster Creek downstream of proposed reservoir.*

As there is no sediment coming from the proposed Harris Reservoir, the inflow of sediment into Reach 3 of Oyster Creek is the same for all five scenarios, including the existing conditions. The outflows from the proposed Harris Reservoir are causing scour of sediment from Oyster Creek, increasing erosion. **Figure 43** shows that all five scenarios show the same results for the amount of sediment in the inflow into Oyster Creek Reach 3.

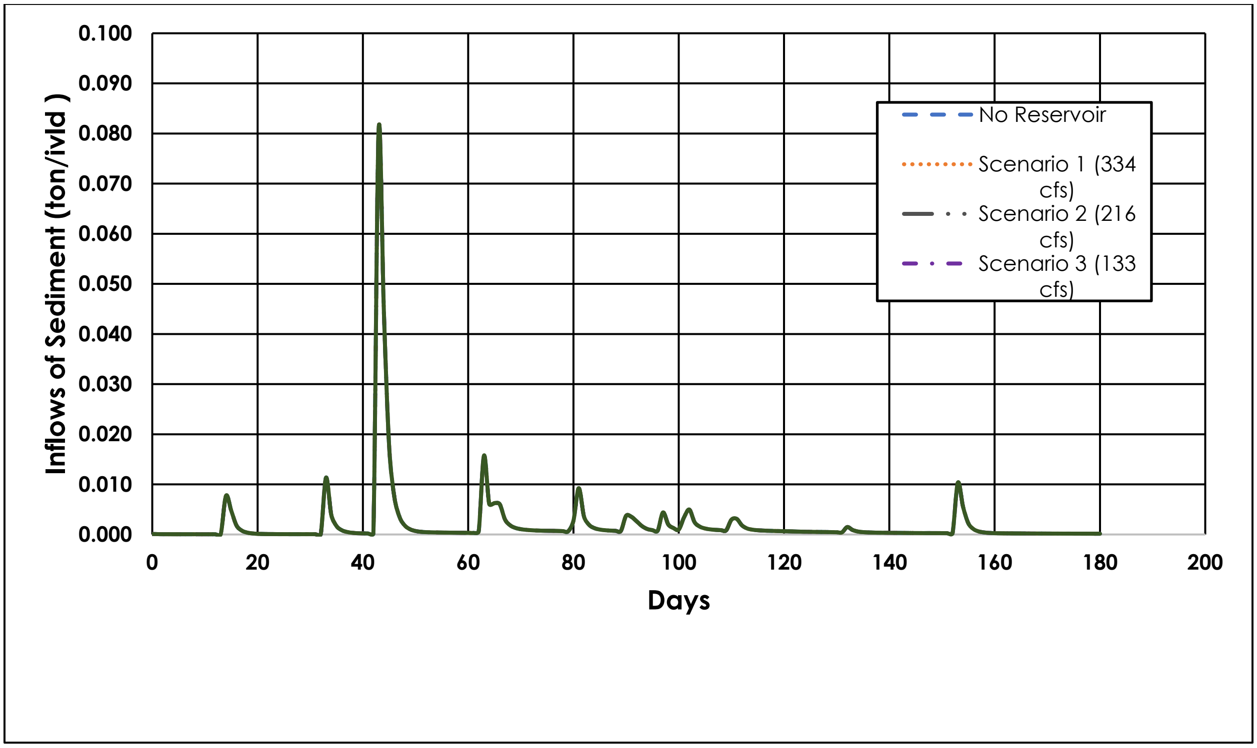


Figure 43: *Sediment inflow into Oyster Creek downstream of proposed Harris Reservoir.*

The total suspended sediment concentration in Reach 3 of Oyster Creek is shown in **Figure 44** below. With the higher flows from the proposed reservoir, the concentration of suspended sediments decreases just downstream of the proposed Harris Reservoir in Oyster Creek. Higher flows in Oyster Creek transports the suspended sediments farther downstream, decreasing their concentration in Reach 3.

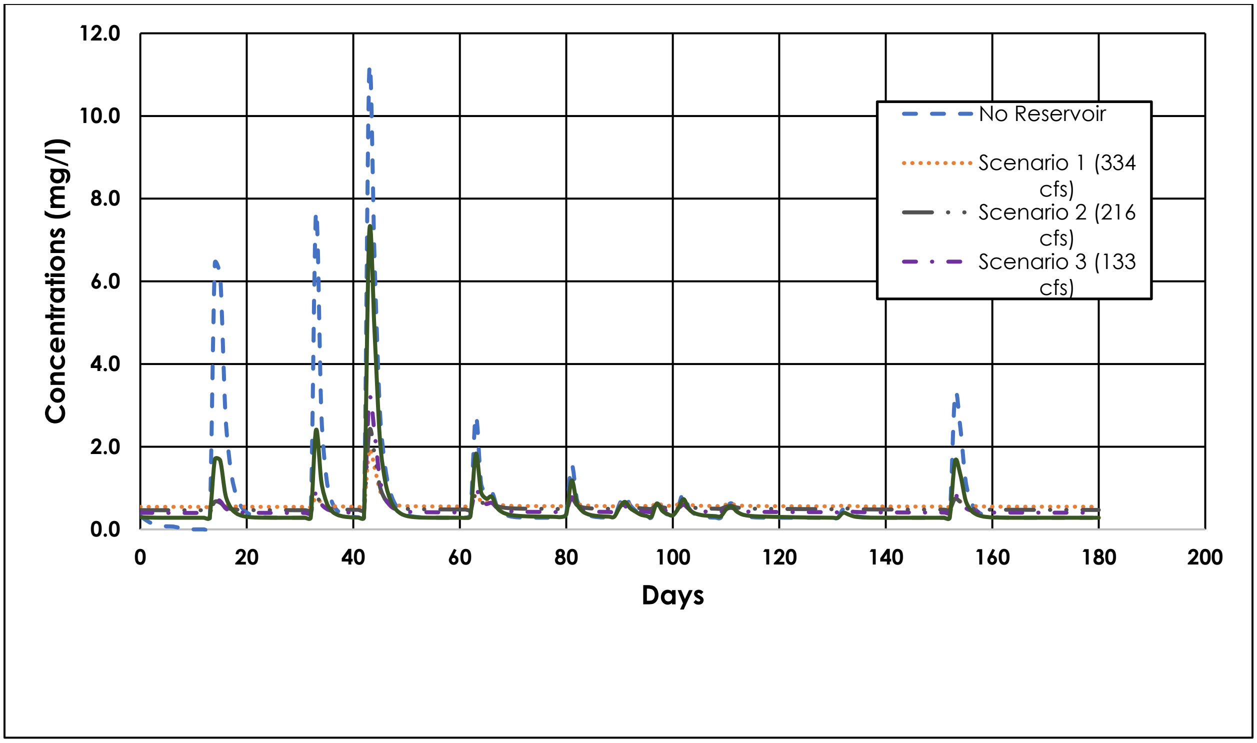


Figure 44: *Total suspended sediment concentration in Oyster Creek.*

One last model result examined was the water temperature in Oyster Creek downstream of proposed reservoir for all five scenarios. This parameter was used in aquatic assessment portion of this study (**Appendix A**). Water temperature in Oyster Creek decreases as the amount of outflow from the proposed Harris Reservoir increases. **Figure 45** shows the water temperature results from the HSPF model. The average water temperature in Oyster Creek before the proposed Harris Reservoir is 71.86 degrees Fahrenheit, whereas this value decreases by 19.87 degrees for Scenario 1, which has the highest constant flow out of the proposed Harris Reservoir into Oyster Creek. This scenario has an average water temperature of 52 degrees Fahrenheit. When there is more water, it takes longer for that water body to absorb heat from atmosphere.

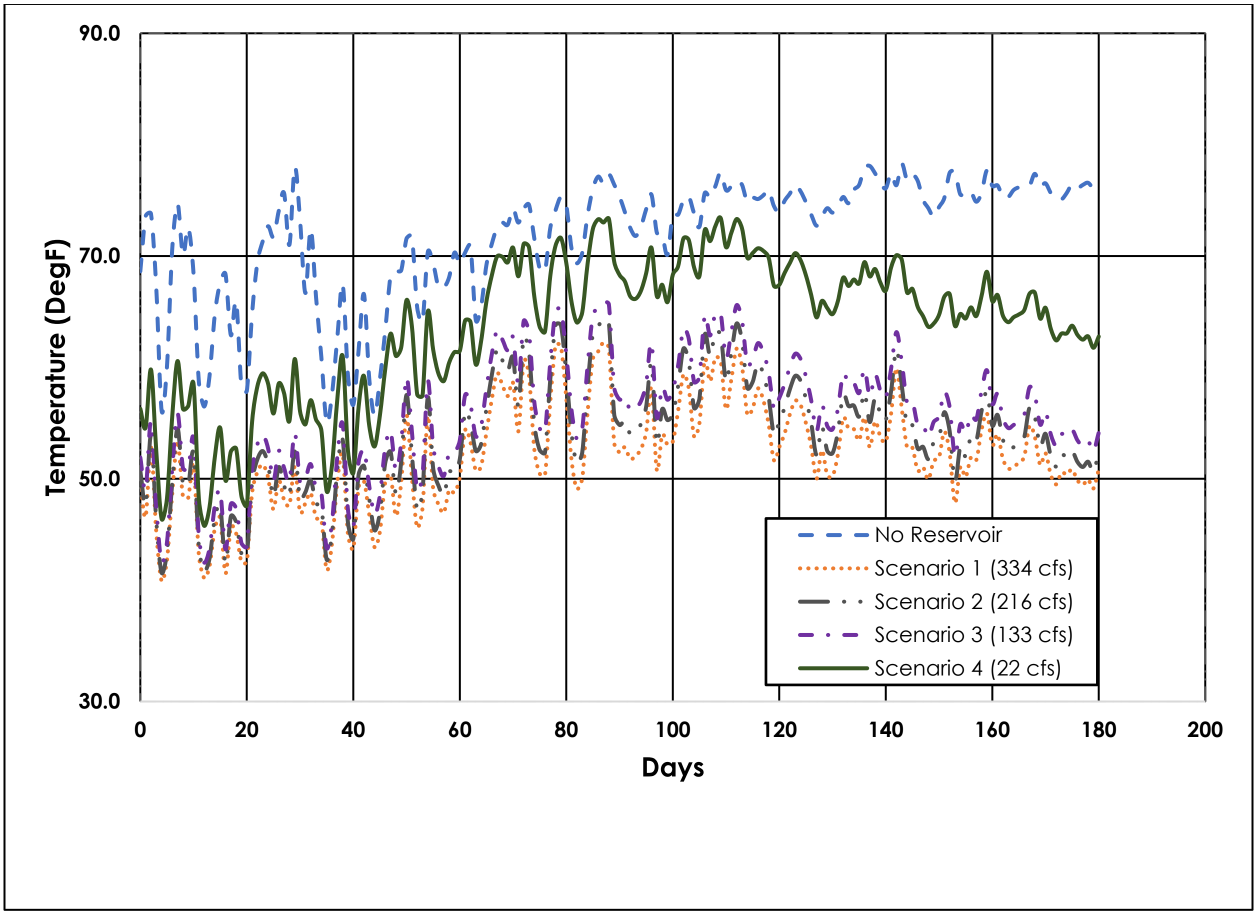


__Figure 45:__ Water temperature in Oyster Creek downstream of proposed reservoir.

HSPF model results indicate that erosion and scour will increase as a result of construction of the proposed Harris Reservoir. Another effect would be on the water temperature. All these results are also used in the analysis of the proposed expansion on the aquatic environment, which is in **Appendix A**.

5.0 Conclusions

5.1 Downstream Impacts to Oyster Creek

The following conclusions can be drawn pertaining to downstream impacts of the proposed Harris Reservoir to Oyster Creek:

5.1.1. Hydrologic and Hydraulic Modeling for Design Storms

1. **Floodplain Storage Loss**
    a. Jacobs HEC-RAS model demonstrates no rise between existing and proposed conditions, but shows a loss of floodplain storage of 1,028 ac-ft .
    b. To address the 1,028 ac-ft loss of floodplain storage, the proposed Harris Reservoir will be operated to counter the effects due to the loss of floodplain storage. All of the results are summarized in **Table 36** and explained here in text. With no drawdown, there is no floodplain gain. With a 18-inch drawdown prior to a 100-year storm event and holding 6 inches of floodplain storage in the reservoir, there is a floodplain gain of 807 ac-ft. With a 1,028 ac-ft floodplain loss, this operational measure supplied a net loss of 221 ac-ft.
    c. The other operational measure modeled for 100-year design storm event is 18 inches of drawdown and 9 inches of storage held in the reservoir. This measure causes a gain of 1,309 ac-ft of floodplain, which results in a net gain of 281 ac-ft.
    d. The next operational measure for 100-year design storm event is 18 inches of drawdown before the storm and holding 12 inches of storage before spillway discharge. The model results for this measure show a floodplain gain of 1,632 ac-ft with a net gain of 604 ac-ft floodplain storage.
    e. The same operational measures were also modeled for 50-year design storm. The no-drawdown scenario for 50-year design storm shows no floodplain gain or loss.
    f. Drawing down the reservoir 18 inches prior to the storm event and holding 6 inches of storage for a 50-year storm event causes a floodplain gain of 993 ac-ft, which has a net floodplain gain of 468 ac-ft.
    g. For 50-year design storm, 18 inches of drawdown and holding 9 inches of storage causes a gross floodplain increase of 1,371 ac-ft and a net floodplain increase of 846 ac-ft.
    h. For 50-year design storm, drawing down the reservoir 18 inches before the storm event and holding 12 inches of storage results in a gross floodplain gain of 1,715 ac-ft and a net floodplain gain of 1,190 ac-ft.

Table 36: Floodplain Storage Gain/Loss with Operational Measures

	50-Year Design Storm					100-Year Design Storm			
	Floodplain Storage (ac-ft)								
	Loss of Floodplain Storage	No Draw-down	Proposed 18" Drawdown and 6" Floodplain Storage	Proposed 18" Drawdown and 9" Floodplain Storage	Proposed 18" Drawdown and 12" Floodplain Storage	No Draw-down	Proposed 18" Drawdown and 6" Floodplain Storage	Proposed 18" Drawdown and 9" Floodplain Storage	Proposed 18" Drawdown and 12" Floodplain Storage
50-year	-525	-525	+993	+1,371	+1,715	N/A	N/A	N/A	N/A
100-year	-1,028	N/A	N/A	N/A	N/A	-1,028	+807	+1,309	+1,632
Total		-525	+468	+846	+1,190	-1,028	-221	+281	+604

2. **Peak Flow Discharge**
    a. There are two peak flows in the HEC-RAS model results. A smaller magnitude peak flow associated with the design storm rainfall that arrives within days after the storm event has ceased. Later, there is a larger peak flow associated with the crossing of interbasin flows into Oyster Creek from the Brazos River that arrives weeks later and is larger in magnitude. The peak flows are generally higher in the proposed conditions model in comparison to the existing conditions model. This increase in flows increases the potential for erosion and hydromodification during larger storm events. All the reaches downstream of the proposed Harris Reservoir experience increases in peak flows. The reaches that experience peak flow impacts are reaches R-O3, R-O4, R-O5, R-O6, and R-O7.
    b. The peak flow increase is associated directly with the proposed Harris Reservoir blocking the interbasin flows from the Brazos River into Oyster Creek. The interbasin flows are modeled as lateral hydrographs in the unsteady HEC-RAS model and sources/sinks in the HEC-HMS. These hydrographs were not adjusted to account for routing or lagging in the watershed but were assumed to have the same timing and shape as overflows from Brazos River.
    c. As the interbasin flow hydrographs for both existing and proposed conditions are the same, the increase in peak is the result of the blockage of these interbasin flows by the proposed Harris Reservoir.
3. **Water Surface Elevations**
    a. The increase in peak flows shown in the HEC-HMS model demonstrates that there is potential for increases in the water surface elevations on the downstream reaches that are farther downstream than what was modeled in the Jacobs model. There is potential for water surface increases for R-O3, R-O4, R-O5, R-O6, and R-O7 between the existing Harris Reservoir (Junction J-O3) and the end of the model at Lake Jackson (Junction J-O7).

b. Watearth recommends the operation of proposed Harris Reservoir to include 18 inches of drawdown prior to a tropical storm event in combination with 12 inches of floodplain storage prior to discharge in order to lessen the peak flow impacts occurring at Junction J-O4, which experiences the highest increase of peak flow of all the modeled junctions. Further analysis is needed to either eliminate the WSEL increase and its potential effects on the floodplain and adjacent land structures.

5.1.2. Watershed Modeling for Drought Conditions

1. Based on modeling during 180 days of drought conditions, with the construction of the proposed Harris Reservoir, sediment erosion and scouring will increase downstream of the proposed in Oyster Creek. Among the four scenarios modeled in HSPF for drought conditions, the most scour occurs for Scenario 1, which has the highest constant outflow from the proposed Harris Reservoir. For this scenario, only scour happens. For Scenarios 3 and 4 (constant flows of 133 cfs and 22 cfs, respectively), deposition also occurs over the 180 days of simulation.
2. The erosion and scour will increase the concentration of suspended sediments in Oyster Creek downstream of the proposed Harris Reservoir. The amount of total sediment concentration flowing out of Reach 3, which is immediately downstream of the proposed Harris Reservoir, increases from 0.0508 tons/ac-ft for existing conditions to 0.0821 tons/ac-ft for Scenario 1, 0.0706 tons/ac-ft for Scenario 2, 0.0630 tons/ac-ft for Scenario 3, and 0.0530 tons/ac-ft for Scenario 4.
3. The average velocity in Oyster Creek will also increase as the discharge from the proposed Harris Reservoir increases. The average velocity in Oyster Creek for existing conditions is 1.68 ft/s. This value increases to 2.36 ft/s for Scenario 1 (334 cfs outflow from the proposed Harris Reservoir), 2.2 ft/s for Scenario 2 (216 cfs outflow from the proposed Harris Reservoir), 2.03 ft/s for Scenario 3 (133 cfs outflow from the proposed Harris Reservoir), and 1.71 cfs for Scenario 4 (22 cfs outflow from the proposed Harris Reservoir).
4. Model results indicate a decrease in water temperatures with outflows from the proposed Harris Reservoir into Oyster Creek, as well. The average water temperature in Oyster Creek for existing conditions is 78.29 degrees Fahrenheit. This value decreases to 62.25 degrees Fahrenheit for Scenario 1, 64.36 degrees Fahrenheit for Scenario 2, 65.88 degrees Fahrenheit for Scenario 3, 73.40 degrees Fahrenheit for Scenario 4.
5. Although not modeled, there will be some impact on Oyster Creek when constant discharge from the proposed Harris Reservoir stops after 180 days of operation. This could potentially impact bank erosion as velocity decreases and potentially impact vegetation on the banks. The wet bank soils would dry when the constant discharge stops causing erosion.

5.1.3. Aquatic Assessment

1. The outflows from the proposed Harris Reservoir will cause an increase in velocity in Oyster Creek that could cause increased sedimentation and turbidity downstream, as well as erosion and scour along the banks of Oyster Creek.
2. The outflows from the proposed Harris Reservoir will cause a decrease in temperature with increased outflows from proposed Harris Reservoir.
3. The outflows from the proposed Harris Reservoir will cause an increase in sedimentation and turbidity in Oyster Creek downstream of the proposed Harris Reservoir due to

increased erosion and scour. This increase in sedimentation could cause water quality issues and decrease clarity downstream.

4. With the increased velocity in Oyster Creek, there will be an environmental shift with less deposition and more scour. Sediments will be removed, therefore deepening the channel.
5. If vegetation is affected by increased velocity, lower temperatures, turbidity, and an influx of sedimentation, the protective measures that streambank vegetation provides will be lessened and could cause increased erosion on Oyster Creek.

5.2 Oyster Creek Flow Pattern Alteration

Oyster Creek is a highly modified drainage system. The Sienna Plantation diversion canal removes 67.28 sq mi of drainage (or 63-percent of drainage at the end of Project 2). This results in a lower peak flows and flow durations from the Sienna Plantation diversion to the Gulf of Mexico when taking into consideration the historical flow patterns before the diversion. This will result in a channel narrowing and a reduction in bankfull channel width over time. Oyster Creek will have more dry periods than it has historically, which can lead to a wetting/drying cycle that can enhance channel erosion.

The stream is being further modified by the geomorphic stream modification starting upstream of the proposed reservoir's northeast corner. The stream modification continues downstream with benching in Project 2 for enhanced riparian plant growth for overall channel stability. Project 3 is an overflow channel that eliminates the greater than 25-year flow from entering an approximately 2.95-mile oxbow in Oyster Creek before the overflow channel re-joins Oyster Creek again at the reservoir outlet channel. This geomorphic stream modification will stabilize the channel, allowing sediment deposited in the benched areas and more uniform velocities to transport sediment through the modified system, noting low sediment loads in reservoir discharges and possibly also natural flows from upstream of the proposed project. Reservoir releases will be from water deprived of sediment. This deprived water can cause stream channel incision and streambank erosion.

The reservoir outlet works will normally only operate when there is no natural/storm flow in Oyster Creek. The outlet sluice gates can operate over a wide range of discharges. These discharges can include emergency reservoir drawdown in preparation for a tropical storm, which may be at maximal allowable discharge during a short period of time due to period of warning provided. Since these releases may be made into a channel that is dry, the release rate needs to be such that the erosion potential of the deprived reservoir water is taken into consideration and is part of the operation plan.

5.3 Reservoir System

The new proposed reservoir will become part of the Dow water supply system, which consists of the following elements: the lower Brazos River, Oyster Creek, and three off-channel pump storage reservoirs. All elements of the system need to be and should be operated as a system.

The system should be operated by a fully functional plan called an operations plan. A comparable system could not be found with a similar plan for reference, but the operations plan needs to include the following:

1. When water will be pumped (what elevation in each reservoir will be the indicator); and
2. Water releases from each reservoir

a. Rate of release
    i. Initial or changes in release rates and duration to reduce channel and bank erosion because of wet and dry cycles
    ii. Controlled planned reductions in release rates. Sudden reduction can cause stream bank instability and bank sloughing.
    iii. The proposed Harris Reservoir causes blockage to interbasin flows from the Brazos River into Oyster Creek. This causes increases in peak flows following 50- and 100-year storm events. To address this, the design of the proposed reservoir can be modified to keep the natural overflow paths, or a conveyance route can be established for interbasin basin flows that are blocked by the proposed Harris Reservoir (especially B11 and B12 in the HEC-HMS model).
    iv. Another measure to address the blockage of interbasin flows from the proposed Harris Reservoir would be to have an additional detention storage to store 50- and 100- year storm events and mimic the current timing of overflows from the Brazos River into Oyster Creek. This would also help decrease the potential water surface elevation increases due to peak flow increases.
b. Water quality releases from all three reservoirs
    i. Visual indicators need to be listed
    ii. Chemical testing indicators need to be listed.

The system should also have a maintenance plan and program. A comparable system could not be found with a similar plan for reference, but the maintenance plan needs to include the following items that are to be inspected on at least an annual basis or more often, as necessary:

1. Reservoir embankments
    a. Adequately vegetated and mowed
    b. No trees or brush on embankment
    c. No embankment cracks, settlement, or bulges present
    d. No embankment erosion from rainfall or wave action
    e. No animal holes or burrows present
    f. Excessive seepage should be repaired
    g. Foundation and toe drains should be functional
2. Inlets and outlets
    a. Concrete deterioration
    b. Conduits structural sound
    c. Pumps maintained
    d. Gates and valves maintained
    e. Metal corrosion
    f. Fences and guardrails are secure

3. Channels
    a. Maintain channel dimensions and slope
    b. Maintain vegetation where applicable
    c. Remove undesired vegetation
    d. Remove debris and sediment when necessary
    e. Repair channel and bank erosion
4. Reservoirs
    a. Sediment should be removed on a rotational schedule from each of the three reservoirs to maintain reservoir storage capacity (i.e., every 10 years) and maintain a clear path to the outlet structures (siphons)
    b. Maintain good water quality in all three reservoirs at all times

These O&M plans should be reviewed annually to make any needed updates and changes. Training should be given to all employees who use the operation plans to manage the system so they understand the processes. The maintenance inspections should be completed by qualified individuals with knowledge of water resources concerning embankments, channels, and water resources. The maintenance inspection shall be documented with any items that need correction and then followed up with documentation when the corrective action is completed.

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Appendix A

Aquatic Assessment Report

Appendix B

Clark's Method Hydrologic Parameters

Appendix C

HCFCD Conveyance Discharge Curve

Appendix D

Locations of Effective Cross-Sections

Appendix E

Meteorological Station (TX 722527) Data

Appendix F

USGS 0807900 Gage Discharge Data

Appendix G

Evapotranspiration Data from EPA Storm Calculator

Watearth™

Appendix H

Proposed Harris Reservoir Expansion Elevation-Volume Relationship

Appendix I

HSPF Model Results

APPENDIX G

Compensatory Mitigation Plan

Note: The Section 508 amendment of the Rehabilitation Act of 1973 requires that the information in federal documents be accessible to individuals with disabilities. The U.S. Army Corps of Engineers (Corps) has made every effort to ensure that the information in this appendix is accessible. However, this appendix is not fully compliant with Section 508, and readers with disabilities are encouraged to contact Mr. Jayson Hudson at the Corps at (409) 766-3108 or at SWG201601027@usace.army.mil if they would like access to the information.

Harris Reservoir Expansion Project Compensatory Mitigation Plan

Document no: PPS0926221241AUS
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SWG Permit File No. SWG-2016-01027

Dow Harris Reservoir Expansion Project, Brazoria County, Texas
March 2023

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Definitions and Acronyms

‘	inch(es)
“	foot or feet
ac	acres
ac-ft	acre-foot or acre-feet
AJD	Approved Jurisdictional Determination
ATV	all-terrain vehicle
BASINS	Better Assessment Science Integrating Point and Non-point Sources analysis system
BMP	best management practice
BNWR	Brazoria National Wildlife Refuge
CFR	Code of Federal Regulations
CMP	Compensatory Mitigation Plan
dbh	diameter at breast height
FAC	facultative (equally likely to occur in wetlands or non-wetlands)
FACW	facultative wetland (usually occurs in wetlands, but occasionally found in non-wetlands)
FCI	functional capacity index
FCU	functional capacity unit
FEMA	Federal Emergency Management Agency
HGM	hydrogeomorphic
HUC	hydrologic unit code
iHGM	interim hydrogeomorphic
LiDAR	light detection and ranging
MPAC	maintenance of plant and animal communities
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resource Conservation Service
OBL	obligate wetland (occurs almost always under natural conditions in wetlands)
PEM	palustrine emergent
PFO	palustrine forested

PRM	Permittee-responsible mitigation
PSS	palustrine scrub-shrub
PVC	polyvinyl chloride
RSEC	removal and sequestration of elements and compounds
SCA	Stream Condition Assessment
SWCA	SWCA Environmental Consultants
SWG	Southwest Galveston (U.S. Army Corps of Engineers)
TCEQ	Texas Commission on Environmental Quality
TDA	Texas Department of Agriculture
TSSW	temporary storage of surface water
U.S.	United States
USDA	U.S. Department of Agriculture
USACE	U.S. Army Corps of Engineers
YR	Yellow-Red hue on the Muncell color chart

1 Project Information

The Dow Chemical Company (Dow) proposes to construct the Harris Reservoir Expansion Project (Proposed Project), an approximately 51,000 acre-foot (ac-ft) off-channel water supply reservoir immediately to the north of the existing Harris Reservoir in central Brazoria County, Texas. A full description of the Project purpose is provided in the Dow application for an individual permit (SWG-2016-01027) from U.S. Army Corps of Engineers (USACE). The Project purpose is to expand Dow's current combined water storage supply of 27,343 ac-ft from Harris Reservoir and Brazoria Reservoir of approximately 63 days to 180 days. The Texas Commission on Environmental Quality (TCEQ) recommends water suppliers have at least 180 days of water storage to allow for continued operations during drought conditions.

Dow proposes the Compensatory Mitigation Plan (CMP) as developed by Stantec (previously Cardno) for offsite mitigation at the Big Slough Bayou (Big Slough) site and Jacobs Engineering Group Inc. (Jacobs) for onsite mitigation at the Oyster Creek site to compensate for unavoidable impacts to waters of the United States (U.S.) in accordance with the USACE Regulatory Program regulations Code of Federal Regulations (CFR) Title 33 Sections 320 through 332 (30 CFR 320) and 40 CFR 230. The CMP will begin commencement after permit issuance. It is anticipated that mitigation activities at the Big Slough site will be initiated simultaneously with construction of the Proposed Project. The financial assurances will be implemented prior to construction and within 30 days of start of construction activities. The real estate instrument will be put into effect at a minimum of 30 days prior to implementation of the CMP.

As part of the Draft Environmental Impact Statement process, SWCA Environmental Consultants (SWCA), acting at the direction of the USACE Galveston District, completed a wetland delineation and functional assessment for the properties associated with the Proposed Project. The USACE reviewed and concurred with the wetland delineation and subsequently issued a wetland delineation verification on October 23, 2019.

The Proposed Project includes an off-channel reservoir that covers approximately 2,000 acres and includes a pump intake station on the Brazos River, as well as a gravity outfall to Oyster Creek via a new bypass channel that will be operated independently of the existing Harris and Brazoria reservoirs. The proposed property for the reservoir expansion sits immediately north of Harris Reservoir, in between the Brazos River and Oyster Creek, in rural north-central Brazoria County. The approximate center of the Proposed Project is at 29.267725 ºN, 95.543750 ºW. The combined floodplain of Oyster Creek and Brazos River covers the agricultural fields in this area with elevations ranging from 0 to 50 feet above mean sea level. The hydrologic unit codes (HUCs) associated with the Proposed Project are the Austin-Oyster (HUC 12040205) and Lower Brazos (HUC 12070104) watersheds. The latitude and longitude for Oyster Creek mitigation site is 29.270976 ºN, -95.554911 ºW. Big Slough mitigation site is located at latitude and longitude 29.055801 ºN, -95.309776 ºW. Figure 1-1 provides an overall site plan for the Proposed Project. Figure 1-2 provides an overview of the Big Slough mitigation site.

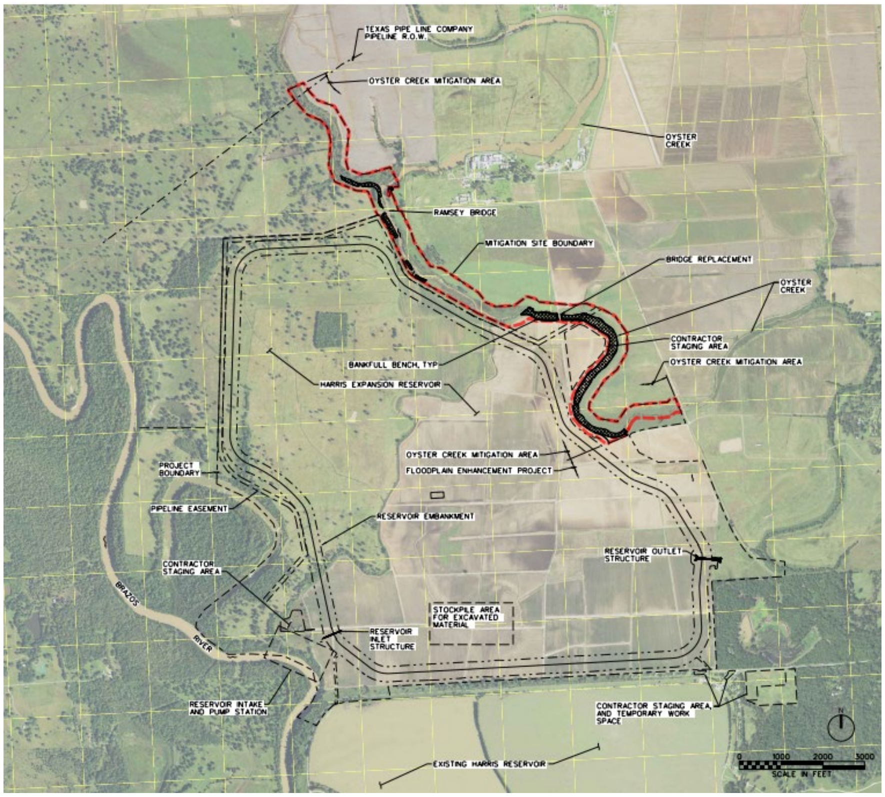

Figure 1-1. Overall Site Map of the Proposed Project and the Oyster Creek Mitigation Site

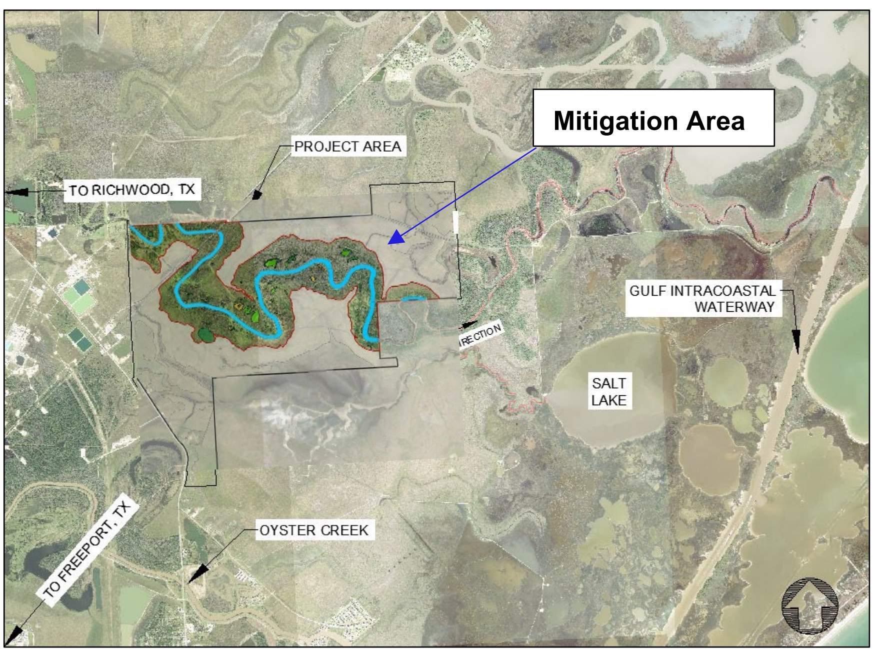

Figure 1-2. Overview of the Big Slough Mitigation Site

2 Avoidance and Minimization

Efforts were taken to avoid and minimize impacts to waters of the US. This section provides an overview of avoidance and minimization efforts.

2.1 Avoidance

Avoidance of wetland and waterbody impacts to the maximum extent possible is initially accomplished through a robust alternative project selection process. For the Proposed Project, avoidance of wetland and waterbody impacts is primarily accomplished through site selection and temporary workspace siting during design iterations. Impacts to wetlands and other waters could not be completely avoided due to the nature of the Proposed Project which includes inundation of water bodies on the site as a means of facilitating efficient use of resources. The floodplain enhancement project includes increasing hydraulic capacity above the Ordinary High Water Mark of Oyster Creek. Impacts are also avoided by siting temporary construction workspaces to avoid sensitive wetland and other water features. In addition, wetlands outside of construction workspaces will be demarcated in the field and identified on work plans as “no work zones” to avoid impacts during construction.

2.2 Minimization

Construction and restoration activities within wetlands will be conducted in accordance with conditions defined in the USACE permit. Appropriate construction techniques will be used to prevent turbidity resulting from erosion of adjacent areas (for example, Oyster Creek and the Brazos River) during and after construction, and erosion control measures will be implemented to minimize siltation, sedimentation, and other impacts that may temporarily affect surface waterbodies in the construction area and during operation. Minimization of the impacts to the aquatic resources will also be realized through implementation of onsite mitigation and reestablishment of riparian areas along Oyster Creek.

Dow will avoid and minimize potential adverse impacts to wetland and waters of the U.S. by implementing the following techniques as appropriate. Other techniques may be identified during final design and construction that can be implemented in addition to or in lieu of the following:

- Install appropriate BMPs and erosion control measures to protect wetland and water resources on the subject property and adjacent areas.
- Locate equipment refueling areas away from wetlands and waters of the U.S.
- Reduce the disturbance to the Brazos River and Oyster Creek and associated vegetation to the extent practical and minimize clearing of trees and other plants in the temporary workspace areas to leave in place as much vegetation as possible on stream banks within the temporary workspace.
- Stabilize and restore stream banks and adjacent upland areas after construction.
- Segregate wetland topsoil and its associated seedbank and returning it to the top where applicable.
- Use of matting to protect the underlying soil and root stock, where applicable such as during restoration and reestablishment projects along Oyster Creek.
- Inspect construction areas periodically during and after construction and repair any erosion controls and/or performing restoration, as needed, in a timely manner.

3 Compensatory Mitigation Goals and Objectives

The wetland delineation, performed by SWCA and verified by USACE on October 23, 2019, identified three wetland vegetation community types within the Project area including palustrine emergent (PEM), palustrine scrub-shrub (PSS), and palustrine forested (PFO) wetlands totaling approximately 21.380 acres (that is, 9.624 acres of PEM, 4.933 acres of PSS, and 6.823 acres of PFO). The following descriptions identify the general vegetation communities associated with the property.

PEM Wetland. PEM wetland communities include a prevalence of hydrophytic non-woody vegetation less than 3 feet in height. Dominant herbaceous species within the Project area included jungle-rice (*Echinochloa colona*; FACW), sand spikerush (*Eleocharis montevidensis*; FACW), tall scouring-rush (*Equisetum hyemale*; FACW), common rush

(*Juncus effusus*; OBL), golden crown grass (*Paspalum dilatatum*; FAC), mild water-pepper (*Persicaria hydropiper*; OBL), and swamp smartweed (*P. hydropiperoides*; OBL).[1]

PSS Wetland. PSS wetland communities include a prevalence of hydrophytic woody species less than 20 feet in height and 3 inches or greater in diameter-at-breast height (dbh). PSS wetlands within the Project area were dominated by black willow (*Salix nigra*; OBL), poison-bean (*Sesbania drummondii*; FACW), and Chinese tallowtree (*Triadica sebifera*; FAC). Golden crown grass was the prevalent herbaceous species within these wetland communities.

PFO Wetland. PFO wetland communities include a prevalence of hydrophytic woody species greater than 20 feet in height and 3 inches in dbh. PFO wetlands in the Project area were dominated by tree and shrub species of pecan (*Carya illinoinensis*, FAC), sugarberry (*Celtis laevigata*; FACW), green ash (*Fraxinus pennsylvanica*; FACW), and American elm (*Ulmus americana*; FAC). The tree species found within these communities are typical of forested areas in the coastal plains.

In addition, SWCA identified 41 waterbodies including 11 streams, 5 ditches, 22 agricultural ditches, and 3 ponds within the Project area. These waterbodies total 109,338 linear feet of linear waterbodies (26,250 feet of ephemeral waterbodies, 26,916 feet of intermittent waterbodies, and 56,172 feet of perennial waterbodies). Not all of the wetlands and water bodies on the project site will be impacted by the Proposed Project; Tables 6-1 and 6-2 presented impacts to wetlands and other water bodies, respectively-.

3.1 Mitigation Goal

The goal for this mitigation plan is to successfully replace functions of the waters of the U.S. in terms of aquatic ecosystem functions and hydrologic conditions from impacts within the Proposed Project footprint by meeting the following objectives.

3.2 Mitigation Objectives

To support the mitigation goal associated with the Proposed Project, specific objectives for the Oyster Creek and Big Slough have been developed to address specific characteristics of the sites.

3.2.1 Objectives for Oyster Creek

- Enhance approximately 170 acres of riparian buffer, via the eradication of Chinese tallow and other invasive and noxious species followed by planting of native trees and shrubs and seeding.
- Improve the function of Oyster Creek by reconnecting to its floodplain and riparian buffers by excavating approximately 25.9 acres of bankfull benches.
- Ensure long-term site protection by executing a deed restriction on the site.
- Protect established and enhanced mitigation area riparian buffer by eliminating impacts from cattle grazing and predation by other species.

3.2.2 Objectives for Big Slough

The objective of the mitigation strategies proposed to be implemented at Big Slough include enhancement, establishment, and reestablishment of Big Slough and associated wetlands. The mitigation strategies will accomplish the following:

- Enhance approximately 139 acres of riparian buffer and 12.65 acres of forested wetlands, via the eradication of Chinese tallow and other invasive species followed by planting.

[1] FAC = facultative (equally likely to occur in wetlands or non-wetlands); FACW = facultative wetland (usually occurs in wetlands, but occasionally found in non-wetlands); OBL = obligate wetland (occurs almost always under natural conditions in wetlands)

- Establish 7.45 acres of forested and 12.16 acres of herbaceous relic river scroll wetlands within the Big Slough Bayou floodplain to compensate for stream impacts at the Project area.
- Rehabilitate natural flows in 33,400 feet of Big Slough Bayou by removing five earthen dams and enhancing water flow upstream of the mitigation site, but within the property boundary via installation of three 10-foot, 36-inch diameter corrugated metal pipe culverts at the main access road. Current flow is achieved via two 10-inch pipes that become block by much and woody debris.
- Ensure long-term site protection by executing a deed restriction on the site.
- Protect established and enhanced areas within the bayou and riparian buffer, as well as established scroll wetlands by eliminating impacts from cattle grazing and predation by other species.

4 Site Selection

Dow reviewed current mitigation banks available within the respective watershed and found that adequate stream mitigation credits were not available to meet mitigation needs for the Proposed Project. Stream mitigation comprises the largest portion of the required mitigation, incorporating wetlands into the stream mitigation provide a more robust watershed approach and improvement to ecological functions within the watershed. Dow determined that a combination of Oyster Creek and Big Slough mitigation sites on lands currently owned by Dow and within the same watershed as the Proposed Project would collectively meet the needs for both stream and wetland impacts. Details of the mitigation sites are provided below. Site figures for the proposed mitigation sites may be found in Attachment 1.

4.1 Factors Considered

During the mitigation site selection process, Dow considered factors including proximity to the Proposed Project, the potential for and feasibility to create ecological uplift, stream characteristics and land ownership. The Oyster Creek and Big Slough site are wholly owned by Dow.

Additional factors considered included avoidance of airports within 5 miles and areas with a high likelihood of adjacent development. Additionally, proximity to adjacent public lands or complementary restoration areas and other elements described in the following sections were considered in accordance with 33 CFR 332.3(d).

4.2 Alternatives Considered

During the site selection process, several options for providing compensatory mitigation for the unavoidable impacts by the Proposed Project were considered. The 2008 Final Compensatory Mitigation Rule states that mitigation options should be considered based on the following hierarchy:

1.0 Purchasing credits from an operational mitigation bank. The Proposed Project and both the Oyster Creek and Big Slough mitigation sites lie within the same prime service area, the Austin-Oyster Sub-basin (HUC 12040205). This service area is historically underserved by mitigation bank credits, with only two small mitigation banks with available credits: The Lower Brazos River (297 acres) and Mill Creek (188.6 acres) banks. Within these, only 32 riverine herbaceous-shrub credits and 20 riverine forested credits are available collectively. Using Big Slough for compensatory mitigation would add ecological benefit to the region and adjacent Brazoria National Wildlife Refuge without creating an additional pull on the already limited supply of available credits within the service area.

1.1 Purchasing credits from an approved in-lieu fee program. The Project site is outside of the primary and secondary service areas for in-lieu fee programs that offer stream credits; therefore, permittee-responsible mitigation through onsite and offsite, in-kind mitigation was selected for stream and wetland mitigation

4.3 Oyster Creek

4.3.1 Consideration of Watershed Needs

The Proposed Project area lies within the Oyster Creek watershed, which has been highly modified upstream of the Project area due to historical land use and water management activities. Directly adjacent to the proposed reservoir, segments of the Oyster Creek riparian corridor have been impacted by decades of agricultural production that have diminished the physical, biological, and chemical functionality of the creek. The watershed would benefit from restoration (reestablishment or rehabilitation). Other segments of Oyster Creek in the Project area are largely intact and would benefit from enhancement or reestablishment.

4.3.2 Practicability of Ecologically Self-sustaining Establishment

The proposed mitigation is expected to be practicable and ecologically self-sustaining. Creating bankfull benches, the removal of invasive and noxious species and riparian seeding and planting are designed to facilitate the maintenance, re-establishment, and restoration of a healthy riparian corridor along Oyster Creek (the onsite mitigation area). Ongoing maintenance and adaptive management during the monitoring period will focus on a self-sustaining riparian corridor for the long-term.

A detailed geomorphic assessment was conducted for Oyster Creek in 2019 that established that Oyster Creek is a sinuous, low-gradient (less than 0.0001 foot per feet) stream with fine-grained (silt/clay) bed and banks (Jacobs 2019). The channel exhibits lateral and vertical stability, but the riparian zone has been significantly narrowed due to the encroachment of agricultural land use practices such as row crops and pasture. The mean and maximum bankfull depths are approximately 2.5 and 4 feet, respectively, and the bankfull width averages about 100 feet, but varies considerably across the mitigation site. The riparian soils are predominantly of the Norwood-Asa silt loams complex (USDA 2018).

4.3.3 Hydrology

The naturally occurring hydrology of Oyster Creek provides sufficient water for the proposed mitigation strategies. Water has been present in Oyster Creek during all Project site visits spanning 2018 through 2022 and is observed on aerial imagery from 1943 through 2022 (26 images). There is a stream gage maintained by the United States (U.S.) Geological Survey near Angleton, but the flows are influenced by releases from the existing Harris Reservoir and therefore does not reflect flow conditions within the onsite mitigation area. In general, Oyster Creek is a perennial stream and baseflows appear to be less than about 10 cubic feet per second. Average annual precipitation in the area is approximately 51 inches and flows in the creek rise in response to rainfall runoff (Perica et al. 2018). Sufficient flow occurs in the creek to maintain the existing ecology and provide for successful restoration, enhancement and reestablishment described in the proposed mitigation plan.

The proposed mitigation plan is consistent with floodplain management goals in that bankfull benches will be created to increase the land area subject to more frequent flooding by events that overtop the bankfull elevation. They also reduce flow velocities during flows above bankfull. This benching will enhance the success of riparian revegetation as well as provide planting areas at elevations closer to the groundwater table.

4.4 Big Slough

4.4.1 Consideration of Watershed Needs

The Big Slough mitigation site is an approximately 1,100-acre area located on Dow property 7 miles east of Lake Jackson near the Brazoria National Wildlife Refuge. As with the proposed onsite mitigation, this mitigation site also lies within the Oyster Creek watershed and has been diminished in physical, biological, and chemical functionality throughout the past century. Big Slough has experienced a mixed history of use including rangeland management for grazing and oil well drilling and extraction. These uses have contributed to pollution, erosion, subsidence, and ecological disturbance, which have altered natural wetland functions across the region (USFS 2013). Analysis of geologic maps and light detection and ranging (LiDAR) data indicates that Big Slough is a paleo-channel (slough) of the Brazos River that was left behind due to avulsion of the main channel; therefore, it used to experience much higher flow rates from a larger drainage area in the past (Cardno 2020). Development pressures in and around Richmond, Texas, led to conversion of open areas to impervious surfaces, and increased stormwater outfalls often directed north toward Big Slough (Cardno 2020). The upper end of Big Slough was excavated, and stormwater conveyance culverts were installed to convey water toward Oyster Creek and Big Slough. It appears that the Oyster Creek outfall may have silted in, causing the majority of stormwater to flow into Big Slough (Cardno 2020). Stagnant flows are present in Big Slough that have been caused by multiple embankment crossings with undersized culverts, which have increased fine sediment deposition, reduced flows, and reduced hydraulic connectivity (Cardno 2020). Fine organic sediments have accumulated for more than 100 years, creating an anoxic channel bottom with low biological diversity and poor water quality. Cattle have likely contributed to eutrophication of the Big Slough stream system, in which nutrients accumulate due to poor flow conveyance (Cardno 2020).

4.4.2 Practicability of Ecologically Self-sustaining Establishment

The proposed mitigation is expected to be practicable and ecologically self-sustaining. Dow proposes to restore approximately 33,400 linear feet of Big Slough and adjacent riparian areas within an approximate 100-foot buffer to increase stream function. The key mitigation components include increased flow through the bayou, riparian buffer restoration (exotic species eradication and native plantings), bank stabilization, reestablishment, and creation of riparian buffer habitats (scroll wetlands).

In addition, the Brazoria National Wildlife Refuge (BNWR) lies directly east of the Big Slough site. This coastal refuge complex is known to host upward of 320 bird species, which in addition to other wildlife regularly use the refuge habitats during parts or all of their life cycle. The proposed creation, enhancement, and protection of wetland and stream habitat within the Big Slough mitigation site will provide an expanded range of potential establishment for the species that use the BNWR.

4.4.3 Hydrology

The primary sources of hydrology to the Big Slough mitigation area are tides influenced by wind and pressure, direct rainfall, and runoff from surrounding properties during rainfall events. The majority of Big Slough mitigation area is within the FEMA 100-year floodplain (Attachment 1). During the onsite field investigation, it was determined that the Big Slough area contained 61 wetlands occupying 1,820.8 acres, 2 ephemeral, 1 intermittent, and 5 perennial streams and waterbodies, as well as 11 ponds. All wetlands identified were either inundated with at least 1 inch of water or had saturated soils. Big Slough currently has several earthen dams that are used as access roads; each dam has culverts within the channel that allow continual but constricted flow downstream. The Big Slough area drains precipitation and floodwater south of Big Slough Bayou into Salt Bayou and then into Salt Lake, while precipitation north of Big Slough Bayou appears to drain north to Bastrop Bayou and eventually Cox Lake. Hydrological modeling has shown that sufficient hydrology exists at this site to establish and restoration riparian wetland scrolls to enhance the overall connectivity of wetlands to Big Slough, affording a more diverse riparian ecosystem. Removing existing earthen structures within the bayou would also promote movement of aquatic life forms within the entire 33,400 foot reach.

5 Liens, Easements or Encumbrances

5.1 Oyster Creek

The Oyster Creek mitigation site adjacent to the Harris Reservoir Expansion site has a Commitment for Title Insurance and is being provided as an attachment (Attachment 7). Also, a 1946 judgment on Declaration of Taking is being provided. The Declaration of Taking identifies various properties along Oyster Creek in the proximity of the Proposed Project which have been subjected to Petition in Condemnation to acquire lands under the authority of the Attorney General of the United States, granting to the United States of America immediate possession of the described property. The United States of America is entitled to acquire property by eminent domain for the purposes as set out and prayed in said Petition and the amendments thereto. A perpetual easement and right to use, maintain and repair the bed, banks and channel of that section or part of Oyster Creek in Fort Bend County and Brazoria County, Texas, passing through and traversing the land described for the purpose of conveying, transporting, flowing and delivering water without hindrance, interruption, obstruction or interference of any kind or nature; together with the right to keep the said bed, banks and channel of said section or part of Oyster Creek free from silt and mud deposits, debris and/or any and all other obstructions of any kind whatsoever; together with the right to place and dispose of spoil upon the bank and banks of said section or part of Oyster Creek; and all incidental rights for the purposes aforesaid. (Attachment 7).

5.2 Big Slough

The Big Slough mitigation site is included in the 1979 Fifth Supplemental Title Opinion for a larger area of property. The Title Opinion is provided as an attachment (Attachment 7). To supplement the Title Opinion, an aerial Google map containing an outline of the properties described in the Title Opinion is being provided in Attachment 7.

6 Baseline Information / Site History

This section describes baseline conditions for the Proposed Project and the mitigation sites.

6.1 Reservoir Site (Proposed Project)

The results of delineated jurisdictional waters of U.S. and impacts from the Proposed Project to those resources are summarized in this section.

6.1.1 Aquatic Resources at Proposed Project Site

The assessment findings for wetland features and waterbodies which will be impacted by the Proposed Project are from the wetland delineation performed by SWCA (SWCA 2019a) and verified by USACE on October 23, 2019 (). Based on SWCA's delineation and stream assessment within the Project area using USACE Galveston District's 2013 Level I and Level II Stream Condition Assessment (SCA) protocols) USACE 2013), stream reaches impacted by the Proposed Project were quantified (SWCA 2019b). Tables 6-1 and 6-2 provide a summary of the results of the assessment prepared by USACE. Attachment 5 provides a detailed calculation of the functional assessments for the wetlands.

Table 6-1. Summary of Assessment Findings for Wetlands that will be Impacted by the Dow Harris Reservoir Expansion

	Total	TSSW (physical)		MPAC (biological)		RSEC (chemical)	
Wetlands Feature	**Acreage**	**FCI**	**FCU**	**FCI**	**FCU**	**FCI**	**FCU**
Palustrine emergent	7.048	0.540-0.602	4.036	0.533-0.667	4.249	0.543-0.583	3.947
Palustrine scrub/shrub	4.701	0.564-0.638	2.988	0.583-0.750	3.500	0.617-0.633	2.902
Palustrine forested	6.804	0.669-0.712	4.776	0.663-0.750	4.893	0.667-0.733	4.883
Total non-forested total	**11.749**		**7.024**		**7.749**		**6.849**
Total forested total	**6.804**		**4.776**		**4.893**		**4.883**

FCI = functional capacity index
FCU = functional capacity unit
MPAC = maintenance of plant and animal communities
RSEC = removal and sequestration of elements and compounds
TSSW = temporary storage of surface water

Table 6-2. Summary of Assessment Findings for Waterbodies that will be Impacted by the Dow Harris Reservoir Expansion

Channel Type	Stream Reach	Total Length (ft)	Acreage
Ephemeral Stream	SB003, SB007, SB013	3,226	0.206
Intermittent Stream	SA001, SA003, SX014	26,912	12.867
Perennial Stream	SC001, SX002, SX024	13,718	11.272
	Total	**43,856**	**24.345**

Full wetland and stream functional reports were prepared by SWCA (SWCA 2019a).

6.1.2 Project Impacts

Drawing from the Project's design plans, the delineated wetlands summarized herein were identified within the Project footprint. These wetlands were generally associated with three main impact areas: the reservoir footprint, temporary workspaces, and habitat restoration areas (Table 6-3).

Table 6-3. Summary of Wetland Functional Values Associated with the Dow Harris Reservoir Expansion

WAA ID	Impact Area	Wetland Type	Acreage	TSSW	MPAC	RSEC
WA002_PEM	Reservoir	PEM	0.186	0.108	0.115	0.104
WA003_PFO	Reservoir	PFO	2.100	1.495	1.575	1.539
WA004_PEM	Reservoir	PEM	2.437	1.467	1.625	1.389
WA004_PSS	Reservoir	PSS	4.547	2.901	3.410	2.805
WA004_PFO	Reservoir	PFO	3.120	2.221	2.237	2.287
WB004_ PEM	Reservoir	PEM	0.640	0.371	0.395	0.358
WC001_PEM	Reservoir	PEM	0.097	0.055	0.057	0.054
WC002_PEM	Reservoir	PEM	0.217	0.122	0.127	0.127
WC003_PFO	Temporary Workspace	PFO	1.551	1.038	1.059	1.035
WC004_PEM	Temporary Workspace	PEM	0.031	0.017	0.017	0.017
WC005_PEM	Reservoir	PEM	0.008	0.005	0.005	0.004
WC005_PEM	Temporary Workspace	PEM	0.34	0.197	0.210	0.190
WC005_PFO	Temporary Workspace	PFO	0.033	0.022	0.022	0.022
WC006_PEM	Habitat Restoration Area	PEM	0.457	0.247	0.244	0.262
WC007_PSS	Habitat Restoration Area	PSS	0.154	0.087	0.090	0.097
WD001_PEM	Reservoir	PEM	0.464	0.269	0.286	0.260
WD002_PEM	Habitat Restoration Area	PEM	0.144	0.084	0.089	0.081
WD003_PEM	Habitat Restoration Area	PEM	2.027	1.095	1.080	1.101
	Reservoir	PEM	3.409	2.026	2.215	1.938
		PSS	4.547	2.901	3.410	2.805
		PFO	5.220	3.716	3.812	3.826
	Temporary Workspace	PEM	0.371	0.214	0.227	0.207
		PFO	1.584	1.060	1.081	1.057
	Habitat Restoration Area	PEM	2.628	1.426	1.413	1.444
		PSS	0.154	0.087	0.090	0.097

Many waterbodies identified within the property are within the construction footprint of the Project (SWCA 2019a, 2019b). However, based on current USACE Galveston District guidance, ditches and ponds that are constructed entirely from uplands are not jurisdictional and do not require mitigation, if filled.

Considering that the majority of waterbodies within the Project area are roadside ditches, agricultural ditches, and man-made ponds, mitigation will only be required for natural waterbodies and modified waterbodies that will be impacted by the Project. These waterbodies were generally associated with the following four main impact areas: (1) the reservoir footprint, (2) temporary workspaces, (3) habitat restoration areas, and (4) temporary workspace (Table 6-4).

Table 6-4. Summary of Waterbody Values Associated with the Dow Harris Reservoir Expansion

Waterbody	Type	Flow	USGS Name	Impact Area	Length (feet)
SA001	Modified Stream	Intermittent	Jennings Bayou	Reservoir	13,496
SA003	Modified Stream	Intermittent	N/A	Reservoir	6,130

Waterbody	Type	Flow	USGS Name	Impact Area	Length (feet)
SB003	Modified Stream	Ephemeral	N/A	Reservoir	2,590
SB007	Modified Stream	Ephemeral	N/A	Reservoir	520
SB013	Modified Stream	Ephemeral	N/A	Reservoir	116
SC001	Modified Stream	Perennial	Oyster Creek	Habitat Restoration Area	8,080
				Temporary Workspace	1,874
SX002	Natural Stream	Perennial	Brazos River	Pump Station	415
				Temporary Workspace	3,195
SX014	Modified Stream	Intermittent	N/A	Reservoir	7,286
SX024	Natural Stream	Perennial	Oyster Creek	Habitat Restoration Area	154
				Reservoir Subtotal	*30,138*
				Temporary Workspace Subtotal	*5,069*
				Pump Station Subtotal	*415*
				Habitat Restoration Area Subtotal	*8,234*
				Total	**43,856**

6.2 Oyster Creek

The Oyster Creek mitigation area is intended to compensate for unavoidable impacts to wetlands and waterbodies determined by USACE to be waters of the U.S.

6.2.1 Plant Communities

The Proposed Project's Oyster Creek mitigation area consists of a majority of herbaceous upland and tilled cropland with smaller portions of woods and shrublands forming riparian buffers. Six vegetation community types were determined to be within the Project area, including three wetland vegetation communities (that is, PEM, PSS, and PFO) and three non-wetland/upland vegetation communities (that is, herbaceous, scrub/shrub, and forested). Detailed descriptions of each vegetation community type can be found in the Wetland Delineation Report for the Dow Harris Reservoir Expansion Project in Brazoria County, Texas (SWCA 2019a).

6.2.2 Soil Conditions

The Oyster Creek mitigation area is entirely within the Gulf Coastal Prairie soil region and the Lake Charles-Bernard-Edna Series (USDA 2018). Direct observations of soil epipedons revealed that the typical soil matrix was 10 and 7.5 YR (yellow-red hue on the Muncell color chart) in hue and chroma of 2/1 to 5/6., while typical redox components were 10, 7.5, and 5 YR in hue and chroma of 5/6 to 5/8. Soils textures observed were predominantly clays and silty clays, occasionally including loam components and less often sand components. According to the Natural Resources Conservation Service Soil Survey for Brazoria County, Texas, out of the nine mapped soil units for the Project area, only Churnabog clay, 0 to 1 percent slopes, frequently flooded, is mapped as a hydric soil.

6.2.3 Drainage Area

The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps that include the Project area are 48039C0245K and 48039C0240K (FEMA 2020). The contributory drainage area to the Oyster Creek mitigation area is approximately 50 square miles; however, the drainage area to Oyster Creek upstream of the Project area has been significantly reduced (63 percent) from historical conditions due to low head dams and diversions (Jacobs 2019).

6.3 Big Slough

The Big Slough mitigation area is intended to compensate for unavoidable impacts to wetlands and waterbodies determined by USACE to be waters of the U.S.

According to the TCEQ Level III and IV Ecoregions of Texas report, the Big Slough mitigation site falls mostly within the Floodplains and Low Terraces (34c) and Northern Humid Gulf Coastal Prairies (34a) ecoregions with a small portion in the Mid-Coast Barrier Islands and Coastal Marshes (34h) ecoregion.

The Floodplains and Low Terraces ecoregion generally consist of bottomland forests of pecan *(Carya illinoinensis)*, water oak *(Quercus nigra)*, southern live oak *(Quercus virginiana)*, and elm *(Ulmus* sp*.)* species. Bald Cypress *(Taxodium distichum)* occasionally exist on larger streams or rivers. The Brazos and Colorado River floodplains are a broad expanse of alluvial sediments, while floodplains to the south are narrower. Soils include Vertisols, Millisols, and Entisols. Large portions of floodplain forest have been removed and land cover is now a mix of forest, cropland, and pasture (Griffith et al. 2017).

The Northern Humid Gulf Coastal Prairies (34a) ecoregion consists of gently sloping, mostly flat, coastal plain. Due to the low relief and clay subsoils, drainage is generally poor and soils remain wet for parts of the year. The historical vegetation was mostly tallgrass grasslands with a few clusters of oaks, known as oak mottes or maritime woodlands. Little bluestem (*Schizachyrium scoparium*), yellow Indiangrass (*Sorghastrum nutans*), brownseed paspalum *(Paspalum plicatulum*), gulf muhly (*Muhlenbergia capillaris*), and switchgrass (*Panicum virgatum*) were the dominant grassland species in a mixture with hundreds of other herbaceous species across these prairies. Today, almost all of the coastal prairies have been converted to cropland, rangeland, pasture, or urban and industrial land uses. Extensive networks of drainage canals and stream channelization have occurred in many areas. Soil surface texture of the region varies but tends to be fine textured, with darker, clayey soils associated with Vertisols (Griffith et al. 2017).

The Mid-Coast Barrier Islands and Coastal Marshes ecoregion (34h) encompasses primarily Holocene deposits with saline, brackish, and freshwater marshes, barrier islands with minor washover fans, and tidal flat sands and clays. Typical soils on the coastal marshes are Entisols, with a minor extent of Histosols. Mollisols occur on tidal flats and coastal marshes, and Entisols form in sandy banier islands and dunes. Smooth cordgrass, marshhay cordgrass, and gulf saltgrass dominate in more saline zones. Other native vegetation is mainly grassland composed of seacoast bluestem, sea-oats, and common reed, Gulf dune paspalum, and soilbind morning-glory. Some areas have clumps of sweetbay, redbay, and dwarf southern live oak trees. Salt marsh and wind-tidal flats are mostly confined to the back-side of barrier islands with fresh or brackish marshes associated with river-mouth delta areas (Yang et al. 2019).

6.3.1 Plant Communities

Stantec conducted an onsite delineation to determine the presence, location, and extent of potential waters of the U.S., and to determine the potential credits for mitigation within the Big Slough Project area from October 2019 to December 2019.

Seven vegetation communities were documented within the Project site: (1) herbaceous upland, (2) herbaceous wetlands, (3) scrub-shrub upland, (4) scrub-shrub wetlands, (5) forested upland, (6) forested wetlands, and (7) tidal wetlands.

Herbaceous wetlands are the most predominant wetland community within the Project area, comprising approximately 1560.55 acres and are dominated by woodrush flatsedge (*Cyperus entreianus),* green flatsedge (*Cyerus virens),* common spikerush (*Eleocharis palustris),* alligatorweed (*Alternanthera philoxeroides), Sagittaria sp.,* and southern cutgrass (*Leersia hexandra).*

Forested wetlands comprising approximately 26.34 acres are dominated by Chinese tallow (*Triadica sebifera),* sugarberry (*Celtis laevigata),* alligatorweed (*Alternanthera philoxeroides),* woodrush flatsedge (*Cyperus entreianus),* cherokee sedge (*Carex cherokeensis),* eastern poison ivy (*Toxicodendron radicans), and* common rush (*Juncus effuses).*

Scrub-shrub wetlands comprising approximately 8.79 acres are dominated by Chinese tallow (*Triadica sebifera),* rattlebush (*Sesbania drummondii),* eastern baccharis (*Baccharis halimifolia),* annual marsh elder (*Iva annua),* bushy bluestem (*Andropogon glomeratus),* seaside goldenrod (*Solidago sempervirens),* and yellow foxtail (*Setaria pumila).*

Herbaceous uplands were observed to be dominated by Macartney rose (*Rosa bracteata),* guajillo (*Acacia berlandieri),* sneezeweed (*Helenium amarum),* smutgrass (*Sporobalus indicus),* and St. Augustine grass (*Stenotaphrum secondatum*).

Forested uplands were observed to be dominated by southern live oak (*Quercus virginica),* common hackberry (*Celtis occidentalis),* Chinese tallow (*Triadica sebifera),* yaupon (*Ilex vomitoria),* Macartney rose *(Rosa bracteata), and* St. Augustine grass (*Stenotaphrum secondatum*).

Chinese tallow (*Triadica sebifera*) has a substantial presence throughout the area. They tend to grow in crowded places and will outcompete nearby plant species for available resources. Chinese tallow can invade a variety of habitats ranging from swampy to saline waters, and from full sun to shade situations. It is often found growing along roadsides, coastal areas, and streams. Many of the delineated forested and shrub-scrub wetlands feature mature (more than 3-inch dbh) and/or sapling (less than 3-inch dbh) Chinese tallows; in addition, upland areas featured thick clusters of saplings and larger trees between 30- and 40-feet tall.

6.3.2 Soil Conditions

Soils within the Project area can be generally described as well drained soils that occur on broad, nearly level land to gently sloping floodplains, uplands, and terraces. According to the U.S. Department of Agriculture (USDA), Natural Resource Conservation Service (NRCS) website accessed January 2020 (USDA 2020), and USDA Soil Conservation Service Soil Survey of Brazoria County (Crenwelge et al. 1981), the project is located within nine soil map units. Four of the nine soil map units present within the mitigation area have a hydric soil rating according to the NRCS State Soil Data Hydric Soils List.

6.3.3 Wetland Delineation

Table 6-5 contains a summary of the potential waters of the U.S. delineated within the Big Slough Project area. The wetland delineation report containing a detailed mapbook, as well as field data recorded on Atlantic Gulf Coastal Plain wetland delineation sheets are provided in Attachment 2.

Table 6-5. Potential Jurisdictional Waters of the U.S. within the Big Slough Project Area

Resource Classification	Acreage	Feet
Forested (PFO) wetlands	26.34	—
Scrub-Shrub (PSS) wetlands	8.79	—
Herbaceous (PEM) wetlands	1,560.55	—
Perennial waterbodies	195.61	33,792
Intermittent streams	12.98	11,771
Ephemeral drainages	2.15	5,610
Ponds	2.64	—
Total wetlands	1,595.68	—
Total waterbodies	213.38	51,173

6.3.4 Hydrogeomorphic Functional Assessment

The interim hydrogeomorphic (iHGM) approach is a procedure for measuring the capacity of a wetland to perform various functions (such as chemical, physical, and biological). The model was designed to satisfy the need for better information on wetland functions within the programmatic requirements of the Clean Water Act Section 404 regulatory program. Information obtained using the iHGM approach is meant to assist Project proponents and regulators in assessing the level of environmental impact of a Proposed Project, in determining the appropriate level of regulatory review, and in assessing compensatory mitigation required for offsetting environmental impacts.

Stantec used the iHGM models for riverine herbaceous/shrub and riverine forested wetlands to determine a FCI for each delineated wetland within the Big Slough mitigation area. Each wetland's FCI was then multiplied by its delineated acreage to obtain the FCUs. Table 6-6 summarizes the FCUs obtained for each of the iHGM categories within the proposed mitigation area. Hydrogeomorphic (HGM) assessment sheets are attached in Attachment 2.

Table 6-6. Summary of Existing Interim Hydrogeomorphic Wetland Functional Capacity Units within the Big Slough Mitigation Area

iHGM Category	Credit Type	FCUs
Riverine Herbaceous/Shrub	Temporary storage of water	239.0
	Plant and animal community	426.0
	Removal of elements and compounds	237.0
	Total	902.0
Riverine Forested	Temporary storage of water	13.6
	Plant and animal community	12.5
	Removal of elements and compounds	15.9
	Total	42.0
	Total Existing FCUs	**944.0**

Stream mitigation requirements met were determined by length of Big Slough scoped for enhancement and reestablishment of riparian areas and measures 33,400 linear feet or 139 acres.

7 Mitigation Work Plan

Onsite locations were evaluated to assess the potential to meet the Proposed Project's compensatory mitigation goals for impacts to linear water features. Priority was given to onsite mitigation that would provide the most direct compensation (location and in-kind) for Project impacts. Based on the USACE determination of the mitigation requirements met through the Oyster Creek site, additional compensatory mitigation is required, whereas Big Slough will provide both stream mitigation and wetlands mitigation.

As noted previously, the goals of the mitigation strategies to be implemented include reestablishment of the ecological functions of the aquatic resources and water bodies impacted by the Proposed Project and establishment of wetlands. The mitigation strategies will be accomplished through a sustainable mitigation design, implementation and maintenance. This section provides the work plans for both the Oyster Creek and the Big Slough mitigation sites.

7.1 Oyster Creek Mitigation Work Plan

The onsite Oyster Creek mitigation area includes re-establishment of Oyster Creek which is located adjacent to the Proposed Project. The location relative to the Harris Reservoir Expansion Project and a detailed view of the onsite Oyster Creek mitigation area are presented on Figures 1 and 2 in Attachment 1, respectively. Design sheets that include Oyster Creek fencing, grading, and planting plans and details, including the plant species list, are included in Attachment 4. The bankfull benches and native riparian buffer plantings will improve the ecological health of Oyster Creek by filtering nutrients and sediment, and reducing flow velocities, during flood events. The physical, chemical, and biological characteristics of the stream corridor will benefit from the lateral and longitudinal topographic and vegetative community diversity resulting from the mitigation design. The bankfull benches create an active floodplain zone that function differently than upland areas of the stream corridor thereby enhancing the ecological diversity of the site. Well vegetated bankfull benches will help lower water temperatures and provide a source of detritus and large woody debris to the stream corridor. The benches also reduce the near-bank shear stress, thereby decreasing the likelihood of bank erosion.

Additionally, as part of the Proposed Project, an existing wooden bridge (refer to Figures 1 and 2 in Attachment 3) with pilings within Oyster Creek will be removed. A new bridge will be constructed with supports located outside of the ordinary high water mark, thereby removing unnatural obstructions to flow that can accumulate debris and alter flow patterns, potentially inducing bed scour or bank instability. This work represents an improvement for Oyster Creek.

7.1.1 Oyster Creek Overview

The upstream extent of the Oyster Creek mitigation area is located along the downstream reach of a perennial, unnamed tributary to Oyster Creek. The mitigation area extends downstream from the mouth of the unnamed tributary along Oyster Creek.

The portion of the Oyster Creek mitigation area surrounding the unnamed tributary averages approximately 450 feet wide and includes approximately 3,600 linear feet of the unnamed tributary measured along the stream centerline. The existing stream reach has a mature riparian buffer up to approximately 100 feet along both sides of the stream and has instream structure in the form of vegetation and large woody debris. Mitigation activities within this area will include bankfull benching (approximately 1,000 linear feet, average width of approximately 75 feet, including the tie-ins to existing grades) and planting, and buffer reestablishment up to 200 feet (100 feet beyond the existing buffer) along both sides of the stream (refer to Figure 2 in Attachment 1 and the design sheets in Attachment 4). In Attachment 3, Figures 3 through 5 are representative photographs of the existing riparian buffer along the unnamed tributary, and Figures 6 through 8 are representative photographs of where a forested buffer will be reestablished. Adjustments to the implementation may occur based on field conditions to incorporate existing, healthy and mature riparian buffer areas into the overall mitigation.

The Oyster Creek mitigation area located along the mainstem, perennial reach of Oyster Creek is approximately 12,865 linear feet as measured along the creek centerline. The average width of the mitigation area along this reach is approximately 450 feet. The north and east sides of this area extend to the overall Project boundary. For the most part, the south and west sides extend to an existing pipeline easement (refer to Figure 2 in Attachment 1).

This segment of Oyster Creek currently has a mature riparian buffer out to about 100 feet in select locations within its northern portion and is heavily impacted by farming activities in the middle and southern portion with a much narrower riparian buffer. Woody vegetation is absent or nearly absent from much of the middle and downstream reaches. Mitigation activities will include bankfull benching (approximately 7,700 linear feet, average width of approximately 135 feet, including the tie-ins to existing grades) and planting, and buffer reestablishment out to approximately 200 feet where possible (refer to Figure 2 in Attachment 1 and the design sheets in Attachment 4). Existing buffer areas that are healthy and comprised of native species will be left intact. Figures 9 through 14 in Attachment 3 are photographs of representative areas that include a location where bankfull benching is to occur, an existing stand of invasive Johnson grass will be eliminated, and where buffer reestablishment is to occur. As with the portion along the unnamed tributary, adjustments may be made to the implementation to incorporate existing, healthy and mature riparian areas.

7.1.2 Construction Methods, Timing, and Sequence

Reestablishing bankfull benches will require mechanized equipment to remove existing vegetation; strip and stockpile topsoil; excavate, grade, prepare the subgrade to receive topsoil; reapply topsoil; and prepare the seedbed. Given the large acreage to be seeded (primarily where excavation has occurred for the bankfull benches), the use of hydroseeding and hydromulching equipment is anticipated. The planting of woody vegetation to reestablish riparian buffers is anticipated to be accomplished using manual labor. Tens-of-thousands of bare root sprigs and approximately 600 trees, at least one age class older than the bare roots, in the form of containerized or balled and burlapped trees will be planted. The planting density included in the design sheets for the Oyster Creek mitigation area is 538 stems per acre following a 9-foot by 9-foot spacing.

A grade-control structure will be constructed near the downstream end of Oyster Creek (refer to Figure 2 in Attachment 1). This structure will serve as a protective measure against potential headcutting in Oyster Creek. The structure is designed to be made of steel sheet piles, extending laterally beyond both banks approximately 20 feet, and downward approximately 15 to 25 feet from 1 foot below the ground surface or creek bed. These piles will be driven by mechanized equipment, and it is anticipated that the work will be accomplished from above the creek banks.

One of the first construction activities to be accomplished will be surveying and staking or flagging to identify or map the following site features: Project boundary/limits, pipeline easements, stockpile areas, bankfull elevations, clearing and grubbing limits, invasive species will be removed or treated with herbicide, exclusion areas, and planting areas. A field review of the staking/flagging effort will be conducted before earthwork activities commence.

Many areas to be planted are likely to require mowing of existing vegetation to plant bare root sprigs, with follow-up maintenance mowing as necessary to prevent overgrowth of vegetation surrounding the bare root sprigs during their early development. The duration of the overall construction effort for Oyster Creek (refer to Figure 1 in Attachment 1) is approximately 2 years.

7.1.3 Water Source

The naturally occurring hydrology of Oyster Creek provides sufficient water for the proposed mitigation strategies. Water has been present in Oyster Creek during all Project site visits spanning 2018 through 2022, and it is visible in all aerial images that represent snapshots of conditions during 18 different years from 1943 through 2022 (26 images). A stream gage is maintained by the U.S. Geological Survey near Angleton, but the flows are influenced by releases from the existing Harris Reservoir and therefore does not reflect flow conditions within the mitigation area. In general, Oyster Creek is a perennial stream and baseflows appear to be less than about 10 cubic feet per second.

Average annual precipitation in the area is approximately 51 inches and flows in the creek rise in response to rainfall runoff (SWCA 2019b). Sufficient flow occurs in the creek to maintain the existing ecology and provide for the successful enhancement, restoration, and reestablishment of ecological functions in the proposed mitigation area. Review of hydrological data indicates that sufficient flow occurs in the creek to maintain the existing ecology and provide sufficient water for the successful Oyster Creek mitigation area.

7.1.4 Methods for Establishing the Vegetation and Riparian Plantings

Native vegetation plantings will occur within the Oyster Creek mitigation area.

Following site preparation discussed in Section 7.1.2 and the selective removal of invasive species discussed in Section 7.1.5, reestablishment of the riparian buffers will occur through plantings of desirable native plant species. Tree and shrub species will include species native to the local forested riparian habitat, along with less common species, to increase the overall species diversity of the riparian buffer and to provide increased benefits to wildlife species. Native species plantings will include different size classes planted at densities appropriate for developing stable vegetation stratum, reducing erosion, and improving overall habitat. A mosaic of herbaceous (that is, pocket meadows) and woody plant communities will be allowed to become established to model historic riparian ecosystems. After the 5-year monitoring period, the planted native trees and shrubs communities will be self-sustaining and self-organizing.

Species selected either occur in or have a native range encompassing Brazoria County or adjacent counties. The planting effort will integrate fast-growing soft mast species with slower-growing hard mast species to allow for greater vertical structural diversity. Selected species will be site-appropriate for habitat design, soil-moisture regime, and species richness that are commercially available. The exact species and quantities for seeding and planting will be determined by the availability of the species from commercial nurseries providing seedlings. Examples of species used within the mitigation area will include some or all of the following trees and shrubs listed in Table 7-1.

Table 7-1. Planting List for Oyster Creek Mitigation Site

ZONE	WOODY PLANTS					SEED MIX					
	COMMON NAME	BOTANICAL NAME	SPACING	PLANTED ACRES	QTY	COMMON NAME	BOTANICAL NAME	LBS PLS/AC	Percent	SEEDED ACRES	LBS PLS
1	Common Buttonbush	*Cephalanthus occidentalis*	9' x 9'	6.76	1,818	Swamp Milkweed	*Asclepias incarnata*	3.5	23.3	4.20	15
						Big Bluestem	*Andropogon gerardii*	2.1	14.0		9
						Bushy Bluestem	*Andropogon glomeratus*	1.0	6.7		4
						Illinois Bundleflower	*Desmanthus illinoensis*	1.0	6.7		4
	Black Willow	*Salix nigra*			1,818	Switchgrass	*Panicum virgatum*	3.0	20.0		13
						Prairie Cordgrass	*Spartina pectinata*	3.0	20.0		13
						Gaping Panicum	*Steinchisma hians*	0.4	2.7		2
						Eastern Gammagrass	*Tripsacum dactyloides*	1.0	6.7		4
				TOTAL	3,636		**TOTAL**	15.0	100		63
						SUBSTITUTES (IF NECESSARY):					
						Broomsedge Bluestem	*Andropogon virginicus*				
						Mistflower	*Conoclinium spp.*				
						Late Boneset	*Eupatorium serotinum*				
2	Red Maple	*Acer rubrum*	9' x 9'	26.73	1,798	Butterfly Milkweed	*Asclepias tuberosa*	1.6	10.7	28.50	46
	Sugarberry	*Celtis laevigata*			1,798	Green Antelope Horn	*Asclepias viridis*	1.6	10.7		46
	Roughleaf Dogwood	*Cornus drummondii*			1,798	Big Bluestem	*Andropogon gerardii*	2.2	14.7		63
	Common Persimmon	*Diospyros virginiana*			1,798	Sideoats Grama	*Bouteloua curtipendula*	3.1	20.7		88
	Water Oak	*Quercus nigra*			1,798	Illinois Bundleflower	*Desmanthus illinoensis*	0.8	5.3		23
	Dwarf Palmetto	*Sabal minor*			1,798	Green Sprangletop	*Leptochloa dubia*	0.3	2.0		9
	American Elm	*Ulmus americana*			1,798	Switchgrass	*Panicum virgatum*	1.8	12.0		51
	Cedar Elm	*Ulmus crassifolia*			1,798	Little Bluestem	*Schizachyrium scoparium*	1.0	6.7		29
				TOTAL	14,384	Indiangrass	*Sorghastrum nutans*	2.0	13.3		57
						Prairie Cordgrass	*Spartina pectinata*	0.6	4.0		17
							TOTAL	15.0	100		428
3	Red Maple	*Acer rubrum*	9' x 9'	82.20	4,422	Butterfly Milkweed	*Asclepias tuberosa*	1.8	12.0	81.12	146
	Common Hackberry	*Celtis occidentalis*			4,422	Green Antelope Horn	*Asclepias viridis*	1.8	12.0		146
	Roughleaf Dogwood	*Cornus drummondii*			4,422	Big Bluestem	*Andropogon gerardii*	1.8	12.0		146
	Common Persimmon	*Diospyros virginiana*			4,422	Sideoats Grama	*Bouteloua curtipendula*	2.9	19.3		235
	Carolina Laurelcherry	*Prunus caroliniana*			4,422	Illinois Bundleflower	*Desmanthus illinoensis*	1.0	6.7		81
	Water Oak	*Quercus nigra*			4,422	Green Sprangletop	*Leptochloa dubia*	0.3	2.0		24
	Live Oak	*Quercus virginiana*			4,422	Switchgrass	*Panicum virgatum*	1.5	10.0		122
	Western Soapberry	*Sapindus saponaria*			4,422	Little Bluestem	*Schizachyrium scoparium*	1.6	10.7		130
	American Elm	*Ulmus americana*			4,422	Indiangrass	*Sorghastrum nutans*	2.3	15.3		187
	Cedar Elm	*Ulmus crassifolia*			4,422		**TOTAL**	15.0	100		1,217
				TOTAL	44,220						

Notes:
For the three zones combined, the total number of plants is 62,240 (538 stems per acre), and the total weight of seed mix is 1,708 lbs pure live seed.
Actual plantings and seed mix will vary based on availability.
The proposed planting plan is also available in the Oyster Creek Planting section (Attachment 4).

7.1.5 Control of Invasive, Noxious, or Exotic Species

The Texas Department of Agriculture (TDA) provides a list of noxious and invasive plant species that have serious potential to cause economical or ecological harm to the agriculture, horticulture, native plants, ecology and waterways of Texas (TDA 2022). Abatement will be focused on those species known to occur within or near the vicinity of the Project area or that have the potential to be brought in during construction of the Project.

Invasive plant species such as Chinese tallow (*Triadica sebifera*), Bermudagrass (*Cynodon dactylon*), King Ranch bluestem (*Bothriochloa ishaemum*), Johnson grass (*Sorghum halepense*) readily occur throughout both the Oyster Creek and Big Slough sites - particularly in disturbed areas and while not observed within the Project area, it is likely that other species on the list are present adjacent to or upstream of the Project area.

Invasive plant species will be selectively removed and controlled using chemical methods during initial installation of the mitigation and periodically during the maintenance of the Project. Herbicides will be selected based on the species and the type of application procedure and will be in accordance with federal regulations. The invasive plant removal and follow-up herbicide applications will be conducted by experienced contracted personnel.

Best practices for herbicide treatment will be used such as the following protocols:

- The application of herbicide shall be pursuant to the regulations maintained by the TDA.
- Herbicide shall be applied under the direction of a State-licensed herbicide applicator.
- The contractor shall be responsible for acquiring a spray permit through the TDA.
- Herbicides are to be used in accordance with label requirements and special use labels.
  The contractor will be solely responsible for any penalty, fine, or damages resulting from misuse of herbicides. If damages occur as a result of herbicide misuse, the contractor will replant at their own expense.
- The contractor shall apply herbicides in a manner to minimize damage to non-target species (that is, milkweeds).
- Herbicides shall have a marking dye to show where treatments have taken place.
- Soil herbicides, such as Spike or Velpar, will not be used.
- The best management practices (BMPs) listed herein are not all-inclusive. Additional BMPs are provided in the Proposed Project’s herbicide specifications construction documents.

7.1.6 Proposed Grading Plan

The grading plans and cross-sections are included in Attachment 4. The plans include 6-inches of over-excavation on the bankfull benches to account for the stripping and reapplication of topsoil up to the finished grade. The excavation required to reestablish the bankfull benches shown on the design drawings results in a net cut volume of approximately 158,000 cubic yards. The net excavated soils are planned to be used to fill in depressions on the floor of the proposed reservoir (i.e., within the embankment). The bench surfaces are to be sloped at 2 percent toward the creek to allow for positive drainage. The back of the benches is to be tied to existing ground using a slope ratio of 4 horizontal to 1 vertical.

7.1.7 Soil Management

The mitigation design includes a soil preparation specification that requires the contractor to submit a topsoil work plan to address the site plan (locations and depths of topsoil to be worked), stockpile locations, equipment, subgrade preparation, topsoil amendments, topsoil placement, and seedbed finishing. The contractor will collect and send representative topsoil samples to a soils testing laboratory to quantify the agronomic properties of the existing soil, primarily nutrients, organic matter content, and texture. The need for and application rates of soil amendments will be determined based on the results of the soil testing results. Where topsoil has been worked and requires seeding, the contractor will use equipment approved by the engineer to lightly compact soil to ensure a uniform surface, free of large clods, at the correct grade and firmness for the seed to be planted. The seedbed will be worked to promote good contact between the soil and the seed to be planted.

7.1.8 Erosion Control Measures

The contractor will be responsible for developing a stormwater pollution prevention plan for construction activities associated with the onsite mitigation construction. The total ground surface area to be excavated for bankfull benching in the Oyster Creek mitigation is approximately 26 acres. The steepest excavated slopes will be 4 horizontal to 1 vertical. In addition to construction BMPs, such as silt fencing, control of run-on and runoff, and limiting the extent of exposed ground to be worked at a given time, the contractor may choose to include a soil tackifier with their hydroseeding/hydromulching application. No work is to be done below the bankfull elevation, so retaining and protecting the existing vegetation along the bankfull elevation line will help to reduce the velocity of overbank flows should they occur. The area is too large to feasibly cover with temporary erosion blanket, so the hydromulching and tackifier will serve as the primary erosion control measure until the ground cover becomes rooted.

7.2 Big Slough Mitigation Work Plan

The Proposed Project is within the primary and secondary service areas of multiple mitigation banks; therefore, this option was identified for mitigation of loss of wetlands within the Project area in the initial permit application. However, the Project area is outside of the primary and secondary service areas for any mitigation banks or in-lieu fee programs that offer stream credits. Therefore, PRM through reestablishment, enhancement, and restoration of Oyster Creek (onsite) and Big Slough Bayou (off site) was selected for stream mitigation in this plan.

Following coordination and advisement, the USACE Galveston District provided a memorandum explaining that while the USACE Galveston District SCA standard operating procedure is an important tool in evaluating the need for stream mitigation, it is limited in assessing compensatory mitigation in this complex Proposed Project where in-kind mitigation is not attainable (Griffith et al. 2007). Numerous quantitative methods, specifically the U.S. Environmental Protection Agency's Better Assessment Science Integrating Point and Non-point Sources (BASINS)environmental analysis system and Hydrological Simulation Program—Fortran modeling of the hydrology and hydraulics of the Big Slough, have been employed to supplement the District's evaluation. These strategies provide the District-approved compensation to lost ecological functions at the Project area and are consistent with USACE Galveston District guidance.

7.2.1 Big Slough Overview

Offsite locations within the watershed were evaluated to assess the potential to meet the Proposed Project's compensatory mitigation goals for impacts to streams and wetlands within the Project area. Priority was given to onsite mitigation that would provide the most direct compensation for Project impacts.

As stated in Section 3.2.2, the goals of the mitigation strategies proposed to be implemented off site include establishment, restoration, and reestablishment of Big Slough and associated wetlands. The factors considered in obtaining the goals via the plan included the following: (1) the existence of natural oxbow, pond, and pothole wetlands adjacent to Big Slough Bayou in the Texas Mid-Coast Wildlife Refuge Complex, (2) the existing hydrologic and soil conditions within the Project site, and (3) prevalent habitat types found within the Gulf Coast Prairies and Marshes ecoregion and the Project site.

Stantec completed a detailed analysis of reference habitat types and wetland features in the adjacent Texas Mid-Coast Wildlife refuge complex. The wetland reference features assessed include prairie potholes, freshwater oxbow wetlands, and open water ponds. Stantec incorporated the observed characteristics of each of these wetland features into design through plant selection, location (catering to site-specific conditions), feature geometry, and planform. Stantec used this information, coupled with a detailed site water balance, to ensure that wetland enhancement and creation actions would create self-sustaining and resilient aquatic resources.

7.2.2 Construction Methods, Timing, and Sequence

The proposed construction sequence is comprised of phase 1: implementation, phase 2: invasive species removal, phase 3: construction of proposed wetland features, and phase 4: Big Slough enhancements and final planting. The implementation phase will include preliminary topographic survey of the phase 1 construction area, and the initial Chinese tallow removal treatment. The contractors will also be responsible for assembling the access and staging areas, completing road and crossing improvements as necessary, and stockpiling materials in approved staging areas. Phase 2 will include follow-up treatment for Chinese tallow removal. All excavation of wetland enhancement features including potholes and scrolls will be completed in phase 3. Excavation of features that are outside of herbicide application zones should be completed first to allow enough time for herbicide compounds to biodegrade. Phase 4 will consist of Big Slough enhancements including removal of five earthen dams and the installation of an improved culvert on the primary access road. All disturbed areas, including wetland features and areas disturbed by Chinese tallow removal, will be planted as a final enhancement step. To wrap up construction in phase 1, sensitive access roads will be decommissioned, and access and staging areas will be restored and planted.

It is anticipated that phase 1 construction will take 2 years to complete but may take longer given the large size of the Project area. The timing of each action was chosen to provide the best conditions for invasive species eradication and native planting success. Therefore, we suggest only minor modifications be made to this timeline. Initial Chinese tallow removal should occur in May or August for the greatest herbicide success rate. This step then requires a minimum of 4 months for biodegradation of the herbicide before any other actions can be completed in these zones. Native plantings may be adversely impacted by residual herbicides up to a year after application; therefore, we highly suggest planting be delayed until phase 4 of construction in any areas impacted by herbicides.

7.2.3 Methods for Establishing the Vegetation and Riparian Plantings

Proposed wetland and stream impacts from the Proposed Project will be offset through the proposed wetland enhancement and riparian reestablishment, stream enhancement, and wetland creation actions proposed. Our enhancement plan prioritized creating and or restoring high-quality habitat types, including bottomland hardwood forest and the Texas- Louisiana coastal prairie. These habitat types dominated the Gulf Coast Prairies and Marshes ecoregion historically but have drastically decreased in size since the early 1900s. Our first objective will enhance existing forested wetlands and riparian areas through the eradication of Chinese tallow, Johnson grass, McCartney rose and other invasive species and planting with preferred wood species. These actions should accelerate the transition to old-growth bottomland forest conditions. The second objective will enhance existing coastal prairie wetlands and establish new palustrine emergent and forested wetlands through the excavation of a heterogeneous topography (mounds and valleys) designed to capture and retain precipitation and runoff. These open water areas will provide seasonal shallow water habitat and emergent wetlands in the bayou adjacent scrolls and a perennial source of freshwater forested habitat within the bayou adjacent forested scrolls. The third objective was chosen to improve the connectivity of Big Slough Bayou, which will aid in the distribution and abundance of fish and other aquatic species. The last objective was chosen to ensure a long-term commitment to the overall mitigation area.

7.2.4 Invasive, Noxious and Exotic Species

Chinese tallow is a highly invasive species that thrives in disturbed habitat, reproduces at a prolific rate, and is highly resistant to conventional or natural controls (Cameron et al. 2000; Yang et al. 2019). Clearing with fire or by clear cutting is ineffective because the trees can regenerate from rootstock. Chemical controls, such as the herbicides triclopyr or 2,4-D picloran + D, have been widely used as an effective means of tallow removal. Stantec suggests that a combination of mechanical removal and herbicide treatment be used to eradicate Chinese tallow within the Project site.

Stantec staff members will need to delineate the exact locations and distribution of Chinese tallow on the Project site before removal actions begin. Areas infested with the species will be flagged and marked for treatment. Large trees that cannot be removed mechanically need to be tagged for herbicide application. Mechanical removal of small trees and saplings will occur before herbicide application and must completely remove all root biomass from the soil surface to prevent regrowth. The contractor will be allowed to use small- to medium-sized equipment for mechanical removal outside of existing wetlands but will be limited to non-mechanized equipment within existing wetlands. The mechanically removed tallow will be stored in small stockpiles adjacent to the areas they were removed from. To avoid seed dispersal, this biomass shall not be transported to another location. The contractor must complete controlled burns on these piles as soon as possible after stockpiling to sterilize the tallow seeds and to prevent regrowth in the future.

The contractor will apply the chosen herbicide to large tallow trees between the months of April and August when the trees are actively circulating nutrients for the development of catkins in the spring and seeds during the summer. Herbicide application during this period ensures that the toxins will circulate throughout the tree and prevent the year's seed stock from reaching maturity. The herbicide is most efficiently applied by cutting slots in the tree bark where the toxin can be directly sprayed onto live tissue (hack and squirt). To make the cuts, using a hatchet to cut at a 45-degree angle through the bark to the inner wood of the tree is suggested. Cuts should be placed at waist height and spaced every 10 to 12 inches around the tree's diameter. The contractor must not cut down or fully girdle the tree; this could cause tissue mortality and all transpiration would cease. The cuts maintain the flow of sap and water circulating through the tree from root to crown, thereby allowing the herbicide to be conveyed throughout the tree. For large diameter tallow extensive girdling and cambium painting may be required.

Once the herbicide has killed a tree, it takes at minimum 4 months for the toxins to break down. Chinese tallow leaves contain a milky sap that also contains a natural toxin. The trees are a very soft wood that will fall of its own accord within 2 to 3 years, or can be mulched and left for the toxins to decompose. It is best for herbicide to be applied in the spring and early summer, followed by repeated clearing of smaller trees, pulling of saplings and sprouts, and extraction of rootstock during the summer and autumn. Replanting is possible beginning in October, if herbicide applications were concluded in the spring. However, it is preferable to allow 1 year before replanting to allow toxins to fully break down and provide ample time to fully clear the year's tallow sprouts. The contractor shall remove new tallow sprouts and reapply herbicides in late summer and fall, as necessary. After the toxins in the sap have been broken down, tallow wood is suitable for mulching. However, we suggest leaving the trees to naturally break down so that seeds are not accidentally distributed throughout the Project site.

Chinese tallow grows rapidly, outcompeting native tree species. Once native trees are established, though, they are able to keep tallow growth in relative check. Once the site has been sufficiently cleared of Chinese tallow, prompt replanting of herbaceous and woody ground cover, shrubs, and shade-tolerant native trees will help prevent dormant tallow seeds from repopulating the site (Foss and Norrid, pers. comm. 2020).

7.2.5 Native Vegetation Plantings and Water Source

A major part of the proposed enhancement plan is the reintroduction and planting of native species, particularly to restore the forested wetlands and riparian zones adjacent to Big Slough. Stantec developed four unique vegetation community types for planting of disturbed areas and in locations designated for Chinese tallow and other invasive species removal. Mast producing trees were preferentially selected, specifically oak, elm, ash, and maple. These community types included upland forest, wetland forest, transitional forest, and oxbow wetland emergent (refer to Attachment 2). Stantec selected species that are well adapted to local soil structure and hydrology, tolerate the stresses of reestablishing in disturbed habitat, and provide high-quality habitat for local and migratory wildlife (Tables 7-2, 7-3, and 7-4). The species and specified planting density of each community type were chosen after extensive research and consultation with local experts (Foss and Norrid, pers. comm. 2020).

The planting types include up to 400 trees, 1,500 shrubs, 250 to 500 aquatic edge small trees/shrubs, and 25 pounds of seed per acre depending on location. Seed will be spread evenly on top of exposed soil using a mechanical seeding device. The contractor must prepare a level and homogenous seed bed in all areas that were heavily disturbed (for example, wetland features, habitat mounds, decommissioned roads) prior to seed application. Seed beds will be prepared with appropriate tillage or excavation equipment, but soil shall not be tilled if it is excessively dry or wet as this will destroy soil structure and reduce germination success rates. In locations designated for revegetation that still have noticeable ground cover (for example, tallow removal areas), a bare soil seed bed does not need to be established because this would only cause increased disturbance. The contractor will apply seed by hand on exposed ground in this situation. It is critical that all seed application has direct seed-to-soil contact for successful germination. The contractor will ideally apply seed immediately after construction is complete and follow up the seed with a 1-inch layer of straw mulch or mowed plant material.

After revegetation areas have been seeded and mulched, crews should plant seedlings and 1-year old trees and shrubs by hand. This should not occur until at least 1 year has passed since the last herbicide application. Planting should occur in fall or early winter (September through January) so that plants have a chance to establish before the water stressed months in summer. New trees and shrubs should be surrounded with another thin layer of mulch (approximately 1 inch) and protected from grazing species with individual plastic fencing. This fencing should be collected during monitoring, 2 years after planting.

Table 7-2. Planting List for Big Slough Mitigation Site

SPECIES COMMON NAME	SCIENTIFIC NAME	NWPL INDEX CODE	PLANTING DENSITY
Emergent Wetland Planting (Type 4)			
TREES			**#/ACRE**
OVERCUP OAK	*QUERCUS LYRATA*	OBL	50
WATER HICKORY	*CARY A AQUATICA*	OBL	50
SOUTHERN BALD-CYPRESS	*TAXODIUM DISTICHUM*	OBL	50
BLACK WILLOW	*SALIX NIGRA*	OBL	50
TOTAL			**200**
UNDERSTORY / SHRUBS			
COMMON BUTTONBUSH	*CEPHALANTHUS OCCIDENTALIS*	OBL	150
EASTERN SWAMP-PRIVET	*FORESTIERA ACUMINATA*	OBL	150
TOTAL			**300**
HERBACEOUS			**%OF SEED MIX BY WEIGHT**
CHEROKEE SEDGE	*CAREX CHEROKEENSIS*	FACW	2
SLENDER WOOD-OATS	*CHASMANTHIUM LAXUM*	FACW	2
CROWFOOT SEDGE	*CAREX CRUS-CORVI*	OBL	2
DELTA ARROWHEAD	*SAGITTARIA PLATYPHYLLA*	OBL	16
FLOATING PRIMROSE-WILLOW	*LUDWIGIA PEPLOIDES*	OBL	2
GRASS-LEAF ARROWHEAD	*SAGITTARIA GRAMINEA*	OBL	2
LIZARD'S-TAIL	*SAURURUS CERNUUS*	OBL	2
LITTLE DUCKWEED	*LEMNA OBSCURA*	OBL	2
GULF SWAMPWEED	*HYGROPHILA LACUSTRIS*	OBL	2
PICKEREL WEED	*PONTEDERIA CORDATA*	OBL	16
BEAKED SPIKERUSH	*ELEOCHARIS ROSTELLATA*	OBL	2
COMMON SPIKERUSH	*ELEOCHARIS PALUSTRIS*	OBL	2
DWARF SPIKERUSH	*ELEOCHARIS PARVULA*	OBL	2
SQUARESTEM SPIKERUSH	*ELEOCHARI5 QUADRANGULATA*	OBL	2
MOUNTAIN SPIKERUSH	*ELEOCHARIS MONTANA*	OBL	2
HORNED BEAK SEDGE	*RHYNCHOSPORA CORNICULATA*	OBL	2
COASTAL WATERHYSSOP	*BACOPA MONNIERI*	OBL	2
LEMON BACOPA	*BACOPA CAROLINIANA*	OBL	2
THINSCALESEDGE	*CAREX HYALINOLEPIS*	OBL	2
CREEPING BURRHEAD	*ECHINODORUS CORDIFOLIUS*	OBL	2
COMMON RUSH	*JUNCUS EFFUSUS*	OBL	2
BULLTONGUE ARROWHEAD	*SAGITTARIA LANCIFOLIA*	OBL	16
GULF CORDGRASS	*SPARTINA SPARTINAE*	OBL	2
CRIMSON-EYED ROSE MALLOW	*HIBISCUS MOSCHEUTOS*	OBL	2
HALBERT-LEAF HIBISCUS	*HIBISCUS LAEVIS*	OBL	2
MUD PLANTAIN	*HETERANTHERA LIMOSA*	OBL	2

SPIDER LILY	*HYMENOCALLIS LIRIOSME*	OBL	2
POWDERY ALLIGATOR FLAG	*THALIA DEALBATA*	OBL	2
DROPSEED PASPALUM	*PASPALUM VAGINATUM*	OBL	2
		TOTAL	**100**
	Wetland Forest Planting (Type 5)		
	OVERSTORY - CANOPY		**#/ACRE**
AMERICAN ELM	*ULMUS AMERICANA*	FAC	30
GREEN ASH	*FRAXINUS PENNSYLVANICA*	FACW	60
OVERCUP OAK	*QUERCUS LYRATA*	DBL	15
NUTTALL OAK	*QUERCUS TEXANA*	FACW	25
WATERHICKORY	*CARYA AQUATICA*	DBL	25
SOUTHERN BALO-CYPRESS	*TAXODIUM DISTICHUM*	OBL	10
AMERICAN SYCAMORE	*PLATANUS OCCIDENTALIS*	FACW	10
CEDAR ELM	*ULMUS CRASSIFOLIA*	FAC	40
WILLOW OAK	*QUERCUS PHELLOS*	FACW	15
BLACK TUPELO	*NYSSA SYLVATICA*	FAC	15
SUGAR-BERRY	*CELTIS LAEVIGATA*	FACW	40
EASTERN COTTONWOOD	*POPULUS DELTOIDES*	FAC	10
DRUMMOND RED MAPLE	*ACER RUBRUM DRUMMONDII*	FAC	20
SWEET-GUM	*LIQUIDAMBAR STYRACIFLUA*	FAC	15
WATER OAK	*QUERCUS NIGRA*	FAC	25
BOTTOM-LAND POST OAK	*QUERCUS SIMILIS*	FACW	15
LAUREL OAK	*QUERCUS LAURIFOLIA*	FACW	15
BLACK WILLOW	*SALIX NIGRA*	DBL	15
	TOTAL		**400**
	UNDERSTORY - SHRUBS		
PARSLEY HAWTHORN	*CRATAEGUS MARSHALLII*	FAC	75
DOWNY HAWTHORN	*CRATAEGUS MOLLIS*	FAC	75
ROUGH-LEAF DOGWOOD	*CORNUS DRUMMONDII*	FAC	100
YAUPON	*ILEX VOMITORIA*	FAC	350
SUGAR HACKBERRY	*CELTIS LAEVIGATA*	FACW	350
AMERICAN BUCKWHEATVINE	*BRUNNICHIA OVATA*	FACW	50
CATBIRD GRAPE	*VITIS PALMATA*	FACW	50
DECIDUOUS HOLLY	*ILEX DECIDUA*	FACW	300
COMMON BUTTONBUSH	*CEPHALANTHUS OCCIDENTALIS*	DBL	75
EASTERN SWAMP-PRIVET	*FORESTIERA ACUMINATA*	DBL	75
		TOTAL	**1500**
	HERBACEOUS		**%OF SEED MIX BY WEIGHT**
LONG-LEAF WOOD-OATS	*CHASMANTHIUM SESSILIFLORUM*	FAC	2
INDIAN WOOD-OATS	*CHASMANTHIUM LATIFOLIUM*	FAC	2
LONG-LEAFBASKET GRASS	*OPLISMENUS HIRTELLUS*	FAC	10
STRAGGLERDAISY	*CALYPTOCARPUS VIALIS*	FAC	3
CHEROKEE SEDGE	*CAREX CHEROKEENSIS*	FACW	10
SLENDER WOOD-OATS	*CHASMANTHIUM LAXUM*	FACW	3
SOUTHERN CUT GRASS	*LEERSIA HEXANDRA*	DBL	3
CROWFOOT SEDGE	*CAREX CRUS-CORVI*	DBL	2

DELTA ARROWHEAD	*SAGITTARIA PLATYPHYLLA*	OBL	2
FLOATING PRIMROSE-WILLOW	*LUDWIGIA PEPLOIDES*	OBL	2
GRASS-LEAF ARROWHEAD	*SAGITTARIA GRAMINEA*	DBL	2
LIZARD'S-TAIL	*SAURURUS CERNUUS*	DBL	2
LITTLE DUCKWEED	*LEMNA OBSCURA*	DBL	5
GULF SWAMPWEED	*HYGROPHILALACUSTRIS*	DBL	2
PICKEREL WEED	*PONTEDERIA CORDATA*	OBL	2
BEAKED SPIKERUSH	*ELEOCHARIS ROSTELLATA*	DBL	2
COMMON SPIKERUSH	*ELEOCHARIS PALUSTRIS*	OBL	2
DWARF SPIKERUSH	*ELEOCHARIS PARVULA*	DBL	2
SQUARESTEM SPIKERUSH	*ELEOCHARIS QUADRANGULATA*	DBL	2
MOUNTAIN SPIKERUSH	*ELEOCHARIS MONTANA*	DBL	2
HORNED BEAK SEDGE	*RHYNCHOSPORA CORNICULATA*	DBL	2
COASTAL WATER HYSSOP	*BACOPA MONNIER!*	DBL	3
LEMON BACOPA	*BACOPA CAROLINIANA*	DBL	2
THINSCALESEDGE	*CAREX HYALINOLEPIS*	DBL	2
CREEPING BURRHEAD	*ECHINODORUS CORDIFOLIUS*	DBL	2
COMMON RUSH	*JUNCUS EFFUSUS*	OBL	2
BULLTONGUE ARROWHEAD	*SAGITTARIA LANCIFOLIA*	OBL	2
GULF CORDGRASS	*SPARTINA SPARTINAE*	DBL	10
CRIMSON-EYED ROSE MALLOW	*HIBISCUS MOSCHEUTOS*	OBL	2
HALBERT-LEAF HIBISCUS	*HIBISCUS LAEVIS*	DBL	2
MUD PLANTAIN	*HETERANTHERA LIMOSA*	DBL	2
POWDERY ALLIGATOR FLAG	*THALIA DEALBATA*	OBL	2
DROPSEED PASPALUM	*PASPALUM VAGINATUM*	OBL	5
TOTAL			**100**
Forest Transition (Type 6)			
OVERSTORY: UPPER SLOPE			**#/ACRE**
AMERICAN ELM	*ULMUS AMERICANA*	FAC	30
AMERICAN HORNBEAM	*CARPINUSCAROLINIANA*	FAC	15
CEDAR ELM	*ULMUS CRASSIFOLIA*	FAC	30
EASTERN COTTONWOOD	*POPULUS DELTOIDES*	FAC	10
RED MAPLE	*ACER RUBRUM*	FAC	15
SWEET-GUM	*LIQUIDAMBARSTVRACIFLUA*	FAC	15
WATER OAK	*QUERCUS NIGRA*	FAC	25
CAROLINA LAUREL CHERRY	*PRUNUS CAROLINIANA*	FACU	50
OVERSTORY: LOWER SLOPE			
SWAMP CHESTNUT OAK	*QUERCUS MICHAUXII*	FAC*	25
AMERICAN SYCAMORE	*PLATANUS OCCIDENTALIS*	FACW	10
POST OAK	*QUERCUS STELLATA*	FACW	25
GREEN ASH	*FRAXINUS PENNSYLVANICA*	FACW	25
LAUREL OAK	*QUERCUSLAURIFOLIA*	FACW	25
SUGAR-BERRY	*CELTIS LAEVIGATA*	FACW	50
NUTTALL OAK	*QUERCUS TEXANA*	FACW	25
WILLOW OAK	*QUERCUS PHELLOS*	FACW	25
TOTAL			**400**
UNDERSTORY - SHRUBS			
SOUTHERN WAX MYRTLE	*MORELLA CERIFERA*	FAC	270
SUGAR HACKBERRY	*CELTIS LAEVIGATA*	FACW	270
YAUPON	*ILEX VOMITORIA*	FAC	270

ROUGH-LEAF DOGWOOD	*CORNUS DRUMMONDII*	FAC	75
LITTLE-HIPHAWTHORN	*CRATAEGUS SPATHULATA*	FAC	75
UPLAND SWAMP-PRIVET	*FORESTIERA LIGUSTRINA*	FAC	150
PARSLEY HAWTHORN	*CRATAEGUS MARSHALLII*	FAC	50
DOWNY HAWTHORN	*CRATAEGUSMOLLIS*	FAC	50
GREEN HAWTHORN	*CRATAEGUS VIRIDIS*	FACW	50
HERCULESCLUB	*ZANTHOXYLUM CLAVA-HERCULIS*	FAC	50
CAROLINA BUCKTHORN	*FRANGULA CAROLINIANA*	FACU	55
WOODY VINES			
MUSCADINE	*VITIS ROTUNDIFOLIA*	FAC	15
PEPPERVINE	*AMPELOPSIS ARBOREA*	FAC	15
ALABAMA SUPPLEJACK	*BERCHEMIA SCANDENS*	FAC	15
TRUMPET-CREEPER	*CAMPSISRADICANS*	FAC	15
CAROLINA CORALBEAD	*COCCULUS CAROLINUS*	FAC	15
HORSEBRIER	*SMILAX ROTUNDIFOLIA*	FAC	15
SUMMER GRAPE	*VITISAE5TIVALIS*	FACU	15
AMERICAN BUCKWHEATVINE	*BRUNNICHIA OVATA*	FACW	15
MUSCADINE	*VITISROTUNDIFOLIA*	FAC	15
TOTAL			**1500**
HERBACEOUS			**%OF SEED MIXBY WEIGHT**
BROWNSEED PASPALUM	*PASPALUM PLICATULUM*	FAC	5
GULFMUHLY	*MUHLENBERGIA CAPILLARIS*	FAC	3
JUMPSEED	*PERSICARIA VIRGINIANA*	FAC	4
BROWNSEED PASPALUM	*PASPALUM PLICATULUM*	FAC	4
GULFMUHLY	*MUHLENBERGIA CAPILLARIS*	FAC	3
PURPLETOP TRIDENS	*TRIDENS FLAVUS*	FACU	4
ARROWWOOD VIBURNUM	*VIBURNUM DENTATUM*	FACU*	8
SLENDER WOOD-OATS	*CHASMANTHIUM LAXUM*	FACW	15
POSSUMHAW VIBURNUM	*VIBURNUM NUDUM*	FACW	5
SLENDER SPIKERUSH	*ELEOCHARIS TENUIS*	FACW	8
SAND SPIKERU5H	*ELEOCHARIS MONTEVIDENSIS*	FACW	11
MARSH HAY CORDGRASS	*SPARTINA PATENS*	FACW	11
EGG-LEAF INDIAN-PLANTAIN	*ARNOGLOSSUM OVATUM*	FACW	4
BUSHY BLUESTEM	*ANDROPOGON GLOMERATUS*	FACW	15
TOTAL			**100**

7.2.5.1 Stream Buffer Improvement

Stream buffer riparian improvement will include a combination of invasive species removal, planting, and excavation of adjacent river scroll wetlands within the Big Slough Bayou floodplain. Chinese tallow will be eradicated in the stream buffer zone per the methods and timeline described previously. The contractor may use small- to medium-sized tracked equipment (for example, excavators) for the mechanical removal of tallow trees that are readily accessible from site access roads and outside of existing wetlands. However, Stantec suggests that most tallow removal and treatment be completed by hand crews with non-mechanized equipment to minimize construction disturbance on the landscape. Mechanized equipment shall not be allowed within 50 feet of the Big Slough Bayou high water line for tallow removal unless the area is part of a proposed river scroll or habitat mound feature. The contractor must take extreme care during herbicides application on trees adjacent to Big Slough Bayou. The chosen herbicide must only be applied directly onto live tallow tissue and should not be overapplied; this will prevent the potential for adverse impacts on other vegetation. Herbicide treatment must occur in dry conditions so that toxins do not immediately runoff or leach into Big Slough Bayou.

7.2.5.2 River Scroll Construction

River scrolls are proposed adjacent to Big Slough Bayou and will mimic already existing relic river features within the Big Slough floodplain. River scrolls are proposed to support stream mitigation as well as meet or exceed the wetland mitigation required. The contractor will not need to install temporary mat roads or off haul excavated material from these features because they are outside of existing wetlands. River scrolls will have a 10 to 1 side slope and average depths varying between 1 to 3 feet. The scroll bottoms shall be excavated with varying topography but must not have locations with a final elevation deeper than 1.5 feet below the average specified elevation in the plans. Areas on the scroll bottom that are deeper than the average proposed elevation should be compacted with rollers or similar equipment to prevent water loss.

Palustrine emergent inoculum for these features should be collected from Big Slough Bayou and stockpiled near the scrolls. The contractor should collect inoculum from locations in Big Slough Bayou slated for earthen dam removal. Trees and shrubs slated for the creation of forested scrolls will be planted using native stock from local nurseries.

7.2.5.3 Embankment and Clogged Culvert Removal

Five earthen dams along Big Slough Bayou will be removed as part of the stream enhancement plan. Four of these dams will be completely removed with no replacement, while the fifth shall be replaced with three 10-foot wide corrugated metal pipe culverts as an improved fish passage measure. The contractor shall install floating turbidity curtain 50 feet upstream and downstream of the embankment to prevent sediment pollution in Big Slough Bayou. The area within the turbidity curtain must be de-fished using electrofishing equipment prior to groundwork. The contractor may use large mechanized equipment during the excavation of the earthen dams. The dams will be excavated to the same thalweg elevation of Big Slough Bayou 50 feet upstream of the dam. Material removed from the embankment deemed for replacement will be temporarily stockpiled and reused after the new culverts are installed. Other material (from the four other embankments) must be hauled off site to be used at the discretion of Dow. Remnant culvert material exposed during excavation must be hauled to a staging area and properly disposed of.

7.2.5.4 Scroll Density and Location

The water balance results determined that 7 percent of total sub-basin area could be sustained during an average year as perennial open water features. Stantec used these results to determine scroll density. The scroll features could theoretically cover a maximum cumulative area that was 4 percent of the drainage basin area, while the remaining 3 percent may be covered with pothole features (for future mitigation). Stantec used a factor of safety of approximately 2 when determining the actual cumulative area of features because it was unrealistic to assume these features would capture all annual runoff. Therefore, the total scroll feature area covered approximately 2 percent of the drainage basin area, while potholes covered approximately1.5 percent. Each sub-basin had a maximum of two scroll features to mimic the occurrence frequency of features in nearby BNWR. Scrolls were adjacent to the alluvial ridge within the former channel migration zone. 15.61 acres of scroll features are proposed for this mitigation plan.

7.2.6 Soil Management and Erosion Control Measures

The contractor will take extra care and follow all appropriate BMPs to reduce soil erosion, compaction, and loss of soil structure. Grading work will only occur in dry conditions and will be limited to the areas shown in the design plans. The contractor must spray down soils with water before grading work if the material becomes excessively dry and dusty. In contrast, contractors shall not drive equipment on excessively wet and muddy soil unless appropriate measure have been taken to stabilize roads or isolate the work area.

Soil fertility is essential for the revegetation success of the mitigation bank, therefore fertile topsoil (top 4 to 6 inches) will be stockpiled in separate locations from deeper soil horizons. This soil will be reapplied on all bare-earth sites where planting occurs before seed application (that is, habitat mounds, wetland features). Soils will not be imported onto the project site nor will soils be fertilized after planting to prevent nutrient pollution. The contractor must apply straw mulch or a similar erosion control mulch on top of all stockpiled and bare soil if there are no plans to actively use the material for an extended period of time (more than 1 month). This time frame can be reduced during wet months and when storms are predicted. Soil stockpiles located in the staging areas must also have an appropriate barrier (for example, silt fence) to prevent turbid water from running into streams. All equipment leaving the project site will be thoroughly cleaned in one of the equipment cleaning zones shown in the design plans to prevent soil track-out.

8 Determination of Mitigation Compensation Provided

Wetlands and waterbodies within the proposed reservoir footprint will be lost in their current state. Likewise, impacts associated with the planned pump station will permanently impact the shoreline of the Brazos River. This section summarizes mitigation requirements needed and provided through the CMP.

8.1 Waterbody and Wetlands Mitigation Requirement

Typically, USACE Galveston District recommends the use of the SCA standard operating procedure to develop a baseline, qualitative assessment of a stream to determine the degree of impact associated with the Proposed Project. This approach is most appropriate for impacts that alter a stream, but do not result in total loss of streams. For a project that proposes to eliminate streams altogether, the SCA is limited and additional data analyses may be necessary. Based on data collected and consultation with USACE, stream mitigation will be achieved through the implementation of stream restoration and enhancement projects (USACE 2022). Wetlands will also be replaced at their full value (USACE 2022).

8.1.1 Waterbody Mitigation Requirement

As noted in Section 6 (Table 6-2), streams within the reservoir embankment and the pump station footprint will require mitigation for 43,856 linear feet of impacts. Stream mitigation requirements will be provided at both the Oyster Creek and the Big Slough mitigation sites.

8.1.2 Wetland Mitigation Requirement

Wetlands that are within the footprint of the proposed reservoir will be considered to be completely impacted. Therefore, these wetlands will require mitigation for their full value. Wetlands in the temporary workspace will require clearing of trees but will otherwise be kept intact because these areas will be restored to preconstruction contours. This will result in the conversion of forested wetlands to non-forested wetland habitats. Considering the potentially long-term construction timeline of the Project, converted forested wetlands will be treated as a permanent impact. Wetlands within the restoration area will augment stream functional values and, therefore, will count as neither wetland impact nor impact minimization.

Permanent impacts to non-forested wetlands within the Proposed Project footprint will require 7.024, 7.749, and 6.849 credits of non-forested TSSW, MPAC, and RSEC, respectively. Likewise, temporary and permanent impacts to forested wetlands within the Proposed Project footprint will require 4.776, 4.893, and 4.883 credits of forested TSSW, MPAC, and RSEC, respectively.

8.2 Oyster Creek Mitigation Waterbody Compensation Provided

The Oyster Creek mitigation area provides 16,489 linear feet of stream mitigation compensation (USACE 2022) and includes approximately 170 acres of riparian buffer.

The remaining stream (waterbody) mitigation compensation is provided in the Big Slough mitigation area.

8.3 Big Slough Mitigation Waterbody and Wetlands Compensation Provided

Based on data collected and consultation with USACE, stream mitigation will be achieved in part through stream restoration and enhancement/establishment at Big Slough and adjacent proposed wetlands.

The Big Slough mitigation site will provide 33,400 linear feet (155 acres) of stream improvements. In addition, the mitigation site will provide establishment of 8.86, 8.11, and 7.85 TSSW, MPAC, and RSEC non-forested wetland credits, respectively, establishment of 4.85, 5.96, and 4.75 TSSW, MPAC, and RSEC forested wetland credits, respectively, and enhancement totaling 0.59, 3.48, and 0.68 TSSW, MPAC, and RSEC forested wetland credits, respectively.

9 Maintenance Plan

Maintenance is needed at mitigation sites with activities to control predation, replace plants, control invasive species, repair fencing and other elements of maintenance to ensure continued success of the mitigation. This Section provides maintenance plans for both Oyster Creek and Big Slough mitigation sites.

After construction and initial mitigation installation is completed, routine maintenance will occur as identified during subsequent monitoring and surveys. Maintenance actions that may be needed could include replanting of dead or dying trees or shrubs, herbivory deterrence, and control of invasive exotic, noxious or competing vegetation (primarily Johnson grass for Oyster Creek and Chinese tallow for Big Slough) which could threaten achievement of the performance standards.

9.1 Overview and Schedule of Maintenance Plan

During routine maintenance and annual monitoring, the mitigation area will be visually assessed to determine if excessive erosion is occurring. The erosion assessment will be focused primarily on the bankfull benches and temporary or permanent access roads given the necessary excavation or ground disturbance that will have occurred at these features. If erosion has occurred, the steps outlined in the adaptive management plan (Section 13) will be used.

Seeding and plantings will be native species from local stocks. If the local supply of a given native species is limited, sourcing will extend beyond the local area only to the extent necessary, while remaining within similar climate and ecological zones. Therefore, these species should be adapted to local site conditions and climate, so little to no maintenance is anticipated. To restore/maintain the vegetation community, the following schedule of activities is anticipated:

- Year 0 – Remove exotic invasive species
- Year 1 – Visual monitoring to assess success of Year 0 activities
- Year 2 – Plot-based monitoring to determine needed planting density
- Year 3 through end of monitoring period – Plot-based monitoring to determine success of supplemental plantings and invasive species control.

The vegetation community will be monitored on a yearly basis and should survivorship requirements not meet the criteria outlined in the performance standards, the steps outlined in the adaptive management plan will be used.

Anticipated maintenance may also include activities such as mowing or trimming around woody plantings where existing ground cover exists, clearing of vegetation for temporary access needs, or fence repair.

Vegetation clearing would be on an as-needed basis, such as to provide all-terrain vehicle (ATV) passage; efforts will be made to minimize impacts wherever possible.

9.2 Measures to Control Grazing

Livestock from off-property areas will be excluded from the mitigation area by a perimeter barbed wire fence and gates that will encompass the Oyster Creek mitigation area and the Proposed Project. The fence is not anticipated to entirely cross the creek, so as not to create a debris and flow barrier. Periodic inspection of the site will occur to ensure livestock that enter the area are removed.

Planted trees may be shielded with tubes if herbivory becomes a cause of significant plant mortality or is notably reducing growth and hindering achievement of the survivorship goals. Herbivory on planted vegetation within restoration areas by livestock and native and invasive wildlife species such as nutria and wild hogs will be noted during monitoring events. Dow personnel or the designated contractor will determine if protection from herbivory is needed and take corrective measures as required.

9.3 Measures to Control Invasive, Noxious or Exotic Species

If areas require treatment for control of invasive exotic and noxious vegetation, a subsequent site visit would be made as soon as practical to conduct physical removal and/or species-appropriate-herbicide spraying of the problem vegetation. Herbicide application treatments will be performed by a licensed professional contractor certified to safely handle and apply herbicides in accordance with state and federal regulations.

If significant damage occurs to the mitigation plantings stemming from invasive animals, such as feral hogs or nutria, the adaptive management plan will be implemented for control measures. This might entail additional monitoring methods or frequencies and removal methods, such as trapping.

9.4 Replacement Plan

Planting survivorship challenges that are identified during routine maintenance or monitoring inspections will be remediated as soon as practicable. Corrective actions that may be needed could include repairing and stabilizing failed slopes; replanting dead or dying trees or shrubs, deterring herbivory; and controlling invasive exotic, noxious or competing vegetation (primarily Johnson grass). More detail is provided in the adaptive management plan (Section 13).

9.5 Maintenance and Repair

The exclusionary (perimeter) fence will be walked and or driven (where possible) at least twice within 12 months after installation. Thereafter, for the duration of the mitigation monitoring period, the perimeter fence will be walked or driven at least annually with necessary repairs occurring during inspection or within a short time from the observation. Observations of livestock within the onsite mitigation area will require the need to identify the access point and remedy the problem as soon as practical.

9.6 Perpetual Site Protection Instrument

The Site Protection Instrument currently is intended to be a deed restriction. The preparation of the restriction will commence prior to construction and no later than 30 days prior to start of construction for implementation of the CMP.

9.7 Oyster Creek

Oyster Creek is a jurisdictional water of the U.S. and is thereby protected by the Clean Water Act. Dow owns the property of the Oyster Creek mitigation area. Dow will prepare the deed restriction prior to construction of the CMP and no later than 30 days prior to start of construction of the CMP as a protective instrument on the mitigation area. Dow, as owner, will continue to be responsible for the protection of the site.

9.8 Big Slough

Big Slough is a jurisdictional water of the U.S. and is thereby protected by the Clean Water Act. Dow owns the property of the Big Slough mitigation area. Dow will place a deed restriction as a protective instrument on the mitigation area no later than 30 days prior to start of construction of the CMP. Existing potential jurisdictional areas outside the mitigation area will not be disturbed; however, it may be used in the future for wetland enhancement and restoration mitigation. Dow, as owner, will continue to be responsible for the protection of the site.

10 Performance Standards

CFR 322 establishes that ecologically based standards will be used to determine whether a compensatory mitigation project is achieving its objectives.

Dow plans to initially collect baseline data, produce a 60-day monitoring report and then monitor the Oyster Creek and Big Slough mitigation areas for a period of 5 years (10 years for forested mitigation) in accordance with Regulatory Guidance Letter 08-03 issued by the USACE Director of Civil Works on October 10, 2008. The guidance also establishes that if the mitigation project meets the success criteria for two consecutive monitoring reports, the monitoring period may be reduced.

For the Oyster Creek and Big Slough mitigation areas, the following four categories of performance standards will be used to determine if the Project is achieving its objectives:

- Invasive and noxious species reduction
- Herbaceous species planting success
- Woody species (including trees/shrubs) planting success
- Successful establishment of forested river scroll wetlands
- Geomorphological stability within the mitigation area at the Oyster Creek site

10.1 Invasive, Noxious, or Exotic Species Control Success Criteria

The success of invasive and noxious species control will be evaluated on the extent of coverage of any of the species listed on the TDA Noxious and Invasive plants list (TDA 2022). Herbicide application or removal of invasive or noxious plant species will vary based on the species.

- One year following completion of final construction activities achieve less than 25 percent average cover of non-native invasive species.
- Years 2 to 5 following completion of final construction activities achieve average cover of less than 5 percent non-native invasive species with no area greater than 0.25 acre in size with greater than 10 percent non-native invasive species.

Monitoring will measure percent cover of non-native plant species. Vegetation will be sampled annually, at the mitigation site. Permanent vegetation monitoring stations will be established as well as randomized plots selected yearly, using stratified semi-random plot transect sampling for assessing the vegetation community at each site. Sites will be sampled annually post-construction until success is determined. Initial control/removal of unwanted plants will be evaluated, and determinations made on an annual or semi-annual basis on whether additional action will be needed.

10.2 Herbaceous Species Planting Success Criteria

The measure of vegetation planting success shall be evaluated on target transplant clump survival success criteria initially and target areal coverage success criteria at the end of each monitoring period within the herbaceous planting areas.

- If at least 50 percent survival of transplants is not achieved within 60 calendar days of planting, a second planting effort will be completed within 30 days of completing the initial survey.

- If, after 1 year from the initial planting effort (or subsequent planting efforts), the site does not have at least 35 percent areal coverage of target vegetation, those areas that are not vegetated will be replanted using the original planting specifications.
- If, after 2 years from the initial planting effort (or subsequent planting efforts), the site does not have at least 50 percent areal coverage of target vegetation, those areas that are not vegetated will be replanted using the original planting specifications.
- If, after 3 years from the initial planting effort (or subsequent planting efforts), the site does not have at least 70 percent areal coverage of target vegetation, those areas that are not vegetated will be replanted using the original planting specifications.
- If, after 4 years from the initial planting effort (or subsequent planting efforts), the site does not have at least 75 percent areal coverage of target vegetation, those areas that are not vegetated will be replanted using the original planting specifications.
- If, after 5 years from the initial planting effort (or subsequent planting efforts), the site does not have at least 75 percent areal coverage of target vegetation, those areas that are not vegetated will be replanted using the original planting specifications.

Vegetation sample plots shall be located on a stratified semi-random plot transect sampling basis over the Project. The following minimum numbers of samples will be required:

- Given the size of the Oyster Creek mitigation area, a minimum of 2 plots/acre is required for the first 20 acres, then 1 plot/acre is required for the remaining acreage.
- Big Slough mitigation area, based on differences in vegetation communities from Oyster Creek will use 1 plot/acre for those vegetation sample plots.

Each plot shall be of a size no less than 3 meters by 3 meters. The vegetation data shall be collected during the growing season and shall include:

- Dominant vegetative species identification
- Percent ground cover assessment
- Percent survival by planted species
- A non-native/invasive species assessment including percent cover

10.3 Woody Species (including Trees and Shrubs) Planting Success Criteria

The success of vegetated planting of woody species (including trees and shrubs) will be evaluated at Oyster Creek in open (for example, agricultural fields) and newly graded areas where historically no tree canopy existed. Woody species planting success will be evaluated within the Big Slough riparian restoration areas as well as newly created forested river scrolls. Native woody species success will be monitored for a minimum of 10 years and extended accordingly if success criteria have not been met.

Survivability, diversity and percent cover / canopy cover will be measured to determine success and is described as follows:

- From monitoring years 1 through 5, for scrub-shrub or forested buffers and river scroll wetlands; estimate the percent survival of planted trees and the number of native trees/shrubs per acre (including planted or volunteer woody species). Data will be summarized for each plot, random plot and also for overall site. Survivorship of less than 50% will require supplemental planting. Stationary and random plots will be established to determine percent cover and diversity within the mitigation area. For years 1, 3 and 5, percent cover will average 20, 35, and 50 percent, respectively. The diversity index will be compared between baseline and year 3. Supplemental species planting will be completed if the diversity index does not increase by 10 percent in year 3 and 15 percent in year 5. Shannon’s diversity Index will be calculation utilized and is based on species richness (number of species) and relative abundance (evenness). Quadrants size of 25m by 25m will be utilized.
- From monitoring years 6 through 10, a minimum of 60 and 75 percent cover, respectively, of native woody vegetation (planted and volunteer trees and shrubs) will be present within the mitigation areas.

- Satellite imagery and/or drone-based photography will be utilized to supplement percent cover at 5 and 10 years to determine successful canopy development determined by overall area coverage. Aerial canopy cover of 75 percent at year 10 will be deemed successful.

10.4 Geomorphological Stability within the Mitigation Area Criteria

Geomorphological stability will be monitored for up to 3 bankfull events to compare potential destabilization through observations of entrenchment, overwidening, erosion or deposition compared with the post-construction baseline survey. The Oyster Creek mitigation area does not include streambank stabilization measures, given that the banks were observed to be stable with low erosion potential (Jacobs 2019); however, observations of bank stability will be noted during each of three bankfull monitoring events.

11 Monitoring Requirements

Monitoring requirements provide a description of monitoring parameters to be used to determine whether the mitigation project is on track to meet performance standards and if adaptive management is needed. Monitoring plans, schedules and reporting content for both Oyster Creek and Big Slough mitigation sites are provided in this section.

The monitoring plan addresses monitoring parameters to determine if the mitigation projects are meeting performance standards as well as monitoring techniques, adaptive management strategies, schedules, and reporting. The monitoring plan is designed to measure and document the progress, successes, and failures (if any) of the main strategies of the proposed CMP.

Monitoring and reporting requirements are to be in accordance with USACE Regulatory Guidance Letter (RGL) 08-03 “Minimum Monitoring Requirements for Compensatory Mitigation projects Involving the Restoration, Establishment, and / or Enhancement of Aquatic Resources.” Reports presenting documentation of monitoring findings will be submitted to USACE annually, until all success criteria and performance standards are met.

11.1 Parameters to Be Monitored

The Oyster Creek mitigation area will be monitored for site-specific parameters during each monitoring event. Applicable success criteria and performance standards will vary between the projects, depending on the restoration or enhancement goal at each site. Some sites will be evaluated against more than one criterion. A photographic log documenting existing conditions and progress made will be maintained and submitted with the annual report to the USACE Galveston District. Refer to Section 9 for a summary of success criteria and performance standards.

The following parameters will be monitored within the Oyster Creek mitigation area:

- Maintenance of existing high-functioning designated riparian buffers
- Vegetation planting success within designated heavy buffer planting areas (which include the reestablished bankfull benches)
- Invasive, noxious or exotic species control
- Evidence of stream geomorphological stability

The following parameters will be monitored within the Big Slough mitigation area:

- Vegetation planting success within designated heavy buffer planting areas (which include the Big Slough riparian buffer and scroll wetland features)
- Increased wetland hydrology success in enhanced and established wetland features

  Invasive, noxious or exotic species control

11.2 Monitoring Techniques

Monitoring techniques and methodologies are described in this section.

11.2.1 Data Collection

Vegetation monitoring plots will be established in one or more locations within each planted area. Vegetation sample plots shall be located on a stratified semi-random plot transect sampling basis over the mitigation site. Plots no larger than 2m x 2m will be established for monitoring of herbaceous communities and plots no smaller than 25m x 25m will be established for monitoring of shrub and forested communities. Some planted areas will have more than one monitoring plot, set up in representative locations, so as to sample at least 25 percent of the area planted. Monitoring plots will be situated to span all planting zones (Zones 1 through 3). Plot locations will remain fixed from one monitoring event to the next; and plot corners will be marked in the field by aboveground polyvinyl chloride (PVC) pipe and flagging. In addition to the fixed plots, random plots will also be sampled during each monitoring event and will change yearly.

Data recorded by species will include measurements, such as height class, dbh, basal area, and frequency of occurrence, and number of stems. Data recorded will also include a list of plants that have colonized the mitigation area, an estimated percent cover of desirable native species and that of invasive exotic species. In addition, general observations, wildlife use, and photographs of the area will be recorded.

From these data, the survival rate per species, density, relative percent cover, and general health of the mitigation areas can be assessed. Percent survivability for each monitoring event will be calculated as follows:

- Percent survivability = existing number of plantings of Species A in Zone X divided by original number of plantings of Species A in Zone X multiplied by 100.

The number of remaining viable shrubs, saplings, and trees will be tallied against the total number originally planted and any subsequent replantings. The total recorded will be extrapolated to determine the overall survival rate for the area per planting zone. Canopy percent cover per plot will be estimated and used for annual assessment of health and growth comparisons.

Piezometers will be installed at several locations at each mitigation site, within enhanced riparian buffers, planting areas, and established wetland features, as well as several control (native upland) areas. Readings will be focused on collecting saturation depths and/or ground water levels or “head” potential. Hydrologic monitoring in this context emphasizes water quantity (levels, flows, volumes, duration, and frequency) rather than quality (chemistry). Piezometer readings will be collected at these locations over a 5-year period. Wetland and riparian area readings will be compared to control areas to determine if increased and successful hydrology has been achieved within mitigation riparian areas and within established wetland features, respectively. Additionally, piezometer data will be paired with cumulative rainfall and temperatures recorded at the nearest local NOAA stations to monitor potential levels of drought that could necessitate the use of supplemental watering as an adaptive management measure during years 1 through 3.

11.2.2 General Observation

During each monitoring visit, biologists will record a general description of the mitigation areas, which will include wildlife observations and assessment of the vegetation health and growth.

In addition, assessment and photographic documentation of potential problem situations will be made during each monitoring visit. These potential problems might include the presence of invasive exotic, noxious vegetation, lack of hydrology (drought conditions), or significant die-off of planted material.

11.2.3 Photograph Stations

Photographic monitoring will be conducted at each visit to provide a qualitative estimate of changes in dominant vegetation over time. Photographs will be taken from the same location and in the same direction at each visit. Each photograph station, set up during the first monitoring visit, will be marked in the field by above ground PVC pipe and flagging; and its location will be recorded using a handheld GPS unit. A minimum of three photograph stations will be established in each of the planting zones. Photographs will also be taken at randomly sampled plots. Location position (GPS) will be collected and added to the photolog.

Oyster Creek bank stability will also be photographically monitored after bankfull events.

11.2.4 Frequency and Timing of Monitoring (Schedule)

Baseline monitoring events and preparation of as-builts will be performed for the mitigation areas after the mitigation construction period. The data collected from the baseline monitoring event and recorded in the as-builts will serve as the basis of comparison for future monitoring events and for the calculation of success criteria. During these events, permanent monitoring plots will be established at all mitigation areas. These events will also serve to confirm the "as-built" conditions of the mitigation areas. Deficiencies, such as dead or dying plants noted during the baseline events will be immediately corrected. Such corrections (for example, replantings) will be considered part of the baseline events and those areas reevaluated to update the baseline "as-built" conditions.

Subsequent to the initial baseline and 60-day monitoring and documentation, monitoring events will occur annually for no less than 5 years in herbaceous planting areas and 10 years in forested planting areas, unless directed otherwise in the permit conditions written by the USACE Galveston District.

Exclusionary fences will be walked and or driven (where possible) at least twice within 12 months after installation. Thereafter, for the duration of the mitigation monitoring period, the exclusionary fence will be walked or driven at least annually with necessary repairs occurring during inspection or within a short time from the observation. Observations of feral hogs, cattle, or other non-native species within the mitigation areas will require the need to identify and close access points as soon as practical.

11.2.5 Length of Monitoring Period

Mitigation areas will be monitored yearly for no less than 5 years for herbaceous planting areas and 10 years for forested planting areas to ensure success of the plantings and to make sure that performance standards are being met in multiple monitoring reports.

11.2.6 Party Responsible for Monitoring

Dow personnel or a qualified contractor will be responsible for monitoring the mitigation areas for a period of 10 years, unless specified otherwise by the District Engineer.

11.2.7 Reporting (Contents and Schedule)

Results from each monitoring event will be summarized in a report to be submitted annually to the District, or on another reporting schedule as directed in the permit conditions. Monitoring reports submitted will include the following:

- Project name and permit number
- Site aerial showing Project location, sampling plots, and photographic station locations
- Permittee's name, address, and phone number
- Report preparer's name, address, and phone number
- Purpose and goals for mitigation site
- Brief summary of mitigation strategy/actions
- Date mitigation action commenced
- Dates of site inspections
- Dates of maintenance activities

- Summary of observations and measurements
- Assessment of success toward the performance standards or success criteria
- Observed problems (such as slope failure, erosion, stressed or dead trees or shrubs, vandalism, invasive plants, storm damage, and similar)
- Implemented or recommended adaptive management solutions to correct problems or deficiencies
- Photographs from each of the site inspections by photographic station, location, and date

12 Long-term Management Plan for Oyster Creek and Big Slough Mitigation Sites

The long-term management plan describes how the mitigation project will be managed after the performance standards have been achieved to ensure the long-term sustainability of the resource. This section provides an overview of plans for long-term management for both Oyster Creek and Big Slough.

The sustainability of the mitigation sites after the performance standards have been achieved will be accomplished in three primary ways:

1. Proper maintenance and adaptive management activities during the initial monitoring period will facilitate achievement of the performance standards outlined in this plan and in the permit issued for the Proposed Project. Long-term management and adaptive management provide a means to maintain the riparian buffer vegetation and stable hydrogeomorphic conditions for the long-term sustainability of the mitigation site.
2. Financial assurances as described in Section 15.
3. Legal protections as described in Section 5.

12.1.1 Ownership of Mitigation Area

As noted in Section 4, Dow owns the property for both the Oyster Creek and Big Slough mitigation areas. Once the mitigation projects have met the performance standards and the mitigation obligation, Dow will place a deed restriction on the mitigation area.

12.1.2 Long-term Steward

Dow is the long-term steward of the sites and will provide for contractual management activities or otherwise provide for long-term management activities. Should ownership or operation of the Project be conveyed to another entity, conveyance documents will include provisions for long-term management of the mitigation areas.

12.1.3 Long-term Management Activities

In addition to 5-year monitoring and reporting outlined in Section 10, an additional 5 years of invasive species monitoring and control will be performed. Fencing will be inspected and maintained to provide predation control and to prevent trespassing which might reduce ongoing success of the mitigation. Adaptive management techniques as further described in Section 14 rely on ongoing monitoring to inform long-term management and corrective actions if required.

12.1.4 Funding Mechanism

Long-term management activities will be funded through the Dow budget process for expense spending as a line item as required for site budgeting of routine activities. This particular budget item will be linked to the issued permit for the project. The permit will be part of an ongoing compliance task which would include review and funding of activities needed for the mitigation areas. Dow is a large, international company and is able to ensure funding for the sustainability of these mitigation activities.

13 Adaptive Management Plan

The adaptive management plan is a strategy used to address foreseeable or unforeseen changes in site conditions or other components that adversely affect compensatory mitigation success. The adaptive management plan approach and details for Oyster Creek and Big Slough are included in this section.

The concept of adaptive management acknowledges the dynamic nature of natural systems and the changing state of knowledge and developing management strategies. Adaptive management, as most appropriately applied to ecological reestablishment, restoration and enhancement, relies on ongoing monitoring results to inform subsequent mitigation phases and develop corrective actions or contingency plans. Where areas of the functional ability of the mitigation sites are compromised or where unstable conditions develop during the monitoring period, Dow or their qualified contractor will focus on implementing appropriate adaptive management measures. Following the completion of enhancement, the wetland hydrology, stream geomorphology and plant establishment success rate will be the primary indicators used to guide adaptive management decisions.

13.1.1 Parties Responsible

Dow is responsible for the mitigation plan and the activities it describes, including monitoring, maintenance, funding, and remedial or adaptive measures that may be needed if the performance standards are not met. The criteria defined in the performance standards will be regularly measured, monitored, and reported as described in this mitigation plan to track potential deviations from the mitigation goals and objectives.

13.1.2 Potential Remedial or Corrective Measures

The active monitoring will allow for remedial actions, such as reseeding, replanting, installing plant protection devices (for example, tubes, fencing, or wraps), and measures to control invasive, noxious or exotic species, such as herbicide applications to plants or trapping and removal of feral hogs, cattle, nutria and other species. The financial assurances provided by Dow will ensure that funding remedial actions as may be needed will be available.

13.1.3 Coordination with USACE

If proposed adaptive management measures would be expected to substantially alter the mitigation measures, Dow will propose adaptive measures to the USACE and obtain approval prior to implementation.

13.1.4 Anticipated Challenges Potentially Requiring Adaptive Management

Potential challenges that exist include extreme flood events that could disturb vegetation or destabilize stream banks. The design of the Oyster Creek mitigation area is intended to accommodate flood events. The shallowly sloped bankfull benches will slow flow velocities during flows above bankfull events. The bankfull benches also create areas where the root length necessary to reach the water table is decreased; however, across both the Oyster Creek and Big Slough sites, extreme drought conditions could affect plantings, particularly before plants become well-established. Watering of plants may be needed and will be determined by Dow or a designated qualified contractor using the water schedule and approach described in Section 11.2.1.

If performance standards are not being met after the application of remedial actions, Dow may incorporate additional maintenance activities. The roughly 6.7 miles of Oyster Creek between the downstream end of the Oyster Creek mitigation program and the outfall of the existing Harris Reservoir provide a reference reach for assessing impacts of extreme flood or drought events to the riparian corridor. The riparian corridor in this reach varies in forested width and density, and the trees within the forested area appear to be mostly mature trees exceeding 25 years old. There are also areas of well-established and diverse riparian vegetation in the upper reaches of the Oyster Creek mitigation with well-established vegetation and ecosystem functions. These areas will be good indicators of stressors on more mature vegetation and thereby influence the adaptive management measures that may be considered for the newly planted areas.

14 Short-term and Long-term Financial Assurances

This section includes a description of the financial assurances that Dow will provide for both mitigation projects that provide a high level of confidence that the mitigation project will be successfully completed, in accordance with its performance standards.

Financial Assurances Overview

Dow is financially able to complete all compensatory mitigation proposed by this CMP, including post mitigation maintenance and monitoring. Dow and/or its designated representative(s) will be responsible for the implementation of the design, including construction activities, planting, and associated work. Financial management will be provided for managing the remedial measures to ensure mitigation success, and long-term management of the proposed mitigation site.

Dow's mechanism for financial assurance is part of the company's overall capital planning and approval process, which identifies funding for the Project and associated environmental requirements, which would include the CMP implementation. The contracts will be issued to an appropriate contractor and payment for services will occur as work is completed and invoiced. This includes adaptive management actions, if identified during the periodic monitoring and invasive species control.

The long-term management of invasive species survey and control (as needed) and reporting as needed will be funded through the Dow site budget expense process as a compliance task and added to the routine maintenance budget as a line item. This ensures that the funds are available on an annual basis for the survey and control as needed.

In the unlikely event that Dow is unable to complete the compensatory mitigation implementation a Performance Bond, Surety Bond or Letter of Credit is being prepared to cover the cost of the mitigation. The Financial Instrument will be issued to a Conservation Organization such as The Nature Conservancy or similar organization.

The financial assurance and real estate instruments will be initialized prior to and within 30 days of start of construction. This will be in alignment with commencement of the construction of the CMP.

Calculation and Costs of Near-term (Construction and Monitoring) and Long-term Maintenance

Dow has mitigation area cost estimates established based on design of the mitigation areas. These costs have been included in the capital requests for funding of the project. The estimate for the financial assurance for the mitigation areas is $12,000,000.

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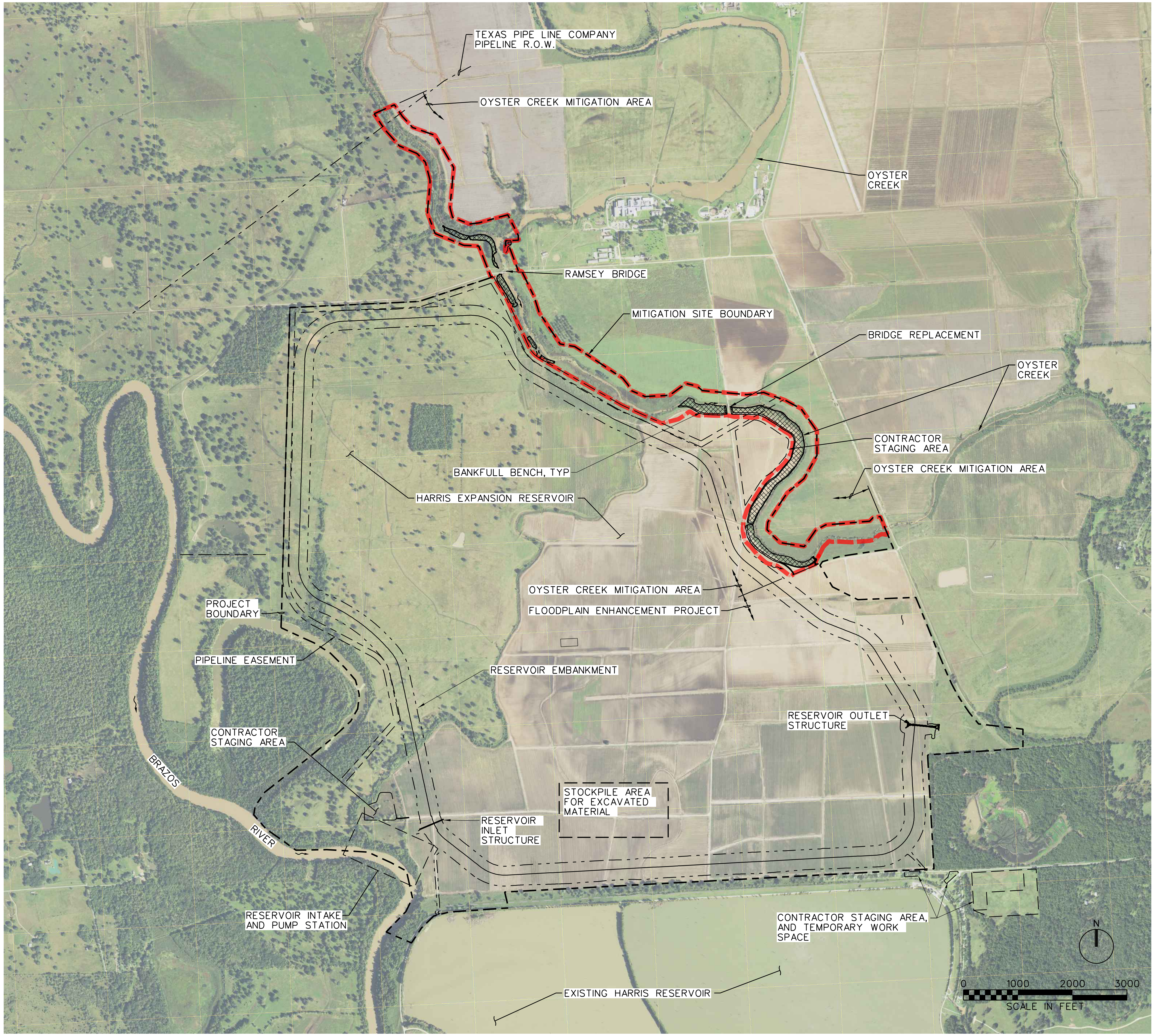
Attachment 1
General Location Map and Mitigation Figures

Oyster Creek



NOTE:

1. OYSTER CREEK MITIGATION PLANTING AREAS NOT SHOWN, SEE FIGURE 2.

Worley — TEXAS REGISTERED ENGINEERING FIRM F-1480
JACOBS — TEXAS REGISTERED ENGINEERING FIRM F-2966

THE DOW CHEMICAL COMPANY	
TEXAS OPERATIONS	FREEPORT, TEXAS
ENVIRONMENTAL OPERATIONS	HARRIS EXPANSION
HARRIS EXPANSION PROJECT GENERAL OVERALL SITE PLAN	

PROJECT NUMBER	SCALE		REV.
017491	1"=1000'	FIGURE 1	

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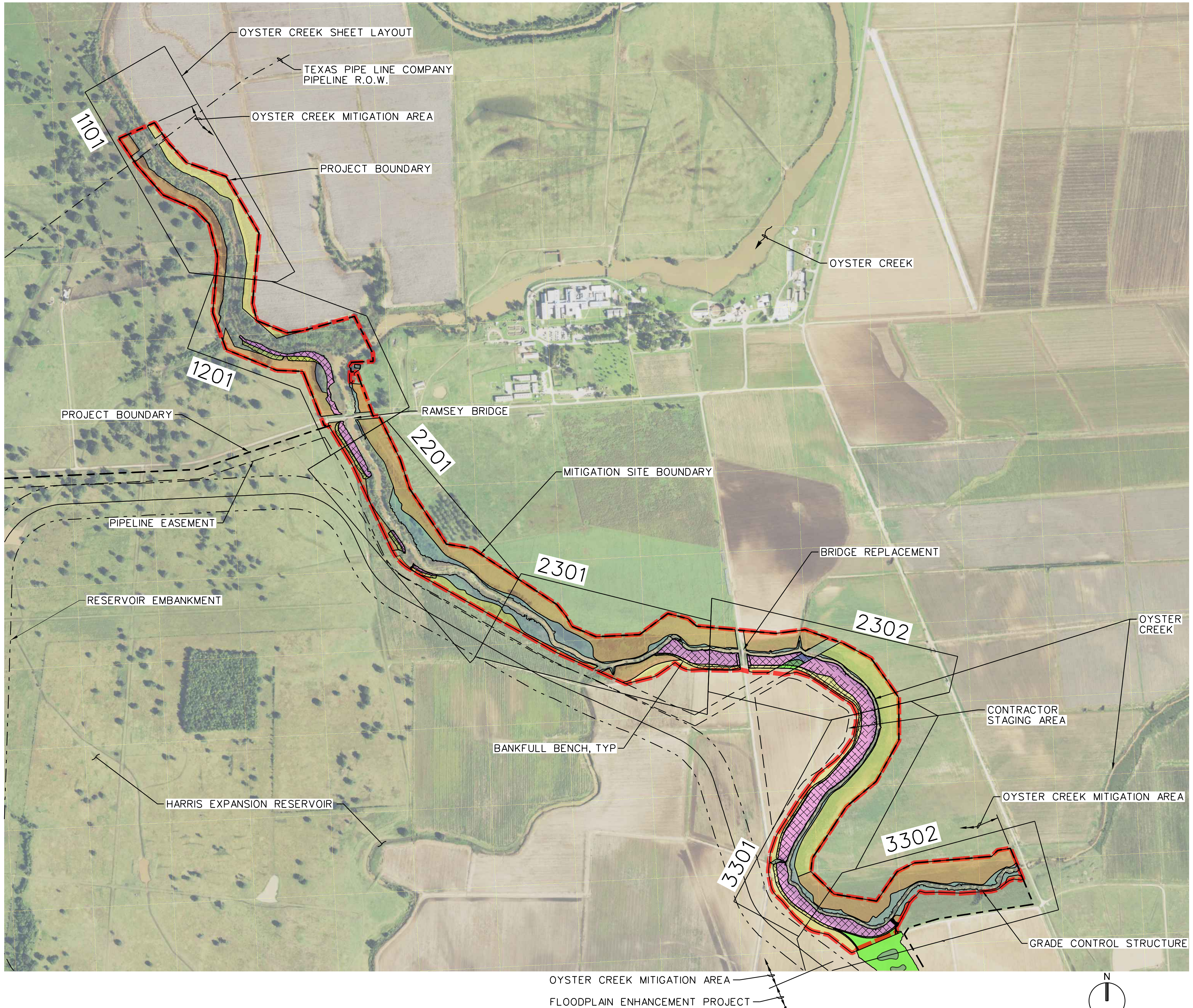

LEGEND:

BANKFULL BENCH

PLANTING (P) AND SEEDING (S) ZONES

P1+2	ZONES 1 AND 2, PLANTS ONLY	
P3	ZONE 3, PLANTS ONLY	
PS1	ZONE 1, PLANTS AND SEED	
PS1+2	ZONES 1 AND 2, PLANTS AND SEED	
PS3	ZONE 3, PLANTS AND SEED	
S1	ZONE 1, SEED ONLY	
S2	ZONE 2, SEED ONLY	
S3	ZONE 3, SEED ONLY	

SEE OYSTER CREEK PLANTING PLAN AND DETAILS SHEETS FOR LOCATIONS OF PLANTING AND SEEDING ZONES AND SPECIES.

Worley energy | chemicals | resources
TEXAS REGISTERED ENGINEERING FIRM F-1480

JACOBS
TEXAS REGISTERED ENGINEERING FIRM F-2966

THE DOW CHEMICAL COMPANY

TEXAS OPERATIONS — FREEPORT, TEXAS
ENVIRONMENTAL OPERATIONS — HARRIS EXPANSION

HARRIS EXPANSION PROJECT
GENERAL
OYSTER CREEK MITIGATION AREA

PROJECT NUMBER	SCALE		REV.
017491	1"=1000'	FIGURE 2	2

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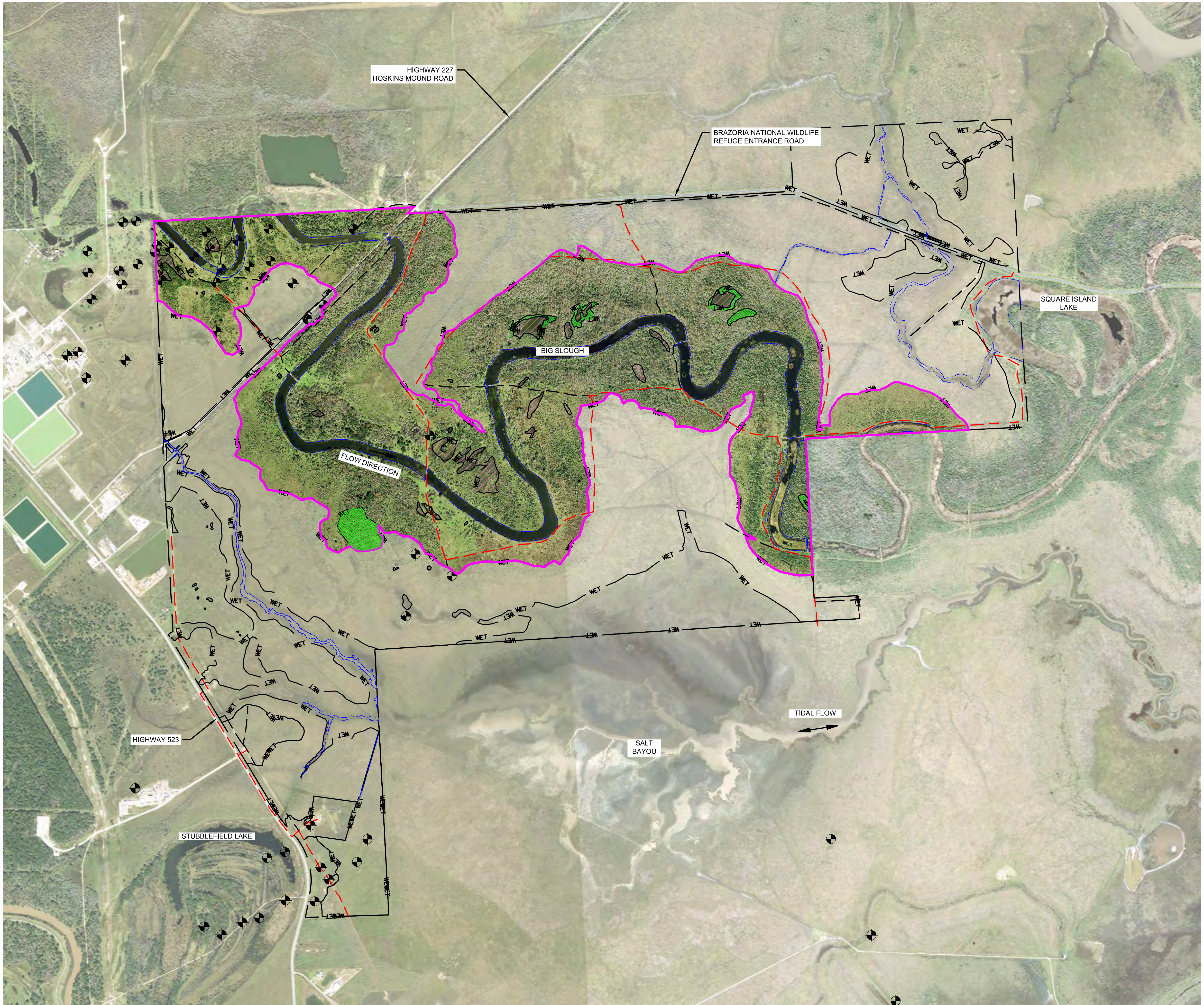
Big Slough



LEGEND

- PROPERTY BOUNDARY
- MITIGATION SITE BOUNDARY
- ACCESS ROADS
- PARCEL BOUNDARIES
- EXISTING STREAM BOUNDARY
- STREAM OR CHANNEL CL
- EXISTING HERBACEOUS WETLANDS
- EXISTING TIDAL WETLANDS
- EXISTING FORESTED WETLANDS
- OIL WELL

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EXISTING CONDITIONS
BIG SLOUGH MITIGATION SITE
DOW CHEMICAL
BRAZORIA COUNTY, TX

#	DATE	DESCRIPTION	BY

PRELIMINARY NOT FOR CONSTRUCTION

DATE	JANUARY 2021
DRAWN	FA/LE/JC
DESIGNED	DE/LE/FA
CHECKED	DE/SM/BJ
PROJECT #	E515018116

SHEET TITLE
EXISTING CONDITIONS
SHEET NUMBER
03
LAND USE #

Plot Stamp: 3/3/2023 9:02:06 AM - Gorden, Jeremy
File: Z:\Sam Waltman\20221005\BIG SLOUGH-EXISTING CONDITIONS.dwg, Tab: 03 EXISTING CONDITIONS

Attachment 2
Delineation of Waters of the U.S.

Reservoir

Wetland Delineation Report for the Dow Harris Reservoir Expansion Project in Brazoria County, Texas

USACE File No. SWG-2016-01027

SEPTEMBER 2019

PREPARED FOR

Dow Chemical Company

PREPARED BY

SWCA Environmental Consultants

WETLAND DELINEATION REPORT FOR THE DOW HARRIS RESERVOIR EXPANSION PROJECT IN BRAZORIA COUNTY, TEXAS

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SWCA Project No. 52872
USACE File No. SWG-2016-01027

September 2019

CONTENTS

Appendices

Tables

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1 INTRODUCTION

In response to Dow Chemical Company's required Environmental Impact Statement, Dow Chemical Company retained SWCA Environmental Consultants (SWCA) to conduct an evaluation of waters of the U.S. (WOTUS) (otherwise known as a wetland delineation) on a parcel totaling approximately 2,529 acres associated with the proposed Dow Harris Reservoir Expansion Project (Project) located in Brazoria County, Texas. The location of the proposed Project is illustrated in Figure 1 in Appendix A. To facilitate the increasing water demands of their Texas Operations facilities in Freeport, Texas, Dow Chemical Company plans to expand their existing reservoir impoundment complex that currently lies immediately south of the project area. The project area is adjacent to both the Brazos River and Oyster Creek and would be used for surface water diversion. Additional reservoir facilities, including intake and pump stations, inlets, outlets, and spillways would be constructed for the proposed Project. Previous WOTUS delineations covering portions of the project area were performed by Cardno PPI (Cardno) in 2012, 2017, and 2019, the results of which were provided to SWCA by U.S. Army Corps of Engineers (USACE) to inform our delineation efforts (Appendix B).

The purpose of the wetland delineation was to determine the presence, location, and extent of WOTUS within the project area to achieve compliance with permit requirements. To achieve its intended purpose, the wetland delineation boundary was determined by a combination of desktop resource reviews and field surveys of the proposed project area. According to the USACE, WOTUS include territorial seas, tidal waters, traditional navigable waters, interstate waters, and the adjacent waters, contributing waters, or impoundments of these waters (e.g., rivers, creeks, streams, lakes, reservoirs). Special aquatic resources associated with these waters are also considered WOTUS and include sanctuaries and refuges, wetlands, mud flats, vegetated shallows, coral reefs, and riffle and pool complexes.

Wetlands are typically the most common special aquatic resources present and are defined by the USACE as "areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (40 Code of Federal Regulations [CFR] 230.3[t]). Based on this definition, for an area to be considered a wetland it must possess the following parameters under normal circumstances: 1) a predominance of vegetation adapted to live in water or saturated soils (i.e., hydrophytic vegetation), 2) soil characteristics of frequent saturation (i.e., hydric soils), and 3) the presence of hydrology showing evidence of regular flooding or ponding (i.e., wetland hydrology).

2 METHODS

2.1 Desktop Resource Review

Prior to performing the delineation, SWCA conducted a resource review of available background information to help identify the portions of the project area most likely to contain wetlands and/or waterbodies. Resources reviewed included historic aerial photography, U.S. Fish and Wildlife Service National Wetlands Inventory (NWI) data, U.S. Geological Survey (USGS) National Hydrography Dataset (NHD) data, historic USGS topographic quadrangles, and the most recently available Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map data. Additionally, SWCA reviewed the previous WOTUS delineations which were performed by Cardno in 2012, 2017, and 2019.

2.2 Field Survey of Wetlands

SWCA conducted field surveys of the project area from June through July 2019, following the wetland delineation guidelines provided in both the *Corps of Engineers Wetlands Delineation Manual* (Manual) (USACE 1987) and the subsequent *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region (Version 2.0)* (Regional Supplement) (USACE 2010). Field surveys were focused along nine transects traversing the project area to access the presence or absence of the three wetland parameters (i.e., hydrophytic vegetation, hydric soils, and wetland hydrology) and areas bearing aerial image signatures typical of wetlands.

Data sheets, which document representative areas of uniformity (i.e., similar vegetation, soils, and hydrology), were completed at select locations (i.e., data points) within the project area to differentiate wetland and non-wetland areas based on the presence or absence of the wetland parameters (Appendix B. Data point locations included wetland/non-wetland boundaries, NWI/NHD feature locations and areas suggestive of inundation or saturation in aerial imagery evaluated during the desktop reviews, and the various non-wetland vegetation community types encountered within the project area. At each data point, SWCA took photographs to support the information recorded on the data sheets and document the general conditions observed in the field. A subset of the photographs is provided in the photographic log in Appendix C.

2.2.1 Vegetation Community Types and Hydrophytic Vegetation

Vegetation community types within the project area were categorized based on the uppermost layer of vegetation that comprised at least 20% areal cover into one of three categories: emergent, scrub-shrub, or forested. Wetland communities were further described using the USFWS *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al. 1979; Federal Geographic Data Committee 2013). Wetland and non-wetland vegetation communities were differentiated by the presence or absence of hydrophytic vegetation, respectively.

Hydrophytic vegetation refers to plant species adapted to survive in saturated or inundated soils for at least 5% of the growing season. A given area is said to have hydrophytic vegetation when the prevalence of hydrophytes (water-adapted plants) exceeds that of non-hydrophytes based on species wetland indicator status ratings assigned by the USACE. To assess this parameter consistently with the Regional Supplement, SWCA personnel listed all plants by strata within circular sample plots centered at each data point as well as each plant species' areal cover. Then, based on the USACE *National Wetland Plant List: 2016 Wetland Ratings* (Lichvar et al. 2016), SWCA personnel assigned the appropriate wetland indicator status rating to each species and assessed dominance and prevalence values, as appropriate, to determine if the assessed plant community met the hydrophytic vegetation parameter.

2.2.2 Hydric Soils

Hydric soils typically have characteristics indicating that they formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper strata (Soil Conservation Service 1994). Characteristic indicators of hydric soils are described in *Field Indicators of Hydric Soils in the United States, Version 8.1* (U.S. Department of Agriculture Natural Resources Conservation Service [NRCS] 2017). Soils that do not match any of the accepted hydric soil indicators are considered non-hydric. To assess this parameter consistent with the Regional Supplement, SWCA personnel extracted soil pedons to a depth of no more than 20 inches at the data points and recorded soil characteristics (e.g., color, texture, redoximorphic features) necessary for comparison to known indicators. The hydric soil parameter was met when the soil profile matched the description of a regionally accepted hydric soil indicator.

2.2.3 Wetland Hydrology

Wetland hydrology refers to observable characteristics that confirm recent or continuing inundation and/or soil saturation within an assessed area during the growing season. Direct observation of continuous saturation or inundation within 12 inches of the soil surface for a duration of no less than 14 consecutive days will meet the standard for hydrology specified in the *Technical Standard for Water-Table Monitoring of Potential Wetland Sites* (USACE 2005a). Because on-site investigations to accurately determine the presence or absence of this standard are often impractical, the Regional Supplement describes a variety of readily observable primary (more reliable) and secondary (less reliable) hydrologic indicators that serve as sufficient evidence of wetland hydrology, when present. In accordance with the Regional Supplement, all indications of periodic inundation and/or soil saturation within an assessed area were recorded and compared to known wetland hydrology indicators. If the area displayed at least one primary indicator or two secondary indicators, the wetland hydrology parameter was met.

Of the three wetland assessment parameters, wetland hydrology is perhaps the most difficult to accurately assess because it is both transitory and influenced by physical and climatic factors (e.g., precipitation, soil permeability, stratigraphy, topography). In this region, the normality of precipitation (primarily as rainfall) has a substantial temporal influence on wetland hydrology. This is particularly true for the summer months when evapotranspiration rates are highest and typically result in receding water tables. Therefore, it is essential to assess wetland hydrology with respect to rainfall normality within the project area. This was done by following the direct antecedent rainfall evaluation method (DAREM) (Sprecher and Warne 2000). This method assesses an area's wetland hydrologic condition by comparing prior 3-month precipitation values to 30-year norms available from the NRCS in tabular form as Wetlands Evaluation Tables (WETS) (NRCS 1997). Evaluation using DAREM classifies the wetland hydrologic condition of an area into one of three categories: drier than normal, normal, or wetter than normal. This assessment along with rainfall events during or shortly before the delineation were considered to determine if identified wetland hydrology indicators should be considered normal or resultant of wetter than normal hydrologic conditions, or if hydrology indicators were lacking due to abnormal or problematic conditions.

2.3 Field Surveys of Waterbodies

SWCA delineated all waterbodies within the project area that possess an ordinary high-water mark (OHWM). An OHWM is a line on the shore established by the fluctuations of water during ordinary high water flows and indicated by physical characteristics such as "a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas" (33 CFR 328.3[e]). The OHWM was delineated following the recommendations of the 2005 USACE Regulatory Guidance Letter (RGL) 05-05: Ordinary High Water Mark Identification (USACE 2005b). For each waterbody, SWCA took photographs and documented its general characteristics (e.g., OHWM dimensions, flow, substrate).

2.4 Mapping

SWCA used a Trimble Geo-Explorer 7X series global positioning system (GPS) unit to geographically reference features, such as data point locations and wetland/waterbody boundaries, identified during the delineation. Geographic information system (GIS) software was used to differentially correct (i.e., post-process) recorded features, calculate areas, and generate the wetland delineation map (see Appendix A). The point, line, and polygon data displayed on the attached wetland delineation map, though recorded with a GPS unit capable of submeter accuracy, are for review purposes only, and do not represent a professional civil survey. Data points and delineated features are identified by a unique identifier. Waterbodies were identified by "P" for ponds and "S" for channels as the first character and followed by the team designation, "A," and a unique sequential number beginning with 001. For example, SA001 is the first channel that was delineated by team A. Data points are identified by the transect number "T#," followed by "DP," the team letter designation, a unique sequential number beginning with 001, and the type of vegetation community in which the data point is located (e.g., "U" for upland). For example, T1DPA003_U represents the third data point, which is in an upland, recorded by team A, along transect 1.

2.5 Aerial Interpretation of Wetlands and Waterbodies

Portions of the project area contained potential WOTUS identified by Cardno PPI in previous delineation efforts. SWCA verified particular features within the project area during the desktop reviews and field surveys and these features were added to the wetland delineation data set using Google Earth and GIS software. The aerially interpreted wetlands and waterbodies include "X" in the feature identification number within report tables and maps.

3 RESULTS

3.1 Resource Review

According to the resource review, the project area consists primarily of undeveloped land primarily used for agricultural purposes with agricultural ditches surrounding tracts at the base of bermed farm roads. The NWI depicts multiple palustrine emergent (PEM) wetlands, palustrine forested (PFO) wetlands, freshwater ponds, and riverine habitats primarily following the main waterbodies which dissect the project area (USFWS 2019). SWCA used FEMA floodplain mapping instruments to evaluate the locations of wetlands relative to the 100-year floodplain, which typically defines the USACE Galveston District's limit of jurisdiction. The FEMA FIRM Maps 48039C0245H and 48039C0240H indicate that approximately 98% of the project area is within the 100-year floodplain (FEMA 2019) (see Figure 1, Appendix A). Please refer to the vicinity and wetland delineation maps in Appendix A for more detailed information.

According to Houston Wilderness (2019), the project area is outside the current limits of the Columbia Bottomlands ecological area; however, the region is not well defined. As a result, the field observations were evaluated to determine if any of the forested communities in the project area are consistent with the descriptions of historical Columbia Bottomlands.

3.2 Wetlands

SWCA delineated 23 wetlands within the project area, consisting of 16 PEM wetlands, three palustrine scrub-shrub (PSS) wetlands, and four PFO wetlands. The type and acreage of each wetland identified within the project area are provided in Table 1. Figure 2 in Appendix A provides an Index Map for Figure 3 which illustrates the location of each wetland and data point recorded within the project area. Photographs of select wetlands are provided in Appendix C.

Table 1. Wetland Characteristics

Map Page Number (Figure 3)	Wetland ID	Latitude	Longitude	Wetland Community Type	Wetland Acreage in Project Area*
1	WA002	29.277314	-95.561142	PEM	0.186
1	WA003	29.275841	-95.558368	PFO	2.100
1	WA004	29.277070	-95.558099	PEM	2.437
1	WA004	29.276564	-95.558772	PFO	3.120
1	WA004	29.276772	-95.559722	PSS	4.547
1	WA005	29.279598	-95.552662	PEM	0.046
3	WB001	29.256580	-95.565756	PEM	0.174
3	WB002	29.257160	-95.565025	PEM	1.105
3	WB003	29.259335	-95.562436	PEM	0.054
1	WB004	29.277343	-95.553189	PEM	0.640
3	WB005	29.257187	-95.566643	PEM	1.129
3	WB005	29.256935	-95.566913	PSS	0.105
1, 2	WC001	29.271008	-95.549308	PEM	0.097
1	WC002	29.271366	-95.550582	PEM	0.217
3	WC003	29.250921	-95.560021	PFO	1.570
3	WC004	29.251396	-95.559081	PEM	0.031
3	WC005	29.251679	-95.558576	PEM	0.347
3	WC005	29.251491	-95.558690	PFO	0.033
1	WC006	29.284840	-95.554806	PEM	0.457
1	WC007	29.279442	-95.551982	PSS	0.281
2, 3	WD001	29.263545	-95.549025	PEM	0.464
2, 4	WD002	29.261430	-95.529353	PEM	0.144
2, 4	WD003	29.259356	-95.529090	PEM	2.096
Subtotal PEM Wetlands					*9.624*
Subtotal PSS Wetlands					*4.933*
Subtotal PFO Wetlands					*6.823*
Total					**21.380**

* Acreages were rounded to the nearest 0.001 acre.

3.2.1 Vegetation Communities

Overall, the project area consists of a majority of herbaceous upland and tilled cropland with smaller portions of woods and shrublands forming riparian buffers. Six vegetation community types were determined to be within the project area, including three wetland vegetation communities (i.e., PEM, PSS, and PFO) and three non-wetland/upland vegetation communities (i.e., herbaceous, scrub/shrub, and forested). The species identified at each data point along with their areal coverage are recorded on the data sheets in Appendix B. A photographic log, which includes a representative subset of the vegetation communities observed within the project area as viewed from select data points, is provided in Appendix C The dominant species identified within sample points by vegetation community type and their assigned wetland indicator status (i.e., facultative [FAC], facultative upland [FACU], facultative wet [FACW], obligate [OBL], upland [UPL]) are summarized in the following paragraphs.

PEM Wetland. PEM wetland communities consist of a prevalence of hydrophytic non-woody vegetation less than 3 feet in height. Dominant herbaceous species within the project area included jungle-rice

(*Echinochloa colona*; FACW), sand spike-rush (*Eleocharis montevidensis*; FACW), tall scouring-rush (*Equisetum hyemale*; FACW), common rush (*Juncus effusus*; OBL), golden crown grass (*Paspalum dilatatum*; FAC), mild water-pepper (*Persicaria hydropiper*; OBL), and swamp smartweed (*P. hydropiperoides*; OBL).

PSS Wetland. PSS wetland communities consist of a prevalence of hydrophytic woody species less than 20 feet in height and 3 inches or greater in diameter at breast height. PSS wetlands within the project area were dominated by black willow (*Salix nigra*; OBL), poison-bean (*Sesbania drummondii*; FACW), and Chinese tallowtree (*Triadica sebifera*; FAC). Golden crown grass was the prevalent herbaceous species within these wetland communities.

PFO Wetland. PFO wetland communities consist of a prevalence of hydrophytic woody species greater than 20 feet in height and 3 inches in diameter at breast height. PFO wetlands in the project area were dominated by tree and shrub species of pecan (*Carya illinoinensis*, FAC), sugarberry (*Celtis laevigata*; FACW), green ash (*Fraxinus pennsylvanica*; FACW), and American elm (*Ulmus americana*; FAC). The tree species found within these communities are typical of forested areas in the coastal plains; however, they do not appear to be consistent with remnants of the historical Columbia Bottomlands.

Herbaceous Upland. Herbaceous upland communities consist of non-wetland areas dominated by non-woody vegetation. Dominant herbaceous species in the project area included careless weed (*Amaranthus palmeri*; FACU), great ragweed (*Ambrosia trifida*; FAC), tumble windmill grass (*Chloris verticillata*; UPL), Bermuda grass (*Cynodon dactylon*; FACU), jungle-rice, sand spike-rush, petticoat-climber (*Eragrostis spectabilis*; FACU), soybean (*Glycine max*; UPL), upland cotton (*Gossypium hirsutum*; FACU), annual marsh-elder (*Iva annua*; FAC), Santa Maria feverfew (*Parthenium hysterophorus*; FAC), golden crown grass, poison-bean, Johnsongrass (*Sorghum halepense*; FACU), St. Augustine grass (*Stenotaphrum secundatum*; FAC), and corn (*Zea mays*; UPL).

Scrub/Shrub Upland. Scrub/shrub upland communities consist of non-wetland areas dominated by woody vegetation less than 20 feet in height and 3 inches or greater in diameter at breast height. The dominant shrub species in the project area consisted of poison-bean, while the dominant herbaceous species consisted of Bermuda grass and golden crown grass.

Forested Upland. Forested upland communities consist of a prevalence of non-wetland woody species greater than 3 inches in diameter at breast height. The dominant trees in this community type within the project area are pecan, sugarberry, American elm, and Virginia live oak (*Ulmus crassifolia*; FAC). Bermuda grass, long-leaf basket grass (*Oplismenus hirtellus*; FAC), and golden crown grass were the dominant herbaceous species. As with the forested wetlands, forested uplands communities within the project area are consistent with the coastal plains but do not bear the hallmarks of historical Columbia Bottomlands communities.

3.2.2 Soils

According to the NRCS Soil Survey for Brazoria County, Texas (NRCS 2019), nine soil map units are present within the project area and one soil map unit is listed as hydric soils or includes hydric components (Table 2) (NRCS 2017). Brief descriptions of the NRCS soil map units present within the project area are provided in Appendix D

Although an NRCS hydric listing alone is generally insufficient to determine if soils for a site are hydric, it does indicate that suitable soil properties or conditions exist that promote the formation of hydric soil conditions. As a result, the portions of the project area depicted as containing hydric soil map units were subjected to greater scrutiny with respect to the presence of hydric soil indicators. The NRCS mapped soil units are described in Appendix D.

Table 2. NRCS-Mapped Soils and Their Hydric Characteristics

Map Unit Name (Unit Code)	Hydric Map Unit (Yes/No)	Hydric Component Characteristics			Acreage within Project Area†
		Name (Unit Percent)	Landform	Hydric Criteria*	
Brazoria County					
Asa silty clay loam, 0 to 1 percent slopes, rarely flooded (3)	No	N/A	N/A	N/A	15.1
Brazoria clay, 0 to 1 percent slopes, rarely flooded (10)	No	N/A	N/A	N/A	1024.8
Brazoria clay, 1 to 3 percent slopes, rarely flooded (11)	No	N/A	N/A	N/A	70.2
Clemville silty clay loam, 0 to 1 percent slopes, occasionally flooded (12)	No	N/A	N/A	N/A	138.7
Norwood loam, 0 to 1 percent slopes, rarely flooded (33)	No	N/A	N/A	N/A	183.1
Norwood silt loam, 1 to 5 percent slopes, rarely flooded (34)	No	N/A	N/A	N/A	115.4
Norwood-Asa complex, 1 to 8 percent slopes (35)	No	N/A	N/A	N/A	132.3
	No	N/A	N/A	N/A	
Pledger clay, 0 to 1 percent slopes, rarely flooded (36)	No	N/A	N/A	N/A	776.5
Churnabog clay, 0 to 1 percent slopes, frequently flooded (38)	Yes	Churnabog (90%)	Floodplains, oxbows	2, 3	12.8

* 2 = somewhat poorly to very poorly drained soils that have a shallow water table (i.e., at a depth of less than 1 foot) during the growing season; 3 = soils that are frequently ponded for a long or very long duration during the growing season.

† Acreages were calculated using ESRI ArcMap on July 2019 and rounded to the nearest 0.1 acre.

The project area is entirely located within the Gulf Coastal Prairie soil region and the Lake Charles-Bernard-Edna Series (USDA 2008). Direct observations of soil epipedons revealed that the typical soil matrix was 10YR and 7.5YR in hue and 1, 2, 3, 4, 6 in chroma, while typical redox components were 10YR, 7.5YR, and 5YR in hue and 2, 4, 6 in chroma. Soils textures observed were predominantly clays and silty clays, occasionally including loam components and less often sand components. Wetland areas displayed the depleted matrix (F3), redox dark surface (F6), and red parent material (TF2) hydric soil indicators. Non-wetland/upland areas either failed to display hydric soil indicators, or they displayed hydric soils but failed to meet vegetation and/or hydrology parameters. Refer to Appendix B for data point specific soil observations.

3.2.3 Hydrology

The DAREM wetland hydrologic conditions for June 2019 (Table 3a) and July 2019 (Table 3b) were calculated using WETS and monthly precipitation data from the Angleton 2 W weather station (Global Historical Climatology Network [GHCN]: USC00410257) located approximately 7.51 miles southeast of the project area (National Oceanic and Atmospheric Administration 2019; Sprecher and Warne 2000). Monthly precipitation data for June 2019 were provided from the Angleton Lake Jackson Brazoria County AP (GHCN: USC00012976) located approximately 10.41 miles southeast of the project area

(National Oceanic and Atmospheric Administration 2019). The precipitation and 30-year normal range values used to calculate the wetland hydrologic conditions at the times of the surveys are also provided. According to the DAREM, the wetland hydrologic condition transitioned from normal to wetter than normal during the wetland delineation.

Table 3a. DAREM Wetland Hydrologic Conditions during June 2019

Prior Month		WETS Percentile (inches)		Measured Rainfall	Rainfall Condition*	Month Weight†	Score‡
		30th	70th				
1st	May	1.96	5.50	6.81	3	3	9
2nd	April	1.32	4.06	1.81	2	2	4
3rd	March	2.21	4.55	1.02	1	1	1
DAREM Score (i.e., Scores Total)							**14**

DAREM Score	6	7	8	9	10	11	12	13	**14**	15	16	17	18
DAREM Wetland Hydrologic Condition	Drier than normal				**Normal**					Wetter than normal			

Data source: Angleton 2 W weather station (TX08; GHCND No. USC00410257).
* 1 = measured rainfall that was less than the WETS 30th percentile, 2 = measured rainfall that was between the WETS 30th and 70th percentiles, and 3 = measured rainfall that was greater than the WETS 70th percentile.
† 1st prior month = 3, 2nd prior month = 2, and 3rd prior month = 1.
‡ Scores are the product of the Condition × Weight.

Table 3b. DAREM Wetland Hydrologic Conditions during July 2019

Prior Month		WETS Percentile (inches)		Measured Rainfall	Rainfall Condition*	Month Weight†	Score‡
		30th	70th				
1st	June	2.75	6.55	9.26	3	3	9
2nd	May	1.96	5.50	6.81	3	2	6
3rd	April	1.32	4.06	1.81	2	1	2
DAREM Score (i.e., Scores Total)							**17**

DAREM Score	6	7	8	9	10	11	12	13	14	15	16	**17**	18
DAREM Wetland Hydrologic Condition	Drier than normal				Normal					**Wetter than normal**			

Data source: Angleton 2 W weather station (GHCND No. USC00410257) and Angleton Lake Jackson Brazoria County AP (GHCND No. USW00012976)
* 1 = measured rainfall that were less than the WETS 30th percentile, 2 = measured rainfall that were between the WETS 30th and 70th percentiles, and 3 = measured rainfall that were greater than the WETS 70th-percentile.
†1st prior month = 3, 2nd prior month = 2, and 3rd prior month = 1.
‡ Scores are the product of the Condition × Weight.

Wetland hydrology indicators observed in the field included primary wetland hydrology indicators (i.e., surface water, high water table, saturation, sediment deposits, algal mat/crust, water marks, inundation visible on aerial imagery, water-stained leaves, aquatic fauna, and hydrogen sulfide odor) and secondary wetland hydrology indicators (i.e., surface soil cracks, sparsely vegetated concave surface, crayfish burrows, geomorphic position, and positive FAC-neutral test). Refer to the data sheets in Appendix B for the wetland hydrology indicators observed at a specific data point.

3.3 Waterbodies

SWCA delineated 41 waterbodies consisting of 11 streams, 5 ditches, 22 agricultural ditches, and 3 ponds within the project area. The type, OHWM width, length, and acreage of each waterbody within the project area are provided in Table 4. Refer to Figure 3 in Appendix A for the location of each waterbody within the project area. Photographs of a subset of the waterbodies are provided in Appendix C.

Table 4. Waterbody Characteristics

Map Page Number (Figure 3)	Waterbody ID	Latitude	Longitude	Flow	Waterbody Type	Waterbody Sub-Type	USGS Name*	OHWM Width (feet)	Waterbody Length in Project Area (feet)	Waterbody Acreage in Project Area†
3	SA001	29.265231	-95.554668	Intermittent	Modified	Stream	Jennings Bayou	30	13,497	11.343
1, 3	SA003	29.270622	-95.560341	Intermittent	Modified	Ditch	UT of Jennings Bayou	10	6,129	1.409
3	SB002	29.267012	-95.56052	Ephemeral	Modified	Ag Ditch	N/A	3	1,257	0.087
3	SB003	29.269085	-95.564918	Ephemeral	Modified	Stream	UT of Brazos River	3	2,589	0.178
3	SB004	29.268567	-95.562722	Ephemeral	Modified	Ag Ditch	N/A	2	2,807	0.193
1	SB005	29.274512	-95.552484	Ephemeral	Modified	Ag Ditch	N/A	3	1,738	0.133
1	SB006	29.279423	-95.554144	Ephemeral	Modified	Ag Ditch	N/A	4	1,197	0.110
1	SB007	29.281621	-95.563656	Ephemeral	Modified	Stream	N/A	4	678	0.063
3	SB013	29.260737	-95.559104	Ephemeral	Modified	Stream	UT of Jennings Bayou	1	116	0.003
3, 4	SB014	29.261892	-95.547528	Ephemeral	Man-Made	Ag Ditch	N/A	6	3,740	0.516
1, 2	SC001	29.280204	-95.549075	Perennial	Modified	Stream	Oyster Creek	30	16,888	21.335
1, 2	SC005	29.271447	-95.548408	Ephemeral	Natural	Stream	UT of Jennings Bayou	1	73	0.002
1	SC016	29.286476	-95.557825	Ephemeral	Modified	Stream	UT of Oyster Creek	10	201	0.041
2, 4	SD016	29.261634	-95.528514	Ephemeral	Man-Made	Ag Ditch	N/A	8	523	0.097
2, 4	SD017	29.260563	-95.528734	Ephemeral	Man-Made	Ag Ditch	N/A	8	594	0.110
3	SX001	29.262504	-95.564496	Perennial	Modified	River	Brazos River	300	4,309	15.963
3	SX002	29.253758	-95.562461	Perennial	Modified	River	Brazos River	300	4,530	9.008
1	SX003	29.279016	-95.558534	Ephemeral	Man-Made	Ditch	N/A	4	3,946	0.362
1	SX004	29.279147	-95.562531	Ephemeral	Man-Made	Ditch	N/A	4	3,189	0.292
1	SX005	29.281655	-95.554482	Ephemeral	Man-Made	Ditch	N/A	5	2,569	0.294
1	SX006	29.281533	-95.554826	Ephemeral	Man-Made	Ag Ditch	N/A	5	1,341	0.154
4	SX007	29.260645	-95.542613	Ephemeral	Man-Made	Ag Ditch	N/A	4	2,816	0.259
3	SX008	29.254434	-95.558953	Ephemeral	Man-Made	Ag Ditch	N/A	8	1,384	0.255
3	SX009	29.254435	-95.55879	Ephemeral	Man-Made	Ag Ditch	N/A	10	1,326	0.306
2	SX010	29.273381	-95.540811	Ephemeral	Man-Made	Ag Ditch	N/A	10	1,938	0.447

Map Page Number (Figure 3)	Waterbody ID	Latitude	Longitude	Flow	Waterbody Type	Waterbody Sub-Type	USGS Name*	OHWM Width (feet)	Waterbody Length in Project Area (feet)	Waterbody Acreage in Project Area†
1, 3	SX011	29.270579	-95.550388	Ephemeral	Man-Made	Ag Ditch	N/A	12	486	0.135
4	SX012	29.257545	-95.536386	Ephemeral	Man-Made	Ditch	N/A	15	3,474	1.200
2, 4	SX013	29.257775	-95.539679	Ephemeral	Man-Made	Ag Ditch	N/A	12	3,885	1.071
3	SX014	29.257925	-95.548556	Intermittent	Modified	Stream	N/A	16	7,290	2.678
3, 4	SX015	29.254985	-95.547728	Ephemeral	Man-Made	Ag Ditch	N/A	16	2,421	0.891
4	SX016	29.259067	-95.541417	Ephemeral	Man-Made	Ag Ditch	N/A	4	924	0.085
4	SX017	29.259368	-95.533469	Ephemeral	Man-Made	Ag Ditch	N/A	5	2,074	0.239
4	SX018	29.259372	-95.533333	Ephemeral	Man-Made	Ag Ditch	N/A	5	2,061	0.237
2, 4	SX019	29.26643	-95.53796	Ephemeral	Man-Made	Ag Ditch	N/A	8	2,170	0.400
2, 4	SX020	29.266058	-95.534439	Ephemeral	Man-Made	Ag Ditch	N/A	5	322	0.037
2, 4	SX021	29.266011	-95.534325	Ephemeral	Man-Made	Ag Ditch	N/A	5	276	0.032
2, 3	SX022	29.265983	-95.544676	Ephemeral	Modified	Ag Ditch	N/A	12	4,057	1.120
4	SX024	29.259485	-95.52556	Perennial	Modified	Stream	Oyster Creek	15	523	0.179
1, 3	PA001	29.270161	-95.556922	Perennial	Modified	Pond	N/A	N/A	N/A	1.028
1	PB001	29.281622	-95.56364	Perennial	Modified	Pond	N/A	N/A	N/A	1.077
3	PB002	29.260762	-95.559083	Perennial	Modified	Pond	N/A	N/A	N/A	0.731
Subtotal of Ephemeral Waterbodies									26,250	49.321
Subtotal of Intermittent Waterbodies									26,916	15.430
Subtotal of Perennial Waterbodies									56,172	9.349
Total									**109,338**	**74.100**

* UT=unnamed tributary
† Acreages were rounded to the nearest 0.001 acre.

4 SUMMARY AND CONCLUSIONS

SWCA performed a wetland delineation of the Dow Harris Reservoir Expansion Project site between June and July 2019. Collectively, the delineations identified 23 wetlands totaling 21.380 acres within the project area. Additionally, 41 waterbodies were identified within the project area totaling 109,338 linear feet and 74.100 acres.

In comparison to the results of the WOTUS delineations conducted by Cardno, SWCA's wetland delineation observed a greater total of wetland and waterbody acreage. When each of the Cardno reports are combined to cover the majority of the project area, this results in wetlands totaling 19.149 acres and waterbodies totaling 104,435 linear feet and 60.743 acres.

Table 5. Comparison of Cardno and SWCA Wetland Delineation Results

	Cardno Results		SWCA Results	
	Acreage in Project Area†	**Waterbody Length in Project Area (feet)**	**Acreage in Project Area†**	**Waterbody Length in Project Area (feet)**
Wetland Subtotal	19.149	--	21.380	--
Waterbody Subtotal	60.743	104,435	74.100	109,338
Total	**79.892**	**104,435**	**95.480**	**109,338**

† Acreages were rounded to the nearest 0.001 acre.

The delineation findings contained within this report represent the professional opinion of SWCA and are not a verification or jurisdictional determination of WOTUS. No other warranty, expressed or implied, is made.

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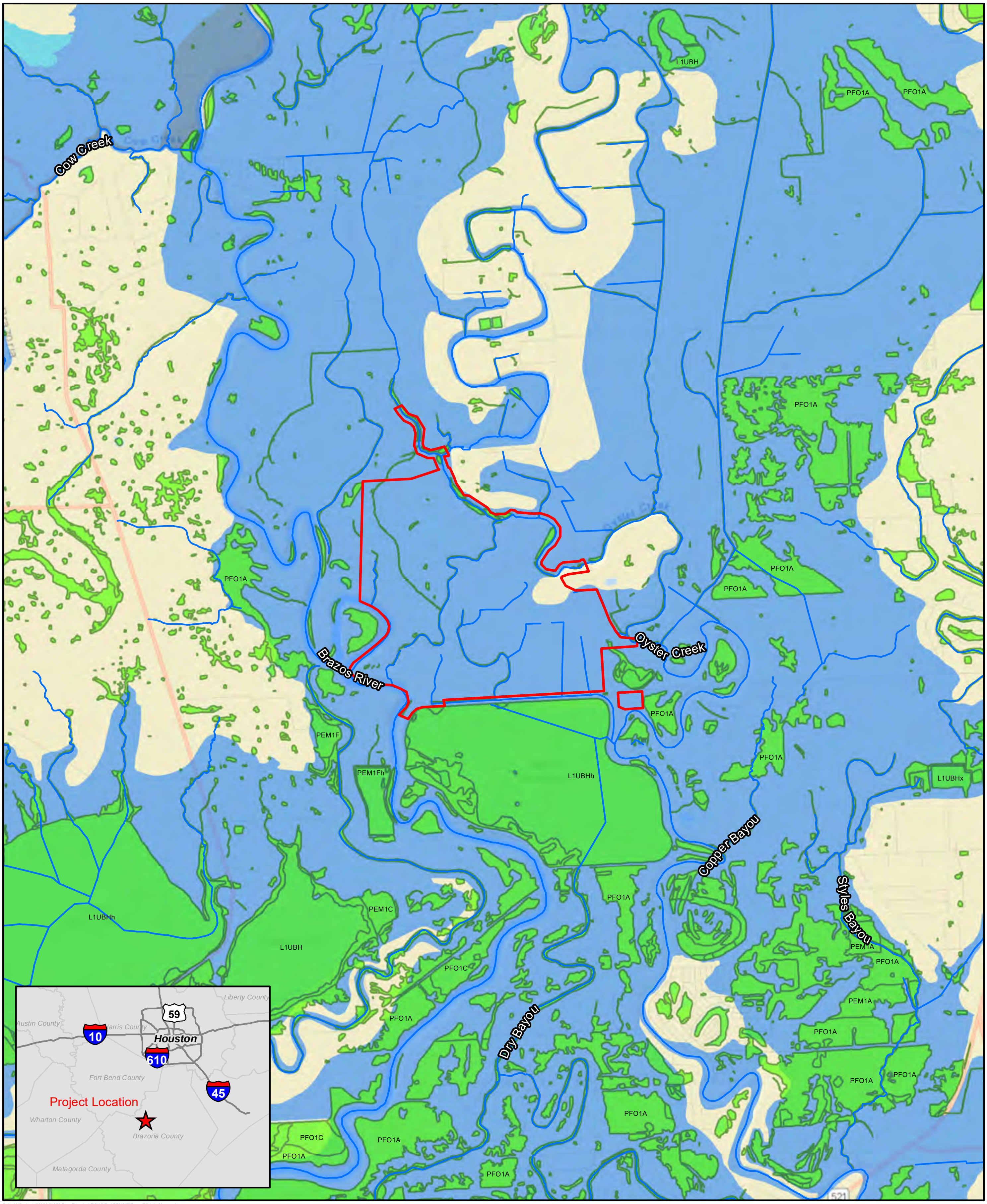
APPENDIX A

Maps



SWCA ENVIRONMENTAL CONSULTANTS

DOW CHEMICAL HARRIS RESEVOIR EXPANSION PROJECT

VICINITY MAP
BRAZORIA COUNTY, TEXAS

FIGURE 1

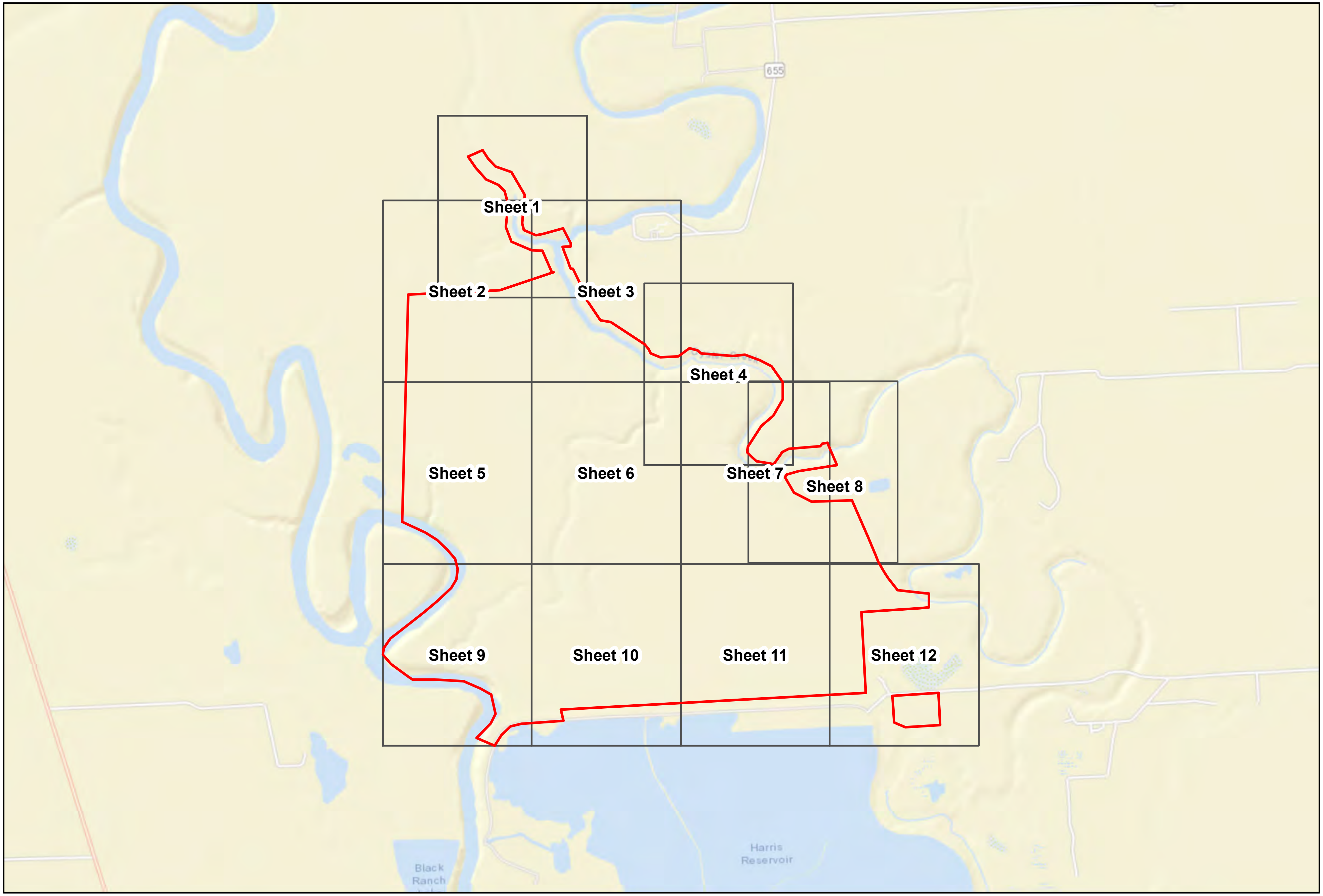
Project Boundary
Named NHD Stream
NWI Wetlands
100-Year Floodplain (Floodway)
100-Year Floodplain
500-Year Floodplain

1:75,000

Created By: CM
Project Number: 52872
Date: 7/30/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

0 1,000 2,000 3,000 4,000 5,000 6,000 Feet

0 200 400 600 800 1,000 1,200 1,400 Meters



SWCA
ENVIRONMENTAL CONSULTANTS

DOW CHEMICAL HARRIS RESEVOIR EXPANSION PROJECT
INDEX MAP
USACE GALVESTON DISTRICT

Figure 2

Project Boundary
Mapbook Index

1:40,000

Created By: C. McConnell
Project Number: 52872
Date: 7/30/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

N

0 0.25 0.5 Miles

0 187.5 375 750 1,125 1,500 Miles

SWCA ENVIRONMENTAL CONSULTANTS

DOW CHEMICAL HARRIS RESEVOIR EXPANSION PROJECT

WETLAND DELINEATION MAP
BRAZORIA COUNTY, TEXAS

FIGURE 3 - SHEET 1 of 12

Legend	
Project Boundary	Intermittent
Data Points	Perennial
Transect	Emergent Wetland
Soil Map Unit Boundary	Forested Wetland
Ephemeral	Scrub-Scrub Wetland

1:7,500

Created By: CM
Project Number: 52872
Date: 7/30/2019
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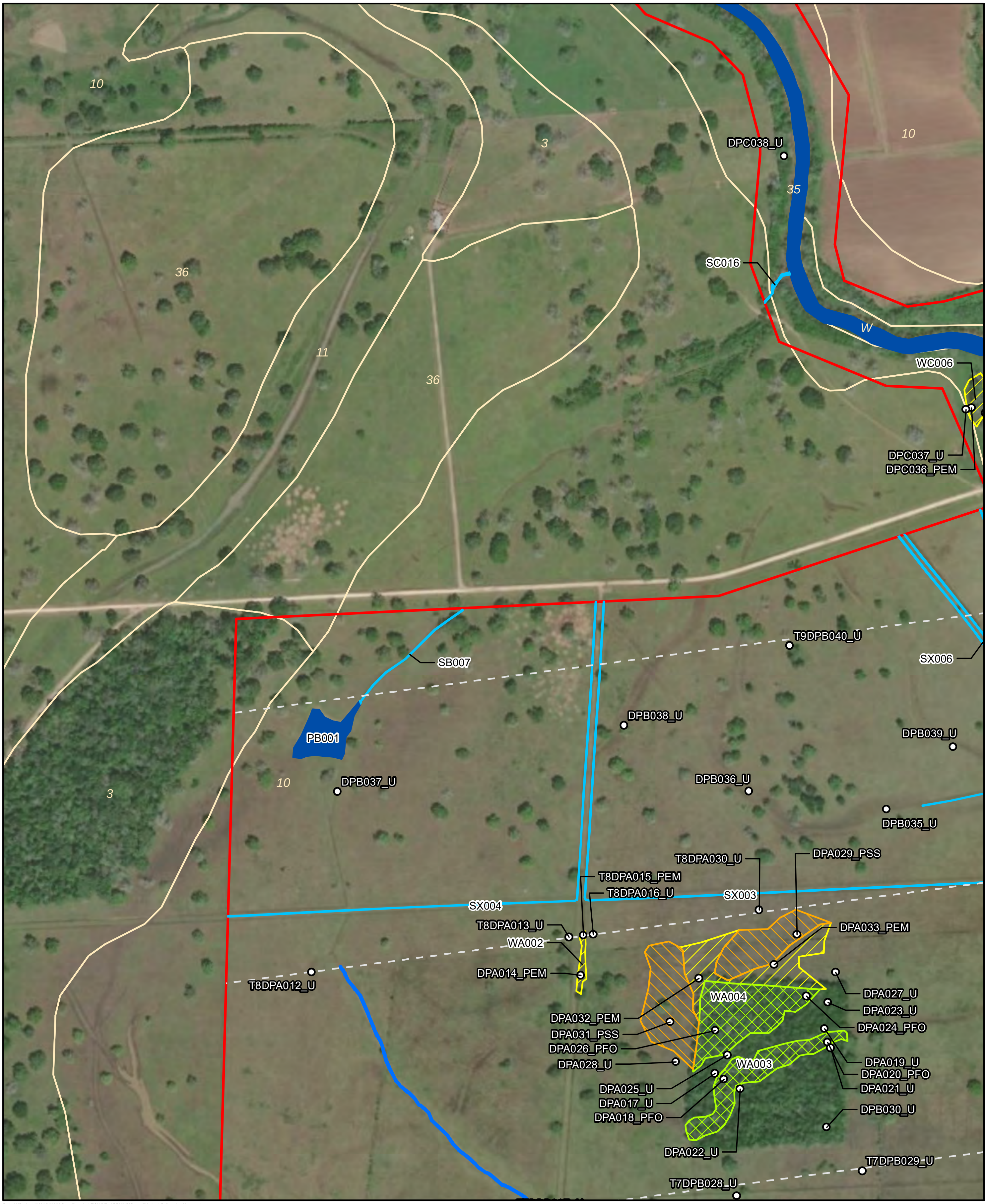
0 30 60 90 120 150 Meters



SWCA ENVIRONMENTAL CONSULTANTS

DOW CHEMICAL HARRIS RESEVOIR EXPANSION PROJECT

WETLAND DELINEATION MAP
BRAZORIA COUNTY, TEXAS

FIGURE 3 - SHEET 2 of 12

Project Boundary
Data Points
Transect
Soil Map Unit Boundary
Ephemeral
Intermittent
Perennial
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland

1:7,500

Created By: CM
Project Number: 52872
Date: 7/30/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

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0 30 60 90 120 150 Meters

SWCA ENVIRONMENTAL CONSULTANTS

DOW CHEMICAL HARRIS RESEVOIR EXPANSION PROJECT

WETLAND DELINEATION MAP
BRAZORIA COUNTY, TEXAS

FIGURE 3 - SHEET 3 of 12

Project Boundary
Data Points
Transect
Soil Map Unit Boundary
Ephemeral
Intermittent
Perennial
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland

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Created By: CM
Project Number: 52872
Date: 7/30/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

0 150 300 450 600 Feet
0 30 60 90 120 150 Meters

SWCA ENVIRONMENTAL CONSULTANTS

DOW CHEMICAL HARRIS RESEVOIR EXPANSION PROJECT

WETLAND DELINEATION MAP
BRAZORIA COUNTY, TEXAS

FIGURE 3 - SHEET 4 of 12

Project Boundary	Intermittent
Data Points	Perennial
Transect	Emergent Wetland
Soil Map Unit Boundary	Forested Wetland
Ephemeral	Scrub-Scrub Wetland

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Created By: CM
Project Number: 52872
Date: 7/30/2019
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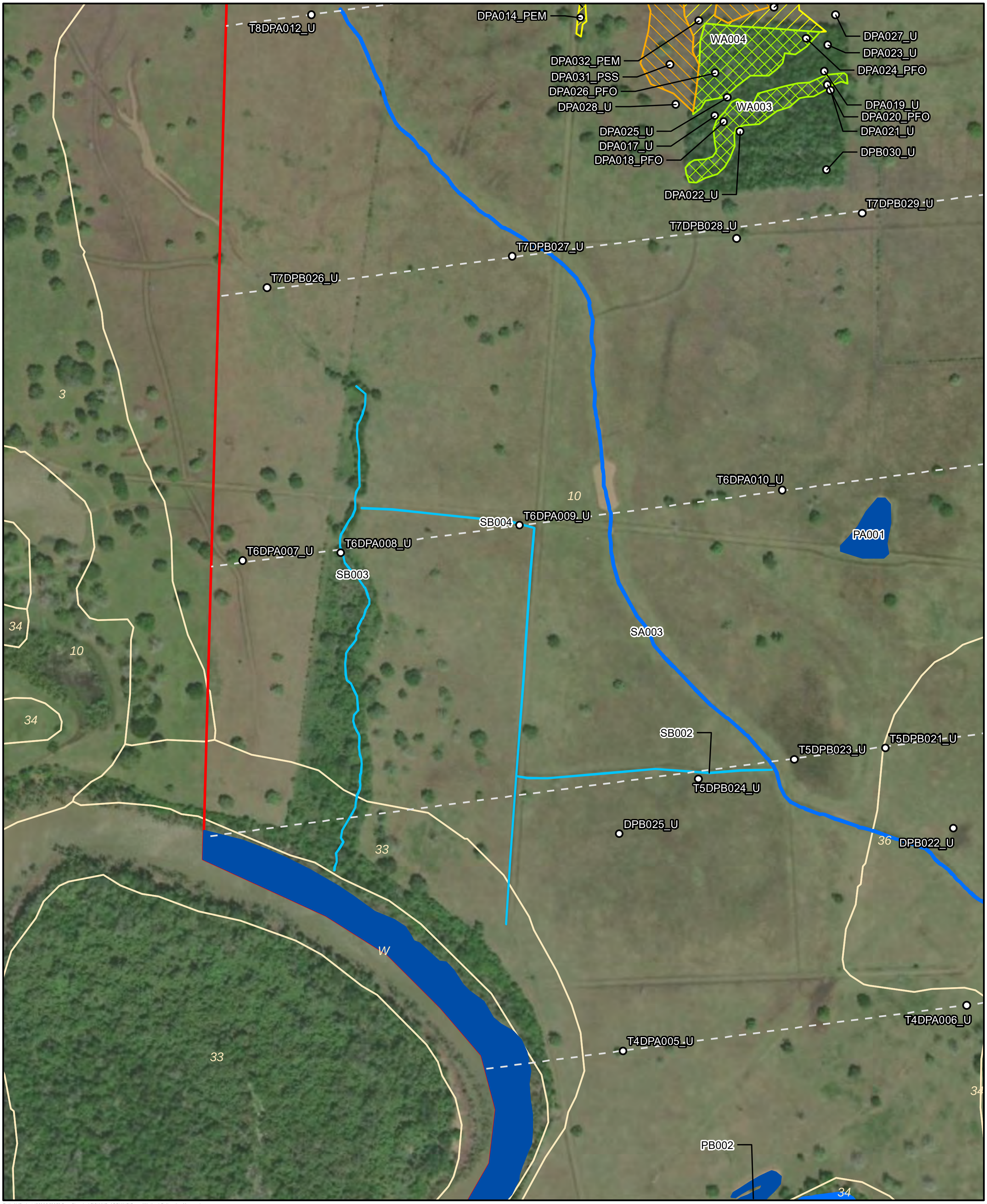

DOW CHEMICAL HARRIS RESEVOIR EXPANSION PROJECT

WETLAND DELINEATION MAP
BRAZORIA COUNTY, TEXAS

FIGURE 3 - SHEET 5 of 12

SWCA ENVIRONMENTAL CONSULTANTS

Project Boundary
Data Points
Transect
Soil Map Unit Boundary
Ephemeral
Intermittent
Perennial
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland

1:7,500

Created By: CM
Project Number: 52872
Date: 7/30/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

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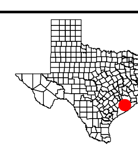
SWCA ENVIRONMENTAL CONSULTANTS

DOW CHEMICAL HARRIS RESEVOIR EXPANSION PROJECT

WETLAND DELINEATION MAP
BRAZORIA COUNTY, TEXAS

FIGURE 3 - SHEET 6 of 12

Project Boundary
Data Points
Transect
Soil Map Unit Boundary
Ephemeral
Intermittent
Perennial
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland



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Created By: CM
Project Number: 52872
Date: 7/30/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

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SWCA ENVIRONMENTAL CONSULTANTS

DOW CHEMICAL HARRIS RESEVOIR EXPANSION PROJECT

WETLAND DELINEATION MAP
BRAZORIA COUNTY, TEXAS

FIGURE 3 - SHEET 7 of 12

Project Boundary
Data Points
Transect
Soil Map Unit Boundary
Ephemeral
Intermittent
Perennial
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland

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Created By: CM
Project Number: 52872
Date: 7/30/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

0 150 300 450 600 Feet

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SWCA ENVIRONMENTAL CONSULTANTS

DOW CHEMICAL HARRIS RESEVOIR EXPANSION PROJECT

WETLAND DELINEATION MAP
BRAZORIA COUNTY, TEXAS

FIGURE 3 - SHEET 8 of 12

Project Boundary
Data Points
Transect
Soil Map Unit Boundary
Ephemeral
Intermittent
Perennial
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland

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Created By: CM
Project Number: 52872
Date: 7/30/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

0 150 300 450 600 Feet
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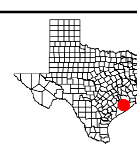
SWCA ENVIRONMENTAL CONSULTANTS

DOW CHEMICAL HARRIS RESEVOIR EXPANSION PROJECT

WETLAND DELINEATION MAP
BRAZORIA COUNTY, TEXAS

FIGURE 3 - SHEET 9 of 12

- Project Boundary
- Data Points
- Transect
- Soil Map Unit Boundary
- Ephemeral
- Intermittent
- Perennial
- Emergent Wetland
- Forested Wetland
- Scrub-Scrub Wetland



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SWCA ENVIRONMENTAL CONSULTANTS

DOW CHEMICAL HARRIS RESEVOIR EXPANSION PROJECT

WETLAND DELINEATION MAP
BRAZORIA COUNTY, TEXAS

FIGURE 3 - SHEET 10 of 12

Project Boundary
Data Points
Transect
Soil Map Unit Boundary
Ephemeral
Intermittent
Perennial
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland

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Created By: CM
Project Number: 52872
Date: 7/30/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

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SWCA
ENVIRONMENTAL CONSULTANTS

DOW CHEMICAL HARRIS RESEVOIR EXPANSION PROJECT

WETLAND DELINEATION MAP
BRAZORIA COUNTY, TEXAS

FIGURE 3 - SHEET 11 of 12

Project Boundary
Data Points
Transect
Soil Map Unit Boundary
Ephemeral
Intermittent
Perennial
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland

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Created By: CM
Project Number: 52872
Date: 7/30/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

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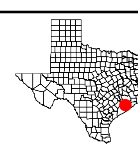

SWCA
ENVIRONMENTAL CONSULTANTS

DOW CHEMICAL HARRIS RESEVOIR EXPANSION PROJECT

WETLAND DELINEATION MAP
BRAZORIA COUNTY, TEXAS

FIGURE 3 - SHEET 12 of 12

Project Boundary
Data Points
Transect
Soil Map Unit Boundary
Ephemeral
Intermittent
Perennial
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland

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Created By: CM
Project Number: 52872
Date: 7/30/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

0 150 300 450 600 Feet
0 30 60 90 120 150 Meters

APPENDIX B

Wetland Delineation Data Sheets

Available upon request

APPENDIX C

Photographic Log

Available upon request

APPENDIX D

NRCS Soil Map Unit Descriptions

Available upon request

COPY

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, GALVESTON DISTRICT
5151 FLYNN PARKWAY, SUITE 306
CORPUS CHRISTI, TEXAS 78411-4318

October 23, 2019

Policy Analysis Branch

SUBJECT: Permit Application No. SWG-2016-01027

Dow Chemical
ATTN: Ms. Yvonne Sampson
2301 North Brazosport Boulevard
Freeport, Texas 77541

Dear Ms. Sampson:

This is in regards to Dow Chemical's (Dow) May 23, 2019 request for the U.S. Army Corps of Engineers, Galveston District (Corp) to verify the wetland delineation report for the proposed Harris Reservoir Expansion Project (Project). The project site is approximately 2,529 acres and is located between the Brazos River and Oyster Creek approximately eight miles northwest of the City of Angleton, Brazoria County, Texas.

During the May 22, 2019, Environmental Impact Statement (EIS) Kickoff meeting, Dow agreed to allow the EIS Third-Party Contractor (TPC), SWCA Environmental Consultants (SWCA), to conduct the wetland delineation in accordance with the Corps memorandum on *Environmental Impact Statements – Third Party Contracting*. SWCA completed the wetland delineation and submitted it to the Corps on September 30, 2019. The Corps has reviewed and concurs with the TPC findings in the delineation report, dated September 2019. The wetland delineation maps, enclosed in 14 sheets, identify 21.4 acres of palustrine wetlands, and 74.1 acres and 109,338 linear feet of 41 water bodies that consist of 11 streams, 5 ditches, 22 agricultural ditches, and 3 ponds. The Corps will proceed with our evaluation of the Project based on this verification.

This request is based on a wetland delineation verification for your subject site, or a "No JD Whatsoever" because circumstances where questions over jurisdiction are not anticipated to arise. This wetland delineation verification does not establish geographical jurisdiction. If you wish, you may request an AJD, which may be appealed, by submitting a written request to us within 30 days from the date of this letter.

Please reference file number **SWG-2016-01027** in future correspondence pertaining to this subject. If you have any questions, please contact Ms. Kristie Brink at the letterhead address or by telephone at 361-814-5847 ext. 1005.

COPY

To assist us in improving our service to you, please complete the survey found at: http://corpsmapu.usace.army.mil/cm_apex/f?p=136:4:0.

Sincerely,

BOTELLO.JANET.THOMAS.1230563779 Digitally signed by BOTELLO.JANET.THOMAS.1230563779 Date: 2019.10.22 19:42:03 -05'00'

Janet Thomas Botello
Acting Policy Analysis Branch Chief
Regulatory Division, Galveston District

cc w/Encl.

SWCA:
Ms. Whitney Fiore (wfiore@swca.com)
Mr. Rick Howard (RHoward@swca.com)
Ms. Christine Hartman (Christine.Hartmann@swca.com)
Ms. Kara Giblin (KGiblin@swca.com)
Mr. Lee Forbes (Lforbes@swca.com)

Dow:
Mr. Greg Bond (GABond@dow.com)
Mr. Rick Bell (wrbell@dow.com)
Mr. Tim Finley (tdfinley@dow.com)
Mr. Glen Lord (MGLord@dow.com)
Ms. Rena Rehman (rrehman@dow.com)

Corps:
Mr. Jayson Hudson (Jayson.M.Hudson@usace.army.mil)
Mr. Robert Jones (Robert.N.Jones2@usace.army.mil)

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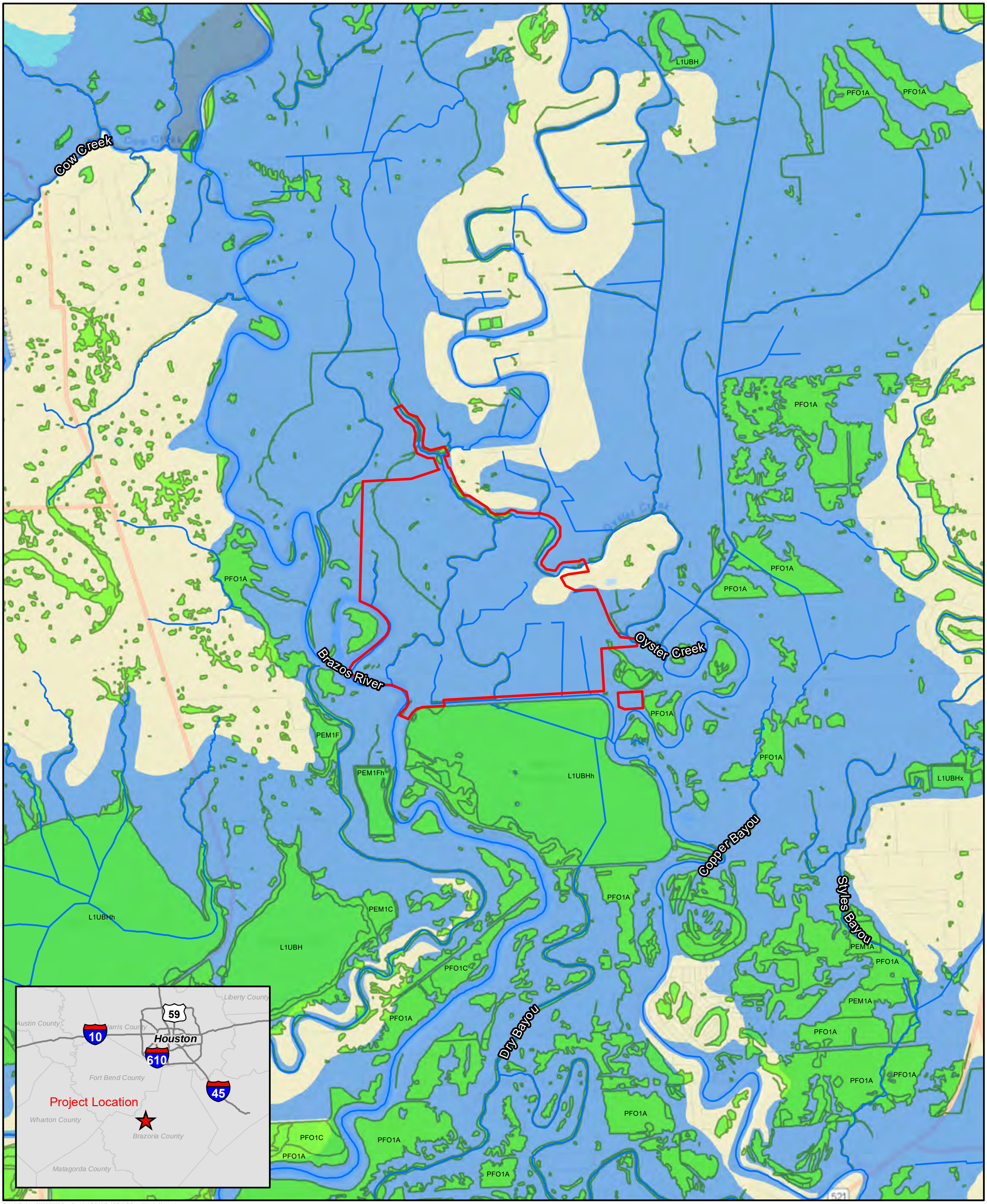
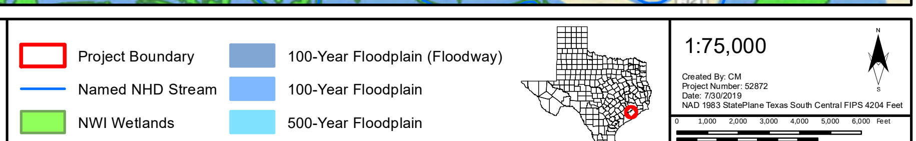


SWCA ENVIRONMENTAL CONSULTANTS

DOW CHEMICAL HARRIS RESEVOIR EXPANSION PROJECT

VICINITY MAP
BRAZORIA COUNTY, TEXAS

FIGURE 1



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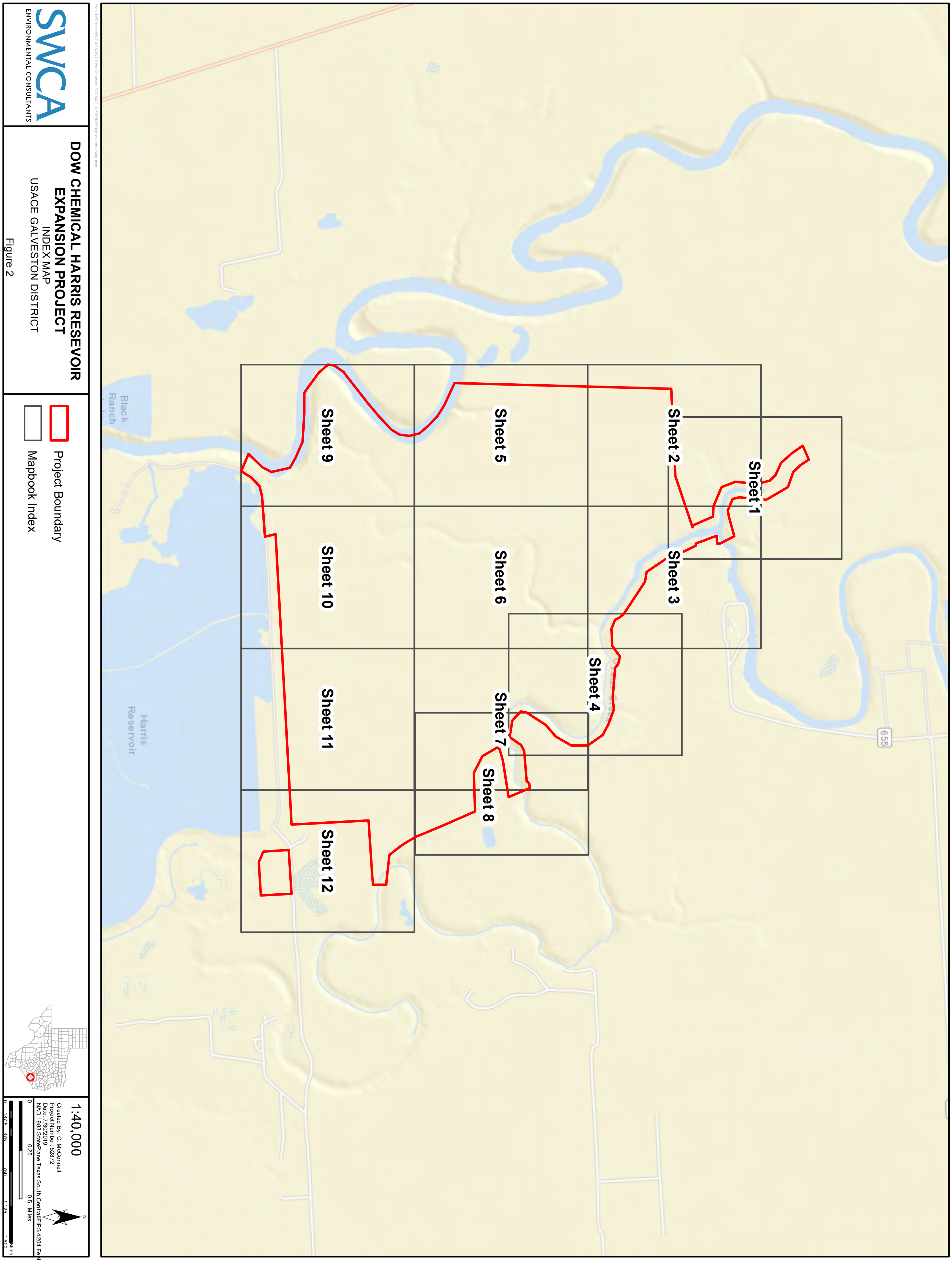
SWCA
ENVIRONMENTAL CONSULTANTS
DOW CHEMICAL HARRIS RESEVOIR
EXPANSION PROJECT
INDEX MAP
USACE GALVESTON DISTRICT
Figure 2
Project Boundary
Mapbook Index
1:40,000
Created By: C. McConnell
Project Number: 52872
Date: 7/30/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet
0 0.25 0.5 Miles
Sheet 1
Sheet 2
Sheet 3
Sheet 4
Sheet 5
Sheet 6
Sheet 7
Sheet 8
Sheet 9
Sheet 10
Sheet 11
Sheet 12
Black Ranch
Harris Reservoir
655

COPY

SWCA ENVIRONMENTAL CONSULTANTS

DOW CHEMICAL HARRIS RESEVOIR EXPANSION PROJECT

WETLAND DELINEATION MAP
BRAZORIA COUNTY, TEXAS

FIGURE 3 - SHEET 1 of 12

Project Boundary
Data Points
Transect
Soil Map Unit Boundary
Ephemeral
Intermittent
Perennial
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland

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Created By: CM
Project Number: 52872
Date: 7/30/2019
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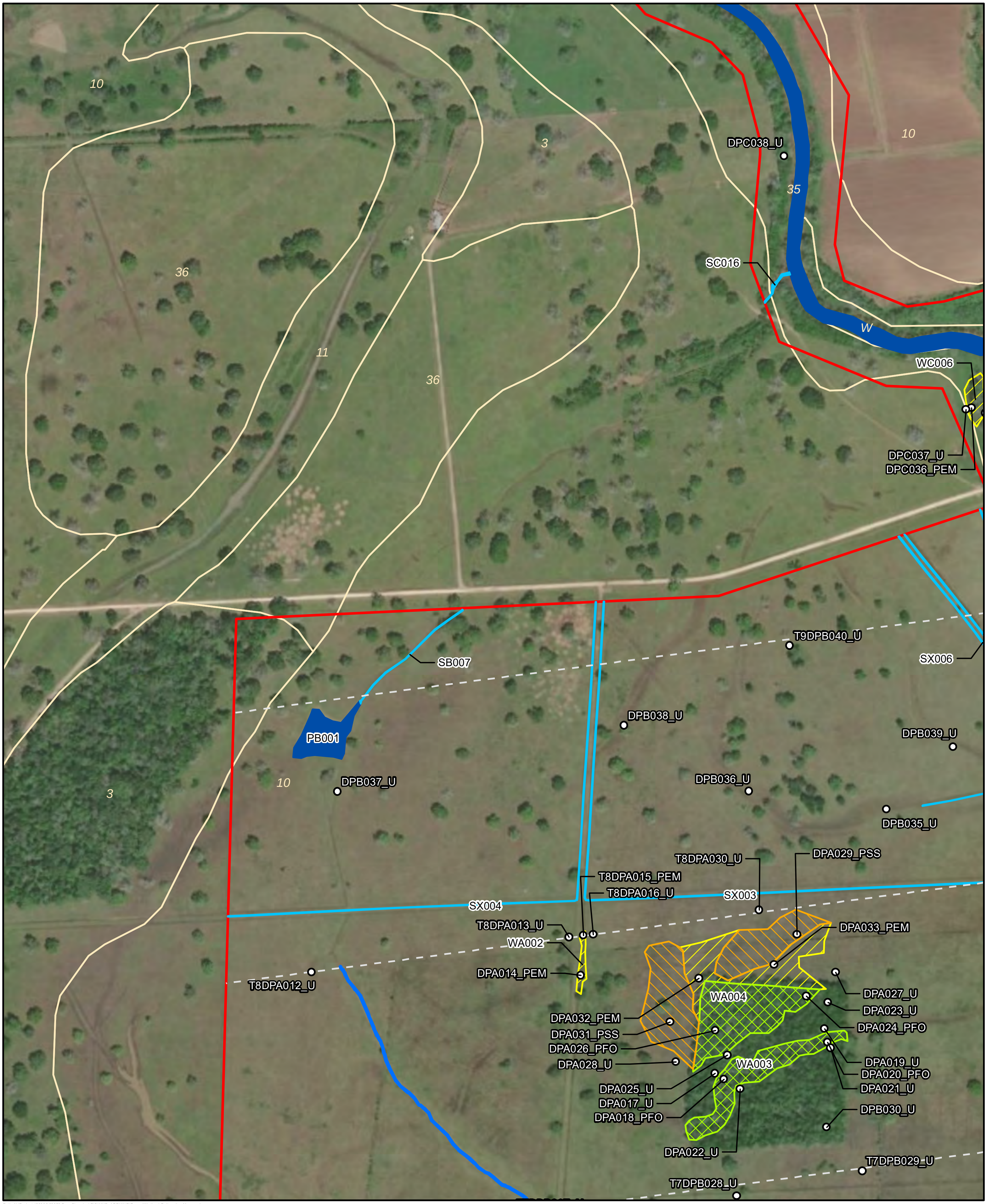

SWCA ENVIRONMENTAL CONSULTANTS

DOW CHEMICAL HARRIS RESEVOIR EXPANSION PROJECT

WETLAND DELINEATION MAP
BRAZORIA COUNTY, TEXAS

FIGURE 3 - SHEET 2 of 12

Project Boundary	Intermittent
Data Points	Perennial
Transect	Emergent Wetland
Soil Map Unit Boundary	Forested Wetland
Ephemeral	Scrub-Scrub Wetland

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Created By: CM
Project Number: 52872
Date: 7/30/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

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SWCA ENVIRONMENTAL CONSULTANTS

DOW CHEMICAL HARRIS RESEVOIR EXPANSION PROJECT

WETLAND DELINEATION MAP
BRAZORIA COUNTY, TEXAS

FIGURE 3 - SHEET 3 of 12

Project Boundary
Data Points
Transect
Soil Map Unit Boundary
Ephemeral
Intermittent
Perennial
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland

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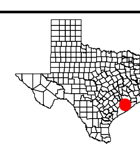
SWCA
ENVIRONMENTAL CONSULTANTS

DOW CHEMICAL HARRIS RESEVOIR EXPANSION PROJECT

WETLAND DELINEATION MAP
BRAZORIA COUNTY, TEXAS

FIGURE 3 - SHEET 4 of 12

Project Boundary
Data Points
Transect
Soil Map Unit Boundary
Ephemeral
Intermittent
Perennial
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland



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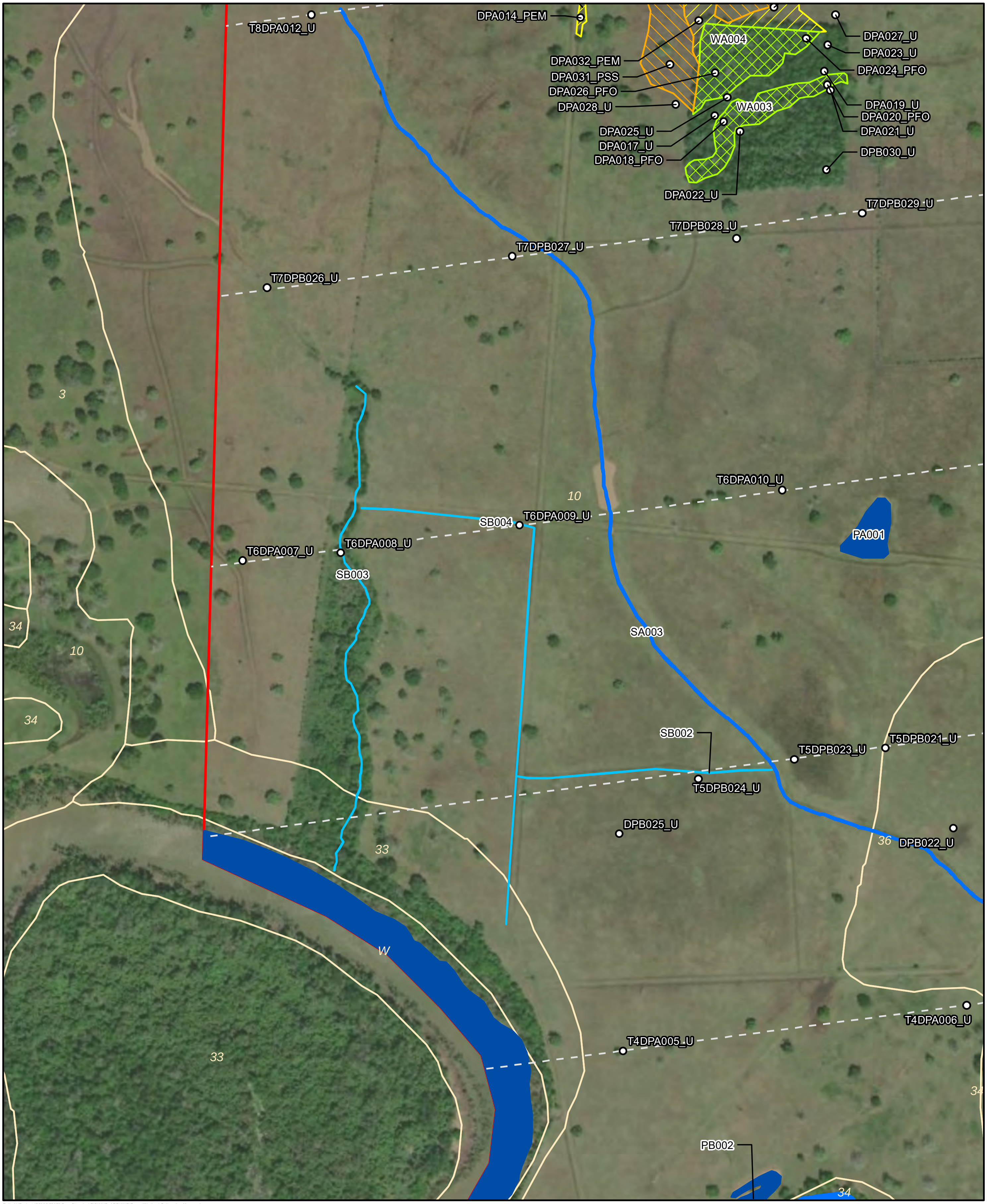

SWCA ENVIRONMENTAL CONSULTANTS

DOW CHEMICAL HARRIS RESEVOIR EXPANSION PROJECT

WETLAND DELINEATION MAP
BRAZORIA COUNTY, TEXAS

FIGURE 3 - SHEET 5 of 12

Project Boundary
Data Points
Transect
Soil Map Unit Boundary
Ephemeral
Intermittent
Perennial
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland

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Created By: CM
Project Number: 52872
Date: 7/30/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

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COPY

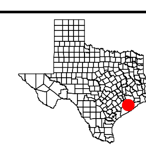
SWCA
ENVIRONMENTAL CONSULTANTS

DOW CHEMICAL HARRIS RESEVOIR EXPANSION PROJECT

WETLAND DELINEATION MAP
BRAZORIA COUNTY, TEXAS

FIGURE 3 - SHEET 6 of 12

Project Boundary
Data Points
Transect
Soil Map Unit Boundary
Ephemeral
Intermittent
Perennial
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland



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Created By: CM
Project Number: 52872
Date: 7/30/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

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COPY

SWCA ENVIRONMENTAL CONSULTANTS

DOW CHEMICAL HARRIS RESEVOIR EXPANSION PROJECT

WETLAND DELINEATION MAP
BRAZORIA COUNTY, TEXAS

FIGURE 3 - SHEET 7 of 12

Project Boundary
Data Points
Transect
Soil Map Unit Boundary
Ephemeral
Intermittent
Perennial
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland

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Project Number: 52872
Date: 7/30/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

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COPY

SWCA ENVIRONMENTAL CONSULTANTS

DOW CHEMICAL HARRIS RESEVOIR EXPANSION PROJECT

WETLAND DELINEATION MAP
BRAZORIA COUNTY, TEXAS

FIGURE 3 - SHEET 8 of 12

Project Boundary
Data Points
Transect
Soil Map Unit Boundary
Ephemeral
Intermittent
Perennial
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland

1:7,500

Created By: CM
Project Number: 52872
Date: 7/30/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

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COPY

SWCA ENVIRONMENTAL CONSULTANTS

DOW CHEMICAL HARRIS RESEVOIR EXPANSION PROJECT

WETLAND DELINEATION MAP
BRAZORIA COUNTY, TEXAS

FIGURE 3 - SHEET 9 of 12

Project Boundary
Data Points
Transect
Soil Map Unit Boundary
Ephemeral
Intermittent
Perennial
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland

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Created By: CM
Project Number: 52872
Date: 7/30/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

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0 30 60 90 120 150 Meters

DOW CHEMICAL HARRIS RESEVOIR EXPANSION PROJECT

WETLAND DELINEATION MAP
BRAZORIA COUNTY, TEXAS

FIGURE 3 - SHEET 10 of 12

SWCA ENVIRONMENTAL CONSULTANTS

Project Boundary	Intermittent
Data Points	Perennial
Transect	Emergent Wetland
Soil Map Unit Boundary	Forested Wetland
Ephemeral	Scrub-Scrub Wetland

1:7,500

Created By: CM
Project Number: 52872
Date: 7/30/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

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COPY

SWCA ENVIRONMENTAL CONSULTANTS

DOW CHEMICAL HARRIS RESEVOIR EXPANSION PROJECT

WETLAND DELINEATION MAP
BRAZORIA COUNTY, TEXAS

FIGURE 3 - SHEET 11 of 12

Project Boundary
Data Points
Transect
Soil Map Unit Boundary
Ephemeral
Intermittent
Perennial
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Date: 7/30/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

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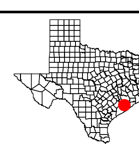
SWCA ENVIRONMENTAL CONSULTANTS

DOW CHEMICAL HARRIS RESEVOIR EXPANSION PROJECT

WETLAND DELINEATION MAP
BRAZORIA COUNTY, TEXAS

FIGURE 3 - SHEET 12 of 12

Project Boundary
Data Points
Transect
Soil Map Unit Boundary
Ephemeral
Intermittent
Perennial
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland



1:7,500

Created By: CM
Project Number: 52872
Date: 7/30/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

0 150 300 450 600 Feet
0 30 60 90 120 150 Meters

October 8, 2021

Cardno

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Suite 100
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USA

Phone: +1 713 868 1591
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Yvonne Samson
Senior EH&S Leveraged Delivery Leader
LDAR, Water & Wetlands
Texas Operations, Freeport

Re: **Wetland and Other "Waters of the U.S." Delineation Report**
Alternate Equipment Laydown Area-Harris Reservoir Project
Rosharon, Texas

Dear Yvonne:

This letter report presents the results of a wetland delineation conducted at specific alternate equipment laydown area associated with the Harris Reservoir Project (Project Area) near Rosharon, Brazoria County, Texas. The Project Area is owned by The Dow Chemical Company.

A delineation of "Waters of the U.S.", including wetlands was performed by Cardno in the Project Area on September 28, 2021 to determine:

- If potential "Waters of the U.S." (WOTUS) exist within the Project area as defined by Section 404 of the Clean Water Act;
- Delineate and survey WOTUS boundaries if they exist;
- Determine the potential jurisdictional status of identified wetlands; and
- Document general site conditions.

The attached Wetland Delineation Report contains a delineation of all resources that potentially fall under the jurisdiction of the U.S. Army Corps of Engineers (USACE). Wetlands are collectively defined by the USACE (Federal Register 1982) and the U.S. Environmental Protection Agency (EPA; Federal Register 1980) as "those areas that are inundated or saturated by surface or groundwater at a frequency or duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions".

Wetlands

Based on the current definition of WOTUS, as defined by the U.S. Environmental Protection Agency and USACE, the federal regulatory process identifies three parameters as key to determining the presence of a wetland:

- Hydrophytic vegetation
- Hydric soils, and
- Wetland hydrology

All three key parameters must be present to be considered a potential WOTUS. During the wetland delineation, Cardno biologists assessed the presence of all three of these parameters. This letter report summarizes the results of their findings. Once a wetland was identified in the Project Area, an opinion was rendered by Cardno biologists to determine if the wetland was jurisdictional or isolated (non-jurisdictional).

Ordinary High Water Mark Delineation

Section 328.4(c)1 of the Federal Register defines the lateral limit of jurisdiction in non-tidal waters as the OHWM, provided the jurisdiction in not extended by the presence of wetlands. Typical OWHM indicators include the existing water level, the presence of shelving, changes in soils, scouring, damage of terrestrial vegetation, or a distinct change between terrestrial and aquatic vegetation.

Oyster Creek is a perennial stream that lies east of the Project Area. The presence of shelving and soil color change were primarily used to define the OHWM.

I. Area Description

The Project Area is located in an undeveloped land parcel adjacent to the existing Harris Reservoir. The Project Area was formerly a mobile home park and now owned by The Dow Chemical Company. Isolated areas of mixed herbaceous and woody vegetation are found in the Project Area.

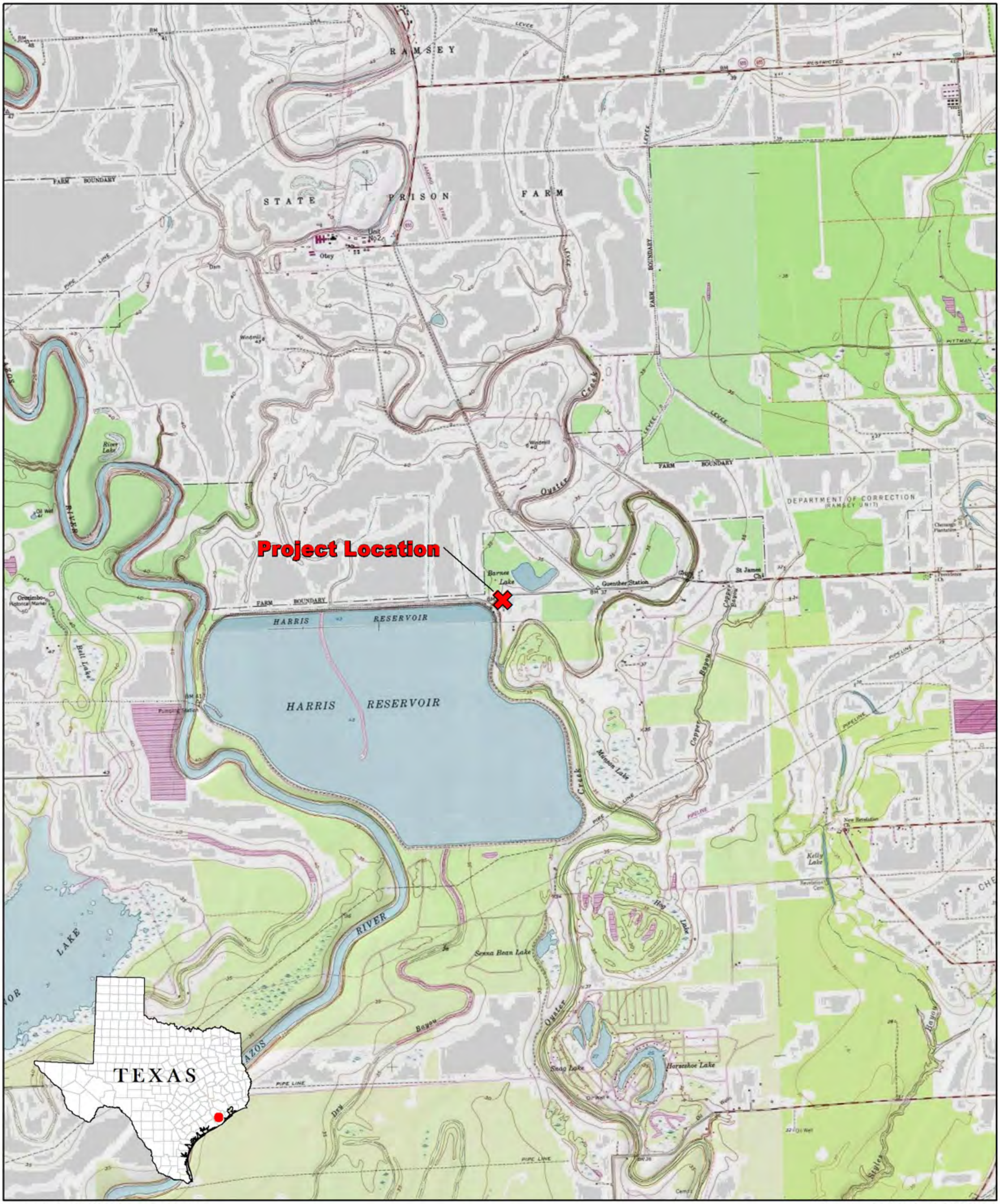
II. Wetland Delineation Methodology

Field evaluation of the Project Area was performed on September 28, 2021 by Cardno biologist Bob Nailon. The evaluation of potential jurisdictional wetlands consisted of a site examination to determine whether the three wetland characteristics (hydrophytic vegetation, hydric soils, and wetland hydrology), as defined by the U.S. Army Corps of Engineers (USACE) criteria for jurisdictional wetlands, were present within the proposed Project area.

The *Federal Manual for Identification of Jurisdictional Wetlands* (1987 Manual) was followed, as well as the *USACE Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region* (2010). Background soils information of the Project Area was obtained from the Brazoria County Soil Survey prepared by the USDA Natural Resources Conservation Service (NRCS). The publication, *2016 National Plant List*-USACE Engineer Research and Development Center (ERDC) (Lichvar et al. 2016), was used to determine the wetland status of plant species found at the Project Area.

Reference material used in the field and during report preparation included:

- Munsell Soil Color Charts;
- The Natural Resource Conservation Service's Soil Survey of Brazoria County and list of Hydric Soils in Brazoria County, Texas;
- U.S. Army Corps of Engineers 1987 Wetlands Delineation Manual;
- U.S. Army Corps of Engineers 2010 Wetland Delineation Manual Gulf Coast Regional Supplement; and
- 2016 National Plant List - USACE ERDC.



Basemap: 1:24K USGS Topographic Maps

Map Created/Revised: 9/29/2021

0 0.5 1

Miles

Figure 1
Site Vicinity Map
Harris Alternative Laydown Area
The DOW Chemical Company

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Cardno relied upon field measurements, Trimble® Geo-XH Global Positioning System (GPS), and recent color infrared photo-imagery to determine potential jurisdictional wetland boundaries and acreage. The GPS data were overlaid onto recent commercially available photo-imagery, developing a Geographic Information System (GIS) based exhibit.

Federal Emergency Management Agency (FEMA) Brazoria County floodplain data was reviewed to determine if the Project Area potentially falls within the 100-Year or 500-Year floodplain. This information, as well as the presence/absence of hydrological connections of the Project area to other WOTUS, were used to help determine the “isolated” or “adjacent” status of any wetlands identified in this delineation. Based upon recent regulatory interpretation of jurisdictional wetlands by the USACE, all wetlands identified in the scope of this wetland delineation that either fall within the 100-Year floodplain or have a hydrologic connection possessing an OHWM would be “adjacent” wetlands and/or considered jurisdictional by the USACE.

The findings of the field delineation are presented below. The field data sheets are included in Attachment A. Site photographs are included in Attachment B. An archeological/Historical desktop survey is included in Attachment C.

III. Results

A. Vegetation

Hydrophytic vegetation grows in soils that are saturated for a sufficient duration of time to cause anaerobic conditions. Hydrophytic vegetation for some morphological, physiological, or reproductive adaptation are well suited for living in an environment periodically deficient of oxygen. Dominant vegetation was identified and categorized in accordance with the regional indicator status in the 2016 National Plant List - USACE ERDC. (Lichvar et. al. 2016). The indicator status of a plant species is expressed in terms of the estimated probability of that species to occur in wetland conditions within a given region. The table below (Table 1) lists the plant indicator status categories. A vegetative community would be determined to be hydrophytic if greater than 50 percent of the dominant species present are FAC, FACW, or OBL.

Table 1. Wetland Indicator Status Description

Indicator status	Designation	Qualitative Description
Obligate (OBL)	Hydrophyte	Almost always occurs in wetlands
Facultative Wetland (FACW)	Hydrophyte	Usually occurs in wetlands, but may occur in non-wetlands
Facultative (FAC)	Hydrophyte	Occur in wetlands and non-wetlands
Facultative Upland (FACU)	Non-hydrophyte	Usually occur in non-wetlands, but may occur in wetlands
Upland (UPL)	Non-hydrophyte	Almost never occur in wetlands

The following dominant vegetative species and wetland indicator status were recorded within upland portions of the Project Area during the wetland delineation:

- St Augustine grass (*Stenotaphrum secundatum*), FAC
- Cherokee Sedge (*Carex cherokeensis*), FACW
- Elegant sedge (*Cyperus elegans*), FACW
- Poison sumac (*Toxicodendron vernix*), OBL
- Black walnut (*Juglans nigra*), UPL

- Powderpuff (*Mimosa strigillosa*), FAC
- Crowpoison (*Nothoscordum bivalve*), FACU
- Live oak (*Quercus virginiana*), FACU
- Chinese tallow (*Triadica sebifera*), FAC
- Straggler daisy (*Calyptocarpus vialis*), FAC
- Giant ragweed (*Ambrosia trifida*), FAC
- Feverfew (*Parthenium hysterophorus*), FAC

The following species were documented in a potential jurisdictional drainage within the Project Area:

- Cedar elm (*Ulmus crassifolia*), FAC
- Sugarberry (*Celtis laevigata*), FACW
- Palmetto (*Sabal minor*), FACW
- Cherokee sedge (*Carex cherokeensis*), FACW

B. Soils

The 1987 *Manual* defines a hydric soil as a "soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions that favor the growth and regeneration of hydrophytic vegetation".

The USDA-NRCS mapped soils within the Project area as:

- Brazoria Series soils

Brazoria Series

The Brazoria series consists of very deep, moderately well drained, very slowly permeable soils formed in clayey alluvial sediments on the flood plains of the Brazos and Colorado Rivers. These gently to moderate sloping soils occur on flood plains of the Coastal Plains. Slope ranges from 0 to 5 percent. Mean annual precipitation range from 1092 to 1397 mm (43 to 55 in), and mean annual air temperature is about 19.5 to 21.7 degrees C (67 to 71 degrees F).

TAXONOMIC CLASS: Very-fine, smectitic, hyperthermic Chromic Hapluderts

TYPICAL PEDON: Brazoria clay, on a nearly level 0.2 percent slope, in woodland; elevation is 18 m (59 ft) (Colors are for moist soil unless otherwise stated.)

A--0 to 14 cm (0 to 6 in); dark brown (7.5YR 3/2) clay; moderate medium wedge structure parts to moderate medium angular blocky; firm; many very fine roots and common fine roots; common very fine pores; 20 percent pressure faces on all faces of peds; 1 percent fine carbonate nodules; slight effervescence; slightly alkaline; gradual smooth boundary. (Thickness is 13 to 18 cm [5 to 7 in].)
Bss1--14 to 42 cm (6 to 17 in); dark brown (7.5YR 3/2) clay; moderate medium wedge structure parts to moderate medium angular blocky; firm; common very fine roots; common very fine pores; 5 percent slickensides (pedogenic); 1 percent fine carbonate nodules; slight effervescence; moderately alkaline; gradual wavy boundary. (Combined thickness of the Bss horizons is 98 to 155 cm [39 to 61 in])

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In several cases during the delineation, a dominance of hydrophytic vegetation was present, but hydrology indicators were lacking and redoximorphic features were absent in the soils.

C. Hydrology

The 1987 *Manual* definition of wetland hydrology "encompasses all hydrologic characteristics of areas that are periodically inundated or have soils saturated to the surface at some time during the growing season". The following describes 1987 *Manual* field indicators for wetland hydrology determinations:

- Test pits excavated at specific points within the Project Area indicate that the presence of both primary and/or sufficient secondary wetland indicators are not met in upland areas.
- Representative test pit excavated in potential jurisdictional portions of the Project Area possessed the presence of primary and/or sufficient secondary hydrology indicators.
- Potential jurisdictional portions of the Project Area appear to meet the duration period requirement, i.e. seasonally inundated or saturated from 12.5 - 25% of the growing season, as well as 1987 *Manual* soil saturation criteria.

Portions of the Project Area in the vicinity of Pit #2 exhibited wetland hydrology indicators, including surface water, saturation, water-stained leaves, algal mat or crust, saturation, and crawfish burrows.

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IV. Conclusions

Cardno investigated the Project Area for the presence/absence of jurisdictional Waters of the U.S., including wetlands. One jurisdictional drainage (0.006 acres) with a nexus to Oyster Creek was identified and mapped in the Project Area. (Figure 2). No other wetlands or waterbodies were observed within the Project Area.

The Project Area falls within the 100-year floodplain (Figure 3). The identified drainage feature possesses a significant nexus to a traditional navigable waterway or other “Water of the U.S.”. It is Cardno’s opinion that the identified drainage is jurisdictional.

It should be understood that the scope of this delineation and determination was to determine whether or not, in our professional opinion, wetlands exist within the Project area and is not a legal delineation of jurisdictional (isolated/adjacent) wetland boundaries. The USACE has regulatory authority regarding wetland issues, and the USACE is responsible for the final jurisdictional determination of wetlands at a given site. This wetland delineation is not official until it has been approved by the USACE.

If you have any questions regarding the findings reported in this letter, please feel free to contact me at 713-817-2469 (Cell) or by email at bob.nailon@cardno.com.

Sincerely,

Bob Nailon

Robert W. Nailon
Senior Wetlands Scientist

Basemap: Bing Aerial

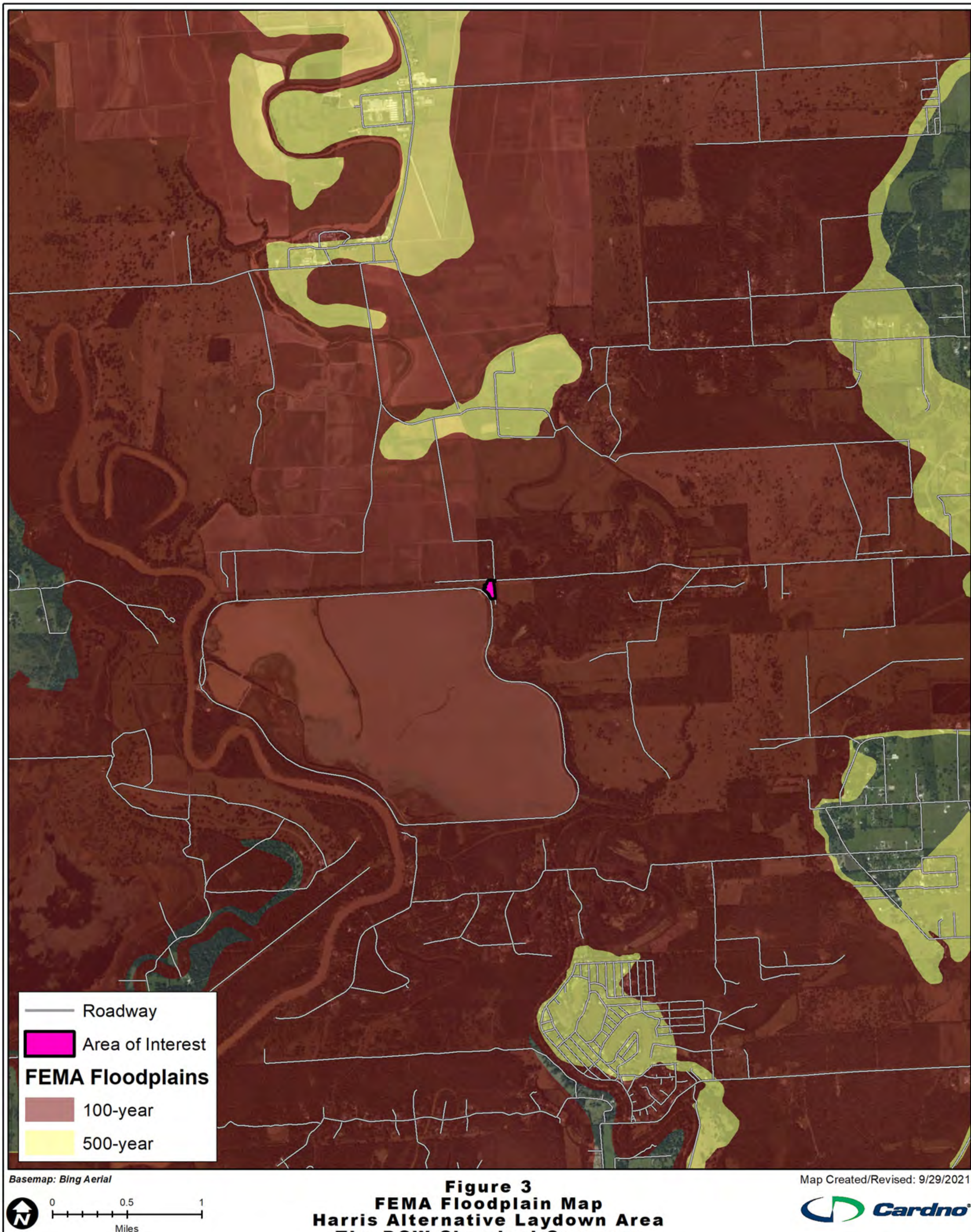
Map Created/Revised: 10/4/2021

0 50 100

Feet

Figure 2
Delineation Map
Harris Alternative Laydown Area
The DOW Chemical Company

Cardno



Map Created/Revised: 9/29/2021

Figure 3
FEMA Floodplain Map
Harris Alternative Laydown Area
The DOW Chemical Company

Cardno

ATTACHMENT A
Field Data Sheets

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Harris Reservoir Alternate Laydown Area City/County: Brazoria Sampling Date: 9/28/21

Applicant/Owner: The Dow Chemical Company State: TX Sampling Point: Pit 1 Up

Investigator(s): R. Nailon - Cardno Section, Township, Range: ______

Landform (hillslope, terrace, etc.): Flat Local relief (concave, convex, none): ______ Slope (%): ______

Subregion (LRR or MLRA): LRRT Lat: 29.25241085° N Long: 95.52882456° W Datum: WGS84

Soil Map Unit Name: Brazoria Clay 0-1% Slopes, Rarely Flooded NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ______ (If no, explain in Remarks.)

Are Vegetation ______, Soil ______, or Hydrology ______ significantly disturbed? Are "Normal Circumstances" present? Yes X No ______

Are Vegetation ______, Soil ______, or Hydrology ______ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ______	**Is the Sampled Area within a Wetland?**	**Yes** ______ **No** X
Hydric Soil Present?	Yes ______ No X		
Wetland Hydrology Present?	Yes ______ No X		

Remarks:

Upland area

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)		Secondary Indicators (minimum of two required)
___ Surface Water (A1)	___ Aquatic Fauna (B13)	___ Surface Soil Cracks (B6)
___ High Water Table (A2)	___ Marl Deposits (B15) **(LRR U)**	___ Sparsely Vegetated Concave Surface (B8)
___ Saturation (A3)	___ Hydrogen Sulfide Odor (C1)	___ Drainage Patterns (B10)
___ Water Marks (B1)	___ Oxidized Rhizospheres along Living Roots (C3)	___ Moss Trim Lines (B16)
___ Sediment Deposits (B2)	___ Presence of Reduced Iron (C4)	___ Dry-Season Water Table (C2)
___ Drift Deposits (B3)	___ Recent Iron Reduction in Tilled Soils (C6)	___ Crayfish Burrows (C8)
___ Algal Mat or Crust (B4)	___ Thin Muck Surface (C7)	___ Saturation Visible on Aerial Imagery (C9)
___ Iron Deposits (B5)	___ Other (Explain in Remarks)	X Geomorphic Position (D2)
___ Inundation Visible on Aerial Imagery (B7)		___ Shallow Aquitard (D3)
___ Water-Stained Leaves (B9)		___ FAC-Neutral Test (D5)
		___ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ______ No X	Depth (inches): 0	
Water Table Present?	Yes ______ No X	Depth (inches): >15	
Saturation Present? (includes capillary fringe)	Yes ______ No X	Depth (inches): >15	**Wetland Hydrology Present? Yes** ______ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Lacks hydrology

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: Pit 1 Up

Tree Stratum (Plot size: 30' x 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
		= Total Cover	
50% of total cover:		20% of total cover:	

Sapling Stratum (Plot size: 30' x 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Toxicodendron vernix	30	Y	OBL
2.			
3.			
4.			
5.			
6.			
	30	= Total Cover	
50% of total cover: 15		20% of total cover: 6	

Shrub Stratum (Plot size: 30' x 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
		= Total Cover	
50% of total cover:		20% of total cover:	

Herb Stratum (Plot size: 30' x 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Stenotaphrum secundatum	75	Y	FAC
2. Mimosa strigillosa	5	N	FAC
3. Nothoscordum bivalve	5	N	FACU
4. Cyperus elegans	1	N	FACW
5. Ambrosia trifida	15	N	FAC
6.			
7.			
8.			
9.			
10.			
11.			
	101	= Total Cover	
50% of total cover: 50		20% of total cover: 20	

Woody Vine Stratum (Plot size: 30' x 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
		= Total Cover	
50% of total cover:		20% of total cover:	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	50	x 1 = 50
FACW species		x 2 =
FAC species	75	x 3 = 225
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	125 (A)	275 (B)

Prevalence Index = B/A = 2.2

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes X No ___

Remarks: (If observed, list morphological adaptations below).

Meets hydrophytic veg requirement

SOIL

Sampling Point: Pit 1 Up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-15	7.5YR3/2	100					Clay	Brazoria Clay 0-1% Slopes, Rarely Flooded

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Organic Bodies (A6) **(LRR P, T, U)**
___ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
___ Muck Presence (A8) **(LRR U)**
___ 1 cm Muck (A9) **(LRR P, T)**
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Coast Prairie Redox (A16) **(MLRA 150A)**
___ Sandy Mucky Mineral (S1) **(LRR O, S)**
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7) **(LRR P, S, T, U)**
___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
___ Thin Dark Surface (S9) **(LRR S, T, U)**
___ Loamy Mucky Mineral (F1) **(LRR O)**
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) **(LRR U)**
___ Depleted Ochric (F11) **(MLRA 151)**
___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
___ Umbric Surface (F13) **(LRR P, T, U)**
___ Delta Ochric (F17) **(MLRA 151)**
___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

___ 1 cm Muck (A9) **(LRR O)**
___ 2 cm Muck (A10) **(LRR S)**
___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
___ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
___ Red Parent Material (TF2)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type: ________
Depth (inches): ________

Hydric Soil Present? Yes ____ No X

Remarks:
Lacks hydric indicators

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Harris Reservoir Alternate Laydown Area City/County: Brazoria Sampling Date: 9/28/21

Applicant/Owner: The Dow Chemical Company State: TX Sampling Point: Pit 2 Wet

Investigator(s): R. Nailon - Cardno Section, Township, Range: ______

Landform (hillslope, terrace, etc.): Flat Local relief (concave, convex, none): Concave Slope (%): ______

Subregion (LRR or MLRA): LRRT Lat: 29.25235695° N Long: 95.52854742° W Datum: WGS84

Soil Map Unit Name: Brazoria Clay 0-1% Slopes, Rarely Flooded NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** **Yes** X **No** ____
Hydric Soil Present?	Yes ____	No ____	
Wetland Hydrology Present?	Yes X	No ____	

Remarks:

Jurisdictional drainage--Tributary to Oyster Creek; Connects to original laydown area boundary

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15) **(LRR U)**
- ___ Hydrogen Sulfide Odor (C1)
- X Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ____	No X	Depth (inches): 0
Water Table Present?	Yes ____	No X	Depth (inches): >15
Saturation Present? (includes capillary fringe)	Yes ____	No X	Depth (inches): >15

Wetland Hydrology Present? Yes X **No** ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Jurisdictional drainage--Tributary to Oyster Creek;

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: Pit 2 Wet

Tree Stratum (Plot size: 30' x 30')

	Absolute % Cover	Dominant Species?	Indicator Status
1. Ulmus crassifolia	50	Y	FAC
2. Celtis laevigata	40	Y	FACW
3.			
4.			
5.			
6.			
= Total Cover	90		

50% of total cover: 45 20% of total cover: 18

Sapling Stratum (Plot size: 30' x 30')

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
= Total Cover			

50% of total cover: ____ 20% of total cover: ____

Shrub Stratum (Plot size: 30' x 30')

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
= Total Cover			

50% of total cover: ____ 20% of total cover: ____

Herb Stratum (Plot size: 30' x 30')

	Absolute % Cover	Dominant Species?	Indicator Status
1. Sabol minor	10	Y	FACW
2. Carex cherokeensis	20	Y	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover	30		

50% of total cover: 15 20% of total cover: 6

Woody Vine Stratum (Plot size: 30' x 30')

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
= Total Cover			

50% of total cover: ____ 20% of total cover: ____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species	70	x 2 = 140
FAC species	50	x 3 = 150
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	120 (A)	290 (B)

Prevalence Index = B/A = 2.42

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
X 3 - Prevalence Index is ≤3.0[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: Pit 2 Wet

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-20	7.5YR3/2	98	7.5YR4/6	2	C	M	Clay	Brazoria Clay 0-1% Slopes, Rarely Flooded

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

__ Histosol (A1)
__ Histic Epipedon (A2)
__ Black Histic (A3)
__ Hydrogen Sulfide (A4)
__ Stratified Layers (A5)
__ Organic Bodies (A6) **(LRR P, T, U)**
__ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
__ Muck Presence (A8) **(LRR U)**
__ 1 cm Muck (A9) **(LRR P, T)**
__ Depleted Below Dark Surface (A11)
__ Thick Dark Surface (A12)
__ Coast Prairie Redox (A16) **(MLRA 150A)**
__ Sandy Mucky Mineral (S1) **(LRR O, S)**
__ Sandy Gleyed Matrix (S4)
__ Sandy Redox (S5)
__ Stripped Matrix (S6)
__ Dark Surface (S7) **(LRR P, S, T, U)**
__ Polyvalue Below Surface (S8) **(LRR S, T, U)**
__ Thin Dark Surface (S9) **(LRR S, T, U)**
__ Loamy Mucky Mineral (F1) **(LRR O)**
__ Loamy Gleyed Matrix (F2)
x Depleted Matrix (F3)
__ Redox Dark Surface (F6)
__ Depleted Dark Surface (F7)
__ Redox Depressions (F8)
__ Marl (F10) **(LRR U)**
__ Depleted Ochric (F11) **(MLRA 151)**
__ Iron-Manganese Masses (F12) **(LRR O, P, T)**
__ Umbric Surface (F13) **(LRR P, T, U)**
__ Delta Ochric (F17) **(MLRA 151)**
__ Reduced Vertic (F18) **(MLRA 150A, 150B)**
__ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
__ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

__ 1 cm Muck (A9) **(LRR O)**
__ 2 cm Muck (A10) **(LRR S)**
__ Reduced Vertic (F18) **(outside MLRA 150A,B)**
__ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
__ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
__ Red Parent Material (TF2)
__ Very Shallow Dark Surface (TF12)
__ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ________

Depth (inches): ________

Hydric Soil Present? **Yes** X **No** ____

Remarks:
Contains hydric indicators

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Harris Reservoir Alternate Laydown Area City/County: Brazoria Sampling Date: 9/28/21

Applicant/Owner: The Dow Chemical Company State: TX Sampling Point: Pit 3 Up

Investigator(s): R. Nailon - Cardno Section, Township, Range: ______

Landform (hillslope, terrace, etc.): Flat Local relief (concave, convex, none): ______ Slope (%): ______

Subregion (LRR or MLRA): LRRT Lat: 29.2516934° N Long: 95.52891945° W Datum: WGS84

Soil Map Unit Name: Brazoria Clay 0-1% Slopes, Rarely Flooded NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ___	No X	**Is the Sampled Area within a Wetland?** Yes ___ No X
Hydric Soil Present?	Yes ___	No X	
Wetland Hydrology Present?	Yes ___	No X	

Remarks:

Upland area--former trailer park

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15) **(LRR U)**
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): 0
Water Table Present?	Yes ___	No X	Depth (inches): >15
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): >15

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Lacks sufficient hydrology

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: Pit 3 Up

Tree Stratum (Plot size: 30' x 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Juglans nigra	50	Y	UPL
2.			
3.			
4.			
5.			
6.			
	50 = Total Cover		
50% of total cover: 25	20% of total cover: 10		

Sapling Stratum (Plot size: 30' x 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Shrub Stratum (Plot size: 30' x 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Herb Stratum (Plot size: 30' x 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Stenotaphrum secundatum	100	Y	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		
50% of total cover: 50	20% of total cover: 20		

Woody Vine Stratum (Plot size: 30' x 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species	100	x 3 = 300
FACU species		x 4 =
UPL species	50	x 5 = 250
Column Totals:	150 (A)	550 (B)

Prevalence Index = B/A = 3.66

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ______ No X

Remarks: (If observed, list morphological adaptations below).

Dominated by Stenotaphrum and Juglans

SOIL

Sampling Point: Pit 3 Up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-15	7.5YR3/2	100					Clay	Brazoria Clay 0-1% Slopes, Rarely Flooded

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6) **(LRR P, T, U)**
- ___ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ___ Muck Presence (A8) **(LRR U)**
- ___ 1 cm Muck (A9) **(LRR P, T)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Coast Prairie Redox (A16) **(MLRA 150A)**
- ___ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) **(LRR P, S, T, U)**
- ___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ___ Thin Dark Surface (S9) **(LRR S, T, U)**
- ___ Loamy Mucky Mineral (F1) **(LRR O)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR U)**
- ___ Depleted Ochric (F11) **(MLRA 151)**
- ___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ___ Umbric Surface (F13) **(LRR P, T, U)**
- ___ Delta Ochric (F17) **(MLRA 151)**
- ___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR O)**
- ___ 2 cm Muck (A10) **(LRR S)**
- ___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** ______ **No** X

Remarks:
Lacks hydric indicators

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Harris Reservoir Alternate Laydown Area City/County: Brazoria Sampling Date: 9/28/21

Applicant/Owner: The Dow Chemical Company State: TX Sampling Point: Pit 4 Up

Investigator(s): R. Nailon - Cardno Section, Township, Range: ______

Landform (hillslope, terrace, etc.): Flat Local relief (concave, convex, none): ______ Slope (%): ______

Subregion (LRR or MLRA): LRRT Lat: 29.25206187° N Long: 95.52889277° W Datum: WGS84

Soil Map Unit Name: Brazoria Clay 0-1% Slopes, Rarely Flooded NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ___	**Is the Sampled Area within a Wetland?** Yes ___ No X
Hydric Soil Present?	Yes ___	No X	
Wetland Hydrology Present?	Yes ___	No X	

Remarks:

Upland area--former trailer park

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15) **(LRR U)**
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): 0
Water Table Present?	Yes ___	No X	Depth (inches): >15
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): >15

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Lacks hydrology

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: Pit 4 Up

Tree Stratum (Plot size: 30' x 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Quercus virginiana	70	Y	FACU
2. Triadica sebifera	25	Y	FAC
3.			
4.			
5.			
6.			
	95 = Total Cover		
50% of total cover: 48	20% of total cover: 10		

Sapling Stratum (Plot size: 30' x 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Shrub Stratum (Plot size: 30' x 30')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Herb Stratum (Plot size: 30' x 30')			
1. Stenotaphrum secundatum	25	Y	FAC
2. Calyptocarpus vialis	35	Y	FAC
3. Parthenium hysterophorus	20	Y	FAC
4. Ambrosia trifida	10	N	FAC
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	90 = Total Cover		
50% of total cover: 45	20% of total cover: 18		

Woody Vine Stratum (Plot size: 30' x 30')			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species	115	x 3 = 345
FACU species	70	x 4 = 280
UPL species		x 5 =
Column Totals:	185 (A)	625 (B)

Prevalence Index = B/A = 3.38

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes X No ___

Remarks: (If observed, list morphological adaptations below).

Meets Dominance Test

SOIL

Sampling Point: Pit 4 Up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-15	7.5YR3/2	100					Clay	Brazoria Clay 0-1% Slopes, Rarely Flooded

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Organic Bodies (A6) **(LRR P, T, U)**
___ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
___ Muck Presence (A8) **(LRR U)**
___ 1 cm Muck (A9) **(LRR P, T)**
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Coast Prairie Redox (A16) **(MLRA 150A)**
___ Sandy Mucky Mineral (S1) **(LRR O, S)**
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7) **(LRR P, S, T, U)**
___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
___ Thin Dark Surface (S9) **(LRR S, T, U)**
___ Loamy Mucky Mineral (F1) **(LRR O)**
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) **(LRR U)**
___ Depleted Ochric (F11) **(MLRA 151)**
___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
___ Umbric Surface (F13) **(LRR P, T, U)**
___ Delta Ochric (F17) **(MLRA 151)**
___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

___ 1 cm Muck (A9) **(LRR O)**
___ 2 cm Muck (A10) **(LRR S)**
___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
___ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
___ Red Parent Material (TF2)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type: ______
Depth (inches): ______

Hydric Soil Present? **Yes** ______ **No** X

Remarks:
Lacks hydric indicators

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Harris Reservoir Alternate Laydown Area City/County: Brazoria Sampling Date: 9/28/21

Applicant/Owner: The Dow Chemical Company State: TX Sampling Point: Pit 5 Up

Investigator(s): R. Nailon - Cardno Section, Township, Range: ______

Landform (hillslope, terrace, etc.): Flat Local relief (concave, convex, none): ______ Slope (%): ______

Subregion (LRR or MLRA): LRRT Lat: 29.25256513° N Long: 95.52900982° W Datum: WGS84

Soil Map Unit Name: Brazoria Clay 0-1% Slopes, Rarely Flooded NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ______ (If no, explain in Remarks.)

Are Vegetation ______, Soil ______, or Hydrology ______ significantly disturbed? Are "Normal Circumstances" present? Yes X No ______

Are Vegetation ______, Soil ______, or Hydrology ______ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ______	**Is the Sampled Area within a Wetland?** **Yes** ______ **No** X
Hydric Soil Present?	Yes ______	No X	
Wetland Hydrology Present?	Yes ______	No X	

Remarks:

Upland area

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15) **(LRR U)**
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): 0
Water Table Present?	Yes _____	No X	Depth (inches): >15
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches): >15

Wetland Hydrology Present? Yes ______ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Lacks hydrology

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: Pit 5 Up

Tree Stratum (Plot size: 30' x 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Sapling Stratum (Plot size: 30' x 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Toxicodendron vernix	50	Y	OBL
2.			
3.			
4.			
5.			
6.			
	5 = Total Cover		
50% of total cover: 2.5		20% of total cover: 1	

Shrub Stratum (Plot size: 30' x 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Herb Stratum (Plot size: 30' x 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Stenotaphrum secundatum	75	Y	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	101 = Total Cover		
50% of total cover: 50		20% of total cover: 20	

Woody Vine Stratum (Plot size: 30' x 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	50	x 1 = 50
FACW species		x 2 =
FAC species	75	x 3 = 225
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	125 (A)	275 (B)

Prevalence Index = B/A = 2.2

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- X 3 - Prevalence Index is ≤3.0[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes X No ___

Remarks: (If observed, list morphological adaptations below).

Meets hydrophytic veg requirement

SOIL

Sampling Point: Pit 5 Up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-15	7.5YR3/2	100					Clay	Brazoria Clay 0-1% Slopes, Rarely Flooded

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6) **(LRR P, T, U)**
- ___ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ___ Muck Presence (A8) **(LRR U)**
- ___ 1 cm Muck (A9) **(LRR P, T)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Coast Prairie Redox (A16) **(MLRA 150A)**
- ___ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) **(LRR P, S, T, U)**
- ___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ___ Thin Dark Surface (S9) **(LRR S, T, U)**
- ___ Loamy Mucky Mineral (F1) **(LRR O)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR U)**
- ___ Depleted Ochric (F11) **(MLRA 151)**
- ___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ___ Umbric Surface (F13) **(LRR P, T, U)**
- ___ Delta Ochric (F17) **(MLRA 151)**
- ___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR O)**
- ___ 2 cm Muck (A10) **(LRR S)**
- ___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** ______ **No** X

Remarks:

Lacks hydric indicators

ATTACHMENT B
Site Photographs

PHOTOGRAPHIC LOG

Project Name:	Location:	
Alternate Laydown Area	Upland Swale	Harris Reservoir Project

Photo No.	Date:
1	09/28/21

Direction Photo Taken:
Southwest

Description:

View of Pit 1 (Upland Swale) looking Southwest

PHOTOGRAPHIC LOG

Project Name:	Location:	
Alternate Laydown Area	Upland Swale	Harris Reservoir Project

Photo No.	Date:
2	09/28/21

Direction Photo Taken:
West

Description:

View of Pit 1 (Upland Swale) looking West

PHOTOGRAPHIC LOG

Project Name: Alternate Laydown Area	Location: Upland Swale	Harris Reservoir Project

Photo No. 3	Date: 09/28/21
Direction Photo Taken:	
Description: Soils—Pit 1 (Upland Swale)	

PHOTOGRAPHIC LOG

Project Name: Alternate Laydown Area	Location: Potential Jurisdictional Area	Harris Reservoir Project

Photo No. 4	Date: 09/28/21
Direction Photo Taken: Northeast	
Description: View of potential jurisdictional drainage (Pit 2 Area)	

PHOTOGRAPHIC LOG

Project Name: Alternate Laydown Area	**Location:** Potential Jurisdictional Area	Harris Reservoir Project

Photo No. 5	**Date:** 09/28/21
Direction Photo Taken: Southwest	
Description: View of potential jurisdictional drainage (Pit 2 Area)	

PHOTOGRAPHIC LOG

Project Name: Alternate Laydown Area	**Location:** Potential Jurisdictional Area	Harris Reservoir Project

Photo No. 6	**Date:** 09/28/21
Direction Photo Taken:	
Description: Soils—Pit 2 (Potential jurisdictional drainage)	

PHOTOGRAPHIC LOG		
Project Name: Alternate Laydown Area	**Location:** Upland – Vicinity of Pit 3	Harris Reservoir Project

Photo No. 7	**Date:** 09/28/21
Direction Photo Taken: West	
Description: View of Pit 3 (Upland) looking West	

PHOTOGRAPHIC LOG		
Project Name: Alternate Laydown Area	**Location:** Upland – Vicinity of Pit 5	Harris Reservoir Project

Photo No. 8	**Date:** 09/28/21
Direction Photo Taken: West	
Description: View of Upland (Pit 5) looking West	

ATTACHMENT C
Archeological/Historical Desktop Survey

August 18, 2021

Cardno

3905 Crescent Park Drive
Riverview, FL 33578
USA

Phone 813 664 4500
Toll-free 800 368 7511
Fax 813 664 0440

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RE: Harris Reservoir Project, Brazoria County, Texas - Archaeological and Historical Review

A desktop review of the area for the proposed facility in Brazoria County, Texas was completed in order to fulfill due diligence. A search of the Texas Historical Commission's (THC) Archeological Sites Atlas revealed that no cultural resource surveys were recorded in the Atlas within one mile of the project area (Figure 1).

Only one archeological site (41BO273) has been recorded within one mile of the project area (Table 1). It was recorded in 2018 during a Phase I archeological survey of a 2200-acre Dow tract. This survey does not appear in the Atlas. The site was recorded as an historic surface scatter with artifacts including brick fragments, concrete, glazed earthenware, a clear glass bottle base, and an amber bottle shard associated with a structure indicated on an historic 1907 plat map. There were no subsurface artifacts recovered. At some point after 1907, the Texas Prison System obtained this land and demolished existing structures to develop farms in the early twentieth century. Site 41BO273 was recommended as ineligible for the National Register of Historic Places (NRHP).

Despite the lack of surveys that have been conducted within the proximity of the project area, the land is extremely disturbed from previous construction projects. In addition, the environment and topography indicate a low probability that archeological sites are present (Figure 2). Therefore, it is not likely that the Texas SHPO will request that a Phase I survey be conducted within the project area.

Please let me know if you have any questions or comments regarding the above desktop assessment. Thank you for the opportunity to help you with this project.

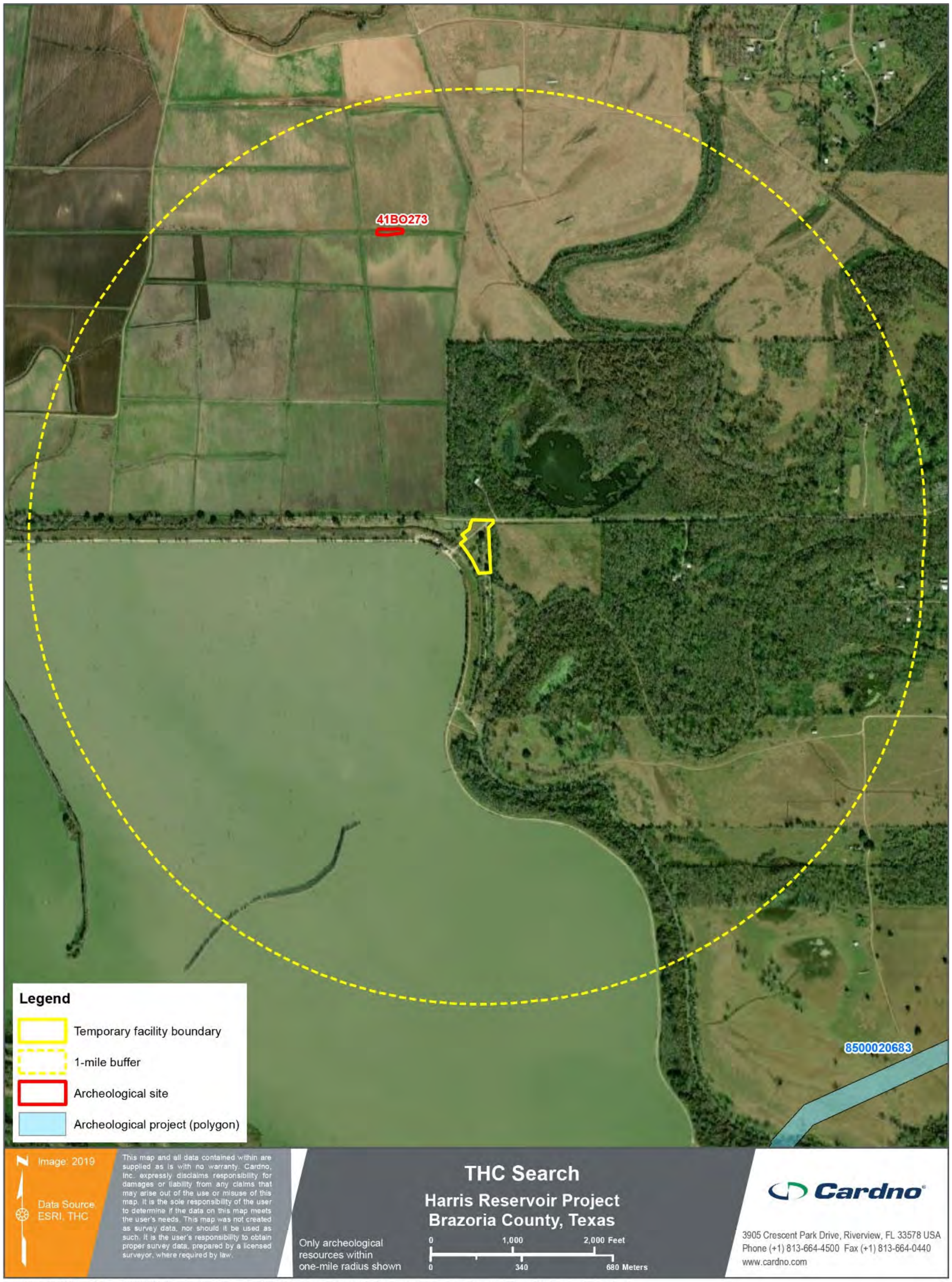

Figure 1 **Map indicating project area boundaries and previous surveys conducted within a mile**

Table 1 Previously Recorded Archeological Site within One Mile of the Project Area

Site Number	Name	Type	Culture	Survey Evaluation	SHPO Evaluation
41BO289	No Name	Historic spill bank/levee and canal	20th century	Not eligible	Not eligible

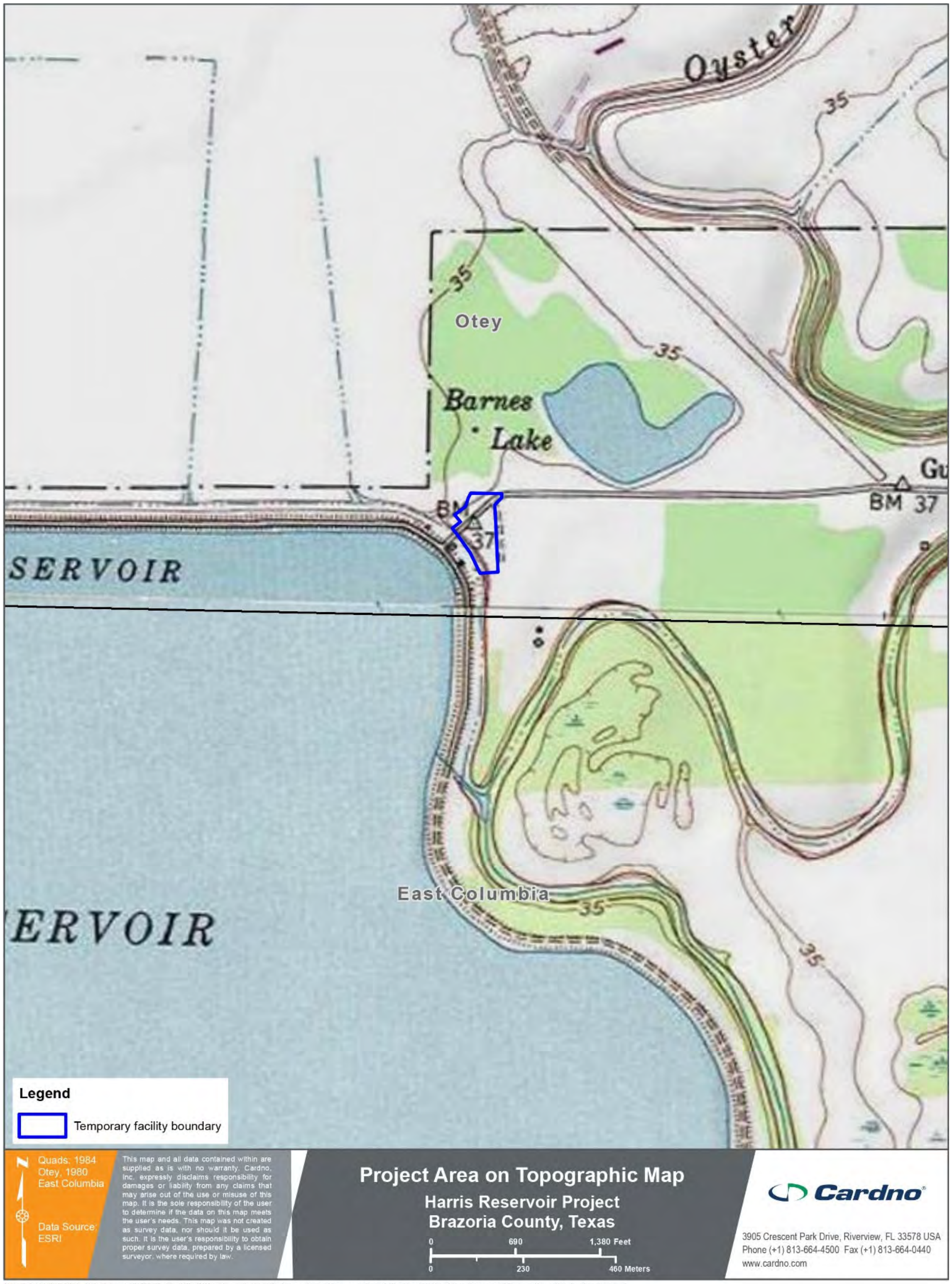

Figure 2 **Project area shown on topographic map**

Sincerely,

Meg Stack, MA, RPA
Project Archaeologist
for Cardno
Direct Line 813-257-0019
Email: meg.stack@cardno.com

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Oyster Creek

Threatened and Endangered Species Assessment

Harris Expansion Project

Project E317502100

Cardno
Shaping the Future

Document Information

Prepared for	CH2M
Project Name	Harris Expansion Project
Project Number	E317502100
Project Manager	Bob Nailon
Date	June 2017

Prepared for:

CH2M

12301 Research Blvd, Suite 250

Austin, TX 78759

Prepared by:

Cardno
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Table of Contents

Appendices

Tables

Acronyms

Dow	The Dow Chemical Company
ESA	Endangered Species Act
GIS	Geographic information systems
GPS	Global positioning systems
HDD	Horizontal directional drill
Project Area	Harris Expansion Project
T&E	Threatened and Endangered
TPWD	Texas Parks and Wildlife Department
U.S.	United States
USACE	United States Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service

Executive Summary

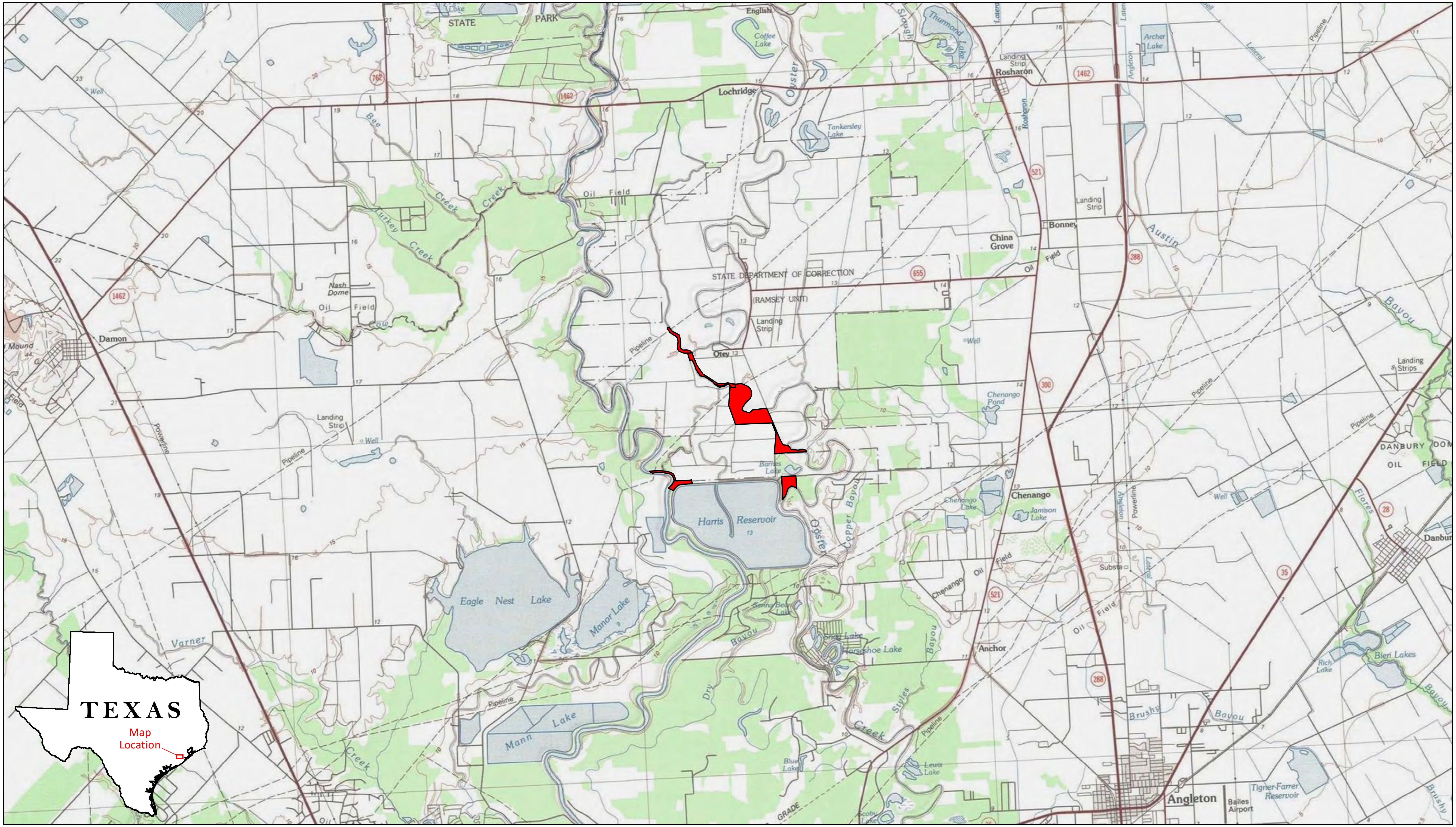
Cardno was contracted by CH2M to conduct a threatened and endangered (T&E) species assessment on specific proposed drainage improvement and equipment and logistics land parcels (Project Area) associated with the Harris Expansion Project near Rosharon, Brazoria County, Texas (Figure 1). The Project Area is located in south central Brazoria County east of the Brazos River. The specific properties are owned by The Dow Chemical Company and the Texas Department of Criminal Justice (TDCJ).The Dow Chemical Company (Dow) desires to expand freshwater storage.

Cardno's Threatened and Endangered (T & E) Species Assessment:

On April 13 through April 27, 2017, Cardno conducted a T&E species field survey in conjunction with a wetland and other "Waters of the U.S." delineation to determine whether potential habitat and evidence of occurrence exist for state and federally listed T&E species (Table 1-1). This Harris Expansion Project report addresses threatened and endangered species that may occur within the boundaries of the Project. The results of the assessment are summarized in this report.

Within the enclosed desktop survey, Cardno biologists identified 26 T&E species listed by TPWD, 10 T&E species listed by the USFWS, and 2 USFWS candidate species listed as potentially occurring in Brazoria County, Texas (Table 1-1). There is one species (Piping Plover) that has critical habitat in Brazoria County, but the proposed project area falls well outside of designated critical habitat for this species.

No listed species (state or federal) were observed during field surveys.



LEGEND

Harris Expansion Project

Figure 1 - Site & Vicinity Map

Harris Expansion Project
The Dow Chemical Company
Brazoria County, Texas

0 0.5 1 1.5 2 2.5
SCALE IN MILES

Cardno
Shaping the Future

Map Prepared/Revised: 6/3/2017

1 Assessment Methodology

The Endangered Species Act (ESA) of 1973 (16 United States Code [USC] A-1535-1543, P.L. 93-205) provides for the protection of plant and animal species that are of aesthetic, ecological, educational, historic and scientific value to the United States. The ESA protects fish, wildlife, plants, and invertebrates that are federally-listed as threatened or endangered. A federally-listed endangered species is any species that is in danger of extinction throughout all or a significant portion of its range, with the exception of certain insect pests. A federally-listed threatened species is any species that is likely to become endangered in the foreseeable future throughout all or a significant portion of its range. In addition to the protection of individual species, federal regulatory protection is afforded to rare natural vegetation communities.

Under the ESA, protection is also given to critical habitat areas, which are defined by the U.S. Fish and Wildlife Service (USFWS) as specific areas both within and outside the geographic range occupied by a species. Critical habitat areas contain physical and biological features essential to species conservation.

In addition to the federal threatened and endangered species list, the Texas Parks and Wildlife Department (TPWD) maintains county-specific state threatened and endangered species lists.

Cardno personnel conducted an assessment of state- and federally-listed T&E species and critical habitats potentially occurring within the Project Area. The assessment included a review of available maps of the area (topographic maps, infrared aerial photography), files and species lists available from the natural resource agencies, and other published information. The Cardno assessment included a search of the USFWS - Texas (by county) T&E Species Report (USFWS 2017) and TPWD Rare, Threatened, and Endangered Species list for Brazoria County (TPWD 2017). All State and Federal T&E Species research was conducted using 2017 data resources

Additionally, Element Occurrence data describing the presence of T&E species in the Project Area documented by TPWD were obtained.

Cardno biologists were alert for any sightings of the listed species and signs of listed species habitat identified as potentially occurring within the Project Area.

2 Results and Findings

Following the initial assessment, a field survey was conducted in conjunction with the wetland assessment. Cardno scientists were alert for any sightings of the listed species and signs of listed species habitat identified as potentially occurring within Brazoria County.

There are 26 T&E species listed by TPWD, 10 T&E species listed by the USFWS, and 2 TPWD candidate species listed as potentially occurring in Brazoria County, Texas (Table 1-1). There is one species (Piping Plover) that has critical habitat in Brazoria County, but the proposed Project Area falls well outside of designated critical habitat for this species.

The Project is not expected to adversely impact any of the listed species. In addition, there were no sightings of the listed species during the field survey. As per the TPWD Element Occurrence Database, no critically listed species and or wading bird rookeries have been listed within the Project Area. Additionally, no critical habitats or other state- or federally-listed species were observed in or adjacent to, the Project Area during field surveys.

Table 2-1 Brazoria County Listed Threatened and Endangered Species

Group	Common Name	Scientific Name	Federal Status	State Status	Critical Habitat Present?
Birds	American peregrine falcon	*Falco peregrinus anatum*		Threatened	N
	Bald eagle	*Haliaeetus leucocephalus*		Threatened	N
	Eskimo curlew	*Numenius borealis*		Endangered	N
	Peregrine falcon	*Falco peregrinus*		Threatened	N
	Piping plover	*Charadrius melodus*	Threatened	Threatened	N
	Red knot	*Calidris canutus rufa*	Threatened		N
	Reddish egret	*Egretta rufescens*		Threatened	N
	Sooty tern	*Sterna fuscata*		Threatened	N
	Sprague's pipit	*Anthus spragueeii*			N
	White-faced ibis	*Plegadis chihi*		Threatened	N
	White-tailed hawk	*Buteo albicaudatus*		Threatened	N
	Whooping crane	*Grus americana*	Endangered	Endangered	N
	Wood stork	*Mycteria americana*		Threatened	N
Fish	Sharpnose shiner	*Notropis oxyrhynchus*			N
	Smalltooth sawfish	*Pristis pectinata*		Endangered	N
Mammals	Jaguarundi	*Herpailurus yaguarondi*		Endangered	N
	Louisiana black bear	*Ursus americanus luteolus*		Threatened	N
	Ocelot	*Leopardus pardalis*		Endangered	N
	Red Wolf	*Canis rufus*		Endangered	N
	West Indian manatee	*Trichechus manatus*	Threatened	Endangered	N
Mollusks	Smooth pimpleback	*Quadrula houstonensis*	Candidate	Threatened	N
	Texas fawnsfoot	*Truncilla macrodon*	Candidate	Threatened	N

Table 2-1	**Brazoria County Listed Threatened and Endangered Species**				
Group	**Common Name**	**Scientific Name**	**Federal Status**	**State Status**	**Critical Habitat present?**
Reptiles	Alligator snapping turtle	*Macrochelys temminckii*		Threatened	N
	Atlantic hawksbill sea turtle	*Eretmochelys imbricata*	Endangered	Endangered	N
	Green sea turtle	*Chelonia mydas*		Threatened	N
	Kemp's Ridley sea turtle	*Lepidochelys kempii*	Endangered	Endangered	N
	Leatherback sea turtle	*Dermochelys coriacea*	Endangered	Endangered	N
	Loggerhead sea turtle	*Caretta caretta*	Threatened	Threatened	N
	Texas horned lizard	*Phrynosoma cornutum*		Threatened	N
	Timber/Canebreak rattlesnake	*Crotalus horridus*		Threatened	N

State and federally-listed T&E species potentially occurring within the Project Area are described in the next section.

2.1 Birds

Bald Eagle (*Haliaeetus leucocephalus*) – The bald eagle is known to potentially occur in Brazoria County. Bald eagles are primarily found near rivers and large lakes, and nest in tall trees or on cliffs near water. They are opportunistic predators that hunt live prey, including fish and waterfowl, they scavenge, or pirate food from other birds (TPWD 2014).

Although a portion of the Project is located along the Brazos River and suitable bald eagle habitat may exist within the Project Area, no bald eagles or nests were observed during field surveys. Construction activities may cause only minor, short-term disturbances in a localized area if any bald eagles were present in the immediate vicinity of the Project Area. Disturbance impacts would likely result in species avoidance of the area during project activities. The Project is not likely to adversely affect the bald eagle.

Eskimo Curlew (*Numenius borealis*) – The Eskimo curlew is a historic small shorebird whose habitat includes grasslands, pastures, plowed fields and, less frequently, marshes and mudflats.

Although possible Eskimo curlew habitat exists within the Project Area, no Eskimo curlews were observed during field surveys. The last confirmed sightings were in 1962 on Galveston Island, TX; therefore, since it has not been seen in over 50 years, the Eskimo curlew is now considered possibly extinct.

Peregrine Falcon (Falco peregrinus) – Two subspecies of the peregrine falcon are known to occur in Brazoria County, Texas. The American peregrine falcon (*Falco peregrinus anatum*) is a year-round resident of west Texas and breeds locally, nesting in tall cliff eyries; the arctic peregrine falcon (*Falco peregrines tundrius*) is a highly migratory bird that winters in Texas. Peregrine falcons migrate across Texas to winter along the coast. They stop at a wide range of habitats during migration including lake shores, coastlines, and barrier islands (TPWD 2014).

Peregrine falcons are not expected to reside in the Project Area, thus impacts due to construction are not *likely to adversely affect this species. Furthermore, no peregrine falcons were observed during field surveys. While this species may transit the Project Area during migration periods, it's highly mobile and, should they occur within the Project vicinity during construction activities, they would temporarily avoid the area.*

Piping Plover (*Charadrius melodus*) – The piping plover is a small shorebird and a winter migrant along the Texas Gulf Coast. Piping plover habitat includes beaches and bayside mud or salt flats (TPWD 2014

No piping plovers were observed during field surveys and no suitable beach habitat exists within the Project Area. T herefore, the Project is not likely to adversely affect the piping plover.

Red Knot (*Calindris canutus rufa*) – The red knot migrates long distances in flocks northward through the contiguous United States mainly April-June, and southward July-October. The red knot prefers the shoreline of coast and bays and also uses mudflats during inland encounters. Red knots are known to winter in Brazoria County, and prefers seacoasts on tidal flats and beaches, herbaceous wetland, and tidal flat/shore. (TPWD 2014).

No suitable habitat was observed within the Project Area and no individuals were observed during field surveys. Therefore, the proposed Project is not likely to adversely affect the red knot.

Reddish Egret (*Egretta rufescens*) – The reddish egret is a resident of the Texas Gulf Coast. This egret prefers brackish marshes, shallow salt ponds, and tidal flats; nests on the ground or in trees or bushes, on dry coastal islands in brushy thickets or yucca or prickly pear (TPWD 2014).

No suitable habitat was observed within the Project Area and no individuals were observed during field surveys. Due to the distance from the Project Area to suitable habitat, the proposed Project is not likely to adversely affect the reddish egret.

Sooty Tern (*Sterna fuscata)* – This species is generally far out at sea, avoiding shallow waters and areas near mainland coast. Breeding occurs April-July, and sooty terns mostly nest on small islands, on open sandy beaches with sparse vegetation (TPWD 2014).

Neither suitable sandy beach habitat nor individuals were observed in the Project Area; therefore, the proposed Project is not likely to adversely impact the sooty tern.

Sprague's Pipit (*Anthus spragueii)* – This species is a diurnal migrant that is found in Texas from mid-September to early April. Sprague's pipit habitat includes native upland prairie and coastal grasslands. This species is sensitive to patch size and avoids edge habitat (TPWD 2014).

Although potential suitable contiguous, native prairie habitat was observed in the Project Area, construction activities may cause only minor, short-term disturbances in a localized area if any Sprague's Pipit were present in the immediate vicinity of the Project Area. Disturbance impacts would likely result in species avoidance of the area during project activities; therefore, the proposed p roject is not likely to adversely impact Sprague's pipit.

White-faced Ibis (*Plegadis chihi*) – The white-faced ibis is not known to potentially occur in the Project Area. White-faced ibis favors very shallow water as in freshwater marshes, sloughs, flooded pastures and irrigated fields. These ibis nest in marshes, low trees, and on the ground in bulrushes or reeds, or on floating mats of vegetation (TPWD 2014).

Potential suitable habitat was observed within the Project Area. No white-faced ibis were observed during field surveys. Construction activities could cause minor disturbances to white-faced ibis if found in the immediate vicinity of the Project Area. Disturbance impacts would likely result in species avoidance of the area but likely would return upon completion of construction activities. Additionally, conducting construction activities in the summer months would limit any impacts to nesting/brood-rearing. Therefore, the proposed Project is not likely to adversely affect the white-faced ibis.

White-tailed hawk (*Buteo albicaudatus*) – The white-tailed hawk can be found along the Texas Gulf Coast and prefers habitats of coastal prairie, cordgrass flats, and scrub-live oak; these hawks can also be found further inland on prairies, mesquite and oak savannas, and mixed savanna-chaparral.

Possible suitable coastal prairie or oak savannas were observed within the Project Area. No individuals *were observed during field surveys. Construction activities could cause minor disturbances to white-tailed hawk if found in the immediate vicinity of the Project Area. Disturbance impacts would likely result in species avoidance of the area but would return upon completion of construction activities.*

Whooping Crane (*Grus americana*) – The whooping crane breeds, migrates, winters, and forages in a variety of wetland and other habitats, including coastal marshes and estuaries, inland marshes, lakes, ponds, wet meadows and rivers, and agricultural fields. The whooping crane favors prairie pools and marshes in the summer, and coastal marsh in the winter. This species is a potential migrant via plains throughout most of state to the coast. There is one known flock that winters on the central Texas coast and flies north to nest in central Canada.

No suitable prairie pools or coastal marsh were observed within the Project Area and no individuals were observed during field surveys.

Wood Stork (*Mycteria americana*) – The wood stork is not known to potentially occur in the Project Area. Wood storks are associated with shallow standing fresh- and saltwater, including prairie ponds, flooded pastures, ditches, mud flats and wetlands. They roost communally in tall snags and may be found in wetlands associated with forested areas. This species has not been documented as nesting in Texas since 1960 (TPWD 2014).

Although possible wood stork habitat was observed in the Project Area, no individuals were observed during field surveys. Construction activities could result in negligible disturbance to wood stork, if found in the immediate vicinity of the Project. The species is highly mobile and would avoid the area during construction activities. The proposed Project is not likely to adversely affect the wood stork.

2.2 Fish

Sharpnose Shiner (*Notropis oxyrhynchus*) – The sharpnose shiner is endemic to the Brazos River drainage, and has also apparently been introduced into the adjacent Colorado River drainage. The sharpnose shiner's habitat is primarily large turbid rivers, with bottoms of a combination of sand, gravel, and clay mud. Originally, the sharpnose shiner's historical habitat included the lower Brazos River, but according to the USFWS, their current habitat is now restricted to the contiguous river segments of the upper Brazos River basin in north-central Texas (USFWS. 2014a).

Suitable sharpnose shiner habitat is located within the Project Area. Portions of the Project Area are located in an along the banks of the Brazos River and Oyster Creek. Although streambank improvements and mitigation construction are proposed along Oyster Creek, aquatic habitats along Oyster Creek and the Brazos River would not be disturbed. Construction activities may cause only minor, short-term disturbances in a localized area if any sharpnose shiner were present in the immediate vicinity of the Project Area. Disturbance impacts would likely result in species avoidance of the area during project activities. The Project is not likely to adversely affect the sharpnose shiner.

Smalltooth Sawfish (*Pristis pectinata*) – The smalltooth sawfish has varying habitat use patterns during different life stages. Young sawfish are found close to the shore in muddy and sand bottoms; in sheltered bays, shallow banks, and estuaries and river mouths. Adult sawfish utilize various habitat types, such as mangrove, reef, seagrass, and coral; in varying salinity regimes, temperatures, and water depths. They feed on a variety of fish species and crustaceans (TPWD 2014).

No suitable smalltooth sawfish habitat is located within the Project Area. The Project Area is located in along a river, though no mangroves, reefs, or seagrass are present. Therefore, the proposed project would have no effect on the smalltooth sawfish.

2.3 Mammals

Jaguarundi (*Herpailurus yaguarondi*) – The Jaguarundi favors habitat in thick brushlands, especially near water; 60 to 75 day gestation, young born sometimes twice per year in March and August, elsewhere the beginning of the rainy season and end of the dry season

No suitable habitat of thick brushlands were found near the Project Area and the jaguarundi is not known to exist in the vicinity of the Project Area. Construction activities would have no effect on the jaguarundi.

Louisiana Black Bear (*Ursus americanus luteolus*) – The Louisiana black bear is a state-listed threatened species known to formerly occur in the Project Area. The Louisiana black bear would only be possible as a transient as it prefers bottomland hardwoods and large tracts of inaccessible forested areas (TPWD 2014).

The Project Area does not contain suitable habitat for the Louisiana black bear. The Project Area is primarily upland pasture and croplands and does not contain large areas of dense hardwood forest. The Project would likely have no effect this species.

Ocelot (*Leopardus pardalis*) – The ocelot can be found in dense chaparral thickets, mesquite-thorn scrub and live oak mottes. Ocelots avoid open areas and breed June-November.

No suitable habitat of chaparral thickets were found near the Project Area and the ocelot is not known to exist in the vicinity of the Project Area. Construction activities would have no effect on the ocelot.

Red Wolf (*Canis rufus*) – The red wolf is extirpated, though the species was formerly known throughout the eastern half of Texas in brushy and forested areas, as well as coastal prairies (TPWD 2014).

The red wolf is not known to exist in Texas or the vicinity of the Project Area. Construction activities would have no effect on the red wolf.

West Indian Manatee (*Trichechus manatus*) – The West Indian manatee can be found in the Gulf of Mexico and habitat includes warm freshwater, estuarine and marine environments. This species seeks out natural, warm-water sites including springs, deep water areas, and areas thermally influenced by the Gulf Stream. Manatees forage for which include but are not limited to: cord grass, alga, turtle grass, shoal grass, manatee grass, and eel grass. (USFWS 2014b).

The proposed Project is in upland pastureland and cropland habitat with sparse riparian habitat along the Brazos River. No suitable marine environment for the manatee is present in the Project Area. The proposed Project would have no effect on the manatee.

2.4 Mollusks

Smooth Pimpleback (*Quadrula houstonensis*) – The smooth pimpleback is a nearly round, thick-shelled freshwater mussel. This species has been found in mixed mud, sand, and fine gravel substrate in medium-to-large rivers and some reservoirs. Other species in the same genus (Quadrula) successfully parasitize catfish, and it is likely smooth pimpleback does as well. Adult freshwater mussels are filter-feeders, siphoning algae, bacteria, detritus, microscopic animals, and dissolved organic matter. The smooth pimpleback has been nearly extirpated from the Colorado River basin, but a few small populations persist in the Brazos River basin. Recent surveys suggest a greater abundance and distribution of the smooth pimpleback in the central and lower Brazos River drainage than was indicated by collections from the past 40 years, with five populations represented by more than a few individuals. Smooth pimpleback are more numerous in the lower mainstem Brazos River. There are no historical records of this species occurring as far downstream as Fort Bend County.

Portions of the Project Area are located along the bank of the Brazos River, but since no populations have been documented as far south as Brazoria County, the smooth pimpleback mussel is not expected to be present in the Project vicinity. The proposed Project would have no effect on the smooth pimpleback.

Texas Fawnsfoot (*Truncilla macrodon*) – The Texas fawnsfoot is a small, thin-shelled freshwater mussel, but since the species has not been found alive for many years, very little information is available about its habitat preferences. In the past, only Texas fawnsfoot shells and recently dead individuals were occasionally found along rivers following drought-related dewatering or bank deposition after high floods. These shells and recently dead individuals indicated that the Texas fawnsfoot occurs in flowing water, as it was never found in ponds, lakes, or reservoirs, suggesting that it is intolerant of deep, low-velocity waters created by artificial impoundments. The recently discovered live population in the Brazos River in Grimes and Washington Counties, Texas indicates that the species occurs in rivers with soft, sandy sediment with moderate water flow (Randkley et al. 2010).

Portions of the Project Area are located along the bank of the Brazos River. The recently discovered live population in the Brazos River in Grimes and Washington Counties, Texas indicates that the species occurs in rivers with soft, sandy sediment with moderate water flow, so it is not expected to be present in the Project vicinity. The proposed Project would have no effect on the Texas fawnsfoot.

2.5 Reptiles

Alligator Snapping Turtle (*Macroclemys temminckii*) – Alligator snapping turtles are found in deep, flowing waters of perennial rivers, canals, lakes, oxbows, swamps, bayous, and ponds. They typically occur in water with abundant aquatic vegetation and muddy sediments (TPWD 2014).

The proposed Project is located along the bank of the Brazos River which might serve as potential habitat for the alligator snapping turtle. Disturbance impacts would likely result in species avoidance of the area during Project activities. The proposed Project is not likely to adversely affect the alligator snapping turtle.

Atlantic hawksbill sea turtle (*Eretmochelys imbricate)* – The Atlantic hawksbill sea turtle is found in warm, shallow waters in gulf and bay systems. Habitat for juveniles of this species is floating vegetation mats. Atlantic hawksbill sea turtles feed on a variety of invertebrates, including crustaceans, mollusks, jellyfish and sponges. The Atlantic hawksbill sea turtle nesting season is from April through November (TPWD 2014).

The proposed Project is located inland and no hawksbill sea turtle habitat exists within the Project Area. The proposed Project would have no effect on the Atlantic hawksbill sea turtle.

Green sea turtle (*Chelonia mydas)* – Green sea turtle habitat includes shallow seagrass beds and open water in gulf and bay systems. Juveniles feed on marine invertebrates, then transition to feeding on sea grasses and seaweeds. Adults are herbivorous. Green sea turtles nest on barrier island beaches from March to October (TPWD 2014).

Portions of the proposed Project Area are located along an inland river and no green sea turtle habitat exists within the Project Area. The proposed Project would have no effect on the green sea turtle.

Kemp's Ridley sea turtle (*Lepidochelys kempii)* –Kemp's Ridley sea turtle habitat includes shallow waters and bays of the Gulf of Mexico. Juveniles feed on sargassum and associated fauna, while adult Kemp's Ridley sea turtles feed on crabs, other crustaceans, snails and plants. The females come ashore only to lay eggs, and nesting season is from April through August (TPWD 2014).

Portions of the proposed Project Area are located along an inland River and no sea turtle habitat exists within the Project Area. The proposed Project would have no effect on the Kemp's Ridley sea turtle.

Leatherback sea turtle (*Dermochelys coriacea)* – Leatherback sea turtle habitat includes the Gulf of Mexico and associated bays. Leatherback sea turtles are omnivorous, and show a preference for jellyfish. The leatherback sea turtle nesting season is from March to August (TPWD 2014).

Portions of the proposed Project Area are located along an inland river and no sea turtle habitat exists within the Project Area. The proposed Project would have no effect on the leatherback sea turtle.

Loggerhead sea turtle (*Caretta caretta)* – Juvenile loggerhead sea turtle habitat includes the Gulf of Mexico and associated bays; adults are pelagic. Loggerhead sea turtles are omnivorous, with a very broad diet. The nesting season for loggerhead sea turtles is from April through November (TPWD 2014).

Portions of the proposed Project Area are located along the bank of an inland river and no loggerhead sea turtle habitat exists within the Project Area. The proposed Project would have no effect on the loggerhead sea turtle.

Texas Horned Lizard (*Phrynosoma cornutum*) – The Texas horned lizard inhabits sandy fields, dunes, open, arid, and semi-arid regions with sparse vegetation, including cactus, grass and scattered brush.

When inactive, the Texas horned lizard burrows into the soil, under rocks, or enters rodent burrows (TPWD 2014).

No suitable Texas horned lizard habitat or individuals were observed in the Project Area during field surveys; therefore the proposed Project is expected to have no effect on the Texas horned lizard.

Timber/Canebrake Rattlesnake (*Crotalus horridus*) – Timber/canebrake rattlesnake habitat includes upland pine and deciduous woodlands, riparian zones, moist lowland forests, and swamps near permanent water sources. This species prefers areas with dense ground cover, such as grapevines or palmetto, and may seek refuge in tree stumps, logs and branches (TPWD 2014).

The Project Area is located in a riparian zone and may be suitable habitat for this species. Construction activities could cause negligible disturbances to timber/canebrake rattlesnakes if found in the immediate vicinity of the Project area. Disturbance impacts would likely result in species avoidance of the area during project activities. Additionally, conducting construction activities in the summer months when this species is active would allow any individuals within the vicinity to avoid the area during construction. The proposed Project is not likely to adversely affect the timber/canebrake rattlesnake.

3 Conclusions

Within the enclosed desktop survey, Cardno biologists identified 26 T&E species listed by TPWD, 10 T&E species listed by the USFWS, and 2 USFWS candidate species listed as potentially occurring in Brazoria County, Texas (Table 1-1). There is one species (Piping Plover) that has Federally-Listed critical habitat in Brazoria County, but the proposed project area falls well outside of designated critical habitat for this species.

No listed species (state or Federal) were observed during field surveys. Impacts to T&E species as a result of Project construction would be limited to minor, short-term temporary impacts associated with enhancing and re-establishing riparian habitats. Any disturbance impacts would likely result in a species avoidance of the area during construction activities. If any of the species documented within this report are encountered during construction activities, construction would be shut down immediately and that particular species would be allowed to vacate the Project vicinity without harassment prior to work commencing.

4 References

Randkley, C.R., B.J. Lundeen, R.G. Howells, and J.H. Kennedy. 2010. *First Account of a Living Population of Texas Fawnsfoot, Truncilla macrodon (Bivalvia: Unionidae), in the Brazos River, Texas.* The Southwestern Naturalist 55(2):297-298. 2010. *doi:* http://dx.doi.org/10.1894/JS-31.1

Texas Parks and Wildlife Department (TPWD). 2017. Rare, Threatened and Endangered Species of Texas, Annotated County Lists of Rare Species. Available at http://tpwd.texas.gov/gis/rtest/. Accessed May 2017.

Texas Parks and Wildlife Department (TPWD). 2017a. Texas River Basins, Major Bays and Streams. Available on-line: http://www.tpwd.state.tx.us/publications/pwdpubs/media/pwd_mp_e0100_1070k_08.pdf. Accessed

United States Fish and Wildlife Service (USFWS). 2014a. Species Status Assessment Report for the Sharpnose Shiner (*Notropis oxyrhynchus*) and Smalleye Shiner (*N. buccula*). Prepared by the Arlington, Texas Ecological Field Office USFWS. Available on-line: https://www.fws.gov/southwest/es/arlingtontexas/pdf/20140721%20SSA-Report_Brazos-Shiners.pdf

United States Fish and Wildlife Service (USFWS). 2014b. West Indian manatee (*Trichechus manatus*). Last updated 16 December 2014. Available on-line: http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=A007.

United States Fish and Wildlife Service (USFWS). 2017. Species by County Report--IPAC.. Available on-line: http://www.fws.gov/endangered/. Accessed May 19, 2017.

ATTACHMENT

A

USFWS IpaC Report

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Texas Coastal Ecological Services Field Office
17629 El Camino Real #211
Houston, TX 77058
Phone: (281) 286-8282 Fax: (281) 488-5882
http://www.fws.gov/southwest/es/TexasCoastal/
http://www.fws.gov/southwest/es/ES_Lists_Main2.html

In Reply Refer To: May 19, 2017
Consultation Code: 02ETTX00-2017-SLI-1238
Event Code: 02ETTX00-2017-E-02242
Project Name: Floodplain Mitigation Properties--Harris Expansion Project

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The U.S. Fish and Wildlife Service (Service) field offices in Clear Lake, Tx, and Corpus Christi, Tx, have combined administratively to form the Texas Coastal Ecological Services Field Office. A map of the Texas Coastal Ecological Services Field Office area of responsibility can be found at: http://www.fws.gov/southwest/es/TexasCoastal/Map.html. All project related correspondence should be sent to the field office responsible for the area in which your project occurs. For projects located in southeast Texas please write to: Field Supervisor; U.S. Fish and Wildlife Service; 17629 El Camino Real Ste. 211; Houston, Texas 77058. For projects located in southern Texas please write to: Field Supervisor; U.S. Fish and Wildlife Service; P.O. Box 81468; Corpus Christi, Texas 78468-1468. For projects located in six counties in southern Texas (Cameron, Hidalgo, Starr, Webb, Willacy, and Zapata) please write: Santa Ana NWR, ATTN: Ecological Services Sub Office, 3325 Green Jay Road, Alamo, Texas 78516.

The enclosed species list identifies federally threatened, endangered, and proposed to be listed species; designated critical habitat; and candidate species that may occur within the boundary of your proposed project and/or may be affected by your proposed project.

New information from updated surveys, changes in the abundance and distribution of species, changes in habitat conditions, or other factors could change the list. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. The Service recommends that verification be completed by visiting the ECOS-IPaC website http://ecos.fws.gov/ipac/ at regular intervals during project planning and implementation for updates to species list and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

Candidate species have no protection under the Act but are included for consideration because they could be listed prior to the completion of your project. The other species information should help you determine if suitable habitat for these listed species exists in any of the proposed project areas or if project activities may affect species on-site, off-site, and/or result in "take" of a federally listed species.

"Take" is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. In addition to the direct take of an individual animal, habitat destruction or modification can be considered take, regardless of whether it has been formally designated as critical habitat, if the activity results in the death or injury of wildlife by removing essential habitat components or significantly alters essential behavior patterns, including breeding, feeding, or sheltering.

Section 7

Section 7 of the Act requires that all Federal agencies consult with the Service to ensure that actions authorized, funded or carried out by such agencies do not jeopardize the continued existence of any listed threatened or endangered species or adversely modify or destroy critical habitat of such species. It is the responsibility of the Federal action agency to determine if the proposed project may affect threatened or endangered species. If a "may affect" determination is made, the Federal agency shall initiate the section 7 consultation process by writing to the office that has responsibility for the area in which your project occurs.

Is not likely to adversely affect - the project may affect listed species and/or critical habitat; however, the effects are expected to be discountable, insignificant, or completely beneficial. Certain avoidance and minimization measures may need to be implemented in order to reach this level of effects. The Federal agency or the designated non-Federal representative should seek written concurrence from the Service that adverse effects have been eliminated. Be sure to include all of the information and documentation used to reach your decision with your request for concurrence. The Service must have this documentation before issuing a concurrence.

Is likely to adversely affect - adverse effects to listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not discountable, insignificant, or beneficial. If the overall effect of the proposed action is beneficial to the listed species but also is likely to cause some adverse effects to individuals of that species, then the proposed action "is likely to adversely affect" the listed species. An "is likely to adversely affect" determination requires the Federal action agency to initiate formal section 7 consultation with this office.

No effect - the proposed action will not affect federally listed species or critical habitat (i.e., suitable habitat for the species occurring in the project county is not present in or adjacent to the action area). No further coordination or contact with the Service is necessary. However, if the project changes or additional information on the distribution of listed or proposed species becomes available, the project should be reanalyzed for effects not previously considered.

Regardless of your determination, the Service recommends that you maintain a complete record of the evaluation, including steps leading to the determination of affect, the qualified personnel conducting the evaluation, habitat conditions, site photographs, and any other related articles.

Please be advised that while a Federal agency may designate a non-Federal representative to conduct informal consultations with the Service, assess project effects, or prepare a biological assessment, the Federal agency must notify the Service in writing of such a designation. The Federal agency shall also independently review and evaluate the scope and contents of a biological assessment prepared by their designated non-Federal representative before that document is submitted to the Service.

The Service's Consultation Handbook is available online to assist you with further information on definitions, process, and fulfilling Act requirements for your projects at:
http://www.fws.gov/endangered/esa-library/pdf/esa_section7_handbook.pdf

Section 10

If there is no federal involvement and the proposed project is being funded or carried out by private interests and/or non-federal government agencies, and the project as proposed may affect listed species, a section 10(a)(1)(B) permit is recommended. The Habitat Conservation Planning Handbook is available at:
http://www.fws.gov/endangered/esa-library/pdf/HCP_Handbook.pdf

Service Response

Please note that the Service strives to respond to requests for project review within 30 days of receipt, however, this time period is not mandated by regulation. Responses may be delayed due to workload and lack of staff. Failure to meet the 30-day timeframe does not constitute a concurrence from the Service that the proposed project will not have impacts to threatened and endangered species.

Proposed Species and/or Proposed Critical Habitat

While consultations are required when the proposed action may affect listed species, section 7(a)(4) was added to the ESA to provide a mechanism for identifying and resolving potential conflicts between a proposed action and proposed species or proposed critical habitat at an early planning stage. The action agency should seek conference from the Service to assist the action agency in determining effects and to advise the agency on ways to avoid or minimize adverse effect to proposed species or proposed critical habitat.

Candidate Species

Candidate species are species that are being considered for possible addition to the threatened and endangered species list. They currently have no legal protection under the ESA. If you find you have potential project impacts to these species the Service would like to provide technical assistance to help avoid or minimize adverse effects. Addressing potential impacts to these species at this stage could better provide for overall ecosystem healh in the local area and ay avert potential future listing.

Several species of freshwater mussels occur in Texas and four are candidates for listing under the ESA. The Service is also reviewing the status of six other species for potential listing under the ESA. One of the main contributors to mussel die offs is sedimentation, which smothers and suffocates mussels. To reduce sedimentation within rivers, streams, and tributaries crossed by a project, the Service recommends that that you implement the best management practices found at: http://www.fws.gov/southwest/es/TexasCoastal/FreshwaterMussels.html.

Candidate Conservation Agreements (CCAs) or Candidate Conservation Agreements with Assurances (CCAAs) are voluntary agreements between the Service and public or private entities to implement conservation measures to address threats to candidate species. Implementing conservation efforts before species are listed increases the likelihood that simpler, flexible, and more cost-effective conservation options are available. A CCAA can provide participants with assurances that if they engage in conservation actions, they will not be required to implement additional conservation measures beyond those in the agreement. For additional information on CCAs/CCAAs please visit the Service's website at http://www.fws.gov/endangered/what-we-do/cca.html.

Migratory Birds

The Migratory Bird Treaty Act (MBTA) implements various treaties and conventions for the protection of migratory birds. Under the MBTA, taking, killing, or possessing migratory birds is unlawful. Many may nest in trees, brush areas or other suitable habitat. The Service recommends activities requiring vegetation removal or disturbance avoid the peak nesting period of March through August to avoid destruction of individuals or eggs. If project activities must be conducted during this time, we recommend surveying for active nests prior to commencing work. A list of migratory birds may be viewed at http://www.fws.gov/migratorybirds/regulationspolicies/mbta/mbtandx.html.

The bald eagle (Haliaeetus leucocephalus) was delisted under the Act on August 9, 2007. Both the bald eagle and the goden eagle (Aquila chrysaetos) are still protected under the MBTA and BGEPA. The BGEPA affords both eagles protection in addition to that provided by the MBTA, in particular, by making it unlawful to "disturb" eagles. Under the BGEPA, the Service may issue limited permits to incidentally "take" eagles (e.g., injury, interfering with normal breeding, feeding, or sheltering behavior nest abandonment). For more information on bald and golden eagle management guidlines, we recommend you review information provided at http://www.fws.gov/midwest/eagle/pdf/NationalBaldEagleManagementGuidelines.pdf.

The construction of overhead power lines creates threats of avian collision and electrocution. The Service recommends the installation of underground rather than overhead power lines whenever possible. For new overhead lines or retrofitting of old lines, we recommend that project developers implement, to the maximum extent practicable, the Avian Power Line Interaction Committee guidelines found at http://www.aplic.org/.

Meteorological and communication towers are estimated to kill millions of birds per year. We recommend following the guidance set forth in the Service Interim Guidelines for

Recommendations on Communications Tower Siting, Constructions, Operation and Decommissioning, found online at: http://www.fws.gov/habitatconservation/communicationtowers.html, to minimize the threat of avian mortality at these towers. Monitoring at these towers would provide insight into the effectiveness of the minimization measures. We request the results of any wildlife mortality monitoring at towers associated with this project.

We request that you provide us with the final location and specifications of your proposed towers, as well as the recommendations implemented. A Tower Site Evaluation Form is also available via the above website; we recommend you complete this form and keep it in your files. If meteorological towers are to be constructed, please forward this completed form to our office.

More information concerning sections 7 and 10 of the Act, migratory birds, candidate species, and landowner tools can be found on our website at: http://www.fws.gov/southwest/es/TexasCoastal/ProjectReviews.html.

Wetlands and Wildlife Habitat

Wetlands and riparian zones provide valuable fish and wildlife habitat as well as contribute to ood control, water quality enhancement, and groundwater recharge. Wetland and riparian vegetation provides food and cover for wildlife, stabilizes banks and decreases soil erosion. These areas are inherently dynamic and very sensitive to changes caused by such activities as overgrazing, logging, major construction, or earth disturbance. Executive Order 11990 asserts that each agency shall provide leadership and take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial value of wetlands in carrying out the agency's responsibilities. Construction activities near riparian zones should be carefully designed to minimize impacts. If vegetation clearing is needed in these riparian areas, they should be re-vegetated with native wetland and riparian vegetation to prevent erosion or loss of habitat. We recommend minimizing the area of soil scarification and initiating incremental re-establishment of herbaceous vegetation at the proposed work sites. Denuded and/or disturbed areas should be re-vegetated with a mixture of native legumes and grasses. Species commonly used for soil stabilization are listed in the Texas Department of Agriculture's (TDA) Native Tree and Plant Directory, available from TDA at P.O. Box 12847, Austin, Texas 78711. The Service also urges taking precautions to ensure sediment loading does not occur to any receiving streams in the proposed project area. To prevent and/or minimize soil erosion and compaction associated with construction activities, avoid any unnecessary clearing of vegetation, and follow established rights-of-way whenever possible. All machinery and petroleum products should be stored outside the oodplain and/or wetland area during construction to prevent possible contamination of water and soils.

Wetlands and riparian areas are high priority fish and wildlife habitat, serving as important sources of food, cover, and shelter for numerous species of resident and migratory wildlife. Waterfowl and other migratory birds use wetlands and riparian corridors as stopover, feeding, and nesting areas. We strongly recommend that the selected project site not impact wetlands and riparian areas, and be located as far as practical from these areas. Migratory birds tend to concentrate in or near wetlands and riparian areas and use these areas as migratory yways or corridors. After every effort has been made to avoid impacting wetlands, you anticipate unavoidable wetland impacts will occur; you should contact the appropriate U.S. Army Corps of Engineers office to determine if a permit is necessary prior to commencement of construction activities.

If your project will involve filling, dredging, or trenching of a wetland or riparian area it may require a Clean Water Act Section 404 permit from the U.S. Army Corps of Engineers (COE). For permitting requirements please contact the U.S. Corps of Engineers, District Engineer, P.O. Box 1229, Galveston, Texas 77553-1229, (409) 766-3002.

Beneficial Landscaping

In accordance with Executive Order 13112 on Invasive Species and the Executive Memorandum on Beneficial Landscaping (42 C.F.R. 26961), where possible, any landscaping associated with project plans should be limited to seeding and replanting with native species. A mixture of grasses and forbs appropriate to address potential erosion problems and long-term cover should be planted when seed is reasonably available. Although Bermuda grass is listed in seed mixtures, this species and other introduced species should be avoided as much as possible. The Service also recommends the use of native trees, shrubs, and herbaceous species that are adaptable, drought tolerant and conserve water.

State Listed Species

The State of Texas protects certain species. Please contact the Texas Parks and Wildlife Department (Endangered Resources Branch), 4200 Smith School Road, Austin, Texas 78744 (telephone 512/389-8021) for information concerning fish, wildlife, and plants of State concern or visit their website at:
http://www.tpwd.state.tx.us/huntwild/wild/wildlife_diversity/texas_rare_species/listed_species/.

If we can be of further assistance, or if you have any questions about these comments, please contact 281/286-8282 if your project is in southeast Texas, or 361/994-9005, ext. 246, if your project is in southern Texas. Please refer to the Service consultation number listed above in any future correspondence regarding this project.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Texas Coastal Ecological Services Field Office
17629 El Camino Real #211
Houston, TX 77058
(281) 286-8282

Project Summary

Consultation Code: 02ETTX00-2017-SLI-1238

Event Code: 02ETTX00-2017-E-02242

Project Name: Harris Expansion Project

Project Type: LAND - RESTORATION / ENHANCEMENT

Project Description: Harris Expansion Project

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/29.18431011126871N95.45646068216985W

Counties: Brazoria, TX

Endangered Species Act Species

There is a total of 10 threatened, endangered, or candidate species on your species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area. Please contact the designated FWS office if you have questions.

Mammals

NAME	STATUS
West Indian Manatee *(Trichechus manatus)* There is a **final** critical habitat designated for this species. Your location is outside the designated critical habitat. Species profile: https://ecos.fws.gov/ecp/species/4469	Threatened

Birds

NAME	STATUS
Piping Plover *(Charadrius melodus)* Population: except Great Lakes watershed There is a **final** critical habitat designated for this species. Your location overlaps the designated critical habitat. Species profile: https://ecos.fws.gov/ecp/species/6039	Threatened
Red Knot *(Calidris canutus rufa)* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1864	Threatened
Whooping Crane *(Grus americana)* Population: Wherever found, except where listed as an experimental population There is a **final** critical habitat designated for this species. Your location is outside the designated critical habitat. Species profile: https://ecos.fws.gov/ecp/species/758	Endangered

Reptiles

NAME	STATUS
Hawksbill Sea Turtle *(Eretmochelys imbricata)* There is a **final** critical habitat designated for this species. Your location is outside the designated critical habitat. Species profile: https://ecos.fws.gov/ecp/species/3656	Endangered
Kemp's Ridley Sea Turtle *(Lepidochelys kempii)* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/5523	Endangered
Leatherback Sea Turtle *(Dermochelys coriacea)* There is a **final** critical habitat designated for this species. Your location is outside the designated critical habitat. Species profile: https://ecos.fws.gov/ecp/species/1493	Endangered
Loggerhead Sea Turtle *(Caretta caretta)* Population: Northwest Atlantic Ocean DPS There is a **final** critical habitat designated for this species. Your location is outside the designated critical habitat. Species profile: https://ecos.fws.gov/ecp/species/1110	Threatened

Clams

NAME	STATUS
Smooth Pimpleback *(Quadrula houstonensis)* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8967	Candidate
Texas Fawnsfoot *(Truncilla macrodon)* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8965	Candidate

Critical habitats

There is 1 critical habitat wholly or partially within your project area.

NAME	STATUS
Piping Plover *(Charadrius melodus)*	Final designated

Big Slough

Preliminary WOTUS Delineation

Big Slough Mitigation Site

Focused Study Area

Brazoria County, Texas

Cardno

now

Stantec

Document Information

Prepared for	DOW Chemical
Project Name	Big Slough Mitigation Site
Project Number	E515018116
Project Manager	Chad Martin
Date	October 21, 2022

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Acronyms

CFR	Code of Federal Regulations
CWA	Clean Water Act
EPA	U.S. Environmental Protection Agency
FEMA	Federal Emergency Management Agency
GIS	Geographic information systems
GPS	Global Positioning System
LiDAR	Light Detection and Ranging
NAD	North American Datum
NWI	National Wetland Inventory
NRCS	Natural Resources Conservation Service
OHWM	Ordinary High-Water Mark
SWPPP	Storm Water Pollution Prevention Plan
TCEQ	Texas Commission on Environmental Quality
TNW	Traditionally Navigable Water
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
WOTUS	Waters of the U.S.

1 Introduction

Cardno Now Stantec (Cardno) was contracted by the Dow Chemical (Dow) to perform a preliminary delineation of potential Waters of the U.S. (WOTUS) within the 3,300-acre Big Slough Mitigation Site in Brazoria County, Texas (Figure 1-1).

The results of the delineation survey revealed a series of wetlands within an upland buffer of Big Slough, that were bounded by expansive herbaceous wetlands to the north, and herbaceous/tidal wetlands to the south. This report details the results of the survey within a focused study area consisting of the upland buffer of Big Slough (Figure 1-2).

All potential wetlands identified by the National Wetlands Inventory (NWI) as well as all potential jurisdictional waters identified by the National Hydrography Dataset (NHD) in the study area during the desktop evaluation were investigated in the field. In compliance with Section 404 of the Clean Water Act (CWA), this report contains a delineation of all resources within the Project that may fall under the jurisdiction of the U.S. Army Corps of Engineers (USACE).

The methodology (Section 3) and results (Section 4) of the preliminary delineation of potential WOTUS as they pertain to the study area are contained within and summarized in the following sections.

Wetlands are defined by the USACE (33 CFR 328.3, 1986) and the U.S Environmental Protection Agency (EPA) (40 CFR 230.3, 1980) as “areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Many wetlands and other aquatic features, including ephemeral, intermittent, and perennial streams are considered WOTUS by the USACE and these "'jurisdictional" areas are regulated under Section 404 of the CWA.

Project Boundary

0 2,450 4,900 9,800

Feet

Cardno now Stantec

Site and Vicinity

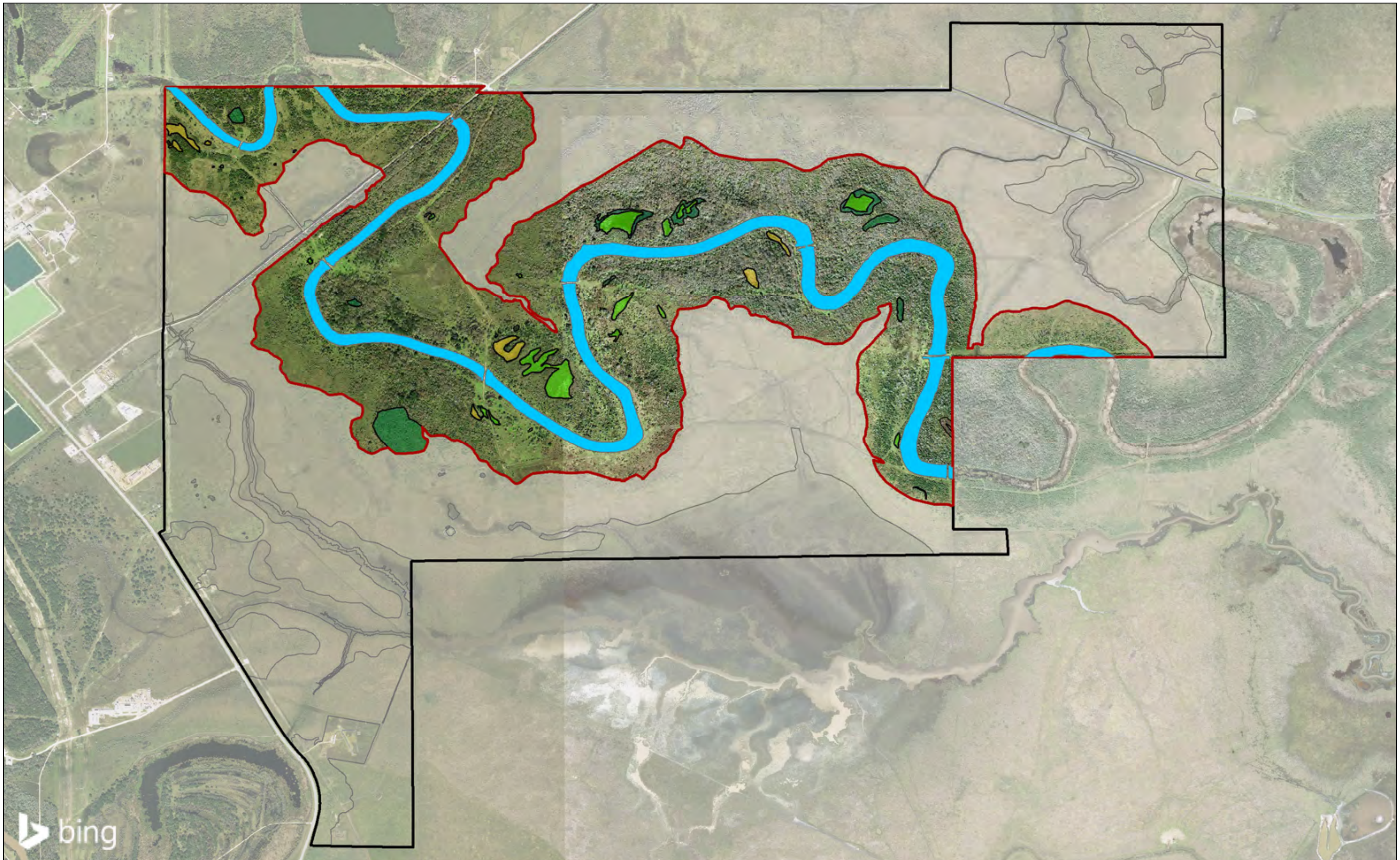
Big Slough Mitigation Site
Dow Chemical

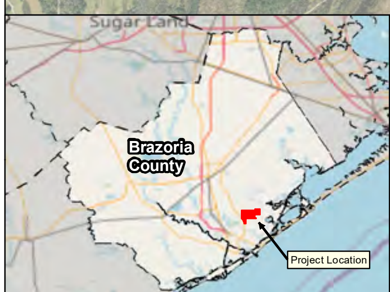
Date:	Project No:	Figure No:
October 2022	E515018116	1-1

Date Created: 10/20/2022 Date Revised: 10/20/2022 File Path: S:\PROJECTS\DOW Chemical\E515018116 - DOW Big Slough 3K Mitigation Site Project\GIS\1-1 Site and Vicinity_focused study area.mxd

GIS Analyst: samuel.waltman

Data Source: Basemap: Bing Maps Aerial (2018)





Property Boundary
Focused Study Area
Big Slough

Wetlands
PEM
PFO
PSS
PUB

N

0 487.5975 1,950
Feet

Cardno now Stantec

Focused Study Area Overview

Big Slough Mitigation Site
Dow Chemical

Date:	Project No:	Figure No:
October 2022	E515018116	1-2

Date Created: 10/20/2022 Date Revised: 10/20/2022 File Path: S:\PROJECTS\DOW Chemical\E515018116 - DOW Big Slough 3K Mitigation Site Project\GIS\Focused Study Area Overview.mxd
GIS Analyst: samuel.waltman

Data Source: Basemap: Bing Maps Aerial (2018)

2 Project Location

2.1 Property Description

The property consists of private rangelands, primarily used for cattle grazing. Additionally, the majority of the study area is located within the Federal Emergency Management Agency (FEMA) 100-Year floodplain (Figure 2-1).

2.2 Land Use / Land Cover

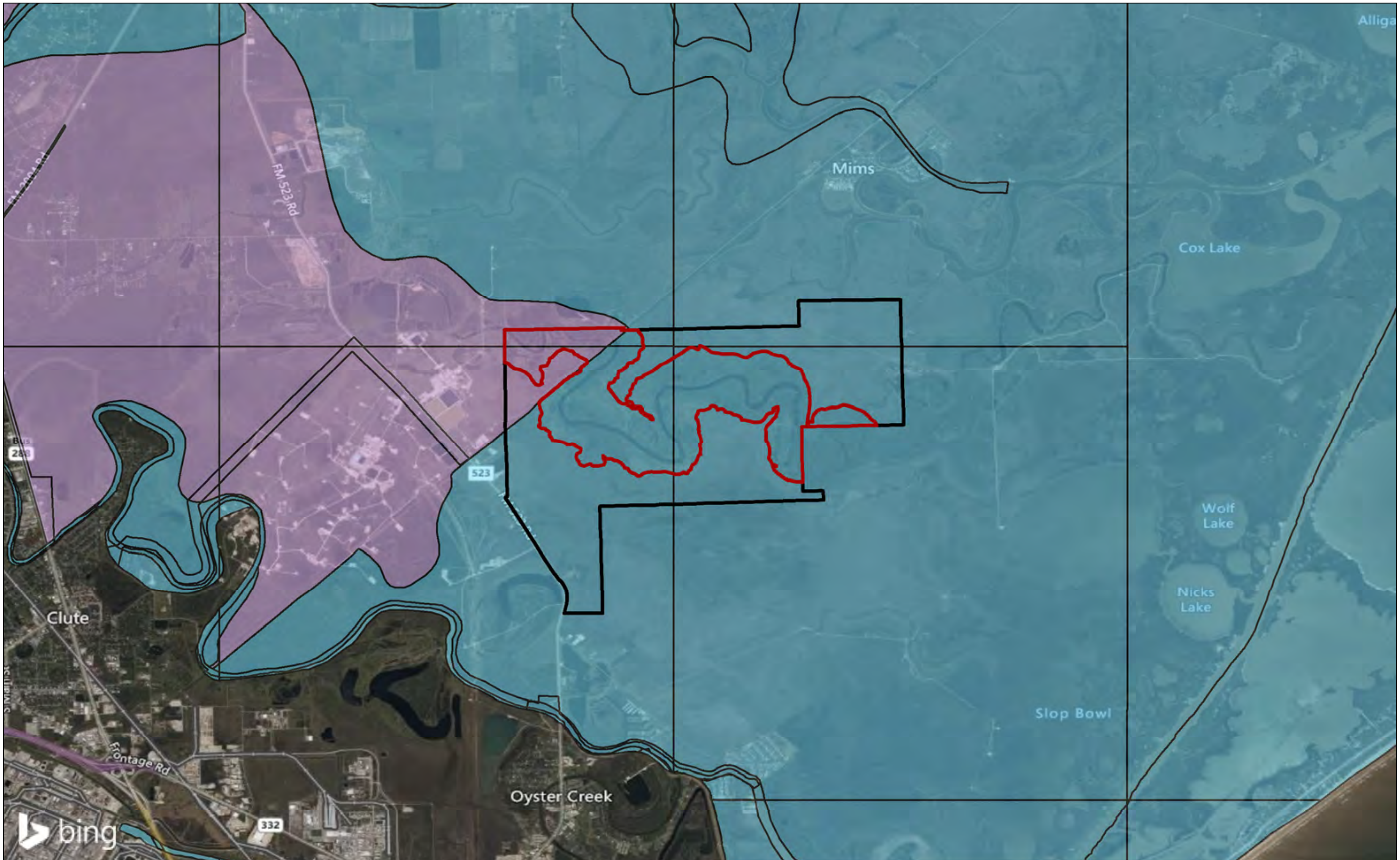
The land use located within and in proximity to the Project is rural, mostly forested/scrub shrub and grazing pasture. Oyster Creek, one of the closest towns to the Project is located approximately two miles south of the intersection of the FM 523 and FM 792 just below the southern Project boundary.

According to the Texas Commission on Environmental Quality (TCEQ) Level III and IV Ecoregions of Texas report accessed September 2019, the study area falls mostly within the Floodplains and Low Terraces (34c) and Northern Humid Gulf Coastal Prairies (34a) ecoregions with a small portion in the Mid-Coast Barrier Islands and Coastal Marshes (34h) ecoregion.

The Floodplains and Low Terraces ecoregion generally consist of bottomland forests of pecan *(Carya illinoinensis)*, water oak *(Quercus nigra)*, southern live oak *(Quercus virginiana)*, and elm *(Ulmus sp.)* species. Bald Cypress *(Taxodium distichum)* occasionally exist on larger streams or rivers. The Brazos and Colorado River floodplains are a broad expanse of alluvial sediments, while floodplains to the south are narrower. Soils include Vertisols, Millisols, and Entisols. Large portions of floodplain forest have been removed and land cover is now a mix of forest, cropland, and pasture (Griffith et al 2007).

The Northern Humid Gulf Coastal Prairies (34a) ecoregion consists of gently sloping, mostly flat, coastal plain. Due to the low relief and clay subsoils, drainage is generally poor and soils remain wet for parts of the year. The historical vegetation was mostly tallgrass grasslands with a few clusters of oaks, known as oak mottes or maritime woodlands. Little bluestem (*Schizachyrium scoparium*), yellow Indiangrass (*Sorghastrum nutans*), brownseed paspalum *(Paspalum plicatulum*), gulf muhly (*Muhlenbergia capillaris*), and switchgrass (*Panicum virgatum*) were the dominant grassland species in a mixture with hundreds of other herbaceous species across these prairies. Today, almost all of the coastal prairies have been converted to cropland, rangeland, pasture, or urban and industrial land uses. Extensive networks of drainage canals and stream channelization have occurred in many areas. Soil surface texture of the region varies but tends to be fine textured, with darker, clayey soils associated with Vertisols (Griffith et al 2007).

The Mid-Coast Barrier Islands and Coastal Marshes ecoregion (34h) encompasses primarily Holocene deposits with saline, brackish, and freshwater marshes, barrier islands with minor washover fans, and tidal flat sands and clays. Typical soils on the coastal marshes are Entisols, with a minor extent of Histosols. Mollisols occur on tidal flats and coastal marshes, and Entisols fonn in sandy barrier islands and dunes. Smooth cordgrass, marshhay cordgrass, and gulf saltgrass dominate in more saline zones. Other native vegetation is mainly grassland composed of seacoast bluestem, sea-oats, common reed. Gulf dune paspalum, and soilbind morning-glory. Some areas have clumps of sweetbay, redbay, and dwarf southern live oak trees. Salt marsh and wind-tidal flats are mostly confined to the back side of barrier islands with fresh or brackish marshes associated with river-mouth delta areas (Griffith et al 2007).



Property Boundary
Focused Study Area
100-Year Floodplain
500-Year Floodplain

0 1,300 2,600 5,200
Feet

Cardno now Stantec

FEMA Floodplain Map

Big Slough Mitigation Site
Dow Chemical

Date:	Project No:	Figure No:
October 2022	E515018116	2-1

Date Created: 10/20/2022 Date Revised: 10/20/2022 File Path: S:\PROJECTS\DOW Chemical\E515018116 - DOW Big Slough 3K Mitigation Site Project\GIS\2-1 Floodplain Map.mxd
GIS Analyst: samuel.waltman

Data Source: Basemap: Bing Maps Aerial (2018)

2.3 Soil Series

Soils within the study area can be generally described as well drained soils that occur on broad, nearly level land to gently sloping floodplains, uplands, and terraces. According to the U.S. Department of Agriculture (USDA), Natural Resource Conservation Service (NRCS) website accessed September 2019 (Soil Survey Staff, 2019), and USDA Soil Conservation Service Soil Survey of Brazoria County (Crenwelge et. al. 1981), the Project is located within four soil map units, which are listed and described below. Three of the four soil map units present within the study area have a hydric soil rating according to the NRCS State Soil Data Hydric Soils List.

It should also be noted that caution must be used when comparing the list of hydric components to soil survey maps. Many of the soils on the list have ranges in water table depths that allow the soil component to range from hydric to non-hydric depending on the location of the soil within the landscape as described in the map unit. Lists of hydric soils along with soil survey maps are good off-site ancillary tools to assist in wetland determinations, but they are not a substitute for observations made during onsite investigations.

Asa Silt Loam (2) – Non Hydric

The Asa series consists of nearly level, well drained soils formed in loamy alluvium derived from mixed sources from the Permian redbed sediments. These soils are on flats on flat coastal plains. Slopes range from 0 to 1 percent and are rarely flooded. This soil series does not have a hydric soil rating. All are prime cropland.

Pledger clay (36) Predominantly – Hydric

The Pledger series consists of very deep, moderately well drained, very slowly permeable soils that formed in clayey alluvium. These nearly level soils are on flood plains. Slope ranges from 0 to 1 percent, but mostly less than 0.5 percent. Mean annual precipitation is about 1245 mm (45 in). Mean annual air temperature is about 20.6 degrees C (69 degrees F). This soil series is on the hydric soils list.

Churnabog clay (38) – Predominantly Hydric

This soil series consists of nearly level to sloping, poorly drained soils that formed in clayey alluvium derived from igneous, metamorphic and sedimentary rock. These soils are typically on oxbows and experience frequent flooding. Slopes mainly range from 0 to 1 percent and are not considered prime farmland. This soil series is on the hydric soils list.

Surfside clay (39) – Hydric

The Surfside series consists of very deep, very poorly drained, saline soils that formed in saline clayey alluvium of Holocene age. These level to depressed soils are on flood plains on delta plains near sea level. Slope is less than 1 percent.

3 Assessment Methodology

3.1 Table Top Site Investigation

Cardno conducted a desktop environmental assessment utilizing local and federal GIS data to identify potential wetlands, hydric soils, floodplains, and waterbodies that would be found within the study area. Potential WOTUS were identified from the USFWS NWI GIS data layer (USFWS 2017), light detection and ranging (LiDAR) imaging (TNRIS 2018), United States Geologic Survey (USGS) topographic maps, and FEMA Flood Insurance Rate Map (FEMA 2010).

3.2 Field Site Investigation

A wetland delineation survey of the Project was conducted periodically from October 2019 to December 2019. All wetland delineation surveys were performed in accordance with the USACE Wetland Delineation Manual (USACE Manual; Environmental Laboratory 1987) in conjunction with the Atlantic and Gulf Coastal Regional Supplement to the USACE Delineation Manual (USACE 2012). The 1987 manual recommends the establishment of transects along a survey area baseline for parcels larger than 5 acres; however, the desktop investigation revealed a potentially complex range of habitats with defined boundaries throughout the study area. Due to the level of detail obtained, particularly from the LiDAR dataset and aerial imagery, it was decided that this background information would be more beneficial as a guide for on-the-ground investigations than baseline transects.

3.3 Wetlands and Waterbodies

Wetlands are collectively defined by the USACE (Environmental Laboratory 1987) and the U.S. Environmental Protection Agency (EPA; Federal Register 1980) as those areas that are inundated or saturated by surface or groundwater at a frequency or duration sufficient to support and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. An area is a wetland if it meets the wetland hydrology, hydrophytic vegetation, and hydric soil criteria established in the USACE Manual. Cardno scientists surveyed the study area for the presence/absence of wetlands and waterbodies. All pertinent field data collected were placed on USACE Atlantic and Gulf Coastal wetland determination datasheets (Appendix A).

Hydrophytic Vegetation

Hydrophytic vegetation is defined as "the sum total of macrophytic plant life that occurs in areas where the frequency and duration of inundation or soil saturation produce permanently or periodically saturated soils of sufficient duration to exert a controlling influence on the plant species present" (Environmental Laboratory 1987). Dominant vegetation was identified and categorized in accordance with the regional indicator status in the national list of plant species that occur in wetlands (Lichvar et. al. 2016). The indicator status of a plant species is expressed in terms of the estimated probability of that species to occur in wetland conditions within a given region. Table 3-1 lists the plant indicator status categories. A vegetative community would be determined to be hydrophytic if more than 50 percent of the dominant species present were FAC, FACW, or OBL.

Table 3-1 Plant Indicator Status Categories

Indicator Category	Indicator Symbol	Frequency of Occurrence in Wetlands (percent)
Obligate Wetland Plants	OBL	Plants that occur almost always (estimated probability >99%) in wetlands under natural conditions, but which may also occur rarely (estimated probability <1%) in non-wetlands. Examples: *Carya aquatica, Persicarian punctata*.
Facultative Wetland Plants	FACW	Plants that occur usually (estimated probability 67-99%) in wetlands, but also occurring in both wetlands and non-wetlands. Examples: *Spartina patens; Panicum dichotomiflrum*.
Facultative Plants	FAC	Plants with a similar likelihood (estimated probability of 33-67%) of occurring in both wetlands and non-wetlands. Examples: *Stenotaphrum secundatum; Rumex cripsus*.
Facultative Upland Plants	FACU	Plants that occur sometimes (estimated probability 1-33%) in wetlands, but occur more often (estimated probability 67-99%) in non-wetlands. Examples: *Cirsium vulgare; Rubus trivialis.*
Obligate Upland Plants	UPL	Plants that occur rarely (estimated probability <1%) in wetlands, but almost always (>99% estimated probability) in non-wetlands. Examples: *Geranium carolinianum.*

Wetland Hydrology

Wetland hydrology includes all hydrologic characteristics of areas that are periodically inundated or have soils saturated to the surface at some time during the growing season. Areas with evident characteristics of wetland hydrology are those where the presence of water has an overriding influence on characteristics of vegetation and soils due to anaerobic and reducing conditions, respectively (Environmental Laboratory 1987).

Hydric Soils

Hydric soils are defined as soils that are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper stratum. In general, hydric soils are flooded, ponded, or saturated for a week or more during the growing season when soil temperatures are above 32 degrees Fahrenheit. The anaerobic conditions created by repeated or prolonged saturation or flooding result in permanent changes in soil color and chemistry, and are used to differentiate hydric from non-hydric soils (Environmental Laboratory 1987).

At each recorded data point, a pit up to 20-inches deep was excavated for evaluation. The Regional Supplement recommends excavation depth of 20-inches although a shallower pit may suffice for indicators in this region and soil type, i.e. Histic Epipedon (USACE 2010). Soils were surveyed for horizon profile, matrix, value, chroma, texture, and concretions. Hydric soils were determined to be present if one primary hydric soil indicator was present. Background soil information of the study area was obtained from the USDA NRCS Web Soil Survey.

3.4 Mapping

Cardno scientists geographically referenced data points within the study area using a sub-meter Global Positioning System (GPS) device. The GPS was programmed to record points with a minimum of four satellites and a Position Dilution of Precision value no greater than 6.0. Water features were delineated by collecting GPS points along the perimeter of the wetland or ordinary high water mark (OHWM) with suitable frequency to represent the feature within the study area.

3.5 Photographs

Photographs are the visual documentation of site conditions as they existed during the field survey. Representative photos were taken at wetland and upland areas. For all other features, a minimum of one photo was taken, unless the area was large and required additional representation. The photographic log is provided in Appendix B.

4 Results of Findings

4.1 Wetlands

Cardno scientists surveyed the study area for presence/absence of wetlands. Cardno scientists delineated 35 wetlands, totaling 55.28 acres that possessed the three USACE criteria (hydrophytic vegetation, wetland hydrology and hydric soils) (Appendix C). Herbaceous, scrub shrub, and forested, wetlands were documented within the study area, and are summarized in Table 4-1.

Vegetation Community Types

Cardno scientists identified five types of vegetative communities within the study area: herbaceous upland, herbaceous wetland, forested wetland, upland forest, and scrub shrub wetland. Community identification was based on soils, hydrology and an emphasis on dominant vegetation. Appendix A provides datasheets which include data point-specific vegetative community species data.

Hydrology

Much of the study area falls within the floodplain of Oyster Creek (Figure 2-1). During most of the duration of Cardno's investigation, all wetlands identified were either inundated with at least one-inch of water or had saturated soils. Precipitation south of Big Slough drains into Salt Bayou and then into Salt Lake, while precipitation north of Big Slough appears to drain north to Bastrop Bayou and eventually Cox Lake.

Table 4-1 Delineated Wetlands

Map and Wetland Datasheet ID[1]	Class	Latitude*	Longitude[3]	Acreage
WET-A-3	PEM	29.052429	-95.318660	0.04
WET-A-5	PSS	29.051776	-95.318022	3.12
WET-A-15	PSS	29.061938	-95.335405	0.59
WET-A-16	PSS	29.062558	-95.335097	2.00
WET-A-17	PSS	29.062118	-95.333733	0.15
WET-A-18	PFO	29.063525	-95.332253	1.24
WET-A-22	PSS	29.061056	-95.330229	0.02
WET-A-23	PSS	29.061760	-95.329239	0.04
WET-A-24	PEM	29.060864	-95.333417	0.01
WET-A-25	PEM	29.060891	-95.332976	0.05
WET-A-36	PFO	29.053421	-95.298022	0.90
WET-A-37	PEM	29.048115	-95.298111	0.38
WET-B-2	PFO	29.047375	-95.323553	12.66
WET-B-3	PEM	29.056111	-95.328332	0.13
WET-B-4	PEM	29.048087	-95.318700	0.35
WET-B-5	PEM	29.048456	-95.319210	0.31

Table 4-1 Delineated Wetlands

Map and Wetland Datasheet ID[1]	Class	Latitude*	Longitude[3]	Acreage
WET-B-6	PSS	29.048392	-95.319686	0.50
WET-B-7	PEM	29.052574	-95.312495	0.44
WET-B-8	PEM	29.054032	-95.312256	1.47
WET-B-9	PEM	29.053769	-95.310147	0.34
WET-B-10	PFO	29.055358	-95.312913	0.29
WET-B-11	PSS	29.055678	-95.305527	1.35
WET-B-12	PSS	29.057505	-95.304165	1.02
WET-C-3	PFO	29.058689	-95.298913	1.94
WET-C-4	PFO	29.059319	-95.299511	2.45
WET-C-5	PEM	29.059611	-95.300065	2.52
WET-C-6	PFO	29.058618	-95.312096	2.11
WET-C-7	PEM	29.058414	-95.312368	4.35
WET-C-8	PEM	29.058148	-95.309947	0.88
WET-C-9	PFO	29.059022	-95.308976	3.27
WET-C-10	PEM	29.059108	-95.309007	0.89
WET-C-12	PEM	29.058510	-95.322095	0.14
WET-C-13	PEM	29.050484	-95.315796	8.75
WET-C-14	PFO	29.053962	-95.326002	0.50
WET-C-15	PEM	29.055559	-95.317514	0.10
Total				55.28

1 Wetland Identification represents unique designations given to each wetland during field surveys.
2 Wetland Classification represents the wetland classes based on Cowardin, *et al.* (1979)
3 Latitude and Longitude are represented in NAD 83, decimal degrees.

Rainfall data was obtained for the calendar months of September to December 2018 from the Wunderground online database for Brazoria County, Texas and is presented in Table 4-2 (Wunderground 2019).

Table 4-2 Rainfall Data for Brazoria County, Texas

Period	Recorded Monthly Rainfall To Date (inches)[A]
December 2019	0.05
November 2019	2.61
October 2019	10.72
September 2019	18.00

[A] - Rainfall data month of December to date (December 10, 2019)

Soils

Soils were delineated with the X-Rite Munsell M50215B Soil Book of Color, and exhibited a hue, lightness, and chroma ranging from 5 YR (4/6) to 10YR (4/2) throughout the study area. The datasheets presented in Appendix A provide soils color data for each soil pit.

4.2 Waterbodies

One perennial waterbody, Big Slough, was delineated withing the study area (Appendix C).

Table 4-3 Delineated Streams and Waterbodies

Map ID[1]	Stream Classification[2]	Latitude	Longitude[3]	OHWM (Feet)	Length (Linear Feet)	Acreage
S-A-1	Perennial (Big Slough)	29.056964	-95.312763	28	34058.20	160.41
Total					60733.48	213.37

[1] Map Identification represents unique designations given to each stream during field surveys.
[2] Stream Classification determined from topographic maps and field observations.
[3] Latitude and Longitude are represented in NAD 83, decimal degrees.

5 Conclusion

In compliance with Section 404 of the CWA, this report contains a delineation of potential WOTUS that may fall under the jurisdiction of the USACE. The desktop review and field delineation were performed by Cardno scientists in which all potentially jurisdictional waters within the study area were mapped and characterized. Based on the field survey, it was determined that the study area contains 35 wetlands totaling 55.28 acres, and one perennial waterbody, Big Slough. It is Cardno's opinion that these wetlands and waterbody have a significant nexus to a Traditional Navigable Water (TNW) and therefore may be considered jurisdictional under Section 404 of the CWA.

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APPENDIX

A

WETLAND DETERMINATION DATASHEETS

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 09-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-A-29

Investigator(s): Corbin Hoffmann, Bob Nailon **Section, Township, Range:** S T R

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** concave **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.05243 **Long.:** -95.318614 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ◉ No ○	Depth (inches): 8	
Water Table Present?	Yes ◉ No ○	Depth (inches): 1	**Wetland Hydrology Present?** Yes ◉ No ○
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 1	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-A-29

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	10	☑	66.7%	FAC
2. Acacia berlandieri	2	☐	13.3%	UPL
3. Crataegus aestivalis	2	☐	13.3%	OBL
4. Ilex vomitoria	1	☐	6.7%	FAC
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 7.5 20% of Total Cover: 3	15	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Carex cherokeensis	30	☑	30.0%	FACW
2. Cyperus entrerianus	10	☐	10.0%	FACW
3. Cyperus virens	10	☐	10.0%	FACW
4. Bacopa monnieri	10	☐	10.0%	OBL
5. Persicaria hydropiperoides	5	☐	5.0%	OBL
6. Potamogeton alpinus	30	☑	30.0%	OBL
7. Eleocharis palustris	5	☐	5.0%	OBL
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 50 20% of Total Cover: 20	100	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	52	x 1 =	52
FACW species	50	x 2 =	100
FAC species	11	x 3 =	33
FACU species	0	x 4 =	0
UPL species	2	x 5 =	10
Column Totals:	115 (A)		195 (B)

Prevalence Index = B/A = 1.696

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-A-29

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-2	10YR	3/1	95						Clay	
3-16	7.5YR	3/2		7.5YR	4/4	5			Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☑ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 10-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-A-30**

Investigator(s): Corbin Hoffmann, Bob Nailon **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** convex **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.052301 **Long.:** -95.31855 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?** Yes ( ) No (●)
Hydric Soil Present?	Yes ( ) No (●)	
Wetland Hydrology Present?	Yes (●) No ( )	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (●)	Depth (inches):	
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (●)	Depth (inches):	

Wetland Hydrology Present? Yes (●) No ( )

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-A-30

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Celtis laevigata	70	☑	77.8%	FACW
2. Triadica sebifera	20	☑	22.2%	FAC
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 45 20% of Total Cover: 18	90	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	5	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 2.5 20% of Total Cover: 1	5	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Carex cherokeensis	70	☑	85.4%	FACW
2. Axonopus fissifolius	10	☐	12.2%	FACW
3. Iva annua	2	☐	2.4%	FAC
4.		☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 41 20% of Total Cover: 16.4	82	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Ampelopsis arborea	5	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 2.5 20% of Total Cover: 1	5	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	150	x 2 =	300
FAC species	32	x 3 =	96
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	182 (A)		396 (B)

Prevalence Index = B/A = 2.176

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-A-30

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR	3/2	100						Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2] Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ________

Depth (inches): ________

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 10-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-A-31**

Investigator(s): Corbin Hoffmann, Bob Nailon **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** concave **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.052041 **Long.:** -95.318116 **Datum:** WGS 1983

Soil Map Unit Name: 38 - Churnabog clay, 0 - 1 percent slopes, freq flooded, occassional ponded **NWI classification:** PEM1C

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?** Yes (●) No ( )
Hydric Soil Present?	Yes (●) No ( )	
Wetland Hydrology Present?	Yes (●) No ( )	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes (●) No ( )	Depth (inches): 4
Water Table Present?	Yes (●) No ( )	Depth (inches): 1
Saturation Present? (includes capillary fringe)	Yes (●) No ( )	Depth (inches): 1

Wetland Hydrology Present? Yes (●) No ( )

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-A-31

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	5	✔	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 2.5 20% of Total Cover: 1	5	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	15	✔	50.0%	FAC
2. Sesbania drummondii	15	✔	50.0%	FACW
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 15 20% of Total Cover: 6	30	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Leersia hexandra	30	✔	30.0%	OBL
2. Eleocharis quadrangulata	10	☐	10.0%	OBL
3. Zizaniopsis miliacea	30	✔	30.0%	OBL
4. Alternanthera philoxeroides	10	☐	10.0%	OBL
5. Cyperus virens	10	☐	10.0%	FACW
6. Sagittaria graminea	10	☐	10.0%	OBL
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 50 20% of Total Cover: 20	100	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	90	x 1 =	90
FACW species	25	x 2 =	50
FAC species	20	x 3 =	60
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	135 (A)		200 (B)

Prevalence Index = B/A = 1.481

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-A-31

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR	3/1	100						Clay	
3-16	7.5YR	3/2	95	7.5YR	4/4	5			Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) (LRR P, T, U)
- [ ] 5 cm Mucky Mineral (A7) (LRR P, T, U)
- [ ] Muck Presence (A8) (LRR U)
- [ ] 1 cm Muck (A9) (LRR P, T)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Coast Prairie Redox (A16) (MLRA 150A)
- [ ] Sandy Muck Mineral (S1) (LRR O, S)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) (LRR P, S, T, U)
- [ ] Polyvalue Below Surface (S8) (LRR S, T, U)
- [x] Thin Dark Surface (S9) (LRR S, T, U)
- [ ] Loamy Mucky Mineral (F1) (LRR O)
- [ ] Loamy Gleyed Matrix (F2)
- [x] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) (LRR U)
- [ ] Depleted Ochric (F11) (MLRA 151)
- [ ] Iron-Manganese Masses (F12) (LRR O, P, T)
- [ ] Umbric Surface (F13) (LRR P, T, U)
- [ ] Delta Ochric (F17) (MLRA 151)
- [ ] Reduced Vertic (F18) (MLRA 150A, 150B)
- [ ] Piedmont Floodplain Soils (F19) (MLRA 149A)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) (LRR O)
- [ ] 2 cm Muck (A10) (LRR S)
- [ ] Reduced Vertic (F18) (outside MLRA 150A,B)
- [ ] Piedmont Floodplain Soils (F19) (LRR P, S, T)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes (●) No ( )

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 10-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-A-32**

Investigator(s): Corbin Hoffmann, Bob Nailon **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** convex **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.051954 **Long.:** -95.317894 **Datum:** WGS 1983

Soil Map Unit Name: 38 - Churnabog clay, 0 - 1 percent slopes, freq flooded, occasionaly ponded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?** Yes ( ) No (●)
Hydric Soil Present?	Yes ( ) No (●)	
Wetland Hydrology Present?	Yes ( ) No (●)	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (●)	Depth (inches):	
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (●)	Depth (inches):	

Wetland Hydrology Present? Yes ( ) No (●)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-A-32

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rosa bracteata	40	☑	40.0%	UPL
2. Ilex vomitoria	40	☑	40.0%	FAC
3. Conoclinium coelestinum	20	☑	20.0%	FAC
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 50 20% of Total Cover: 20	100	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Stenotaphrum secundatum	75	☑	75.0%	FAC
2. Sporobolus indicus	10	☐	10.0%	FACU
3. Baptisia sphaerocarpa	10	☐	10.0%	UPL
4. Cephalanthus occidentalis	5	☐	5.0%	OBL
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 50 20% of Total Cover: 20	100	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	3	(A)
Total Number of Dominant Species Across All Strata:	4	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	75.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	5	x 1 =	5
FACW species	0	x 2 =	0
FAC species	135	x 3 =	405
FACU species	10	x 4 =	40
UPL species	50	x 5 =	250
Column Totals:	200 (A)		700 (B)

Prevalence Index = B/A = 3.500

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-A-32

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-16	10YR	3/2	100						Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 10-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-A-33

Investigator(s): Corbin Hoffmann, Bob Nailon **Section, Township, Range:** S T R

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** concave **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.052654 **Long.:** -95.317672 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** PEM1Fx

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☑ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☑ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ◉ No ○	Depth (inches):	24
Water Table Present?	Yes ◉ No ○	Depth (inches):	1
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches):	1

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-A-33

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	5	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 2.5 20% of Total Cover: 1	5	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Sagittaria graminea	15	☑	19.5%	OBL
2. Sagittaria lancifolia	5	☐	6.5%	OBL
3. Sagittaria latifolia	15	☑	19.5%	OBL
4. Bacopa monnieri	20	☑	26.0%	OBL
5. Leersia hexandra	10	☐	13.0%	OBL
6. Cyperus entrerianus	3	☐	3.9%	FACW
7. Alternanthera philoxeroides	2	☐	2.6%	OBL
8. Juncus effusus	3	☐	3.9%	OBL
9. Persicaria hydropiperoides	3	☐	3.9%	OBL
10. Peltandra sagittifolia	1	☐	1.3%	OBL
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 38.5 20% of Total Cover: 15.4	77	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	74	x 1 =	74
FACW species	3	x 2 =	6
FAC species	5	x 3 =	15
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	82 (A)		95 (B)

Prevalence Index = B/A = 1.159

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-A-33

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)		%	Type[1]	Loc²	Texture	Remarks
0-2	10YR	3/1	100							
3-16	7.5YR	3/2	95	7.5YR	4/4	5				

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) (LRR P, T, U)
- [ ] 5 cm Mucky Mineral (A7) (LRR P, T, U)
- [ ] Muck Presence (A8) (LRR U)
- [ ] 1 cm Muck (A9) (LRR P, T)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Coast Prairie Redox (A16) (MLRA 150A)
- [ ] Sandy Muck Mineral (S1) (LRR O, S)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) (LRR P, S, T, U)
- [ ] Polyvalue Below Surface (S8) (LRR S, T, U)
- [x] Thin Dark Surface (S9) (LRR S, T, U)
- [ ] Loamy Mucky Mineral (F1) (LRR O)
- [ ] Loamy Gleyed Matrix (F2)
- [x] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) (LRR U)
- [ ] Depleted Ochric (F11) (MLRA 151)
- [ ] Iron-Manganese Masses (F12) (LRR O, P, T)
- [ ] Umbric Surface (F13) (LRR P, T, U)
- [ ] Delta Ochric (F17) (MLRA 151)
- [ ] Reduced Vertic (F18) (MLRA 150A, 150B)
- [ ] Piedmont Floodplain Soils (F19) (MLRA 149A)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) (LRR O)
- [ ] 2 cm Muck (A10) (LRR S)
- [ ] Reduced Vertic (F18) (outside MLRA 150A,B)
- [ ] Piedmont Floodplain Soils (F19) (LRR P, S, T)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes (●) No ( )

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 16-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-A-55**

Investigator(s): Corbin Hoffmann, Bob Nailon **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.036481 **Long.:** -95.32333 **Datum:** WGS 1983

Soil Map Unit Name: 32 - Narta fine sandy loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?** Yes (●) No ( )
Hydric Soil Present?	Yes (●) No ( )	
Wetland Hydrology Present?	Yes (●) No ( )	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☑ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes (●) No ( )	Depth (inches):	2
Water Table Present?	Yes (●) No ( )	Depth (inches):	1
Saturation Present? (includes capillary fringe)	Yes (●) No ( )	Depth (inches):	1

Wetland Hydrology Present? Yes (●) No ( )

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-A-55

Tree Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = **Total Cover**

Sapling or Sapling/Shrub Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = **Total Cover**

Shrub Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = **Total Cover**

Herb Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Spartina spartinae	100	☑	100.0%	OBL
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	

50% of Total Cover: 50 20% of Total Cover: 20 100 = **Total Cover**

Woody Vine Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = **Total Cover**

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	100	x 1 =	100
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	100 (A)		100 (B)

Prevalence Index = B/A = 1.000

Hydrophytic Vegetation Indicators:

- ☑ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-A-55

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR	3/1	97	10YR	4/4	3			Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2] Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) (LRR P, T, U)
- [ ] 5 cm Mucky Mineral (A7) (LRR P, T, U)
- [ ] Muck Presence (A8) (LRR U)
- [ ] 1 cm Muck (A9) (LRR P, T)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [x] Coast Prairie Redox (A16) (MLRA 150A)
- [ ] Sandy Muck Mineral (S1) (LRR O, S)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) (LRR P, S, T, U)
- [ ] Polyvalue Below Surface (S8) (LRR S, T, U)
- [ ] Thin Dark Surface (S9) (LRR S, T, U)
- [ ] Loamy Mucky Mineral (F1) (LRR O)
- [ ] Loamy Gleyed Matrix (F2)
- [x] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) (LRR U)
- [ ] Depleted Ochric (F11) (MLRA 151)
- [ ] Iron-Manganese Masses (F12) (LRR O, P, T)
- [ ] Umbric Surface (F13) (LRR P, T, U)
- [ ] Delta Ochric (F17) (MLRA 151)
- [ ] Reduced Vertic (F18) (MLRA 150A, 150B)
- [ ] Piedmont Floodplain Soils (F19) (MLRA 149A)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) (LRR O)
- [ ] 2 cm Muck (A10) (LRR S)
- [ ] Reduced Vertic (F18) (outside MLRA 150A,B)
- [ ] Piedmont Floodplain Soils (F19) (LRR P, S, T)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes (●) No ( )

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 16-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-A-57

Investigator(s): Corbin Hoffmann, Bob Nailon **Section, Township, Range:** S T R

Landform (hillslope, terrace, etc.): PlainNO **Local relief (concave, convex, none):** **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.035027 **Long.:** -95.326474 **Datum:** WGS 1983

Soil Map Unit Name: 17 - Francitas clay loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** PEM1A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?**	Yes (●) No ( )
Hydric Soil Present?	Yes (●) No ( )		
Wetland Hydrology Present?	Yes (●) No ( )		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☑ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes (●) No ( )	Depth (inches):	2
Water Table Present?	Yes (●) No ( )	Depth (inches):	1
Saturation Present? (includes capillary fringe)	Yes (●) No ( )	Depth (inches):	1

Wetland Hydrology Present? Yes (●) No ( )

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-A-57

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Spartina spartinae	30	☑	30.0%	OBL
2. Distichlis spicata	40	☑	40.0%	OBL
3. Iva frutescens	15	☐	15.0%	FACW
4. Lycium carolinianum	5	☐	5.0%	FACW
5. Sarcocornia ambigua	5	☐	5.0%	OBL
6. Batis maritima	5	☐	5.0%	OBL
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 50 20% of Total Cover: 20	100	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	80	x 1 =	80
FACW species	20	x 2 =	40
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	100 (A)		120 (B)

Prevalence Index = B/A = 1.200

Hydrophytic Vegetation Indicators:

- ☑ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-A-57

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR	3/1	97	10YR	4/4	3			Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☑ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 16-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-A-58**

Investigator(s): Corbin Hoffmann, Bob Nailon **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.03502 **Long.:** -95.326399 **Datum:** WGS 1983

Soil Map Unit Name: 17 - Francitas clay loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** PEM1A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?**	Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○		
Wetland Hydrology Present?	Yes ◉ No ○		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☑ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches):	1

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

SOIL

Sampling Point: DP-A-82

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-16	10YR	3/2	100							

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 22-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-A-83**

Investigator(s): Corbin Hoffmann, Bob Nailon **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): PLAIN **Local relief (concave, convex, none):** concave **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.062382 **Long.:** -95.323817 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?** Yes ( ) No (●)
Hydric Soil Present?	Yes ( ) No (●)	
Wetland Hydrology Present?	Yes ( ) No (●)	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (●)	Depth (inches):	
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (●)	Depth (inches):	

Wetland Hydrology Present? Yes ( ) No (●)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-A-83

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Poncirus trifoliata	60	✔	75.0%	UPL
2. Diospyros virginiana	20	✔	25.0%	FAC
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 40 20% of Total Cover: 16	80	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Iva annua	70	✔	70.0%	FAC
2. Stenotaphrum secundatum	20	✔	20.0%	FAC
3. Sporobolus indicus	10	☐	10.0%	FACU
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 50 20% of Total Cover: 20	100	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 75.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	110	x 3 =	330
FACU species	10	x 4 =	40
UPL species	60	x 5 =	300
Column Totals:	180 (A)		670 (B)

Prevalence Index = B/A = 3.722

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ✔ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-A-83

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR	3/2	100						Clay Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) (LRR P, T, U)
- [ ] 5 cm Mucky Mineral (A7) (LRR P, T, U)
- [ ] Muck Presence (A8) (LRR U)
- [ ] 1 cm Muck (A9) (LRR P, T)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Coast Prairie Redox (A16) (MLRA 150A)
- [ ] Sandy Muck Mineral (S1) (LRR O, S)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) (LRR P, S, T, U)
- [ ] Polyvalue Below Surface (S8) (LRR S, T, U)
- [ ] Thin Dark Surface (S9) (LRR S, T, U)
- [ ] Loamy Mucky Mineral (F1) (LRR O)
- [ ] Loamy Gleyed Matrix (F2)
- [ ] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) (LRR U)
- [ ] Depleted Ochric (F11) (MLRA 151)
- [ ] Iron-Manganese Masses (F12) (LRR O, P, T)
- [ ] Umbric Surface (F13) (LRR P, T, U)
- [ ] Delta Ochric (F17) (MLRA 151)
- [ ] Reduced Vertic (F18) (MLRA 150A, 150B)
- [ ] Piedmont Floodplain Soils (F19) (MLRA 149A)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) (LRR O)
- [ ] 2 cm Muck (A10) (LRR S)
- [ ] Reduced Vertic (F18) (outside MLRA 150A,B)
- [ ] Piedmont Floodplain Soils (F19) (LRR P, S, T)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 31-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-A-89**

Investigator(s): Corbin Hoffmann, Shane Cantrell **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.058886 **Long.:** -95.332216 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?** Yes ( ) No (●)
Hydric Soil Present?	Yes ( ) No (●)	
Wetland Hydrology Present?	Yes (●) No ( )	

Remarks:
RECENT RAIN EVENT

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (●)	Depth (inches):	
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes (●) No ( )	Depth (inches):	1

Wetland Hydrology Present? Yes (●) No ( )

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-A-89

Tree Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Sapling or Sapling/Shrub Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	30	☑	50.0%	FAC
2. Poncirus trifoliata	30	☑	50.0%	UPL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	

50% of Total Cover: 30 20% of Total Cover: 12 60 = Total Cover

Shrub Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Herb Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Stenotaphrum secundatum	40	☑	40.0%	FAC
2. Iva annua	30	☑	30.0%	FAC
3. Spartina patens	5	☐	5.0%	FACW
4. Rubus argutus	15	☐	15.0%	FAC
5. Sporobolus indicus	5	☐	5.0%	FACU
6. Cyperus entrerianus	5	☐	5.0%	FACW
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	

50% of Total Cover: 50 20% of Total Cover: 20 100 = Total Cover

Woody Vine Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 75.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	10	x 2 =	20
FAC species	115	x 3 =	345
FACU species	5	x 4 =	20
UPL species	30	x 5 =	150
Column Totals:	160 (A)		535 (B)

Prevalence Index = B/A = 3.344

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-A-89

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	100						Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ⦿

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 31-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-A-91**

Investigator(s): Corbin Hoffmann, Shane Cantrell **Section, Township, Range:** **S** **T** **R**

Landform (hillslope, terrace, etc.): PLAIN **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.062528 **Long.:** -95.328529 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?**	Yes ( ) No (●)
Hydric Soil Present?	Yes ( ) No (●)		
Wetland Hydrology Present?	Yes (●) No ( )		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (●)	Depth (inches):	
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes (●) No ( )	Depth (inches):	1

Wetland Hydrology Present? Yes (●) No ( )

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-A-91

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Poncirus trifoliata	15	☑	100.0%	UPL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 7.5 20% of Total Cover: 3	15	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Acacia berlandieri	10	☑	50.0%	UPL
2. Triadica sebifera	10	☑	50.0%	FAC
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 10 20% of Total Cover: 4	20	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Stenotaphrum secundatum	50	☑	50.0%	FAC
2. Iva annua	40	☑	40.0%	FAC
3. Sporobolus indicus	10	☐	10.0%	FACU
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 50 20% of Total Cover: 20	100	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 60.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	100	x 3 =	300
FACU species	10	x 4 =	40
UPL species	25	x 5 =	125
Column Totals:	135 (A)		465 (B)

Prevalence Index = B/A = 3.444

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-A-91

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-20	10YR	3/1	100						Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 31-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-A-93**

Investigator(s): Corbin Hoffmann, Shane Cantrell **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): PLAIN **Local relief (concave, convex, none):** none **Slope:** 0.0 **% /** 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.061799 **Long.:** -95.329216 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** PEM1J

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ◉ No ○	Depth (inches):	2
Water Table Present?	Yes ◉ No ○	Depth (inches):	1
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches):	1

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-A-93

Tree Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Sapling or Sapling/Shrub Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Poncirus trifoliata	40	☑	50.0%	UPL
2. Sesbania drummondii	40	☑	50.0%	FACW
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	

50% of Total Cover: 40 20% of Total Cover: 16 80 = Total Cover

Shrub Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Herb Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Leersia hexandra	30	☑	33.3%	OBL
2. Stenotaphrum secundatum	30	☑	33.3%	FAC
3. Iva annua	20	☑	22.2%	FAC
4. Spartina patens	10	☐	11.1%	FACW
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	

50% of Total Cover: 45 20% of Total Cover: 18 90 = Total Cover

Woody Vine Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 80.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	30	x 1 =	30
FACW species	50	x 2 =	100
FAC species	50	x 3 =	150
FACU species	0	x 4 =	0
UPL species	40	x 5 =	200
Column Totals:	170	(A)	480 (B)

Prevalence Index = B/A = 2.824

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-A-93

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/2	98	7.5YR	4/4	2			Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☑ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 31-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-A-94

Investigator(s): Corbin Hoffmann, Shane Cantrell **Section, Township, Range:** S T R

Landform (hillslope, terrace, etc.): PLAIN **Local relief (concave, convex, none):** concave **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.06107 **Long.:** -95.330223 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ◉ No ○	Depth (inches): 8	**Wetland Hydrology Present?** Yes ◉ No ○
Water Table Present?	Yes ◉ No ○	Depth (inches): 1	
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches): 1	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-A-94

Tree Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 — 20% of Total Cover: 0	0	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Sesbania drummondii	60	☑	100.0%	FACW
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 30 — 20% of Total Cover: 12	60	= Total Cover		

Shrub Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 — 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Alternanthera philoxeroides	40	☑	40.0%	OBL
2. Leersia hexandra	30	☑	30.0%	OBL
3. Eleocharis palustris	20	☑	20.0%	OBL
4. Sagittaria latifolia	10	☐	10.0%	OBL
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 50 — 20% of Total Cover: 20	100	= Total Cover		

Woody Vine Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 — 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	100	x 1 =	100
FACW species	60	x 2 =	120
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	160 (A)		220 (B)

Prevalence Index = B/A = 1.375

Hydrophytic Vegetation Indicators:

- ☑ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-A-94

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/2	90	7.5YR	4/4	10			Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☑ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 31-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-A-95

Investigator(s): Corbin Hoffmann, Shane Cantrell **Section, Township, Range:** S T R

Landform (hillslope, terrace, etc.): **Local relief (concave, convex, none):** **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.062026 **Long.:** -95.335717 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ◉ No ○	Depth (inches):	4
Water Table Present?	Yes ◉ No ○	Depth (inches):	1
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches):	1

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-A-95

Tree Stratum (Plot size:)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		0	☐	0.0%	
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	
7.		0	☐	0.0%	
8.		0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 **= Total Cover**

Sapling or Sapling/Shrub Stratum (Plot size:)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Sesbania drummondii	5	☑	100.0%	FACW
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	
7.		0	☐	0.0%	
8.		0	☐	0.0%	

50% of Total Cover: 2.5 20% of Total Cover: 1 5 **= Total Cover**

Shrub Stratum (Plot size:)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		0	☐	0.0%	
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 **= Total Cover**

Herb Stratum (Plot size:)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Leersia hexandra	30	☑	37.5%	OBL
2.	Alternanthera philoxeroides	15	☐	18.8%	OBL
3.	Carex cherokeensis	30	☑	37.5%	FACW
4.	Sagittaria latifolia	5	☐	6.3%	OBL
5.		0	☐	0.0%	
6.		0	☐	0.0%	
7.		0	☐	0.0%	
8.		0	☐	0.0%	
9.		0	☐	0.0%	
10.		0	☐	0.0%	
11.		0	☐	0.0%	
12.		0	☐	0.0%	

50% of Total Cover: 40 20% of Total Cover: 16 80 **= Total Cover**

Woody Vine Stratum (Plot size:)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		0	☐	0.0%	
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 **= Total Cover**

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	50	x 1 =	50
FACW species	35	x 2 =	70
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	85 (A)		120 (B)

Prevalence Index = B/A = 1.412

Hydrophytic Vegetation Indicators:

- ☑ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-A-95

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/2	85	7.5YR	4/4	15			Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) (LRR P, T, U)
- [ ] 5 cm Mucky Mineral (A7) (LRR P, T, U)
- [ ] Muck Presence (A8) (LRR U)
- [ ] 1 cm Muck (A9) (LRR P, T)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Coast Prairie Redox (A16) (MLRA 150A)
- [ ] Sandy Muck Mineral (S1) (LRR O, S)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) (LRR P, S, T, U)
- [ ] Polyvalue Below Surface (S8) (LRR S, T, U)
- [ ] Thin Dark Surface (S9) (LRR S, T, U)
- [ ] Loamy Mucky Mineral (F1) (LRR O)
- [ ] Loamy Gleyed Matrix (F2)
- [x] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) (LRR U)
- [ ] Depleted Ochric (F11) (MLRA 151)
- [ ] Iron-Manganese Masses (F12) (LRR O, P, T)
- [ ] Umbric Surface (F13) (LRR P, T, U)
- [ ] Delta Ochric (F17) (MLRA 151)
- [ ] Reduced Vertic (F18) (MLRA 150A, 150B)
- [ ] Piedmont Floodplain Soils (F19) (MLRA 149A)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) (LRR O)
- [ ] 2 cm Muck (A10) (LRR S)
- [ ] Reduced Vertic (F18) (outside MLRA 150A,B)
- [ ] Piedmont Floodplain Soils (F19) (LRR P, S, T)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes (●) No ( )

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 31-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-A-96

Investigator(s): Corbin Hoffmann, Shane Cantrell **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): PLAIN **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.061823 **Long.:** -95.33528 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** PEM1A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (•) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (•) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (•) No ( )	**Is the Sampled Area within a Wetland?** Yes (•) No ( )
Hydric Soil Present?	Yes (•) No ( )	
Wetland Hydrology Present?	Yes (•) No ( )	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes (•) No ( )	Depth (inches): 5	**Wetland Hydrology Present?** Yes (•) No ( )
Water Table Present?	Yes (•) No ( )	Depth (inches): 1	
Saturation Present? (includes capillary fringe)	Yes (•) No ( )	Depth (inches): 1	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-A-96

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Sesbania drummondii	65	☑	100.0%	FACW
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 32.5 20% of Total Cover: 13	65	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Leersia hexandra	40	☑	47.1%	OBL
2. Alternanthera philoxeroides	20	☑	23.5%	OBL
3. Juncus effusus	20	☑	23.5%	OBL
4. Sagittaria latifolia	5	☐	5.9%	OBL
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 42.5 20% of Total Cover: 17	85	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	4	(A)
Total Number of Dominant Species Across All Strata:	4	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	85	x 1 =	85	
FACW species	65	x 2 =	130	
FAC species	0	x 3 =	0	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	150	(A)	215	(B)

Prevalence Index = B/A = 1.433

Hydrophytic Vegetation Indicators:

- ☑ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-A-96

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/2	85	7.5YR	4/4	15			Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2] Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 31-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-A-97**

Investigator(s): Corbin Hoffmann, Shane Cantrell **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): **Local relief (concave, convex, none):** **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.061689 **Long.:** -95.335131 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** PEM1A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?** Yes (●) No ( )
Hydric Soil Present?	Yes (●) No ( )	
Wetland Hydrology Present?	Yes (●) No ( )	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes (●) No ( )	Depth (inches):	5
Water Table Present?	Yes (●) No ( )	Depth (inches):	1
Saturation Present? (includes capillary fringe)	Yes (●) No ( )	Depth (inches):	1

Wetland Hydrology Present? Yes (●) No ( )

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-A-97

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		
Sapling or Sapling/Shrub Stratum (Plot size:)				
1. Triadica sebifera	70	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 35 20% of Total Cover: 14	70	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		
Herb Stratum (Plot size:)				
1. Juncus roemeranus	15	☑	60.0%	OBL
2. Sagittaria lancifolia	5	☑	20.0%	OBL
3. Leersia hexandra	5	☑	20.0%	OBL
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 12.5 20% of Total Cover: 5	25	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	25	x 1 =	25
FACW species	0	x 2 =	0
FAC species	70	x 3 =	210
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	95 (A)		235 (B)

Prevalence Index = B/A = 2.474

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-A-97

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix			Redox Features					Texture	Remarks
	Color (moist)		%	Color (moist)		%	Type[1]	Loc²		
0-20	10YR	3/2	85	7.5YR	4/4	15			Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 31-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-A-98**

Investigator(s): Corbin Hoffmann, Shane Cantrell **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): PLAIN **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.062969 **Long.:** -95.335785 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?** Yes (●) No ( )
Hydric Soil Present?	Yes (●) No ( )	
Wetland Hydrology Present?	Yes (●) No ( )	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes (●) No ( )	Depth (inches): 5	
Water Table Present?	Yes (●) No ( )	Depth (inches): 1	**Wetland Hydrology Present?** Yes (●) No ( )
Saturation Present? (includes capillary fringe)	Yes (●) No ( )	Depth (inches): 1	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-A-98

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	10	☑	50.0%	FAC
2. Sesbania drummondii	10	☑	50.0%	FACW
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 10 20% of Total Cover: 4	20	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Cyperus entrerianus	20	☑	21.1%	FACW
2. Leersia hexandra	70	☑	73.7%	OBL
3. Alternanthera philoxeroides	5	☐	5.3%	OBL
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 47.5 20% of Total Cover: 19	95	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	75	x 1 =	75
FACW species	30	x 2 =	60
FAC species	10	x 3 =	30
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	115 (A)		165 (B)

Prevalence Index = B/A = 1.435

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-A-98

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/2	90	7.5YR	4/4	10			Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 31-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-A-99

Investigator(s): Corbin Hoffmann, Shane Cantrell **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): PLAIN **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.062172 **Long.:** -95.3347 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** PEM1A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (•) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (•) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (•) No ( )	**Is the Sampled Area within a Wetland?** Yes (•) No ( )
Hydric Soil Present?	Yes (•) No ( )	
Wetland Hydrology Present?	Yes (•) No ( )	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes (•) No ( )	Depth (inches):	6
Water Table Present?	Yes (•) No ( )	Depth (inches):	1
Saturation Present? (includes capillary fringe)	Yes (•) No ( )	Depth (inches):	1

Wetland Hydrology Present? Yes (•) No ( )

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-A-99

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	20	☑	33.3%	FAC
2. Sesbania drummondii	40	☑	66.7%	FACW
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 30 20% of Total Cover: 12	60	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Leersia hexandra	40	☑	36.4%	OBL
2. Juncus roemeranus	20	☐	18.2%	OBL
3. Calyptocarpus vialis	5	☐	4.5%	FAC
4. Spartina patens	5	☐	4.5%	FACW
5. Cyperus entrerianus	10	☐	9.1%	FACW
6. Alternanthera philoxeroides	30	☑	27.3%	OBL
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 55 20% of Total Cover: 22	110	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	90	x 1 =	90
FACW species	55	x 2 =	110
FAC species	25	x 3 =	75
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	170 (A)		275 (B)

Prevalence Index = B/A = 1.618

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-A-99

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-20	10YR	3/2	90	7.5YR	4/4	10			Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) (LRR P, T, U)
- [ ] 5 cm Mucky Mineral (A7) (LRR P, T, U)
- [ ] Muck Presence (A8) (LRR U)
- [ ] 1 cm Muck (A9) (LRR P, T)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Coast Prairie Redox (A16) (MLRA 150A)
- [ ] Sandy Muck Mineral (S1) (LRR O, S)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) (LRR P, S, T, U)
- [ ] Polyvalue Below Surface (S8) (LRR S, T, U)
- [ ] Thin Dark Surface (S9) (LRR S, T, U)
- [ ] Loamy Mucky Mineral (F1) (LRR O)
- [ ] Loamy Gleyed Matrix (F2)
- [x] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) (LRR U)
- [ ] Depleted Ochric (F11) (MLRA 151)
- [ ] Iron-Manganese Masses (F12) (LRR O, P, T)
- [ ] Umbric Surface (F13) (LRR P, T, U)
- [ ] Delta Ochric (F17) (MLRA 151)
- [ ] Reduced Vertic (F18) (MLRA 150A, 150B)
- [ ] Piedmont Floodplain Soils (F19) (MLRA 149A)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) (LRR O)
- [ ] 2 cm Muck (A10) (LRR S)
- [ ] Reduced Vertic (F18) (outside MLRA 150A,B)
- [ ] Piedmont Floodplain Soils (F19) (LRR P, S, T)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes (●) No ( )

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 31-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-A-100**

Investigator(s): Corbin Hoffmann, Shane Cantrell **Section, Township, Range: S** ___ **T** ___ **R** ___

Landform (hillslope, terrace, etc.): PLAIN **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.061948 **Long.:** -95.334112 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ( ) No (●)	**Is the Sampled Area within a Wetland?**	Yes ( ) No (●)
Hydric Soil Present?	Yes ( ) No (●)		
Wetland Hydrology Present?	Yes ( ) No (●)		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (●)	Depth (inches):	
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (●)	Depth (inches):	

Wetland Hydrology Present? Yes ( ) No (●)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-A-100

Tree Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Sapling or Sapling/Shrub Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Shrub Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Herb Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Stenotaphrum secundatum	50	☑	50.0%	FAC
2. Sporobolus indicus	35	☑	35.0%	FACU
3. Iva annua	15	☐	15.0%	FAC
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	

50% of Total Cover: 50 20% of Total Cover: 20 100 = Total Cover

Woody Vine Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	65	x 3 =	195
FACU species	35	x 4 =	140
UPL species	0	x 5 =	0
Column Totals:	100	(A)	335 (B)

Prevalence Index = B/A = 3.350

Hydrophytic Vegetation Indicators:

☐ **1 - Rapid Test for Hydrophytic Vegetation**
☐ **2 - Dominance Test is > 50%**
☐ **3 - Prevalence Index is ≤3.0** [1]
☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-A-100

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc²	Texture	Remarks
0-20	10YR	3/1	100						Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 31-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-A-101**

Investigator(s): Corbin Hoffmann, Shane Cantrell **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): PLAIN **Local relief (concave, convex, none):** concave **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.062077 **Long.:** -95.333765 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?**	Yes (●) No ( )
Hydric Soil Present?	Yes (●) No ( )		
Wetland Hydrology Present?	Yes (●) No ( )		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes (●) No ( )	Depth (inches):	1
Water Table Present?	Yes (●) No ( )	Depth (inches):	2
Saturation Present? (includes capillary fringe)	Yes (●) No ( )	Depth (inches):	1

Wetland Hydrology Present? Yes (●) No ( )

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-A-101

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Sesbania drummondii	40	☑	80.0%	FACW
2. Triadica sebifera	10	☑	20.0%	FAC
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 25 20% of Total Cover: 10	50	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Leersia hexandra	20	☑	50.0%	OBL
2. Alternanthera philoxeroides	20	☑	50.0%	OBL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 20 20% of Total Cover: 8	40	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	40	x 1 =	40
FACW species	40	x 2 =	80
FAC species	10	x 3 =	30
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	90 (A)		150 (B)

Prevalence Index = B/A = 1.667

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-A-101

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-20	10YR	3/2	95	10YR	4/4	5			Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) (LRR P, T, U)
- [ ] 5 cm Mucky Mineral (A7) (LRR P, T, U)
- [ ] Muck Presence (A8) (LRR U)
- [ ] 1 cm Muck (A9) (LRR P, T)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [x] Coast Prairie Redox (A16) (MLRA 150A)
- [ ] Sandy Muck Mineral (S1) (LRR O, S)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) (LRR P, S, T, U)
- [ ] Polyvalue Below Surface (S8) (LRR S, T, U)
- [ ] Thin Dark Surface (S9) (LRR S, T, U)
- [ ] Loamy Mucky Mineral (F1) (LRR O)
- [ ] Loamy Gleyed Matrix (F2)
- [x] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) (LRR U)
- [ ] Depleted Ochric (F11) (MLRA 151)
- [ ] Iron-Manganese Masses (F12) (LRR O, P, T)
- [ ] Umbric Surface (F13) (LRR P, T, U)
- [ ] Delta Ochric (F17) (MLRA 151)
- [ ] Reduced Vertic (F18) (MLRA 150A, 150B)
- [ ] Piedmont Floodplain Soils (F19) (MLRA 149A)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) (LRR O)
- [ ] 2 cm Muck (A10) (LRR S)
- [ ] Reduced Vertic (F18) (outside MLRA 150A,B)
- [ ] Piedmont Floodplain Soils (F19) (LRR P, S, T)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes (●) No ( )

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 31-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-A-102**

Investigator(s): Corbin Hoffmann, Shane Cantrell **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): PLAIN **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.063977 **Long.:** -95.332125 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ◉ No ○	Depth (inches):	8
Water Table Present?	Yes ◉ No ○	Depth (inches):	1
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches):	1

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-A-102

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Celtis occidentalis	10	✔	25.0%	FACU
2. Triadica sebifera	30	✔	75.0%	FAC
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 20 20% of Total Cover: 8	40	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	20	✔	40.0%	FAC
2. Sesbania drummondii	10	✔	20.0%	FACW
3. Poncirus trifoliata	20	✔	40.0%	UPL
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 25 20% of Total Cover: 10	50	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Leersia hexandra	30	✔	30.0%	OBL
2. Alternanthera philoxeroides	30	✔	30.0%	OBL
3. Cyperus odoratus	20	✔	20.0%	FACW
4. Cyperus entrerianus	20	✔	20.0%	FACW
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 50 20% of Total Cover: 20	100	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rosa bracteata	50	✔	100.0%	UPL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 25 20% of Total Cover: 10	50	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 7 (A)

Total Number of Dominant Species Across All Strata: 10 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 70.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	60	x 1 =	60
FACW species	50	x 2 =	100
FAC species	50	x 3 =	150
FACU species	10	x 4 =	40
UPL species	70	x 5 =	350
Column Totals:	240 (A)		700 (B)

Prevalence Index = B/A = 2.917

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-A-102

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix			Redox Features					Texture	Remarks
	Color (moist)		%	Color (moist)		%	Type[1]	Loc²		
0-20	10YR	3/1	95	7.5YR	4/4	5			Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☑ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 31-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-A-103**

Investigator(s): Corbin Hoffmann, Shane Cantrell **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): PLAIN **Local relief (concave, convex, none):** none **Slope:** 0.0 **% /** 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.063649 **Long.:** -95.332277 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** PSS1A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●)	No ( )	**Is the Sampled Area within a Wetland?** Yes ( ) No (●)
Hydric Soil Present?	Yes ( )	No (●)	
Wetland Hydrology Present?	Yes ( )	No (●)	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( )	No (●)	Depth (inches):
Water Table Present?	Yes ( )	No (●)	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ( )	No (●)	Depth (inches):

Wetland Hydrology Present? Yes ( ) No (●)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-A-103

Tree Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Sapling or Sapling/Shrub Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Shrub Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Herb Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Stenotaphrum secundatum	60	☑	60.0%	FAC
2. Iva annua	20	☑	20.0%	FAC
3. Sporobolus indicus var. capensis	10	☐	10.0%	FACU
4. Croton texensis	10	☐	10.0%	UPL
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	

50% of Total Cover: 50 20% of Total Cover: 20 100 = Total Cover

Woody Vine Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	80	x 3 =	240
FACU species	10	x 4 =	40
UPL species	10	x 5 =	50
Column Totals:	100 (A)		330 (B)

Prevalence Index = B/A = 3.300

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-A-103

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	100							

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 31-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-A-104

Investigator(s): Corbin Hoffmann, Shane Cantrell **Section, Township, Range:** S T R

Landform (hillslope, terrace, etc.): PLAIN **Local relief (concave, convex, none):** concave **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.060862 **Long.:** -95.333423 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?** Yes (●) No ( )
Hydric Soil Present?	Yes (●) No ( )	
Wetland Hydrology Present?	Yes (●) No ( )	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes (●) No ( )	Depth (inches):	5
Water Table Present?	Yes (●) No ( )	Depth (inches):	1
Saturation Present? (includes capillary fringe)	Yes (●) No ( )	Depth (inches):	1

Wetland Hydrology Present? Yes (●) No ( )

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-A-104

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Sesbania drummondii	65	☑	100.0%	FACW
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 32.5 20% of Total Cover: 13	65	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Leersia hexandra	40	☑	47.1%	OBL
2. Alternanthera philoxeroides	20	☑	23.5%	OBL
3. Juncus effusus	20	☑	23.5%	OBL
4. Sagittaria latifolia	5	☐	5.9%	OBL
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 42.5 20% of Total Cover: 17	85	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	85	x 1 =	85
FACW species	65	x 2 =	130
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	150 (A)		215 (B)

Prevalence Index = B/A = 1.433

Hydrophytic Vegetation Indicators:

- ☑ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-A-104

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-20	10YR	3/2	15	7.5YR	4/4	85			Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 31-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-A-105

Investigator(s): Corbin Hoffmann, Shane Cantrell **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): PLAIN **Local relief (concave, convex, none):** concave **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.060895 **Long.:** -95.332997 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ○	**Is the Sampled Area within a Wetland?**	Yes (●) No ○
Hydric Soil Present?	Yes (●) No ○		
Wetland Hydrology Present?	Yes (●) No ○		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes (●) No ○	Depth (inches):	5
Water Table Present?	Yes (●) No ○	Depth (inches):	1
Saturation Present? (includes capillary fringe)	Yes (●) No ○	Depth (inches):	1

Wetland Hydrology Present? Yes (●) No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-A-105

Tree Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 — 20% of Total Cover: 0	0	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Sesbania drummondii	65	☑	100.0%	FACW
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 32.5 — 20% of Total Cover: 13	65	= Total Cover		

Shrub Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 — 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Leersia hexandra	40	☑	47.1%	OBL
2. Alternanthera philoxeroides	20	☑	23.5%	OBL
3. Juncus effusus	20	☑	23.5%	OBL
4. Sagittaria latifolia	5	☐	5.9%	OBL
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 42.5 — 20% of Total Cover: 17	85	= Total Cover		

Woody Vine Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 — 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	85	x 1 =	85
FACW species	65	x 2 =	130
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	150 (A)		215 (B)

Prevalence Index = B/A = 1.433

Hydrophytic Vegetation Indicators:

- ☑ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-A-105

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-20	10YR	3/2	15	7.5YR	4/4	85			Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) (LRR P, T, U)
- [ ] 5 cm Mucky Mineral (A7) (LRR P, T, U)
- [ ] Muck Presence (A8) (LRR U)
- [ ] 1 cm Muck (A9) (LRR P, T)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Coast Prairie Redox (A16) (MLRA 150A)
- [ ] Sandy Muck Mineral (S1) (LRR O, S)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) (LRR P, S, T, U)
- [ ] Polyvalue Below Surface (S8) (LRR S, T, U)
- [ ] Thin Dark Surface (S9) (LRR S, T, U)
- [ ] Loamy Mucky Mineral (F1) (LRR O)
- [ ] Loamy Gleyed Matrix (F2)
- [x] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) (LRR U)
- [ ] Depleted Ochric (F11) (MLRA 151)
- [ ] Iron-Manganese Masses (F12) (LRR O, P, T)
- [ ] Umbric Surface (F13) (LRR P, T, U)
- [ ] Delta Ochric (F17) (MLRA 151)
- [ ] Reduced Vertic (F18) (MLRA 150A, 150B)
- [ ] Piedmont Floodplain Soils (F19) (MLRA 149A)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) (LRR O)
- [ ] 2 cm Muck (A10) (LRR S)
- [ ] Reduced Vertic (F18) (outside MLRA 150A,B)
- [ ] Piedmont Floodplain Soils (F19) (LRR P, S, T)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes (●) No ( )

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 11-Nov-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-A-106**

Investigator(s): Corbin Hoffmann, Shane Cantrell **Section, Township, Range: S** ___ **T** ___ **R** ___

Landform (hillslope, terrace, etc.): plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.05483 **Long.:** -95.289661 **Datum:** ___

Soil Map Unit Name: 39 - Surfside clay, 0 to 1 percent slopes, occasionally flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ( ) No (●)	**Is the Sampled Area within a Wetland?** Yes ( ) No (●)
Hydric Soil Present?	Yes ( ) No (●)	
Wetland Hydrology Present?	Yes (●) No ( )	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (●)	Depth (inches):	
Water Table Present?	Yes (●) No ( )	Depth (inches):	6
Saturation Present? (includes capillary fringe)	Yes (●) No ( )	Depth (inches):	1

Wetland Hydrology Present? Yes (●) No ( )

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-A-106

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Baccharis halimifolia	50	☑	55.6%	FAC
2. Acacia berlandieri	20	☑	22.2%	UPL
3. Rosa bracteata	20	☑	22.2%	UPL
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 45 20% of Total Cover: 18	90	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Spartina spartinae	70	☑	63.6%	OBL
2. Iva frutescens	20	☐	18.2%	FACW
3. Andropogon glomeratus	20	☐	18.2%	FACW
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 55 20% of Total Cover: 22	110	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	70	x 1 =	70	
FACW species	40	x 2 =	80	
FAC species	50	x 3 =	150	
FACU species	0	x 4 =	0	
UPL species	40	x 5 =	200	
Column Totals:	200	(A)	500	(B)

Prevalence Index = B/A = 2.500

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☐ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-A-106

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	100						Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2] Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 11-Nov-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-A-108**

Investigator(s): Corbin Hoffmann, Shane Cantrell **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.0542456 **Long.:** -95.285138 **Datum:**

Soil Map Unit Name: 39 - Surfside clay, 0 to 1 percent slopes, occasionally flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?**	Yes ( ) No (●)
Hydric Soil Present?	Yes ( ) No (●)		
Wetland Hydrology Present?	Yes ( ) No (●)		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (●)	Depth (inches):	
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (●)	Depth (inches):	

Wetland Hydrology Present? Yes ( ) No (●)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-A-108

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Baccharis halimifolia	40	☑	61.5%	FAC
2. Rosa bracteata	20	☑	30.8%	UPL
3. Celtis laevigata	5	☐	7.7%	FACW
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 32.5 20% of Total Cover: 13	65	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Spartina spartinae	60	☑	57.1%	OBL
2. Calyptocarpus vialis	20	☐	19.0%	FAC
3. Iva annua	10	☐	9.5%	FAC
4. Rubus argutus	10	☐	9.5%	FAC
5. Andropogon glomeratus	5	☐	4.8%	FACW
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 52.5 20% of Total Cover: 21	105	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 66.7% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	60	x 1 =	60
FACW species	10	x 2 =	20
FAC species	80	x 3 =	240
FACU species	0	x 4 =	0
UPL species	20	x 5 =	100
Column Totals:	170 (A)		420 (B)

Prevalence Index = B/A = 2.471

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-A-108

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	100							

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 14-Nov-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-A-140**

Investigator(s): Corbin Hoffmann, Shane Cantrell **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **% /** 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.047965 **Long.:** -95.295269 **Datum:**

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?** Yes (●) No ( )
Hydric Soil Present?	Yes (●) No ( )	
Wetland Hydrology Present?	Yes (●) No ( )	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☑ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes (●) No ( )	Depth (inches):	6
Water Table Present?	Yes (●) No ( )	Depth (inches):	1
Saturation Present? (includes capillary fringe)	Yes (●) No ( )	Depth (inches):	1

Wetland Hydrology Present? Yes (●) No ( )

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-A-140

Tree Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Triadica sebifera	70	✓	93.3%	FAC
2.	Celtis laevigata	5		6.7%	FACW
3.		0		0.0%	
4.		0		0.0%	
5.		0		0.0%	
6.		0		0.0%	
7.		0		0.0%	
8.		0		0.0%	

50% of Total Cover: 37.5 20% of Total Cover: 15 75 = Total Cover

Sapling or Sapling/Shrub Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Triadica sebifera	40	✓	80.0%	FAC
2.	Sesbania drummondii	10	✓	20.0%	FACW
3.		0		0.0%	
4.		0		0.0%	
5.		0		0.0%	
6.		0		0.0%	
7.		0		0.0%	
8.		0		0.0%	

50% of Total Cover: 25 20% of Total Cover: 10 50 = Total Cover

Shrub Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		0		0.0%	
2.		0		0.0%	
3.		0		0.0%	
4.		0		0.0%	
5.		0		0.0%	
6.		0		0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Herb Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Carex cherokeensis	30	✓	33.3%	FACW
2.	Leersia hexandra	30	✓	33.3%	OBL
3.	Juncus roemeranus	15		16.7%	OBL
4.	Alternanthera philoxeroides	10		11.1%	OBL
5.	Iva annua	5		5.6%	FAC
6.		0		0.0%	
7.		0		0.0%	
8.		0		0.0%	
9.		0		0.0%	
10.		0		0.0%	
11.		0		0.0%	
12.		0		0.0%	

50% of Total Cover: 45 20% of Total Cover: 18 90 = Total Cover

Woody Vine Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Rubus argutus	5	✓	100.0%	FAC
2.		0		0.0%	
3.		0		0.0%	
4.		0		0.0%	
5.		0		0.0%	

50% of Total Cover: 2.5 20% of Total Cover: 1 5 = Total Cover

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	55	x 1 =	55
FACW species	45	x 2 =	90
FAC species	120	x 3 =	360
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	220 (A)		505 (B)

Prevalence Index = B/A = 2.295

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes (●) No ( )

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-A-140

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	90	7.5YR	5/6	10	D	M	Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 14-Nov-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-A-141**

Investigator(s): Corbin Hoffmann, Shane Cantrell **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.050378 **Long.:** -95.295184 **Datum:**

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?** Yes ( ) No (●)
Hydric Soil Present?	Yes ( ) No (●)	
Wetland Hydrology Present?	Yes (●) No ( )	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes (●) No ( )	Depth (inches):	1
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes (●) No ( )	Depth (inches):	1

Wetland Hydrology Present? Yes (●) No ( )

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

recent rain

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-A-141

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rosa bracteata	50	☑	71.4%	UPL
2. Acacia berlandieri	20	☑	28.6%	UPL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 35 20% of Total Cover: 14	70	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Iva annua	50	☑	52.6%	FAC
2. Helenium amarum	10	☐	10.5%	FACU
3. Carex cherokeensis	25	☑	26.3%	FACW
4. Calyptocarpus vialis	10	☐	10.5%	FAC
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 47.5 20% of Total Cover: 19	95	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rubus argutus	5	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 2.5 20% of Total Cover: 1	5	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 60.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	25	x 2 =	50
FAC species	65	x 3 =	195
FACU species	10	x 4 =	40
UPL species	70	x 5 =	350
Column Totals:	170 (A)		635 (B)

Prevalence Index = B/A = 3.735

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-A-141

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	100							

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2] Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 15-Nov-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-A-143

Investigator(s): Corbin Hoffmann, Shane Cantrell **Section, Township, Range:** S T R

Landform (hillslope, terrace, etc.): plain **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.056672 **Long.:** -95.30096 **Datum:**

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?**	Yes ( ) No (●)
Hydric Soil Present?	Yes ( ) No (●)		
Wetland Hydrology Present?	Yes (●) No ( )		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes (●) No ( )	Depth (inches):	1
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes (●) No ( )	Depth (inches):	1

Wetland Hydrology Present? Yes (●) No ( )

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-A-143

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Celtis laevigata	45	✔	56.3%	FACW
2. Triadica sebifera	20	✔	25.0%	FAC
3. Quercus virginiana	15	☐	18.8%	FACU
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 40 20% of Total Cover: 16	80	= Total Cover		
Sapling or Sapling/Shrub Stratum (Plot size: ______)				
1. Quercus virginiana	15	✔	75.0%	FACU
2. Triadica sebifera	5	✔	25.0%	FAC
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 10 20% of Total Cover: 4	20	= Total Cover		
Shrub Stratum (Plot size: ______)				
1. Rosa bracteata	10	✔	33.3%	UPL
2. Acacia berlandieri	5	☐	16.7%	UPL
3. Xanthium strumarium	10	✔	33.3%	FAC
4. Iva annua	5	☐	16.7%	FAC
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 15 20% of Total Cover: 6	30	= Total Cover		
Herb Stratum (Plot size: ______)				
1. Stenotaphrum secundatum	40	✔	50.0%	FAC
2. Carex cherokeensis	40	✔	50.0%	FACW
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 40 20% of Total Cover: 16	80	= Total Cover		
Woody Vine Stratum (Plot size: ______)				
1. Toxicodendron radicans	5	✔	50.0%	FAC
2. Campsis radicans	5	✔	50.0%	FAC
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 5 20% of Total Cover: 2	10	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 8 (A)

Total Number of Dominant Species Across All Strata: 10 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 80.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	85	x 2 =	170
FAC species	90	x 3 =	270
FACU species	30	x 4 =	120
UPL species	15	x 5 =	75
Column Totals:	220 (A)		635 (B)

Prevalence Index = B/A = 2.886

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-A-143

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	100						Clay Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains   [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 15-Nov-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-A-144**

Investigator(s): Corbin Hoffmann, Shane Cantrell **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **% /** 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.055674 **Long.:** -95.301894 **Datum:**

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (•) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (•) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (•) No ( )	**Is the Sampled Area within a Wetland?**	Yes ( ) No (•)
Hydric Soil Present?	Yes ( ) No (•)		
Wetland Hydrology Present?	Yes ( ) No (•)		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (•)	Depth (inches):	
Water Table Present?	Yes ( ) No (•)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (•)	Depth (inches):	

Wetland Hydrology Present? Yes ( ) No (•)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-A-144

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	30	☑	50.0%	FAC
2. Celtis laevigata	30	☑	50.0%	FACW
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 30 20% of Total Cover: 12	60	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	10	☑	20.0%	FAC
2. Celtis laevigata	10	☑	20.0%	FACW
3. Celtis occidentalis	30	☑	60.0%	FACU
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 25 20% of Total Cover: 10	50	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rosa bracteata	20	☑	100.0%	UPL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 10 20% of Total Cover: 4	20	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Carex cherokeensis	40	☑	38.1%	FACW
2. Paspalum notatum	20	☐	19.0%	FACU
3. Stenotaphrum secundatum	30	☑	28.6%	FAC
4. Centella erecta	15	☐	14.3%	FACW
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 52.5 20% of Total Cover: 21	105	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 8 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 75.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	95	x 2 =	190
FAC species	70	x 3 =	210
FACU species	50	x 4 =	200
UPL species	20	x 5 =	100
Column Totals:	235 (A)		700 (B)

Prevalence Index = B/A = 2.979

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes (●) No ( )

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-A-144

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-20	10YR	3/2	100							

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 06-Dec-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-A-146**

Investigator(s): Corbin Hoffmann, Shane Cantrell **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **% /** 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.053421 **Long.:** -95.298022 **Datum:** WGS 1983

Soil Map Unit Name: 32 - Narta fine sandy loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?** Yes (●) No ( )
Hydric Soil Present?	Yes (●) No ( )	
Wetland Hydrology Present?	Yes (●) No ( )	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes (●) No ( )	Depth (inches): 4	**Wetland Hydrology Present?** Yes (●) No ( )
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (●)	Depth (inches):	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-A-146

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	40	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 20 — 20% of Total Cover: 8	40	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	50	☑	90.9%	FAC
2. Rosa bracteata	5	☐	9.1%	UPL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 27.5 — 20% of Total Cover: 11	55	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 — 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Leersia hexandra	50	☑	76.9%	OBL
2. Carex cherokeensis	10	☐	15.4%	FACW
3. Juncus roemeranus	5	☐	7.7%	OBL
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 32.5 — 20% of Total Cover: 13	65	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 — 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	55	x 1 =	55
FACW species	10	x 2 =	20
FAC species	90	x 3 =	270
FACU species	0	x 4 =	0
UPL species	5	x 5 =	25
Column Totals:	160 (A)		370 (B)

Prevalence Index = B/A = 2.313

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-A-146

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix			Redox Features					Texture	Remarks
	Color (moist)		%	Color (moist)		%	Type[1]	Loc²		
0-20	10YR	3/1	95	7.5YR	4/4	5	D	M	Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☑ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 06-Dec-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-A-147

Investigator(s): Corbin Hoffmann, Shane Cantrell **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.048115 **Long.:** -95.298111 **Datum:** WGS 1983

Soil Map Unit Name: 32 - Narta fine sandy loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?**	Yes (●) No ( )
Hydric Soil Present?	Yes (●) No ( )		
Wetland Hydrology Present?	Yes (●) No ( )		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes (●) No ( )	Depth (inches):	4
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (●)	Depth (inches):	

Wetland Hydrology Present? Yes (●) No ( )

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-A-147

Tree Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Sapling or Sapling/Shrub Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Sesbania drummondii	15	☑	100.0%	FACW
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	

50% of Total Cover: 7.5 20% of Total Cover: 3 15 = Total Cover

Shrub Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Herb Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Leersia hexandra	40	☑	40.0%	OBL
2. Eleocharis palustris	30	☑	30.0%	OBL
3. Juncus roemeranus	30	☑	30.0%	OBL
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	

50% of Total Cover: 50 20% of Total Cover: 20 100 = Total Cover

Woody Vine Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	100	x 1 =	100
FACW species	15	x 2 =	30
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	115 (A)		130 (B)

Prevalence Index = B/A = 1.130

Hydrophytic Vegetation Indicators:

- ☑ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-A-147

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	95	7.5YR	4/6	5	D	M	Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) (LRR P, T, U)
- [ ] 5 cm Mucky Mineral (A7) (LRR P, T, U)
- [ ] Muck Presence (A8) (LRR U)
- [ ] 1 cm Muck (A9) (LRR P, T)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [x] Coast Prairie Redox (A16) (MLRA 150A)
- [ ] Sandy Muck Mineral (S1) (LRR O, S)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) (LRR P, S, T, U)
- [ ] Polyvalue Below Surface (S8) (LRR S, T, U)
- [ ] Thin Dark Surface (S9) (LRR S, T, U)
- [ ] Loamy Mucky Mineral (F1) (LRR O)
- [ ] Loamy Gleyed Matrix (F2)
- [ ] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) (LRR U)
- [ ] Depleted Ochric (F11) (MLRA 151)
- [ ] Iron-Manganese Masses (F12) (LRR O, P, T)
- [ ] Umbric Surface (F13) (LRR P, T, U)
- [ ] Delta Ochric (F17) (MLRA 151)
- [ ] Reduced Vertic (F18) (MLRA 150A, 150B)
- [ ] Piedmont Floodplain Soils (F19) (MLRA 149A)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) (LRR O)
- [ ] 2 cm Muck (A10) (LRR S)
- [ ] Reduced Vertic (F18) (outside MLRA 150A,B)
- [ ] Piedmont Floodplain Soils (F19) (LRR P, S, T)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes (●) No ( )

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-B-2

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range:** S T R

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.054615 **Long.:** -95.331134 **Datum:** WGS 1983

Soil Map Unit Name: 36- Pledger clay, 0 to 1 percent slopes, rarely flooded **NWI classification:** None

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?** Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉	
Wetland Hydrology Present?	Yes ○ No ◉	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○ No ◉	Depth (inches):	

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-2

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Iva annua	60	☑	63.2%	FAC
2. Helenium amarum	25	☑	26.3%	FACU
3. Stenotaphrum secundatum	10	☐	10.5%	FAC
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 47.5 20% of Total Cover: 19	95	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	70	x 3 =	210
FACU species	25	x 4 =	100
UPL species	0	x 5 =	0
Column Totals:	95 (A)		310 (B)

Prevalence Index = B/A = 3.263

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☐ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/2	100						Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-B-4**

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range: S** ___ **T** ___ **R** ___

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.052152 **Long.:** -95.330886 **Datum:** WGS 1983

Soil Map Unit Name: 36- Pledger clay, 0 to 1 percent slopes, rarely flooded **NWI classification:** None

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ( ) No (●)	**Is the Sampled Area within a Wetland?** Yes ( ) No (●)
Hydric Soil Present?	Yes ( ) No (●)	
Wetland Hydrology Present?	Yes ( ) No (●)	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (●)	Depth (inches):	
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (●)	Depth (inches):	

Wetland Hydrology Present? Yes ( ) No (●)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-4

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Ilex vomitoria	15	☑	60.0%	FAC
2. Rosa bracteata	10	☑	40.0%	UPL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 12.5 20% of Total Cover: 5	25	= Total Cover		

Shrub Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Iva annua	60	☑	66.7%	FAC
2. Helenium amarum	20	☑	22.2%	FACU
3. Paspalum notatum	10	☐	11.1%	FACU
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 45 20% of Total Cover: 18	90	= Total Cover		

Woody Vine Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	75	x 3 =	225
FACU species	30	x 4 =	120
UPL species	10	x 5 =	50
Column Totals:	115	(A)	395 (B)

Prevalence Index = B/A = 3.435

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☐ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/2	100					Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 08-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-B-6**

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.050216 **Long.:** -95.329284 **Datum:** WGS 1983

Soil Map Unit Name: 36- Pledger clay, 0 to 1 percent slopes, rarely flooded **NWI classification:** None

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉	
Wetland Hydrology Present?	Yes ○ No ◉	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○ No ◉	Depth (inches):	

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-6

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Ilex vomitoria	15	☑	42.9%	FAC
2. Rosa bracteata	10	☑	28.6%	UPL
3. Sesbania drummondii	10	☑	28.6%	FACW
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 17.5 20% of Total Cover: 7	35	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Iva annua	50	☑	58.8%	FAC
2. Helenium amarum	20	☑	23.5%	FACU
3. Paspalum notatum	10	☐	11.8%	FACU
4. Euphorbia bicolor	5	☐	5.9%	UPL
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 42.5 20% of Total Cover: 17	85	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 60.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	10	x 2 =	20
FAC species	65	x 3 =	195
FACU species	30	x 4 =	120
UPL species	15	x 5 =	75
Column Totals:	120 (A)		410 (B)

Prevalence Index = B/A = 3.417

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-6

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-20	10YR	3/2	100						Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 08-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-B-8**

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.049307 **Long.:** -95.326353 **Datum:** WGS 1983

Soil Map Unit Name: 36- Pledger clay, 0 to 1 percent slopes, rarely flooded **NWI classification:** None

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ( ) No (●)	**Is the Sampled Area within a Wetland?**	Yes ( ) No (●)
Hydric Soil Present?	Yes ( ) No (●)		
Wetland Hydrology Present?	Yes ( ) No (●)		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (●)	Depth (inches):	
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (●)	Depth (inches):	

Wetland Hydrology Present? Yes ( ) No (●)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-8

Tree Stratum (Plot size: ________)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		0	☐	0.0%	
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	
7.		0	☐	0.0%	
8.		0	☐	0.0%	
50% of Total Cover: 0	20% of Total Cover: 0	0	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size: ________)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Ilex vomitoria	15	☑	60.0%	FAC
2.	Rosa bracteata	10	☑	40.0%	UPL
3.			☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	
7.		0	☐	0.0%	
8.		0	☐	0.0%	
50% of Total Cover: 12.5	20% of Total Cover: 5	25	= Total Cover		

Shrub Stratum (Plot size: ________)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		0	☐	0.0%	
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	
50% of Total Cover: 0	20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size: ________)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Iva annua	50	☑	58.8%	FAC
2.	Helenium amarum	20	☑	23.5%	FACU
3.	Paspalum notatum	10	☐	11.8%	FACU
4.	Euphorbia bicolor	5	☐	5.9%	UPL
5.		0	☐	0.0%	
6.		0	☐	0.0%	
7.		0	☐	0.0%	
8.		0	☐	0.0%	
9.		0	☐	0.0%	
10.		0	☐	0.0%	
11.		0	☐	0.0%	
12.		0	☐	0.0%	
50% of Total Cover: 42.5	20% of Total Cover: 17	85	= Total Cover		

Woody Vine Stratum (Plot size: ________)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		0	☐	0.0%	
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
50% of Total Cover: 0	20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	65	x 3 =	195
FACU species	30	x 4 =	120
UPL species	15	x 5 =	75
Column Totals:	110 (A)		390 (B)

Prevalence Index = B/A = 3.545

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☐ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-8

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-20	10YR	3/2	100						Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 08-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-B-9**

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.047536 **Long.:** -95.325109 **Datum:** WGS 1983

Soil Map Unit Name: 36- Pledger clay, 0 to 1 percent slopes, rarely flooded **NWI classification:** None

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ● No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ● No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ○	No ●
Hydric Soil Present?	Yes ○	No ●
Wetland Hydrology Present?	Yes ○	No ●

Is the Sampled Area within a Wetland? Yes ○ No ●

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ○	No ●	Depth (inches):
Water Table Present?	Yes ○	No ●	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ○	No ●	Depth (inches):

Wetland Hydrology Present? Yes ○ No ●

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-9

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Ilex vomitoria	15	☑	60.0%	FAC
2. Rosa bracteata	10	☑	40.0%	UPL
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 12.5 20% of Total Cover: 5	25	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Iva annua	50	☑	58.8%	FAC
2. Helenium amarum	20	☑	23.5%	FACU
3. Paspalum notatum	10	☐	11.8%	FACU
4. Euphorbia bicolor	5	☐	5.9%	UPL
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 42.5 20% of Total Cover: 17	85	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	0	x 1 =	0	
FACW species	0	x 2 =	0	
FAC species	65	x 3 =	195	
FACU species	30	x 4 =	120	
UPL species	15	x 5 =	75	
Column Totals:	110	(A)	390	(B)

Prevalence Index = B/A = 3.545

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☐ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-9

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/2	100						Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 08-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-B-10**

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.047642 **Long.:** -95.32445 **Datum:** WGS 1983

Soil Map Unit Name: 36- Pledger clay, 0 to 1 percent slopes, rarely flooded **NWI classification:** None

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?**	Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○		
Wetland Hydrology Present?	Yes ◉ No ○		

Remarks:
PFO wetland. Likely would not be considered PFO if Chinese tallow trees are removed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○ No ◉	Depth (inches):	

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-10

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	50	☑	58.8%	FAC
2. Ilex decidua	20	☑	23.5%	FACW
3. Celtis laevigata	15	☐	17.6%	FACW
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 42.5 20% of Total Cover: 17	85	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Paspalum notatum	40	☑	100.0%	FACU
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 20 20% of Total Cover: 8	40	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Toxicodendron radicans	15	☑	50.0%	FAC
2. Campsis radicans	15	☑	50.0%	FAC
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 15 20% of Total Cover: 6	30	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	4	(A)
Total Number of Dominant Species Across All Strata:	5	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	80.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	35	x 2 =	70
FAC species	80	x 3 =	240
FACU species	40	x 4 =	160
UPL species	0	x 5 =	0
Column Totals:	155 (A)		470 (B)

Prevalence Index = B/A = 3.032

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-10

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	95	5YR	4/6	5	C	PL	Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☑ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 08-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-B-12

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range:** S T R

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.047021 **Long.:** -95.320456 **Datum:** WGS 1983

Soil Map Unit Name: 36- Pledger clay, 0 to 1 percent slopes, rarely flooded **NWI classification:** None

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ( ) No (●)	**Is the Sampled Area within a Wetland?**	Yes ( ) No (●)
Hydric Soil Present?	Yes ( ) No (●)		
Wetland Hydrology Present?	Yes ( ) No (●)		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (●)	Depth (inches):	
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (●)	Depth (inches):	

Wetland Hydrology Present? Yes ( ) No (●)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-12

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	25	☑	71.4%	FAC
2. Celtis occidentalis	10	☑	28.6%	FACU
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 17.5 20% of Total Cover: 7	35	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rosa bracteata	15	☑	88.2%	UPL
2. Ilex vomitoria	2	☐	11.8%	FAC
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 8.5 20% of Total Cover: 3.4	17	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Iva annua	75	☑	88.2%	FAC
2. Spartina spartinae	10	☐	11.8%	OBL
3.		☐	0.0%	
4.		☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 42.5 20% of Total Cover: 17	85	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	10	x 1 =	10
FACW species	0	x 2 =	0
FAC species	102	x 3 =	306
FACU species	10	x 4 =	40
UPL species	15	x 5 =	75
Column Totals:	137 (A)		431 (B)

Prevalence Index = B/A = 3.146

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☐ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-12

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/2	100						Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains   [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 08-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-B-14**

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.045527 **Long.:** -95.315652 **Datum:** WGS 1983

Soil Map Unit Name: 36- Pledger clay, 0 to 1 percent slopes, rarely flooded **NWI classification:** None

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ( ) No (●)	**Is the Sampled Area within a Wetland?**	Yes ( ) No (●)
Hydric Soil Present?	Yes ( ) No (●)		
Wetland Hydrology Present?	Yes ( ) No (●)		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (●)	Depth (inches):	
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (●)	Depth (inches):	

Wetland Hydrology Present? Yes ( ) No (●)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-14

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	25	☑	71.4%	FAC
2. Celtis occidentalis	10	☑	28.6%	FACU
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 17.5 20% of Total Cover: 7	35	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rosa bracteata	15	☑	88.2%	UPL
2. Ilex vomitoria	2	☐	11.8%	FAC
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 8.5 20% of Total Cover: 3.4	17	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Stenotaphrum secundatum	80	☑	59.3%	FAC
2. Euphorbia bicolor	20	☐	14.8%	UPL
3. Spartina spartinae	15	☐	11.1%	OBL
4. Iva annua	10	☐	7.4%	FAC
5. Croton capitatus	5	☐	3.7%	UPL
6. Helenium amarum	5	☐	3.7%	FACU
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 67.5 20% of Total Cover: 27	135	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	2	(A)
Total Number of Dominant Species Across All Strata:	4	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	50.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	15	x 1 =	15
FACW species	0	x 2 =	0
FAC species	117	x 3 =	351
FACU species	15	x 4 =	60
UPL species	40	x 5 =	200
Column Totals:	187 (A)		626 (B)

Prevalence Index = B/A = 3.348

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☐ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-14

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix			Redox Features				Texture	Remarks
	Color (moist)		%	Color (moist)	%	Type[1]	Loc²		
0-20	10YR	3/2	100					Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 09-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-B-16**

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.046099 **Long.:** -95.310381 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** None

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○ No ◉	Depth (inches):	

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-16

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	25	✔	71.4%	FAC
2. Celtis occidentalis	10	✔	28.6%	FACU
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 17.5 20% of Total Cover: 7	35	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rosa bracteata	15	✔	88.2%	UPL
2. Ilex vomitoria	2	☐	11.8%	FAC
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 8.5 20% of Total Cover: 3.4	17	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Stenotaphrum secundatum	80	✔	59.3%	FAC
2. Euphorbia bicolor	20	☐	14.8%	UPL
3. Spartina spartinae	15	☐	11.1%	OBL
4. Iva annua	10	☐	7.4%	FAC
5. Croton capitatus	5	☐	3.7%	UPL
6. Helenium amarum	5	☐	3.7%	FACU
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 67.5 20% of Total Cover: 27	135	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	15	x 1 =	15
FACW species	0	x 2 =	0
FAC species	117	x 3 =	351
FACU species	15	x 4 =	60
UPL species	40	x 5 =	200
Column Totals:	187	(A)	626 (B)

Prevalence Index = B/A = 3.348

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☐ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-16

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/2	100						Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 09-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-B-18

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range:** S T R

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.051086 **Long.:** -95.309336 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** None

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?** Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉	
Wetland Hydrology Present?	Yes ○ No ◉	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○ No ◉	Depth (inches):	

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-18

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	25	✔	71.4%	FAC
2. Celtis occidentalis	10	✔	28.6%	FACU
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 17.5 20% of Total Cover: 7	35	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rosa bracteata	15	✔	88.2%	UPL
2. Ilex vomitoria	2	☐	11.8%	FAC
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 8.5 20% of Total Cover: 3.4	17	= Total Cover		

Shrub Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Stenotaphrum secundatum	80	✔	59.3%	FAC
2. Euphorbia bicolor	20	☐	14.8%	UPL
3. Spartina spartinae	15	☐	11.1%	OBL
4. Iva annua	10	☐	7.4%	FAC
5. Croton capitatus	5	☐	3.7%	UPL
6. Helenium amarum	5	☐	3.7%	FACU
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 67.5 20% of Total Cover: 27	135	= Total Cover		

Woody Vine Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	15	x 1 =	15
FACW species	0	x 2 =	0
FAC species	117	x 3 =	351
FACU species	15	x 4 =	60
UPL species	40	x 5 =	200
Column Totals:	187	(A)	626 (B)

Prevalence Index = B/A = 3.348

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☐ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-18

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type [1]	Loc [2]	Texture	Remarks
0-20	10YR	3/2	100						Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 09-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-B-20

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range:** S T R

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.05285 **Long.:** -95.302785 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** None

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ○ No (●)	**Is the Sampled Area within a Wetland?** Yes ○ No (●)
Hydric Soil Present?	Yes ○ No (●)	
Wetland Hydrology Present?	Yes ○ No (●)	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ○ No (●)	Depth (inches):	
Water Table Present?	Yes ○ No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○ No (●)	Depth (inches):	

Wetland Hydrology Present? Yes ○ No (●)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-20

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	25	☑	71.4%	FAC
2. Celtis occidentalis	10	☑	28.6%	FACU
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 17.5 20% of Total Cover: 7	35	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rosa bracteata	15	☑	88.2%	UPL
2. Ilex vomitoria	2	☐	11.8%	FAC
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 8.5 20% of Total Cover: 3.4	17	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Stenotaphrum secundatum	80	☑	59.3%	FAC
2. Euphorbia bicolor	20	☐	14.8%	UPL
3. Spartina spartinae	15	☐	11.1%	OBL
4. Iva annua	10	☐	7.4%	FAC
5. Croton capitatus	5	☐	3.7%	UPL
6. Helenium amarum	5	☐	3.7%	FACU
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 67.5 20% of Total Cover: 27	135	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	15	x 1 =	15
FACW species	0	x 2 =	0
FAC species	117	x 3 =	351
FACU species	15	x 4 =	60
UPL species	40	x 5 =	200
Column Totals:	187	(A)	626 (B)

Prevalence Index = B/A = 3.348

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☐ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-20

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-20	10YR	3/2	100						Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) (LRR P, T, U)
- [ ] 5 cm Mucky Mineral (A7) (LRR P, T, U)
- [ ] Muck Presence (A8) (LRR U)
- [ ] 1 cm Muck (A9) (LRR P, T)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Coast Prairie Redox (A16) (MLRA 150A)
- [ ] Sandy Muck Mineral (S1) (LRR O, S)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) (LRR P, S, T, U)
- [ ] Polyvalue Below Surface (S8) (LRR S, T, U)
- [ ] Thin Dark Surface (S9) (LRR S, T, U)
- [ ] Loamy Mucky Mineral (F1) (LRR O)
- [ ] Loamy Gleyed Matrix (F2)
- [ ] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) (LRR U)
- [ ] Depleted Ochric (F11) (MLRA 151)
- [ ] Iron-Manganese Masses (F12) (LRR O, P, T)
- [ ] Umbric Surface (F13) (LRR P, T, U)
- [ ] Delta Ochric (F17) (MLRA 151)
- [ ] Reduced Vertic (F18) (MLRA 150A, 150B)
- [ ] Piedmont Floodplain Soils (F19) (MLRA 149A)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) (LRR O)
- [ ] 2 cm Muck (A10) (LRR S)
- [ ] Reduced Vertic (F18) (outside MLRA 150A,B)
- [ ] Piedmont Floodplain Soils (F19) (LRR P, S, T)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 09-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-B-22**

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.053769 **Long.:** -95.304966 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** None

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ○ No (●)	**Is the Sampled Area within a Wetland?**	Yes ○ No (●)
Hydric Soil Present?	Yes ○ No (●)		
Wetland Hydrology Present?	Yes ○ No (●)		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ○ No (●)	Depth (inches):	
Water Table Present?	Yes ○ No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○ No (●)	Depth (inches):	

Wetland Hydrology Present? Yes ○ No (●)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-22

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	25	✔	71.4%	FAC
2. Celtis occidentalis	10	✔	28.6%	FACU
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 17.5 20% of Total Cover: 7	35	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rosa bracteata	15	✔	88.2%	UPL
2. Ilex vomitoria	2	☐	11.8%	FAC
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 8.5 20% of Total Cover: 3.4	17	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Stenotaphrum secundatum	80	✔	59.3%	FAC
2. Euphorbia bicolor	20	☐	14.8%	UPL
3. Spartina spartinae	15	☐	11.1%	OBL
4. Iva annua	10	☐	7.4%	FAC
5. Croton capitatus	5	☐	3.7%	UPL
6. Helenium amarum	5	☐	3.7%	FACU
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 67.5 20% of Total Cover: 27	135	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	15	x 1 =	15
FACW species	0	x 2 =	0
FAC species	117	x 3 =	351
FACU species	15	x 4 =	60
UPL species	40	x 5 =	200
Column Totals:	187 (A)		626 (B)

Prevalence Index = B/A = 3.348

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☐ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ●

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-22

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/2	100						Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 09-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-B-24**

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.052743 **Long.:** -95.298829 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** None

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉	
Wetland Hydrology Present?	Yes ○ No ◉	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○ No ◉	Depth (inches):	

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-24

Tree Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 **= Total Cover**

Sapling or Sapling/Shrub Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2. Ilex vomitoria	5	☑	100.0%	FAC
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	

50% of Total Cover: 2.5 20% of Total Cover: 1 5 **= Total Cover**

Shrub Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rosa bracteata	5	☑	100.0%	UPL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	

50% of Total Cover: 2.5 20% of Total Cover: 1 5 **= Total Cover**

Herb Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Stenotaphrum secundatum	90	☑	94.7%	FAC
2. Iva annua	5	☐	5.3%	FAC
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	

50% of Total Cover: 47.5 20% of Total Cover: 19 95 **= Total Cover**

Woody Vine Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 **= Total Cover**

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 66.7% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	100	x 3 =	300
FACU species	0	x 4 =	0
UPL species	5	x 5 =	25
Column Totals:	105 (A)		325 (B)

Prevalence Index = B/A = 3.095

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-24

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)		%	Type[1]	Loc²	Texture	Remarks
0-20	10YR	3/1	100						Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) (LRR P, T, U)
- [ ] 5 cm Mucky Mineral (A7) (LRR P, T, U)
- [ ] Muck Presence (A8) (LRR U)
- [ ] 1 cm Muck (A9) (LRR P, T)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Coast Prairie Redox (A16) (MLRA 150A)
- [ ] Sandy Muck Mineral (S1) (LRR O, S)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) (LRR P, S, T, U)
- [ ] Polyvalue Below Surface (S8) (LRR S, T, U)
- [ ] Thin Dark Surface (S9) (LRR S, T, U)
- [ ] Loamy Mucky Mineral (F1) (LRR O)
- [ ] Loamy Gleyed Matrix (F2)
- [ ] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) (LRR U)
- [ ] Depleted Ochric (F11) (MLRA 151)
- [ ] Iron-Manganese Masses (F12) (LRR O, P, T)
- [ ] Umbric Surface (F13) (LRR P, T, U)
- [ ] Delta Ochric (F17) (MLRA 151)
- [ ] Reduced Vertic (F18) (MLRA 150A, 150B)
- [ ] Piedmont Floodplain Soils (F19) (MLRA 149A)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) (LRR O)
- [ ] 2 cm Muck (A10) (LRR S)
- [ ] Reduced Vertic (F18) (outside MLRA 150A,B)
- [ ] Piedmont Floodplain Soils (F19) (LRR P, S, T)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 09-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-B-26**

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.0465 **Long.:** -95.298844 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** None

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?** Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉	
Wetland Hydrology Present?	Yes ○ No ◉	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○ No ◉	Depth (inches):	

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-26

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rosa bracteata	85	☑	94.4%	UPL
2. Triadica sebifera	5	☐	5.6%	FAC
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 45 20% of Total Cover: 18	90	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rosa bracteata	5	☑	100.0%	UPL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 2.5 20% of Total Cover: 1	5	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Iva annua	5	☑	100.0%	FAC
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 2.5 20% of Total Cover: 1	5	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 33.3% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	10	x 3 =	30
FACU species	0	x 4 =	0
UPL species	90	x 5 =	450
Column Totals:	100 (A)		480 (B)

Prevalence Index = B/A = 4.800

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☐ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-26

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-20	10YR	3/1	100						Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 09-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-B-28**

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** **/** 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.044261 **Long.:** -95.295265 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** None

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?** Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉	
Wetland Hydrology Present?	Yes ○ No ◉	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○ No ◉	Depth (inches):	

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-28

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	25	☑	71.4%	FAC
2. Celtis occidentalis	10	☑	28.6%	FACU
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 17.5 20% of Total Cover: 7	35	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rosa bracteata	15	☑	88.2%	UPL
2. Ilex vomitoria	2	☐	11.8%	FAC
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 8.5 20% of Total Cover: 3.4	17	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Stenotaphrum secundatum	80	☑	69.6%	FAC
2. Euphorbia bicolor	20	☐	17.4%	UPL
3. Iva annua	10	☐	8.7%	FAC
4.		☐	0.0%	
5.		☐	0.0%	
6.	5	☐	4.3%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 57.5 20% of Total Cover: 23	115	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	117	x 3 =	351
FACU species	10	x 4 =	40
UPL species	35	x 5 =	175
Column Totals:	162 (A)		566 (B)

Prevalence Index = B/A = 3.494

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☐ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-28

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/2	100					Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 09-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-B-30**

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.054739 **Long.:** -95.307453 **Datum:** WGS 1983

Soil Map Unit Name: 39 - Surfside clay, 0 to 1 percent slopes, occasionally flooded **NWI classification:** None

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?** Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉	
Wetland Hydrology Present?	Yes ○ No ◉	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○ No ◉	Depth (inches):	

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-30

Tree Stratum (Plot size: ______)

#	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Quercus virginiana	5	✓	25.0%	FACU
2.	Celtis occidentalis	5	✓	25.0%	FACU
3.	Triadica sebifera	10	✓	50.0%	FAC
4.		0		0.0%	
5.		0		0.0%	
6.		0		0.0%	
7.		0		0.0%	
8.		0		0.0%	

50% of Total Cover: 10   20% of Total Cover: 4   20 = Total Cover

Sapling or Sapling/Shrub Stratum (Plot size: ______)

#	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Rosa bracteata	20	✓	80.0%	UPL
2.	Ilex vomitoria	5	✓	20.0%	FAC
3.				0.0%	
4.		0		0.0%	
5.		0		0.0%	
6.		0		0.0%	
7.		0		0.0%	
8.		0		0.0%	

50% of Total Cover: 12.5   20% of Total Cover: 5   25 = Total Cover

Shrub Stratum (Plot size: ______)

#	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		0		0.0%	
2.		0		0.0%	
3.		0		0.0%	
4.		0		0.0%	
5.		0		0.0%	
6.		0		0.0%	

50% of Total Cover: 0   20% of Total Cover: 0   0 = Total Cover

Herb Stratum (Plot size: ______)

#	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Iva annua	50	✓	62.5%	FAC
2.	Conoclinium coelestinum	15		18.8%	FAC
3.		10		12.5%	
4.				0.0%	
5.				0.0%	
6.		5		6.3%	
7.		0		0.0%	
8.		0		0.0%	
9.		0		0.0%	
10.		0		0.0%	
11.		0		0.0%	
12.		0		0.0%	

50% of Total Cover: 40   20% of Total Cover: 16   80 = Total Cover

Woody Vine Stratum (Plot size: ______)

#	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		0		0.0%	
2.		0		0.0%	
3.		0		0.0%	
4.		0		0.0%	
5.		0		0.0%	

50% of Total Cover: 0   20% of Total Cover: 0   0 = Total Cover

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:			Multiply by:
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	80	x 3 =	240
FACU species	10	x 4 =	40
UPL species	20	x 5 =	100
Column Totals:	110 (A)		380 (B)

Prevalence Index = B/A = 3.455

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☐ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-30

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-20	10YR	3/2	100						Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 10-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-B-32**

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.056781 **Long.:** -95.329116 **Datum:** WGS 1983

Soil Map Unit Name: 36- Pledger clay, 0 to 1 percent slopes, rarely flooded **NWI classification:** None

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ○	**Is the Sampled Area within a Wetland?**	Yes ○ No (●)
Hydric Soil Present?	Yes ○ No (●)		
Wetland Hydrology Present?	Yes ○ No (●)		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ○ No (●)	Depth (inches):	
Water Table Present?	Yes ○ No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○ No (●)	Depth (inches):	

Wetland Hydrology Present? Yes ○ No (●)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-32

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2. Celtis laevigata	50	☑	100.0%	FACW
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 25 20% of Total Cover: 10	50	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rosa bracteata	15	☑	50.0%	UPL
2. Ilex vomitoria	15	☑	50.0%	FAC
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 15 20% of Total Cover: 6	30	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Stenotaphrum secundatum	85	☑	89.5%	FAC
2. Iva annua	10	☐	10.5%	FAC
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 47.5 20% of Total Cover: 19	95	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 75.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	50	x 2 =	100
FAC species	110	x 3 =	330
FACU species	0	x 4 =	0
UPL species	15	x 5 =	75
Column Totals:	175	(A)	505 (B)

Prevalence Index = B/A = 2.886

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-32

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/2	100						Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 10-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-B-33**

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** concave **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.056034 **Long.:** -95.328291 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** PEM1C

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?**	Yes (●) No ( )
Hydric Soil Present?	Yes (●) No ( )		
Wetland Hydrology Present?	Yes (●) No ( )		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes (●) No ( )	Depth (inches):	12
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (●)	Depth (inches):	

Wetland Hydrology Present? Yes (●) No ( )

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-33

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	10	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 5 20% of Total Cover: 2	10	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Sesbania drummondii	35	☑	77.8%	FACW
2. Rosa bracteata	5	☐	11.1%	UPL
3. Ilex decidua	5	☐	11.1%	FACW
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 22.5 20% of Total Cover: 9	45	= Total Cover		

Shrub Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Cyperus entrerianus	15	☑	60.0%	FACW
2. Juncus effusus	10	☑	40.0%	OBL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 12.5 20% of Total Cover: 5	25	= Total Cover		

Woody Vine Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:
OBL species	10	x 1 =	10
FACW species	55	x 2 =	110
FAC species	10	x 3 =	30
FACU species	0	x 4 =	0
UPL species	5	x 5 =	25
Column Totals:	80	(A)	175 (B)

Prevalence Index = B/A = 2.188

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-33

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	90	5YR	4/6	10	C	PL	Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☑ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ________

Depth (inches): ________

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 10-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-B-34

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range:** S T R

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.055972 **Long.:** -95.328273 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** PEM1C

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ○	**Is the Sampled Area within a Wetland?**	Yes ○ No (●)
Hydric Soil Present?	Yes ○ No (●)		
Wetland Hydrology Present?	Yes ○ No (●)		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ○ No (●)	Depth (inches):	
Water Table Present?	Yes ○ No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○ No (●)	Depth (inches):	

Wetland Hydrology Present? Yes ○ No (●)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-34

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2. Celtis laevigata	15	☑	100.0%	FACW
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 7.5 20% of Total Cover: 3	15	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rosa bracteata	15	☑	50.0%	UPL
2. Ilex vomitoria	15	☑	50.0%	FAC
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 15 20% of Total Cover: 6	30	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Stenotaphrum secundatum	70	☑	70.0%	FAC
2. Iva annua	30	☑	30.0%	FAC
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 50 20% of Total Cover: 20	100	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 80.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	15	x 2 =	30
FAC species	115	x 3 =	345
FACU species	0	x 4 =	0
UPL species	15	x 5 =	75
Column Totals:	145 (A)		450 (B)

Prevalence Index = B/A = 3.103

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-34

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/2	100					Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 10-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-B-35**

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.049401 **Long.:** -95.32194 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** PSS1C

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ○	**Is the Sampled Area within a Wetland?** Yes ○ No (●)
Hydric Soil Present?	Yes ○ No (●)	
Wetland Hydrology Present?	Yes ○ No (●)	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ○ No (●)	Depth (inches):	
Water Table Present?	Yes ○ No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○ No (●)	Depth (inches):	

Wetland Hydrology Present? Yes ○ No (●)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-35

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		
Sapling or Sapling/Shrub Stratum (Plot size:)				
1. Ilex vomitoria	10	☑	50.0%	FAC
2. Triadica sebifera	10	☑	50.0%	FAC
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 10 20% of Total Cover: 4	20	= Total Cover		
Shrub Stratum (Plot size:)				
1. Rubus trivialis	90	☑	100.0%	FACU
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 45 20% of Total Cover: 18	90	= Total Cover		
Herb Stratum (Plot size:)				
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 66.7% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	0	x 1 =	0	
FACW species	0	x 2 =	0	
FAC species	20	x 3 =	60	
FACU species	90	x 4 =	360	
UPL species	0	x 5 =	0	
Column Totals:	110	(A)	420	(B)

Prevalence Index = B/A = 3.818

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-35

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-20	10YR	3/2	100						Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 10-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-B-36**

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.049371 **Long.:** -95.318795 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** PEM1Cx

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ○ No (●)	**Is the Sampled Area within a Wetland?** Yes ○ No (●)
Hydric Soil Present?	Yes ○ No (●)	
Wetland Hydrology Present?	Yes ○ No (●)	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ○ No (●)	Depth (inches):	
Water Table Present?	Yes ○ No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○ No (●)	Depth (inches):	

Wetland Hydrology Present? Yes ○ No (●)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-36

Tree Stratum (Plot size:)

		Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Triadica sebifera	10	☑	100.0%	FAC
2.			☐	0.0%	
3.			☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	
7.		0	☐	0.0%	
8.		0	☐	0.0%	

50% of Total Cover: 5 20% of Total Cover: 2 10 = Total Cover

Sapling or Sapling/Shrub Stratum (Plot size:)

		Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.			☐	0.0%	
2.			☐	0.0%	
3.			☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	
7.		0	☐	0.0%	
8.		0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Shrub Stratum (Plot size:)

		Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.			☐	0.0%	
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Herb Stratum (Plot size:)

		Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Cynodon dactylon	50	☑	62.5%	FACU
2.	Croton capitatus	10	☐	12.5%	UPL
3.	Solanum elaeagnifolium	10	☐	12.5%	UPL
4.	Iva annua	10	☐	12.5%	FAC
5.			☐	0.0%	
6.			☐	0.0%	
7.		0	☐	0.0%	
8.		0	☐	0.0%	
9.		0	☐	0.0%	
10.		0	☐	0.0%	
11.		0	☐	0.0%	
12.		0	☐	0.0%	

50% of Total Cover: 40 20% of Total Cover: 16 80 = Total Cover

Woody Vine Stratum (Plot size:)

		Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		0	☐	0.0%	
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	20	x 3 =	60
FACU species	50	x 4 =	200
UPL species	20	x 5 =	100
Column Totals:	90 (A)		360 (B)

Prevalence Index = B/A = 4.000

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☐ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-36

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/2	100						Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 10-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-B-37

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range:** S T R

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** concave **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.04818 **Long.:** -95.318659 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** PEM1C

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ○	**Is the Sampled Area within a Wetland?**	Yes (●) No ○
Hydric Soil Present?	Yes (●) No ○		
Wetland Hydrology Present?	Yes (●) No ○		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes (●) No ○	Depth (inches):	1
Water Table Present?	Yes ○ No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○ No (●)	Depth (inches):	

Wetland Hydrology Present? Yes (●) No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-37

Tree Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Sapling or Sapling/Shrub Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Shrub Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Herb Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Cyperus entrerianus	65	☑	68.4%	FACW
2. Juncus effusus	20	☑	21.1%	OBL
3. Persicaria pensylvanica	10	☐	10.5%	FACW
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	

50% of Total Cover: 47.5 20% of Total Cover: 19 95 = Total Cover

Woody Vine Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Smilax rotundifolia	5	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	

50% of Total Cover: 2.5 20% of Total Cover: 1 5 = Total Cover

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	20	x 1 =	20
FACW species	75	x 2 =	150
FAC species	5	x 3 =	15
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	100 (A)		185 (B)

Prevalence Index = B/A = 1.850

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-37

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-20	10YR	3/1	95	5YR	4/6	5	C	PL	Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☑ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 10-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-B-38

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range:** S T R

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.048079 **Long.:** -95.319051 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** None

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ( ) No (●)	**Is the Sampled Area within a Wetland?** Yes ( ) No (●)
Hydric Soil Present?	Yes ( ) No (●)	
Wetland Hydrology Present?	Yes ( ) No (●)	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (●)	Depth (inches):	
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (●)	Depth (inches):	

Wetland Hydrology Present? Yes ( ) No (●)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-38

Tree Stratum (Plot size:)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Triadica sebifera	10	☑	100.0%	FAC
2.			☐	0.0%	
3.			☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	
7.		0	☐	0.0%	
8.		0	☐	0.0%	

50% of Total Cover: 5 20% of Total Cover: 2 10 = Total Cover

Sapling or Sapling/Shrub Stratum (Plot size:)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Sesbania drummondii	5	☑	100.0%	FACW
2.			☐	0.0%	
3.			☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	
7.		0	☐	0.0%	
8.		0	☐	0.0%	

50% of Total Cover: 2.5 20% of Total Cover: 1 5 = Total Cover

Shrub Stratum (Plot size:)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		0	☐	0.0%	
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Herb Stratum (Plot size:)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.			☐	0.0%	
2.			☐	0.0%	
3.			☐	0.0%	
4.			☐	0.0%	
5.	Croton capitatus	50	☑	71.4%	UPL
6.	Helenium amarum	20	☑	28.6%	FACU
7.		0	☐	0.0%	
8.		0	☐	0.0%	
9.		0	☐	0.0%	
10.		0	☐	0.0%	
11.		0	☐	0.0%	
12.		0	☐	0.0%	

50% of Total Cover: 35 20% of Total Cover: 14 70 = Total Cover

Woody Vine Stratum (Plot size:)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		0	☐	0.0%	
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	5	x 2 =	10
FAC species	10	x 3 =	30
FACU species	20	x 4 =	80
UPL species	50	x 5 =	250
Column Totals:	85 (A)		370 (B)

Prevalence Index = B/A = 4.353

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☐ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-38

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-20	10YR	3/2	100						Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) (LRR P, T, U)
- [ ] 5 cm Mucky Mineral (A7) (LRR P, T, U)
- [ ] Muck Presence (A8) (LRR U)
- [ ] 1 cm Muck (A9) (LRR P, T)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Coast Prairie Redox (A16) (MLRA 150A)
- [ ] Sandy Muck Mineral (S1) (LRR O, S)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) (LRR P, S, T, U)
- [ ] Polyvalue Below Surface (S8) (LRR S, T, U)
- [ ] Thin Dark Surface (S9) (LRR S, T, U)
- [ ] Loamy Mucky Mineral (F1) (LRR O)
- [ ] Loamy Gleyed Matrix (F2)
- [ ] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) (LRR U)
- [ ] Depleted Ochric (F11) (MLRA 151)
- [ ] Iron-Manganese Masses (F12) (LRR O, P, T)
- [ ] Umbric Surface (F13) (LRR P, T, U)
- [ ] Delta Ochric (F17) (MLRA 151)
- [ ] Reduced Vertic (F18) (MLRA 150A, 150B)
- [ ] Piedmont Floodplain Soils (F19) (MLRA 149A)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) (LRR O)
- [ ] 2 cm Muck (A10) (LRR S)
- [ ] Reduced Vertic (F18) (outside MLRA 150A,B)
- [ ] Piedmont Floodplain Soils (F19) (LRR P, S, T)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 10-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-B-39**

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** concave **Slope:** 0.0 **%** / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.048395 **Long.:** -95.319194 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** PEM1C

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (•) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (•) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (•) No ( )	**Is the Sampled Area within a Wetland?**	Yes (•) No ( )
Hydric Soil Present?	Yes (•) No ( )		
Wetland Hydrology Present?	Yes (•) No ( )		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes (•) No ( )	Depth (inches):	2
Water Table Present?	Yes ( ) No (•)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (•)	Depth (inches):	

Wetland Hydrology Present? Yes (•) No ( )

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-39

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Cyperus entrerianus	65	☑	68.4%	FACW
2. Juncus effusus	20	☑	21.1%	OBL
3. Persicaria pensylvanica	10	☐	10.5%	FACW
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 47.5 20% of Total Cover: 19	95	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	20	x 1 =	20	
FACW species	75	x 2 =	150	
FAC species	0	x 3 =	0	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	95	(A)	170	(B)

Prevalence Index = B/A = 1.789

Hydrophytic Vegetation Indicators:

- ☑ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-39

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	95	5YR	4/6	5	C	PL	Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) (LRR P, T, U)
- [ ] 5 cm Mucky Mineral (A7) (LRR P, T, U)
- [ ] Muck Presence (A8) (LRR U)
- [ ] 1 cm Muck (A9) (LRR P, T)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [x] Coast Prairie Redox (A16) (MLRA 150A)
- [ ] Sandy Muck Mineral (S1) (LRR O, S)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) (LRR P, S, T, U)
- [ ] Polyvalue Below Surface (S8) (LRR S, T, U)
- [ ] Thin Dark Surface (S9) (LRR S, T, U)
- [ ] Loamy Mucky Mineral (F1) (LRR O)
- [ ] Loamy Gleyed Matrix (F2)
- [ ] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) (LRR U)
- [ ] Depleted Ochric (F11) (MLRA 151)
- [ ] Iron-Manganese Masses (F12) (LRR O, P, T)
- [ ] Umbric Surface (F13) (LRR P, T, U)
- [ ] Delta Ochric (F17) (MLRA 151)
- [ ] Reduced Vertic (F18) (MLRA 150A, 150B)
- [ ] Piedmont Floodplain Soils (F19) (MLRA 149A)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) (LRR O)
- [ ] 2 cm Muck (A10) (LRR S)
- [ ] Reduced Vertic (F18) (outside MLRA 150A,B)
- [ ] Piedmont Floodplain Soils (F19) (LRR P, S, T)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes (●) No ( )

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 10-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-B-40**

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** concave **Slope:** 0.0 **%** / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.048238 **Long.:** -95.319551 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** PEM1C

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?**	Yes (●) No ( )
Hydric Soil Present?	Yes (●) No ( )		
Wetland Hydrology Present?	Yes (●) No ( )		

Remarks:
PSS

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes (●) No ( )	Depth (inches):	4
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (●)	Depth (inches):	

Wetland Hydrology Present? Yes (●) No ( )

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-40

Tree Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Sapling or Sapling/Shrub Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Sesbania drummondii	15	☑	100.0%	FACW
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	

50% of Total Cover: 7.5 20% of Total Cover: 3 15 = Total Cover

Shrub Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	15	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	

50% of Total Cover: 7.5 20% of Total Cover: 3 15 = Total Cover

Herb Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Zizaniopsis miliacea	50	☑	62.5%	OBL
2. Juncus effusus	20	☑	25.0%	OBL
3. Persicaria pensylvanica	10	☐	12.5%	FACW
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	

50% of Total Cover: 40 20% of Total Cover: 16 80 = Total Cover

Woody Vine Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	70	x 1 =	70
FACW species	25	x 2 =	50
FAC species	15	x 3 =	45
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	110	(A)	165 (B)

Prevalence Index = B/A = 1.500

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-40

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	95	5YR	4/6	5	C	PL	Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☑ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 10-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-B-41**

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** concave **Slope:** 0.0 **%** **/** 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.052569 **Long.:** -95.312608 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** PEM1C

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ◉ No ○ Hydric Soil Present? Yes ◉ No ○ Wetland Hydrology Present? Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ◉	No ○	Depth (inches):	4
Water Table Present?	Yes ○	No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches):	

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-41

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Cyperus odoratus	30	☑	33.3%	FACW
2. Juncus effusus	30	☑	33.3%	OBL
3. Bacopa monnieri	20	☑	22.2%	OBL
4. Persicaria pensylvanica	10	☐	11.1%	FACW
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 45 20% of Total Cover: 18	90	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	50	x 1 =	50
FACW species	40	x 2 =	80
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	90 (A)		130 (B)

Prevalence Index = B/A = 1.444

Hydrophytic Vegetation Indicators:

- ☑ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0 [1]**
- ☐ **Problematic Hydrophytic Vegetation [1] (Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-41

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	95	5YR	4/6	5	C	PL	Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) (LRR P, T, U)
- [ ] 5 cm Mucky Mineral (A7) (LRR P, T, U)
- [ ] Muck Presence (A8) (LRR U)
- [ ] 1 cm Muck (A9) (LRR P, T)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [x] Coast Prairie Redox (A16) (MLRA 150A)
- [ ] Sandy Muck Mineral (S1) (LRR O, S)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) (LRR P, S, T, U)
- [ ] Polyvalue Below Surface (S8) (LRR S, T, U)
- [ ] Thin Dark Surface (S9) (LRR S, T, U)
- [ ] Loamy Mucky Mineral (F1) (LRR O)
- [ ] Loamy Gleyed Matrix (F2)
- [ ] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) (LRR U)
- [ ] Depleted Ochric (F11) (MLRA 151)
- [ ] Iron-Manganese Masses (F12) (LRR O, P, T)
- [ ] Umbric Surface (F13) (LRR P, T, U)
- [ ] Delta Ochric (F17) (MLRA 151)
- [ ] Reduced Vertic (F18) (MLRA 150A, 150B)
- [ ] Piedmont Floodplain Soils (F19) (MLRA 149A)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) (LRR O)
- [ ] 2 cm Muck (A10) (LRR S)
- [ ] Reduced Vertic (F18) (outside MLRA 150A,B)
- [ ] Piedmont Floodplain Soils (F19) (LRR P, S, T)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes (●) No ( )

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 10-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-B-42

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range:** S T R

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.052447 **Long.:** -95.312619 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** None

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉	
Wetland Hydrology Present?	Yes ○ No ◉	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○ No ◉	Depth (inches):	

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-42

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rubus argutus	10	☑	100.0%	FAC
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 5 20% of Total Cover: 2	10	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Stenotaphrum secundatum	85	☑	89.5%	FAC
2. Iva annua	10	☐	10.5%	FAC
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 47.5 20% of Total Cover: 19	95	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	105	x 3 =	315
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	105	(A)	315 (B)

Prevalence Index = B/A = 3.000

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-42

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/2	100						Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 10-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-B-43

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range:** S T R

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** concave **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.054085 **Long.:** -95.312002 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** None

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (•) No ( ) **(If no, explain in Remarks.)**

Are Vegetation [ ] **, Soil** [ ] **, or Hydrology** [ ] **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (•) No ( )

Are Vegetation [ ] **, Soil** [ ] **, or Hydrology** [ ] **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (•) No ( )	**Is the Sampled Area within a Wetland?** Yes (•) No ( )
Hydric Soil Present?	Yes (•) No ( )	
Wetland Hydrology Present?	Yes (•) No ( )	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- [x] Surface Water (A1)
- [ ] High Water Table (A2)
- [ ] Saturation (A3)
- [ ] Water Marks (B1)
- [ ] Sediment Deposits (B2)
- [ ] Drift Deposits (B3)
- [ ] Algal Mat or Crust (B4)
- [ ] Iron Deposits (B5)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [ ] Water-Stained Leaves (B9)
- [ ] Aquatic Fauna (B13)
- [ ] Marl Deposits (B15) (LRR U)
- [ ] Hydrogen Sulfide Odor (C1)
- [ ] Oxidized Rhizospheres along Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Recent Iron Reduction in Tilled Soils (C6)
- [ ] Thin Muck Surface (C7)
- [ ] Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- [ ] Surface Soil Cracks (B6)
- [ ] Sparsely Vegetated Concave Surface (B8)
- [ ] Drainage Patterns (B10)
- [ ] Moss Trim Lines (B16)
- [ ] Dry Season Water Table (C2)
- [ ] Crayfish Burrows (C8)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [ ] Geomorphic Position (D2)
- [ ] Shallow Aquitard (D3)
- [x] FAC-Neutral Test (D5)
- [ ] Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes (•) No ( )	Depth (inches): 4	**Wetland Hydrology Present?** Yes (•) No ( )
Water Table Present?	Yes ( ) No (•)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (•)	Depth (inches):	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-43

Tree Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Sapling or Sapling/Shrub Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Shrub Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Herb Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Cyperus odoratus	30	☑	33.3%	FACW
2. Juncus effusus	30	☑	33.3%	OBL
3. Bacopa monnieri	20	☑	22.2%	OBL
4. Persicaria pensylvanica	10	☐	11.1%	FACW
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	

50% of Total Cover: 45 20% of Total Cover: 18 90 = Total Cover

Woody Vine Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	50	x 1 =	50
FACW species	40	x 2 =	80
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	90 (A)		130 (B)

Prevalence Index = B/A = 1.444

Hydrophytic Vegetation Indicators:

- ☑ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-43

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-20	10YR	3/1	95	5YR	4/6	5	C	PL	Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) (LRR P, T, U)
- [ ] 5 cm Mucky Mineral (A7) (LRR P, T, U)
- [ ] Muck Presence (A8) (LRR U)
- [ ] 1 cm Muck (A9) (LRR P, T)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [x] Coast Prairie Redox (A16) (MLRA 150A)
- [ ] Sandy Muck Mineral (S1) (LRR O, S)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) (LRR P, S, T, U)
- [ ] Polyvalue Below Surface (S8) (LRR S, T, U)
- [ ] Thin Dark Surface (S9) (LRR S, T, U)
- [ ] Loamy Mucky Mineral (F1) (LRR O)
- [ ] Loamy Gleyed Matrix (F2)
- [ ] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) (LRR U)
- [ ] Depleted Ochric (F11) (MLRA 151)
- [ ] Iron-Manganese Masses (F12) (LRR O, P, T)
- [ ] Umbric Surface (F13) (LRR P, T, U)
- [ ] Delta Ochric (F17) (MLRA 151)
- [ ] Reduced Vertic (F18) (MLRA 150A, 150B)
- [ ] Piedmont Floodplain Soils (F19) (MLRA 149A)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) (LRR O)
- [ ] 2 cm Muck (A10) (LRR S)
- [ ] Reduced Vertic (F18) (outside MLRA 150A,B)
- [ ] Piedmont Floodplain Soils (F19) (LRR P, S, T)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes (●) No ( )

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 10-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-B-44

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.054065 **Long.:** -95.31189 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** None

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?** Yes ( ) No (●)
Hydric Soil Present?	Yes ( ) No (●)	
Wetland Hydrology Present?	Yes ( ) No (●)	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (●)	Depth (inches):
Water Table Present?	Yes ( ) No (●)	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ( ) No (●)	Depth (inches):

Wetland Hydrology Present? Yes ( ) No (●)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-44

Tree Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Sapling or Sapling/Shrub Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Ilex vomitoria	30	☑	75.0%	FAC
2. Rosa bracteata	10	☑	25.0%	UPL
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	

50% of Total Cover: 20 20% of Total Cover: 8 40 = Total Cover

Shrub Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Herb Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Stenotaphrum secundatum	85	☑	89.5%	FAC
2. Iva annua	10	☐	10.5%	FAC
3.		☐	0.0%	
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	

50% of Total Cover: 47.5 20% of Total Cover: 19 95 = Total Cover

Woody Vine Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 66.7% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	125	x 3 =	375
FACU species	0	x 4 =	0
UPL species	10	x 5 =	50
Column Totals:	135	(A)	425 (B)

Prevalence Index = B/A = 3.148

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-44

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/2	100						Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) (LRR P, T, U)
- [ ] 5 cm Mucky Mineral (A7) (LRR P, T, U)
- [ ] Muck Presence (A8) (LRR U)
- [ ] 1 cm Muck (A9) (LRR P, T)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Coast Prairie Redox (A16) (MLRA 150A)
- [ ] Sandy Muck Mineral (S1) (LRR O, S)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) (LRR P, S, T, U)
- [ ] Polyvalue Below Surface (S8) (LRR S, T, U)
- [ ] Thin Dark Surface (S9) (LRR S, T, U)
- [ ] Loamy Mucky Mineral (F1) (LRR O)
- [ ] Loamy Gleyed Matrix (F2)
- [ ] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) (LRR U)
- [ ] Depleted Ochric (F11) (MLRA 151)
- [ ] Iron-Manganese Masses (F12) (LRR O, P, T)
- [ ] Umbric Surface (F13) (LRR P, T, U)
- [ ] Delta Ochric (F17) (MLRA 151)
- [ ] Reduced Vertic (F18) (MLRA 150A, 150B)
- [ ] Piedmont Floodplain Soils (F19) (MLRA 149A)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) (LRR O)
- [ ] 2 cm Muck (A10) (LRR S)
- [ ] Reduced Vertic (F18) (outside MLRA 150A,B)
- [ ] Piedmont Floodplain Soils (F19) (LRR P, S, T)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 10-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-B-45**

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** concave **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.053794 **Long.:** -95.310181 **Datum:** WGS 1983

Soil Map Unit Name: 39 - Surfside clay, 0 to 1 percent slopes, occasionally flooded **NWI classification:** PSS1A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?**	Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○		
Wetland Hydrology Present?	Yes ◉ No ○		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☑ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☑ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○ No ◉	Depth (inches):	

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-45

Tree Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Sapling or Sapling/Shrub Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Shrub Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rubus argutus	10	☑	100.0%	FAC
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	

50% of Total Cover: 5 20% of Total Cover: 2 10 = Total Cover

Herb Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Paspalum notatum	50	☑	55.6%	FACU
2. Cyperus entrerianus	20	☑	22.2%	FACW
3. Eleocharis parvula	20	☑	22.2%	OBL
4.		☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	

50% of Total Cover: 45 20% of Total Cover: 18 90 = Total Cover

Woody Vine Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 75.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	20	x 1 =	20
FACW species	20	x 2 =	40
FAC species	10	x 3 =	30
FACU species	50	x 4 =	200
UPL species	0	x 5 =	0
Column Totals:	100 (A)		290 (B)

Prevalence Index = B/A = 2.900

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-45

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	85	5YR	4/6	15	C	PL	Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) (LRR P, T, U)
- [ ] 5 cm Mucky Mineral (A7) (LRR P, T, U)
- [ ] Muck Presence (A8) (LRR U)
- [ ] 1 cm Muck (A9) (LRR P, T)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [x] Coast Prairie Redox (A16) (MLRA 150A)
- [ ] Sandy Muck Mineral (S1) (LRR O, S)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) (LRR P, S, T, U)
- [ ] Polyvalue Below Surface (S8) (LRR S, T, U)
- [ ] Thin Dark Surface (S9) (LRR S, T, U)
- [ ] Loamy Mucky Mineral (F1) (LRR O)
- [ ] Loamy Gleyed Matrix (F2)
- [ ] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) (LRR U)
- [ ] Depleted Ochric (F11) (MLRA 151)
- [ ] Iron-Manganese Masses (F12) (LRR O, P, T)
- [ ] Umbric Surface (F13) (LRR P, T, U)
- [ ] Delta Ochric (F17) (MLRA 151)
- [ ] Reduced Vertic (F18) (MLRA 150A, 150B)
- [ ] Piedmont Floodplain Soils (F19) (MLRA 149A)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) (LRR O)
- [ ] 2 cm Muck (A10) (LRR S)
- [ ] Reduced Vertic (F18) (outside MLRA 150A,B)
- [ ] Piedmont Floodplain Soils (F19) (LRR P, S, T)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes (●) No ( )

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 10-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-B-46**

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.053965 **Long.:** -95.309986 **Datum:** WGS 1983

Soil Map Unit Name: 39 - Surfside clay, 0 to 1 percent slopes, occasionally flooded **NWI classification:** None

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?**	Yes ( ) No (●)
Hydric Soil Present?	Yes ( ) No (●)		
Wetland Hydrology Present?	Yes ( ) No (●)		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (●)	Depth (inches):	
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (●)	Depth (inches):	

Wetland Hydrology Present? Yes ( ) No (●)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-46

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Celtis laevigata	10	☑	100.0%	FACW
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 5 20% of Total Cover: 2	10	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Ilex vomitoria	20	☑	50.0%	FAC
2. Rosa bracteata	20	☑	50.0%	UPL
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 20 20% of Total Cover: 8	40	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Xanthium strumarium	30	☑	46.2%	FAC
2. Iva annua	20	☑	30.8%	FAC
3. Chloracantha spinosa	15	☑	23.1%	FACW
4.		☐	0.0%	
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 32.5 20% of Total Cover: 13	65	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 83.3% (A/B)

Prevalence Index worksheet:

Total % Cover of:			Multiply by:	
OBL species	0	x 1 =	0	
FACW species	25	x 2 =	50	
FAC species	70	x 3 =	210	
FACU species	0	x 4 =	0	
UPL species	20	x 5 =	100	
Column Totals:	115	(A)	360	(B)

Prevalence Index = B/A = 3.130

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-46

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/2	100						Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) (LRR P, T, U)
- [ ] 5 cm Mucky Mineral (A7) (LRR P, T, U)
- [ ] Muck Presence (A8) (LRR U)
- [ ] 1 cm Muck (A9) (LRR P, T)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Coast Prairie Redox (A16) (MLRA 150A)
- [ ] Sandy Muck Mineral (S1) (LRR O, S)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) (LRR P, S, T, U)
- [ ] Polyvalue Below Surface (S8) (LRR S, T, U)
- [ ] Thin Dark Surface (S9) (LRR S, T, U)
- [ ] Loamy Mucky Mineral (F1) (LRR O)
- [ ] Loamy Gleyed Matrix (F2)
- [ ] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) (LRR U)
- [ ] Depleted Ochric (F11) (MLRA 151)
- [ ] Iron-Manganese Masses (F12) (LRR O, P, T)
- [ ] Umbric Surface (F13) (LRR P, T, U)
- [ ] Delta Ochric (F17) (MLRA 151)
- [ ] Reduced Vertic (F18) (MLRA 150A, 150B)
- [ ] Piedmont Floodplain Soils (F19) (MLRA 149A)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) (LRR O)
- [ ] 2 cm Muck (A10) (LRR S)
- [ ] Reduced Vertic (F18) (outside MLRA 150A,B)
- [ ] Piedmont Floodplain Soils (F19) (LRR P, S, T)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____________________

Depth (inches): ____________________

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 11-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-B-47**

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** concave **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.055218 **Long.:** -95.313074 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** None

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?**	Yes (●) No ( )
Hydric Soil Present?	Yes (●) No ( )		
Wetland Hydrology Present?	Yes (●) No ( )		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

☐ Surface Water (A1)	☐ Aquatic Fauna (B13)
☐ High Water Table (A2)	☐ Marl Deposits (B15) (LRR U)
☑ Saturation (A3)	☐ Hydrogen Sulfide Odor (C1)
☐ Water Marks (B1)	☑ Oxidized Rhizospheres along Living Roots (C3)
☐ Sediment Deposits (B2)	☐ Presence of Reduced Iron (C4)
☐ Drift Deposits (B3)	☐ Recent Iron Reduction in Tilled Soils (C6)
☐ Algal Mat or Crust (B4)	☐ Thin Muck Surface (C7)
☐ Iron Deposits (B5)	☐ Other (Explain in Remarks)
☐ Inundation Visible on Aerial Imagery (B7)	
☐ Water-Stained Leaves (B9)	

Secondary Indicators (minimum of 2 required)

- ☑ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (●)	Depth (inches):	
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes (●) No ( )	Depth (inches):	2

Wetland Hydrology Present? Yes (●) No ( )

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-47

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	40	✔	66.7%	FAC
2. Celtis laevigata	20	✔	33.3%	FACW
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 30 20% of Total Cover: 12	60	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Sesbania drummondii	15	✔	100.0%	FACW
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 7.5 20% of Total Cover: 3	15	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2. Cyperus entrerianus	30	✔	33.3%	FACW
3. Juncus effusus	30	✔	33.3%	OBL
4. Persicaria pensylvanica	10	☐	11.1%	FACW
5. Bacopa monnieri	20	✔	22.2%	OBL
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 45 20% of Total Cover: 18	90	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	50	x 1 =	50
FACW species	75	x 2 =	150
FAC species	40	x 3 =	120
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	165 (A)		320 (B)

Prevalence Index = B/A = 1.939

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-47

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	85	5YR	4/6	15	C	PL	Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☑ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 11-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-B-48**

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.055106 **Long.:** -95.31301 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** None

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (•) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (•) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (•) No ( )	**Is the Sampled Area within a Wetland?**	Yes ( ) No (•)
Hydric Soil Present?	Yes ( ) No (•)		
Wetland Hydrology Present?	Yes ( ) No (•)		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (•)	Depth (inches):	
Water Table Present?	Yes ( ) No (•)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (•)	Depth (inches):	

Wetland Hydrology Present? Yes ( ) No (•)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-48

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		☐	0.0%	
2.		☐	0.0%	
3.		☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rosa bracteata	30	☑	60.0%	UPL
2. Ilex vomitoria	15	☑	30.0%	FAC
3. Poncirus trifoliata	5	☐	10.0%	UPL
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 25 20% of Total Cover: 10	50	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Stenotaphrum secundatum	20	☑	28.6%	FAC
2. Conoclinium coelestinum	20	☑	28.6%	FAC
3. Dysphania ambrosioides	20	☑	28.6%	FACU
4. Rubus argutus	10	☐	14.3%	FAC
5.		☐	0.0%	
6.		☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 35 20% of Total Cover: 14	70	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	3	(A)
Total Number of Dominant Species Across All Strata:	5	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	60.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	65	x 3 =	195
FACU species	20	x 4 =	80
UPL species	35	x 5 =	175
Column Totals:	120 (A)		450 (B)

Prevalence Index = B/A = 3.750

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-48

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-20	10YR	3/2	100						Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 11-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-B-49**

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** concave **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.055381 **Long.:** -95.305468 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** PSS1C

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ○	**Is the Sampled Area within a Wetland?** Yes (●) No ○
Hydric Soil Present?	Yes (●) No ○	
Wetland Hydrology Present?	Yes (●) No ○	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes (●) No ○	Depth (inches): 1	
Water Table Present?	Yes ○ No (●)	Depth (inches):	**Wetland Hydrology Present?** Yes (●) No ○
Saturation Present? (includes capillary fringe)	Yes ○ No (●)	Depth (inches):	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-49

Tree Stratum (Plot size:)

	Absolute % Cover	Dominant Species? Rel.Strat. Cover		Indicator Status
1. Triadica sebifera	30	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 15 20% of Total Cover: 6	30	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)

1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Shrub Stratum (Plot size:)

1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)

1. Carex cherokeensis	45	☑	56.3%	FACW
2. Juncus effusus	20	☑	25.0%	OBL
3. Cyperus entrerianus	15	☐	18.8%	FACW
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 40 20% of Total Cover: 16	80	= Total Cover		

Woody Vine Stratum (Plot size:)

1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	20	x 1 =	20
FACW species	60	x 2 =	120
FAC species	30	x 3 =	90
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	110 (A)		230 (B)

Prevalence Index = B/A = 2.091

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-49

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	90	5YR	4/6	10	C	PL	Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) (LRR P, T, U)
- [ ] 5 cm Mucky Mineral (A7) (LRR P, T, U)
- [ ] Muck Presence (A8) (LRR U)
- [ ] 1 cm Muck (A9) (LRR P, T)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [x] Coast Prairie Redox (A16) (MLRA 150A)
- [ ] Sandy Muck Mineral (S1) (LRR O, S)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) (LRR P, S, T, U)
- [ ] Polyvalue Below Surface (S8) (LRR S, T, U)
- [ ] Thin Dark Surface (S9) (LRR S, T, U)
- [ ] Loamy Mucky Mineral (F1) (LRR O)
- [ ] Loamy Gleyed Matrix (F2)
- [ ] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) (LRR U)
- [ ] Depleted Ochric (F11) (MLRA 151)
- [ ] Iron-Manganese Masses (F12) (LRR O, P, T)
- [ ] Umbric Surface (F13) (LRR P, T, U)
- [ ] Delta Ochric (F17) (MLRA 151)
- [ ] Reduced Vertic (F18) (MLRA 150A, 150B)
- [ ] Piedmont Floodplain Soils (F19) (MLRA 149A)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) (LRR O)
- [ ] 2 cm Muck (A10) (LRR S)
- [ ] Reduced Vertic (F18) (outside MLRA 150A,B)
- [ ] Piedmont Floodplain Soils (F19) (LRR P, S, T)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes (●) No ( )

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 11-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-B-50**

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range:** **S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.055273 **Long.:** -95.305776 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** None

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?**	Yes ( ) No (●)
Hydric Soil Present?	Yes ( ) No (●)		
Wetland Hydrology Present?	Yes ( ) No (●)		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (●)	Depth (inches):	
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (●)	Depth (inches):	

Wetland Hydrology Present? Yes ( ) No (●)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-50

Tree Stratum (Plot size: ______)

#	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Triadica sebifera	30	☑	100.0%	FAC
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	
7.		0	☐	0.0%	
8.		0	☐	0.0%	

50% of Total Cover: 15 20% of Total Cover: 6 30 = **Total Cover**

Sapling or Sapling/Shrub Stratum (Plot size: ______)

#	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Ilex vomitoria	10	☑	66.7%	FAC
2.	Rosa bracteata	5	☑	33.3%	UPL
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	
7.		0	☐	0.0%	
8.		0	☐	0.0%	

50% of Total Cover: 7.5 20% of Total Cover: 3 15 = **Total Cover**

Shrub Stratum (Plot size: ______)

#	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		0	☐	0.0%	
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = **Total Cover**

Herb Stratum (Plot size: ______)

#	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Stenotaphrum secundatum	80	☑	88.9%	FAC
2.	Sabal minor	5	☐	5.6%	FACW
3.	Iva annua	5	☐	5.6%	FAC
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	
7.		0	☐	0.0%	
8.		0	☐	0.0%	
9.		0	☐	0.0%	
10.		0	☐	0.0%	
11.		0	☐	0.0%	
12.		0	☐	0.0%	

50% of Total Cover: 45 20% of Total Cover: 18 90 = **Total Cover**

Woody Vine Stratum (Plot size: ______)

#	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		0	☐	0.0%	
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = **Total Cover**

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	3	(A)
Total Number of Dominant Species Across All Strata:	4	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	75.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	5	x 2 =	10
FAC species	125	x 3 =	375
FACU species	0	x 4 =	0
UPL species	5	x 5 =	25
Column Totals:	135 (A)		410 (B)

Prevalence Index = B/A = 3.037

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-50

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	100						Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 11-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-B-51

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range:** S T R

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** concave **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.057245 **Long.:** -95.303838 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** None

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (•) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (•) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (•) No ( )	**Is the Sampled Area within a Wetland?** Yes (•) No ( )
Hydric Soil Present?	Yes (•) No ( )	
Wetland Hydrology Present?	Yes (•) No ( )	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes (•) No ( )	Depth (inches): 1	**Wetland Hydrology Present?** Yes (•) No ( )
Water Table Present?	Yes ( ) No (•)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (•)	Depth (inches):	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-51

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species? Rel.Strat. Cover		Indicator Status
1. Triadica sebifera	30	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 15 20% of Total Cover: 6	30	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)				
1. Carex cherokeensis	45	☑	56.3%	FACW
2. Juncus effusus	20	☑	25.0%	OBL
3. Cyperus entrerianus	15	☐	18.8%	FACW
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 40 20% of Total Cover: 16	80	= Total Cover		

Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	20	x 1 =	20
FACW species	60	x 2 =	120
FAC species	30	x 3 =	90
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	110 (A)		230 (B)

Prevalence Index = B/A = 2.091

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-51

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-20	10YR	3/1	90	5YR	4/6	10	C	PL	Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☑ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 11-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-B-52

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range:** S T R

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.056971 **Long.:** -95.304022 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** PFO1A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?** Yes ( ) No (●)
Hydric Soil Present?	Yes ( ) No (●)	
Wetland Hydrology Present?	Yes ( ) No (●)	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (●)	Depth (inches):	
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (●)	Depth (inches):	

Wetland Hydrology Present? Yes ( ) No (●)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-52

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	30	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 15 20% of Total Cover: 6	30	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Ilex vomitoria	10	☑	66.7%	FAC
2. Rosa bracteata	5	☑	33.3%	UPL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 7.5 20% of Total Cover: 3	15	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Stenotaphrum secundatum	80	☑	88.9%	FAC
2. Sabal minor	5	☐	5.6%	FACW
3. Iva annua	5	☐	5.6%	FAC
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 45 20% of Total Cover: 18	90	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 75.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	5	x 2 =	10
FAC species	125	x 3 =	375
FACU species	0	x 4 =	0
UPL species	5	x 5 =	25
Column Totals:	135	(A)	410 (B)

Prevalence Index = B/A = 3.037

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-52

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-20	10YR	3/1	100						Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 11-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-B-53**

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.05107 **Long.:** -95.297777 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** PEM1Ah

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (•) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (•) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ( ) No (•)	**Is the Sampled Area within a Wetland?** Yes ( ) No (•)
Hydric Soil Present?	Yes ( ) No (•)	
Wetland Hydrology Present?	Yes ( ) No (•)	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (•)	Depth (inches):	
Water Table Present?	Yes ( ) No (•)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (•)	Depth (inches):	

Wetland Hydrology Present? Yes ( ) No (•)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-53

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Celtis occidentalis	10	☑	100.0%	FACU
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 5 20% of Total Cover: 2	10	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Ilex vomitoria	5	☐	14.3%	FAC
2. Rosa bracteata	30	☑	85.7%	UPL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 17.5 20% of Total Cover: 7	35	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Dysphania ambrosioides	20	☑	36.4%	FACU
2. Rubus argutus	10	☐	18.2%	FAC
3. Iva annua	25	☑	45.5%	FAC
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 27.5 20% of Total Cover: 11	55	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 25.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	40	x 3 =	120
FACU species	30	x 4 =	120
UPL species	30	x 5 =	150
Column Totals:	100 (A)		390 (B)

Prevalence Index = B/A = 3.900

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☐ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-53

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-20	10YR	3/1	100						Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 11-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-B-54**

Investigator(s): Justin Stelly; Erin Berkenkamp **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **% /** 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.059348 **Long.:** -95.325387 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** None

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation [ ] **, Soil** [ ] **, or Hydrology** [ ] **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation [ ] **, Soil** [ ] **, or Hydrology** [ ] **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●)	No ( )	**Is the Sampled Area within a Wetland?** Yes ( ) No (●)
Hydric Soil Present?	Yes ( )	No (●)	
Wetland Hydrology Present?	Yes ( )	No (●)	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- [ ] Surface Water (A1)
- [ ] High Water Table (A2)
- [ ] Saturation (A3)
- [ ] Water Marks (B1)
- [ ] Sediment Deposits (B2)
- [ ] Drift Deposits (B3)
- [ ] Algal Mat or Crust (B4)
- [ ] Iron Deposits (B5)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [ ] Water-Stained Leaves (B9)
- [ ] Aquatic Fauna (B13)
- [ ] Marl Deposits (B15) (LRR U)
- [ ] Hydrogen Sulfide Odor (C1)
- [ ] Oxidized Rhizospheres along Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Recent Iron Reduction in Tilled Soils (C6)
- [ ] Thin Muck Surface (C7)
- [ ] Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- [ ] Surface Soil Cracks (B6)
- [ ] Sparsely Vegetated Concave Surface (B8)
- [ ] Drainage Patterns (B10)
- [ ] Moss Trim Lines (B16)
- [ ] Dry Season Water Table (C2)
- [ ] Crayfish Burrows (C8)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [ ] Geomorphic Position (D2)
- [ ] Shallow Aquitard (D3)
- [ ] FAC-Neutral Test (D5)
- [ ] Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( )	No (●)	Depth (inches):
Water Table Present?	Yes ( )	No (●)	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ( )	No (●)	Depth (inches):

Wetland Hydrology Present? Yes ( ) No (●)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-B-54

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Celtis occidentalis	10	☑	22.2%	FACU
2. Triadica sebifera	35	☑	77.8%	FAC
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 22.5 20% of Total Cover: 9	45	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Ilex vomitoria	15	☑	100.0%	FAC
2.		☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 7.5 20% of Total Cover: 3	15	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Carex cherokeensis	40	☑	66.7%	FACW
2. Rubus argutus	10	☐	16.7%	FAC
3. Iva annua	10	☐	16.7%	FAC
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 30 20% of Total Cover: 12	60	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 75.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	40	x 2 =	80
FAC species	70	x 3 =	210
FACU species	10	x 4 =	40
UPL species	0	x 5 =	0
Column Totals:	120 (A)		330 (B)

Prevalence Index = B/A = 2.750

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-B-54

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	100						Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-C-1**

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.064701 **Long.:** -95.317751 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?** Yes ( ) No (●)
Hydric Soil Present?	Yes ( ) No (●)	
Wetland Hydrology Present?	Yes ( ) No (●)	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (●)	Depth (inches):	
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (●)	Depth (inches):	

Wetland Hydrology Present? Yes ( ) No (●)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-1

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Celtis occidentalis	10	✔	66.7%	FACU
2. Triadica sebifera	5	✔	33.3%	FAC
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 7.5 20% of Total Cover: 3	15	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rosa bracteata	10	✔	100.0%	UPL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 5 20% of Total Cover: 2	10	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Iva annua	50	✔	35.7%	FAC
2. Stenotaphrum secundatum	40	✔	28.6%	FAC
3. Cyperus entrerianus	40	✔	28.6%	FACW
4. Sporobolus indicus	5	☐	3.6%	FACU
5. Solanum elaeagnifolium	5	☐	3.6%	UPL
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 70 20% of Total Cover: 28	140	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Ampelopsis arborea	5	✔	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 2.5 20% of Total Cover: 1	5	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 71.4% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	40	x 2 =	80
FAC species	100	x 3 =	300
FACU species	15	x 4 =	60
UPL species	15	x 5 =	75
Column Totals:	170 (A)		515 (B)

Prevalence Index = B/A = 3.029

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-20	10YR	3/1	100						Silty Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) (LRR P, T, U)
- [ ] 5 cm Mucky Mineral (A7) (LRR P, T, U)
- [ ] Muck Presence (A8) (LRR U)
- [ ] 1 cm Muck (A9) (LRR P, T)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Coast Prairie Redox (A16) (MLRA 150A)
- [ ] Sandy Muck Mineral (S1) (LRR O, S)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) (LRR P, S, T, U)
- [ ] Polyvalue Below Surface (S8) (LRR S, T, U)
- [ ] Thin Dark Surface (S9) (LRR S, T, U)
- [ ] Loamy Mucky Mineral (F1) (LRR O)
- [ ] Loamy Gleyed Matrix (F2)
- [ ] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) (LRR U)
- [ ] Depleted Ochric (F11) (MLRA 151)
- [ ] Iron-Manganese Masses (F12) (LRR O, P, T)
- [ ] Umbric Surface (F13) (LRR P, T, U)
- [ ] Delta Ochric (F17) (MLRA 151)
- [ ] Reduced Vertic (F18) (MLRA 150A, 150B)
- [ ] Piedmont Floodplain Soils (F19) (MLRA 149A)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) (LRR O)
- [ ] 2 cm Muck (A10) (LRR S)
- [ ] Reduced Vertic (F18) (outside MLRA 150A,B)
- [ ] Piedmont Floodplain Soils (F19) (LRR P, S, T)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

No reductions observed

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-C-3

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range:** S T R

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.062563 **Long.:** -95.317108 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉	
Wetland Hydrology Present?	Yes ○ No ◉	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○ No ◉	Depth (inches):	

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-3

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Celtis occidentalis	10	✔	66.7%	FACU
2. Triadica sebifera	5	✔	33.3%	FAC
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 7.5 20% of Total Cover: 3	15	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rosa bracteata	10	✔	100.0%	UPL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 5 20% of Total Cover: 2	10	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Iva annua	50	✔	35.7%	FAC
2. Stenotaphrum secundatum	40	✔	28.6%	FAC
3. Cyperus entrerianus	40	✔	28.6%	FACW
4. Sporobolus indicus	5	☐	3.6%	FACU
5. Solanum elaeagnifolium	5	☐	3.6%	UPL
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 70 20% of Total Cover: 28	140	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Ampelopsis arborea	5	✔	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 2.5 20% of Total Cover: 1	5	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 71.4% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	0	x 1 =	0	
FACW species	40	x 2 =	80	
FAC species	100	x 3 =	300	
FACU species	15	x 4 =	60	
UPL species	15	x 5 =	75	
Column Totals:	170	(A)	515	(B)

Prevalence Index = B/A = 3.029

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-21	10YR	3/1	100						Silty Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-C-5

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range:** S T R

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.060757 **Long.:** -95.31838 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ○ No (●)	**Is the Sampled Area within a Wetland?** Yes ○ No (●)
Hydric Soil Present?	Yes ○ No (●)	
Wetland Hydrology Present?	Yes ○ No (●)	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ○ No (●)	Depth (inches):
Water Table Present?	Yes ○ No (●)	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ○ No (●)	Depth (inches):

Wetland Hydrology Present? Yes ○ No (●)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-5

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Celtis occidentalis	10	✔	40.0%	FACU
2. Triadica sebifera	10	✔	40.0%	FAC
3.	5	✔	20.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 12.5 / 20% of Total Cover: 5	25	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rosa bracteata	10	✔	100.0%	UPL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 5 / 20% of Total Cover: 2	10	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 / 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Iva annua	70	✔	70.0%	FAC
2. Cynodon dactylon	25	✔	25.0%	FACU
3. Calyptocarpus vialis	5	☐	5.0%	FAC
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 50 / 20% of Total Cover: 20	100	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 / 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 33.3% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	85	x 3 =	255
FACU species	35	x 4 =	140
UPL species	10	x 5 =	50
Column Totals:	130 (A)		445 (B)

Prevalence Index = B/A = 3.423

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☐ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	100						Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-C-7**

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **% /** 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.058646 **Long.:** -95.320479 **Datum:** WGS 1983

Soil Map Unit Name: 39 - Surfside clay, 0 to 1 percent slopes, occasionally flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks:
Wetland line based on presence of upland plants

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○ No ◉	Depth (inches):	

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-7

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Iva annua	70	☑	48.3%	FAC
2. Cynodon dactylon	65	☑	44.8%	FACU
3. Helenium amarum	10	☐	6.9%	FACU
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 72.5 20% of Total Cover: 29	145	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	70	x 3 =	210
FACU species	75	x 4 =	300
UPL species	0	x 5 =	0
Column Totals:	145 (A)		510 (B)

Prevalence Index = B/A = 3.517

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☐ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-7

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	100						Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2] Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-C-9

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range:** S T R

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** convex **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.056931 **Long.:** -95.321694 **Datum:** WGS 1983

Soil Map Unit Name: 39 - Surfside clay, 0 to 1 percent slopes, occasionally flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ( ) No (●)	**Is the Sampled Area within a Wetland?** Yes ( ) No (●)
Hydric Soil Present?	Yes (●) No ( )	
Wetland Hydrology Present?	Yes ( ) No (●)	

Remarks:
Built up 2 track separates wetland

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (●)	Depth (inches):	
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (●)	Depth (inches):	

Wetland Hydrology Present? Yes ( ) No (●)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-9

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	0	(A)	0 (B)

Prevalence Index = B/A = 0.000

Hydrophytic Vegetation Indicators:

☐ **1 - Rapid Test for Hydrophytic Vegetation**

☐ **2 - Dominance Test is > 50%**

☐ **3 - Prevalence Index is ≤3.0** [1]

☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-9

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) (LRR P, T, U)
- [ ] 5 cm Mucky Mineral (A7) (LRR P, T, U)
- [ ] Muck Presence (A8) (LRR U)
- [ ] 1 cm Muck (A9) (LRR P, T)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Coast Prairie Redox (A16) (MLRA 150A)
- [ ] Sandy Muck Mineral (S1) (LRR O, S)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) (LRR P, S, T, U)
- [ ] Polyvalue Below Surface (S8) (LRR S, T, U)
- [ ] Thin Dark Surface (S9) (LRR S, T, U)
- [ ] Loamy Mucky Mineral (F1) (LRR O)
- [ ] Loamy Gleyed Matrix (F2)
- [ ] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) (LRR U)
- [ ] Depleted Ochric (F11) (MLRA 151)
- [ ] Iron-Manganese Masses (F12) (LRR O, P, T)
- [ ] Umbric Surface (F13) (LRR P, T, U)
- [ ] Delta Ochric (F17) (MLRA 151)
- [ ] Reduced Vertic (F18) (MLRA 150A, 150B)
- [x] Piedmont Floodplain Soils (F19) (MLRA 149A)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) (LRR O)
- [ ] 2 cm Muck (A10) (LRR S)
- [ ] Reduced Vertic (F18) (outside MLRA 150A,B)
- [ ] Piedmont Floodplain Soils (F19) (LRR P, S, T)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes (●) No ( )

Remarks:

No soil pit

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-C-11**

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.054689 **Long.:** -95.319586 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?** Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉	
Wetland Hydrology Present?	Yes ○ No ◉	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○ No ◉	Depth (inches):	

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-11

Tree Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 — 20% of Total Cover: 0	0	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rosa bracteata	30	☑	60.0%	UPL
2.	20	☑	40.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 25 — 20% of Total Cover: 10	50	= Total Cover		

Shrub Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 — 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Stenotaphrum secundatum	80	☑	72.7%	FAC
2. Sporobolus indicus	15	☐	13.6%	FACU
3. Iva annua	15	☐	13.6%	FAC
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 55 — 20% of Total Cover: 22	110	= Total Cover		

Woody Vine Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 — 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	1	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	33.3%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	95	x 3 =	285
FACU species	15	x 4 =	60
UPL species	30	x 5 =	150
Column Totals:	140 (A)		495 (B)

Prevalence Index = B/A = 3.536

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☐ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-11

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-20	10YR	3/1	100						Silty Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

Same 3/1 soils; however, soils in adjacent wetland have oxidized rizospheres

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-C-13

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.057623 **Long.:** -95.31787 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?**	Yes ( ) No (●)
Hydric Soil Present?	Yes ( ) No (●)		
Wetland Hydrology Present?	Yes ( ) No (●)		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (●)	Depth (inches):	
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (●)	Depth (inches):	

Wetland Hydrology Present? Yes ( ) No (●)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-13

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Celtis occidentalis	10	☑	66.7%	FACU
2. Triadica sebifera	5	☑	33.3%	FAC
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 7.5 20% of Total Cover: 3	15	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rosa bracteata	10	☑	100.0%	UPL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 5 20% of Total Cover: 2	10	= Total Cover		

Shrub Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Iva annua	50	☑	35.7%	FAC
2. Stenotaphrum secundatum	40	☑	28.6%	FAC
3. Cyperus entrerianus	40	☑	28.6%	FACW
4. Sporobolus indicus	5	☐	3.6%	FACU
5. Solanum elaeagnifolium	5	☐	3.6%	UPL
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 70 20% of Total Cover: 28	140	= Total Cover		

Woody Vine Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Ampelopsis arborea	5	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 2.5 20% of Total Cover: 1	5	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 71.4% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	40	x 2 =	80
FAC species	100	x 3 =	300
FACU species	15	x 4 =	60
UPL species	15	x 5 =	75
Column Totals:	170 (A)		515 (B)

Prevalence Index = B/A = 3.029

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-13

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	100						Silty Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

No reductions observed

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-C-15

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range:** S T R

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.059287 **Long.:** -95.31565 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ○	**Is the Sampled Area within a Wetland?**	Yes ○ No (●)
Hydric Soil Present?	Yes ○ No (●)		
Wetland Hydrology Present?	Yes ○ No (●)		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ○ No (●)	Depth (inches):	
Water Table Present?	Yes ○ No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○ No (●)	Depth (inches):	

Wetland Hydrology Present? Yes ○ No (●)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-15

Tree Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Celtis occidentalis	10	✓	66.7%	FACU
2.	Triadica sebifera	5	✓	33.3%	FAC
3.		0		0.0%	
4.		0		0.0%	
5.		0		0.0%	
6.		0		0.0%	
7.		0		0.0%	
8.		0		0.0%	

50% of Total Cover: 7.5 20% of Total Cover: 3 15 = Total Cover

Sapling or Sapling/Shrub Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Rosa bracteata	10	✓	100.0%	UPL
2.		0		0.0%	
3.		0		0.0%	
4.		0		0.0%	
5.		0		0.0%	
6.		0		0.0%	
7.		0		0.0%	
8.		0		0.0%	

50% of Total Cover: 5 20% of Total Cover: 2 10 = Total Cover

Shrub Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		0		0.0%	
2.		0		0.0%	
3.		0		0.0%	
4.		0		0.0%	
5.		0		0.0%	
6.		0		0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Herb Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Iva annua	50	✓	35.7%	FAC
2.	Stenotaphrum secundatum	40	✓	28.6%	FAC
3.	Cyperus entrerianus	40	✓	28.6%	FACW
4.	Sporobolus indicus	5		3.6%	FACU
5.	Solanum elaeagnifolium	5		3.6%	UPL
6.		0		0.0%	
7.		0		0.0%	
8.		0		0.0%	
9.		0		0.0%	
10.		0		0.0%	
11.		0		0.0%	
12.		0		0.0%	

50% of Total Cover: 70 20% of Total Cover: 28 140 = Total Cover

Woody Vine Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Ampelopsis arborea	5	✓	100.0%	FAC
2.		0		0.0%	
3.		0		0.0%	
4.		0		0.0%	
5.		0		0.0%	

50% of Total Cover: 2.5 20% of Total Cover: 1 5 = Total Cover

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 71.4% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	40	x 2 =	80
FAC species	100	x 3 =	300
FACU species	15	x 4 =	60
UPL species	15	x 5 =	75
Column Totals:	170 (A)		515 (B)

Prevalence Index = B/A = 3.029

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-15

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	100						Silty Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

No reductions observed

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-C-17

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range: S** ____ **T** ____ **R** ____

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.061346 **Long.:** -95.312317 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?** Yes ( ) No (●)
Hydric Soil Present?	Yes ( ) No (●)	
Wetland Hydrology Present?	Yes ( ) No (●)	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (●)	Depth (inches):	
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (●)	Depth (inches):	

Wetland Hydrology Present? Yes ( ) No (●)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-17

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Celtis occidentalis	10	☑	66.7%	FACU
2. Triadica sebifera	5	☑	33.3%	FAC
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 7.5 20% of Total Cover: 3	15	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rosa bracteata	10	☑	100.0%	UPL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 5 20% of Total Cover: 2	10	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Iva annua	50	☑	35.7%	FAC
2. Stenotaphrum secundatum	40	☑	28.6%	FAC
3. Cyperus entrerianus	40	☑	28.6%	FACW
4. Sporobolus indicus	5	☐	3.6%	FACU
5. Solanum elaeagnifolium	5	☐	3.6%	UPL
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 70 20% of Total Cover: 28	140	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Ampelopsis arborea	5	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 2.5 20% of Total Cover: 1	5	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 71.4% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	40	x 2 =	80
FAC species	100	x 3 =	300
FACU species	15	x 4 =	60
UPL species	15	x 5 =	75
Column Totals:	170 (A)		515 (B)

Prevalence Index = B/A = 3.029

Hydrophytic Vegetation Indicators:

☐ **1 - Rapid Test for Hydrophytic Vegetation**

☑ **2 - Dominance Test is > 50%**

☐ **3 - Prevalence Index is ≤3.0** [1]

☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-17

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-20	10YR	3/1	100						Silty Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

No reductions observed

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-C-19

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range:** S T R

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.062759 **Long.:** -95.309102 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (•) No ( ) **(If no, explain in Remarks.)**

Are Vegetation [ ] **, Soil** [ ] **, or Hydrology** [ ] **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (•) No ( )

Are Vegetation [ ] **, Soil** [ ] **, or Hydrology** [ ] **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (•) No ( )	**Is the Sampled Area within a Wetland?** Yes ( ) No (•)
Hydric Soil Present?	Yes ( ) No (•)	
Wetland Hydrology Present?	Yes ( ) No (•)	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- [ ] Surface Water (A1)
- [ ] High Water Table (A2)
- [ ] Saturation (A3)
- [ ] Water Marks (B1)
- [ ] Sediment Deposits (B2)
- [ ] Drift Deposits (B3)
- [ ] Algal Mat or Crust (B4)
- [ ] Iron Deposits (B5)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [ ] Water-Stained Leaves (B9)
- [ ] Aquatic Fauna (B13)
- [ ] Marl Deposits (B15) (LRR U)
- [ ] Hydrogen Sulfide Odor (C1)
- [ ] Oxidized Rhizospheres along Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Recent Iron Reduction in Tilled Soils (C6)
- [ ] Thin Muck Surface (C7)
- [ ] Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- [ ] Surface Soil Cracks (B6)
- [ ] Sparsely Vegetated Concave Surface (B8)
- [ ] Drainage Patterns (B10)
- [ ] Moss Trim Lines (B16)
- [ ] Dry Season Water Table (C2)
- [ ] Crayfish Burrows (C8)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [x] Geomorphic Position (D2)
- [ ] Shallow Aquitard (D3)
- [ ] FAC-Neutral Test (D5)
- [ ] Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (•)	Depth (inches):	
Water Table Present?	Yes ( ) No (•)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (•)	Depth (inches):	

Wetland Hydrology Present? Yes ( ) No (•)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-19

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Celtis occidentalis	10	☑	66.7%	FACU
2. Triadica sebifera	5	☑	33.3%	FAC
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 7.5 20% of Total Cover: 3	15	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rosa bracteata	10	☑	100.0%	UPL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 5 20% of Total Cover: 2	10	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Iva annua	50	☑	35.7%	FAC
2. Stenotaphrum secundatum	40	☑	28.6%	FAC
3. Cyperus entrerianus	40	☑	28.6%	FACW
4. Sporobolus indicus	5	☐	3.6%	FACU
5. Solanum elaeagnifolium	5	☐	3.6%	UPL
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 70 20% of Total Cover: 28	140	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Ampelopsis arborea	5	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 2.5 20% of Total Cover: 1	5	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 71.4% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	40	x 2 =	80
FAC species	100	x 3 =	300
FACU species	15	x 4 =	60
UPL species	15	x 5 =	75
Column Totals:	170 (A)		515 (B)

Prevalence Index = B/A = 3.029

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-19

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	100						Silty Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) (LRR P, T, U)
- [ ] 5 cm Mucky Mineral (A7) (LRR P, T, U)
- [ ] Muck Presence (A8) (LRR U)
- [ ] 1 cm Muck (A9) (LRR P, T)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Coast Prairie Redox (A16) (MLRA 150A)
- [ ] Sandy Muck Mineral (S1) (LRR O, S)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) (LRR P, S, T, U)
- [ ] Polyvalue Below Surface (S8) (LRR S, T, U)
- [ ] Thin Dark Surface (S9) (LRR S, T, U)
- [ ] Loamy Mucky Mineral (F1) (LRR O)
- [ ] Loamy Gleyed Matrix (F2)
- [ ] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) (LRR U)
- [ ] Depleted Ochric (F11) (MLRA 151)
- [ ] Iron-Manganese Masses (F12) (LRR O, P, T)
- [ ] Umbric Surface (F13) (LRR P, T, U)
- [ ] Delta Ochric (F17) (MLRA 151)
- [ ] Reduced Vertic (F18) (MLRA 150A, 150B)
- [ ] Piedmont Floodplain Soils (F19) (MLRA 149A)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) (LRR O)
- [ ] 2 cm Muck (A10) (LRR S)
- [ ] Reduced Vertic (F18) (outside MLRA 150A,B)
- [ ] Piedmont Floodplain Soils (F19) (LRR P, S, T)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ●

Remarks:

No reductions observed

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-C-22

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.061583 **Long.:** -95.305699 **Datum:** WGS 1983

Soil Map Unit Name: 39 - Surfside clay, 0 to 1 percent slopes, occasionally flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?** Yes (●) No ( )
Hydric Soil Present?	Yes (●) No ( )	
Wetland Hydrology Present?	Yes (●) No ( )	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (●)	Depth (inches):	
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (●)	Depth (inches):	

Wetland Hydrology Present? Yes (●) No ( )

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-22

Tree Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	5	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 2.5 20% of Total Cover: 1	5	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Baccharis halimifolia	30	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 15 20% of Total Cover: 6	30	= Total Cover		

Shrub Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Iva annua	50	☑	45.5%	FAC
2. Spartina spartinae	50	☑	45.5%	OBL
3. Andropogon glomeratus	5	☐	4.5%	FACW
4. Borrichia frutescens	5	☐	4.5%	OBL
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 55 20% of Total Cover: 22	110	= Total Cover		

Woody Vine Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	55	x 1 =	55
FACW species	5	x 2 =	10
FAC species	85	x 3 =	255
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	145 (A)		320 (B)

Prevalence Index = B/A = 2.207

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-22

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-20	10YR	3/1	98	10YR	3/2	2	C	M		

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☑ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-C-23

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range:** S T R

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.061192 **Long.:** -95.303063 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?** Yes ( ) No (●)
Hydric Soil Present?	Yes ( ) No (●)	
Wetland Hydrology Present?	Yes ( ) No (●)	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (●)	Depth (inches):	
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (●)	Depth (inches):	

Wetland Hydrology Present? Yes ( ) No (●)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-23

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Celtis occidentalis	10	✔	66.7%	FACU
2. Triadica sebifera	5	✔	33.3%	FAC
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 7.5 20% of Total Cover: 3	15	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rosa bracteata	10	✔	100.0%	UPL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 5 20% of Total Cover: 2	10	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Iva annua	50	✔	35.7%	FAC
2. Stenotaphrum secundatum	40	✔	28.6%	FAC
3. Cyperus entrerianus	40	✔	28.6%	FACW
4. Sporobolus indicus	5	☐	3.6%	FACU
5. Solanum elaeagnifolium	5	☐	3.6%	UPL
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 70 20% of Total Cover: 28	140	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Ampelopsis arborea	5	✔	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 2.5 20% of Total Cover: 1	5	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	5	(A)
Total Number of Dominant Species Across All Strata:	7	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	71.4%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	40	x 2 =	80
FAC species	100	x 3 =	300
FACU species	15	x 4 =	60
UPL species	15	x 5 =	75
Column Totals:	170 (A)		515 (B)

Prevalence Index = B/A = 3.029

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-23

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix			Redox Features					Texture	Remarks
	Color (moist)		%	Color (moist)		%	Type[1]	Loc²		
0-20	10YR	3/1	100						Silty Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

No reductions observed

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-C-25**

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.061988 **Long.:** -95.300081 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (•) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (•) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (•) No ( )	**Is the Sampled Area within a Wetland?**	Yes ( ) No (•)
Hydric Soil Present?	Yes ( ) No (•)		
Wetland Hydrology Present?	Yes ( ) No (•)		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (•)	Depth (inches):	
Water Table Present?	Yes ( ) No (•)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (•)	Depth (inches):	

Wetland Hydrology Present? Yes ( ) No (•)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-25

Tree Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Celtis occidentalis	10	☑	66.7%	FACU
2.	Triadica sebifera	5	☑	33.3%	FAC
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	
7.		0	☐	0.0%	
8.		0	☐	0.0%	

50% of Total Cover: 7.5 20% of Total Cover: 3 15 = Total Cover

Sapling or Sapling/Shrub Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Rosa bracteata	10	☑	100.0%	UPL
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	
7.		0	☐	0.0%	
8.		0	☐	0.0%	

50% of Total Cover: 5 20% of Total Cover: 2 10 = Total Cover

Shrub Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		0	☐	0.0%	
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Herb Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Iva annua	50	☑	35.7%	FAC
2.	Stenotaphrum secundatum	40	☑	28.6%	FAC
3.	Cyperus entrerianus	40	☑	28.6%	FACW
4.	Sporobolus indicus	5	☐	3.6%	FACU
5.	Solanum elaeagnifolium	5	☐	3.6%	UPL
6.		0	☐	0.0%	
7.		0	☐	0.0%	
8.		0	☐	0.0%	
9.		0	☐	0.0%	
10.		0	☐	0.0%	
11.		0	☐	0.0%	
12.		0	☐	0.0%	

50% of Total Cover: 70 20% of Total Cover: 28 140 = Total Cover

Woody Vine Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Ampelopsis arborea	5	☑	100.0%	FAC
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	

50% of Total Cover: 2.5 20% of Total Cover: 1 5 = Total Cover

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 71.4% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	0	x 1 =	0	
FACW species	40	x 2 =	80	
FAC species	100	x 3 =	300	
FACU species	15	x 4 =	60	
UPL species	15	x 5 =	75	
Column Totals:	170	(A)	515	(B)

Prevalence Index = B/A = 3.029

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-25

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-20	10YR	3/1	100						Silty Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

No reductions observed

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-C-27**

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.061221 **Long.:** -95.297501 **Datum:** WGS 1983

Soil Map Unit Name: 39 - Surfside clay, 0 to 1 percent slopes, occasionally flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ○	**Is the Sampled Area within a Wetland?**	Yes ○ No (●)
Hydric Soil Present?	Yes ○ No (●)		
Wetland Hydrology Present?	Yes ○ No (●)		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ○ No (●)	Depth (inches):	
Water Table Present?	Yes ○ No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○ No (●)	Depth (inches):	

Wetland Hydrology Present? Yes ○ No (●)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-27

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Celtis occidentalis	10	✔	66.7%	FACU
2. Triadica sebifera	5	✔	33.3%	FAC
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 7.5 20% of Total Cover: 3	15	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rosa bracteata	10	✔	100.0%	UPL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 5 20% of Total Cover: 2	10	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Iva annua	50	✔	35.7%	FAC
2. Stenotaphrum secundatum	40	✔	28.6%	FAC
3. Cyperus entrerianus	40	✔	28.6%	FACW
4. Sporobolus indicus	5	☐	3.6%	FACU
5. Solanum elaeagnifolium	5	☐	3.6%	UPL
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 70 20% of Total Cover: 28	140	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Ampelopsis arborea	5	✔	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 2.5 20% of Total Cover: 1	5	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	5	(A)
Total Number of Dominant Species Across All Strata:	7	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	71.4%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	40	x 2 =	80
FAC species	100	x 3 =	300
FACU species	15	x 4 =	60
UPL species	15	x 5 =	75
Column Totals:	170 (A)		515 (B)

Prevalence Index = B/A = 3.029

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes (●) No ( )

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-27

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-20	10YR	3/1	100						Silty Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) (LRR P, T, U)
- [ ] 5 cm Mucky Mineral (A7) (LRR P, T, U)
- [ ] Muck Presence (A8) (LRR U)
- [ ] 1 cm Muck (A9) (LRR P, T)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Coast Prairie Redox (A16) (MLRA 150A)
- [ ] Sandy Muck Mineral (S1) (LRR O, S)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) (LRR P, S, T, U)
- [ ] Polyvalue Below Surface (S8) (LRR S, T, U)
- [ ] Thin Dark Surface (S9) (LRR S, T, U)
- [ ] Loamy Mucky Mineral (F1) (LRR O)
- [ ] Loamy Gleyed Matrix (F2)
- [ ] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) (LRR U)
- [ ] Depleted Ochric (F11) (MLRA 151)
- [ ] Iron-Manganese Masses (F12) (LRR O, P, T)
- [ ] Umbric Surface (F13) (LRR P, T, U)
- [ ] Delta Ochric (F17) (MLRA 151)
- [ ] Reduced Vertic (F18) (MLRA 150A, 150B)
- [ ] Piedmont Floodplain Soils (F19) (MLRA 149A)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) (LRR O)
- [ ] 2 cm Muck (A10) (LRR S)
- [ ] Reduced Vertic (F18) (outside MLRA 150A,B)
- [ ] Piedmont Floodplain Soils (F19) (LRR P, S, T)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

No reductions observed

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-C-29**

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.059321 **Long.:** -95.295311 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?**	Yes ( ) No (●)
Hydric Soil Present?	Yes ( ) No (●)		
Wetland Hydrology Present?	Yes ( ) No (●)		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (●)	Depth (inches):	
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (●)	Depth (inches):	

Wetland Hydrology Present? Yes ( ) No (●)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-29

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Celtis occidentalis	10	☑	66.7%	FACU
2. Triadica sebifera	5	☑	33.3%	FAC
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 7.5 — 20% of Total Cover: 3	15	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rosa bracteata	10	☑	100.0%	UPL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 5 — 20% of Total Cover: 2	10	= Total Cover		

Shrub Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 — 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Iva annua	50	☑	35.7%	FAC
2. Stenotaphrum secundatum	40	☑	28.6%	FAC
3. Cyperus entrerianus	40	☑	28.6%	FACW
4. Sporobolus indicus	5	☐	3.6%	FACU
5. Solanum elaeagnifolium	5	☐	3.6%	UPL
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 70 — 20% of Total Cover: 28	140	= Total Cover		

Woody Vine Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Ampelopsis arborea	5	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 2.5 — 20% of Total Cover: 1	5	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 71.4% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	40	x 2 =	80
FAC species	100	x 3 =	300
FACU species	15	x 4 =	60
UPL species	15	x 5 =	75
Column Totals:	170 (A)		515 (B)

Prevalence Index = B/A = 3.029

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-29

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	100						Silty Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ●

Remarks:

No reductions observed

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-C-31

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.056924 **Long.:** -95.294171 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉	
Wetland Hydrology Present?	Yes ○ No ◉	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○ No ◉	Depth (inches):	

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-31

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Celtis occidentalis	10	✔	66.7%	FACU
2. Triadica sebifera	5	✔	33.3%	FAC
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 7.5 20% of Total Cover: 3	15	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rosa bracteata	10	✔	100.0%	UPL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 5 20% of Total Cover: 2	10	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Iva annua	50	✔	35.7%	FAC
2. Stenotaphrum secundatum	40	✔	28.6%	FAC
3. Cyperus entrerianus	40	✔	28.6%	FACW
4. Sporobolus indicus	5	☐	3.6%	FACU
5. Solanum elaeagnifolium	5	☐	3.6%	UPL
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 70 20% of Total Cover: 28	140	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Ampelopsis arborea	5	✔	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 2.5 20% of Total Cover: 1	5	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	5	(A)
Total Number of Dominant Species Across All Strata:	7	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	71.4%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	40	x 2 =	80
FAC species	100	x 3 =	300
FACU species	15	x 4 =	60
UPL species	15	x 5 =	75
Column Totals:	170 (A)		515 (B)

Prevalence Index = B/A = 3.029

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-31

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-20	10YR	3/1	100						Silty Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

No reductions observed

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-C-33**

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.054332 **Long.:** -95.293972 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (•) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (•) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (•) No ( )	**Is the Sampled Area within a Wetland?** Yes (•) No ( )
Hydric Soil Present?	Yes (•) No ( )	
Wetland Hydrology Present?	Yes (•) No ( )	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (•)	Depth (inches):	
Water Table Present?	Yes ( ) No (•)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (•)	Depth (inches):	

Wetland Hydrology Present? Yes (•) No ( )

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-33

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species? Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	5	☑ 100.0%	FAC
2.	0	☐ 0.0%	
3.	0	☐ 0.0%	
4.	0	☐ 0.0%	
5.	0	☐ 0.0%	
6.	0	☐ 0.0%	
7.	0	☐ 0.0%	
8.	0	☐ 0.0%	
50% of Total Cover: 2.5 20% of Total Cover: 1	5	= Total Cover	

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species? Rel.Strat. Cover	Indicator Status
1. Baccharis halimifolia	30	☑ 100.0%	FAC
2.	0	☐ 0.0%	
3.	0	☐ 0.0%	
4.	0	☐ 0.0%	
5.	0	☐ 0.0%	
6.	0	☐ 0.0%	
7.	0	☐ 0.0%	
8.	0	☐ 0.0%	
50% of Total Cover: 15 20% of Total Cover: 6	30	= Total Cover	

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species? Rel.Strat. Cover	Indicator Status
1.	0	☐ 0.0%	
2.	0	☐ 0.0%	
3.	0	☐ 0.0%	
4.	0	☐ 0.0%	
5.	0	☐ 0.0%	
6.	0	☐ 0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover	

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species? Rel.Strat. Cover	Indicator Status
1. Iva annua	50	☑ 45.5%	FAC
2. Spartina spartinae	50	☑ 45.5%	OBL
3. Andropogon glomeratus	5	☐ 4.5%	FACW
4. Borrichia frutescens	5	☐ 4.5%	OBL
5.	0	☐ 0.0%	
6.	0	☐ 0.0%	
7.	0	☐ 0.0%	
8.	0	☐ 0.0%	
9.	0	☐ 0.0%	
10.	0	☐ 0.0%	
11.	0	☐ 0.0%	
12.	0	☐ 0.0%	
50% of Total Cover: 55 20% of Total Cover: 22	110	= Total Cover	

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species? Rel.Strat. Cover	Indicator Status
1.	0	☐ 0.0%	
2.	0	☐ 0.0%	
3.	0	☐ 0.0%	
4.	0	☐ 0.0%	
5.	0	☐ 0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	55	x 1 =	55
FACW species	5	x 2 =	10
FAC species	85	x 3 =	255
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	145 (A)		320 (B)

Prevalence Index = B/A = 2.207

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-33

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	98	10YR	3/2	2	C	M		

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) (LRR P, T, U)
- [ ] 5 cm Mucky Mineral (A7) (LRR P, T, U)
- [ ] Muck Presence (A8) (LRR U)
- [ ] 1 cm Muck (A9) (LRR P, T)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [x] Coast Prairie Redox (A16) (MLRA 150A)
- [ ] Sandy Muck Mineral (S1) (LRR O, S)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) (LRR P, S, T, U)
- [ ] Polyvalue Below Surface (S8) (LRR S, T, U)
- [ ] Thin Dark Surface (S9) (LRR S, T, U)
- [ ] Loamy Mucky Mineral (F1) (LRR O)
- [ ] Loamy Gleyed Matrix (F2)
- [ ] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) (LRR U)
- [ ] Depleted Ochric (F11) (MLRA 151)
- [ ] Iron-Manganese Masses (F12) (LRR O, P, T)
- [ ] Umbric Surface (F13) (LRR P, T, U)
- [ ] Delta Ochric (F17) (MLRA 151)
- [ ] Reduced Vertic (F18) (MLRA 150A, 150B)
- [ ] Piedmont Floodplain Soils (F19) (MLRA 149A)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) (LRR O)
- [ ] 2 cm Muck (A10) (LRR S)
- [ ] Reduced Vertic (F18) (outside MLRA 150A,B)
- [ ] Piedmont Floodplain Soils (F19) (LRR P, S, T)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes (•) No ( )

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-C-35

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range:** S T R

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.052387 **Long.:** -95.294319 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?**	Yes ( ) No (●)
Hydric Soil Present?	Yes ( ) No (●)		
Wetland Hydrology Present?	Yes ( ) No (●)		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (●)	Depth (inches):	
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (●)	Depth (inches):	

Wetland Hydrology Present? Yes ( ) No (●)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-35

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Celtis occidentalis	10	✔	66.7%	FACU
2. Triadica sebifera	5	✔	33.3%	FAC
3.	0		0.0%	
4.	0		0.0%	
5.	0		0.0%	
6.	0		0.0%	
7.	0		0.0%	
8.	0		0.0%	
50% of Total Cover: 7.5 20% of Total Cover: 3	15	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rosa bracteata	10	✔	100.0%	UPL
2.	0		0.0%	
3.	0		0.0%	
4.	0		0.0%	
5.	0		0.0%	
6.	0		0.0%	
7.	0		0.0%	
8.	0		0.0%	
50% of Total Cover: 5 20% of Total Cover: 2	10	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0		0.0%	
2.	0		0.0%	
3.	0		0.0%	
4.	0		0.0%	
5.	0		0.0%	
6.	0		0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Iva annua	50	✔	35.7%	FAC
2. Stenotaphrum secundatum	40	✔	28.6%	FAC
3. Cyperus entrerianus	40	✔	28.6%	FACW
4. Sporobolus indicus	5		3.6%	FACU
5. Solanum elaeagnifolium	5		3.6%	UPL
6.	0		0.0%	
7.	0		0.0%	
8.	0		0.0%	
9.	0		0.0%	
10.	0		0.0%	
11.	0		0.0%	
12.	0		0.0%	
50% of Total Cover: 70 20% of Total Cover: 28	140	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Ampelopsis arborea	5	✔	100.0%	FAC
2.	0		0.0%	
3.	0		0.0%	
4.	0		0.0%	
5.	0		0.0%	
50% of Total Cover: 2.5 20% of Total Cover: 1	5	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 71.4% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	40	x 2 =	80
FAC species	100	x 3 =	300
FACU species	15	x 4 =	60
UPL species	15	x 5 =	75
Column Totals:	170	(A)	515 (B)

Prevalence Index = B/A = 3.029

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-35

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	100						Silty Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

No reductions observed

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-C-37**

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.052582 **Long.:** -95.289104 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?** Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉	
Wetland Hydrology Present?	Yes ○ No ◉	

Remarks:
Boundary agrees with NWI lines

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○ No ◉	Depth (inches):	

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-37

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Ligustrum sinense	20	☑	66.7%	FAC
2. Rosa bracteata	10	☑	33.3%	UPL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 15 20% of Total Cover: 6	30	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Sporobolus indicus	40	☑	66.7%	FACU
2. Stenotaphrum secundatum	15	☑	25.0%	FAC
3. Solanum elaeagnifolium	5	☐	8.3%	UPL
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 30 20% of Total Cover: 12	60	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rubus trivialis	5	☑	100.0%	FACU
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 2.5 20% of Total Cover: 1	5	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 40.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	35	x 3 =	105
FACU species	45	x 4 =	180
UPL species	15	x 5 =	75
Column Totals:	95 (A)		360 (B)

Prevalence Index = B/A = 3.789

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☐ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-37

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	4/2	100						Silty Clay Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-C-38**

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range: S** ____ **T** ____ **R** ____

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** concave **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.052402 **Long.:** -95.289289 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** PEM1F

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (•) No ( ) **(If no, explain in Remarks.)**

Are Vegetation [ ] **, Soil** [ ] **, or Hydrology** [ ] **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (•) No ( )

Are Vegetation [ ] **, Soil** [ ] **, or Hydrology** [ ] **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (•) No ( )	**Is the Sampled Area within a Wetland?**	Yes ( ) No (•)
Hydric Soil Present?	Yes ( ) No (•)		
Wetland Hydrology Present?	Yes (•) No ( )		

Remarks:
Remnant bayou channel

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- [x] Surface Water (A1)
- [ ] High Water Table (A2)
- [ ] Saturation (A3)
- [ ] Water Marks (B1)
- [ ] Sediment Deposits (B2)
- [ ] Drift Deposits (B3)
- [ ] Algal Mat or Crust (B4)
- [ ] Iron Deposits (B5)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [ ] Water-Stained Leaves (B9)
- [ ] Aquatic Fauna (B13)
- [ ] Marl Deposits (B15) (LRR U)
- [ ] Hydrogen Sulfide Odor (C1)
- [ ] Oxidized Rhizospheres along Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Recent Iron Reduction in Tilled Soils (C6)
- [ ] Thin Muck Surface (C7)
- [ ] Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- [ ] Surface Soil Cracks (B6)
- [ ] Sparsely Vegetated Concave Surface (B8)
- [ ] Drainage Patterns (B10)
- [ ] Moss Trim Lines (B16)
- [ ] Dry Season Water Table (C2)
- [ ] Crayfish Burrows (C8)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [ ] Geomorphic Position (D2)
- [ ] Shallow Aquitard (D3)
- [x] FAC-Neutral Test (D5)
- [ ] Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes (•) No ( )	Depth (inches):	
Water Table Present?	Yes ( ) No (•)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (•)	Depth (inches):	

Wetland Hydrology Present? Yes (•) No ( )

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-38

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 — 20% of Total Cover: 0	0	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 — 20% of Total Cover: 0	0	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 — 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Schoenoplectus acutus var. acutus	100	☑	100.0%	OBL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 50 — 20% of Total Cover: 20	100	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 — 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	100	x 1 =	100
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	100 (A)		100 (B)

Prevalence Index = B/A = 1.000

Hydrophytic Vegetation Indicators:

- ☑ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes (●) No ( )

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-38

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc²	Texture	Remarks

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ○ No ◉

Remarks:

Because of surface water and only obl plants, pit not connected

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-C-39

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **% /** 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.058933 **Long.:** -95.299127 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ( ) No (●)	**Is the Sampled Area within a Wetland?**	Yes ( ) No (●)
Hydric Soil Present?	Yes ( ) No (●)		
Wetland Hydrology Present?	Yes ( ) No (●)		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (●)	Depth (inches):	
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (●)	Depth (inches):	

Wetland Hydrology Present? Yes ( ) No (●)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-39

Tree Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	20	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	

50% of Total Cover: 10 20% of Total Cover: 4 20 = Total Cover

Sapling or Sapling/Shrub Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Ligustrum sinense	20	☑	80.0%	FAC
2. Poncirus trifoliata	5	☑	20.0%	UPL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	

50% of Total Cover: 12.5 20% of Total Cover: 5 25 = Total Cover

Shrub Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Herb Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Helenium amarum	40	☑	47.1%	FACU
2. Solanum elaeagnifolium	35	☑	41.2%	UPL
3. Iva annua	10	☐	11.8%	FAC
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	

50% of Total Cover: 42.5 20% of Total Cover: 17 85 = Total Cover

Woody Vine Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 40.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	50	x 3 =	150
FACU species	40	x 4 =	160
UPL species	40	x 5 =	200
Column Totals:	130	(A)	510 (B)

Prevalence Index = B/A = 3.923

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☐ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-39

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	100						Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) (LRR P, T, U)
- [ ] 5 cm Mucky Mineral (A7) (LRR P, T, U)
- [ ] Muck Presence (A8) (LRR U)
- [ ] 1 cm Muck (A9) (LRR P, T)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Coast Prairie Redox (A16) (MLRA 150A)
- [ ] Sandy Muck Mineral (S1) (LRR O, S)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) (LRR P, S, T, U)
- [ ] Polyvalue Below Surface (S8) (LRR S, T, U)
- [ ] Thin Dark Surface (S9) (LRR S, T, U)
- [ ] Loamy Mucky Mineral (F1) (LRR O)
- [ ] Loamy Gleyed Matrix (F2)
- [ ] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) (LRR U)
- [ ] Depleted Ochric (F11) (MLRA 151)
- [ ] Iron-Manganese Masses (F12) (LRR O, P, T)
- [ ] Umbric Surface (F13) (LRR P, T, U)
- [ ] Delta Ochric (F17) (MLRA 151)
- [ ] Reduced Vertic (F18) (MLRA 150A, 150B)
- [ ] Piedmont Floodplain Soils (F19) (MLRA 149A)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) (LRR O)
- [ ] 2 cm Muck (A10) (LRR S)
- [ ] Reduced Vertic (F18) (outside MLRA 150A,B)
- [ ] Piedmont Floodplain Soils (F19) (LRR P, S, T)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-C-40**

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** concave **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.058864 **Long.:** -95.299085 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** PEM1C

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?** Yes (●) No ( )
Hydric Soil Present?	Yes (●) No ( )	
Wetland Hydrology Present?	Yes (●) No ( )	

Remarks:
Boundary agrees with NWI

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes (●) No ( )	Depth (inches):	
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (●)	Depth (inches):	

Wetland Hydrology Present? Yes (●) No ( )

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-40

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	80	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 40 20% of Total Cover: 16	80	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	40	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 20 20% of Total Cover: 8	40	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Juncus effusus	5	☑	100.0%	OBL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 2.5 20% of Total Cover: 1	5	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	5	x 1 =	5
FACW species	0	x 2 =	0
FAC species	120	x 3 =	360
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	125 (A)		365 (B)

Prevalence Index = B/A = 2.920

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-40

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	90	10YR	3/6	10	RM	PL		

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☑ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-C-41

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.059037 **Long.:** -95.300065 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** PSS1A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☑ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ◉ No ○	Depth (inches):	0

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-41

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	70	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 35 20% of Total Cover: 14	70	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	20	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 10 20% of Total Cover: 4	20	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Alternanthera philoxeroides	10	☑	33.3%	OBL
2. Persicaria hydropiperoides	10	☑	33.3%	OBL
3. Iva annua	10	☑	33.3%	FAC
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 15 20% of Total Cover: 6	30	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	20	x 1 =	20
FACW species	0	x 2 =	0
FAC species	100	x 3 =	300
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	120 (A)		320 (B)

Prevalence Index = B/A = 2.667

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-41

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	90	10YR	3/6	10	RM	PL	Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☑ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-C-42**

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** concave **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.05927 **Long.:** -95.300174 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** PEM1C

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☑ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?** Yes (●) No ( )
Hydric Soil Present?	Yes (●) No ( )	
Wetland Hydrology Present?	Yes (●) No ( )	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☑ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes (●) No ( )	Depth (inches): 3	
Water Table Present?	Yes ( ) No (●)	Depth (inches):	**Wetland Hydrology Present?** Yes (●) No ( )
Saturation Present? (includes capillary fringe)	Yes ( ) No (●)	Depth (inches):	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-42

Tree Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	10	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 5 — 20% of Total Cover: 2	10	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 — 20% of Total Cover: 0	0	= Total Cover		

Shrub Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 — 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Eleocharis quadrangulata	50	☑	41.7%	OBL
2. Juncus effusus	50	☑	41.7%	OBL
3. Alternanthera philoxeroides	10	☐	8.3%	OBL
4. Persicaria hydropiperoides	10	☐	8.3%	OBL
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 60 — 20% of Total Cover: 24	120	= Total Cover		

Woody Vine Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 — 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	120	x 1 =	120
FACW species	0	x 2 =	0
FAC species	10	x 3 =	30
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	130 (A)		150 (B)

Prevalence Index = B/A = 1.154

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-42

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	90	10YR	3/6	10	RM	PL	Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☑ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-C-43

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.058607 **Long.:** -95.300777 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** PSS1A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ○ No (●)	**Is the Sampled Area within a Wetland?**	Yes ○ No (●)
Hydric Soil Present?	Yes ○ No (●)		
Wetland Hydrology Present?	Yes ○ No (●)		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ○ No (●)	Depth (inches):	
Water Table Present?	Yes ○ No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○ No (●)	Depth (inches):	

Wetland Hydrology Present? Yes ○ No (●)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-43

Tree Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Triadica sebifera	10	☑	100.0%	FAC
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	
7.		0	☐	0.0%	
8.		0	☐	0.0%	

50% of Total Cover: 5 20% of Total Cover: 2 10 = Total Cover

Sapling or Sapling/Shrub Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Rosa bracteata	35	☑	100.0%	UPL
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	
7.		0	☐	0.0%	
8.		0	☐	0.0%	

50% of Total Cover: 17.5 20% of Total Cover: 7 35 = Total Cover

Shrub Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		0	☐	0.0%	
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Herb Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Cynodon dactylon	40	☑	72.7%	FACU
2.	Iva annua	15	☑	27.3%	FAC
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	
7.		0	☐	0.0%	
8.		0	☐	0.0%	
9.		0	☐	0.0%	
10.		0	☐	0.0%	
11.		0	☐	0.0%	
12.		0	☐	0.0%	

50% of Total Cover: 27.5 20% of Total Cover: 11 55 = Total Cover

Woody Vine Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		0	☐	0.0%	
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	25	x 3 =	75
FACU species	40	x 4 =	160
UPL species	35	x 5 =	175
Column Totals:	100 (A)		410 (B)

Prevalence Index = B/A = 4.100

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☐ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-43

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	4/2	100						Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-C-44**

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.060158 **Long.:** -95.299407 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** PSS1A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (•) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (•) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (•)	No ( )
Hydric Soil Present?	Yes (•)	No ( )
Wetland Hydrology Present?	Yes (•)	No ( )

Is the Sampled Area within a Wetland? Yes (•) No ( )

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☑ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( )	No (•)	Depth (inches):
Water Table Present?	Yes ( )	No (•)	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes (•)	No ( )	Depth (inches): 0

Wetland Hydrology Present? Yes (•) No ( )

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-44

Tree Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Triadica sebifera	70	☑	100.0%	FAC
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	
7.		0	☐	0.0%	
8.		0	☐	0.0%	

50% of Total Cover: 35 20% of Total Cover: 14 70 = Total Cover

Sapling or Sapling/Shrub Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Triadica sebifera	20	☑	100.0%	FAC
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	
7.		0	☐	0.0%	
8.		0	☐	0.0%	

50% of Total Cover: 10 20% of Total Cover: 4 20 = Total Cover

Shrub Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		0	☐	0.0%	
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Herb Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Alternanthera philoxeroides	10	☑	33.3%	OBL
2.	Persicaria hydropiperoides	10	☑	33.3%	OBL
3.	Iva annua	10	☑	33.3%	FAC
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	
7.		0	☐	0.0%	
8.		0	☐	0.0%	
9.		0	☐	0.0%	
10.		0	☐	0.0%	
11.		0	☐	0.0%	
12.		0	☐	0.0%	

50% of Total Cover: 15 20% of Total Cover: 6 30 = Total Cover

Woody Vine Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		0	☐	0.0%	
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	20	x 1 =	20
FACW species	0	x 2 =	0
FAC species	100	x 3 =	300
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	120 (A)		320 (B)

Prevalence Index = B/A = 2.667

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-44

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	90	10YR	3/6	10	RM	PL	Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) (LRR P, T, U)
- [ ] 5 cm Mucky Mineral (A7) (LRR P, T, U)
- [ ] Muck Presence (A8) (LRR U)
- [ ] 1 cm Muck (A9) (LRR P, T)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [x] Coast Prairie Redox (A16) (MLRA 150A)
- [ ] Sandy Muck Mineral (S1) (LRR O, S)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) (LRR P, S, T, U)
- [ ] Polyvalue Below Surface (S8) (LRR S, T, U)
- [ ] Thin Dark Surface (S9) (LRR S, T, U)
- [ ] Loamy Mucky Mineral (F1) (LRR O)
- [ ] Loamy Gleyed Matrix (F2)
- [ ] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) (LRR U)
- [ ] Depleted Ochric (F11) (MLRA 151)
- [ ] Iron-Manganese Masses (F12) (LRR O, P, T)
- [ ] Umbric Surface (F13) (LRR P, T, U)
- [ ] Delta Ochric (F17) (MLRA 151)
- [ ] Reduced Vertic (F18) (MLRA 150A, 150B)
- [ ] Piedmont Floodplain Soils (F19) (MLRA 149A)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) (LRR O)
- [ ] 2 cm Muck (A10) (LRR S)
- [ ] Reduced Vertic (F18) (outside MLRA 150A,B)
- [ ] Piedmont Floodplain Soils (F19) (LRR P, S, T)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes (●) No ( )

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-C-45**

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.060043 **Long.:** -95.299137 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** PSS1A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ( ) No (●)	**Is the Sampled Area within a Wetland?** Yes ( ) No (●)
Hydric Soil Present?	Yes ( ) No (●)	
Wetland Hydrology Present?	Yes ( ) No (●)	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (●)	Depth (inches):	
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (●)	Depth (inches):	

Wetland Hydrology Present? Yes ( ) No (●)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-45

Tree Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Triadica sebifera	20	✔	100.0%	FAC
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	
7.		0	☐	0.0%	
8.		0	☐	0.0%	

50% of Total Cover: 10 20% of Total Cover: 4 20 = Total Cover

Sapling or Sapling/Shrub Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Ligustrum sinense	20	✔	80.0%	FAC
2.	Poncirus trifoliata	5	✔	20.0%	UPL
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	
7.		0	☐	0.0%	
8.		0	☐	0.0%	

50% of Total Cover: 12.5 20% of Total Cover: 5 25 = Total Cover

Shrub Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		0	☐	0.0%	
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Herb Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Helenium amarum	40	✔	47.1%	FACU
2.	Solanum elaeagnifolium	35	✔	41.2%	UPL
3.	Iva annua	10	☐	11.8%	FAC
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	
7.		0	☐	0.0%	
8.		0	☐	0.0%	
9.		0	☐	0.0%	
10.		0	☐	0.0%	
11.		0	☐	0.0%	
12.		0	☐	0.0%	

50% of Total Cover: 42.5 20% of Total Cover: 17 85 = Total Cover

Woody Vine Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		0	☐	0.0%	
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 40.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	50	x 3 =	150
FACU species	40	x 4 =	160
UPL species	40	x 5 =	200
Column Totals:	130 (A)		510 (B)

Prevalence Index = B/A = 3.923

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☐ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-45

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-20	10YR	3/1	100						Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-C-46**

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.058867 **Long.:** -95.312999 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** PEM1C

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ○ No ◉
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ○ No ◉	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○ No ◉	Depth (inches):	

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-46

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	30	☑	50.0%	FAC
2. Celtis occidentalis	30	☑	50.0%	FACU
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 30 20% of Total Cover: 12	60	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rosa bracteata	20	☑	57.1%	UPL
2. Ligustrum sinense	15	☑	42.9%	FAC
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 17.5 20% of Total Cover: 7	35	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Paspalum notatum	20	☑	30.8%	FACU
2. Stenotaphrum secundatum	30	☑	46.2%	FAC
3. Cyperus entrerianus	5	☐	7.7%	FACW
4. Senna obtusifolia	5	☐	7.7%	FACU
5. Carex cherokeensis	5	☐	7.7%	FACW
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 32.5 20% of Total Cover: 13	65	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Ampelopsis arborea	5	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 2.5 20% of Total Cover: 1	5	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 57.1% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	10	x 2 =	20
FAC species	80	x 3 =	240
FACU species	55	x 4 =	220
UPL species	20	x 5 =	100
Column Totals:	165 (A)		580 (B)

Prevalence Index = B/A = 3.515

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-46

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/2	98	10YR	3/6	20	C	PL	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☑ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-C-47**

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** concave **Slope:** 0.0 **%** / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.058817 **Long.:** -95.312838 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** PEM1C

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?** Yes (●) No ( )
Hydric Soil Present?	Yes (●) No ( )	
Wetland Hydrology Present?	Yes (●) No ( )	

Remarks:
Boundary agrees with NWI

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes (●) No ( )	Depth (inches):	
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (●)	Depth (inches):	

Wetland Hydrology Present? Yes (●) No ( )

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-47

Tree Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	80	✓	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 40 20% of Total Cover: 16	80	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	40	✓	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 20 20% of Total Cover: 8	40	= Total Cover		

Shrub Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Sagittaria graminea	10	✓	33.3%	OBL
2. Alternanthera philoxeroides	5	☐	16.7%	OBL
3. Persicaria hydropiperoides	5	☐	16.7%	OBL
4. Eleocharis quadrangulata	10	✓	33.3%	OBL
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 15 20% of Total Cover: 6	30	= Total Cover		

Woody Vine Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	4	(A)
Total Number of Dominant Species Across All Strata:	4	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	30	x 1 =	30	
FACW species	0	x 2 =	0	
FAC species	120	x 3 =	360	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	150	(A)	390	(B)

Prevalence Index = B/A = 2.600

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-47

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-20	10YR	3/1	90	10YR	3/6	10	RM	PL	Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) (LRR P, T, U)
- [ ] 5 cm Mucky Mineral (A7) (LRR P, T, U)
- [ ] Muck Presence (A8) (LRR U)
- [ ] 1 cm Muck (A9) (LRR P, T)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [x] Coast Prairie Redox (A16) (MLRA 150A)
- [ ] Sandy Muck Mineral (S1) (LRR O, S)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) (LRR P, S, T, U)
- [ ] Polyvalue Below Surface (S8) (LRR S, T, U)
- [ ] Thin Dark Surface (S9) (LRR S, T, U)
- [ ] Loamy Mucky Mineral (F1) (LRR O)
- [ ] Loamy Gleyed Matrix (F2)
- [ ] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) (LRR U)
- [ ] Depleted Ochric (F11) (MLRA 151)
- [ ] Iron-Manganese Masses (F12) (LRR O, P, T)
- [ ] Umbric Surface (F13) (LRR P, T, U)
- [ ] Delta Ochric (F17) (MLRA 151)
- [ ] Reduced Vertic (F18) (MLRA 150A, 150B)
- [ ] Piedmont Floodplain Soils (F19) (MLRA 149A)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) (LRR O)
- [ ] 2 cm Muck (A10) (LRR S)
- [ ] Reduced Vertic (F18) (outside MLRA 150A,B)
- [ ] Piedmont Floodplain Soils (F19) (LRR P, S, T)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes (●) No ( )

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-C-48**

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range:** **S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** concave **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.058779 **Long.:** -95.31279 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** PEM1C

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (•) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (•) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☑ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (•) No ( )	**Is the Sampled Area within a Wetland?** Yes (•) No ( )
Hydric Soil Present?	Yes (•) No ( )	
Wetland Hydrology Present?	Yes (•) No ( )	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☑ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes (•) No ( )	Depth (inches):	3
Water Table Present?	Yes ( ) No (•)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (•)	Depth (inches):	

Wetland Hydrology Present? Yes (•) No ( )

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-48

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	10	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 5 20% of Total Cover: 2	10	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Eleocharis quadrangulata	50	☑	45.5%	OBL
2. Juncus effusus	50	☑	45.5%	OBL
3. Alternanthera philoxeroides	10	☐	9.1%	OBL
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 55 20% of Total Cover: 22	110	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	3	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	110	x 1 =	110
FACW species	0	x 2 =	0
FAC species	10	x 3 =	30
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	120 (A)		140 (B)

Prevalence Index = B/A = 1.167

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-48

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-20	10YR	3/1	90	10YR	3/6	10	RM	PL	Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☑ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-C-49**

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.058691 **Long.:** -95.310254 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ◉ No ○		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○ No ◉	Depth (inches):	

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-49

Tree Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Triadica sebifera	30	✔	50.0%	FAC
2.	Celtis occidentalis	30	✔	50.0%	FACU
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	
7.		0	☐	0.0%	
8.		0	☐	0.0%	

50% of Total Cover: 30 20% of Total Cover: 12 60 **= Total Cover**

Sapling or Sapling/Shrub Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Rosa bracteata	20	✔	57.1%	UPL
2.	Ligustrum sinense	15	✔	42.9%	FAC
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	
7.		0	☐	0.0%	
8.		0	☐	0.0%	

50% of Total Cover: 17.5 20% of Total Cover: 7 35 **= Total Cover**

Shrub Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		0	☐	0.0%	
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 **= Total Cover**

Herb Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Paspalum notatum	20	✔	30.8%	FACU
2.	Stenotaphrum secundatum	30	✔	46.2%	FAC
3.	Cyperus entrerianus	5	☐	7.7%	FACW
4.	Senna obtusifolia	5	☐	7.7%	FACU
5.	Carex cherokeensis	5	☐	7.7%	FACW
6.		0	☐	0.0%	
7.		0	☐	0.0%	
8.		0	☐	0.0%	
9.		0	☐	0.0%	
10.		0	☐	0.0%	
11.		0	☐	0.0%	
12.		0	☐	0.0%	

50% of Total Cover: 32.5 20% of Total Cover: 13 65 **= Total Cover**

Woody Vine Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Ampelopsis arborea	5	✔	100.0%	FAC
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	

50% of Total Cover: 2.5 20% of Total Cover: 1 5 **= Total Cover**

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 57.1% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	10	x 2 =	20
FAC species	80	x 3 =	240
FACU species	55	x 4 =	220
UPL species	20	x 5 =	100
Column Totals:	165 (A)		580 (B)

Prevalence Index = B/A = 3.515

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-49

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/2	98	10YR	3/6	20	C	PL	Sandy Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☑ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-C-50

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range:** S T R

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** concave **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.058408 **Long.:** -95.309961 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** PEM1C

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☑ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☑ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ◉ No ○	Depth (inches): 3	**Wetland Hydrology Present?** Yes ◉ No ○
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○ No ◉	Depth (inches):	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-50

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	25	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 12.5 20% of Total Cover: 5	25	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Eleocharis quadrangulata	50	☑	40.0%	OBL
2. Juncus effusus	50	☑	40.0%	OBL
3. Alternanthera philoxeroides	10	☐	8.0%	OBL
4. Persicaria hydropiperoides	10	☐	8.0%	OBL
5. Sagittaria graminea	5	☐	4.0%	OBL
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 62.5 20% of Total Cover: 25	125	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	125	x 1 =	125	
FACW species	0	x 2 =	0	
FAC species	25	x 3 =	75	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	150	(A)	200	(B)

Prevalence Index = B/A = 1.333

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-50

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	90	10YR	3/6	10	RM	PL	Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☑ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-C-51**

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.058618 **Long.:** -95.309771 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?** Yes ○ No ◉
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ○ No ◉	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ○ No ◉	Depth (inches):	
Water Table Present?	Yes ○ No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○ No ◉	Depth (inches):	

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-51

Tree Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	30	✔	50.0%	FAC
2. Celtis occidentalis	30	✔	50.0%	FACU
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	

50% of Total Cover: 30 20% of Total Cover: 12 60 = Total Cover

Sapling or Sapling/Shrub Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rosa bracteata	20	✔	57.1%	UPL
2. Ligustrum sinense	15	✔	42.9%	FAC
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	

50% of Total Cover: 17.5 20% of Total Cover: 7 35 = Total Cover

Shrub Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Herb Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Paspalum notatum	20	✔	30.8%	FACU
2. Stenotaphrum secundatum	30	✔	46.2%	FAC
3. Cyperus entrerianus	5	☐	7.7%	FACW
4. Senna obtusifolia	5	☐	7.7%	FACU
5. Carex cherokeensis	5	☐	7.7%	FACW
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	

50% of Total Cover: 32.5 20% of Total Cover: 13 65 = Total Cover

Woody Vine Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Ampelopsis arborea	5	✔	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	

50% of Total Cover: 2.5 20% of Total Cover: 1 5 = Total Cover

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 57.1% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	10	x 2 =	20
FAC species	80	x 3 =	240
FACU species	55	x 4 =	220
UPL species	20	x 5 =	100
Column Totals:	165 (A)		580 (B)

Prevalence Index = B/A = 3.515

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-51

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/2	98	10YR	3/6	20	C	PL	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) (LRR P, T, U)
- [ ] 5 cm Mucky Mineral (A7) (LRR P, T, U)
- [ ] Muck Presence (A8) (LRR U)
- [ ] 1 cm Muck (A9) (LRR P, T)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [x] Coast Prairie Redox (A16) (MLRA 150A)
- [ ] Sandy Muck Mineral (S1) (LRR O, S)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) (LRR P, S, T, U)
- [ ] Polyvalue Below Surface (S8) (LRR S, T, U)
- [ ] Thin Dark Surface (S9) (LRR S, T, U)
- [ ] Loamy Mucky Mineral (F1) (LRR O)
- [ ] Loamy Gleyed Matrix (F2)
- [ ] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) (LRR U)
- [ ] Depleted Ochric (F11) (MLRA 151)
- [ ] Iron-Manganese Masses (F12) (LRR O, P, T)
- [ ] Umbric Surface (F13) (LRR P, T, U)
- [ ] Delta Ochric (F17) (MLRA 151)
- [ ] Reduced Vertic (F18) (MLRA 150A, 150B)
- [ ] Piedmont Floodplain Soils (F19) (MLRA 149A)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) (LRR O)
- [ ] 2 cm Muck (A10) (LRR S)
- [ ] Reduced Vertic (F18) (outside MLRA 150A,B)
- [ ] Piedmont Floodplain Soils (F19) (LRR P, S, T)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes (●) No ( )

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-C-52

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** concave **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.058653 **Long.:** -95.309627 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ○	**Is the Sampled Area within a Wetland?** Yes (●) No ○
Hydric Soil Present?	Yes (●) No ○	
Wetland Hydrology Present?	Yes (●) No ○	

Remarks:
Boundary agrees with NWI

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes (●) No ○	Depth (inches):	
Water Table Present?	Yes ○ No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○ No (●)	Depth (inches):	

Wetland Hydrology Present? Yes (●) No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-52

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species? Rel.Strat. Cover		Indicator Status
1. Triadica sebifera	80	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 40 20% of Total Cover: 16	80	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size: ______)				
1. Triadica sebifera	40	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 20 20% of Total Cover: 8	40	= Total Cover		

Shrub Stratum (Plot size: ______)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size: ______)				
1. Sagittaria graminea	10	☑	33.3%	OBL
2. Alternanthera philoxeroides	5	☐	16.7%	OBL
3. Persicaria hydropiperoides	5	☐	16.7%	OBL
4. Eleocharis quadrangulata	10	☑	33.3%	OBL
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 15 20% of Total Cover: 6	30	= Total Cover		

Woody Vine Stratum (Plot size: ______)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	30	x 1 =	30
FACW species	0	x 2 =	0
FAC species	120	x 3 =	360
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	150 (A)		390 (B)

Prevalence Index = B/A = 2.600

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-52

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	90	10YR	3/6	10	RM	PL	Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☑ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-C-53

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range:** S T R

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** concave **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.058797 **Long.:** -95.309437 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** PEM1C

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (•) No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (•) No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☑ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (•) No ○	**Is the Sampled Area within a Wetland?** Yes (•) No ○
Hydric Soil Present?	Yes (•) No ○	
Wetland Hydrology Present?	Yes (•) No ○	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☑ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes (•) No ○	Depth (inches):	
Water Table Present?	Yes ○ No (•)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○ No (•)	Depth (inches):	

Wetland Hydrology Present? Yes (•) No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-53

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	25	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 12.5 20% of Total Cover: 5	25	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Eleocharis quadrangulata	50	☑	40.0%	OBL
2. Juncus effusus	50	☑	40.0%	OBL
3. Alternanthera philoxeroides	10	☐	8.0%	OBL
4. Persicaria hydropiperoides	10	☐	8.0%	OBL
5. Sagittaria graminea	5	☐	4.0%	OBL
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 62.5 20% of Total Cover: 25	125	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	125	x 1 =	125
FACW species	0	x 2 =	0
FAC species	25	x 3 =	75
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	150 (A)		200 (B)

Prevalence Index = B/A = 1.333

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-53

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	90	10YR	3/6	10	RM	PL	Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☑ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ◉ No ○

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-C-54

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range:** S T R

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.058586 **Long.:** -95.322132 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ○	**Is the Sampled Area within a Wetland?**	Yes ○ No (●)
Hydric Soil Present?	Yes ○ No (●)		
Wetland Hydrology Present?	Yes ○ No (●)		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ○ No (●)	Depth (inches):	
Water Table Present?	Yes ○ No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○ No (●)	Depth (inches):	

Wetland Hydrology Present? Yes ○ No (●)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-54

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species? Rel.Strat. Cover		Indicator Status
1. Triadica sebifera	30	☑	50.0%	FAC
2. Celtis occidentalis	30	☑	50.0%	FACU
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 30 20% of Total Cover: 12	60	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rosa bracteata	20	☑	57.1%	UPL
2. Ligustrum sinense	15	☑	42.9%	FAC
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 17.5 20% of Total Cover: 7	35	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Toxicodendron radicans	10	☑	50.0%	FAC
2. Rubus trivialis	10	☑	50.0%	FACU
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 10 20% of Total Cover: 4	20	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Ampelopsis arborea	5	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 2.5 20% of Total Cover: 1	5	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 57.1% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	60	x 3 =	180
FACU species	40	x 4 =	160
UPL species	20	x 5 =	100
Column Totals:	120 (A)		440 (B)

Prevalence Index = B/A = 3.667

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-54

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	4/2	100				C	PL	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-C-56

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range:** S T R

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.050366 **Long.:** -95.31733 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ○ No ◉ Hydric Soil Present? Yes ○ No ◉ Wetland Hydrology Present? Yes ○ No ◉	**Is the Sampled Area within a Wetland?** Yes ○ No ◉

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches):	
Water Table Present?	Yes ○	No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches):	

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-56

Tree Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Sapling or Sapling/Shrub Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rosa bracteata	20	☑	100.0%	UPL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	

50% of Total Cover: 10 20% of Total Cover: 4 20 = Total Cover

Shrub Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Herb Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Iva annua	50	☑	55.6%	FAC
2. Sporobolus indicus	40	☑	44.4%	FACU
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	

50% of Total Cover: 45 20% of Total Cover: 18 90 = Total Cover

Woody Vine Stratum (Plot size:)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 33.3% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	50	x 3 =	150
FACU species	40	x 4 =	160
UPL species	20	x 5 =	100
Column Totals:	110 (A)		410 (B)

Prevalence Index = B/A = 3.727

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☐ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-56

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-20	10YR	4/2	100						Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-C-57**

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** concave **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.051164 **Long.:** -95.315024 **Datum:** WGS 1983

Soil Map Unit Name: 38 - Churnabog clay, 0 to1 percent slopes, frequently flooded **NWI classification:** PEM1C

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation [ ] **, Soil** [ ] **, or Hydrology** [ ] **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation [ ] **, Soil** [ ] **, or Hydrology** [x] **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?** Yes (●) No ( )
Hydric Soil Present?	Yes (●) No ( )	
Wetland Hydrology Present?	Yes (●) No ( )	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- [x] Surface Water (A1)
- [ ] High Water Table (A2)
- [ ] Saturation (A3)
- [ ] Water Marks (B1)
- [ ] Sediment Deposits (B2)
- [ ] Drift Deposits (B3)
- [ ] Algal Mat or Crust (B4)
- [ ] Iron Deposits (B5)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [ ] Water-Stained Leaves (B9)
- [ ] Aquatic Fauna (B13)
- [ ] Marl Deposits (B15) (LRR U)
- [ ] Hydrogen Sulfide Odor (C1)
- [x] Oxidized Rhizospheres along Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Recent Iron Reduction in Tilled Soils (C6)
- [ ] Thin Muck Surface (C7)
- [ ] Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- [ ] Surface Soil Cracks (B6)
- [ ] Sparsely Vegetated Concave Surface (B8)
- [ ] Drainage Patterns (B10)
- [ ] Moss Trim Lines (B16)
- [ ] Dry Season Water Table (C2)
- [ ] Crayfish Burrows (C8)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [ ] Geomorphic Position (D2)
- [ ] Shallow Aquitard (D3)
- [x] FAC-Neutral Test (D5)
- [ ] Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes (●) No ( )	Depth (inches):	
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (●)	Depth (inches):	

Wetland Hydrology Present? Yes (●) No ( )

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-57

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	15	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 7.5 20% of Total Cover: 3	15	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Sesbania drummondii	20	☑	100.0%	FACW
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 10 20% of Total Cover: 4	20	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Eleocharis quadrangulata	50	☑	43.5%	OBL
2. Juncus effusus	50	☑	43.5%	OBL
3. Alternanthera philoxeroides	10	☐	8.7%	OBL
4. Sagittaria graminea	5	☐	4.3%	OBL
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 57.5 20% of Total Cover: 23	115	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC:	4	(A)
Total Number of Dominant Species Across All Strata:	4	(B)
Percent of dominant Species That Are OBL, FACW, or FAC:	100.0%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	115	x 1 =	115	
FACW species	20	x 2 =	40	
FAC species	15	x 3 =	45	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	150	(A)	200	(B)

Prevalence Index = B/A = 1.333

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-57

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	90	10YR	3/6	10	RM	PL	Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) (LRR P, T, U)
- [ ] 5 cm Mucky Mineral (A7) (LRR P, T, U)
- [ ] Muck Presence (A8) (LRR U)
- [ ] 1 cm Muck (A9) (LRR P, T)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [x] Coast Prairie Redox (A16) (MLRA 150A)
- [ ] Sandy Muck Mineral (S1) (LRR O, S)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) (LRR P, S, T, U)
- [ ] Polyvalue Below Surface (S8) (LRR S, T, U)
- [ ] Thin Dark Surface (S9) (LRR S, T, U)
- [ ] Loamy Mucky Mineral (F1) (LRR O)
- [ ] Loamy Gleyed Matrix (F2)
- [ ] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) (LRR U)
- [ ] Depleted Ochric (F11) (MLRA 151)
- [ ] Iron-Manganese Masses (F12) (LRR O, P, T)
- [ ] Umbric Surface (F13) (LRR P, T, U)
- [ ] Delta Ochric (F17) (MLRA 151)
- [ ] Reduced Vertic (F18) (MLRA 150A, 150B)
- [ ] Piedmont Floodplain Soils (F19) (MLRA 149A)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) (LRR O)
- [ ] 2 cm Muck (A10) (LRR S)
- [ ] Reduced Vertic (F18) (outside MLRA 150A,B)
- [ ] Piedmont Floodplain Soils (F19) (LRR P, S, T)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes (●) No ( )

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-C-58

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range:** S T R

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.051164 **Long.:** -95.315024 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ( ) No (●)	**Is the Sampled Area within a Wetland?** Yes ( ) No (●)
Hydric Soil Present?	Yes ( ) No (●)	
Wetland Hydrology Present?	Yes ( ) No (●)	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (●)	Depth (inches):	
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (●)	Depth (inches):	

Wetland Hydrology Present? Yes ( ) No (●)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-58

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Celtis occidentalis	70	☑	100.0%	FACU
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 35 20% of Total Cover: 14	70	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Ligustrum sinense	30	☑	60.0%	FAC
2. Poncirus trifoliata	20	☑	40.0%	UPL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 25 20% of Total Cover: 10	50	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Rubus trivialis	10	☑	100.0%	FACU
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 5 20% of Total Cover: 2	10	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 25.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	30	x 3 =	90
FACU species	80	x 4 =	320
UPL species	20	x 5 =	100
Column Totals:	130 (A)		510 (B)

Prevalence Index = B/A = 3.923

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☐ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-58

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-20	10YR	3/1	100							

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-C-59

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range:** S T R

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** concave **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.054023 **Long.:** -95.326251 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes (●) No ( )	**Is the Sampled Area within a Wetland?** Yes (●) No ( )	
Hydric Soil Present? Yes (●) No ( )		
Wetland Hydrology Present? Yes (●) No ( )		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes (●) No ( )	Depth (inches):	6
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (●)	Depth (inches):	

Wetland Hydrology Present? Yes (●) No ( )

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-59

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	30	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 15 20% of Total Cover: 6	30	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Zizaniopsis miliacea	70	☑	100.0%	OBL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 35 20% of Total Cover: 14	70	= Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	70	x 1 =	70
FACW species	0	x 2 =	0
FAC species	30	x 3 =	90
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	100 (A)		160 (B)

Prevalence Index = B/A = 1.600

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-59

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	4/1	80	10YR	3/6	20	C	M	Silty Clay Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) (LRR P, T, U)
- [ ] 5 cm Mucky Mineral (A7) (LRR P, T, U)
- [ ] Muck Presence (A8) (LRR U)
- [ ] 1 cm Muck (A9) (LRR P, T)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Coast Prairie Redox (A16) (MLRA 150A)
- [ ] Sandy Muck Mineral (S1) (LRR O, S)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) (LRR P, S, T, U)
- [ ] Polyvalue Below Surface (S8) (LRR S, T, U)
- [ ] Thin Dark Surface (S9) (LRR S, T, U)
- [ ] Loamy Mucky Mineral (F1) (LRR O)
- [ ] Loamy Gleyed Matrix (F2)
- [x] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) (LRR U)
- [ ] Depleted Ochric (F11) (MLRA 151)
- [ ] Iron-Manganese Masses (F12) (LRR O, P, T)
- [ ] Umbric Surface (F13) (LRR P, T, U)
- [ ] Delta Ochric (F17) (MLRA 151)
- [ ] Reduced Vertic (F18) (MLRA 150A, 150B)
- [ ] Piedmont Floodplain Soils (F19) (MLRA 149A)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) (LRR O)
- [ ] 2 cm Muck (A10) (LRR S)
- [ ] Reduced Vertic (F18) (outside MLRA 150A,B)
- [ ] Piedmont Floodplain Soils (F19) (LRR P, S, T)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes (●) No ( )

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** **DP-C-60**

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 **%** / 0.0 **°**

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.053435 **Long.:** -95.325859 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (•) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (•) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ( )	No (•)	**Is the Sampled Area within a Wetland?** Yes ( ) No (•)
Hydric Soil Present?	Yes ( )	No (•)	
Wetland Hydrology Present?	Yes ( )	No (•)	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( )	No (•)	Depth (inches):
Water Table Present?	Yes ( )	No (•)	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ( )	No (•)	Depth (inches):

Wetland Hydrology Present? Yes ( ) No (•)

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-60

Tree Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Celtis occidentalis	70	☑	100.0%	FACU
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	
7.		0	☐	0.0%	
8.		0	☐	0.0%	

50% of Total Cover: 35 20% of Total Cover: 14 70 = Total Cover

Sapling or Sapling/Shrub Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Ligustrum sinense	30	☑	60.0%	FAC
2.	Poncirus trifoliata	20	☑	40.0%	UPL
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	
7.		0	☐	0.0%	
8.		0	☐	0.0%	

50% of Total Cover: 25 20% of Total Cover: 10 50 = Total Cover

Shrub Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		0	☐	0.0%	
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Herb Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		0	☐	0.0%	
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	
7.		0	☐	0.0%	
8.		0	☐	0.0%	
9.		0	☐	0.0%	
10.		0	☐	0.0%	
11.		0	☐	0.0%	
12.		0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Woody Vine Stratum (Plot size: ______)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Rubus trivialis	10	☑	100.0%	FACU
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	

50% of Total Cover: 5 20% of Total Cover: 2 10 = Total Cover

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 25.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	30	x 3 =	90
FACU species	80	x 4 =	320
UPL species	20	x 5 =	100
Column Totals:	130 (A)		510 (B)

Prevalence Index = B/A = 3.923

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☐ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0 [1]**
- ☐ **Problematic Hydrophytic Vegetation [1] (Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-60

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	100							

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-C-61

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range: S** ___ **T** ___ **R** ___

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.056187 **Long.:** -95.321312 **Datum:** WGS 1983

Soil Map Unit Name: 39 - Surfside clay, 0 to 1 percent slopes, occasionally flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●) No ( )	**Is the Sampled Area within a Wetland?** Yes ( ) No (●)
Hydric Soil Present?	Yes ( ) No (●)	
Wetland Hydrology Present?	Yes (●) No ( )	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☑ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (●)	Depth (inches):	
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ( ) No (●)	Depth (inches):	

Wetland Hydrology Present? Yes (●) No ( )

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-61

Tree Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Triadica sebifera	20	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 10 20% of Total Cover: 4	20	= Total Cover		

Sapling or Sapling/Shrub Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Shrub Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Herb Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Iva annua	35	☑	38.9%	FAC
2. Cynodon dactylon	50	☑	55.6%	FACU
3. Cyperus entrerianus	5	☐	5.6%	FACW
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
50% of Total Cover: 45 20% of Total Cover: 18	90	= Total Cover		

Woody Vine Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
50% of Total Cover: 0 20% of Total Cover: 0	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 66.7% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	5	x 2 =	10
FAC species	55	x 3 =	165
FACU species	50	x 4 =	200
UPL species	0	x 5 =	0
Column Totals:	110 (A)		375 (B)

Prevalence Index = B/A = 3.409

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-61

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	100							

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains   [2]Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-C-62

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range:** S T R

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.055471 **Long.:** -95.317568 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ○ No (●)	**Is the Sampled Area within a Wetland?** Yes ○ No (●)
Hydric Soil Present?	Yes ○ No (●)	
Wetland Hydrology Present?	Yes (●) No ○	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☑ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ○ No (●)	Depth (inches):	
Water Table Present?	Yes ○ No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○ No (●)	Depth (inches):	

Wetland Hydrology Present? Yes (●) No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-62

Tree Stratum (Plot size:)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		0	☐	0.0%	
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	
7.		0	☐	0.0%	
8.		0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Sapling or Sapling/Shrub Stratum (Plot size:)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Rosa bracteata	15	☑	100.0%	UPL
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	
7.		0	☐	0.0%	
8.		0	☐	0.0%	

50% of Total Cover: 7.5 20% of Total Cover: 3 15 = Total Cover

Shrub Stratum (Plot size:)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		0	☐	0.0%	
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	
6.		0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Herb Stratum (Plot size:)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	Iva annua	35	☑	36.8%	FAC
2.	Cynodon dactylon	50	☑	52.6%	FACU
3.	Cyperus entrerianus	5	☐	5.3%	FACW
4.	Conoclinium coelestinum	5	☐	5.3%	FAC
5.		0	☐	0.0%	
6.		0	☐	0.0%	
7.		0	☐	0.0%	
8.		0	☐	0.0%	
9.		0	☐	0.0%	
10.		0	☐	0.0%	
11.		0	☐	0.0%	
12.		0	☐	0.0%	

50% of Total Cover: 47.5 20% of Total Cover: 19 95 = Total Cover

Woody Vine Stratum (Plot size:)

	Species	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.		0	☐	0.0%	
2.		0	☐	0.0%	
3.		0	☐	0.0%	
4.		0	☐	0.0%	
5.		0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 33.3% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	5	x 2 =	10
FAC species	40	x 3 =	120
FACU species	50	x 4 =	200
UPL species	15	x 5 =	75
Column Totals:	110 (A)		405 (B)

Prevalence Index = B/A = 3.682

Hydrophytic Vegetation Indicators:

- ☐ **1 - Rapid Test for Hydrophytic Vegetation**
- ☐ **2 - Dominance Test is > 50%**
- ☐ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-62

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Color (moist)		Redox %	Type[1]	Loc[2]	Texture	Remarks
0-20	10YR	3/1	100							

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2] Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) (LRR P, T, U)
- ☐ 5 cm Mucky Mineral (A7) (LRR P, T, U)
- ☐ Muck Presence (A8) (LRR U)
- ☐ 1 cm Muck (A9) (LRR P, T)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) (MLRA 150A)
- ☐ Sandy Muck Mineral (S1) (LRR O, S)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) (LRR P, S, T, U)
- ☐ Polyvalue Below Surface (S8) (LRR S, T, U)
- ☐ Thin Dark Surface (S9) (LRR S, T, U)
- ☐ Loamy Mucky Mineral (F1) (LRR O)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) (LRR U)
- ☐ Depleted Ochric (F11) (MLRA 151)
- ☐ Iron-Manganese Masses (F12) (LRR O, P, T)
- ☐ Umbric Surface (F13) (LRR P, T, U)
- ☐ Delta Ochric (F17) (MLRA 151)
- ☐ Reduced Vertic (F18) (MLRA 150A, 150B)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 149A)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) (LRR O)
- ☐ 2 cm Muck (A10) (LRR S)
- ☐ Reduced Vertic (F18) (outside MLRA 150A,B)
- ☐ Piedmont Floodplain Soils (F19) (LRR P, S, T)
- ☐ Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: Big Slough PMA-13 Mitigation Bank **City/County:** Brazoria County, Texas **Sampling Date:** 07-Oct-19

Applicant/Owner: DOW Chemical Company **State:** TX **Sampling Point:** DP-C-63

Investigator(s): F. Lewis; S. Waltman **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Plain **Local relief (concave, convex, none):** none **Slope:** 0.0 % / 0.0 °

Subregion (LRR or MLRA): MLRA 257 in LRR T **Lat.:** 29.055557 **Long.:** -95.31755 **Datum:** WGS 1983

Soil Map Unit Name: 2 - Asa silt loam, 0 to 1 percent slopes, rarely flooded **NWI classification:** N/A

Are climatic/hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes (●) No ( )

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes (●) No ( ) Hydric Soil Present? Yes (●) No ( ) Wetland Hydrology Present? Yes (●) No ( )	**Is the Sampled Area within a Wetland?** Yes (●) No ( )
Remarks:	

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) (LRR U)
- ☐ Hydrogen Sulfide Odor (C1)
- ☑ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of 2 required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) (LRR T, U)

Field Observations:

Surface Water Present?	Yes ( ) No (●)	Depth (inches):	
Water Table Present?	Yes ( ) No (●)	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes (●) No ( )	Depth (inches):	0

Wetland Hydrology Present? Yes (●) No ( )

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata) - Use scientific names of plants.

Sampling Point: DP-C-63

Tree Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Sapling or Sapling/Shrub Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Shrub Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Herb Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Alternanthera philoxeroides	5	☐	6.7%	OBL
2. Eleocharis montevidensis	70	☑	93.3%	FACW
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	

50% of Total Cover: 37.5 20% of Total Cover: 15 75 = Total Cover

Woody Vine Stratum (Plot size: ______)

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	

50% of Total Cover: 0 20% of Total Cover: 0 0 = Total Cover

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	5	x 1 =	5
FACW species	70	x 2 =	140
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	75	(A)	145 (B)

Prevalence Index = B/A = 1.933

Hydrophytic Vegetation Indicators:

- ☑ **1 - Rapid Test for Hydrophytic Vegetation**
- ☑ **2 - Dominance Test is > 50%**
- ☑ **3 - Prevalence Index is ≤3.0** [1]
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1m) tall.

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb - All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine - All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (If observed, list morphological adaptations below).

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

SOIL

Sampling Point: DP-C-63

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		Matrix %	Redox Features Color (moist)		Redox %	Type[1]	Loc²	Texture	Remarks
0-20	10YR	3/1	98	10YR	3/6	20	C	PL	Clay	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) (LRR P, T, U)
- [ ] 5 cm Mucky Mineral (A7) (LRR P, T, U)
- [ ] Muck Presence (A8) (LRR U)
- [ ] 1 cm Muck (A9) (LRR P, T)
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [x] Coast Prairie Redox (A16) (MLRA 150A)
- [ ] Sandy Muck Mineral (S1) (LRR O, S)
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) (LRR P, S, T, U)
- [ ] Polyvalue Below Surface (S8) (LRR S, T, U)
- [ ] Thin Dark Surface (S9) (LRR S, T, U)
- [ ] Loamy Mucky Mineral (F1) (LRR O)
- [ ] Loamy Gleyed Matrix (F2)
- [ ] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) (LRR U)
- [ ] Depleted Ochric (F11) (MLRA 151)
- [ ] Iron-Manganese Masses (F12) (LRR O, P, T)
- [ ] Umbric Surface (F13) (LRR P, T, U)
- [ ] Delta Ochric (F17) (MLRA 151)
- [ ] Reduced Vertic (F18) (MLRA 150A, 150B)
- [ ] Piedmont Floodplain Soils (F19) (MLRA 149A)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 149A, 153C, 153D)

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) (LRR O)
- [ ] 2 cm Muck (A10) (LRR S)
- [ ] Reduced Vertic (F18) (outside MLRA 150A,B)
- [ ] Piedmont Floodplain Soils (F19) (LRR P, S, T)
- [ ] Anomalous Bright Loamy Soils (F20) (MLRA 153B)
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes (●) No ( )

Remarks:

APPENDIX

B

PHOTOGRAPHIC LOG

Cardno now Stantec

PHOTOGRAPHIC LOG

Property Name:	County/State:	Project No.
Dow Big Slough Mitigation Site	Brazoria County, Texas	E515018116

Photo No. 1	**Date:** 10/10/2019
Coordinates: 29.05243, -95.318614	
Photo Direction:	
Description: DP-A-29, herbaceous wetland (WET-A-3)	

Cardno now Stantec

PHOTOGRAPHIC LOG

Property Name:	County/State:	Project No.
Dow Big Slough Mitigation Site	Brazoria County, Texas	E515018116

Photo No. 2	**Date:** 10/10/2019
Coordinates: 29.052041, -95.318116	
Photo Direction:	
Description: DP-A-31, scrub-shrub wetland (WET-A-5)	

Cardno now Stantec

PHOTOGRAPHIC LOG

Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

Photo No. 3

Date: 10/31/2019

Coordinates: 29.061689, -95.335131

Photo Direction:

Description:

DP-A-95, Scrub-shrub wetland (WET-A-15)

Cardno now Stantec

PHOTOGRAPHIC LOG

Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

Photo No. 4

Date: 10/31/2019

Coordinates: 29.062969, -95.335785

Photo Direction:

Description:

DP-A-99, Scrub-shrub wetland (WET-A-16)

Cardno now Stantec

PHOTOGRAPHIC LOG

Property Name:	County/State:	Project No.
Dow Big Slough Mitigation Site	Brazoria County, Texas	E515018116

Photo No. 5

Date: 10/31/2019

Coordinates:
29.062077, -95.333765

Photo Direction:

Description:

DP-A-101, scrub-shrub (WET-A-17)

Cardno now Stantec

PHOTOGRAPHIC LOG

Property Name:	County/State:	Project No.
Dow Big Slough Mitigation Site	Brazoria County, Texas	E515018116

Photo No. 6

Date: 10/31/2019

Coordinates:
29.063649, -95.332277

Photo Direction:

Description:

DP-A-102, forested wetland (WET-A-18)

PHOTOGRAPHIC LOG

Property Name:	County/State:	Project No.
Dow Big Slough Mitigation Site	Brazoria County, Texas	E515018116

Photo No. 7 — **Date:** 10/31/2019

Coordinates: 29.06107, -95.330223

Photo Direction:

Description:

DP-A-94, scrub/shrub wetland (WET-A-22)

PHOTOGRAPHIC LOG

Property Name:	County/State:	Project No.
Dow Big Slough Mitigation Site	Brazoria County, Texas	E515018116

Photo No. 8 — **Date:** 10/31/2019

Coordinates: 29.061799, -95.329216

Photo Direction:

Description:

DP-A-93, scrub/shrub wetland (WET-A-23)

Cardno now Stantec **PHOTOGRAPHIC LOG**

Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

Photo No. 9	**Date:** 10/31/2019
Coordinates:	
Photo Direction: 29.060862, -95.333423	
Description: DP-A-104, herbaceous wetland (WET-A-24)	

Cardno now Stantec **PHOTOGRAPHIC LOG**

Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

Photo No. 10	**Date:** 10/31/2019
Coordinates: 29.060895, -95.332997	
Photo Direction:	
Description: DP-A-105, herbaceous wetland (WET-A-25)	

Cardno now Stantec		PHOTOGRAPHIC LOG
Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

Photo No. 11 / **Date:** 10/8/2019 **Coordinates:** 29.047642, -95324450 **Photo Direction:** **Description:** DP-B-10, forested wetland (WET-B-2)	

Cardno now Stantec		PHOTOGRAPHIC LOG
Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

Photo No. 12 / **Date:** 10/10/2019 **Coordinates:** 29.056034, -95.328291 **Photo Direction:** **Description:** DP-B-33, herbaceous wetland (WET-B-3)	

PHOTOGRAPHIC LOG

Property Name:	County/State:	Project No.
Dow Big Slough Mitigation Site	Brazoria County, Texas	E515018116

Photo No. 13

Date: 10/10/2019

Coordinates: 29.048180, -95.318659

Photo Direction:

Description:

DP-B-37, herbaceous wetland (WET-B-4)

PHOTOGRAPHIC LOG

Property Name:	County/State:	Project No.
Dow Big Slough Mitigation Site	Brazoria County, Texas	E515018116

Photo No. 14

Date: 10/10/2019

Coordinates: 29.048395, -95.319194

Photo Direction:

Description:

DP-B-39, herbaceous wetland (WET-B-5)

PHOTOGRAPHIC LOG

Property Name: Dow Big Slough Mitigation Site	County/State: Brazoria County, Texas	Project No. E515018116

Photo No. 15

Date: 10/10/2019

Coordinates: 29.048238, -95.319551

Photo Direction:

Description:

DP-B-40, scrub/shrub wetland (WET-B-6)

PHOTOGRAPHIC LOG

Property Name: Dow Big Slough Mitigation Site	County/State: Brazoria County, Texas	Project No. E515018116

Photo No. 16

Date: 10/10/2019

Coordinates: 29.052569, -95.312608

Photo Direction:

Description:

DP-B-41, herbaceous wetland (WET-B-7)

Cardno now Stantec **PHOTOGRAPHIC LOG**

Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

Photo No. 17

Date: 10/10/2019

Coordinates: 29.054085, -95.312002

Photo Direction:

Description:

DP-B-43, herbaceous wetland (WET-B-8)

Cardno now Stantec **PHOTOGRAPHIC LOG**

Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

Photo No. 18

Date: 10/10/2019

Coordinates: 29.053769, -95.310147

Photo Direction:

Description:

DP-B-45, herbaceous wetland (WET-B-9)

Cardno now Stantec		PHOTOGRAPHIC LOG
Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

Photo No. 19	**Date:** 10/11/2019
Coordinates: 29.055381, -95.305468	
Photo Direction:	
Description: DP-B-49, scrub/shrub wetland (WET-B-11)	

Cardno now Stantec		PHOTOGRAPHIC LOG
Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

Photo No. 20	**Date:** 10/9/2019
Coordinates: 29.05886, -95.2991	
Photo Direction:	
Description: DP-C-40, forested wetland (WET-C-3)	

Cardno now Stantec **PHOTOGRAPHIC LOG**

Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

Photo No. **21** | **Date:** 10/9/2019

Coordinates: 29.05904, -95.3001

Photo Direction:

Description:

DP-C-41, forested wetland (WET-C-4)

Cardno now Stantec **PHOTOGRAPHIC LOG**

Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

Photo No. **22** | **Date:** 10/9/2019

Coordinates: 29.05927, -95.3002

Photo Direction:

Description:

DP-C-42, herbaceous wetland (WET-C-5)

Cardno now Stantec	PHOTOGRAPHIC LOG

Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

Photo No. 23	**Date:** 10/10/2019
Coordinates: 29.05882, -95.3128	
Photo Direction:	
Description: DP-C-47, forested wetland (WET-C-6)	

Cardno now Stantec	PHOTOGRAPHIC LOG

Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

Photo No. 24	**Date:** 10/10/2019
Coordinates: 29.05878, -95.312800	
Photo Direction:	
Description: DP-C-48, herbaceous wetland (WET-C-7)	

PHOTOGRAPHIC LOG

Property Name: Dow Big Slough Mitigation Site	County/State: Brazoria County, Texas	Project No. E515018116

Photo No. 25 | **Date:** 10/10/2019

Coordinates: 29.05841, -95.310000

Photo Direction:

Description:

DP-C-50, herbaceous wetland (WET-C-8)

PHOTOGRAPHIC LOG

Property Name: Dow Big Slough Mitigation Site	County/State: Brazoria County, Texas	Project No. E515018116

Photo No. 26 | **Date:** 10/10/2019

Coordinates: 29.05865, -95.3096

Photo Direction:

Description:

DP-C-52, forested wetland (WET-C-9)

PHOTOGRAPHIC LOG

Property Name:	County/State:	Project No.
Dow Big Slough Mitigation Site	Brazoria County, Texas	E515018116

Photo No. 27

Date: 10/10/2019

Coordinates:
29.0588, -95.309400

Photo Direction:

Description:

DP-C-53, herbaceous wetland (WET-C-10)

PHOTOGRAPHIC LOG

Property Name:	County/State:	Project No.
Dow Big Slough Mitigation Site	Brazoria County, Texas	E515018116

Photo No. 28

Date: 10/10/2019

Coordinates:
29.05037, -95.3173

Photo Direction:

Description:

DP-C-55, herbaceous wetland (WET-C-12)

now PHOTOGRAPHIC LOG

Property Name: Dow Big Slough Mitigation Site	County/State: Brazoria County, Texas	Project No. E515018116

Photo No. 29	Date: 10/10/2019
Coordinates: 29.05116, -95.31500	
Photo Direction:	
Description: DP-C-57, herbaceous wetland (WET-C-13)	

now PHOTOGRAPHIC LOG

Property Name: Dow Big Slough Mitigation Site	County/State: Brazoria County, Texas	Project No. E515018116

Photo No. 30	Date: 10/11/2019
Coordinates: 29.05402, -95.326300	
Photo Direction:	
Description: DP-C-59, forested wetland (WET-C-14)	

Cardno now Stantec **PHOTOGRAPHIC LOG**

Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

Photo No. 31	**Date:** 10/11/2019
Coordinates: 29.05556, -95.317600	
Photo Direction:	
Description: DP-C-63, herbaceous wetland (WET-C-15)	

Cardno now Stantec **PHOTOGRAPHIC LOG**

Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

Photo No. 32	**Date:** 10/22/2019
Coordinates: 29.056964, -95.312763	
Photo Direction: West	
Description: Northern most point of Big Slough, upstream	

Cardno now Stantec **PHOTOGRAPHIC LOG**

Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

Photo No. 33

Date: 10/22/2019

Coordinates: 29.056964, -95.312763

Photo Direction: East

Description:

Northern most point of Big Slough, downstream

Cardno now Stantec **PHOTOGRAPHIC LOG**

Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

Photo No. 34

Date: 10/18/2019

Coordinates: 29.055205, -95.314928

Photo Direction: South

Description:

Mid-point of Big Slough, upstream

PHOTOGRAPHIC LOG

Property Name:	County/State:	Project No.
Dow Big Slough Mitigation Site	Brazoria County, Texas	E515018116

Photo No. 35 | **Date:** 10/18/2019

Coordinates: 29.055205, -95.314928

Photo Direction: North

Description:

Mid-point of Big Slough, downstream

PHOTOGRAPHIC LOG

Property Name:	County/State:	Project No.
Dow Big Slough Mitigation Site	Brazoria County, Texas	E515018116

Photo No. 36 | **Date:** 10/18/2019

Coordinates: 29.045811, -95.295197

Photo Direction: West

Description:

Southern most point of Big Slough, downstream

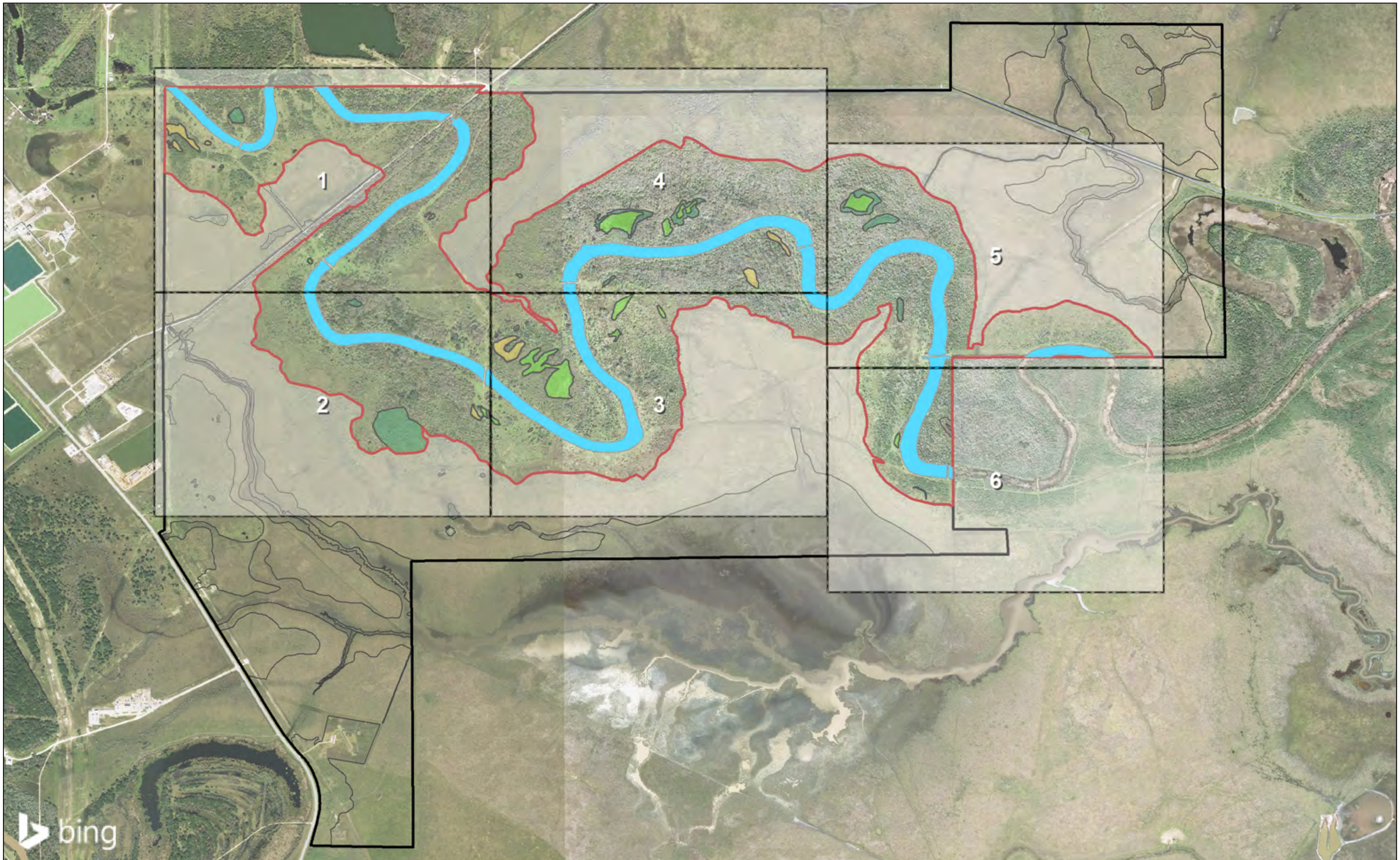
Cardno now Stantec		**PHOTOGRAPHIC LOG**
Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

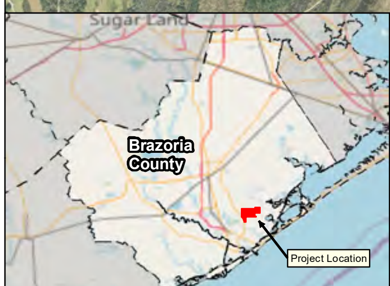
Photo No. **37**	**Date:** 10/18/2019
Coordinates: 29.045811, -95.295197	
Photo Direction: East	
Description: Southern most point of Big Slough, upstream	

APPENDIX

C

WATERBODIES AND WETLANDS MAPBOOK





Property Boundary
Focused Study Area
Big Slough
Mapbook Pages

Wetlands
PEM
PFO
PSS
PUB

N

0 487.5975 1,950
Feet

Cardno now Stantec

Appendix C: Wetlands and Waterbodies Mapbook

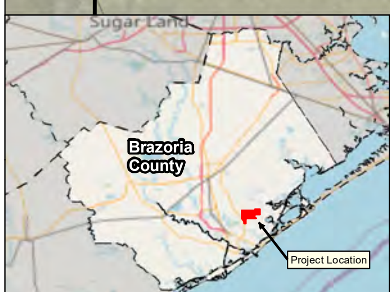
Big Slough Mitigation Site
Dow Chemical

Date:	Project No:	Figure No:
October 2022	E515018116	C

Date Created: 10/20/2022 Date Revised: 10/20/2022 File Path: S:\PROJECTS\DOW Chemical\E515018116 - DOW Big Slough 3K Mitigation Site Project\GIS\Mapbook Overview_Focused Study Area.mxd

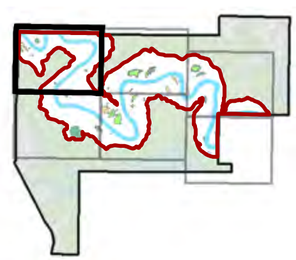
GIS Analyst: samuel.waltman

Data Source: Basemap: Bing Maps Aerial (2018)



Overall Site Boundary
Focused Study Area
Big Slough
Upland Data Point
Wetland Data Point

Wetlands
PEM
PFO
PSS
PUB



N

0 125 250 500
Feet

Cardno now Stantec

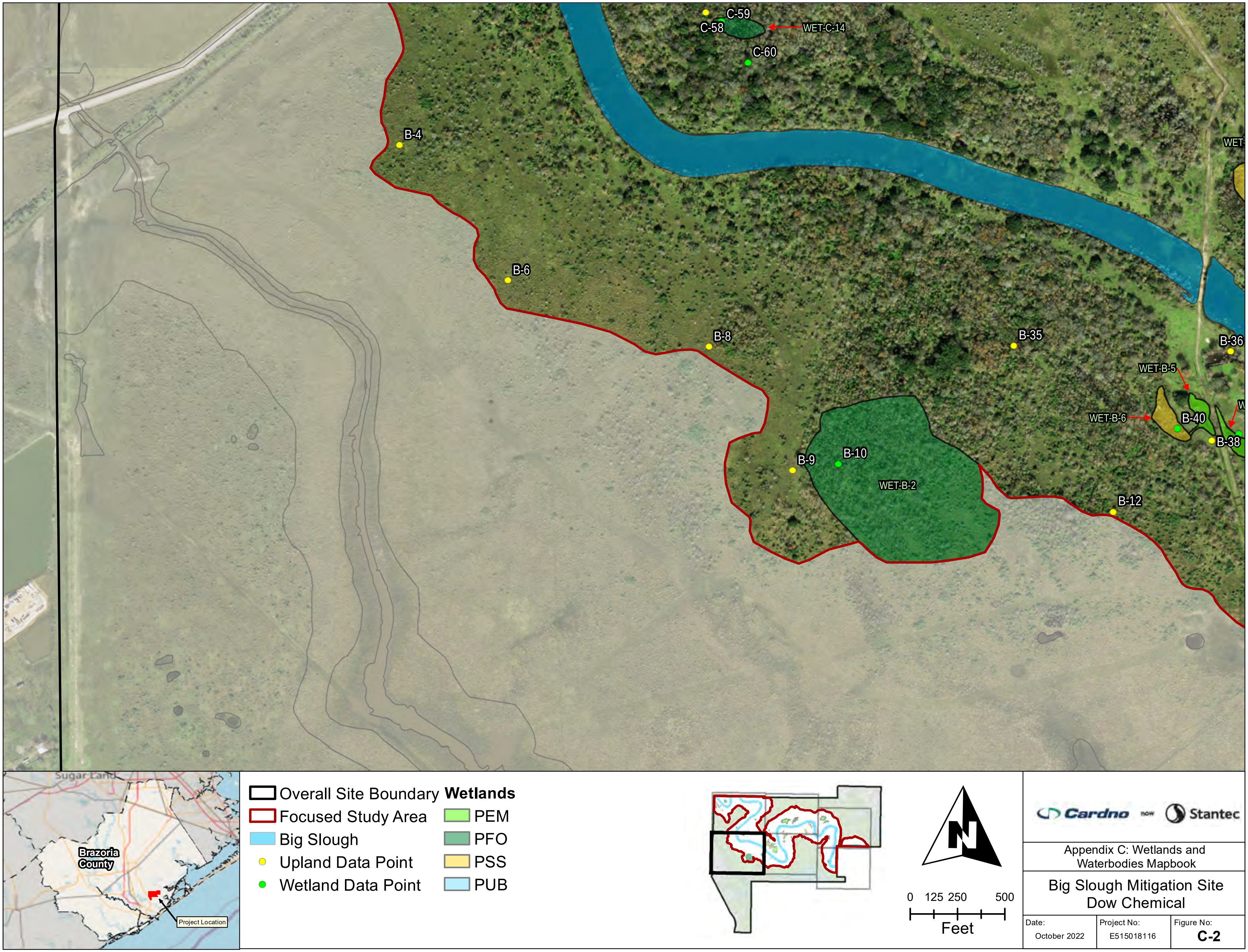
Appendix C: Wetlands and Waterbodies Mapbook

Big Slough Mitigation Site
Dow Chemical

Date:	Project No:	Figure No:
October 2022	E515018116	C-1

Date Created: 10/20/2022 Date Revised: 10/20/2022 File Path: S:\PROJECTS\DOW Chemical\E515018116 - DOW Big Slough 3K Mitigation Site Project\GIS\Appendix C Mapbook_Focused Area.mxd
GIS Analyst: samuel.waltman

Data Source: Basemap: Bing Maps Aerial (2018)



Cardno now Stantec

Appendix C: Wetlands and Waterbodies Mapbook

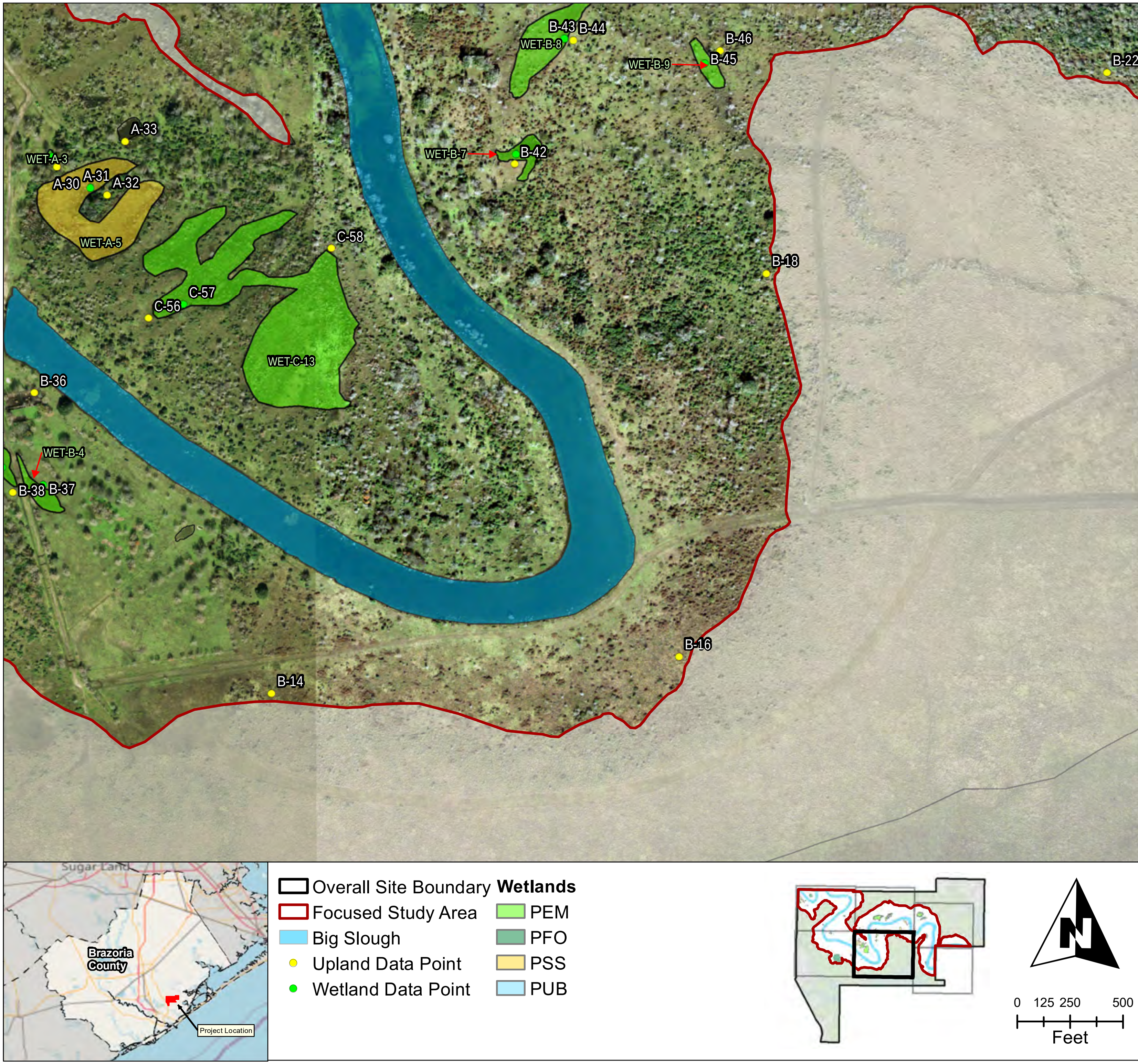
Big Slough Mitigation Site
Dow Chemical

Date:	Project No:	Figure No:
October 2022	E515018116	C-2

Date Created: 10/20/2022 Date Revised: 10/20/2022 File Path: S:\PROJECTS\DOW Chemical\E515018116 - DOW Big Slough 3K Mitigation Site Project\GIS\Appendix C Mapbook_Focused Area.mxd

GIS Analyst: samuel.waltman

Data Source: Basemap: Bing Maps Aerial (2018)



Cardno now Stantec

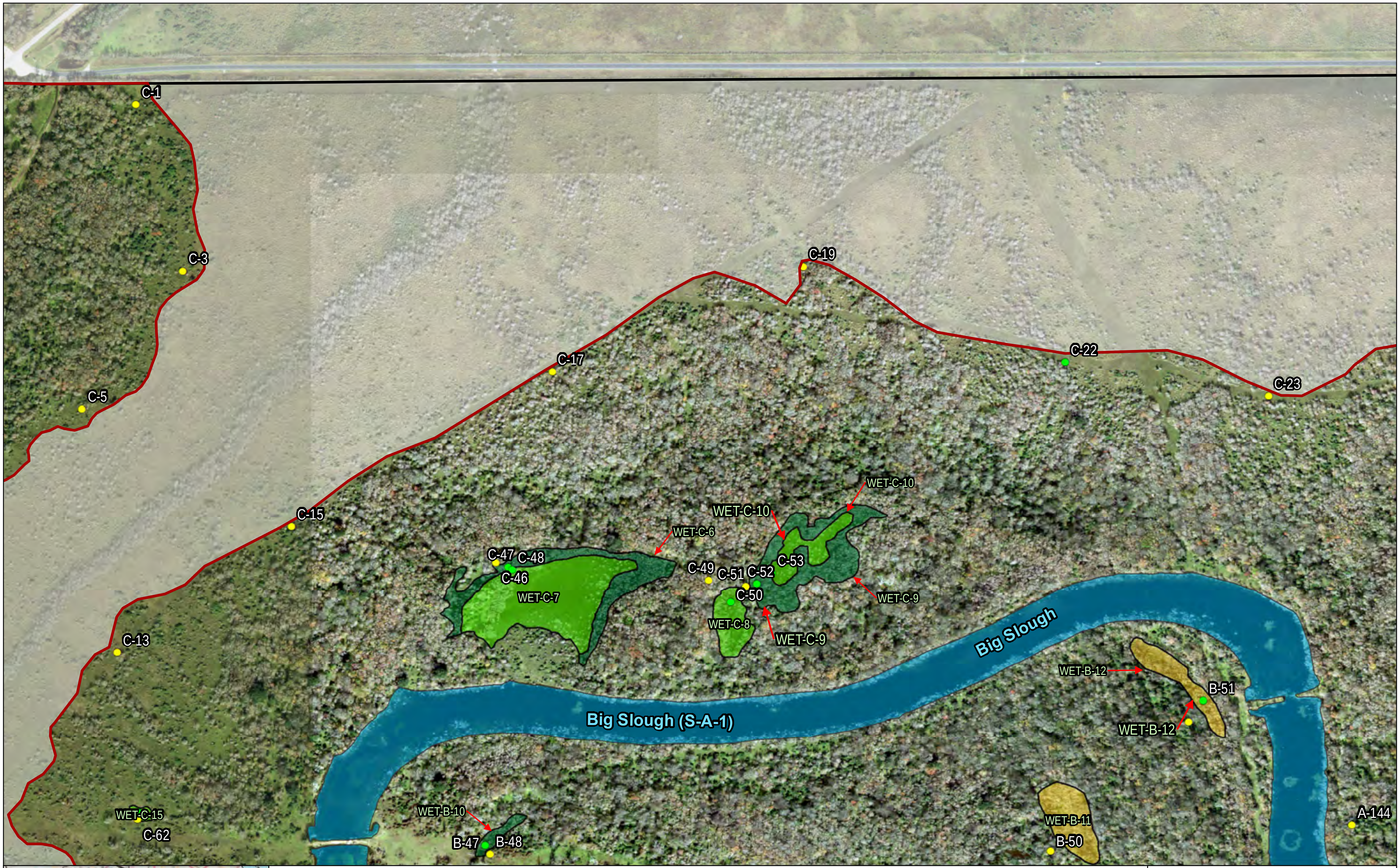
Appendix C: Wetlands and Waterbodies Mapbook

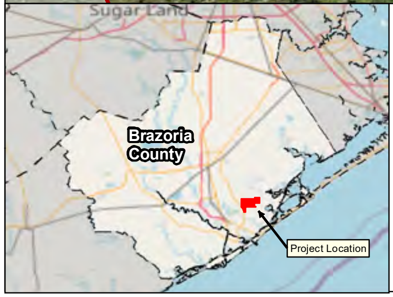
Big Slough Mitigation Site
Dow Chemical

Date:	Project No:	Figure No:
October 2022	E515018116	C-3

Date Created: 10/20/2022 Date Revised: 10/20/2022 File Path: S:\PROJECTS\DOW Chemical\E515018116 - DOW Big Slough 3K Mitigation Site Project\GIS\Appendix C Mapbook_Focused Area.mxd
GIS Analyst: samuel.waltman

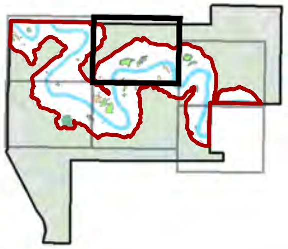
Data Source: Basemap: Bing Maps Aerial (2018)





Overall Site Boundary
Focused Study Area
Big Slough
Upland Data Point
Wetland Data Point

Wetlands
PEM
PFO
PSS
PUB



0 125 250 500
Feet

Cardno now Stantec

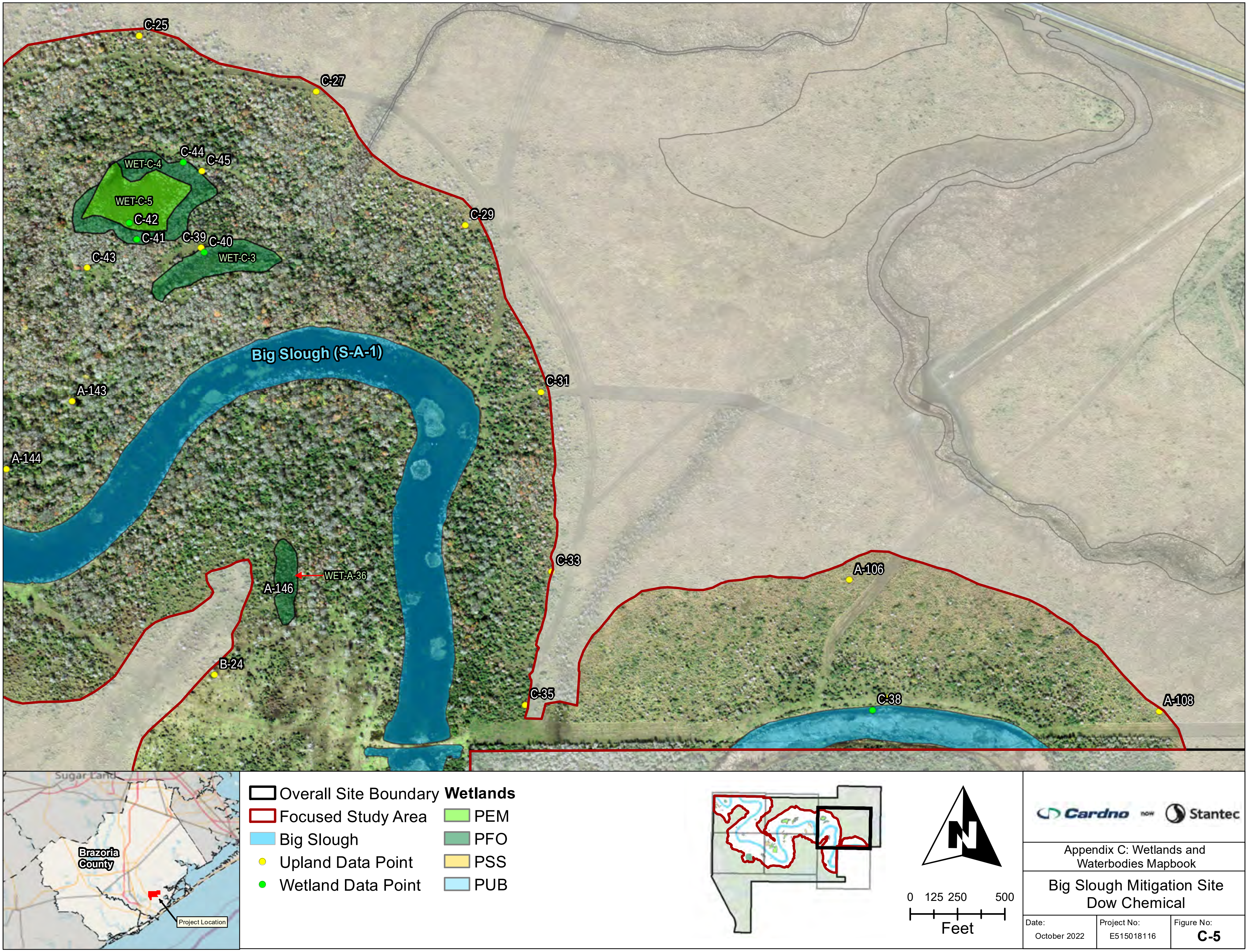
Appendix C: Wetlands and Waterbodies Mapbook

Big Slough Mitigation Site
Dow Chemical

Date:	Project No:	Figure No:
October 2022	E515018116	**C-4**

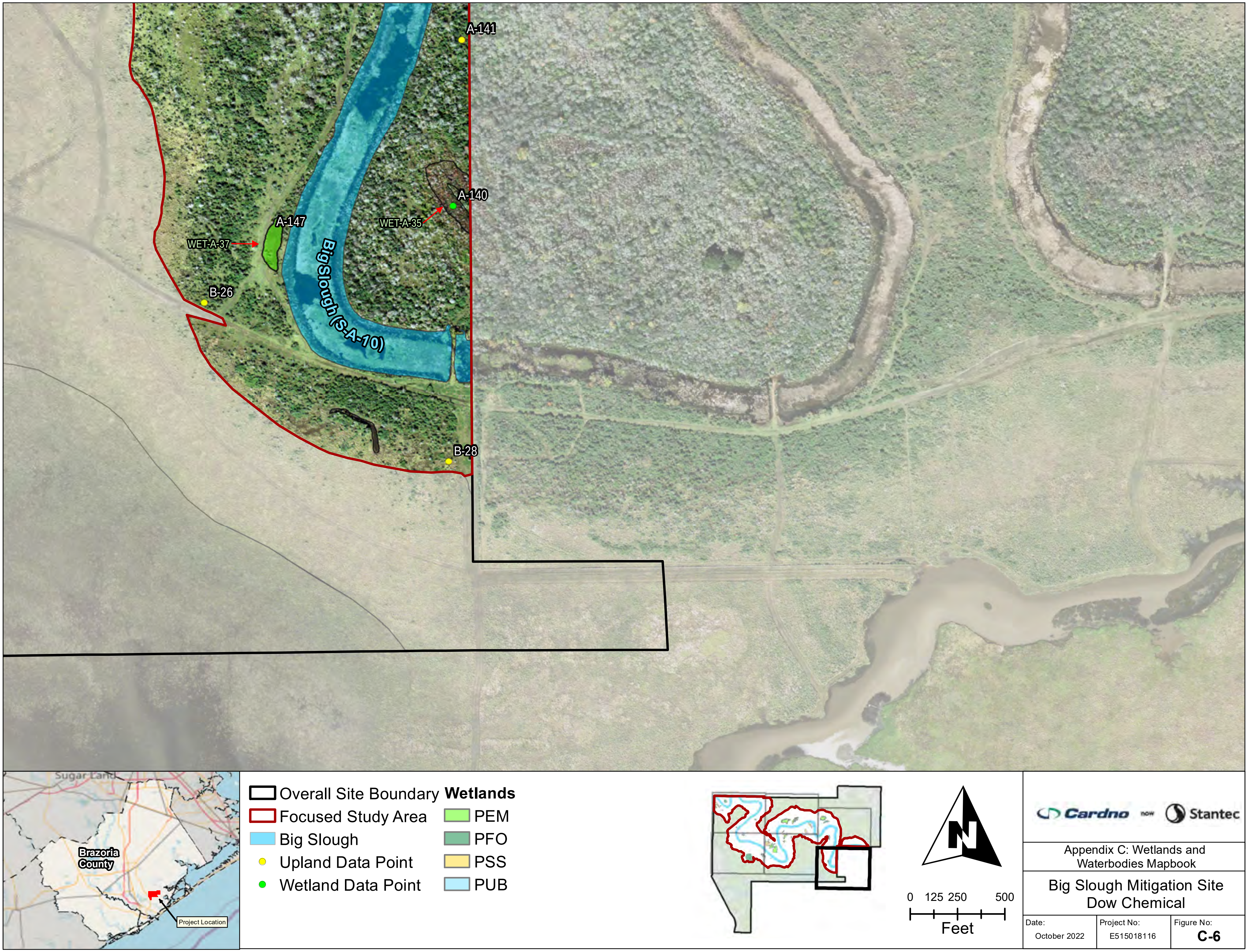
Date Created: 10/20/2022 Date Revised: 10/20/2022 File Path: S:\PROJECTS\DOW Chemical\E515018116 - DOW Big Slough 3K Mitigation Site Project\GIS\Appendix C Mapbook_Focused Area.mxd
GIS Analyst: samuel.waltman

Data Source: Basemap: Bing Maps Aerial (2018)



Date Created: 10/20/2022 Date Revised: 10/20/2022 File Path: S:\PROJECTS\DOW Chemical\E515018116 - DOW Big Slough 3K Mitigation Site Project\GIS\Appendix C Mapbook_Focused Area.mxd
GIS Analyst: samuel.waltman

Data Source: Basemap: Bing Maps Aerial (2018)



Overall Site Boundary
Focused Study Area
Big Slough
Upland Data Point
Wetland Data Point

Wetlands
PEM
PFO
PSS
PUB

0 125 250 500
Feet

Cardno now Stantec

Appendix C: Wetlands and Waterbodies Mapbook

Big Slough Mitigation Site
Dow Chemical

Date:	Project No:	Figure No:
October 2022	E515018116	C-6

Date Created: 10/20/2022 Date Revised: 10/20/2022 File Path: S:\PROJECTS\DOW Chemical\E515018116 - DOW Big Slough 3K Mitigation Site Project\GIS\Appendix C Mapbook_Focused Area.mxd
GIS Analyst: samuel.waltman

Data Source: Basemap: Bing Maps Aerial (2018)

Attachment 3
Site Photographs

Oyster

Figure 1. East Face of Bridge (Shot from North Bank)

Figure 2. East Face of Bridge (Shot from South Bank)

DOW Harris - Oyster Creek Reservoir

Field Site Photo Log

Date: June 30 - July 1, 2021

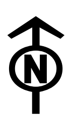
ID: None

Notes: None

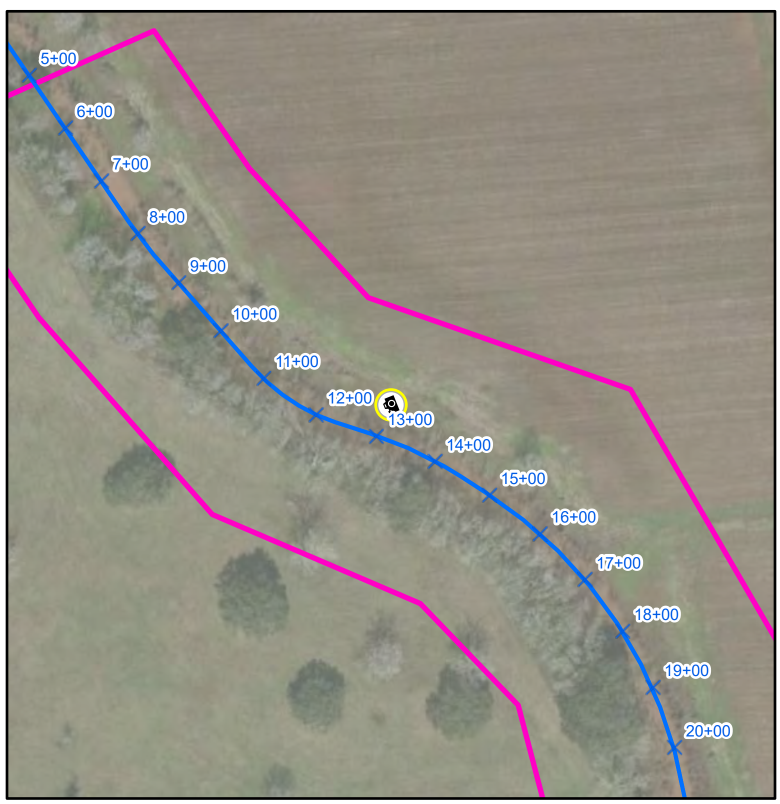
Figure 3: Existing riparian buffer along the unnamed tributary to Oyster Creek.

Legend

Photo Location
Stationing
Centerline
Ditch
Road
Project Boundary
Boundary



0 125 250 500 Feet



DOW Harris - Oyster Creek Reservoir

Field Site Photo Log

Date: June 30 - July 1, 2021

ID: None

Notes: None

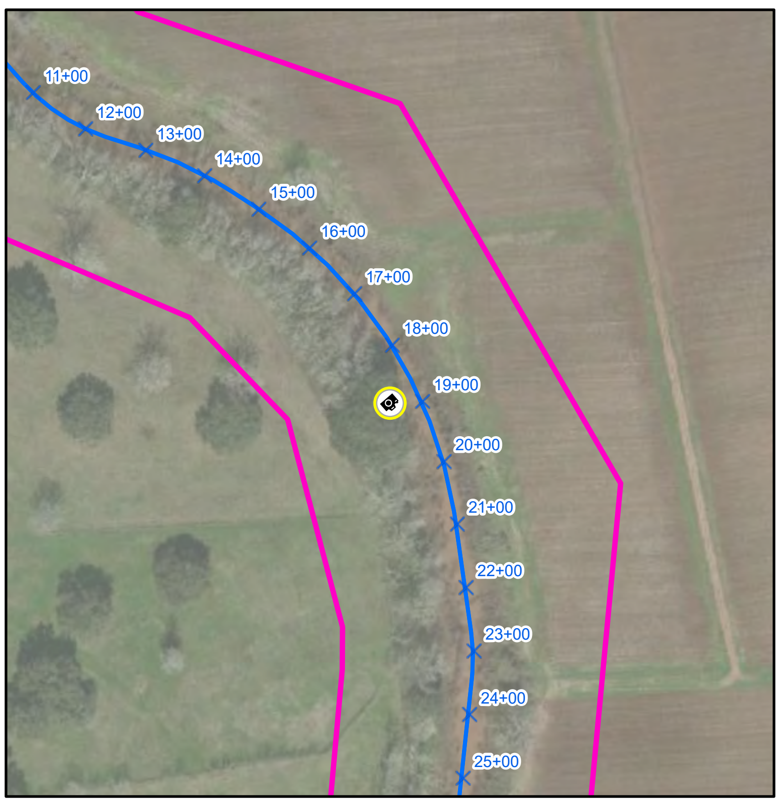
Figure 4: Existing riparian buffer along the unnamed tributary to Oyster Creek.

Legend

- Photo Location
- Stationing
- Centerline
- Ditch
- Road
- Project Boundary
- Boundary

N

0 125 250 500 Feet



DOW Harris - Oyster Creek Reservoir

Field Site Photo Log

Date: June 30 - July 1, 2021

ID: None

Notes: None

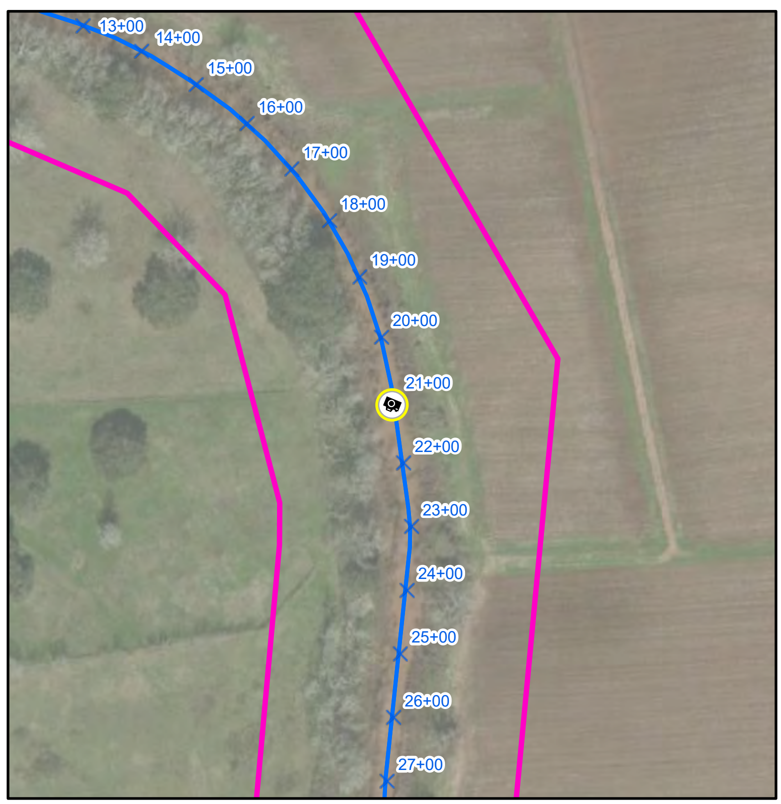
Figure 5: Existing riparian buffer along the unnamed tributary to Oyster Creek.

Legend

- Photo Location
- Stationing
- Centerline
- Ditch
- Road
- Project Boundary
- Boundary

N

0 125 250 500 Feet



DOW Harris - Oyster Creek Reservoir

Field Site Photo Log

Date: June 30 - July 1, 2021

ID: None

Notes: None

Figure 6: Riparian buffer to be re-established.

Legend

- Photo Location
- Stationing
- Centerline
- Ditch
- Road
- Project Boundary
- Boundary

N

0 125 250 500 Feet

DOW Harris - Oyster Creek Reservoir

Field Site Photo Log

Date: June 30 - July 1, 2021

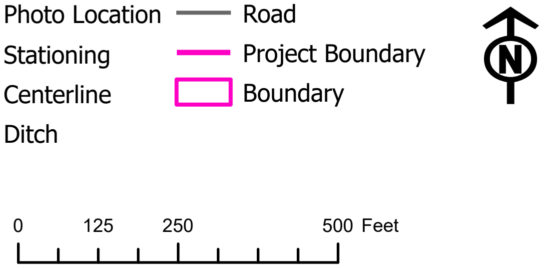
ID: None

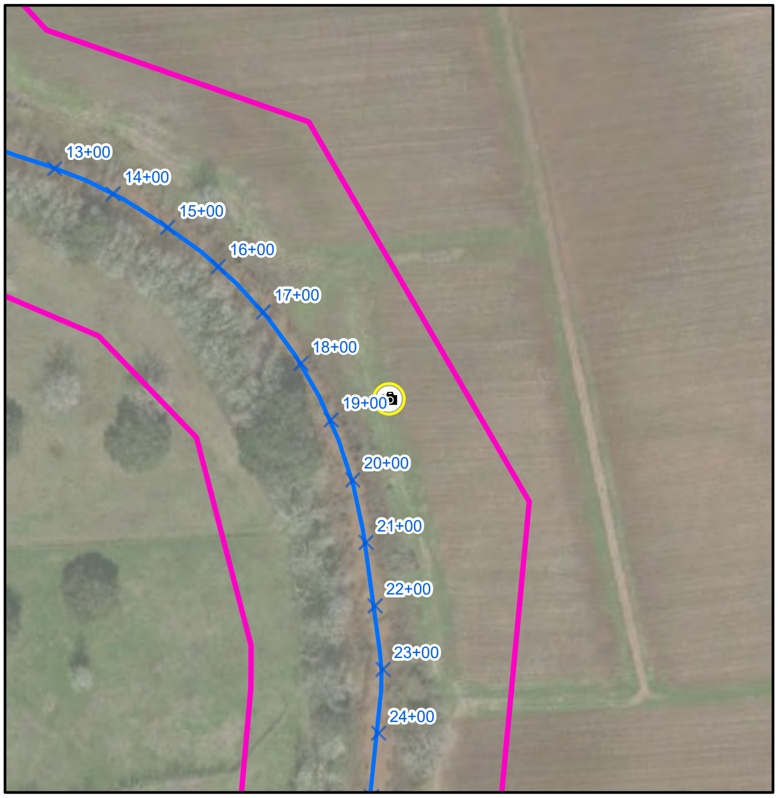
Notes: None

Figure 7: Riparian buffer to be re-established.

Legend

- Photo Location
- Stationing
- Centerline
- Ditch
- Road
- Project Boundary
- Boundary





DOW Harris - Oyster Creek Reservoir

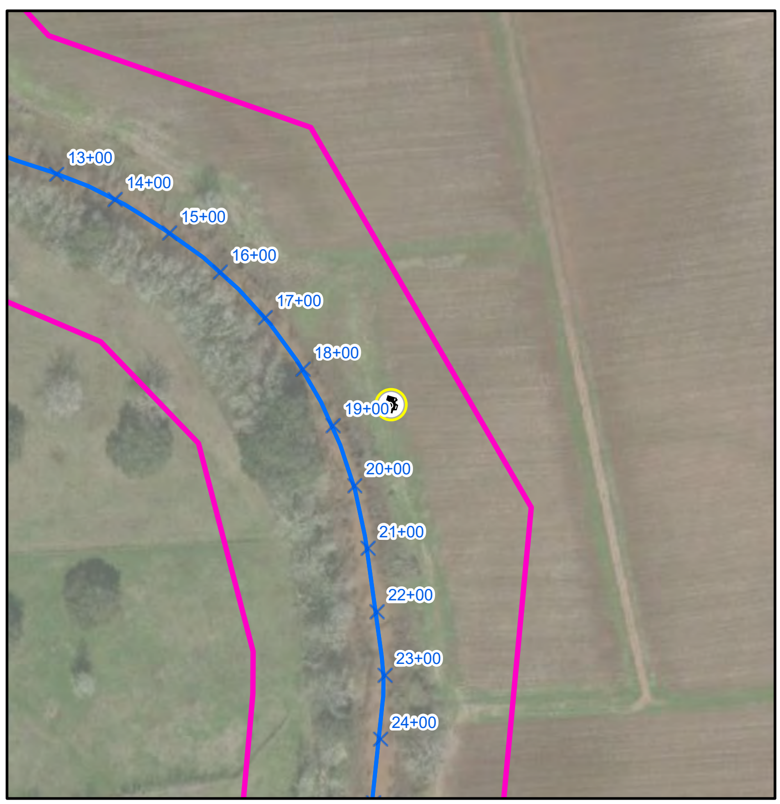
Field Site Photo Log

Date: June 30 - July 1, 2021

ID: None

Notes: None

Figure 8: Riparian buffer to be re-established.



Legend

- Photo Location
- Stationing
- Centerline
- Ditch
- Road
- Project Boundary
- Boundary

N

0 125 250 500 Feet

DOW Harris - Oyster Creek Reservoir

Field Site Photo Log

Date: June 30 - July 1, 2021

ID: None

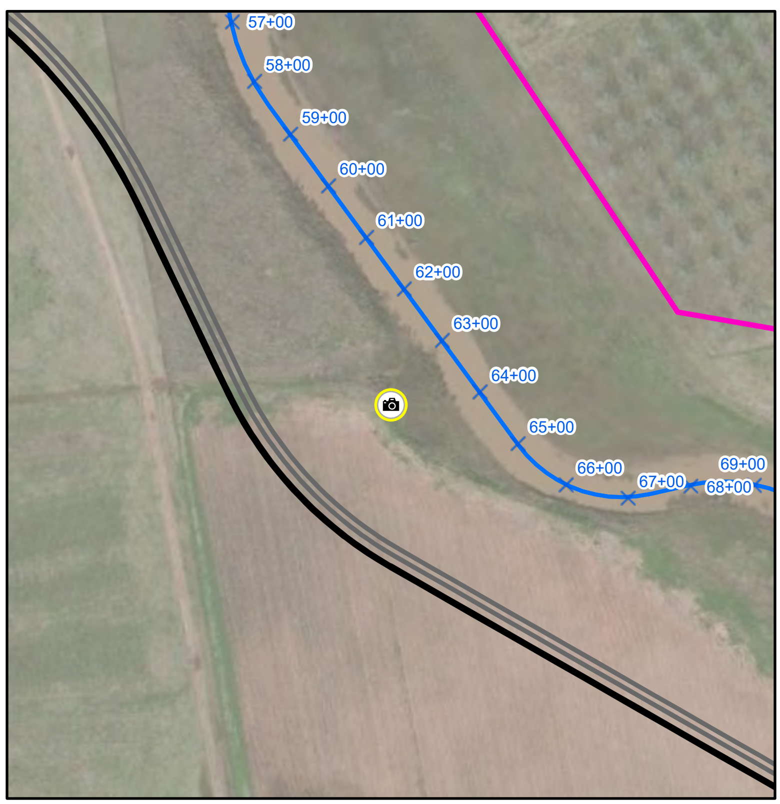
Notes: None

Figure 9: Bankfull bench to be re-established.

Legend

- Photo Location
- Stationing
- Centerline
- Ditch
- Road
- Project Boundary
- Boundary

0 125 250 500 Feet



DOW Harris - Oyster Creek Reservoir

Field Site Photo Log

Date: June 30 - July 1, 2021

ID: None

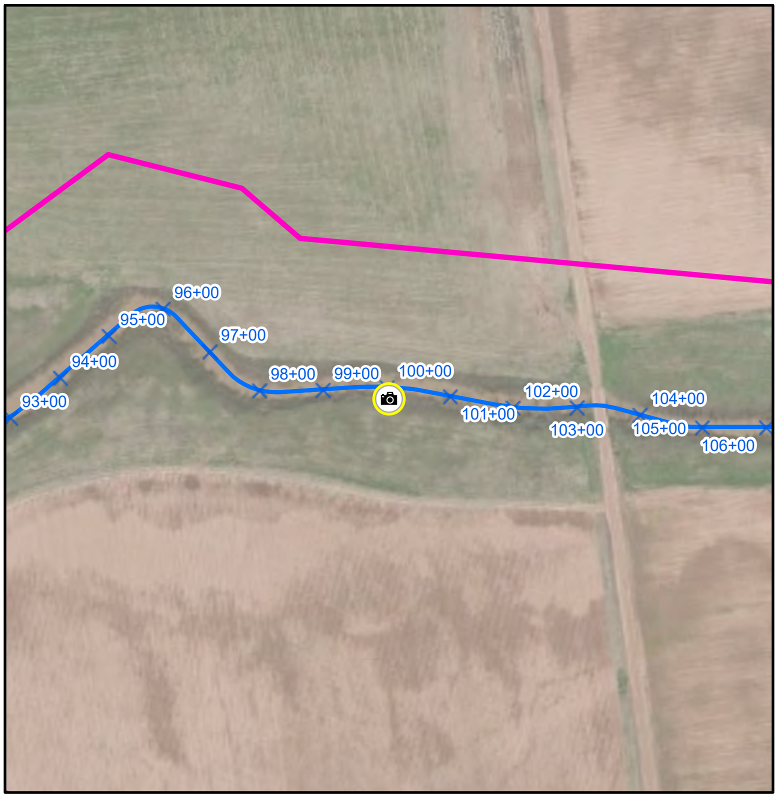
Notes: None

Figure 10: Johnson grass to be eliminated.

Legend

Photo Location
Stationing
Centerline
Ditch
Road
Project Boundary
Boundary

0 125 250 500 Feet



DOW Harris - Oyster Creek Reservoir

Field Site Photo Log

Date: June 30 - July 1, 2021

ID: None

Notes: None

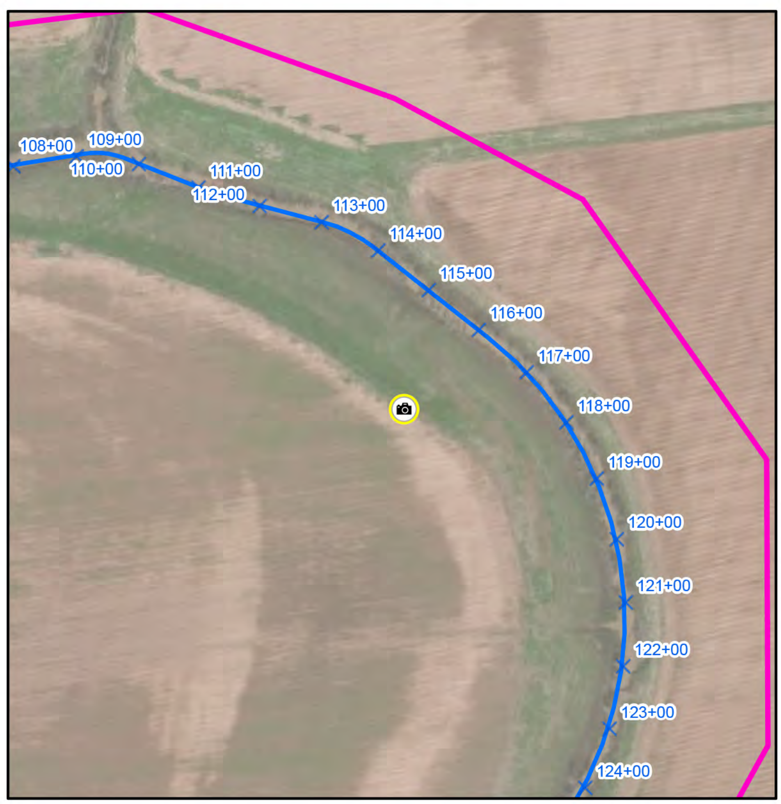
Figure 11: Riparian buffer to be re-established.

Legend

Photo Location
Road
Stationing
Project Boundary
Centerline
Boundary
Ditch

N

0 125 250 500 Feet



DOW Harris - Oyster Creek Reservoir

Field Site Photo Log

Date: June 30 - July 1, 2021

ID: None

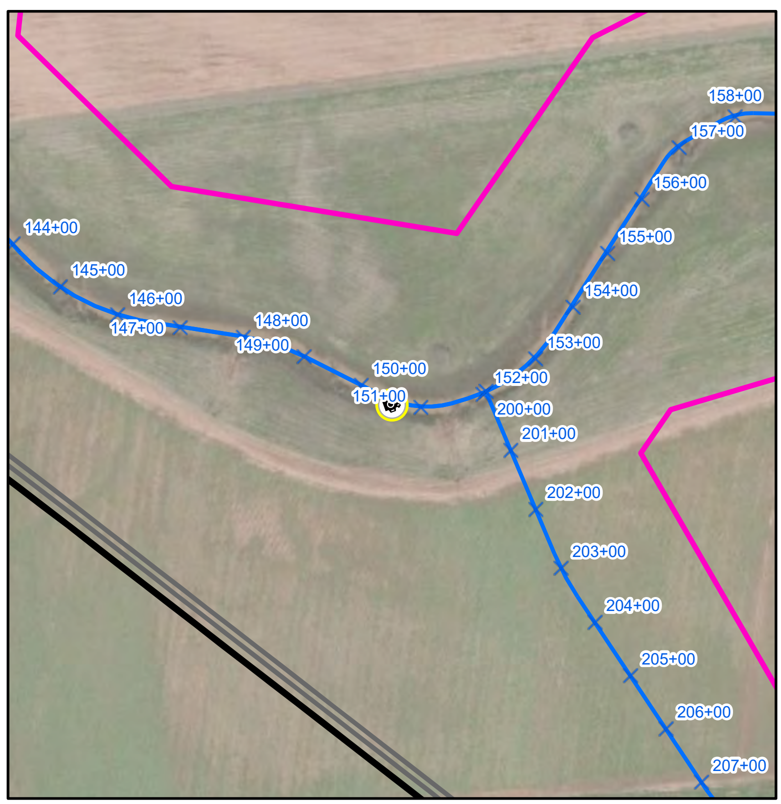
Notes: None

Figure 12: Bankfull bench (foreground) and riparian buffer to be re-established.

Legend

- Photo Location
- Stationing
- Centerline
- Ditch
- Road
- Project Boundary
- Boundary

0 125 250 500 Feet



DOW Harris - Oyster Creek Reservoir

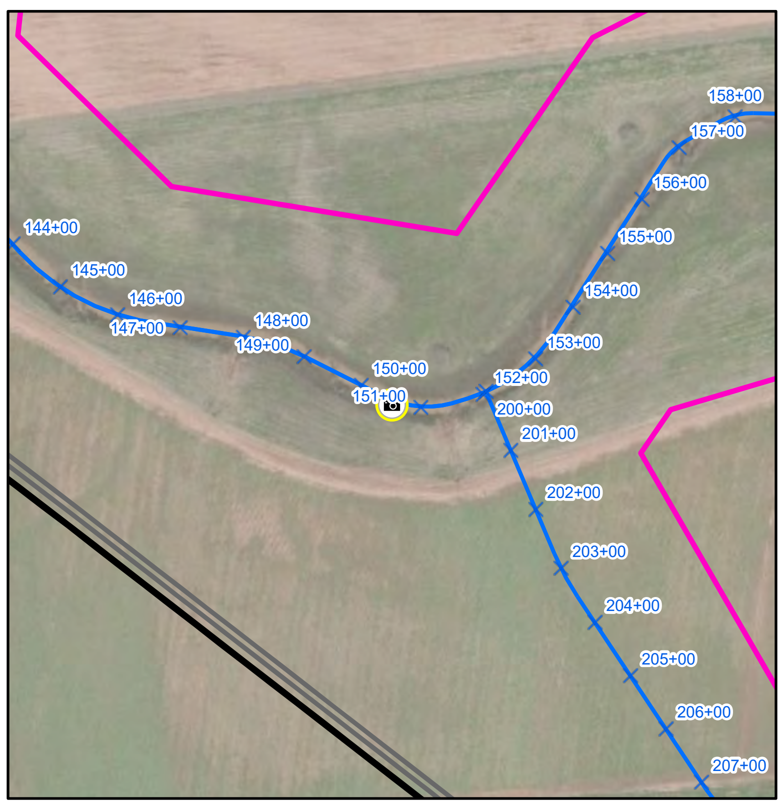
Field Site Photo Log

Date: June 30 - July 1, 2021

ID: None

Notes: None

Figure 13: Riparian buffer to be re-established.



Legend

- Photo Location
- Stationing
- Centerline
- Ditch
- Road
- Project Boundary
- Boundary

0 125 250 500 Feet

DOW Harris - Oyster Creek Reservoir

Field Site Photo Log

Date: June 30 - July 1, 2021

ID: None

Notes: Notes

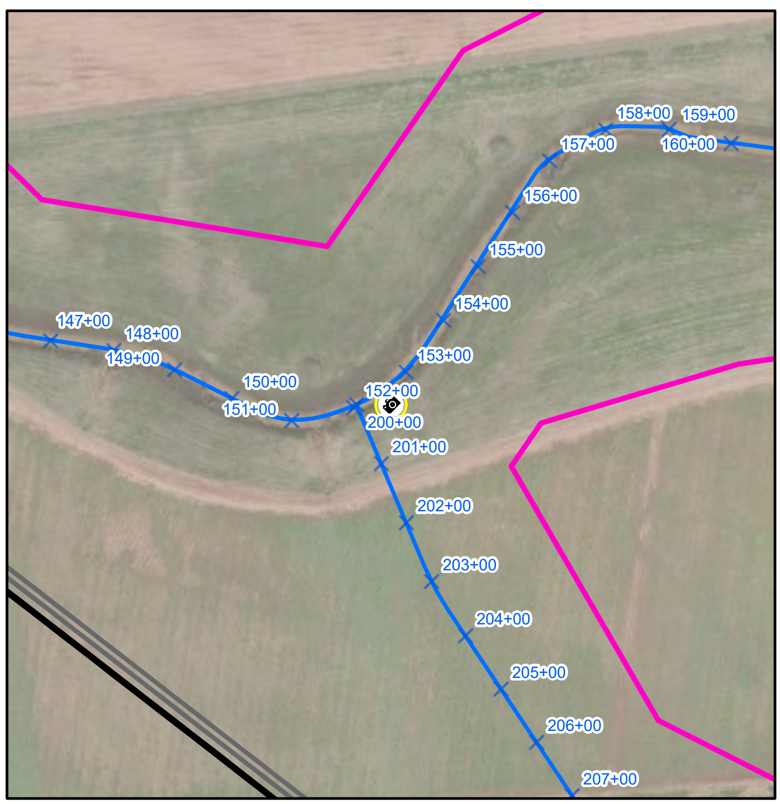
Figure 14: Bankfull bench (foreground) and riparian buffer to be re-established.

Legend

- Photo Location
- Stationing
- Centerline
- Ditch
- Road
- Project Boundary
- Boundary

N

0 125 250 500 Feet



Big Slough

PHOTOGRAPHIC LOG

Property Name: Dow Big Slough Mitigation Site	County/State: Brazoria County, Texas	Project No. E515018116

Photo No. 1	Date: 10/10/2019
Coordinates: 29.05243, -95.318614	
Photo Direction:	
Description: DP-A-29, herbaceous wetland (WET-A-3)	

PHOTOGRAPHIC LOG

Property Name: Dow Big Slough Mitigation Site	County/State: Brazoria County, Texas	Project No. E515018116

Photo No. 2	Date: 10/10/2019
Coordinates: 29.052041, -95.318116	
Photo Direction:	
Description: DP-A-31, scrub-shrub wetland (WET-A-5)	

PHOTOGRAPHIC LOG		
Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

Photo No. 3

Date: 10/31/2019

Coordinates: 29.061689, -95.335131

Photo Direction:

Description:

DP-A-95, Scrub-shrub wetland (WET-A-15)

PHOTOGRAPHIC LOG		
Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

Photo No. 4

Date: 10/31/2019

Coordinates: 29.062969, -95.335785

Photo Direction:

Description:

DP-A-99, Scrub-shrub wetland (WET-A-16)

Cardno now Stantec **PHOTOGRAPHIC LOG**

Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

Photo No. **5**	**Date:** 10/31/2019
Coordinates: 29.062077, -95.333765	
Photo Direction:	
Description: DP-A-101, scrub-shrub (WET-A-17)	

Cardno now Stantec **PHOTOGRAPHIC LOG**

Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

Photo No. **6**	**Date:** 10/31/2019
Coordinates: 29.063649, -95.332277	
Photo Direction:	
Description: DP-A-102, forested wetland (WET-A-18)	

PHOTOGRAPHIC LOG		
Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

Photo No. 7

Date: 10/31/2019

Coordinates: 29.06107, -95.330223

Photo Direction:

Description:

DP-A-94, scrub/shrub wetland (WET-A-22)

PHOTOGRAPHIC LOG		
Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

Photo No. 8

Date: 10/31/2019

Coordinates: 29.061799, -95.329216

Photo Direction:

Description:

DP-A-93, scrub/shrub wetland (WET-A-23)

Cardno now Stantec

PHOTOGRAPHIC LOG

Property Name:	County/State:	Project No.
Dow Big Slough Mitigation Site	Brazoria County, Texas	E515018116

Photo No. 9

Date: 10/31/2019

Coordinates:

Photo Direction:
29.060862, -95.333423

Description:

DP-A-104, herbaceous wetland (WET-A-24)

Cardno now Stantec

PHOTOGRAPHIC LOG

Property Name:	County/State:	Project No.
Dow Big Slough Mitigation Site	Brazoria County, Texas	E515018116

Photo No. 10

Date: 10/31/2019

Coordinates:
29.060895, -95.332997

Photo Direction:

Description:

DP-A-105, herbaceous wetland (WET-A-25)

Cardno now Stantec	PHOTOGRAPHIC LOG	
Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

Photo No. 11 **Date:** 10/8/2019

Coordinates: 29.047642, -95324450

Photo Direction:

Description:

DP-B-10, forested wetland (WET-B-2)

Cardno now Stantec	PHOTOGRAPHIC LOG	
Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

Photo No. 12 **Date:** 10/10/2019

Coordinates: 29.056034, -95.328291

Photo Direction:

Description:

DP-B-33, herbaceous wetland (WET-B-3)

Cardno now Stantec

PHOTOGRAPHIC LOG

Property Name: Dow Big Slough Mitigation Site	County/State: Brazoria County, Texas	Project No. E515018116

Photo No. 13

Date: 10/10/2019

Coordinates: 29.048180, -95.318659

Photo Direction:

Description:

DP-B-37, herbaceous wetland (WET-B-4)

Cardno now Stantec

PHOTOGRAPHIC LOG

Property Name: Dow Big Slough Mitigation Site	County/State: Brazoria County, Texas	Project No. E515018116

Photo No. 14

Date: 10/10/2019

Coordinates: 29.048395, -95.319194

Photo Direction:

Description:

DP-B-39, herbaceous wetland (WET-B-5)

Cardno now Stantec		PHOTOGRAPHIC LOG
Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

Photo No. 15

Date: 10/10/2019

Coordinates: 29.048238, -95.319551

Photo Direction:

Description:

DP-B-40, scrub/shrub wetland (WET-B-6)

Cardno now Stantec		PHOTOGRAPHIC LOG
Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

Photo No. 16

Date: 10/10/2019

Coordinates: 29.052569, -95.312608

Photo Direction:

Description:

DP-B-41, herbaceous wetland (WET-B-7)

PHOTOGRAPHIC LOG

Property Name: Dow Big Slough Mitigation Site	County/State: Brazoria County, Texas	Project No. E515018116

Photo No. 17

Date: 10/10/2019

Coordinates: 29.054085, -95.312002

Photo Direction:

Description:

DP-B-43, herbaceous wetland (WET-B-8)

PHOTOGRAPHIC LOG

Property Name: Dow Big Slough Mitigation Site	County/State: Brazoria County, Texas	Project No. E515018116

Photo No. 18

Date: 10/10/2019

Coordinates: 29.053769, -95.310147

Photo Direction:

Description:

DP-B-45, herbaceous wetland (WET-B-9)

PHOTOGRAPHIC LOG

Property Name:	County/State:	Project No.
Dow Big Slough Mitigation Site	Brazoria County, Texas	E515018116

Photo No. 19

Date: 10/11/2019

Coordinates: 29.055381, -95.305468

Photo Direction:

Description:

DP-B-49, scrub/shrub wetland (WET-B-11)

PHOTOGRAPHIC LOG

Property Name:	County/State:	Project No.
Dow Big Slough Mitigation Site	Brazoria County, Texas	E515018116

Photo No. 20

Date: 10/9/2019

Coordinates: 29.05886, -95.2991

Photo Direction:

Description:

DP-C-40, forested wetland (WET-C-3)

PHOTOGRAPHIC LOG

Property Name:	County/State:	Project No.
Dow Big Slough Mitigation Site	Brazoria County, Texas	E515018116

Photo No. 21 **Date:** 10/9/2019

Coordinates: 29.05904, -95.3001

Photo Direction:

Description:

DP-C-41, forested wetland (WET-C-4)

PHOTOGRAPHIC LOG

Property Name:	County/State:	Project No.
Dow Big Slough Mitigation Site	Brazoria County, Texas	E515018116

Photo No. 22 **Date:** 10/9/2019

Coordinates: 29.05927, -95.3002

Photo Direction:

Description:

DP-C-42, herbaceous wetland (WET-C-5)

PHOTOGRAPHIC LOG

Property Name:	County/State:	Project No.
Dow Big Slough Mitigation Site	Brazoria County, Texas	E515018116

Photo No. 23 **Date:** 10/10/2019

Coordinates: 29.05882, -95.3128

Photo Direction:

Description:

DP-C-47, forested wetland (WET-C-6)

PHOTOGRAPHIC LOG

Property Name:	County/State:	Project No.
Dow Big Slough Mitigation Site	Brazoria County, Texas	E515018116

Photo No. 24 **Date:** 10/10/2019

Coordinates: 29.05878, -95.312800

Photo Direction:

Description:

DP-C-48, herbaceous wetland (WET-C-7)

Cardno now Stantec		PHOTOGRAPHIC LOG
Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

Photo No. 25

Date: 10/10/2019

Coordinates: 29.05841, -95.310000

Photo Direction:

Description:

DP-C-50, herbaceous wetland (WET-C-8)

Cardno now Stantec		PHOTOGRAPHIC LOG
Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

Photo No. 26

Date: 10/10/2019

Coordinates: 29.05865, -95.3096

Photo Direction:

Description:

DP-C-52, forested wetland (WET-C-9)

Cardno now Stantec		PHOTOGRAPHIC LOG
Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

Photo No. 27 | **Date:** 10/10/2019

Coordinates: 29.0588, -95.309400

Photo Direction:

Description:

DP-C-53, herbaceous wetland (WET-C-10)

Cardno now Stantec		PHOTOGRAPHIC LOG
Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

Photo No. 28 | **Date:** 10/10/2019

Coordinates: 29.05037, -95.3173

Photo Direction:

Description:

DP-C-55, herbaceous wetland (WET-C-12)

PHOTOGRAPHIC LOG

Property Name:	County/State:	Project No.
Dow Big Slough Mitigation Site	Brazoria County, Texas	E515018116

Photo No. 29

Date: 10/10/2019

Coordinates:
29.05116, -95.31500

Photo Direction:

Description:

DP-C-57, herbaceous wetland (WET-C-13)

PHOTOGRAPHIC LOG

Property Name:	County/State:	Project No.
Dow Big Slough Mitigation Site	Brazoria County, Texas	E515018116

Photo No. 30

Date: 10/11/2019

Coordinates:
29.05402, -95.326300

Photo Direction:

Description:

DP-C-59, forested wetland (WET-C-14)

Cardno now Stantec		PHOTOGRAPHIC LOG
Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

Photo No. 31	**Date:** 10/11/2019
Coordinates: 29.05556, -95.317600	
Photo Direction:	
Description: DP-C-63, herbaceous wetland (WET-C-15)	

Cardno now Stantec		PHOTOGRAPHIC LOG
Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

Photo No. 32	**Date:** 10/22/2019
Coordinates: 29.056964, -95.312763	
Photo Direction: West	
Description: Northern most point of Big Slough, upstream	

Cardno now Stantec

PHOTOGRAPHIC LOG

Property Name:	County/State:	Project No.
Dow Big Slough Mitigation Site	Brazoria County, Texas	E515018116

Photo No. 33 **Date:** 10/22/2019

Coordinates:
29.056964, -95.312763

Photo Direction:
East

Description:

Northern most point of Big Slough, downstream

Cardno now Stantec

PHOTOGRAPHIC LOG

Property Name:	County/State:	Project No.
Dow Big Slough Mitigation Site	Brazoria County, Texas	E515018116

Photo No. 34 **Date:** 10/18/2019

Coordinates:
29.055205, -95.314928

Photo Direction:
South

Description:

Mid-point of Big Slough, upstream

Cardno now Stantec		PHOTOGRAPHIC LOG
Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

Photo No. 35

Date: 10/18/2019

Coordinates: 29.055205, -95.314928

Photo Direction: North

Description:

Mid-point of Big Slough, downstream

Cardno now Stantec		PHOTOGRAPHIC LOG
Property Name: Dow Big Slough Mitigation Site	**County/State:** Brazoria County, Texas	**Project No.** E515018116

Photo No. 36

Date: 10/18/2019

Coordinates: 29.045811, -95.295197

Photo Direction: West

Description:

Southern most point of Big Slough, downstream

PHOTOGRAPHIC LOG

Property Name:	County/State:	Project No.
Dow Big Slough Mitigation Site	Brazoria County, Texas	E515018116

Photo No. 37

Date: 10/18/2019

Coordinates:
29.045811, -95.295197

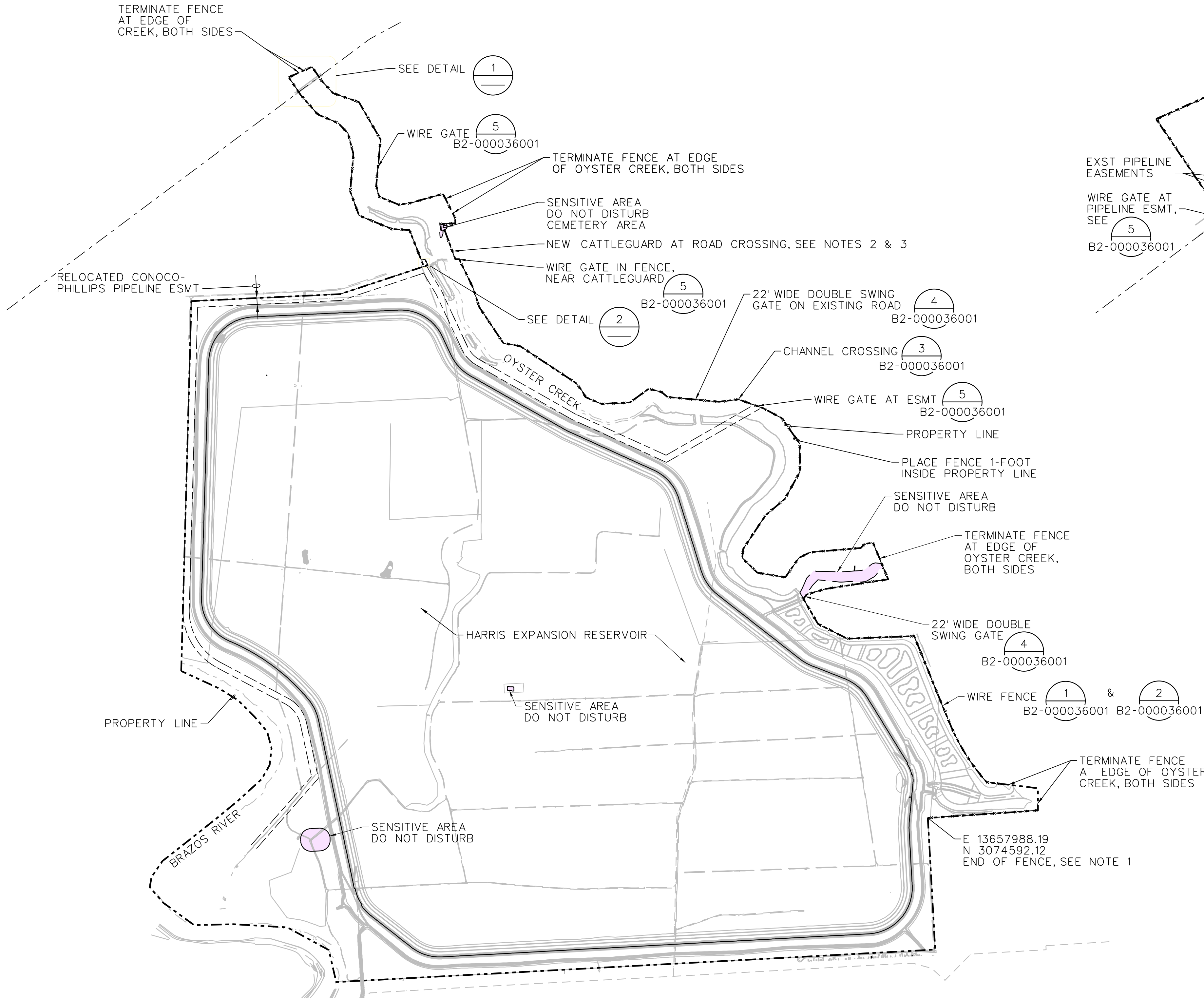
Photo Direction:
East

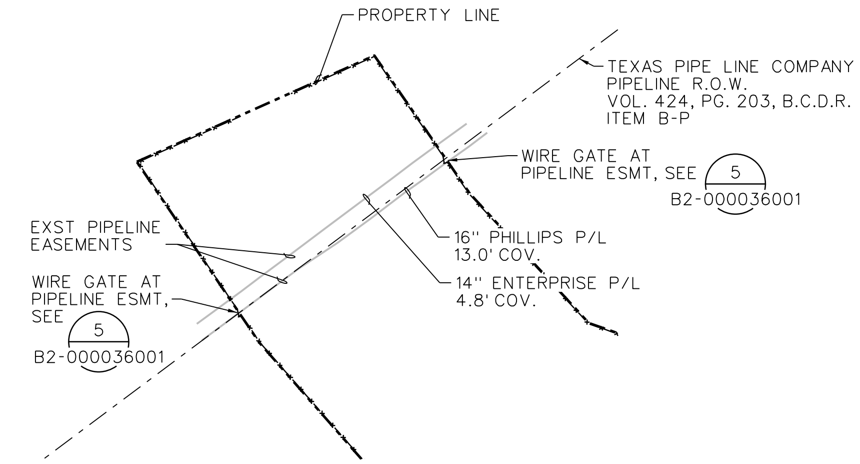
Description:

Southern most point of Big Slough, upstream

Attachment 4
Design/Plan Drawings

Oyster Creek

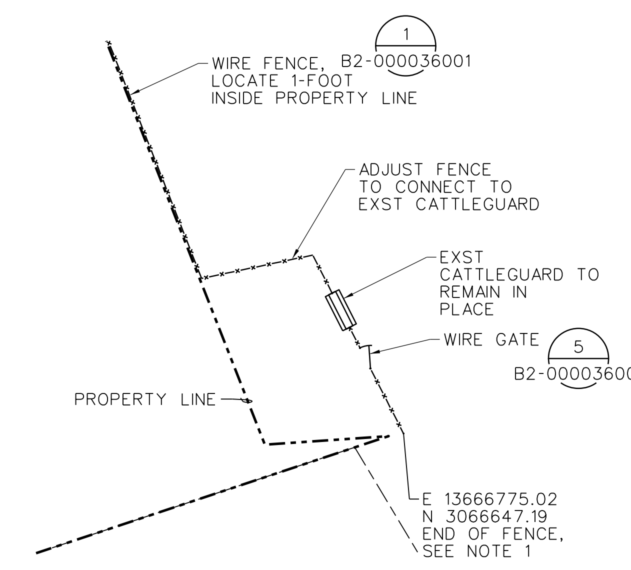




1 DETAIL
1"=150'

NOTES:

1. TERMINATE FENCE WITH APPROPRIATE BRACING. IF RESERVOIR FENCING IS IN PLACE, CONNECT FENCE TO THE RESERVOIR FENCE.
2. PROVIDE CATTLEGUARD WITH CAST-IN-PLACE CONCRETE FOUNDATION. PROVIDE AND CONSTRUCT PER FWHA STANDARD DETAIL 619-1 AND 619-2. WIDTH EQUAL TO EXISTING CATTLEGAURD ON WEST SIDE OF CREEK.
3. PROVIDE 6" HDPE SOLID WALL DRAIN PIPE PER DETAIL 619-1. INSTALL WITH S=2%. FIELD ROUTE FROM CATTLEGUARD TO PROVIDE POSITIVE DRAINAGE TOWARD OYSTER CREEK. MAINTAIN MINIMUM 20-FEET CLEAR FROM EXISTING BRIDGE.
4. PRIOR TO INSTALLING GATES, OBTAIN OWNER APPROVAL OF LOCATION.



2 DETAIL
1"=50'

N

0 1000 2000 3000
SCALE IN FEET

Worley energy | chemicals | resources
TEXAS REGISTERED ENGINEERING FIRM F-1480

JACOBS
TEXAS REGISTERED ENGINEERING FIRM F-2966

REV. MARK	REVISION	BY	CHK	APP	DATE	REV. MARK	REVISION	BY	CHK	APP	DATE

DRAWING ISSUE RECORD

ISSUE NO.	REV	MATERIAL OR JOB SPEC	BID	FAB	CONST	REF
			DATE ISSUED FOR			

DESIGNED	M. LITTLE	2/22
DRAWN	R. BROWN	2/22
CHECKED	D. PETERSON	2/22
APPROVED	S. YANAGIHARA	2/22
PROJ. ENGR.	R. BELL	2/22
MFG. REP.	R. REHMAN	2/22

STATUS | PLANT NO.

P.E. SEAL
THIS DOCUMENT IS RELEASED FOR THE PURPOSE OF INTERIM REVIEW UNDER THE AUTHORITY OF SCOTT YANAGIHARA TEXAS P.E. 137477 ON MARCH 3, 2023
IT IS NOT TO BE USED FOR BIDDING OR CONSTRUCTION PURPOSES

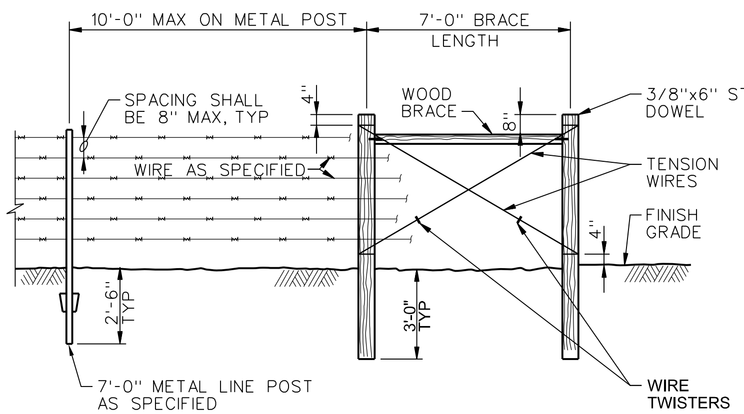
THE DOW CHEMICAL COMPANY
TEXAS OPERATIONS — FREEPORT, TEXAS
ENVIRONMENTAL OPERATIONS — HARRIS EXPANSION

HARRIS EXPANSION PROJECT
SITE FENCING
PLAN

PROJECT NUMBER	SCALE		REV.
017491	1" = 1000'-0"	B2-000031002-017491	2

PRINTED | VER. CIV

B2-000031002-017491.dgn
2023\03\03
12:11:11 PM



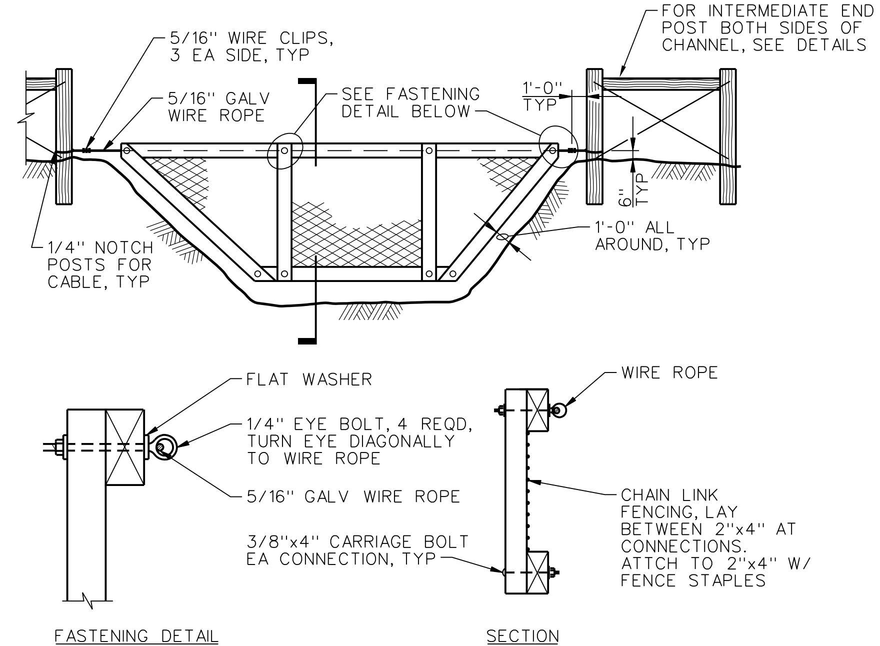
NOTES:

1. SPACING FOR INTERMEDIATE END POST ASSEMBLIES SHALL BE 400 FT MAXIMUM, UNLESS OTHERWISE NOTED.
2. 6"x6"x8'-0" WOOD POSTS TO BE TREATED WITH PRESERVATIVE AS SPECIFIED.

1 WIRE FIELD FENCE DETAIL

NTS

B2-000031002



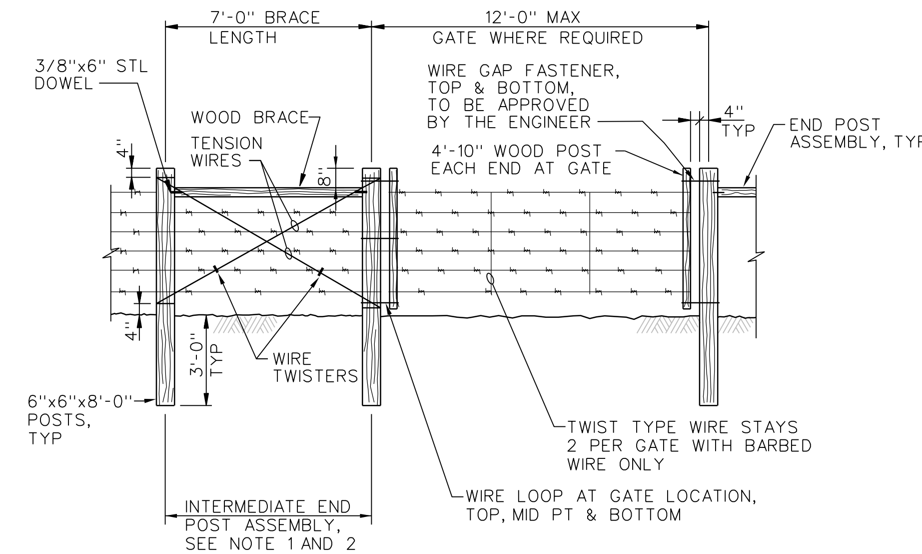
NOTES:

1. ALL LUMBER FOR CHANNEL GATE FRAME TO BE 2"x4" REDWOOD OR CEDAR.
2. ALL BOLTS SHALL BE GALVANIZED.
3. NUT, LOCKWASJER AND FLAT WASHER, TYPICAL ALL BOLTS. ALL BOLTS SHALL BE GALVANIZED.

3 FIELD FENCE CHANNEL CROSSING

NTS

B2-000031002



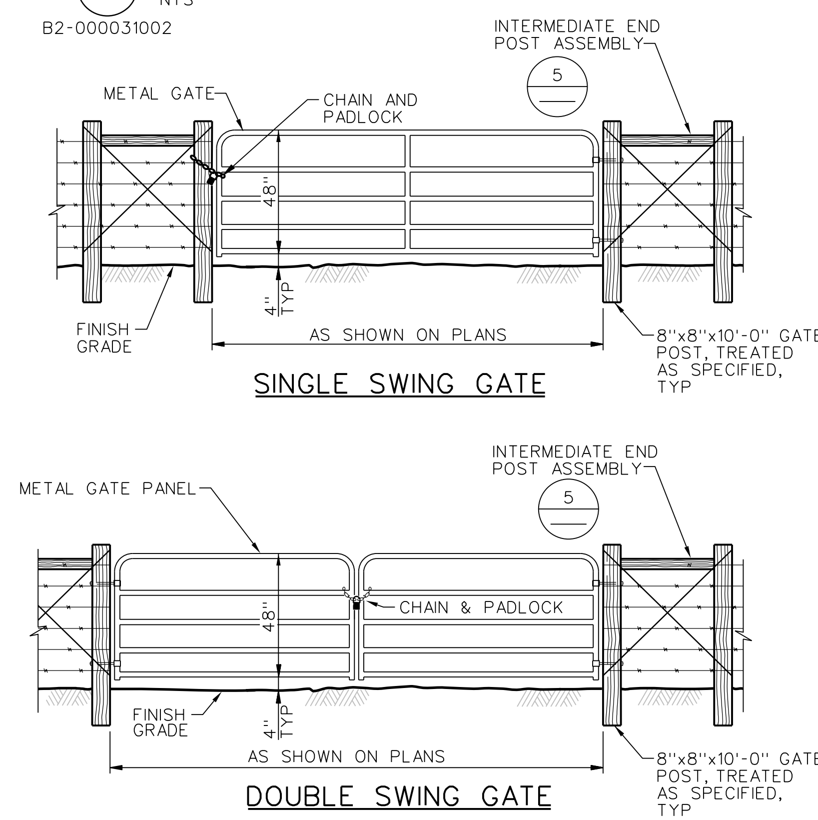
NOTES:

1. 6"x6"x8'-0" WOOD POSTS TO BE TREATED WITH PRESERVATIVE AS SPECIFIED.
2. SPACING FOR INTERMEDIATE END POST ASSEMBLIES SHALL BE 400 FEET MAXIMUM.
3. WIRE FOR FENCE, BARBED OR WOVEN, SHALL BE SPECIFIED.
4. AT GATE LOCATION, TERMINATE FENCE WIRE WITH DOUBLE WRAP AROUND GATE POST.

5 WIRE GATE AND INTERMEDIATE END POST ASSEMBLY

NTS

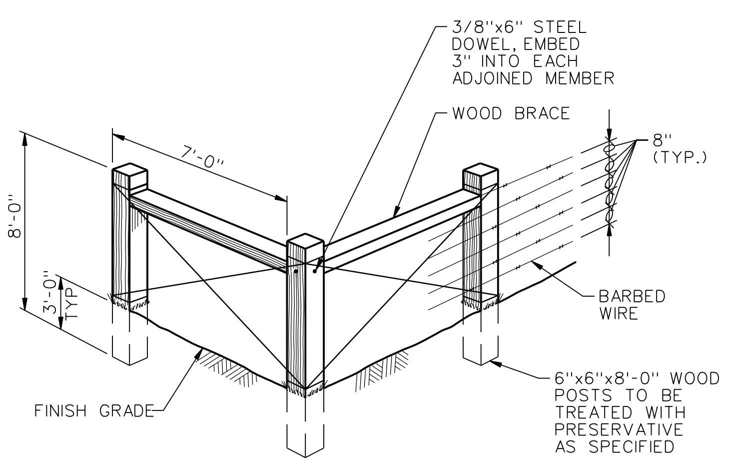
B2-000031002



4 FIELD GATE

NTS

B2-000031002



2 CORNER POST ASSEMBLY

NTS

B2-000031002

Worley energy | chemicals | resources — TEXAS REGISTERED ENGINEERING FIRM F-1480

JACOBS — TEXAS REGISTERED ENGINEERING FIRM F-2966

REV. MARK	REVISION	BY	CHK	APP	DATE	REV. MARK	REVISION	BY	CHK	APP	DATE

DRAWING ISSUE RECORD

ISSUE NO.	REV	MATERIAL OR JOB SPEC	BID	FAB	CONST	REF

DATE ISSUED FOR

DESIGNED	S. YANAGIHARA	4/22
DRAWN	R. BROWN	4/22
CHECKED	D. PETERSON	4/22
APPROVED	S. YANAGIHARA	4/22
PROJ. ENGR.	R. BELL	4/22
MFG. REP.	R. REHMAN	4/22

STATUS | PLANT NO.

P.E. SEAL: THIS DOCUMENT IS RELEASED FOR THE PURPOSE OF INTERIM REVIEW UNDER THE AUTHORITY OF SCOTT YANAGIHARA TEXAS P.E. 137477 ON MARCH 3, 2023. IT IS NOT TO BE USED FOR BIDDING OR CONSTRUCTION PURPOSES

THE DOW CHEMICAL COMPANY

TEXAS OPERATIONS — FREEPORT, TEXAS

ENVIRONMENTAL OPERATIONS — HARRIS EXPANSION

HARRIS EXPANSION PROJECT
SITE FENCING
DETAILS

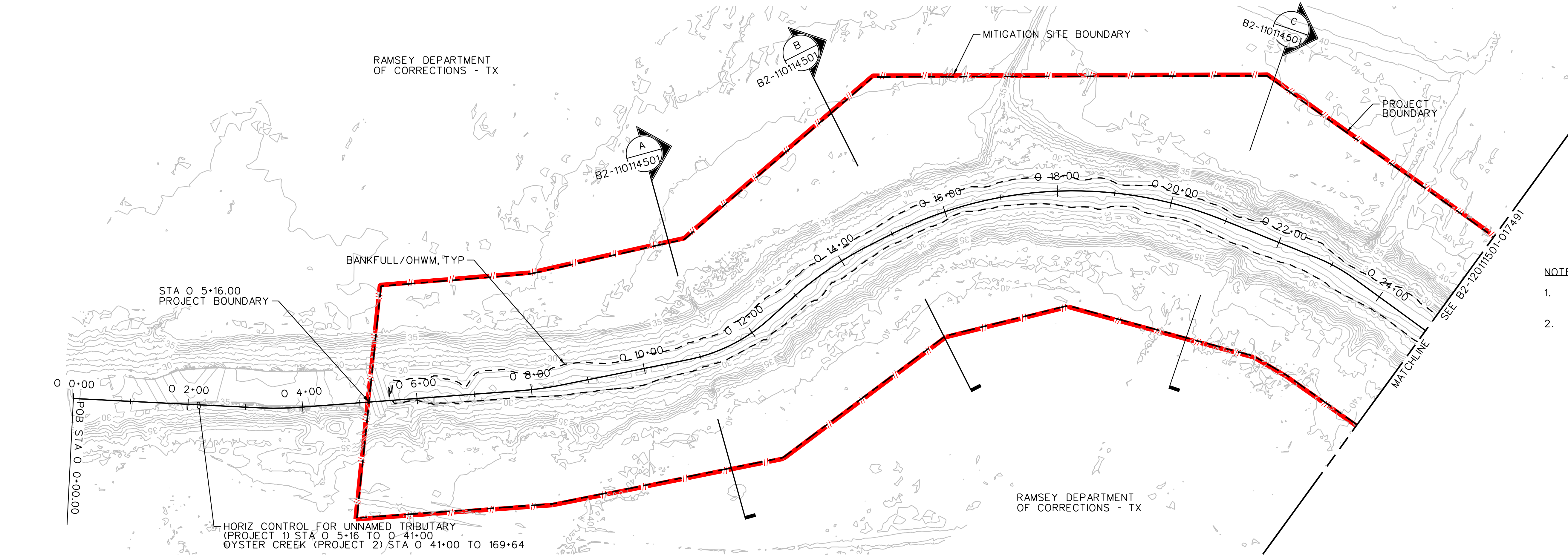
PROJECT NUMBER	SCALE	DRAWING NO.	REV.
017491	AS NOTED	B2-000036001-017491	2

PRINTED | VER. CIV

B2-000036001-017491.dgn

2023\03\03 12:44:49 PM

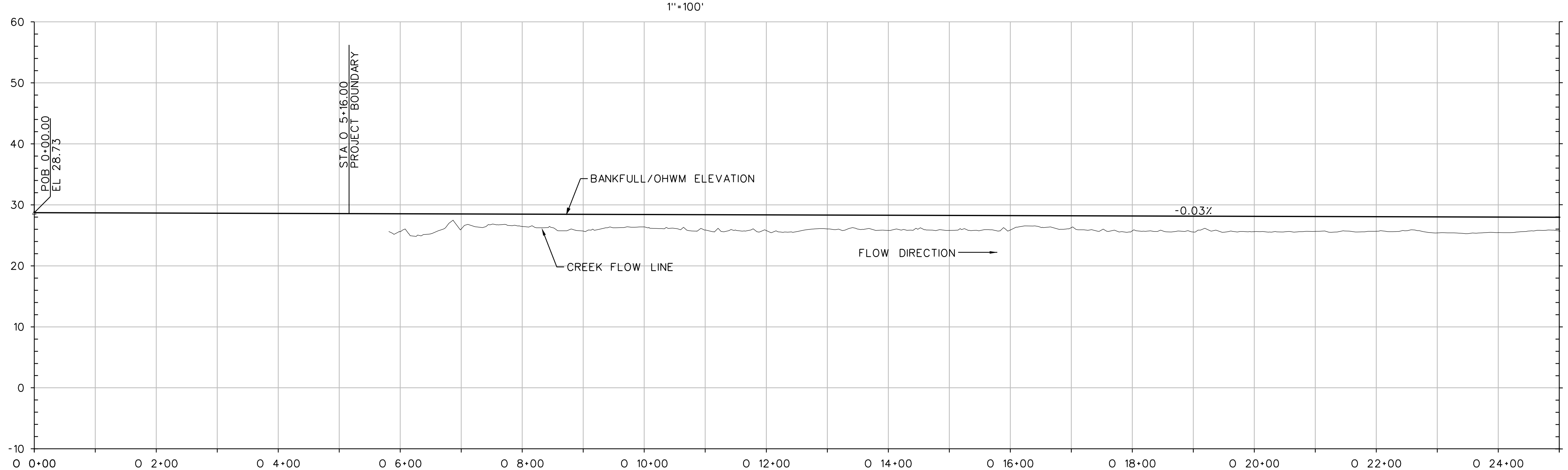
$INSTRUCTIONS $PERSON $TIME $DATE



PLAN
1"=100'

NOTES:

1. CREEK BATHYMETRY UPSTREAM OF STA 0 5+82 IS INACCURATE.
2. FOR HORIZONTAL CONTROL OF OYSTER CREEK, SEE DWG B2-000010002A-017491.



PROFILE
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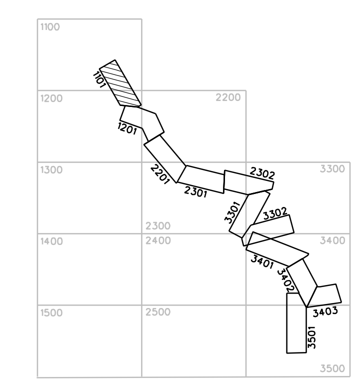
1"=10' VERT



KEY MAP

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B2-110111501-017491.dgn

Worley energy | chemicals | resources — TEXAS REGISTERED ENGINEERING FIRM F-1480
JACOBS — TEXAS REGISTERED ENGINEERING FIRM F-2966

REV. MARK	REVISION	BY	CHK	APP	DATE	REV. MARK	REVISION	BY	CHK	APP	DATE

DRAWING ISSUE RECORD

ISSUE NO.	REV	MATERIAL OR JOB SPEC	BID	FAB	CONST	REF

DESIGNED: S. YANAGIHARA
DRAWN: J. WALKER
CHECKED: D. STEWART
APPROVED: S. YANAGIHARA
PROJ. ENGR.: R. BELL
MFG. REP.: R. REHMAN

STATUS / PLANT NO.

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THE DOW CHEMICAL COMPANY
TEXAS OPERATIONS — FREEPORT, TEXAS
ENVIRONMENTAL OPERATIONS — HARRIS EXPANSION

HARRIS EXPANSION PROJECT
OYSTER CREEK GRADING
PLAN & PROFILE STA 0 0+00 TO 0 25+00, AREA 1101

PROJECT NUMBER	SCALE		REV.
017491	1" = 100'-0"	B2-110111501-017491	2

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PLANTING SCHEDULE

ZONE	WOODY PLANTS: COMMON NAME	BOTANICAL NAME	SPACING	PLANTED ACRES	QTY	SEED MIX: COMMON NAME	BOTANICAL NAME	LBS PLS/AC	%	SEEDED ACRES	LBS PLS
1	COMMON BUTTONBUSH	*Cephalanthus occidentalis*	9' x 9'	6.76	1,818	BIG BLUESTEM	*Andropogon gerardii*	2.6	17	4.20	11
						BUSHY BLUESTEM	*Andropogon glomeratus*	1.0	7		4
						ILLINOIS BUNDLEFLOWER	*Desmanthus illinoensis*	1.0	7		4
	BLACK WILLOW	*Salix nigra*			1,818	SWITCHGRASS	*Panicum virgatum*	4.5	30		19
						PRAIRIE CORDGRASS	*Spartina pectinata*	4.5	30		19
						GAPING PANICUM	*Steinchisma hians*	0.4	3		2
						EASTERN GAMMAGRASS	*Tripsacum dactyloides*	1.0	7		4
		TOTAL			3,636		**TOTAL**	15.0	100		63
						SUBSTITUTES (IF NECESSARY):					
						BROOMSEDGE BLUESTEM	*Andropogon virginicus*				
						MISTFLOWER	*Conoclinium spp.*				
						LATE BONESET	*Eupatorium serotinum*				

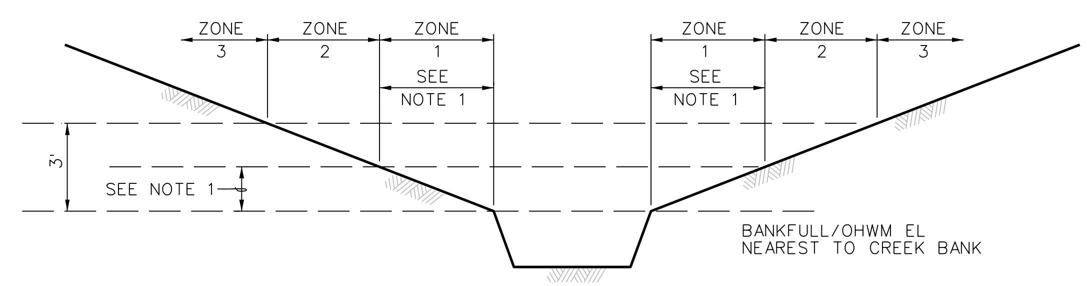
ZONE	WOODY PLANTS: COMMON NAME	BOTANICAL NAME	SPACING	PLANTED ACRES	QTY	SEED MIX: COMMON NAME	BOTANICAL NAME	LBS PLS/AC	%	SEEDED ACRES	LBS PLS
2	RED MAPLE	*Acer rubrum*	9' x 9'	26.73	1,798	BIG BLUESTEM	*Andropogon gerardii*	2.7	18	28.50	77
	SUGARBERRY	*Celtis laevigata*			1,798	SIDEOATS GRAMA	*Bouteloua curtipendula*	3.6	24		103
	ROUGHLEAF DOGWOOD	*Cornus drummondii*			1,798	ILLINOIS BUNDLEFLOWER	*Desmanthus illinoensis*	1.0	7		29
	COMMON PERSIMMON	*Diospyros virginiana*			1,798	GREEN SPRANGLETOP	*Leptochloa dubia*	0.3	2		9
	WATER OAK	*Quercus nigra*			1,798	SWITCHGRASS	*Panicum virgatum*	3.0	20		86
	DWARF PALMETTO	*Sabal minor*			1,798	LITTLE BLUESTEM	*Schizachyrium scoparium*	1.4	9		40
	AMERICAN ELM	*Ulmus americana*			1,798	INDIANGRASS	*Sorghastrum nutans*	2.0	13		57
	CEDAR ELM	*Ulmus crassifolia*			1,798	PRAIRIE CORDGRASS	*Spartina pectinata*	1.0	7		29
		TOTAL			14,384		**TOTAL**	15.0	100		428

ZONE	WOODY PLANTS: COMMON NAME	BOTANICAL NAME	SPACING	PLANTED ACRES	QTY	SEED MIX: COMMON NAME	BOTANICAL NAME	LBS PLS/AC	%	SEEDED ACRES	LBS PLS
3	RED MAPLE	*Acer rubrum*	9' x 9'	82.04	4,414	BIG BLUESTEM	*Andropogon gerardii*	2.0	13	81.12	162
	COMMON HACKBERRY	*Celtis occidentalis*			4,414	SIDEOATS GRAMA	*Bouteloua curtipendula*	3.6	24		292
	ROUGHLEAF DOGWOOD	*Cornus drummondii*			4,414	ILLINOIS BUNDLEFLOWER	*Desmanthus illinoensis*	1.1	7		89
	COMMON PERSIMMON	*Diospyros virginiana*			4,414	GREEN SPRANGLETOP	*Leptochloa dubia*	0.3	2		24
	CAROLINA LAURELCHERRY	*Prunus caroliniana*			4,414	SWITCHGRASS	*Panicum virgatum*	3.0	20		243
	WATER OAK	*Quercus nigra*			4,414	LITTLE BLUESTEM	*Schizachyrium scoparium*	2.0	13		162
	LIVE OAK	*Quercus virginiana*			4,414	INDIANGRASS	*Sorghastrum nutans*	3.0	20		243
	WESTERN SOAPBERRY	*Sapindus saponaria*			4,414		**TOTAL**	15.0	100		1,217
	AMERICAN ELM	*Ulmus americana*			4,414						
	CEDAR ELM	*Ulmus crassifolia*			4,414						
		TOTAL			44,140						

NOTE: FOR THE THREE ZONES COMBINED, THE TOTAL NUMBER OF PLANTS IS 62,160 (538 STEMS/ACRE), AND THE TOTAL WEIGHT OF SEED MIX IS 1,708 LBS PLS.

GENERAL PLANTING NOTES

1. CONTRACTOR SHALL COORDINATE WITH THE WORK OF OTHER TRADES TO ENSURE PROPER AND TIMELY EXECUTION OF THE WORK
2. WOODY PLANTS IN ZONE 1 CAN BE LIVE STAKES, CUTTINGS, BARE ROOT SPRINGS, OR CONTAINERIZED.
3. TO ESTABLISH DIFFERENT AGE CLASSES, A MINIMUM OF 1% OF THE WOODY PLANTS IN ZONE 2, AND 1% IN ZONE 3, SHALL BE AT LEAST 1 AGE CLASS OLDER THAN BARE ROOT SPRIGS PLANTED ONSITE.
4. PLANTING (P) AND SEEDING (S) ACREAGES FOR ZONES 1 AND 2 ARE ESTIMATED ASSUMING AN 11' WIDTH FOR ZONE 1 IN P1•2 AND PS1•2 POLYGONS (ZONES).
5. THE TARGET AS-BUILT PLANTING DENSITY IS 538 STEMS/ACRE (1 STEM PER 81 SQ FT). PLANT AND SEED QUANTITIES IN THE PLANTING SCHEDULE ARE COMPUTED BASED ON ACREAGES DERIVED FROM THE DRAWINGS.
6. THE NUMBER OF PLANTS PER ZONE IN THE PLANTING SCHEDULE ASSUMES AN EQUAL NUMBER OF PLANTS AMONG THE SPECIES LISTED. ADJUSTMENTS TO THE PLANT QUANTITIES BY SPECIES MAY BE REQUIRED DUE TO PLANT AVAILABILITY OR FIELD CONDITIONS, BUT 538 STEMS PER ACRE REMAINS THE TARGET.
7. PLANTING AND SEEDING LOCATIONS MAY BE SUBJECT TO CHANGE AS DIRECTED BY THE ENGINEER.
8. CONTRACTOR SHALL OBTAIN APPROVAL FROM ENGINEER FOR ANY DEVIATIONS FROM THE PLANTING SCHEDULE.



NOTES:
1. ZONE 1 EXTENDS UP TO 1.5' ABOVE, BUT NO MORE THAN 12' HORIZONTALLY, BEYOND THE BANKFULL/OHWM ELEVATION NEAREST TO CREEK BANK.
2. THE PLANTING PLAN DRAWINGS SHOW THE CREEK SIDE OF ZONE 1 AT THE BANKFULL/OHWM EL, AND THE LIMITS OF ZONE 3. THE BOUNDARY BETWEEN ZONES 1 AND 2 IS TO BE DETERMINED IN THE FIELD PER NOTE 1.

1 PROJECTS 1 AND 2 PLANTING (P) AND SEEDING (S) ZONES RELATIVE TO BANKFULL/OHWM

NTS

B2-110181001

Worley energy | chemicals | resources TEXAS REGISTERED ENGINEERING FIRM F-1480
JACOBS TEXAS REGISTERED ENGINEERING FIRM F-2966

REV. MARK	REVISION	BY	CHK	APP	DATE	REV. MARK	REVISION	BY	CHK	APP	DATE

DRAWING ISSUE RECORD

ISSUE NO.	REV	MATERIAL OR JOB SPEC	BID	FAB	CONST	REF
			DATE ISSUED FOR			

DESIGNED	J. SPEIGHTS	5/22
DRAWN	J. WALKER	5/22
CHECKED	S. MILLER	5/22
APPROVED	S. YANAGIHARA	5/22
PROJ. ENGR.	R. BELL	5/22
MFG. REP.	R. REHMAN	5/22

STATUS | PLANT NO.

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THE DOW CHEMICAL COMPANY
TEXAS OPERATIONS FREEPORT, TEXAS
ENVIRONMENTAL OPERATIONS HARRIS EXPANSION
HARRIS EXPANSION PROJECT
OYSTER CREEK
PLANTING SCHEDULE

PROJECT NUMBER	SCALE		REV.
017491	1" = 30'-0"	B2-000085001-017491	2

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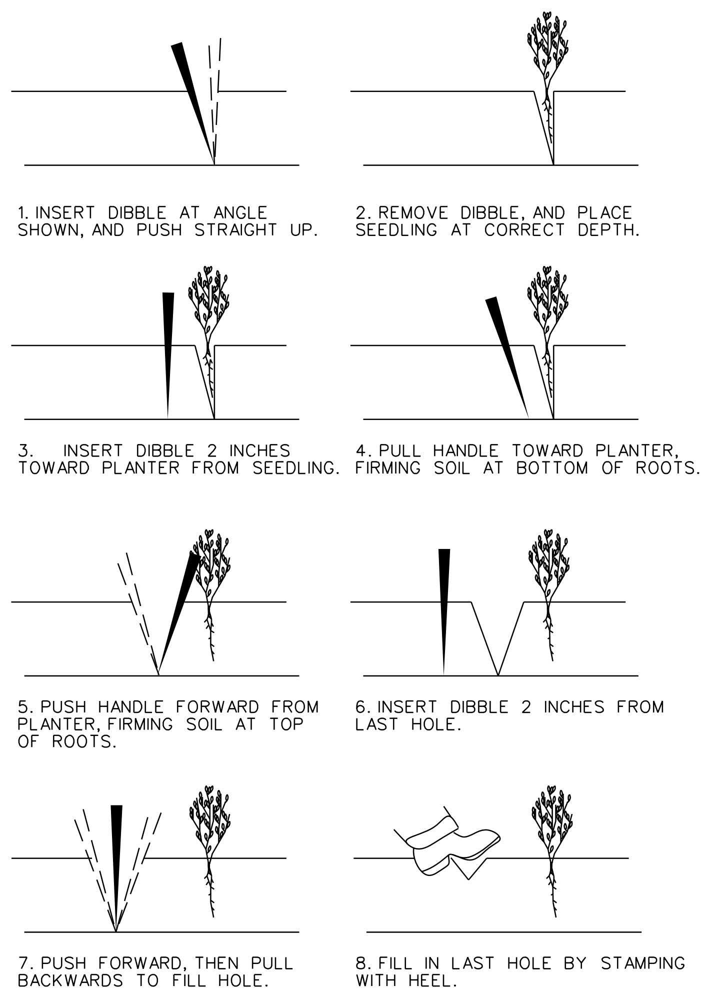


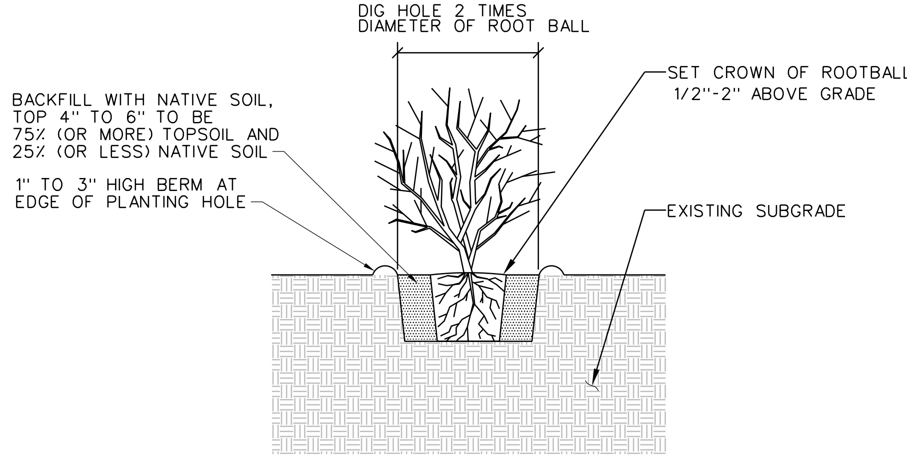
(SOURCE: NRCS, TEXAS FORESTRY TECH. NOTE, TX-FS-12-4)

NOTES:

1. DURING PLANTING, SEEDLINGS SHALL BE KEPT IN A MOIST CANVAS BAG OR SIMILAR CONTAINER TO PREVENT THE ROOT SYSTEMS FROM DRYING.
2. ALL SEEDLINGS SHALL BE ROOT PRUNED, IF NECESSARY, SO THAT NO ROOTS EXTEND MORE THAN 10 INCHES BELOW THE ROOT COLLAR.
3. ROOTS SHALL NOT BE J-HOOKED WHEN PLANTED.

1 BARE ROOT SPRIG INSTALLATION

NTS

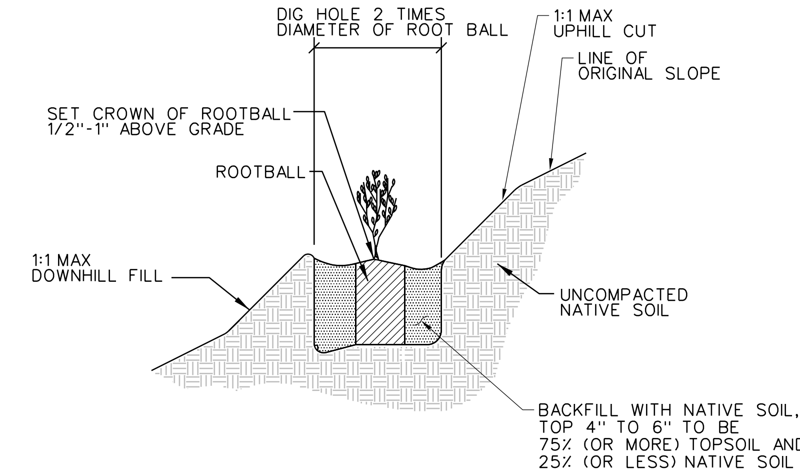


NOTES:

1. WATER HOLES BEFORE PLANTING, PLANT/FILL HOLE, TAMP DOWN SOIL TO REMOVE AIR POCKETS AND WATER AGAIN IMMEDIATELY AFTER PLANTING.
2. MULCH THE NEWLY PLANTED AREA WITH WOOD STRAW AT 75% COVER.

2 CONTAINER PLANTING

NTS

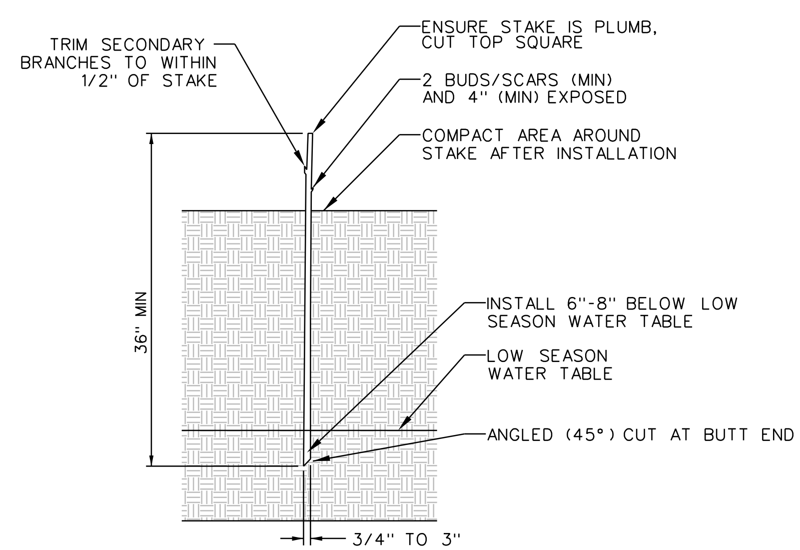


NOTES:

1. WATER HOLES BEFORE PLANTING, PLANT/FILL HOLE, TAMP DOWN SOIL TO REMOVE AIR POCKETS AND WATER AGAIN IMMEDIATELY AFTER PLANTING.
2. MULCH THE NEWLY PLANTED AREA WITH WOOD STRAW AT 75% COVER.

4 CONTAINER PLANTING ON SLOPE

NTS



NOTES:

1. PLANT IN LATE FALL, BUT NOT WHEN GROUND IS FROZEN, OR IN EARLY SPRING WHILE STILL DORMANT.
2. PUSH OR USE A RUBBER MALLET TO DRIVE POINTED END OF STAKE INTO GROUND.

3 LIVE STAKE INSTALLATION

NTS

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JACOBS — TEXAS REGISTERED ENGINEERING FIRM F-2966

REV. MARK	REVISION	BY	CHK	APP	DATE	REV. MARK	REVISION	BY	CHK	APP	DATE

DRAWING ISSUE RECORD

ISSUE NO.	REV	MATERIAL OR JOB SPEC	BID	FAB	CONST	REF

DATE ISSUED FOR

DESIGNED	J. SPEIGHTS	5/22
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CHECKED	S. MILLER	5/22
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MFG. REP.	R. REHMAN	5/22

STATUS | PLANT NO.

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THE DOW CHEMICAL COMPANY

TEXAS OPERATIONS — FREEPORT, TEXAS
ENVIRONMENTAL OPERATIONS — HARRIS EXPANSION

HARRIS EXPANSION PROJECT
OYSTER CREEK
PLANTING DETAILS

PROJECT NUMBER	SCALE		REV.
017491	AS NOTED	B2-000086001-017491	2

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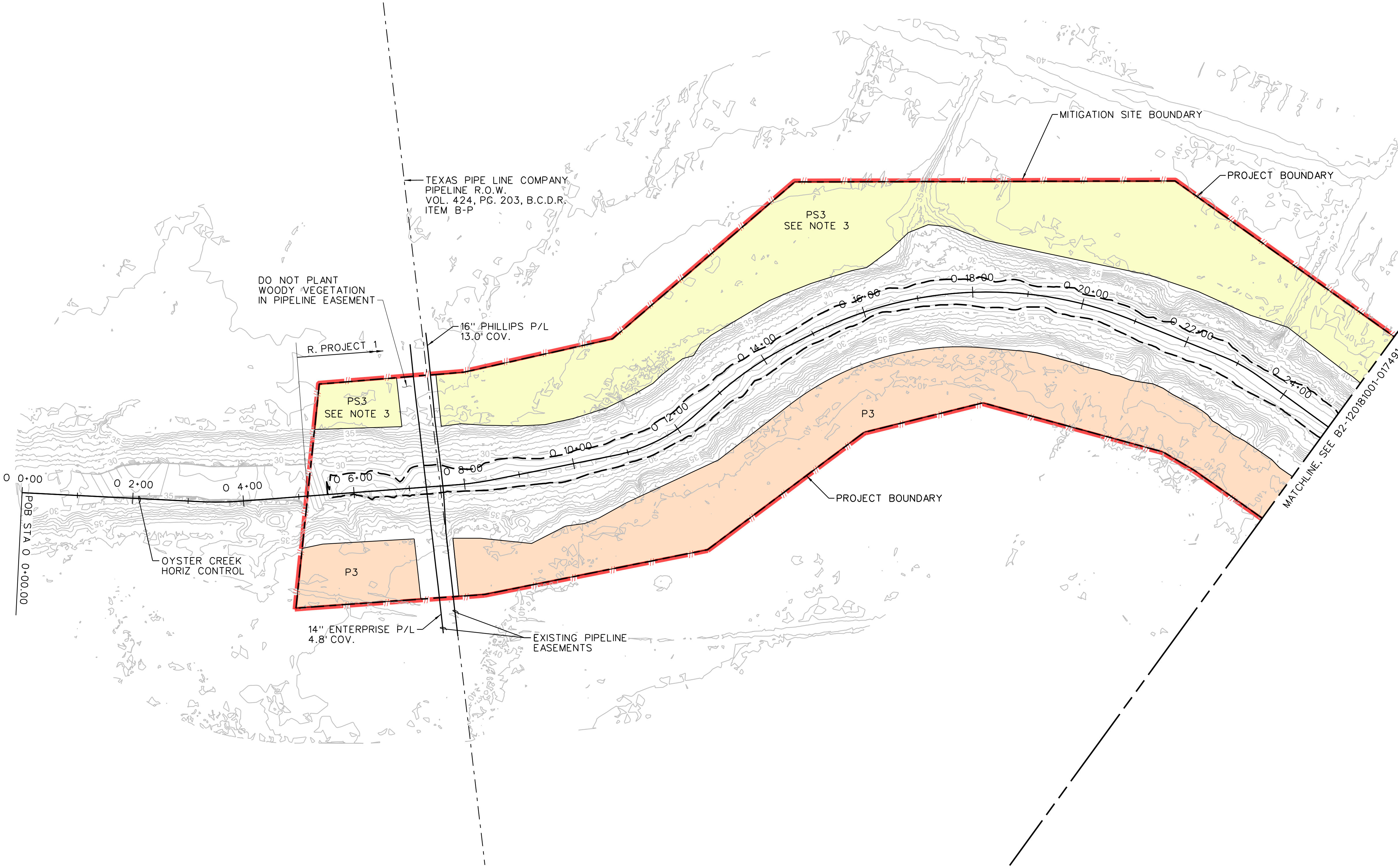


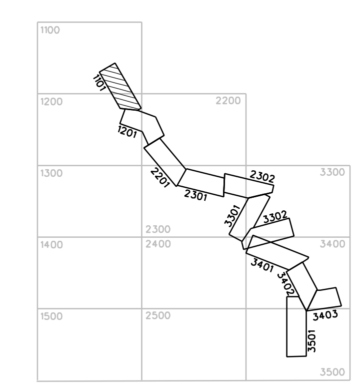
LEGEND:

PLANTING (P) AND SEEDING (S) ZONES

P1+2	ZONES 1 AND 2, PLANTS ONLY
P3	ZONE 3, PLANTS ONLY
PS1	ZONE 1, PLANTS AND SEED
PS1+2	ZONES 1 AND 2, PLANTS AND SEED
PS3	ZONE 3, PLANTS AND SEED
S1	ZONE 1, SEED ONLY
S2	ZONE 2, SEED ONLY
S3	ZONE 3, SEED ONLY
— —	APPROXIMATE LOCATION OF BANKFULL/OHWM ELEVATION

NOTES:

1. EXISTING CONTOURS ARE SCREENED.
2. PROPOSED CONTOURS, WHICH APPLY ONLY TO EXCAVATION AREAS, ARE BLACK.
3. SEEDING AREAS TO BE VERIFIED IN THE FIELD FOR CONGRUENCY WITH LOCATIONS OF EXISTING VEGETATION AND REMOVAL OF INVASIVE SPECIES.
4. FOR DEFINITIONS OF PLANTING AND SEEDING ZONES RELATIVE TO THE BANKFULL/OHWM ELEVATION, SEE 1 B2-000085001.
5. FOR SPECIES AND QUANTITIES PER ZONE, REFER TO THE PLANTING SCHEDULE ON DRAWING B2-000085001-017491.
6. FOR PLANTING DETAILS, SEE DRAWING B2-000086001-017491.



KEY MAP

0 100 200 300
SCALE IN FEET

Worley — TEXAS REGISTERED ENGINEERING FIRM F-1480
JACOBS — TEXAS REGISTERED ENGINEERING FIRM F-2966

DESIGNED J. SPEIGHTS	10/21
DRAWN J. WALKER	10/21
CHECKED S. MILLER	10/21
APPROVED S. YANAGIHARA	10/21
PROJ. ENGR. R. BELL	10/21
MFG. REP. R. REHMAN	10/21

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THE DOW CHEMICAL COMPANY
TEXAS OPERATIONS — FREEPORT, TEXAS
ENVIRONMENTAL OPERATIONS — HARRIS EXPANSION

HARRIS EXPANSION PROJECT
OYSTER CREEK PLANTING PLAN
STA O 0+00 TO O 25+00, AREA 1101

PROJECT NUMBER 017491 — SCALE 1" = 100'-0" — B2-110181001-017491 — REV. 2

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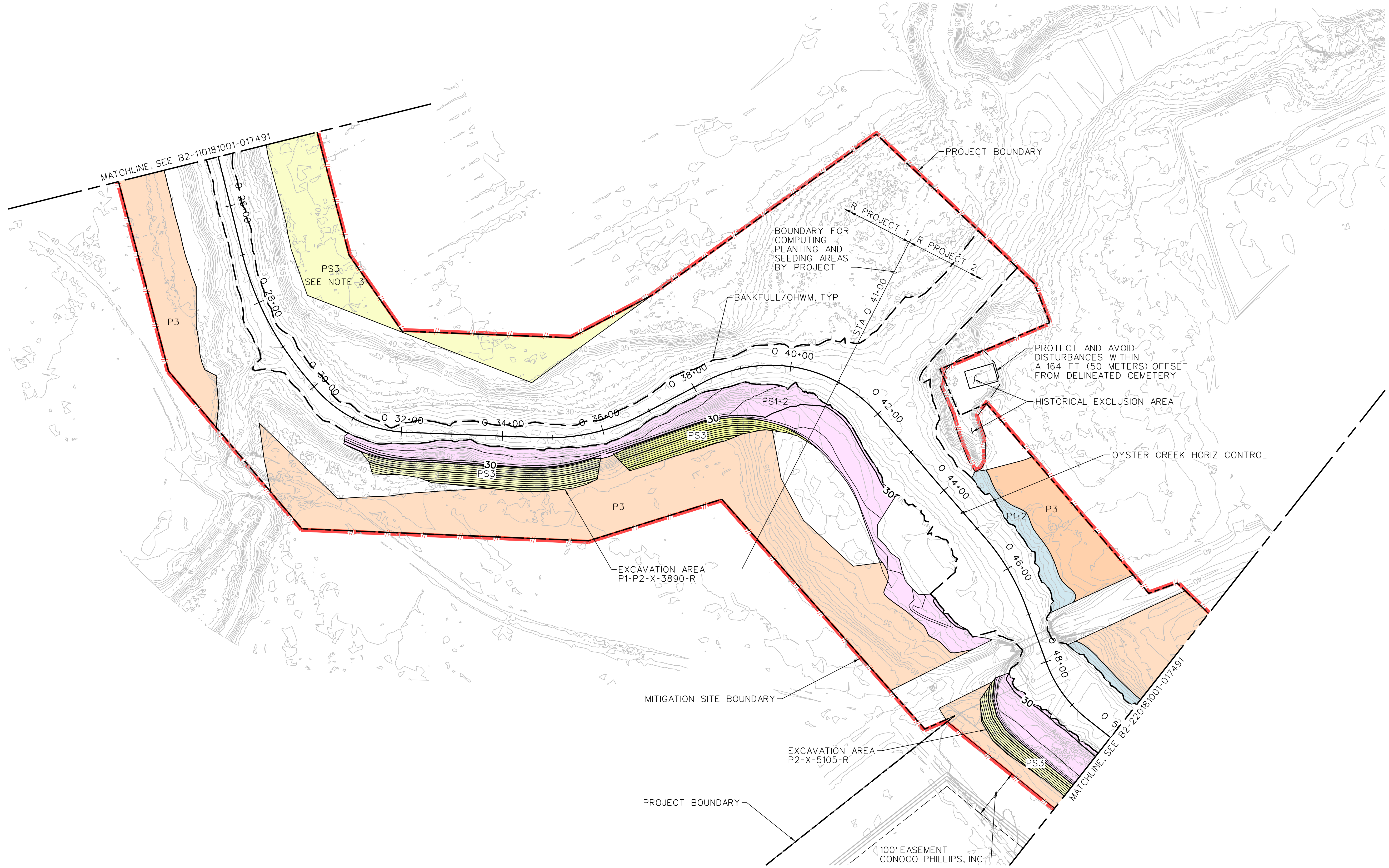
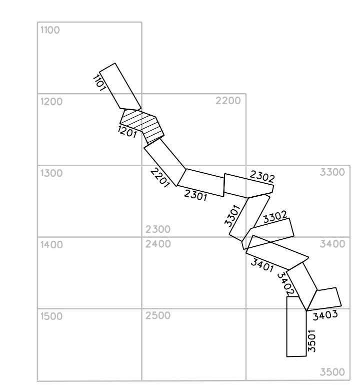
FOR NOTES AND LEGEND, SEE DRAWING B2-110181001-017491





KEY MAP

N

0 100 200 300
SCALE IN FEET

Worley energy | chemicals | resources
TEXAS REGISTERED ENGINEERING FIRM F-1480

JACOBS
TEXAS REGISTERED ENGINEERING FIRM F-2966

REV. MARK	REVISION	BY	CHK	APP	DATE	REV. MARK	REVISION	BY	CHK	APP	DATE

DRAWING ISSUE RECORD

ISSUE NO.	REV	MATERIAL OR JOB SPEC	BID	FAB	CONST	REF
			DATE ISSUED FOR			

DESIGNED	J. SPEIGHTS	9/21
DRAWN	J. WALKER	9/21
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STATUS | PLANT NO.

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THE DOW CHEMICAL COMPANY
TEXAS OPERATIONS FREEPORT, TEXAS
ENVIRONMENTAL OPERATIONS HARRIS EXPANSION

HARRIS EXPANSION PROJECT
OYSTER CREEK PLANTING PLAN
STATION O 25+00 TO O 50+00, AREA 1201

PROJECT NUMBER	SCALE		REV.
017491	1" = 100'-0"	B2-120181001-017491	2

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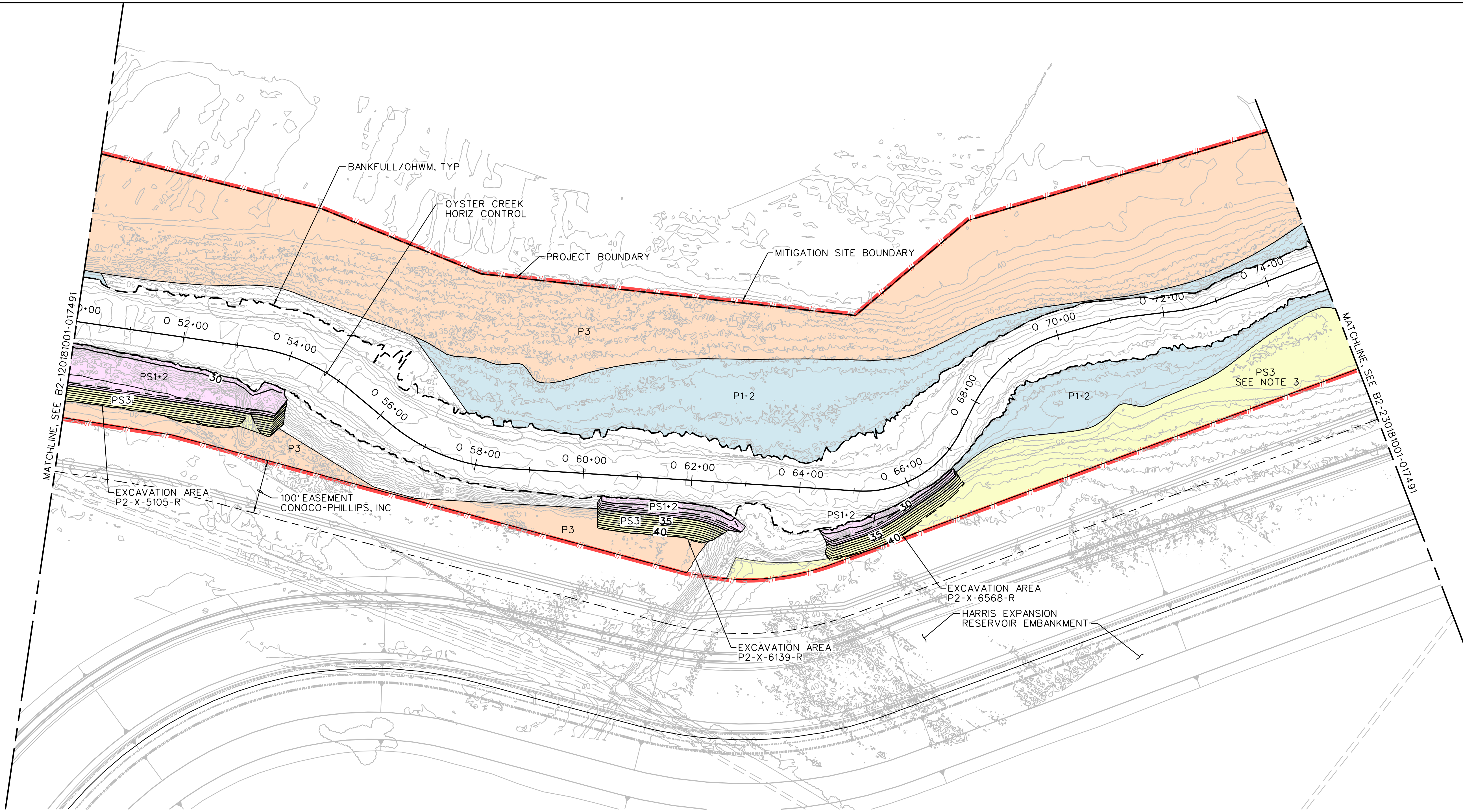
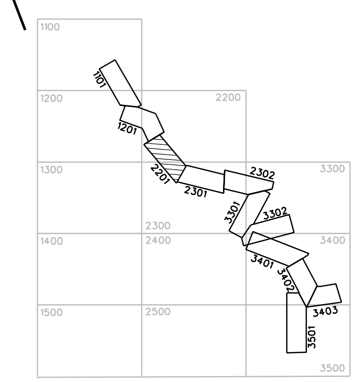
FOR NOTES AND LEGEND, SEE DRAWING B2-110181001-017491





KEY MAP

0 100 200 300
SCALE IN FEET

Worley energy | chemicals | resources
TEXAS REGISTERED ENGINEERING FIRM F-1480

JACOBS
TEXAS REGISTERED ENGINEERING FIRM F-2966

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THE DOW CHEMICAL COMPANY
TEXAS OPERATIONS — FREEPORT, TEXAS
ENVIRONMENTAL OPERATIONS — HARRIS EXPANSION

HARRIS EXPANSION PROJECT
OYSTER CREEK PLANTING PLAN
STA O 50+00 TO O 75+00, AREA 2201

PROJECT NUMBER	SCALE		REV.
017491	1" = 100'-0"	B2-220181001-017491	2

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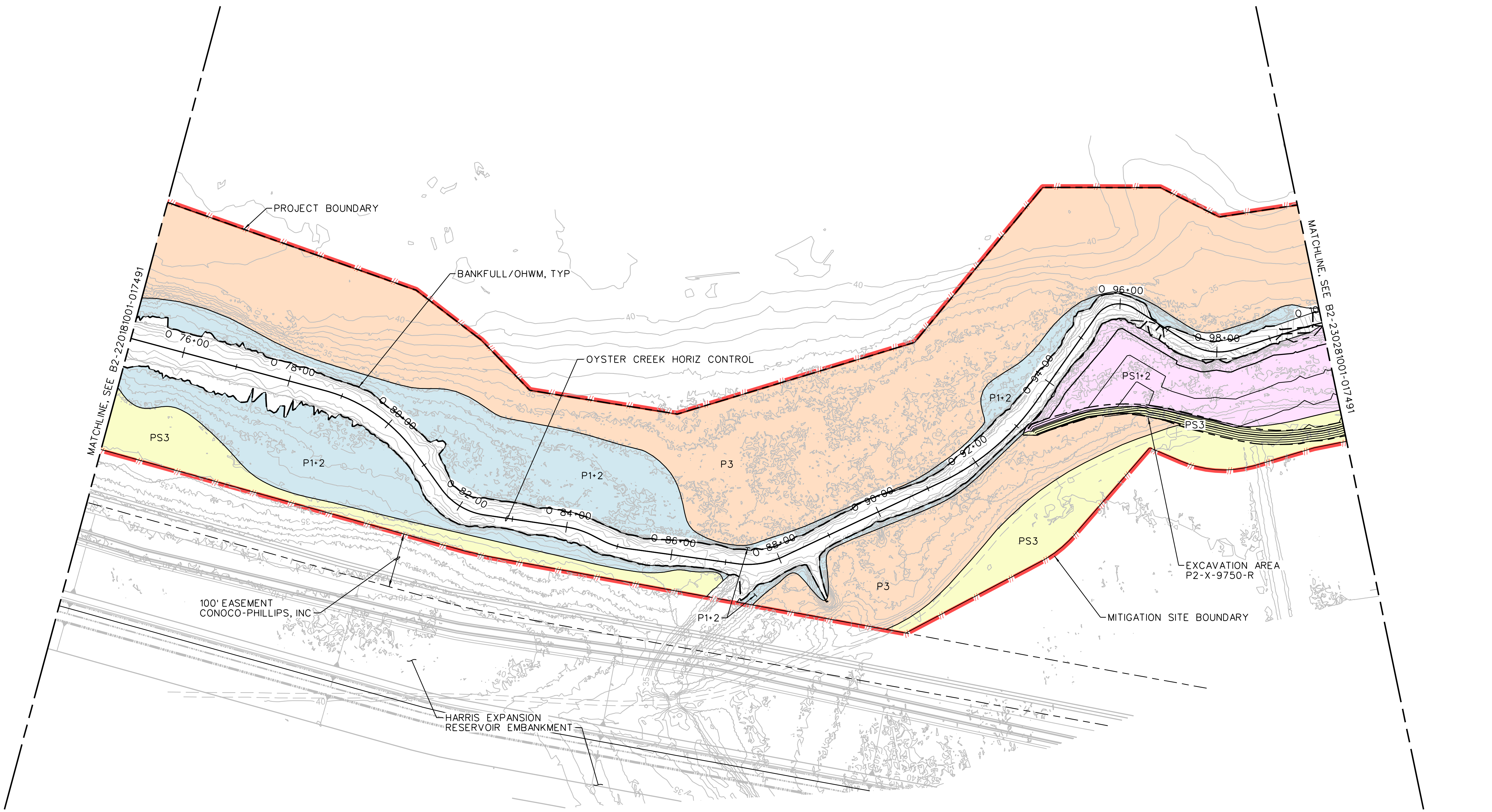

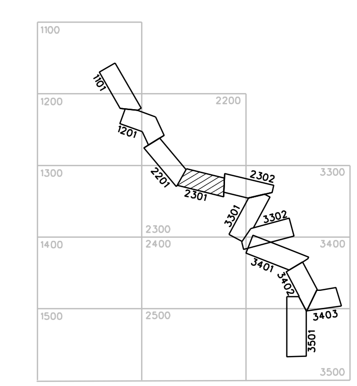

KEY MAP

N

0 100 200 300

SCALE IN FEET

Worley energy | chemicals | resources
TEXAS REGISTERED ENGINEERING FIRM F-1480

JACOBS
TEXAS REGISTERED ENGINEERING FIRM F-2966

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THE DOW CHEMICAL COMPANY

TEXAS OPERATIONS — FREEPORT, TEXAS
ENVIRONMENTAL OPERATIONS — HARRIS EXPANSION

HARRIS EXPANSION PROJECT
OYSTER CREEK PLANTING PLAN
STA O 75+00 TO O 100+00, AREA 2301

PROJECT NUMBER	SCALE		REV.
017491	1" = 100'-0"	B2-230181001-017491	2

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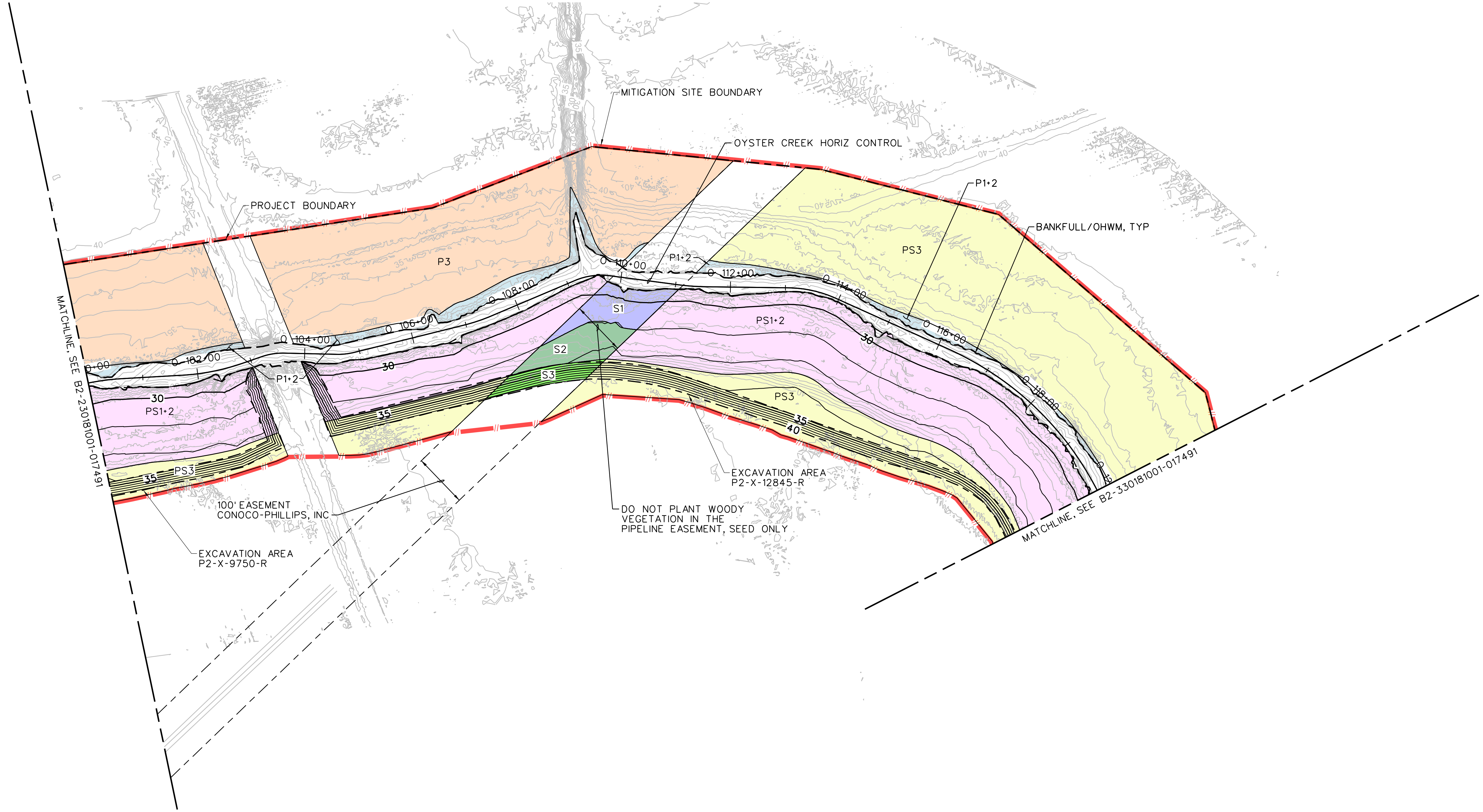
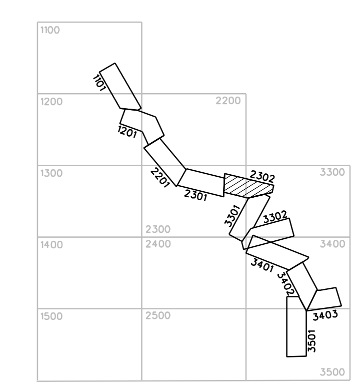
FOR NOTES AND LEGEND, SEE DRAWING B2-110181001-017491





KEY MAP

0 100 200 300
SCALE IN FEET

TEXAS REGISTERED ENGINEERING FIRM F-1480
TEXAS REGISTERED ENGINEERING FIRM F-2966

REV. MARK	REVISION	BY	CHK	APP	DATE	REV. MARK	REVISION	BY	CHK	APP	DATE

DRAWING ISSUE RECORD

ISSUE NO.	REV	MATERIAL OR JOB SPEC	BID	FAB	CONST	REF

DATE ISSUED FOR

DESIGNED	J. SPEIGHTS	10/21
DRAWN	J. WALKER	10/21
CHECKED	S. MILLER	10/21
APPROVED	S. YANAGIHARA	10/21
PROJ. ENGR.	R. BELL	10/21
MFG. REP.	R. REHMAN	10/21

STATUS | PLANT NO.

P.E. SEAL
THIS DOCUMENT IS RELEASED FOR THE PURPOSE OF INTERIM REVIEW UNDER THE AUTHORITY OF SCOTT YANAGIHARA TEXAS P.E. 137477 ON MARCH 3, 2023

IT IS NOT TO BE USED FOR BIDDING OR CONSTRUCTION PURPOSES

THE DOW CHEMICAL COMPANY
TEXAS OPERATIONS — FREEPORT, TEXAS
ENVIRONMENTAL OPERATIONS — HARRIS EXPANSION

HARRIS EXPANSION PROJECT
OYSTER CREEK PLANTING PLAN
STA O 100+00 TO O 120+00, AREA 2302

PROJECT NUMBER	SCALE		REV.
017491	1" = 100'-0"	B2-230281001-017491	2

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2023\03\03
B2-230281001-017491.dgn

$INSTRUCTIONS $PERSON $TIME $DATE

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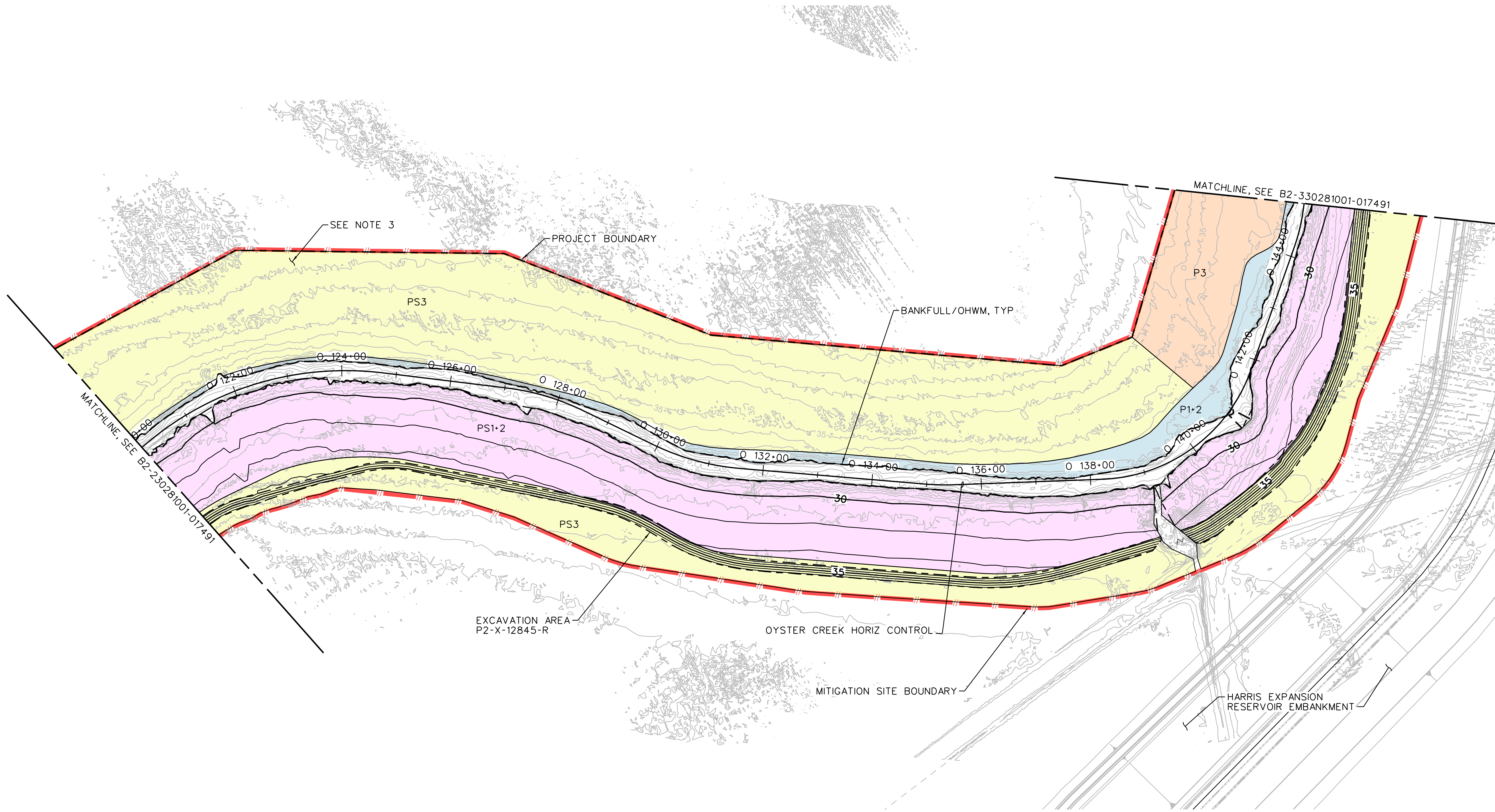
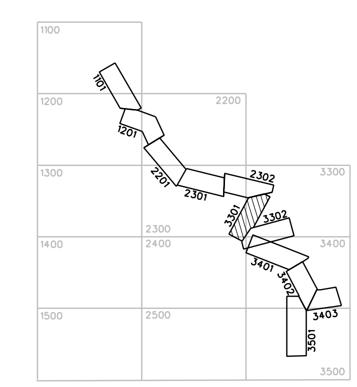
FOR NOTES AND LEGEND, SEE DRAWING B2-110181001-017491





KEY MAP

0 100 200 300
SCALE IN FEET

Worley
TEXAS REGISTERED ENGINEERING FIRM F-1480

JACOBS
TEXAS REGISTERED ENGINEERING FIRM F-2966

REV. MARK	REVISION	BY	CHK	APP	DATE	REV. MARK	REVISION	BY	CHK	APP	DATE

DRAWING ISSUE RECORD

ISSUE NO.	REV	MATERIAL OR JOB SPEC	BID	FAB	CONST	REF
			DATE ISSUED FOR			

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MFG. REP.	R. REHMAN	10/21

STATUS | PLANT NO.

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THE DOW CHEMICAL COMPANY
TEXAS OPERATIONS — FREEPORT, TEXAS
ENVIRONMENTAL OPERATIONS — HARRIS EXPANSION

HARRIS EXPANSION PROJECT
OYSTER CREEK PLANTING PLAN
STA O 120+00 TO O 145+00, AREA 3301

PROJECT NUMBER	SCALE		REV.
017491	1" = 100'-0"	B2-330181001-017491	2

PRINTED | VER. | CIV

B2-330181001-017491.dgn
2023\03\03
2:19:25 PM
$INSTRUCTIONS $PERSON $TIME $DATE

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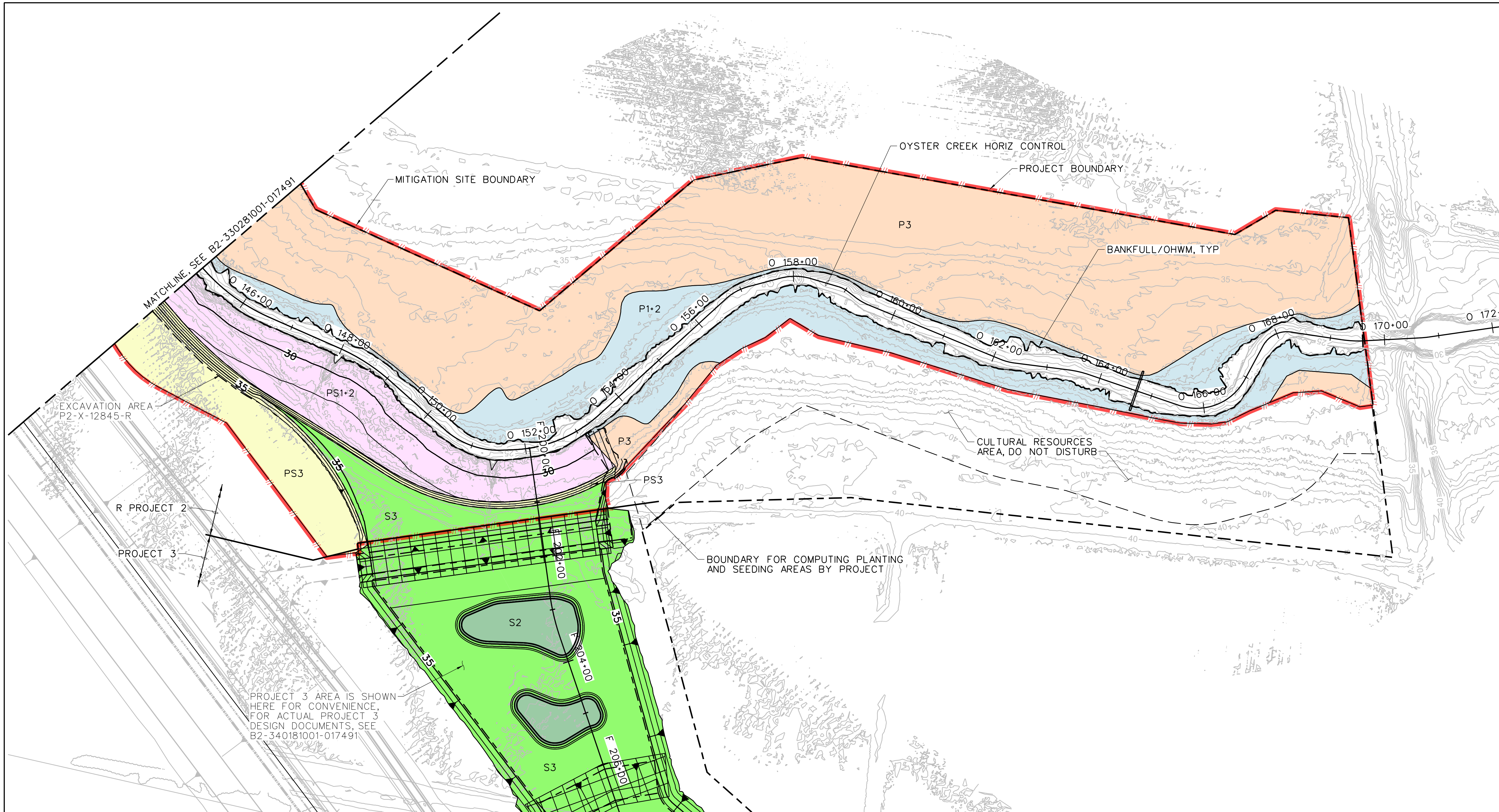
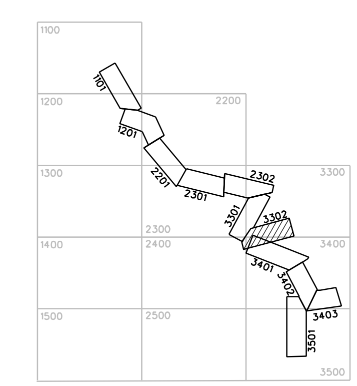
FOR NOTES AND LEGEND, SEE DRAWING B2-110181001-017491



FOR CONTINUATION SEE B2-340181001-017491



N

0 100 200 300
SCALE IN FEET

Worley — TEXAS REGISTERED ENGINEERING FIRM F-1480
JACOBS — TEXAS REGISTERED ENGINEERING FIRM F-2966

REV. MARK	REVISION	BY	CHK	APP	DATE	REV. MARK	REVISION	BY	CHK	APP	DATE

DRAWING ISSUE RECORD

ISSUE NO.	REV	MATERIAL OR JOB SPEC	BID	FAB	CONST	REF
			DATE ISSUED FOR			

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THE DOW CHEMICAL COMPANY

TEXAS OPERATIONS — FREEPORT, TEXAS
ENVIRONMENTAL OPERATIONS — HARRIS EXPANSION

HARRIS EXPANSION PROJECT
OYSTER CREEK PLANTING PLAN
STA O 145+00 TO END, AREA 3302

PROJECT NUMBER	SCALE		REV.
017491	1" = 100'-0"	B2-330281001-017491	2

CIV

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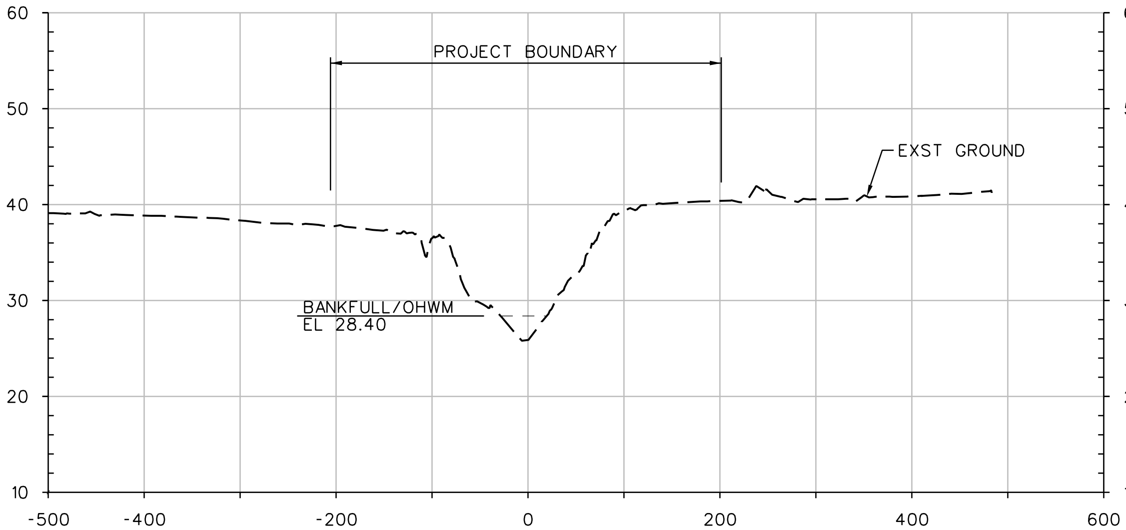
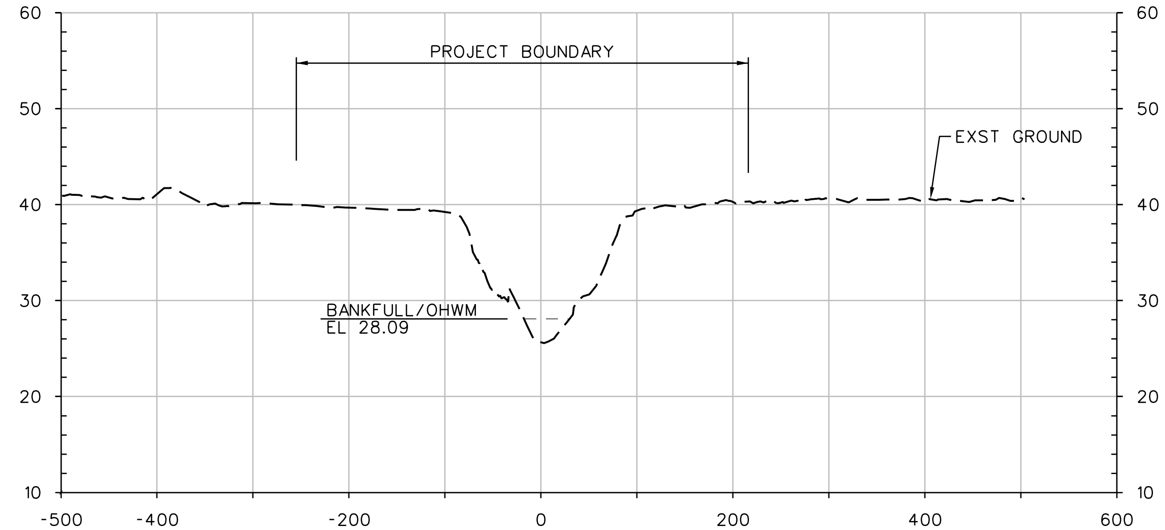
2:20:32 PM
2023\03\03
B2-330281001-017491.dgn
B2-330281001-017491.dgn
$INSTRUCTIONS $PERSON $TIME $DATE

NOTES:

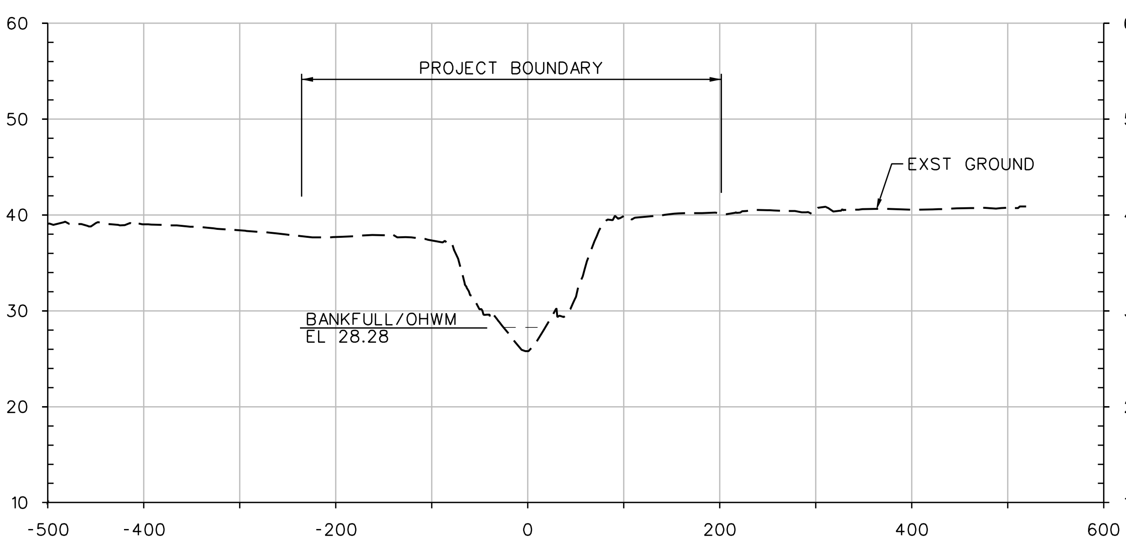
1. NEGATIVE STATIONS ARE LEFT OF CENTERLINE, LOOKING DOWNSTREAM.



(A) SECTION
1"=100' HORIZ
1"=10' VERT
B2-110111501



(C) SECTION
1"=100' HORIZ
1"=10' VERT
B2-110111501



(B) SECTION
1"=100' HORIZ
1"=10' VERT
b2-110111501

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2023\03\03
B2-110114501-017491.dgn

$INSTRUCTIONS $PERSON $TIME $DATE

Worley
TEXAS REGISTERED ENGINEERING FIRM F-1480

JACOBS
TEXAS REGISTERED ENGINEERING FIRM F-2966

REV. MARK	REVISION	BY	CHK	APP	DATE	REV. MARK	REVISION	BY	CHK	APP	DATE

DRAWING ISSUE RECORD

ISSUE NO.	REV	MATERIAL OR JOB SPEC	BID	FAB	CONST	REF

DATE ISSUED FOR

DESIGNED	S. YANAGIHARA	10/21
DRAWN	J. WALKER	10/21
CHECKED	D. STEWART	10/21
APPROVED	S. YANAGIHARA	10/21
PROJ. ENGR.	R. BELL	10/21
MFG. REP.	R. REHMAN	10/21

STATUS | PLANT NO.

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THE DOW CHEMICAL COMPANY
TEXAS OPERATIONS — FREEPORT, TEXAS
ENVIRONMENTAL OPERATIONS — HARRIS EXPANSION

HARRIS EXPANSION PROJECT
OYSTER CREEK GRADING
SECTIONS, AREA 1101

PROJECT NUMBER	SCALE		REV.
017491	AS NOTED	B2-110114501-017491	2

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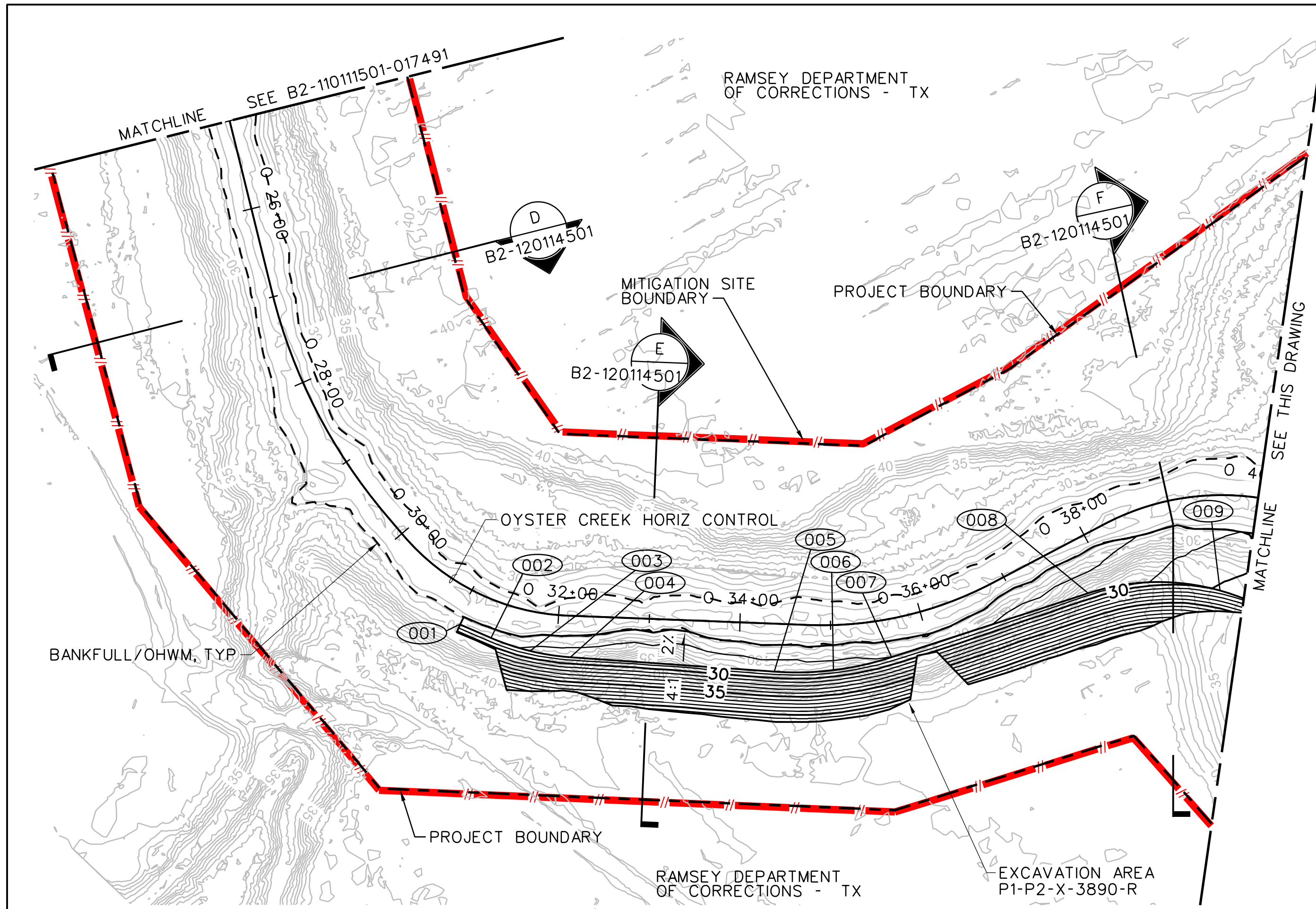
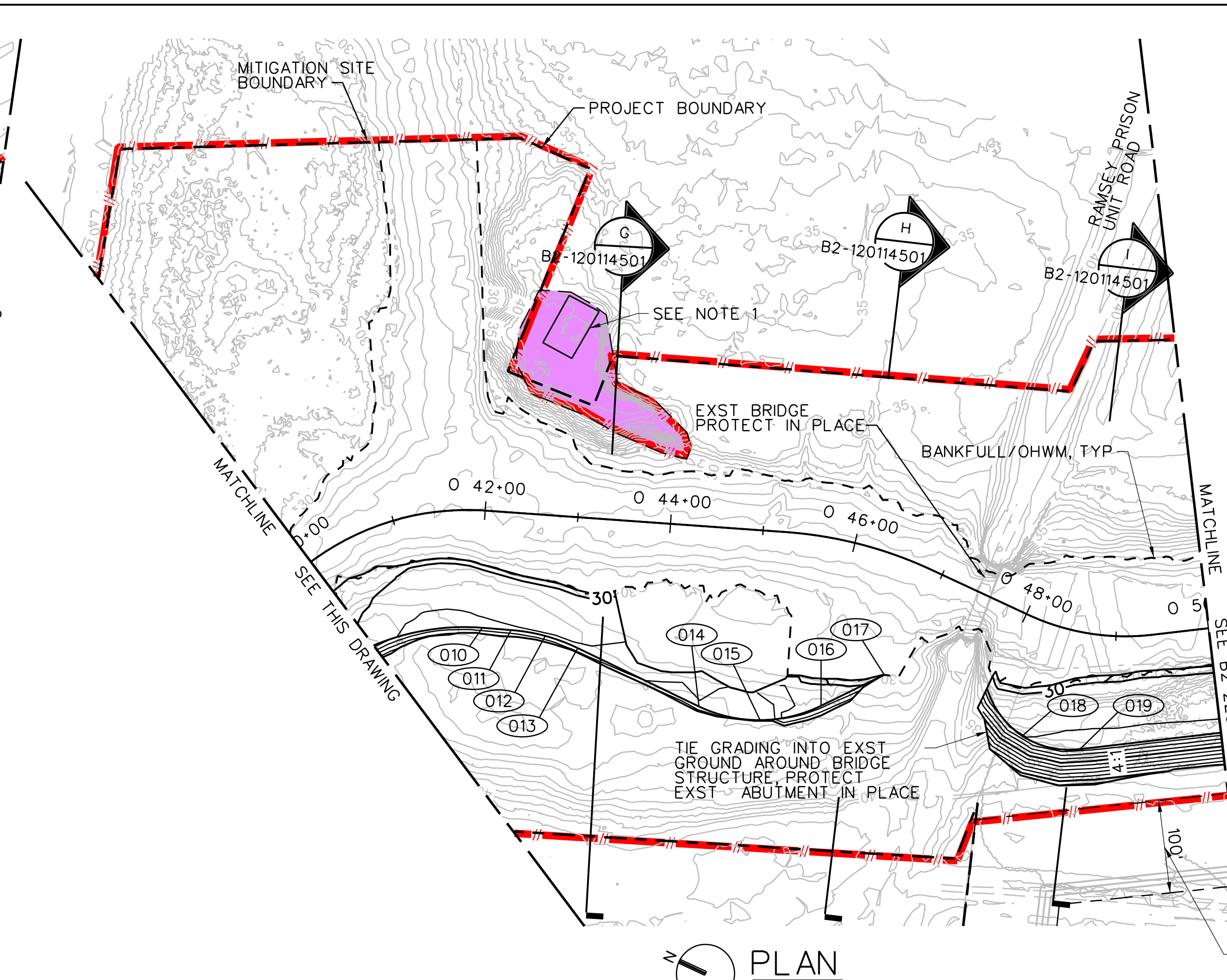
B2-110114501-017491.dgn



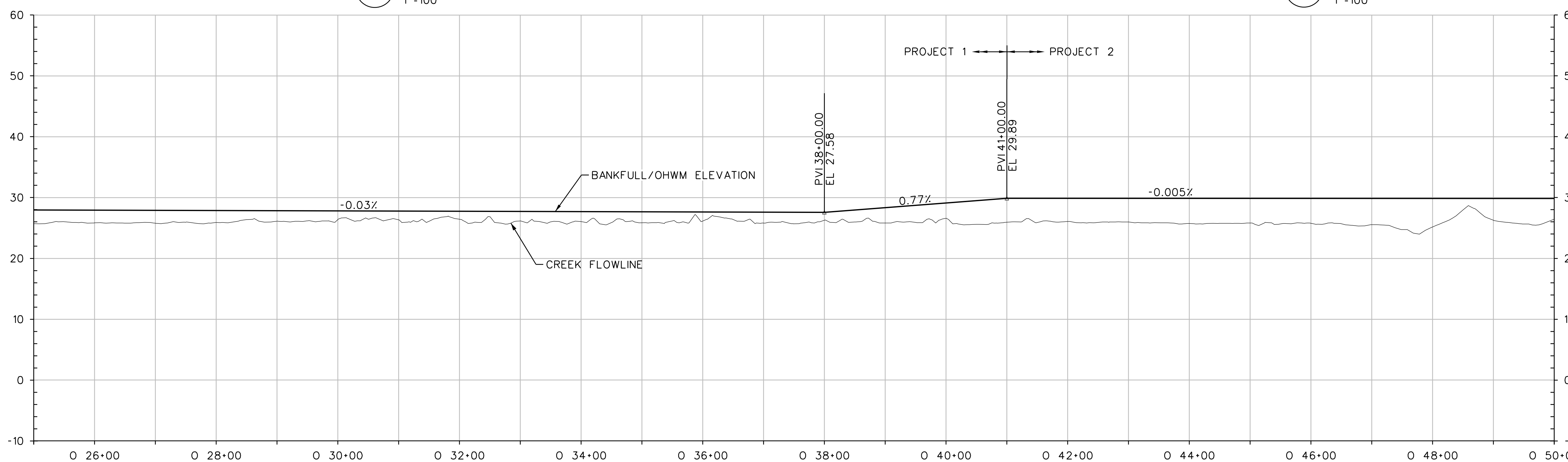
PLAN
1"=100'



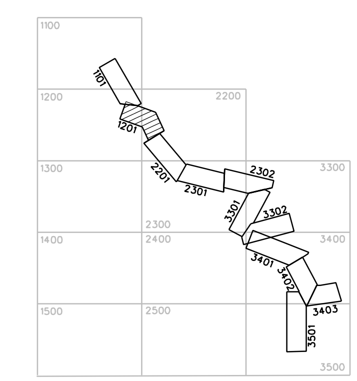
PLAN
1"=100'

NOTE:

1. CULTURAL RESOURCE AREA, DO NOT DISTURB. SITE WILL BE DELINEATED IN THE FIELD BY OTHERS PRIOR TO CONSTRUCTION.
2. FOR HORIZONTAL CONTROL OF OYSTER CREEK, SEE DWG B2-000010002A-017491.
3. (012) FOR HORIZONTAL CONTROL OF EXCAVATION AND GRADING HINGE POINT, SEE COORDINATE LISTING ON DWG B2-000025001-017491.



PROFILE
1"=100' HORIZ
1"=10' VERT



KEY MAP

2:25:51 PM
2023\03\03
B2-120111501-017491.dgn

REV. MARK	REVISION	BY	CHK	APP	DATE	REV. MARK	REVISION	BY	CHK	APP	DATE

DRAWING ISSUE RECORD

ISSUE NO.	REV	MATERIAL OR JOB SPEC	BID	FAB	CONST	REF
			DATE ISSUED FOR			

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APPROVED	S. YANAGIHARA	10/21
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MFG. REP.	R. REHMAN	10/21

STATUS | PLANT NO.

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Worley energy | chemicals | resources — TEXAS REGISTERED ENGINEERING FIRM F-1480
JACOBS — TEXAS REGISTERED ENGINEERING FIRM F-2966

THE DOW CHEMICAL COMPANY
TEXAS OPERATIONS — FREEPORT, TEXAS
ENVIRONMENTAL OPERATIONS — HARRIS EXPANSION
HARRIS EXPANSION PROJECT
OYSTER CREEK GRADING
PLAN & PROFILE, STA 0 25+00 TO 0 50+00, AREA 1201

PROJECT NUMBER	SCALE		REV.
017491	1" = 100'-0"	B2-120111501-017491	2

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B2-120111501-017491.dgn

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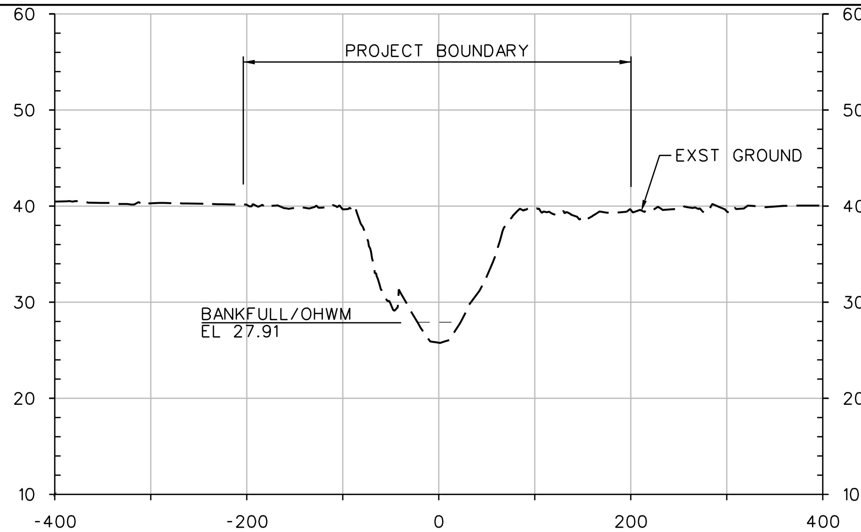
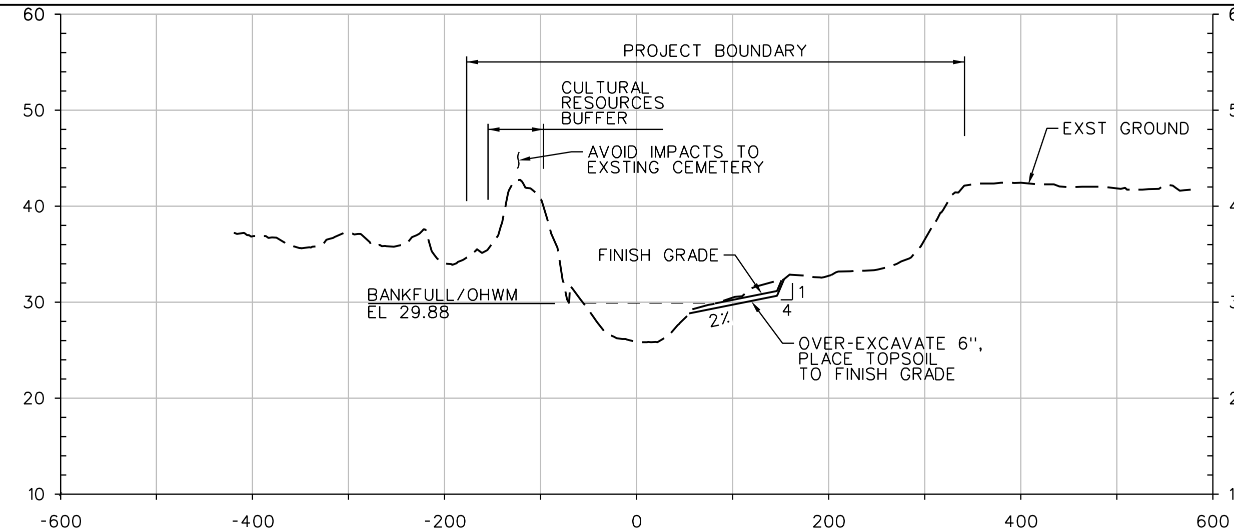
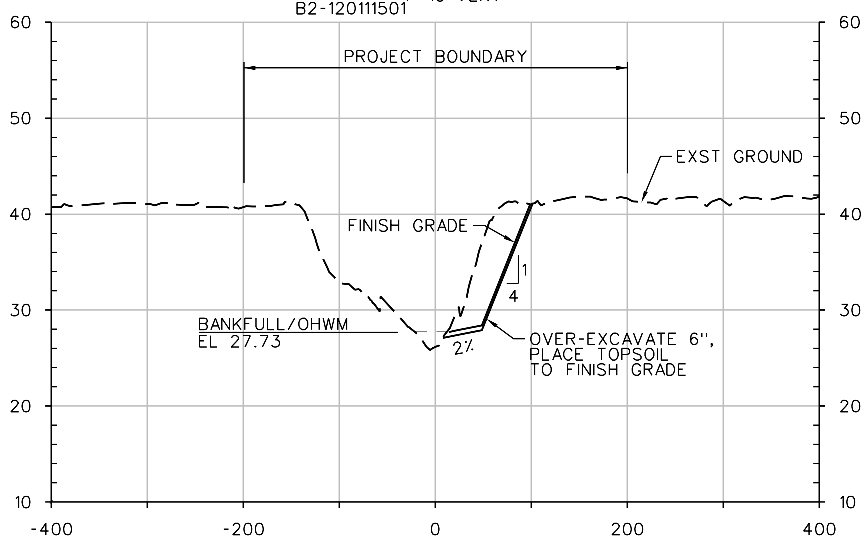
NOTES:
1. NEGATIVE STATIONS ARE LEFT OF CENTERLINE, LOOKING DOWNSTREAM.



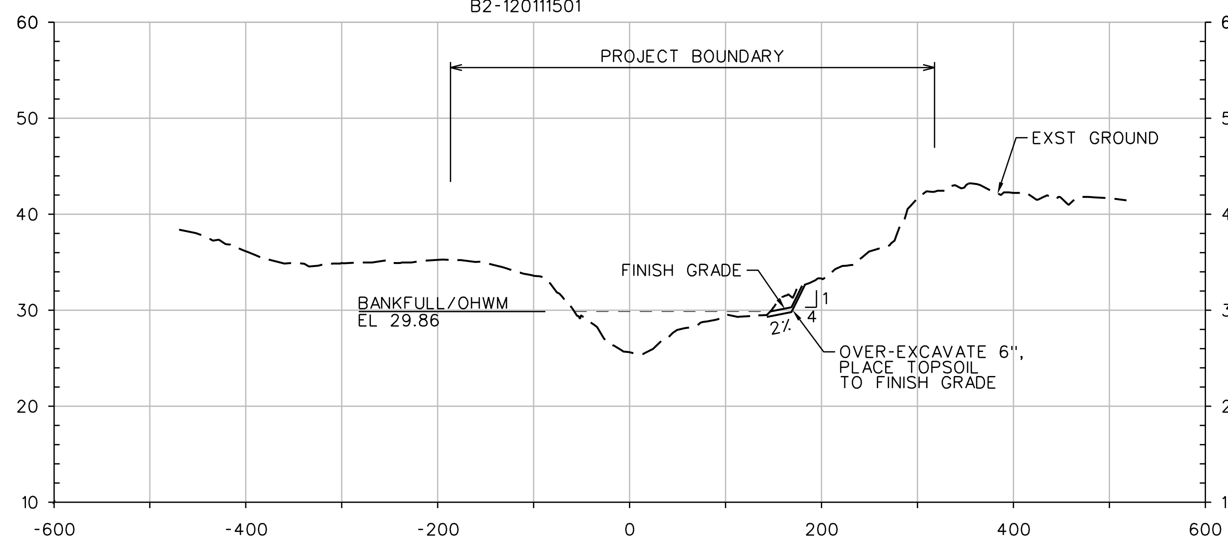
D SECTION
1''=100' HORIZ
1''=10' VERT
B2-120111501



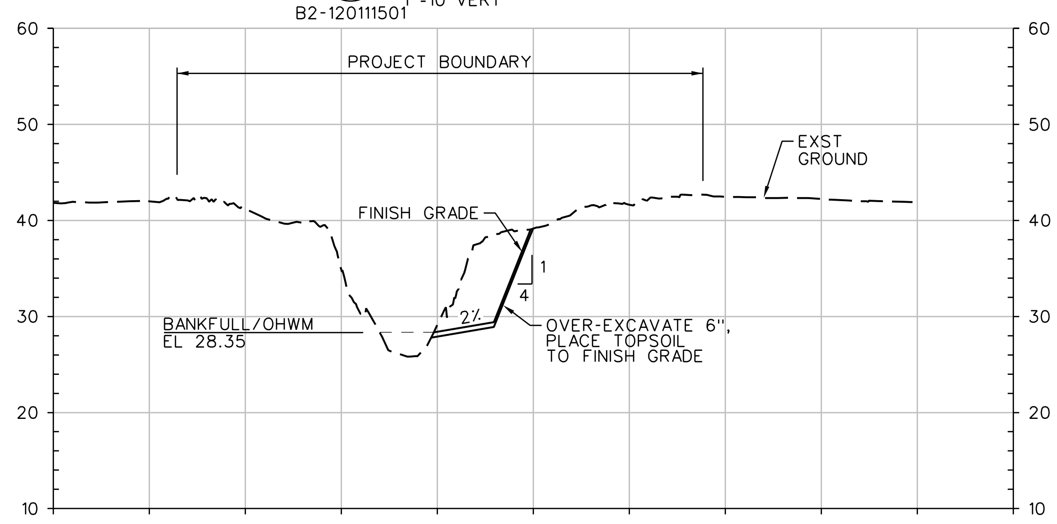
G SECTION
1''=100' HORIZ
1''=10' VERT
B2-120111501



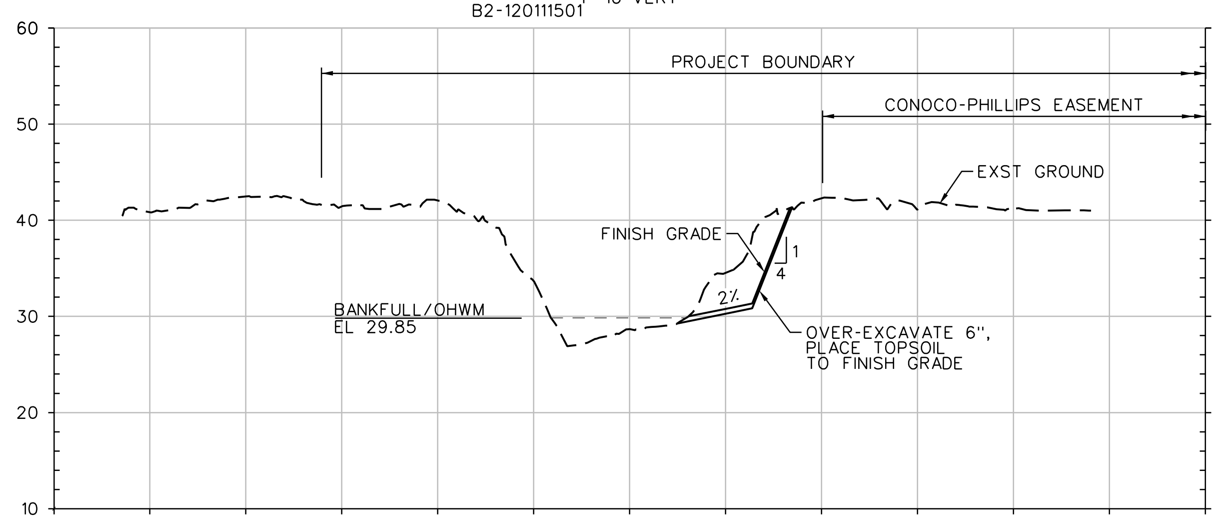
E SECTION
1''=100' HORIZ
1''=10' VERT
B2-120111501



H SECTION
1''=100' HORIZ
1''=10' VERT
B2-120111501



F SECTION
1''=100' HORIZ
1''=10' VERT
B2-120111501



I SECTION
1''=100' HORIZ
1''=10' VERT
B2-120111501

Worley energy | chemicals | resources
TEXAS REGISTERED ENGINEERING FIRM F-1480

JACOBS
TEXAS REGISTERED ENGINEERING FIRM F-2966

REV. MARK	REVISION	BY	CHK	APP	DATE	REV. MARK	REVISION	BY	CHK	APP	DATE

DRAWING ISSUE RECORD

ISSUE NO.	REV	MATERIAL OR JOB SPEC	BID	FAB	CONST	REF

DATE ISSUED FOR

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PROJ. ENGR.	R. BELL	10/21
MFG. REP.	R. REHMAN	10/21

STATUS | PLANT NO.

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THE DOW CHEMICAL COMPANY
TEXAS OPERATIONS — FREEPORT, TEXAS
ENVIRONMENTAL OPERATIONS — HARRIS EXPANSION

HARRIS EXPANSION PROJECT
OYSTER CREEK GRADING
SECTIONS, AREA 1201

PROJECT NUMBER	SCALE		REV.
017491	AS NOTED	B2-120114501-017491	2

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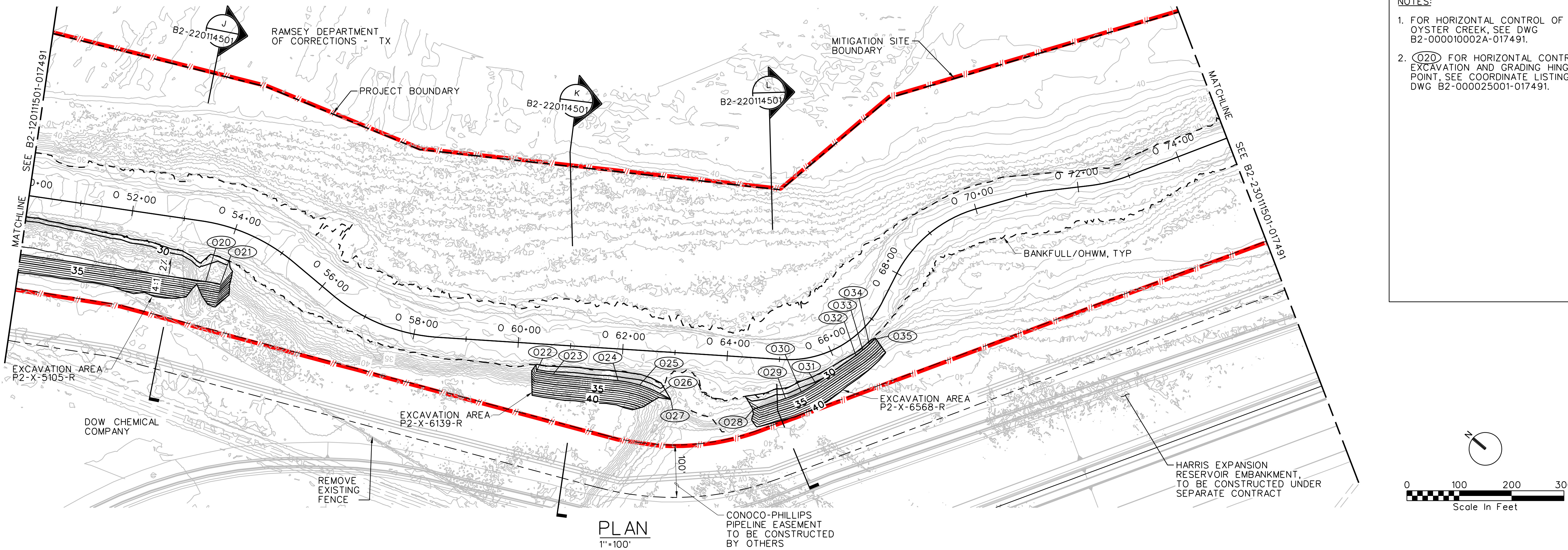
2023\03\03
B2-120114501-017491.dgn

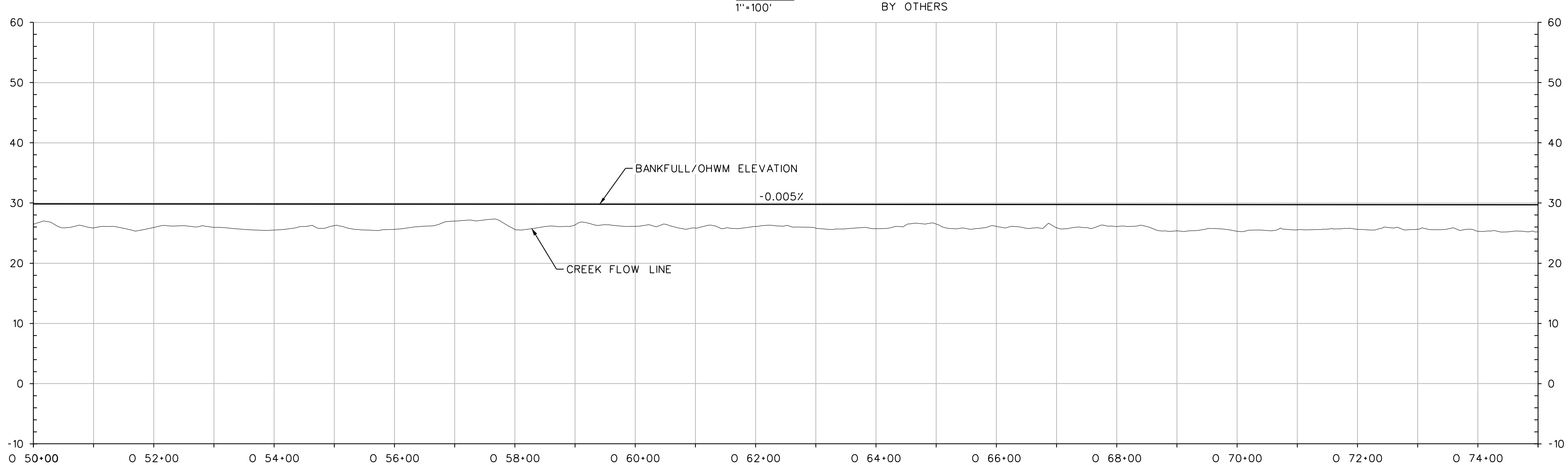
$INSTRUCTIONS $PERSON $TIME $DATE
B2-120114501-017491.dgn

NOTES:

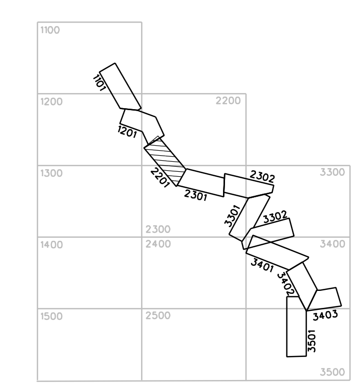
1. FOR HORIZONTAL CONTROL OF OYSTER CREEK, SEE DWG B2-000010002A-017491.
2. (020) FOR HORIZONTAL CONTROL OF EXCAVATION AND GRADING HINGE POINT, SEE COORDINATE LISTING ON DWG B2-000025001-017491.



PLAN
1"=100'



PROFILE
1"=100' HORIZ
1"=10' VERT



KEY MAP

2023\03\03 2:28:27 PM

B2-220111501-017491.dgn

Worley
JACOBS
TEXAS REGISTERED ENGINEERING FIRM F-1480
TEXAS REGISTERED ENGINEERING FIRM F-2966

REV. MARK	REVISION	BY	CHK	APP	DATE	REV. MARK	REVISION	BY	CHK	APP	DATE

DRAWING ISSUE RECORD

ISSUE NO.	REV	MATERIAL OR JOB SPEC	BID	FAB	CONST	REF
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STATUS | PLANT NO.

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THE DOW CHEMICAL COMPANY
TEXAS OPERATIONS — FREEPORT, TEXAS
ENVIRONMENTAL OPERATIONS — HARRIS EXPANSION

HARRIS EXPANSION PROJECT
OYSTER CREEK GRADING
PLAN & PROFILE, STA 0 50+00 TO 0 75+00, AREA 2201

PROJECT NUMBER	SCALE		REV.
017491	1" = 100'-0"	B2-220111501-017491	2

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B2-220111501-017491.dgn

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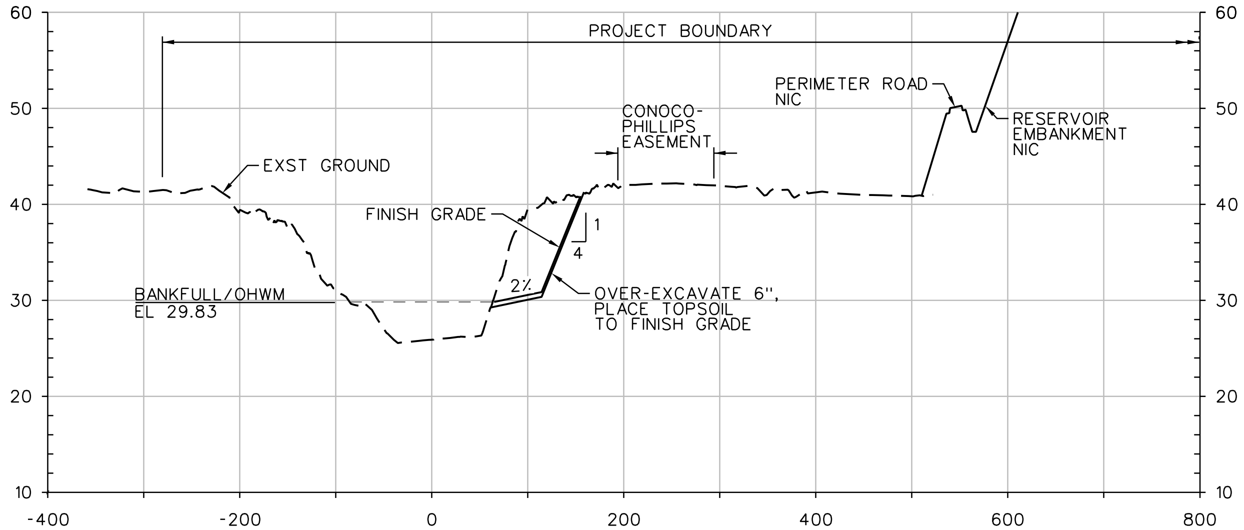
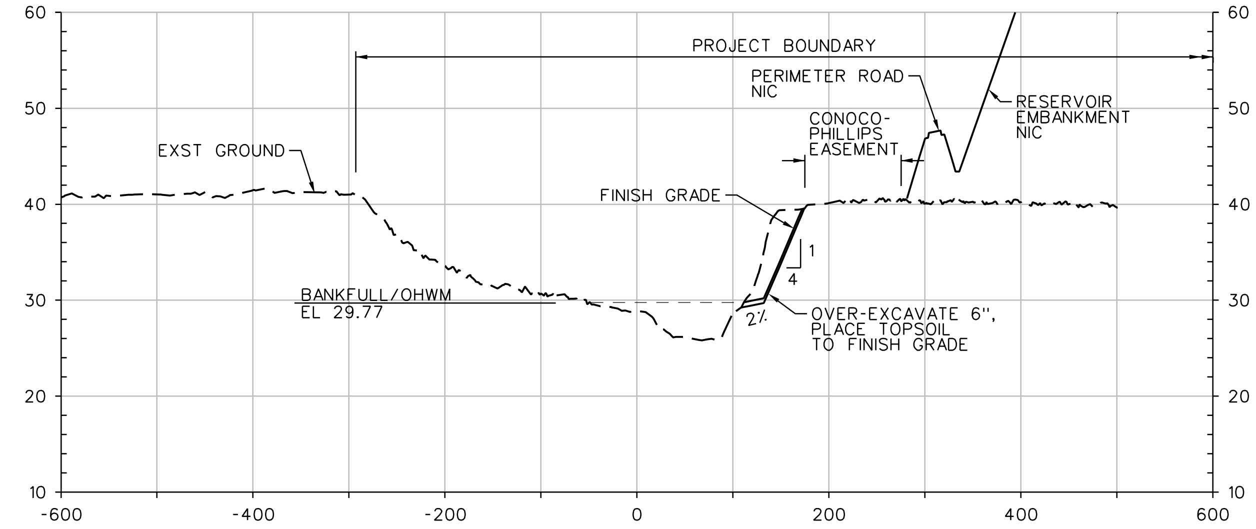
NOTES:

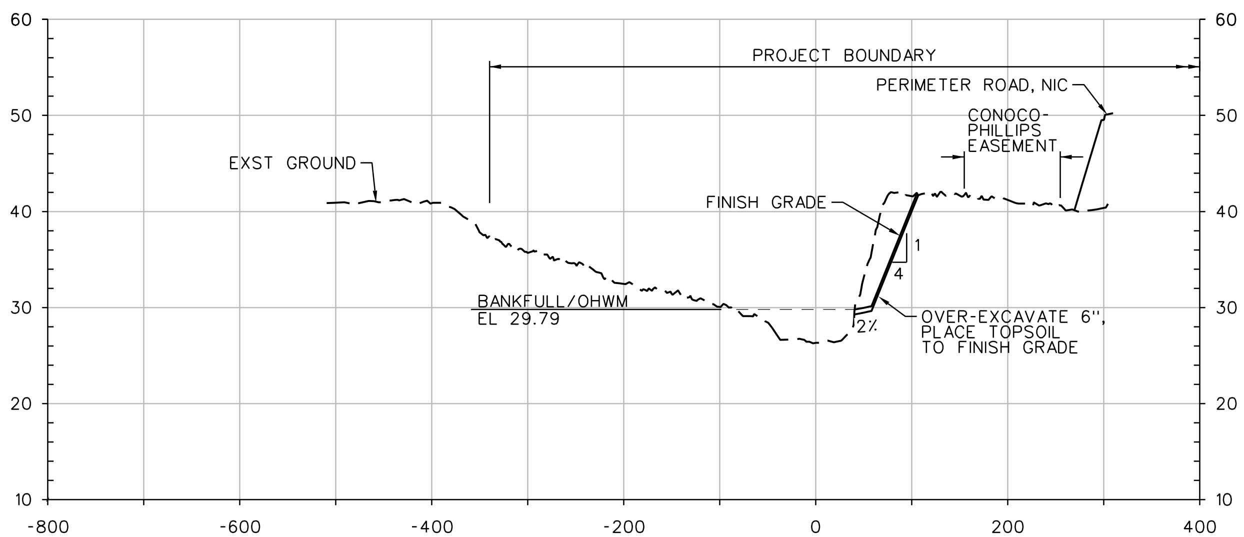
1. NEGATIVE STATIONS ARE LEFT OF CENTERLINE, LOOKING DOWNSTREAM.



J SECTION
1"=100' HORIZ
1"=10' VERT
B2-220111501



L SECTION
1"=100' HORIZ
1"=10' VERT
B2-220111501



K SECTION
1"=100' HORIZ
1"=10' VERT
B2-220111501

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2023\03\03
B2-220114501-017491.dgn

Worley energy | chemicals | resources
TEXAS REGISTERED ENGINEERING FIRM F-1480

JACOBS
TEXAS REGISTERED ENGINEERING FIRM F-2966

REV. MARK	REVISION	BY	CHK	APP	DATE	REV. MARK	REVISION	BY	CHK	APP	DATE

DRAWING ISSUE RECORD

ISSUE NO.	REV	MATERIAL OR JOB SPEC	BID	FAB	CONST	REF
			DATE ISSUED FOR			

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MFG. REP.	R. REHMAN	10/21

STATUS | PLANT NO.

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THE DOW CHEMICAL COMPANY
TEXAS OPERATIONS — FREEPORT, TEXAS
ENVIRONMENTAL OPERATIONS — HARRIS EXPANSION

HARRIS EXPANSION PROJECT
OYSTER CREEK GRADING
SECTIONS, AREA 2201

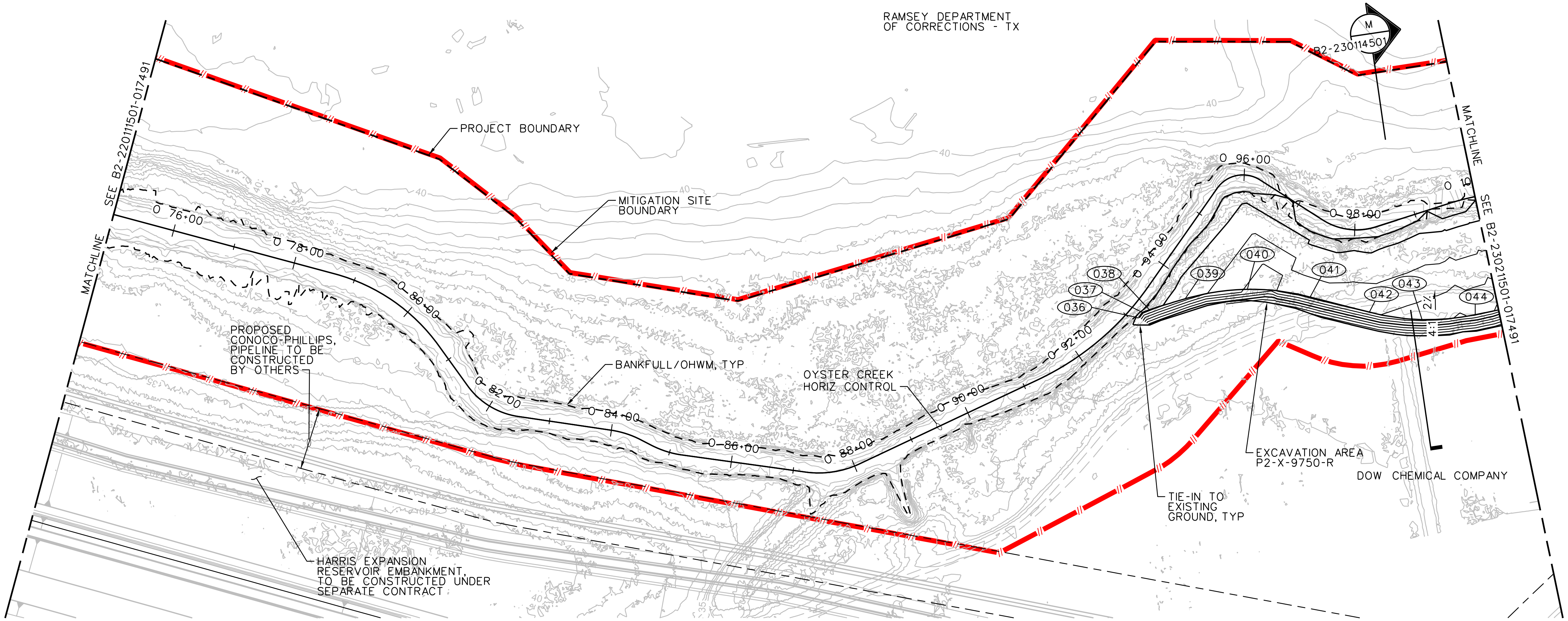
PROJECT NUMBER	SCALE		REV.
017491	AS NOTED	B2-220114501-017491	2

PRINTED | VER. | CIV

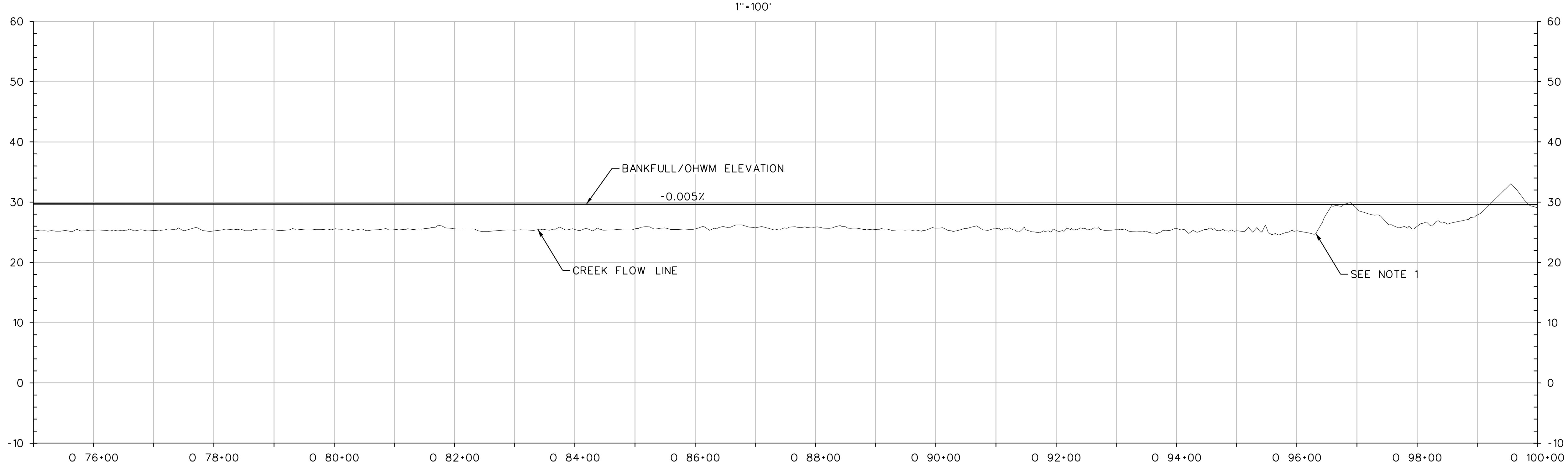
$INSTRUCTIONS $PERSON $TIME $DATE
B2-220114501-017491.dgn

NOTES:

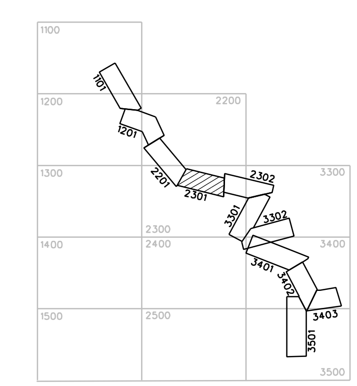
1. CREEK BATHYMETRY BETWEEN STA O 96+30 AND STA O 101+30 IS INACCURATE.
2. FOR HORIZONTAL CONTROL OF OYSTER CREEK, SEE DWG B2-000010002A-017491.
3. (036) FOR HORIZONTAL CONTROL OF EXCAVATION AND GRADING HINGE POINT, SEE COORDINATE LISTING ON DWG B2-000025001-017491.



PLAN
1"=100'



PROFILE
1"=100' HORIZ
1"=10' VERT



KEY MAP

2023\03\03 2:30:54 PM

B2-230111501-017491.dgn

Worley
energy | chemicals | resources
TEXAS REGISTERED ENGINEERING FIRM F-1480

JACOBS
TEXAS REGISTERED ENGINEERING FIRM F-2966

REV. MARK	REVISION	BY	CHK	APP	DATE	REV. MARK	REVISION	BY	CHK	APP	DATE

DRAWING ISSUE RECORD

ISSUE NO.	REV	MATERIAL OR JOB SPEC	BID	FAB	CONST	REF
			DATE ISSUED FOR			

DESIGNED	S. YANAGIHARA	10/21
DRAWN	J. WALKER	10/21
CHECKED	D. STEWART	10/21
APPROVED	S. YANAGIHARA	10/21
PROJ. ENGR.	R. BELL	10/21
MFG. REP.	R. REHMAN	10/21

STATUS | PLANT NO.

P.E. SEAL
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IT IS NOT TO BE USED FOR BIDDING OR CONSTRUCTION PURPOSES

THE DOW CHEMICAL COMPANY

TEXAS OPERATIONS — FREEPORT, TEXAS
ENVIRONMENTAL OPERATIONS — HARRIS EXPANSION

HARRIS EXPANSION PROJECT
OYSTER CREEK GRADING
PLAN & PROFILE, STA O 75+00 TO O 100+00, AREA 2301

PROJECT NUMBER	SCALE		REV.
017491	1" = 100'-0"	B2-230111501-017491	2

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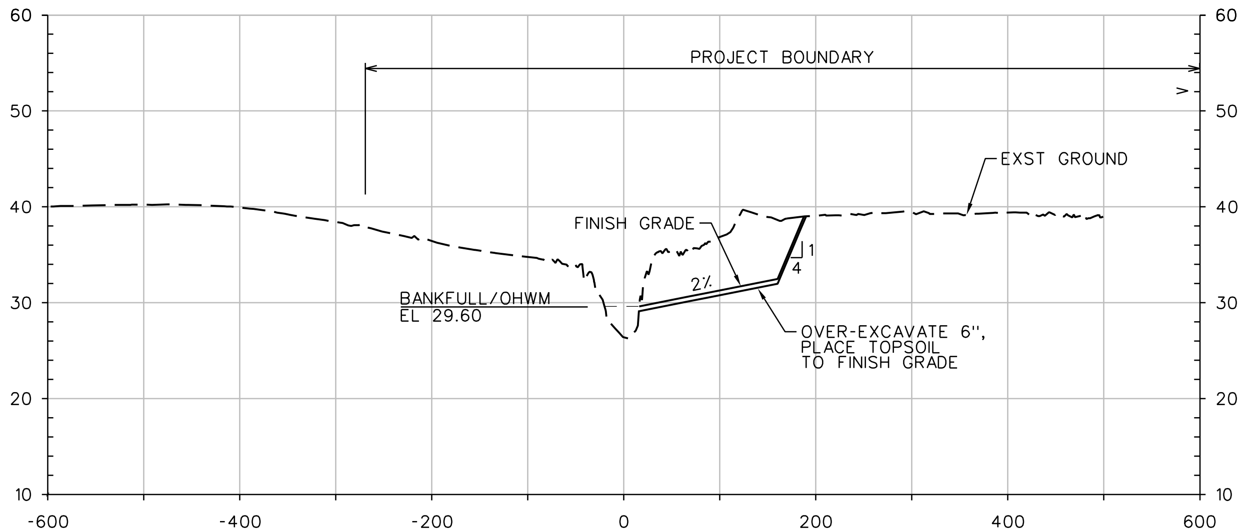
NOTES:

1. NEGATIVE STATIONS ARE LEFT OF CENTERLINE, LOOKING DOWNSTREAM.



M SECTION
1"=100' HORIZ
1"=10' VERT
B2-230111501

2:31:53 PM 2023\03\03 B2-230114501-017491.dgn

REV. MARK	REVISION	BY	CHK	APP	DATE	REV. MARK	REVISION	BY	CHK	APP	DATE

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Worley energy | chemicals | resources
TEXAS REGISTERED ENGINEERING FIRM F-1480
JACOBS
TEXAS REGISTERED ENGINEERING FIRM F-2966

THE DOW CHEMICAL COMPANY
TEXAS OPERATIONS — FREEPORT, TEXAS
ENVIRONMENTAL OPERATIONS — HARRIS EXPANSION

HARRIS EXPANSION PROJECT
OYSTER CREEK GRADING
SECTIONS, AREA 2301

PROJECT NUMBER	SCALE		REV.
017491	AS NOTED	B2-230114501-017491	2

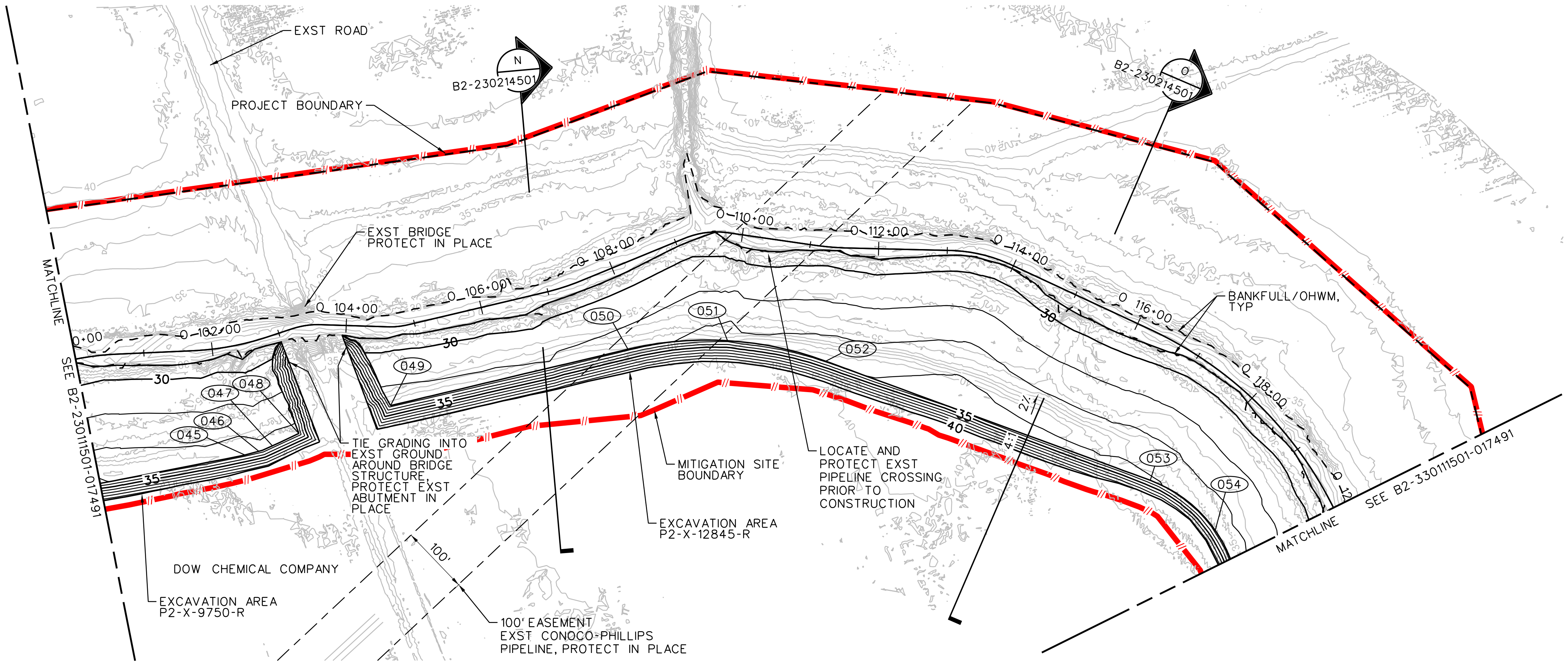
PRINTED | VER. CIV

B2-230114501-017491.dgn

$DATE $TIME $PERSON $INSTRUCTIONS

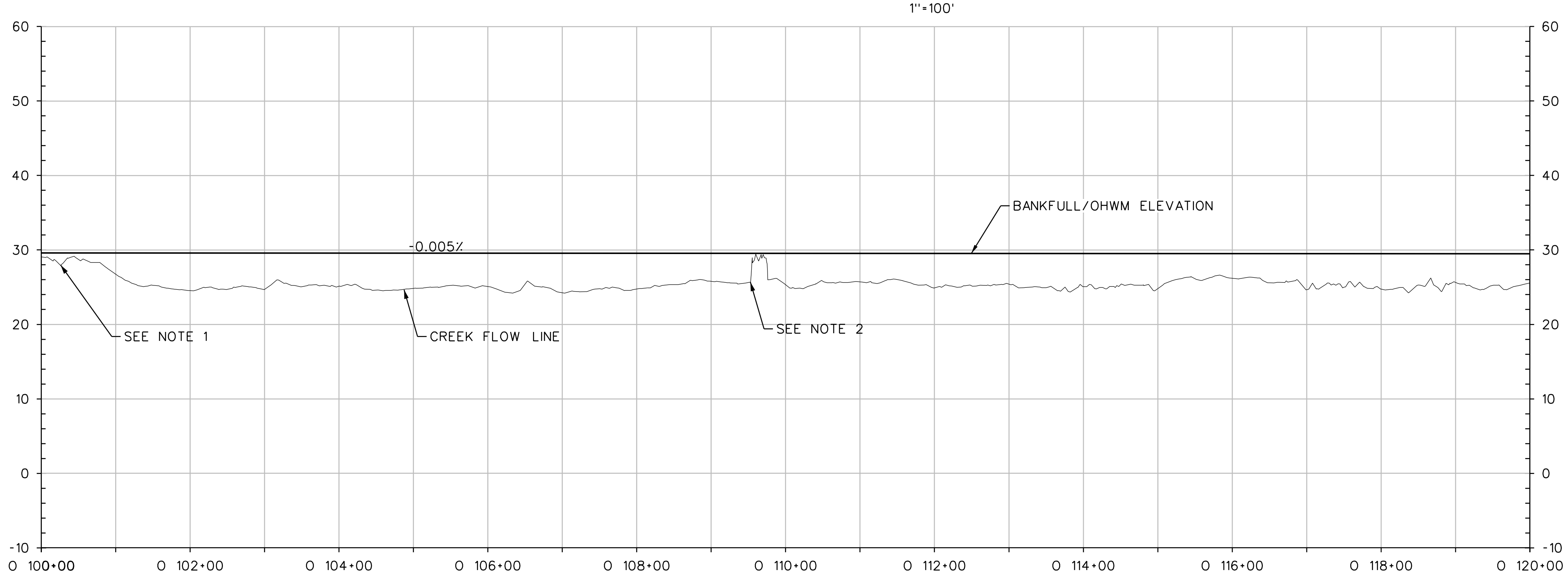
NOTES:

1. CREEK BATHYMETRY BETWEEN STA O 96+30 AND STA O 101+30 IS INACCURATE.
2. THE OYSTER CREEK HORIZ CONTROL LINE DEVIATES FROM THE CREEK FLOWLINE FOR A SHORT DISTANCE IN THE VICINITY OF STA O 109+65.
3. FOR HORIZONTAL CONTROL OF OYSTER CREEK, SEE DWG B2-000010002A-017491.
4. (045) FOR HORIZONTAL CONTROL OF EXCAVATION AND GRADING HINGE POINT, SEE COORDINATE LISTING ON DWG B2-000025001-017491.

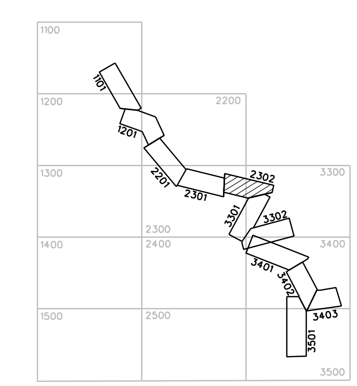


PLAN
1"=100'

0 100 200 300
SCALE IN FEET



PROFILE
1"=100' HORIZ
1"=10' VERT



KEY MAP

2023\03\03 2:34:12 PM
B2-230211501-017491.dgn

Worley energy | chemicals | resources — TEXAS REGISTERED ENGINEERING FIRM F-1480
JACOBS — TEXAS REGISTERED ENGINEERING FIRM F-2966

REV. MARK	REVISION	BY	CHK	APP	DATE	REV. MARK	REVISION	BY	CHK	APP	DATE

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THE DOW CHEMICAL COMPANY
TEXAS OPERATIONS — FREEPORT, TEXAS
ENVIRONMENTAL OPERATIONS — HARRIS EXPANSION

HARRIS EXPANSION PROJECT
OYSTER CREEK GRADING
PLAN & PROFILE, STA O 100+00 TO O 120+00, AREA 2302

PROJECT NUMBER	SCALE		REV.
017491	1" = 100'-0"	B2-230211501-017491	2

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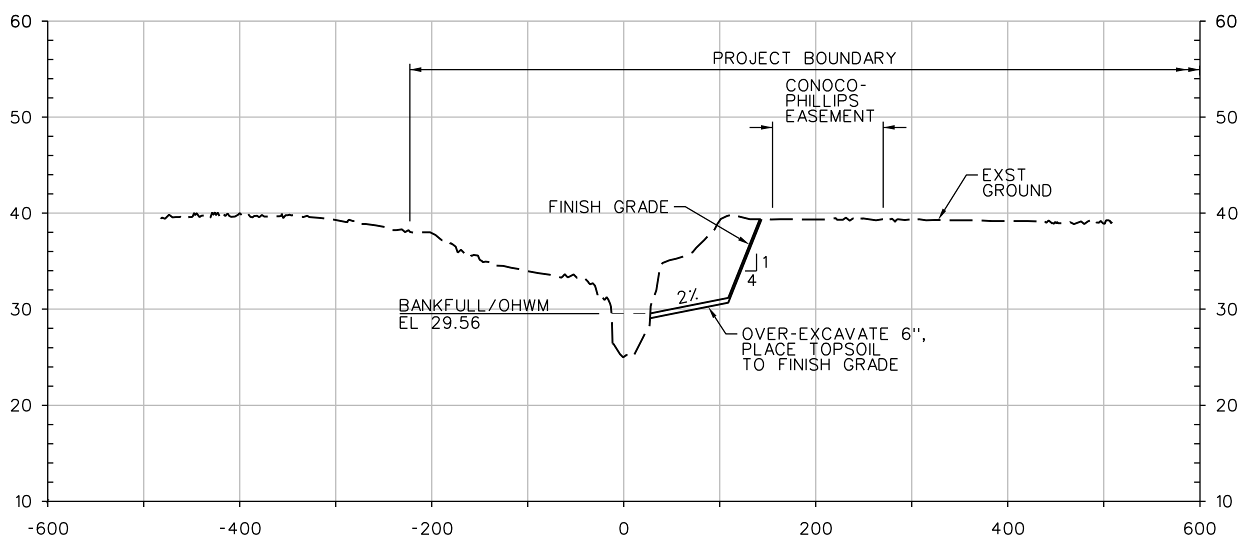
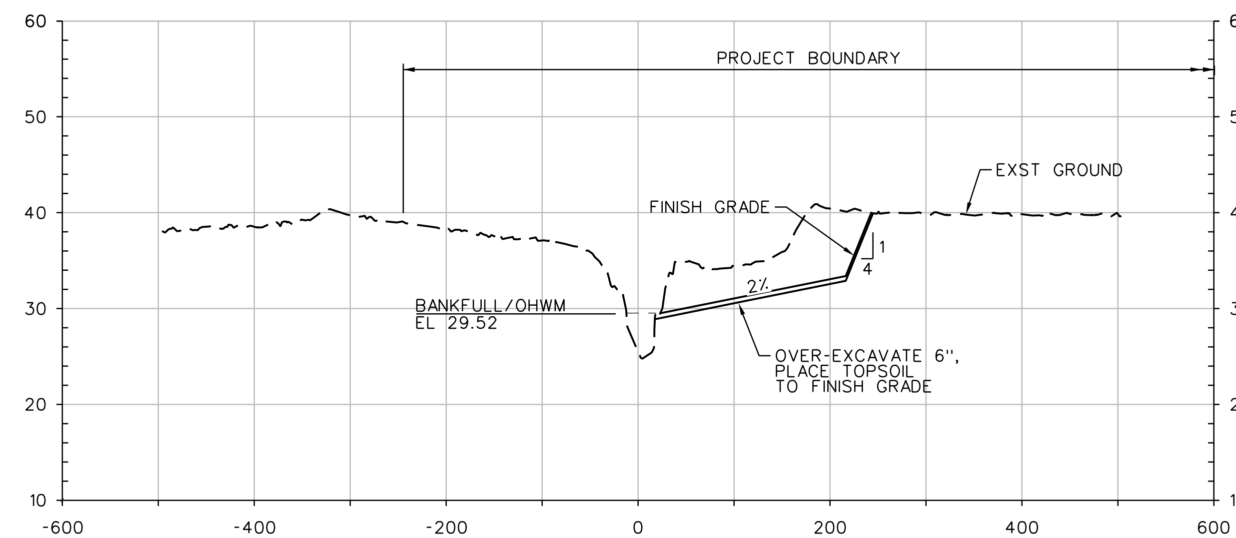


N SECTION
1"=100' HORIZ
1"=10' VERT
B2-230211501



O SECTION
1"=100' HORIZ
1"=10' VERT
B2-230211501

Worley energy | chemicals | resources
TEXAS REGISTERED ENGINEERING FIRM F-1480
JACOBS
TEXAS REGISTERED ENGINEERING FIRM F-2966

REV. MARK	REVISION	BY	CHK	APP	DATE	REV. MARK	REVISION	BY	CHK	APP	DATE

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THE DOW CHEMICAL COMPANY
TEXAS OPERATIONS — FREEPORT, TEXAS
ENVIRONMENTAL OPERATIONS — HARRIS EXPANSION

HARRIS EXPANSION PROJECT
OYSTER CREEK GRADING
SECTIONS, 2302

PROJECT NUMBER	SCALE		REV.
017491	AS NOTED	B2-230214501-017491	2

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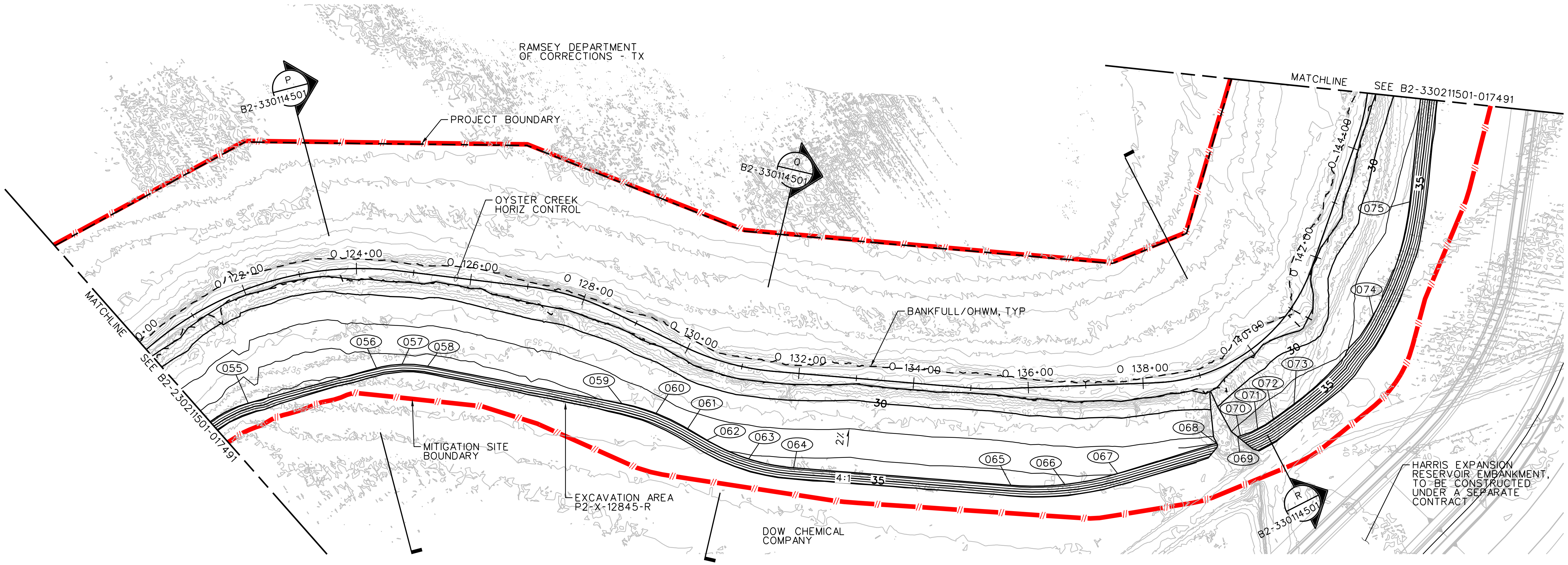
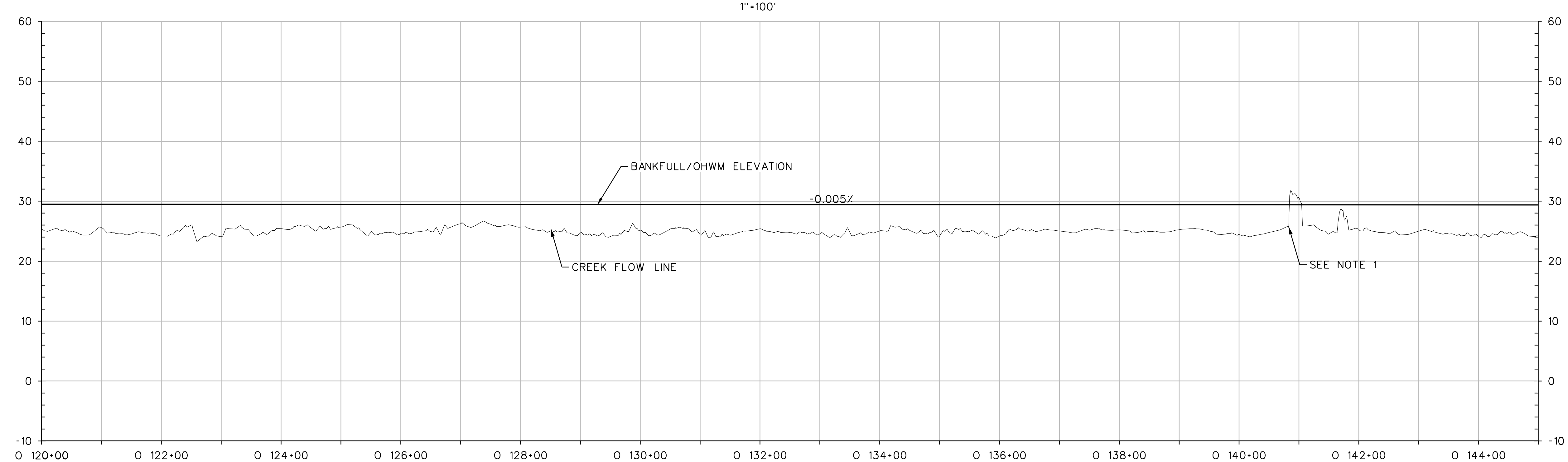
$INSTRUCTIONS $PERSON $TIME $DATE B2-230214501-017491.dgn

NOTES:

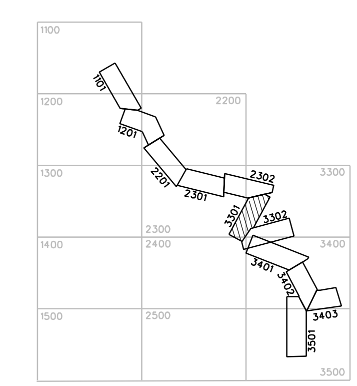
1. THE OYSTER CREEK HORIZ CONTROL LINE DEVIATES FROM THE CREEK FLOW LINE FOR A SHORT DISTANCE IN THE VICINITY OF STA O 140+90 AND STA O 141+80.
2. FOR HORIZONTAL CONTROL OF OYSTER CREEK, SEE DWG B2-000010002A-017491.
3. (055) FOR HORIZONTAL CONTROL OF EXCAVATION AND GRADING HINGE POINT, SEE COORDINATE LISTING ON DWG B2-000025001-017491.



PLAN
1"=100'



PROFILE
1"=100' HORIZ
1"=10' VERT



KEY MAP

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2023\03\03
B2-330111501-017491.dgn

Worley
TEXAS REGISTERED ENGINEERING FIRM F-1480
JACOBS
TEXAS REGISTERED ENGINEERING FIRM F-2966

REV. MARK	REVISION	BY	CHK	APP	DATE	REV. MARK	REVISION	BY	CHK	APP	DATE

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STATUS | PLANT NO.

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THE DOW CHEMICAL COMPANY
TEXAS OPERATIONS — FREEPORT, TEXAS
ENVIRONMENTAL OPERATIONS — HARRIS EXPANSION

HARRIS EXPANSION PROJECT
OYSTER CREEK GRADING
PLAN & PROFILE, STA O 120+00 TO O 145+00, AREA 3301

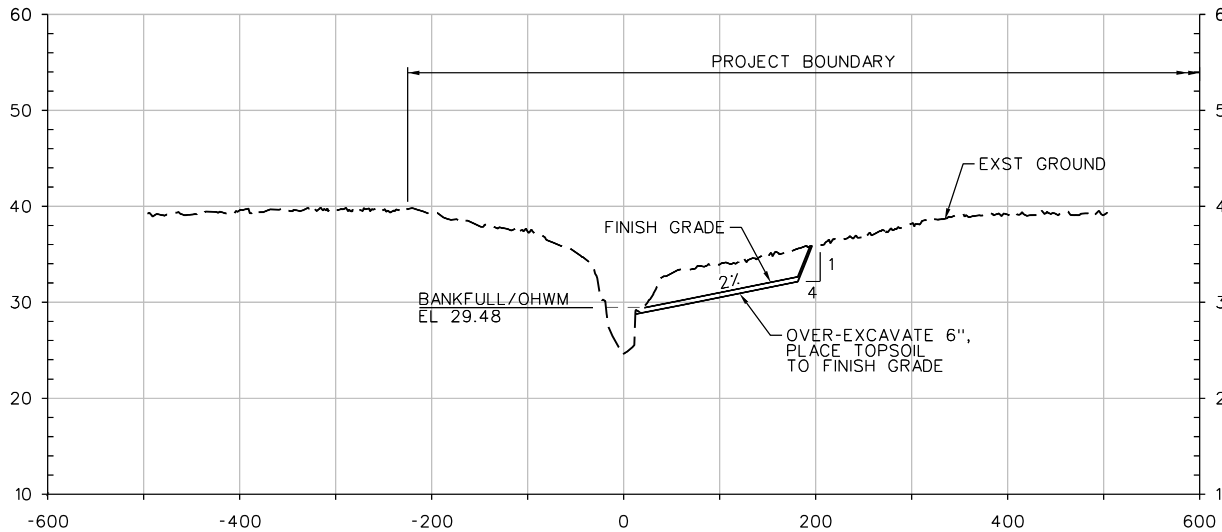
PROJECT NUMBER	SCALE		REV.
017491	1" = 100'-0"	B2-330111501-017491	2

PRINTED | VER. | CIV

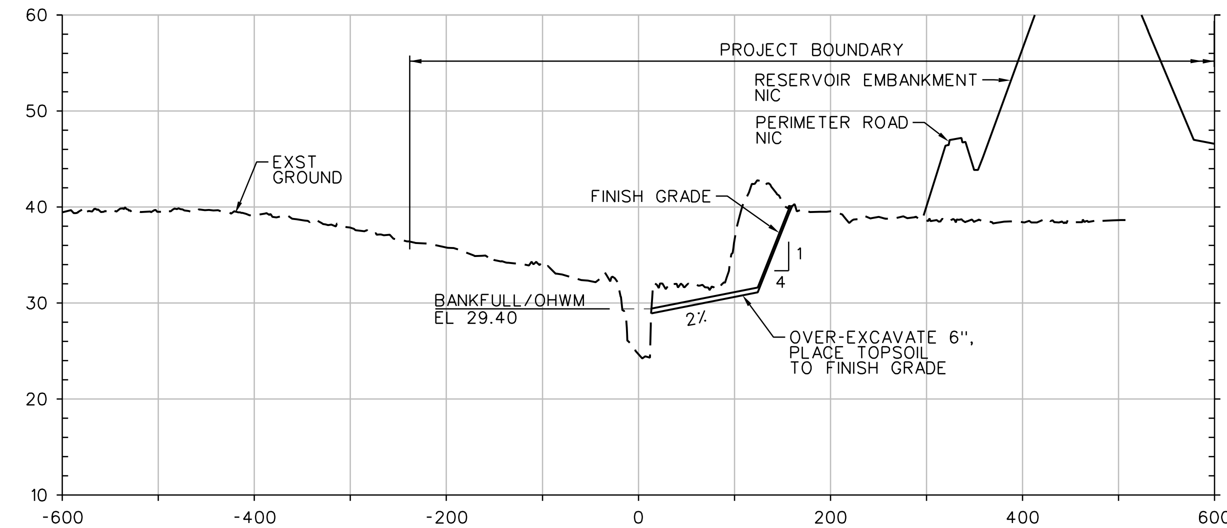
$INSTRUCTIONS $PERSON $TIME $DATE
B2-330111501-017491.dgn

NOTES:

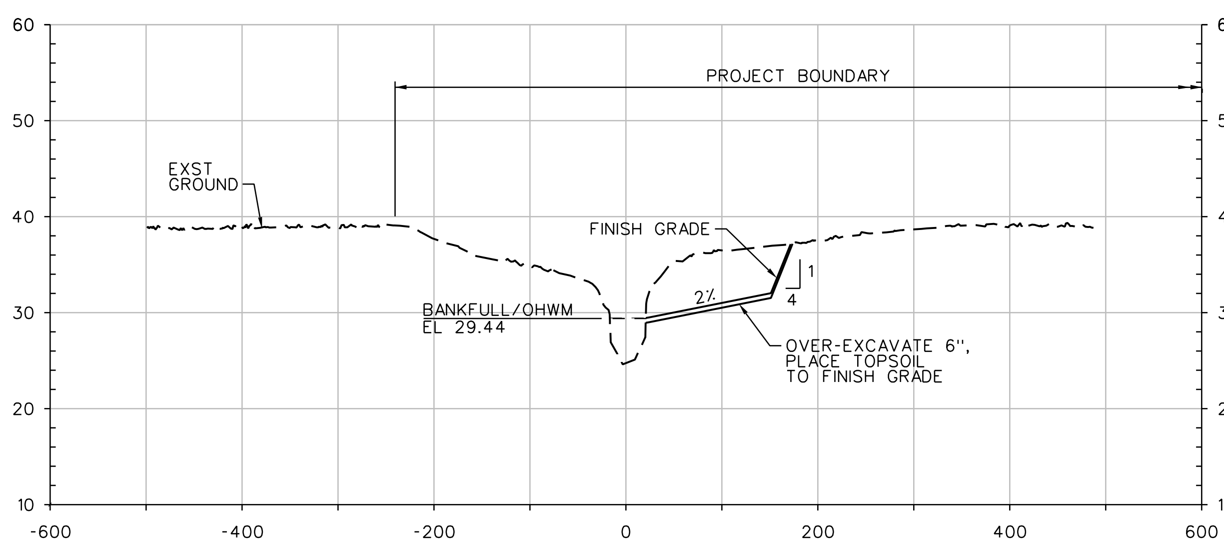
1. NEGATIVE STATIONS ARE LEFT OF CENTERLINE, LOOKING DOWNSTREAM.



P SECTION
1"=100' HORIZ
1"=10' VERT
B2-330111501



R SECTION
1"=100' HORIZ
1"=10' VERT
B2-330111501



Q SECTION
1"=100' HORIZ
1"=10' VERT
B2-330111501

Worley energy | chemicals | resources
TEXAS REGISTERED ENGINEERING FIRM F-1480

JACOBS
TEXAS REGISTERED ENGINEERING FIRM F-2966

REV. MARK	REVISION	BY	CHK	APP	DATE	REV. MARK	REVISION	BY	CHK	APP	DATE

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STATUS
PLANT NO.
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THE DOW CHEMICAL COMPANY

TEXAS OPERATIONS — FREEPORT, TEXAS
ENVIRONMENTAL OPERATIONS — HARRIS EXPANSION

HARRIS EXPANSION PROJECT
OYSTER CREEK GRADING
SECTIONS, AREA 3301

PROJECT NUMBER	SCALE		REV.
017491	AS NOTED	B2-330114501-017491	2

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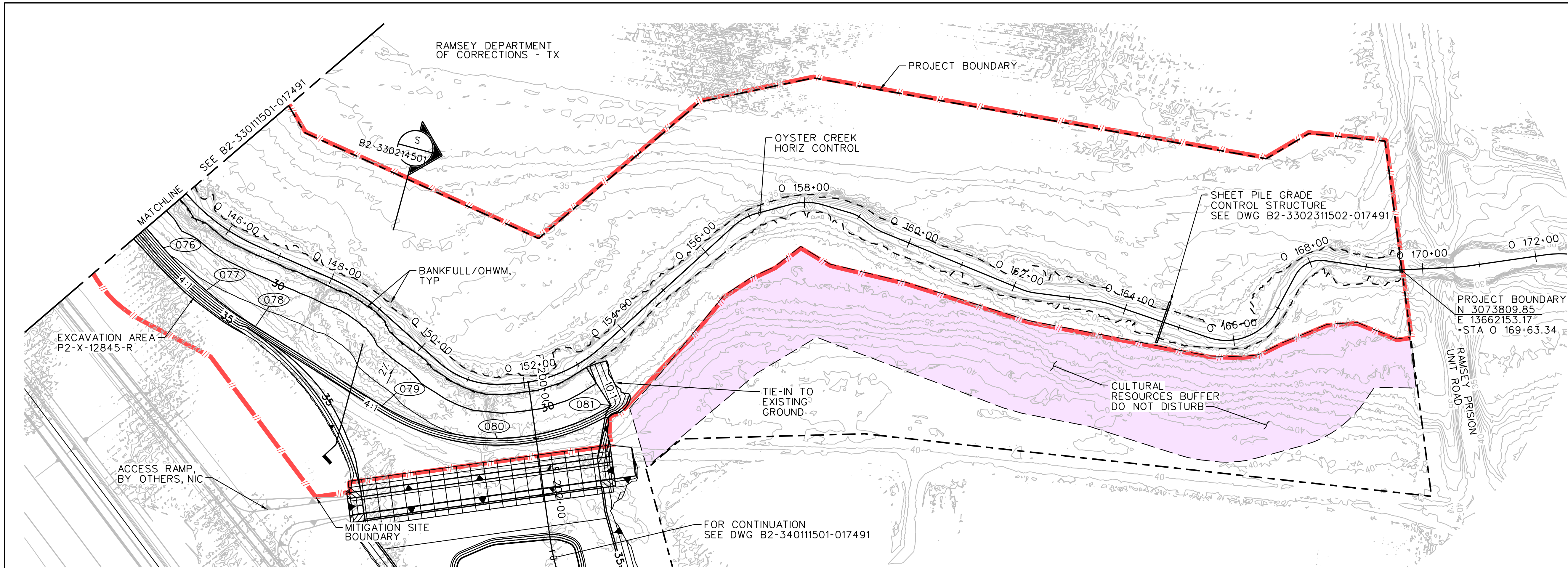
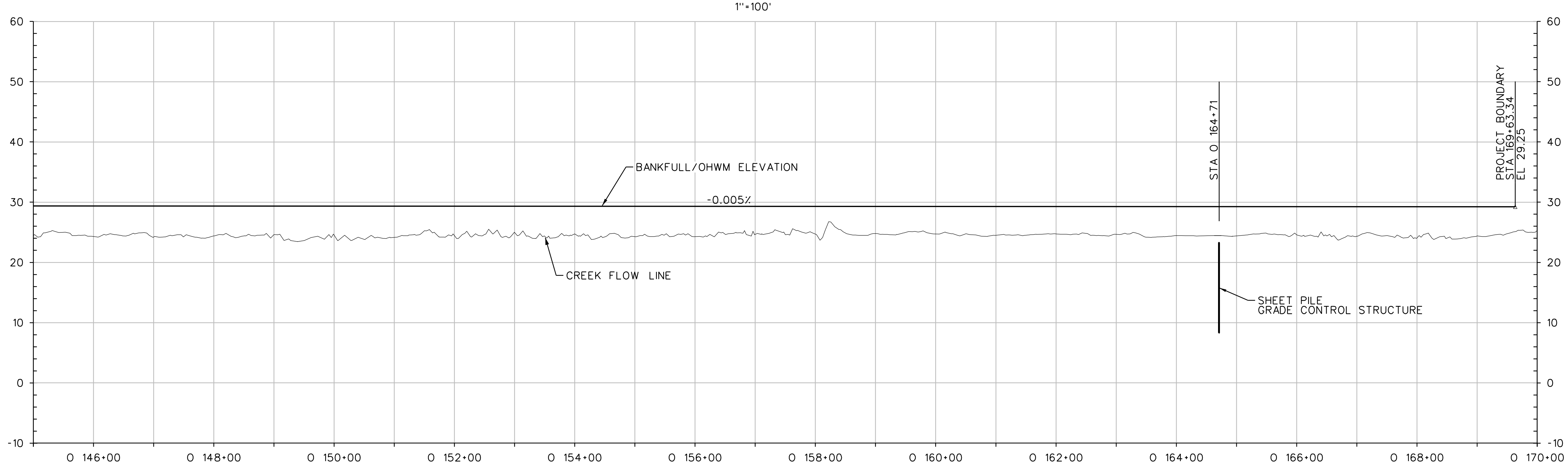
$INSTRUCTIONS $PERSON $TIME $DATE



PLAN
1"=100'



PROFILE
1"=100' HORIZ
1"=10' VERT

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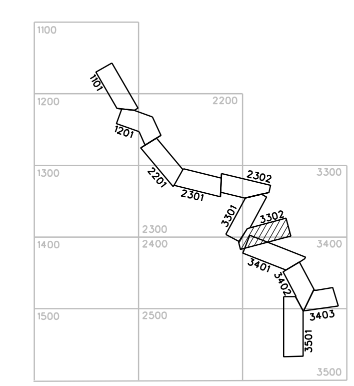

KEY MAP

2023\03\03 2:39:12 PM
B2-330211501-017491.dgn

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Worley energy | chemicals | resources
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JACOBS
TEXAS REGISTERED ENGINEERING FIRM F-2966

THE DOW CHEMICAL COMPANY
TEXAS OPERATIONS — FREEPORT, TEXAS
ENVIRONMENTAL OPERATIONS — HARRIS EXPANSION
HARRIS EXPANSION PROJECT
OYSTER CREEK GRADING
PLAN & PROFILE, STA O 145+00 TO END, AREA 3302

PROJECT NUMBER 017491 | SCALE 1" = 100'-0" | B2-330211501-017491 | REV. 2

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B2-330211501-017491.dgn

$INSTRUCTIONS $PERSON $TIME $DATE

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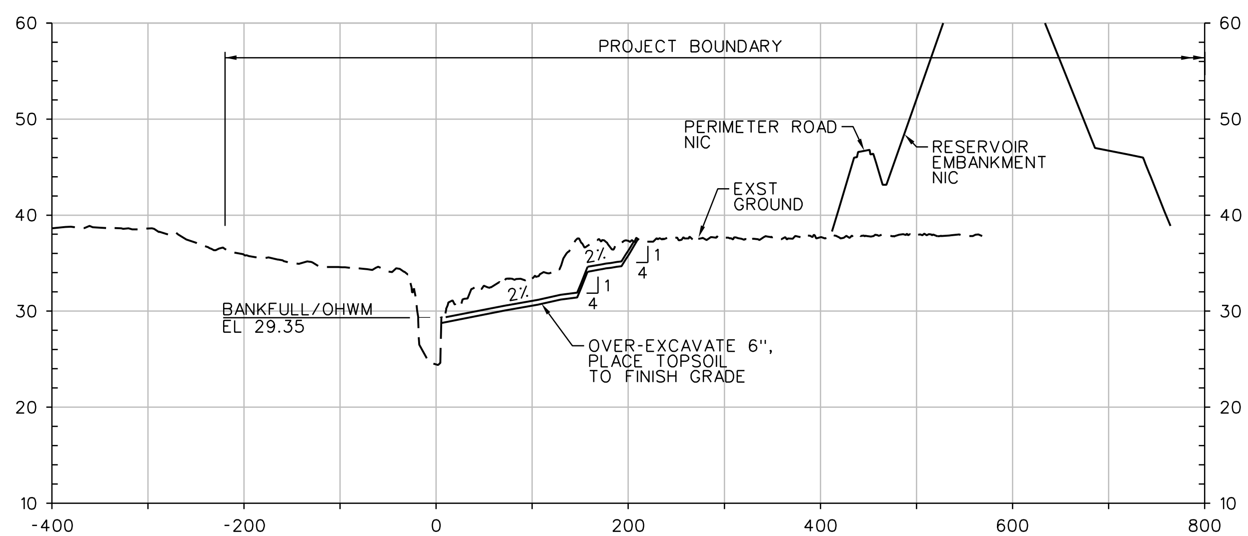

S SECTION
1"=100' HORIZ
1"=10' VERT
B2-330211501

Worley energy | chemicals | resources
TEXAS REGISTERED ENGINEERING FIRM F-1480
JACOBS
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REV. MARK	REVISION	BY	CHK	APP	DATE	REV. MARK	REVISION	BY	CHK	APP	DATE

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HARRIS EXPANSION PROJECT
OYSTER CREEK GRADING
SECTIONS, AREA 3302

PROJECT NUMBER	SCALE		REV.
017491	AS NOTED	B2-330214501-017491	2

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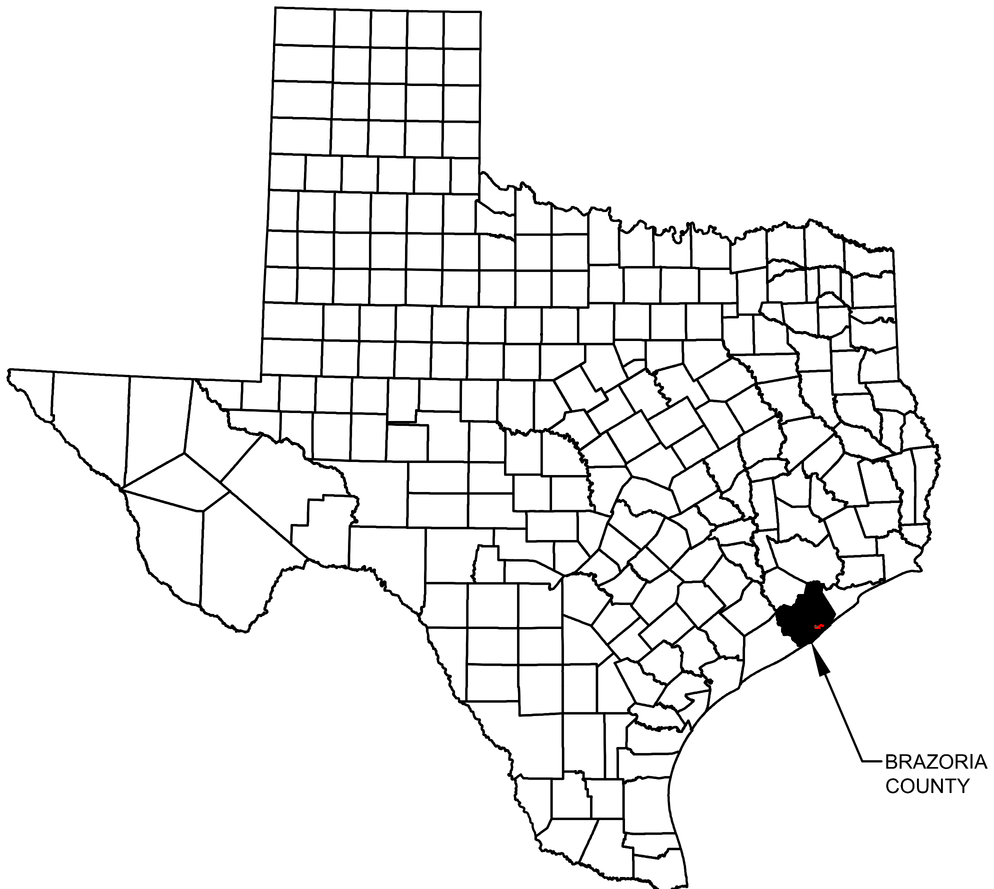
$INSTRUCTIONS $PERSON $TIME $DATE
B2-330214501-017491.dgn

Big Slough

DOW CHEMICAL

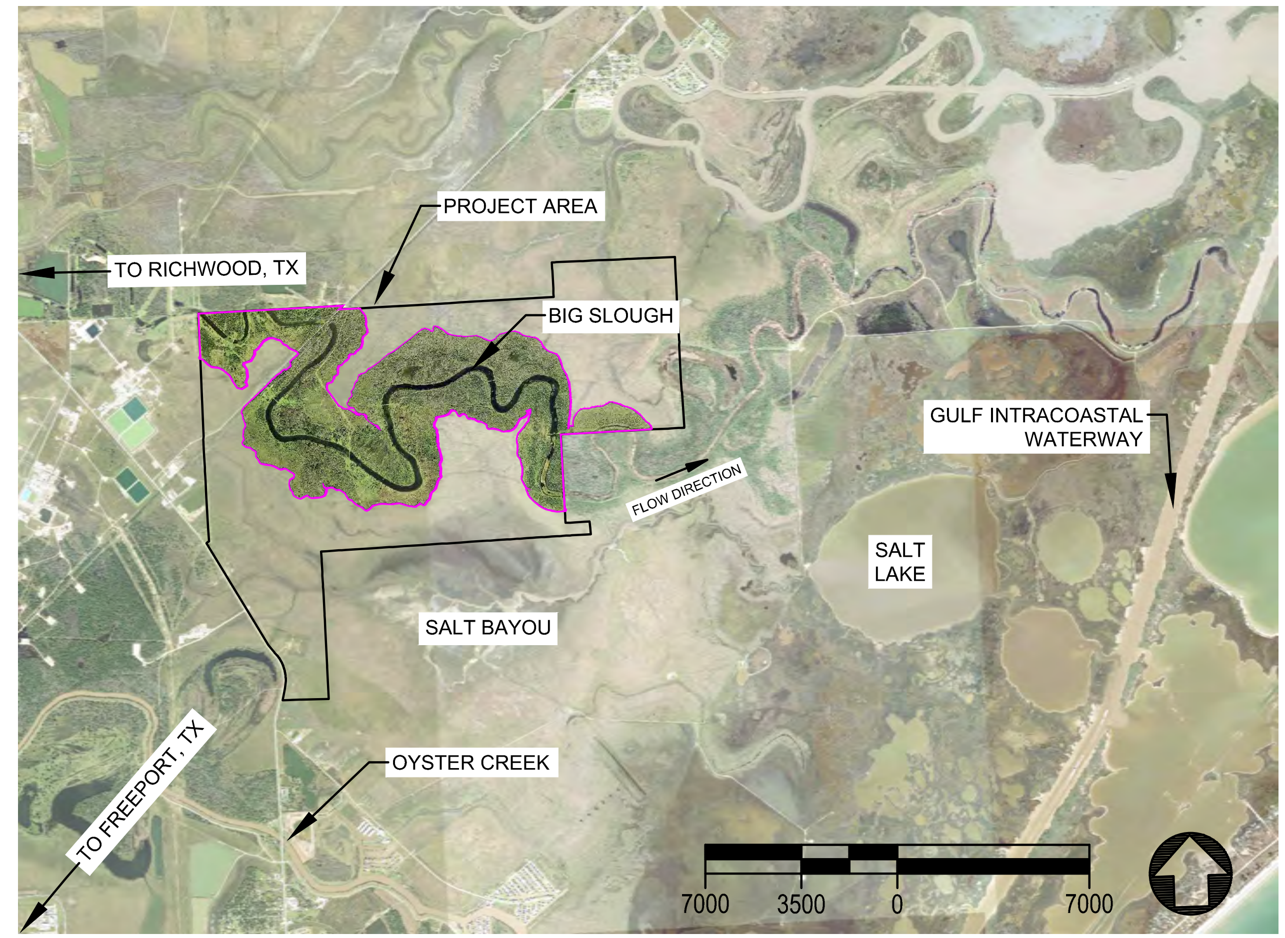
BIG SLOUGH MITIGATION SITE

JANUARY 2021



LOCATION MAP

N.T.S.



VICINITY MAP

SCALE: 1"=3500'

SHEET LIST TABLE	
SHEET NUMBER	SHEET TITLE
01	TITLE
02	NOTES
03	EXISTING CONDITIONS
04	ACCESS STAGING AND TESC
05	OVERVIEW
06	PLANTING PLAN
07	SHEET INDEX
08	SITE PLAN 1
09	SITE PLAN 2
10	SITE PLAN 3
11	SITE PLAN 4
12	SITE PLAN 5
13	SITE PLAN 6
14	SITE PLAN 7
15	PLANTING SCHEDULE
16	PLANTING SCHEDULE
17	DETAILS- OXBOWS AND SCROLLS
18	DETAILS- CULVERT

Plot Stamp: 3/3/2023 9:01:52 AM - Gorden, Jeremy
File: Z:\Sam Waltman\20221005\BIG SLOUGH-TITLE.dwg, Tab: 01 TITLE

60% PLANS

Stantec
SEATTLE
801 SECOND AVE, STE 1150, SEATTLE, WA 98104
TEL: (206) 269-0104 FAX: (206) 269-0098
www.cardno.com

TITLE
BIG SLOUGH MITIGATION SITE
DOW CHEMICAL
BRAZORIA COUNTY, TX

#	DATE	DESCRIPTION	BY

PRELIMINARY
NOT FOR
CONSTRUCTION

DATE	JANUARY 2021
DRAWN	FA/LE/JC
DESIGNED	DE/LE/FA
CHECKED	DE/SM/BJ
PROJECT #	E515018116

SHEET TITLE
TITLE

SHEET NUMBER
01

LAND USE # ----

GENERAL NOTES

1. ALL IMPROVEMENTS SHALL BE ACCOMPLISHED UNDER THE APPROVAL, INSPECTION, AND TO THE SATISFACTION OF DOW CHEMICAL. IMPROVEMENT CONSTRUCTION SHALL COMPLY WITH THESE PLANS.

2. CONSTRUCTION HOURS SHALL BE WEEKDAYS BETWEEN 7:00 A.M. AND 6:30 P.M. UNLESS PRIOR APPROVAL IS RECEIVED FROM DOW CHEMICAL.

3. THE CONTRACTOR SHALL PROVIDE, PLACE, AND MAINTAIN ALL LIGHTS, SIGNS, BARRICADES, FLAG PERSONS, OR OTHER DEVICES NECESSARY TO CONTROL TRAFFIC THROUGH THE CONSTRUCTION AREA AND FOR PUBLIC SAFETY AS ALLOWED BY THE COUNTY ENGINEER AND FEDERAL HIGHWAY ADMINISTRATION (FHWA) MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) CURRENT EDITION.

4. THE CONTRACTOR AGREES TO ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THIS PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY, AND FURTHER AGREES THAT THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS IN ACCORDANCE WITH THE PROVISIONS OUTLINED BY THE PROJECT CONTRACT.

5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR IMPLEMENTING ALL TEMPORARY EROSION CONTROL MEASURES. THE EROSION CONTROL MEASURES SHALL BE IN ACCORDANCE WITH ALL FEDERAL, STATE, AND LOCAL REQUIREMENTS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE MAINTENANCE AND PERFORMANCE OF THE TEMPORARY EROSION CONTROL MEASURES THROUGHOUT THE DURATION OF THE PROJECT.

6. ALL EXTERNAL GREASE AND OIL SHALL BE PRESSURE-WASHED OFF THE EQUIPMENT PRIOR TO TRANSPORT TO THE SITE.

7. THE CONTRACTOR SHALL USE ONLY DESIGNATED SPECIFIC SITES FOR STORAGE OF EQUIPMENT AND MATERIALS AS DIRECTED BY DOW CHEMICAL. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE SECURITY OF ALL EQUIPMENT AND MATERIALS.

8. MECHANIZED EQUIPMENT AND VEHICLES WILL BE SELECTED, OPERATED, AND MAINTAINED IN A MANNER THAT MINIMIZES ADVERSE EFFECTS ON THE ENVIRONMENT (E.G., MINIMALLY-SIZED, LOW PRESSURE TIRES; MINIMAL HARD-TURN PATHS FOR TRACKED VEHICLES; TEMPORARY MATS OR PLATES WITHIN WET AREAS OR ON SENSITIVE SOILS). GAS-POWERED EQUIPMENT WITH TANKS LARGER THAN 5 GALLONS WILL BE REFUELED IN A VEHICLE STAGING AREA PLACED IN AN ISOLATED HARD ZONE, SUCH AS A PAVED PARKING LOT OR ADJACENT, ESTABLISHED ROAD. ALL VEHICLES AND OTHER MECHANIZED EQUIPMENT WILL BE:
   - 8.1. STORED, FUELED, AND MAINTAINED IN A VEHICLE STAGING AREA PLACED ON AN ADJACENT, ESTABLISHED ROAD AREA;
   - 8.2. FILLED WITH BIODEGRADABLE LUBRICANTS AND FLUIDS, OR LUBRICANTS AND FLUIDS APPROVED BY THE SERVICES, ON EQUIPMENT OPERATING IN AND ADJACENT TO THE CHANNEL AND LIVE WATER.
   - 8.3. INSPECTED DAILY FOR FLUID LEAKS BEFORE LEAVING THE VEHICLE STAGING AREA; AND
   - 8.4. THOROUGHLY CLEANED BEFORE OPERATION BELOW ORDINARY HIGH WATER, AND AS OFTEN AS NECESSARY DURING OPERATION, TO REMAIN GREASE FREE.

9. IT IS THE RESPONSIBILITY OF THE CONTRACTOR AND HIS SUBCONTRACTOR(S) TO EXAMINE THE PROJECT SITE PRIOR TO THE OPENING OF BID PROPOSALS. THE CONTRACTOR SHALL BECOME FAMILIAR WITH THE CONDITIONS UNDER WHICH THE WORK IS TO BE PERFORMED, SUCH AS THE NATURE AND LOCATION OF THE WORK AND THE GENERAL AND LOCAL CONDITIONS, PARTICULARLY THOSE AFFECTING THE AVAILABILITY OF TRANSPORTATION, THE DISPOSAL, HANDLING, AND STORAGE OF MATERIALS, AVAILABILITY OF LABOR, WATER, ELECTRICITY, ROADS, THE UNCERTAINTIES OF WEATHER, THE CONDITIONS OF THE GROUND, SURFACE AND SUBSURFACE MATERIALS, THE EQUIPMENT AND FACILITIES NEEDED PRIMARILY FOR AND DURING THE PERFORMANCE OF THE WORK, AND THE COSTS THEREOF. ANY FAILURE BY THE CONTRACTOR AND SUBCONTRACTOR(S) TO ACQUAINT THEMSELVES WITH ALL THE AVAILABLE INFORMATION WILL NOT RELIEVE THEM FROM RESPONSIBILITY FOR PROPERLY ESTIMATING THE DIFFICULTY AND COST OF SUCCESSFULLY PERFORMING THE WORK.

10. THE CONTRACTOR SHALL HAVE AN EMERGENCY SPILL KIT ONSITE AT ALL TIMES.

11. THE CONTRACTOR IS RESPONSIBLE TO REVIEW THE CONTRACT DOCUMENTS FOR ALL SUBMITTALS REQUIRED FOR DOW CHEMICAL REVIEW AND ACCEPTANCE.

12. THE CONSULTANT TEAM AND OVERSEEING ENGINEER RESPONSIBLE FOR PREPARATION OF THESE PLANS AND SPECIFICATIONS WILL NOT BE RESPONSIBLE FOR, OR LIABLE FOR UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES TO THE PLANS MUST BE SUBMITTED IN WRITING AND MUST BE APPROVED BY THE CONSULTANT TEAM AND OVERSEEING ENGINEER RESPONSIBLE FOR PREPARATION OF THESE PLANS.

13. NO NATIVE TREES OR WETLAND VEGETATION SHALL BE REMOVED UNLESS THEY ARE SHOWN AND NOTED TO BE REMOVED ON THE PLANS, OR AS DIRECTLY SPECIFIED ON-SITE. ALL TREES CONFLICTING WITH GRADING SHALL BE TRIMMED.

14. IF, DURING CONSTRUCTION, ARCHAEOLOGICAL REMAINS ARE ENCOUNTERED, CONSTRUCTION IN THE VICINITY SHALL BE HALTED, AND DOW CHEMICAL SHALL BE NOTIFIED IMMEDIATELY.

15. THE CONTRACTOR IS RESPONSIBLE TO ENSURE THAT NO PETROLEUM PRODUCTS, HYDRAULIC FLUID, SEDIMENTS, SEDIMENT-LADEN WATER, CHEMICALS, OR ANY OTHER TOXIC OR DELETERIOUS MATERIALS ARE ALLOWED TO ENTER OR LEACH INTO THE BIG SLOUGH AND SURROUNDING WETLAND AREAS.

16. THE CONTRACTOR IS REQUIRED TO PROVIDE CONSTRUCTION SEQUENCING AND WATER MANAGEMENT PLANS THAT CONSIDER AND PROVIDE PROVISIONS FOR FISH EXCLUSION FROM ACTIVE CONSTRUCTION ZONES. FISH WITHIN THE WORK AREA SHALL BE REMOVED AND RELOCATED TO AREAS NOT IMPACTED BY CONSTRUCTION ACTIVITIES.

17. THE SITE IS SUBJECT TO TIDES. THE CONTRACTOR SHOULD BE INFORMED OF PREDICTED TIDES DURING THE PERIOD OF CONSTRUCTION.

18. THE CONTRACTOR IS REQUIRED TO USE TRACKED EQUIPMENT SUCH AS EXCAVATORS AND TRACKED DUMP TRUCKS. NO WHEELED EQUIPMENT SHALL BE PERMITTED ON THE SITE UNLESS SPECIFIC PERMISSION IS GRANTED BY THE ENGINEER OR DOW CHEMICAL.

SURVEY NOTES

1. UNLESS NOTED OTHERWISE ON THE PLANS, THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION OF ALL EXISTING SURVEY MONUMENTS AND OTHER SURVEY MARKERS DURING CONSTRUCTION.

2. THE CONTRACTOR SHALL MAINTAIN A SET OF PLANS ON THE JOB SHOWING "AS-CONSTRUCTED" CHANGES MADE TO DATE. UPON COMPLETION OF THE PROJECT, THE CONTRACTOR SHALL SUPPLY TO DOW CHEMICAL A SET OF PLANS, MARKED UP TO THE SATISFACTION OF DOW CHECMICAL, REFLECTING THE AS-CONSTRUCTED MODIFICATIONS.

3. BASE TOPOGRAPHY WAS OBTAINED FROM TEXAS WATER DEVELOPMENT BOARD LIDAR OF 2018 (REPORT TITLE: COASTAL LIDAR FOR TEXAS FROM ORANGE TO MATAGORDA COUNTY AND THE H-GAC OPERATING AREA). DATA ACCESSED FROM TEXAS NATURAL RESOURCES INFORMATION SYSTEM.

4. AERIAL IMAGES ARE NATIONAL AERIAL IMAGERY PROGRAM (NAIP) 2018 IMAGES AND WERE DOWNLOADED FROM US GEOLOGICAL SURVEY EARTH EXPLORER WEBSITE..

PERMIT NOTES

1. THE CONTRACTOR SHALL OBTAIN AT HIS OWN EXPENSE ALL PERMITS, LICENSES, INSURANCE POLICIES, ETC., NOT ALREADY OBTAINED BY DOW CHEMICAL, AS MAY BE NECESSARY TO COMPLY WITH STATE AND LOCAL LAWS ASSOCIATED WITH THE PERFORMANCE OF THE WORK. SEE SPECIAL PROVISIONS.

2. PERMIT CONDITIONS MAY CONTAIN SPECIFIC REQUIREMENTS FOR THE CONTROL OF OFF-SITE TURBIDITY FROM PROJECT OPERATIONS. TURBIDITY WILL BE MONITORED ON A FREQUENT BASIS BY THE PROJECT MANAGEMENT AND INSPECTION STAFF ON-SITE. TURBIDITY AMOUNTS IN EXCESS OF THE PERMITTED AMOUNT AND/OR DURATIONS WILL CAUSE WORK TO BE STOPPED UNTIL IMPROVED PRACTICES ARE IN EFFECT AND THE PROBLEMS CONTROLLED. THE CONTRACTOR IS COMPLETELY RESPONSIBLE FOR ANY PROJECT DELAYS THAT OCCUR BY NATURE OF THIS FAILURE TO ADEQUATELY CONTAIN SEDIMENT ON-SITE.

3. THE CONTRACTOR SHALL FOLLOW BMP'S TO CONTROL SEDIMENT AND MINIMIZE DISTURBANCE TO EXISTING VEGETATION.

ABBREVIATIONS

APPROX	APPROXIMATE	MISC	MISCELLANEOUS
CF	CUBIC FEET	N	NORTH
CH	CHANNEL	NTS	NOT TO SCALE
℄	CENTERLINE	FG	FINISHED GRADE
CY	CUBIC YARD	PR	PROPOSED
DIAM OR Ø	DIAMETER	SF	SQUARE FEET
ELEV	ELEVATION	STA	STATION
EG	EXISTING GRADE	TOB	TOP OF BANK
HORIZ	HORIZONTAL	TYP	TYPICAL
IE	INVERT ELEVATION	VERT	VERTICAL
LF	LINEAR FEET	W/	WITH
MIN	MINIMUM	BNDY	BOUNDARY
W/O	WITHOUT	NOAA	NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
MHHW	MEAN HIGHER HIGH WATER		
MLLW	MEAN LOWER LOW WATER		

TIDES

TIDE DATA AT SAN LUIS PASS, TX (NOAA GAGE SITE 8771972)

	MLWW ELEVATION	NAVD88 ELEV
MAX TIDE	4.35	3.95
HIGHEST ASTRONOMICAL TIDE	1.94	1.54
MEAN HIGHER HIGH WATER	1.25	0.85
MEAN SEA LEVEL	0.72	0.32
MEAN LOWER LOW WATER	0	-0.40

HORIZONTAL AND VERTICAL CONTROL/PROJECTION

VERTICAL CONTROL IS NAVD88, US FOOT; HORIZONTAL CONTROL IS NAD83 TEXAS STATE PLANES, SOUTH CENTRAL ZONE, US FOOT.

DETAIL AND SECTION REFERENCING

DETAIL A # — DETAIL REFERENCE LETTER; SHEET ON WHICH DETAIL APPEARS

SECTION A # — SECTION REFERENCE LETTER; SHEET ON WHICH SECTION APPEARS

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NOTES
BIG SLOUGH MITIGATION SITE
DOW CHEMICAL
BRAZORIA COUNTY, TX

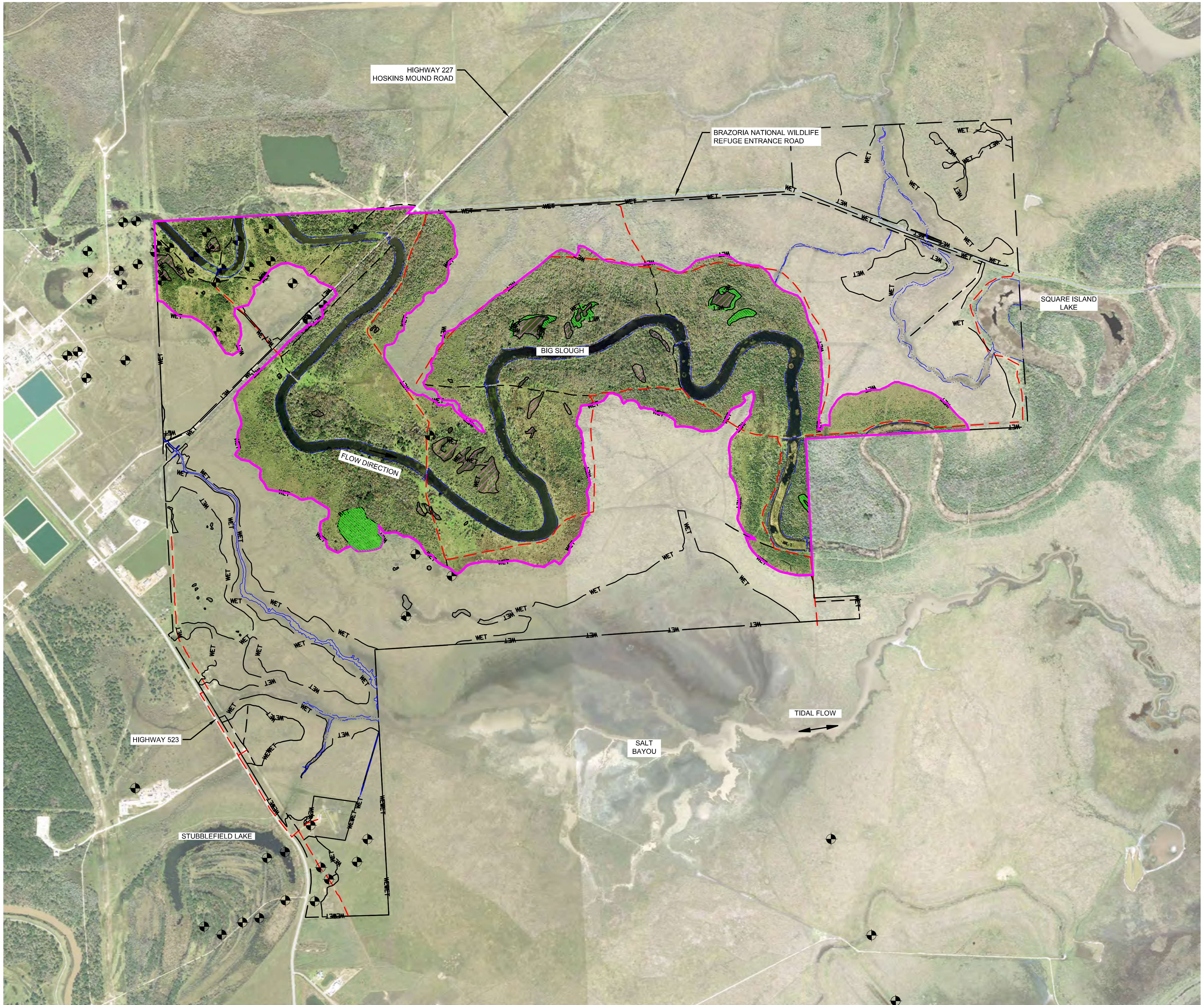
#	DATE	DESCRIPTION	BY

PRELIMINARY NOT FOR CONSTRUCTION

60% PLANS

DATE	JANUARY 2021
DRAWN	FA/LE/JC
DESIGNED	DE/LE/FA
CHECKED	DE/SM/BJ
PROJECT #	E515018116

SHEET TITLE
NOTES
SHEET NUMBER
02
LAND USE # ---



LEGEND

- PROPERTY BOUNDARY
- MITIGATION SITE BOUNDARY
- ACCESS ROADS
- PARCEL BOUNDARIES
- EXISTING STREAM BOUNDARY
- STREAM OR CHANNEL CL
- EXISTING HERBACEOUS WETLANDS
- EXISTING TIDAL WETLANDS
- EXISTING FORESTED WETLANDS
- OIL WELL

2000 1000 0 2000

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EXISTING CONDITIONS
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DOW CHEMICAL
BRAZORIA COUNTY, TX

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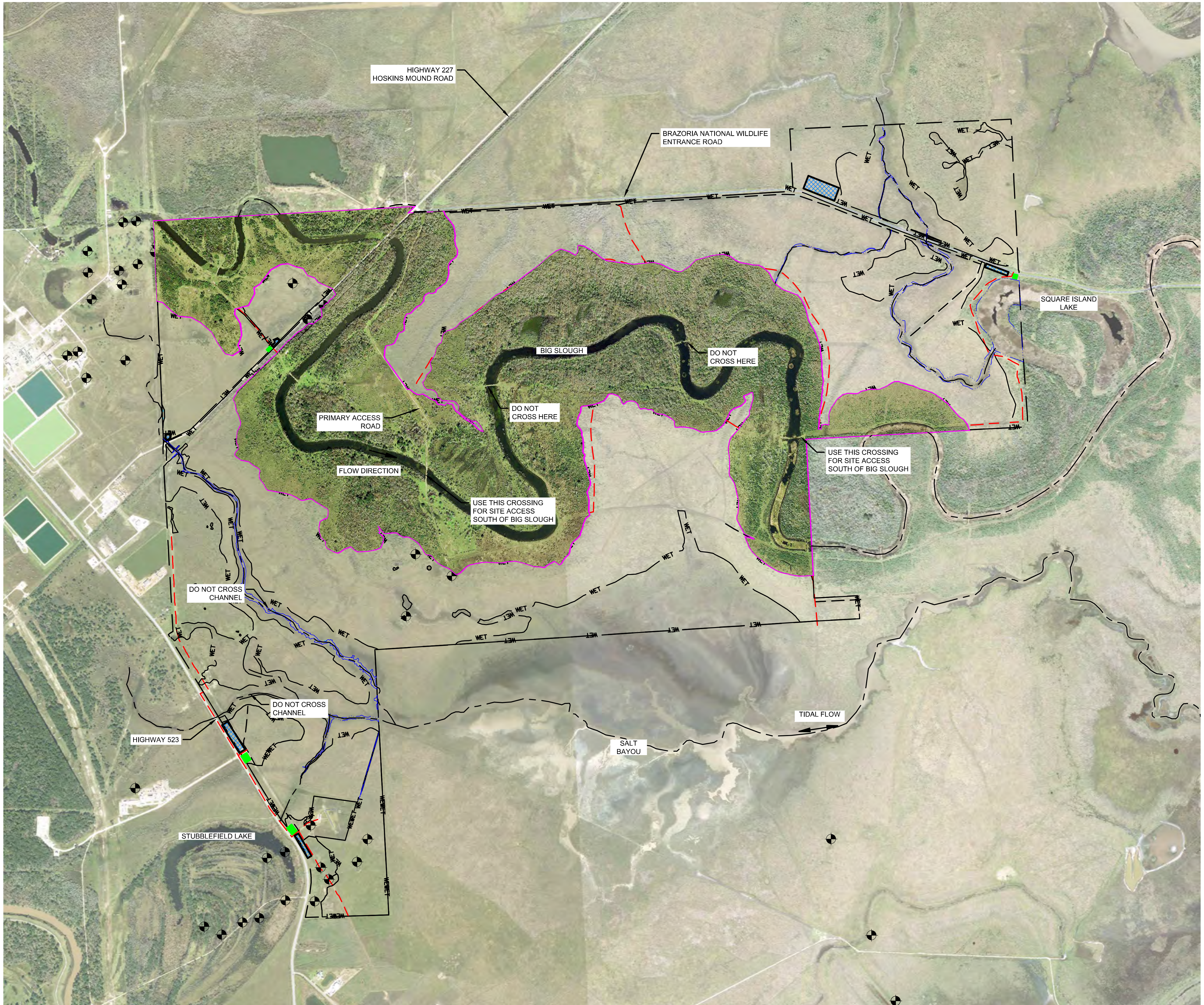
CHECKED	DE/SM/BJ
PROJECT #	E515018116

SHEET TITLE
EXISTING CONDITIONS
SHEET NUMBER
03
LAND USE # ---



LEGEND

- PROPERTY BOUNDARY
- MITIGATION SITE BOUNDARY
- ACCESS ROADS
- SENSITIVE ACCESS ROADS
- PRIMARY HAUL ROUTE
- PROPOSED MATT ROAD
- WET EXISTING WETLAND BNDY
- EXISTING STREAM BOUNDARY
- STREAM OR CHANNEL CL
- PROPOSED STAGING AREA
- PROPOSED EQUIPMENT CLEANING ZONE
- OIL/GAS WELL

NOTES

1. EQUIPMENT AND MATERIAL STAGING ONLY ALLOWED IN APPROVED STAGING AREAS IDENTIFIED IN BLUE HATCHING.
2. MATT ROADS WILL BE INSTALLED IN ALL STREAM CROSSINGS IDENTIFIED, STREAM OR CHANNEL LOCATIONS WITHOUT IDENTIFIED MATT ROADS WILL NOT BE CROSSED.
3. PRIMARY HAUL ROUTES ARE DENOTED IN RED, OFF-HAUL EQUIPMENT WILL BE LIMITED TO THESE ROUTES TO MINIMIZE WETLAND AND VEGETATION IMPACTS.
4. SENSITIVE ACCESS ROADS IDENTIFIED IN YELLOW ARE ONLY FOR USE DURING CONSTRUCTION OF WETLAND ENHANCEMENT FEATURES AND SHOULD NEVER BE UTILIZED BY NON-TRACKED EQUIPMENT. THESE ARE SENSITIVE WETLAND AREAS AND SHOULD BE AVOIDED IN ALL SITUATIONS POSSIBLE.
5. ACCESS ROADS THAT ARE NOT SENSITIVE ACCESS OR A PRIMARY HAUL ROUTE WILL ALLOW TRACKED AND NON-TRACKED EQUIPMENT, BUT SHALL NOT BE REGULARLY USED FOR OFF-HAUL AND SHOULD HAVE A LOW FREQUENCY OF TRAVEL.
6. ALL EQUIPMENT WILL BE SPRAYED DOWN IN AN EQUIPMENT CLEANING LOCATION PRIOR TO LEAVING THE PROJECT SITE. SEE PROPOSED EQUIPMENT CLEANING ZONES.
7. ALL SENSITIVE ACCESS ROADS WILL BE DECOMMISSIONED AND PLANTED AFTER CONSTRUCTION ACTIVITIES ARE COMPLETE. PLANTING WILL BE COMPLETED ACCORDING TO THE PLANTING ZONE THAT THE ROAD IS WITHIN. SEE SHEET 15 FOR PLANTING COMMUNITY TYPES.
8. CROSSINGS THAT ARE MARKED AS NOT TO BE USED WILL BE REMOVED AS PART OF THIS RESTORATION PROJECT.
9. MATT ROADS MUST BE INSTALLED FROM THE CLOSEST SENSITIVE ACCESS ROAD TO PROPOSED EXCAVATION FEATURES FOR ALL CONSTRUCTION ACCESS WITHIN EXISTING WETLANDS.

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ACCESS STAGING AND TESC
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DOW CHEMICAL
BRAZORIA COUNTY, TX

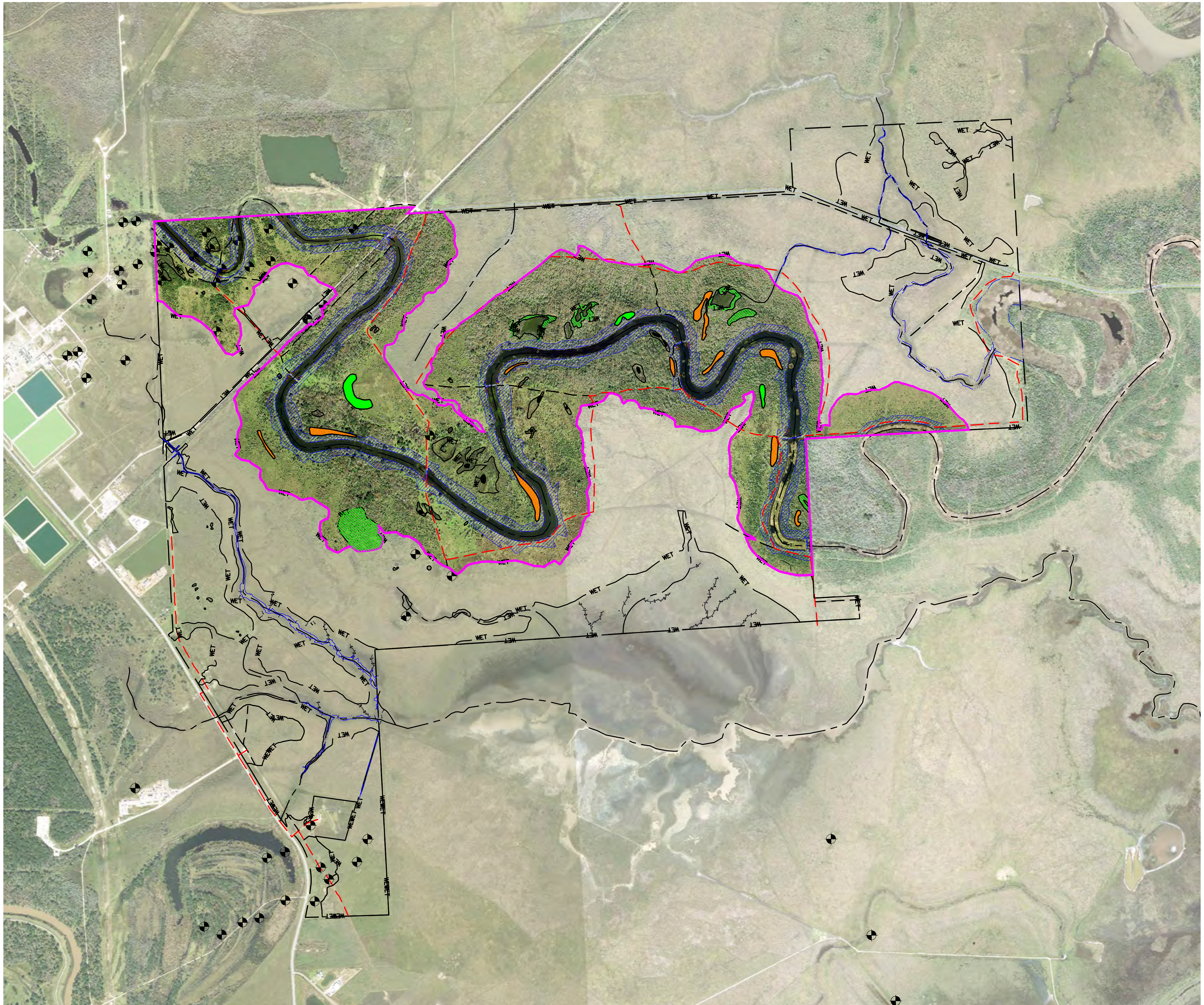
#	DATE	DESCRIPTION	BY

PRELIMINARY NOT FOR CONSTRUCTION

DATE	JANUARY 2021
DRAWN	FA/LE/JC
DESIGNED	DE/LE/FA
CHECKED	DE/SM/BJ
PROJECT #	E515018116

SHEET TITLE
ACCESS STAGING&TESC
SHEET NUMBER
04
LAND USE #

Plot Stamp: 3/3/2023 9:02:35 AM - Gorden, Jeremy
File: Z:\Sam Waltman\2022\005\BIG SLOUGH- OVERVIEW.dwg, Tab: 05 OVERVIEW



LEGEND

— — —	PROPERTY BOUNDARY
	MITIGATION SITE BOUNDARY
- - - -	ACCESS ROADS
- - - -	PRIMARY HAUL ROUTE
	PROPOSED MATT ROAD
— WET —	EXISTING WETLAND BNDY
	EXISTING STREAM BOUNDARY
— - —	CHANNEL/STREAM CENTERLINE
	TIDE CHANNEL DAYLIGHT LINES
	PROPOSED HABITAT MOUNDS
	PROPOSED SCROLL FEATURE
	RIPARIAN PLANTING AREA. SEE SHEET 15.
	PROPOSED FORESTED WETLAND ENHANCEMENT
	OIL/GAS WELL

NOTES

1) FOR ALL PROPOSED PLANTING AREAS REFER TO THE PLANTING PLAN (06) AND SCHEDULE (15).

2) REFER TO DETAILS FOR TYPICAL SECTIONS FOR PROPOSED WETLAND FEATURES INCLUDING POTHOLES, PONDS, OXBOWS, SCROLL AND TIDE CHANNELS (PER SHEETS ##-##).

2000 1000 0 2000

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OVERVIEW
BIG SLOUGH MITIGATION SITE
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BRAZORIA COUNTY, TX

#	DATE	DESCRIPTION	BY

PRELIMINARY NOT FOR CONSTRUCTION

DATE	JANUARY 2021
DRAWN	FA/LE/JC
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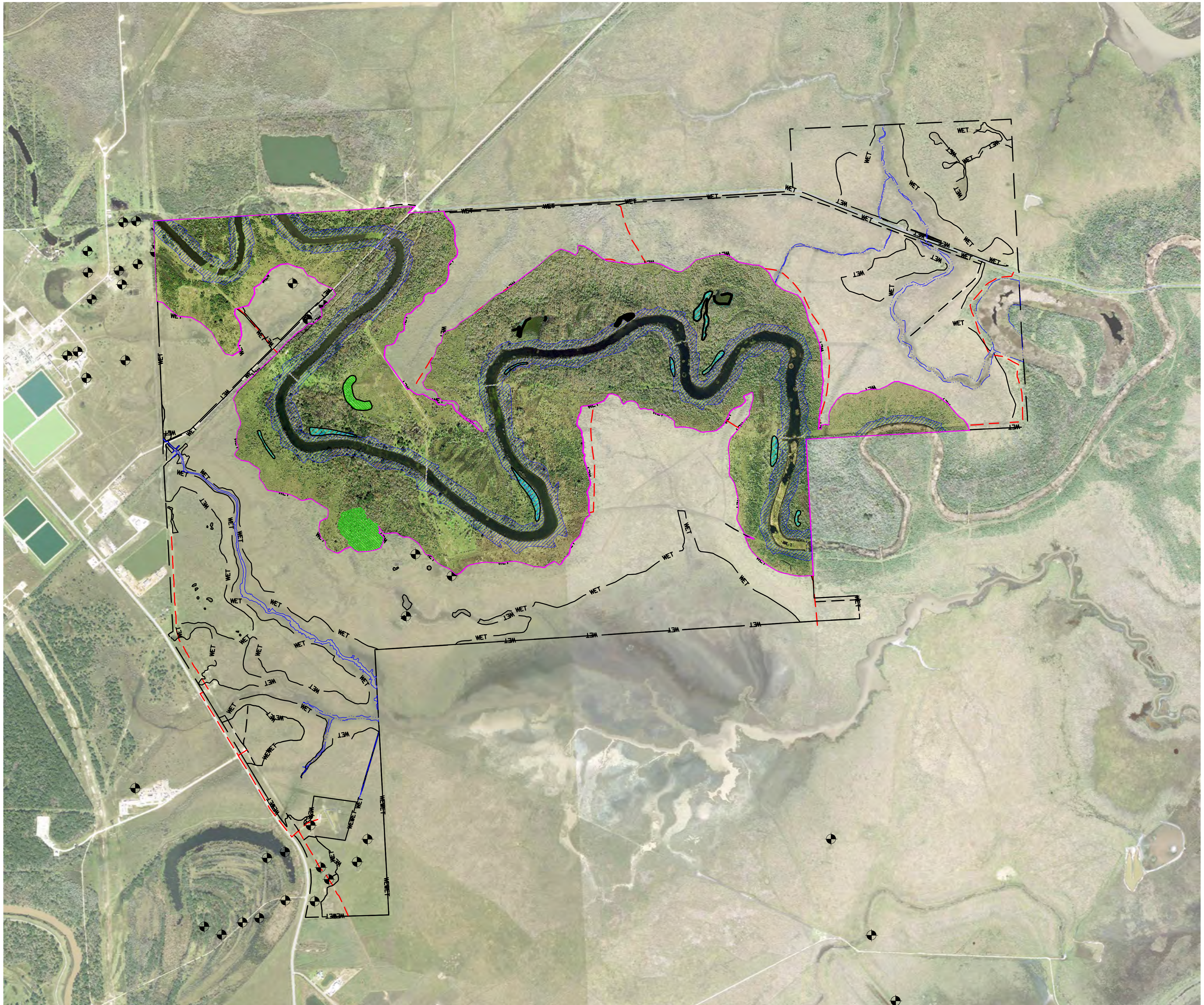
PROJECT #	E515018116

SHEET TITLE
OVERVIEW

SHEET NUMBER
05

LAND USE #



LEGEND

- PROPERTY BOUNDARY
- MITIGATION SITE BOUNDARY
- WET — EXISTING WETLAND BNDY
- EXISTING STREAM BOUNDARY
- TYPE 4: EMERGENT WETLAND
- TYPE 5: FORESTED WETLAND
- BOTTOMLAND HARDWOOD FOREST: PLANTING TYPE 5, 6 AND 7. SEE DETAIL SHEET 15.

NOTES

1. IDENTIFY AND ERADICATE ALL TALLOW NORTH OF THE PHASE 1/PHASE 2 BOUNDARY LINE. AREAS CURRENTLY IDENTIFIED FOR TALLOW REMOVAL ARE APPROXIMATE BASED ON 2018 TRUE COLOR AND CIR AERIAL IMAGERY AND WILL BE REFINED AND STAKED OUT PRIOR TO CONSTRUCTION. ADDITIONAL TALLOW REMOVAL WILL BE NECESSARY OUTSIDE OF IDENTIFIED ZONES.
2. TALLOW REMOVAL TO OCCUR BETWEEN MAY-AUGUST FOR HERBICIDE EFFECTIVENESS AND TO ALLOW FOR CHEMICAL DEGRADATION BEFORE PLANTING.
3. TALLOW REMOVAL TO BE COMPLETED USING THE FOLLOWING STEPS:
   - 3.1. IDENTIFY TALLOW TREES AND TAG
   - 3.2. REMOVE SMALL TREES AND STARTS MECHANICALLY, COMPLETELY REMOVE ROOT MASS FROM SOIL.
   - 3.3. CUT PERPENDICULAR SLASHES INTO BARK OF MATURE TREES AT WAIST HEIGHT SPACED EVERY 10-12 INCHES.
   - 3.4. APPLY CHOSEN HERBICIDE DIRECTLY ON CUTS, DO NOT SPRAY HERBICIDE ON ENTIRE TREE.
   - 3.5. WAIT 4-MONTHS FOR TREE DEATH, MONITOR AND REAPPLY IF NECESSARY.
4. REFER TO PLANTING SCHEDULE FOR DETAILED INFORMATION ON PLANTING TYPES (SEE SHEET 15)
5. THIS PLANTING PLAN DOES NOT SHOW PROPOSED WETLAND ENHANCEMENT FEATURES. FOR PLANTING IN THESE FEATURES, REFER TO THE DETAILED SITE PLAN (SHEETS 08-14) AND THE FEATURE DETAILS (SHEETS 17-18).
6. ALL EXISTING FORESTED WETLANDS LABELED AS "PFO" IN DETAILED SITE PLAN SHEETS REQUIRE TALLOW REMOVAL AND TYPE 4 PLANTING ENHANCEMENT. OTHER EXISTING WETLANDS ON THE BIG SLOUGH ALLUVIAL RIDGE WILL BE ASSESSED IN THE FIELD FOR PLANTING NEEDS.
7. PLANTING WILL OCCUR ON ALL TERMINATED SENSITIVE ACCESS ROADS AFTER CONSTRUCTION IS COMPLETE. SEE SHEET 04 FOR LOCATION OF SENSITIVE ACCESS ROADS.
8. TIDAL FRINGE PLANTING SHOULD BE FOCUSED ON A 25' BUFFER ZONE ADJACENT TO ALL PROPOSED TIDE CHANNELS PER THE SITE PLAN (SHEETS 08-14).

SCALE: 1"=2000'

2000 1000 0 2000

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PLANTING PLAN
BIG SLOUGH MITIGATION SITE
DOW CHEMICAL
BRAZORIA COUNTY, TX

#	DATE	DESCRIPTION	BY

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DATE	JANUARY 2021
DRAWN	FA/LE/JC
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PROJECT #	E515018116

SHEET TITLE
PLANTING PLAN

SHEET NUMBER
06

LAND USE # ---

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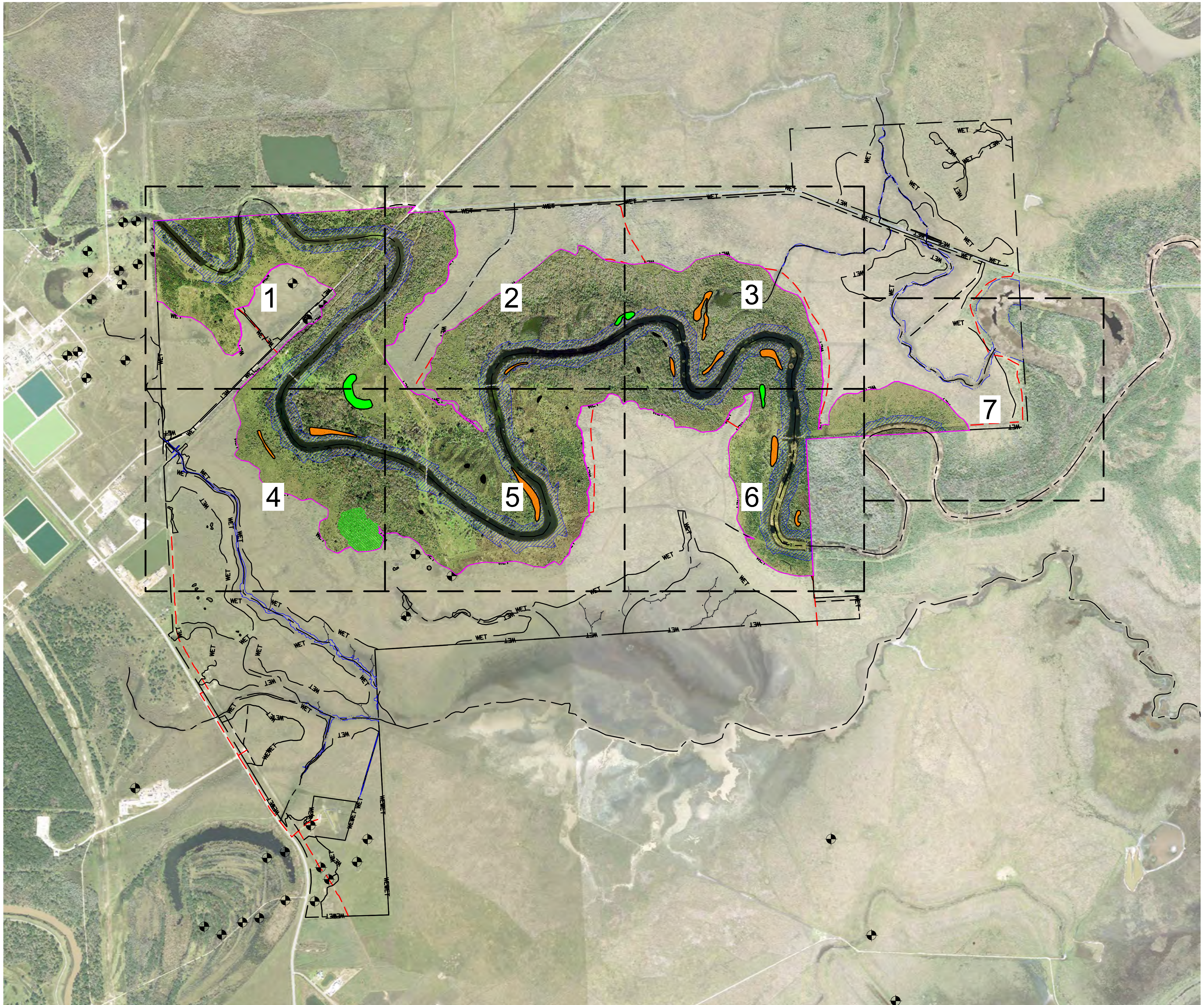
File: Z:\Sam Waltman\20221005\BIG SLOUGH-PLANTING PLAN.dwg, Tab: PLANTING PLAN



LEGEND

EXISTING FEATURES

- PROPERTY BOUNDARY
- MAJOR (5') TOPO LINES
- MINOR (1') TOPO LINES
- CHANNEL/STREAM CENTERLINE
- EXISTING STREAM BOUNDARY
- WET — EXISTING WETLAND BNDY

PROPOSED FEATURES

- MITIGATION SITE BOUNDARY
- ACCESS ROADS
- PRIMARY HAUL ROUTE
- TIDE CHANNEL DAYLIGHT LINES
- PROPOSED SCROLL FEATURE
- RIPARIAN PLANTING AREA, SEE SHEET 15.
- PROPOSED FORESTED WETLAND ENHANCEMENT

NOTES

1) THIS INDEX SHEET DISPLAYS THE LOCATION OF SITE PLAN SHEETS 1-12. USE THESE SITE PLAN SHEETS TO REFER TO THE DETAILED DESIGN.

2) FOR ALL PROPOSED PLANTING AREAS REFER TO THE PLANTING PLAN (06) AND SCHEDULE (15).

3) REFER TO DETAILS FOR TYPICAL SECTIONS FOR PROPOSED WETLAND FEATURES INCLUDING POTHOLES, PONDS, OXBOWS, SCROLL AND TIDE CHANNELS (PER SHEETS 17-18).

2000 1000 0 2000

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SHEET INDEX
BIG SLOUGH MITIGATION SITE
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PROJECT #	E515018116

SHEET TITLE
SHEET INDEX

SHEET NUMBER
07

LAND USE #

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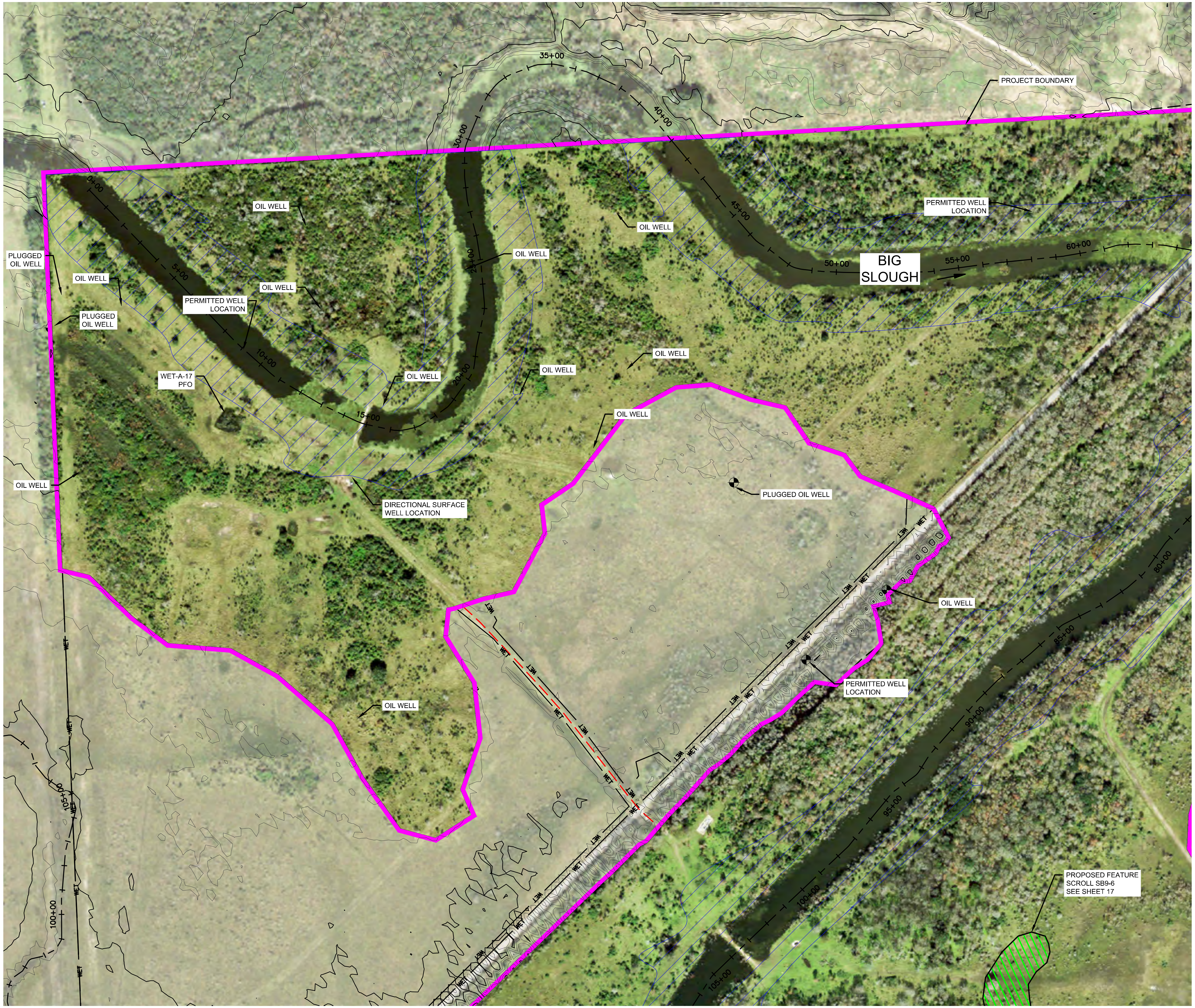

LEGEND

EXISTING FEATURES

- PROPERTY BOUNDARY
- MAJOR (5') TOPO LINES
- MINOR (1') TOPO LINES
- CHANNEL/STREAM CENTERLINE
- EXISTING STREAM BOUNDARY
- WET — EXISTING WETLAND BNDY

PROPOSED FEATURES

- MITIGATION SITE BOUNDARY
- ACCESS ROADS
- PRIMARY HAUL ROUTE
- TIDE CHANNEL DAYLIGHT LINES
- PROPOSED SCROLL FEATURE
- RIPARIAN PLANTING AREA. SEE SHEET 15.
- PROPOSED FORESTED WETLAND ENHANCEMENT

NOTES

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2) REFER TO DETAILS FOR TYPICAL SECTIONS FOR PROPOSED WETLAND FEATURES INCLUDING POTHOLES, PONDS, OXBOWS, SCROLL AND TIDE CHANNELS (PER SHEETS 17-18).

400 200 0 400

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SITE PLAN 1
BIG SLOUGH MITIGATION SITE
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#	DATE	DESCRIPTION	BY

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DATE	JANUARY 2021
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PROJECT #	E515018116

SHEET TITLE
SITE PLAN 1

SHEET NUMBER
08

LAND USE # ---

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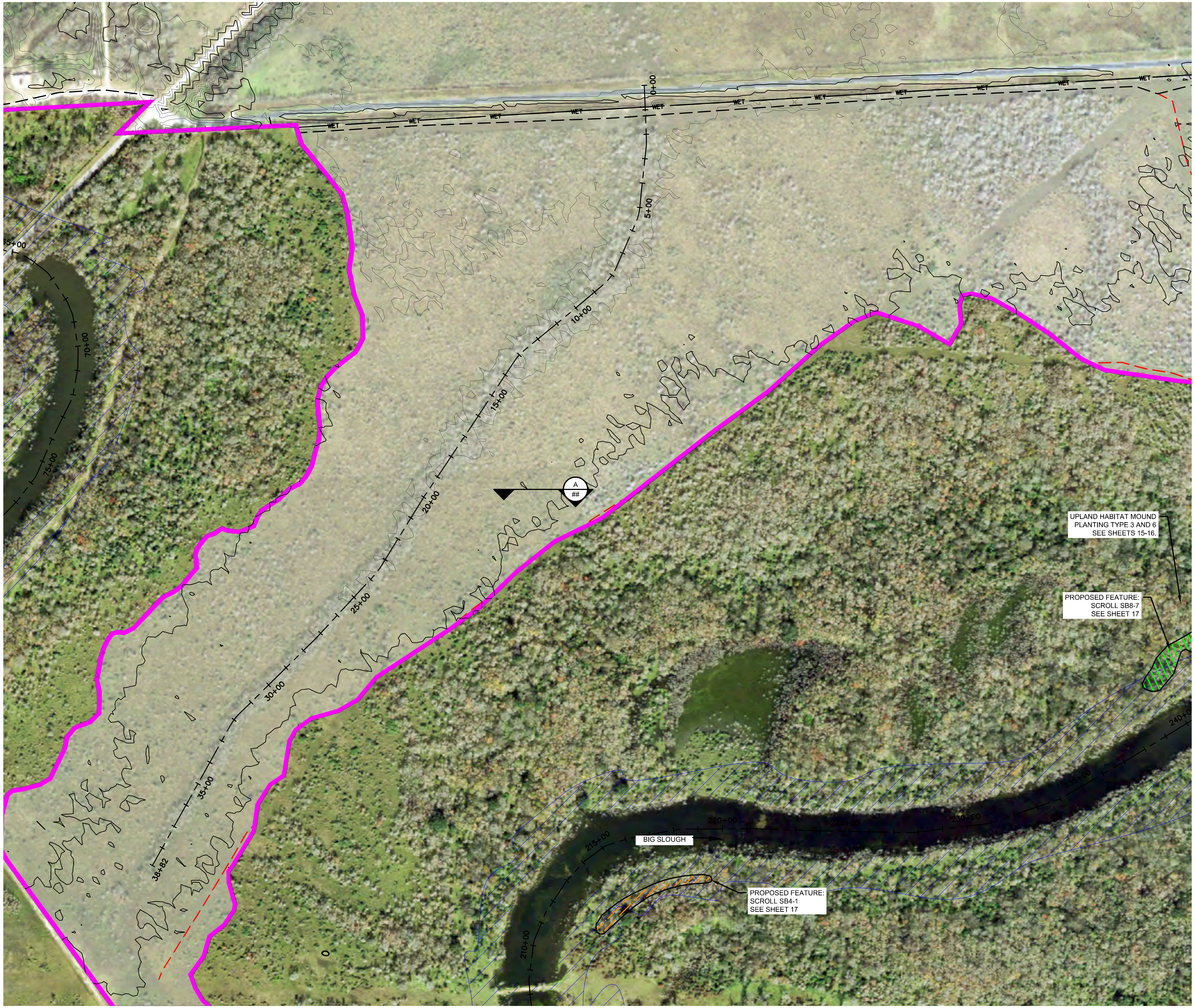

LEGEND

EXISTING FEATURES

- PROPERTY BOUNDARY
- MAJOR (5') TOPO LINES
- MINOR (1') TOPO LINES
- CHANNEL/STREAM CENTERLINE
- EXISTING STREAM BOUNDARY
- WET EXISTING WETLAND BNDY

PROPOSED FEATURES

- MITIGATION SITE BOUNDARY
- ACCESS ROADS
- PRIMARY HAUL ROUTE
- TIDE CHANNEL DAYLIGHT LINES
- PROPOSED SCROLL FEATURE
- RIPARIAN PLANTING AREA. SEE SHEET 15.
- PROPOSED FORESTED WETLAND ENHANCEMENT

NOTES

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400 200 0 400

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SITE PLAN 2
BIG SLOUGH MITIGATION SITE
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BRAZORIA COUNTY, TX

#	DATE	DESCRIPTION	BY

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DATE	JANUARY 2021
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PROJECT #	E515018116

SHEET TITLE
SITE PLAN 2

SHEET NUMBER
09

LAND USE # ---

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LEGEND

EXISTING FEATURES

- PROPERTY BOUNDARY
- MAJOR (5') TOPO LINES
- MINOR (1') TOPO LINES
- CHANNEL/STREAM CENTERLINE
- EXISTING STREAM BOUNDARY
- WET — EXISTING WETLAND BNDY

PROPOSED FEATURES

- MITIGATION SITE BOUNDARY
- ACCESS ROADS
- PRIMARY HAUL ROUTE
- TIDE CHANNEL DAYLIGHT LINES
- PROPOSED SCROLL FEATURE
- RIPARIAN PLANTING AREA, SEE SHEET 15.
- PROPOSED FORESTED WETLAND ENHANCEMENT

NOTES

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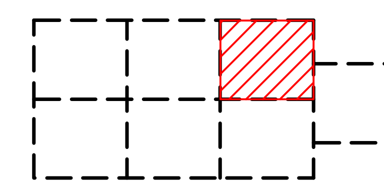

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SITE PLAN 3

BIG SLOUGH MITIGATION SITE

DOW CHEMICAL

BRAZORIA COUNTY, TX

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DATE	JANUARY 2021
DRAWN	FA/LE/JC
DESIGNED	DE/LE/FA
CHECKED	DE/SM/BJ
PROJECT #	E515018116

SHEET TITLE
SITE PLAN 3

SHEET NUMBER
10

LAND USE # ----

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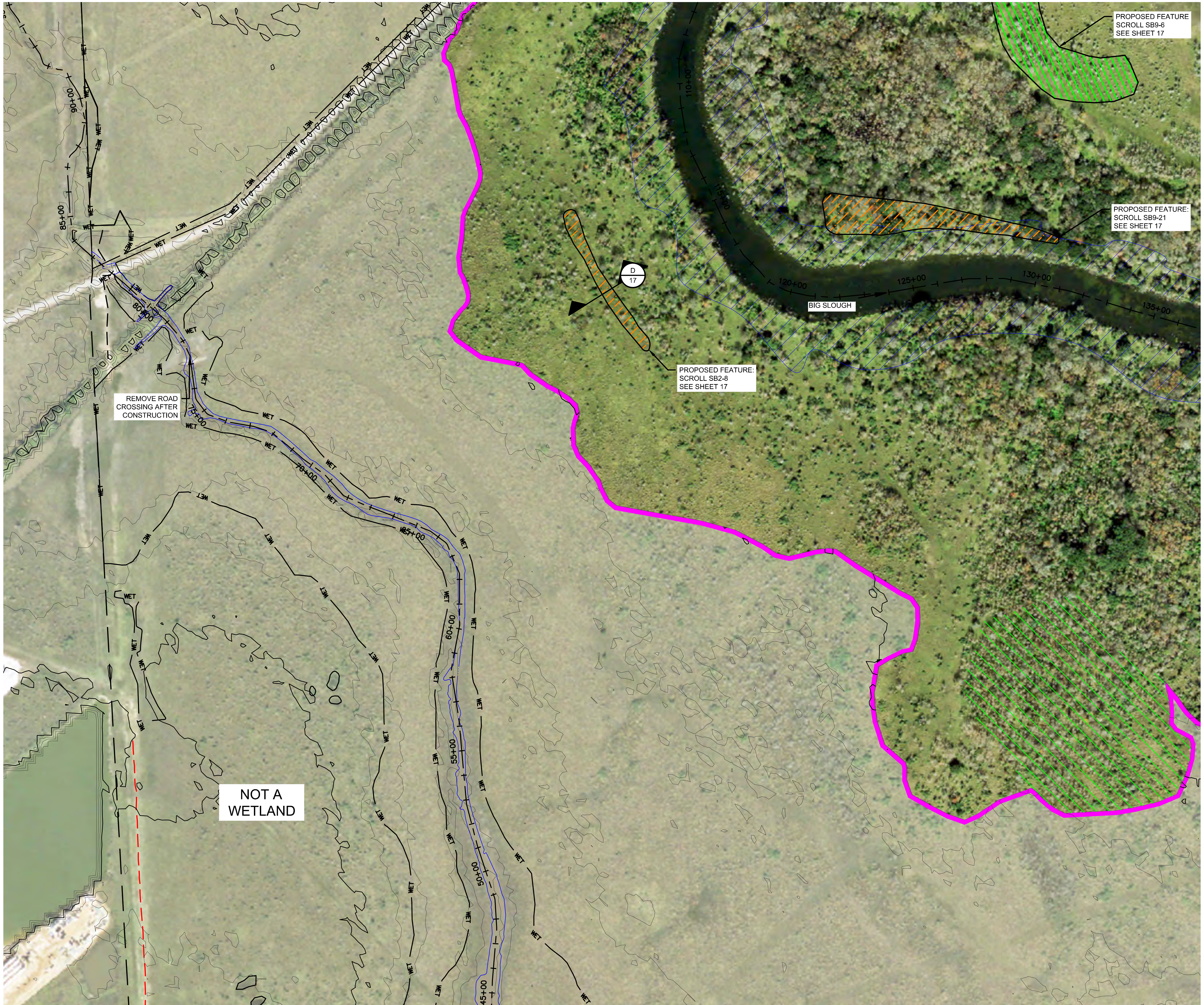
File: Z:\Sam Waltman\2022\1005\BIG SLOUGH-SITE PLAN.dwg, Tab: 10 SITE PLAN 3



LEGEND

EXISTING FEATURES

- PROPERTY BOUNDARY
- MAJOR (5') TOPO LINES
- MINOR (1') TOPO LINES
- CHANNEL/STREAM CENTERLINE
- EXISTING STREAM BOUNDARY
- EXISTING WETLAND BNDY

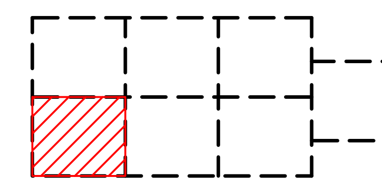
PROPOSED FEATURES

- MITIGATION SITE BOUNDARY
- ACCESS ROADS
- PRIMARY HAUL ROUTE
- TIDE CHANNEL DAYLIGHT LINES
- PROPOSED SCROLL FEATURE
- RIPARIAN PLANTING AREA. SEE SHEET 15.
- PROPOSED FORESTED WETLAND ENHANCEMENT

NOTES

1) FOR ALL PROPOSED PLANTING AREAS REFER TO THE PLANTING PLAN (06) AND SCHEDULE (15).

2) REFER TO DETAILS FOR TYPICAL SECTIONS FOR PROPOSED WETLAND FEATURES INCLUDING POTHOLES, PONDS, OXBOWS, SCROLL AND TIDE CHANNELS (PER SHEETS 17-18).



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60% PLANS

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SITE PLAN 4
BIG SLOUGH MITIGATION SITE
DOW CHEMICAL
BRAZORIA COUNTY, TX

#	DATE	DESCRIPTION	BY

PRELIMINARY NOT FOR CONSTRUCTION

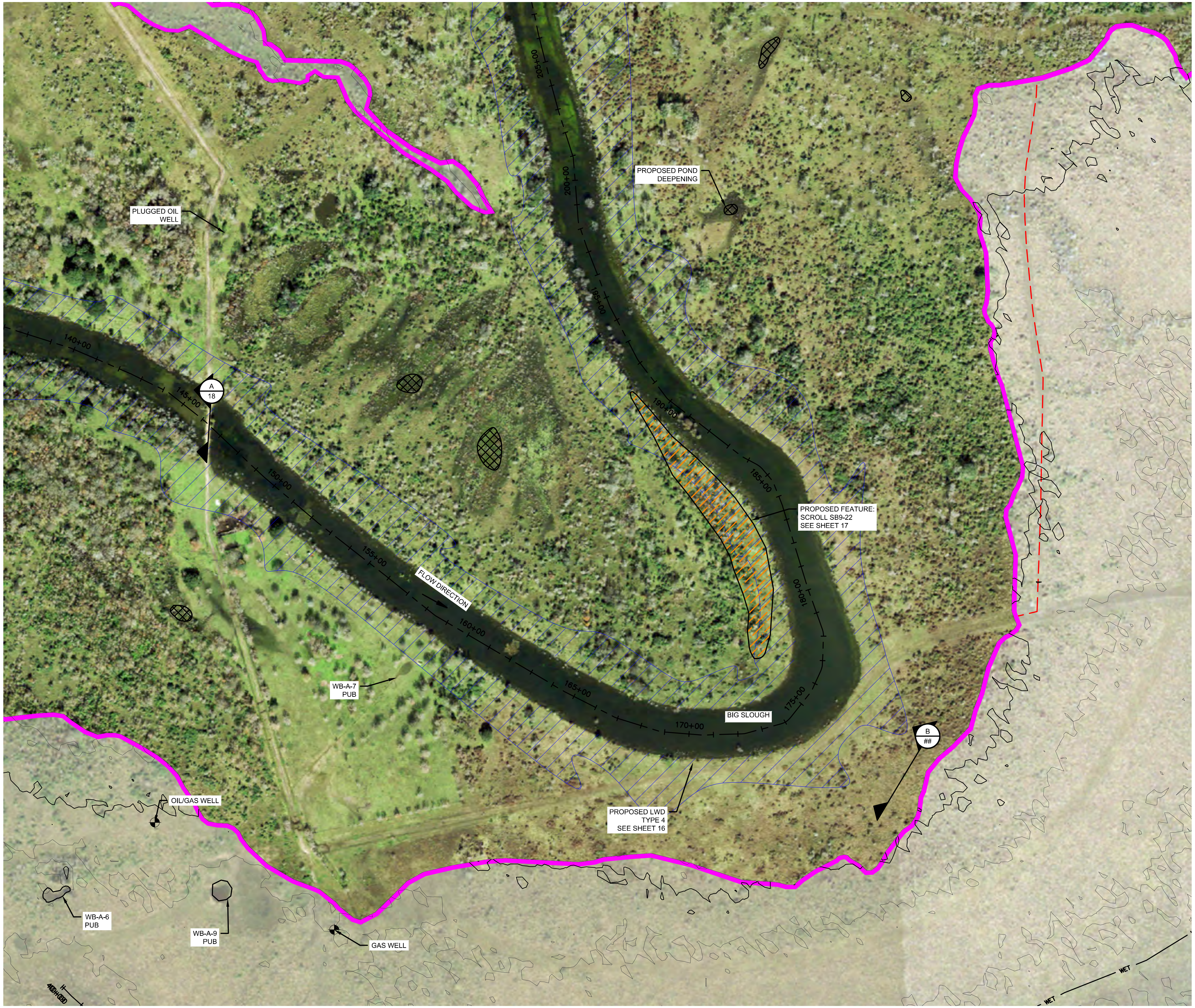
DATE	JANUARY 2021
DRAWN	FA/LE/JC
DESIGNED	DE/LE/FA
CHECKED	DE/SM/BJ
PROJECT #	E515018116

SHEET TITLE
SITE PLAN 4

SHEET NUMBER
11

LAND USE #

Plot Stamp: 3/3/2023 9:03:41 AM - Gorden, Jeremy
File: Z:\Sam Waltman\20221005\BIG SLOUGH-SITE PLAN.dwg, Tab: 11 SITE PLAN 4



LEGEND

EXISTING FEATURES

- PROPERTY BOUNDARY
- MAJOR (5') TOPO LINES
- MINOR (1') TOPO LINES
- CHANNEL/STREAM CENTERLINE
- EXISTING STREAM BOUNDARY
- WET — EXISTING WETLAND BNDY

PROPOSED FEATURES

- MITIGATION SITE BOUNDARY
- ACCESS ROADS
- PRIMARY HAUL ROUTE
- TIDE CHANNEL DAYLIGHT LINES
- PROPOSED SCROLL FEATURE
- RIPARIAN PLANTING AREA. SEE SHEET 15.
- PROPOSED FORESTED WETLAND ENHANCEMENT

NOTES

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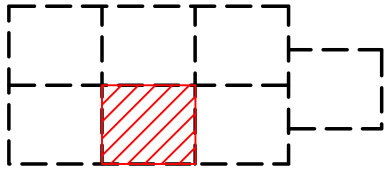

400 200 0 400

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SITE PLAN 5
BIG SLOUGH MITIGATION SITE
DOW CHEMICAL
BRAZORIA COUNTY, TX

#	DATE	DESCRIPTION	BY

PRELIMINARY NOT FOR CONSTRUCTION

DATE	JANUARY 2021
DRAWN	FA/LE/JC
DESIGNED	DE/LE/FA
CHECKED	DE/SM/BJ
PROJECT #	E515018116

SHEET TITLE
SITE PLAN 5

SHEET NUMBER
12

LAND USE # ---

Plot Stamp: 3/3/2023 9:03:51 AM - Gorden, Jeremy
File: Z:\Sam Waltman\20221005\BIG SLOUGH-SITE PLAN.dwg, Tab: 12 SITE PLAN 5

LEGEND

EXISTING FEATURES

- PROPERTY BOUNDARY
- MAJOR (5') TOPO LINES
- MINOR (1') TOPO LINES
- CHANNEL/STREAM CENTERLINE
- EXISTING STREAM BOUNDARY
- WET — EXISTING WETLAND BNDY

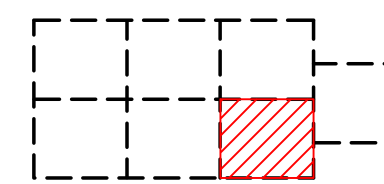
PROPOSED FEATURES

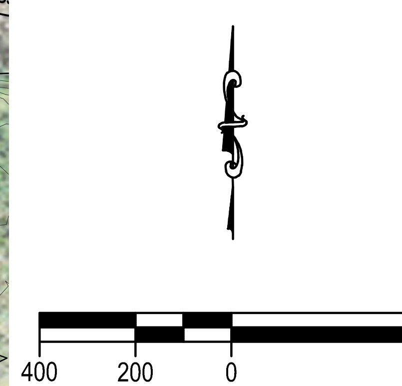
- MITIGATION SITE BOUNDARY
- ACCESS ROADS
- PRIMARY HAUL ROUTE
- TIDE CHANNEL DAYLIGHT LINES
- PROPOSED SCROLL FEATURE
- RIPARIAN PLANTING AREA, SEE SHEET 15.
- PROPOSED FORESTED WETLAND ENHANCEMENT

NOTES

1) FOR ALL PROPOSED PLANTING AREAS REFER TO THE PLANTING PLAN (06) AND SCHEDULE (15).

2) REFER TO DETAILS FOR TYPICAL SECTIONS FOR PROPOSED WETLAND FEATURES INCLUDING POTHOLES, PONDS, OXBOWS, SCROLL AND TIDE CHANNELS (PER SHEETS 17-18).





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SITE PLAN 6
BIG SLOUGH MITIGATION SITE
DOW CHEMICAL
BRAZORIA COUNTY, TX

#	DATE	DESCRIPTION	BY

PRELIMINARY NOT FOR CONSTRUCTION

DATE	JANUARY 2021
DRAWN	FA/LE/JC
DESIGNED	DE/LE/FA
CHECKED	DE/SM/BJ
PROJECT #	E515018116

SHEET TITLE
SITE PLAN 6

SHEET NUMBER
13

LAND USE #

Plot Stamp: 3/3/2023 9:04:01 AM - Gorden, Jeremy
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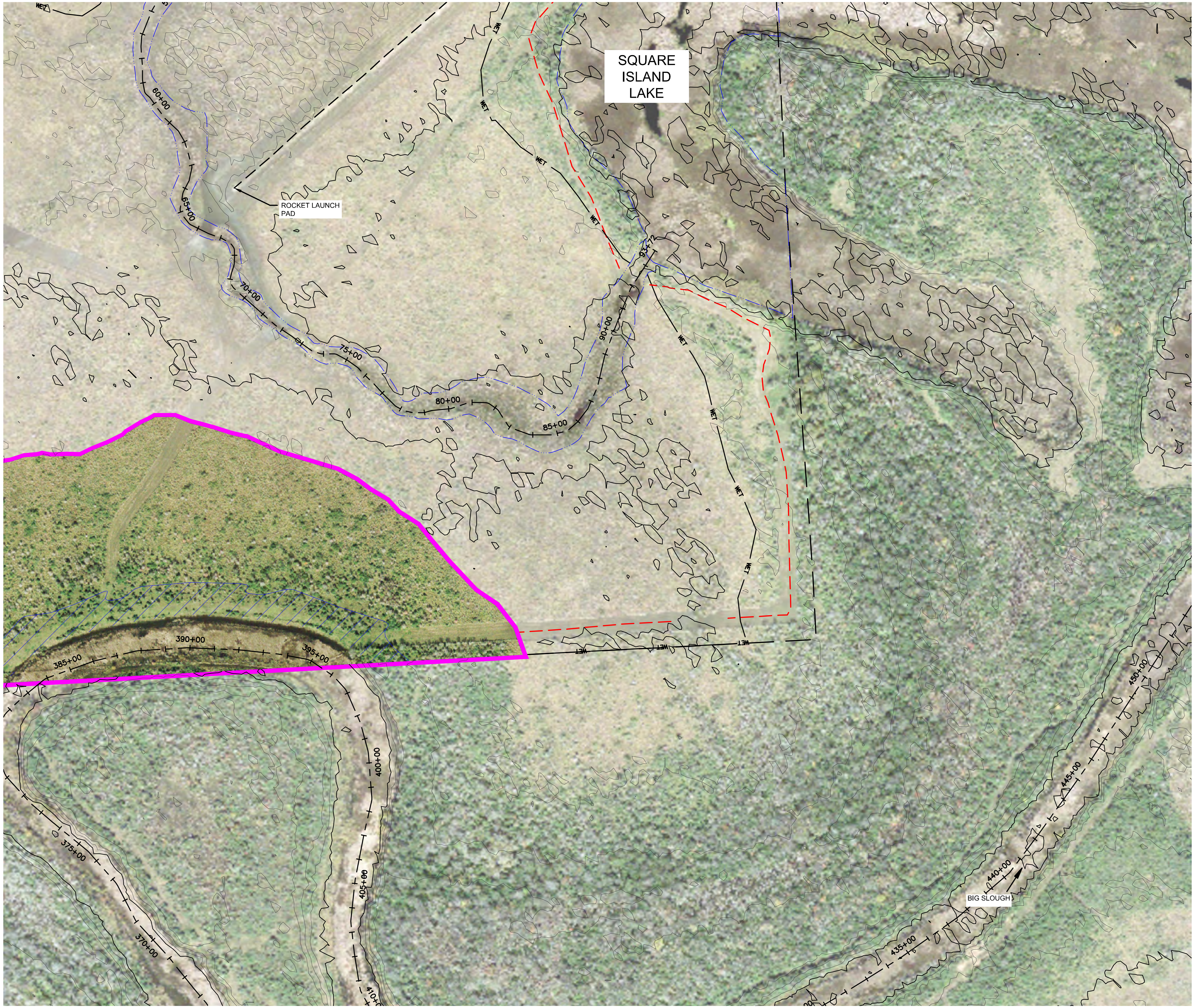

LEGEND

EXISTING FEATURES

- PROPERTY BOUNDARY
- MAJOR (5') TOPO LINES
- MINOR (1') TOPO LINES
- CHANNEL/STREAM CENTERLINE
- EXISTING STREAM BOUNDARY
- WET EXISTING WETLAND BNDY

PROPOSED FEATURES

- MITIGATION SITE BOUNDARY
- ACCESS ROADS
- PRIMARY HAUL ROUTE
- TIDE CHANNEL DAYLIGHT LINES
- PROPOSED SCROLL FEATURE
- RIPARIAN PLANTING AREA. SEE SHEET 15.
- PROPOSED FORESTED WETLAND ENHANCEMENT

NOTES

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2) REFER TO DETAILS FOR TYPICAL SECTIONS FOR PROPOSED WETLAND FEATURES INCLUDING POTHOLES, PONDS, OXBOWS, SCROLL AND TIDE CHANNELS (PER SHEETS 17-18).

400 200 0 400

60% PLANS

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SITE PLAN 7
BIG SLOUGH MITIGATION SITE
DOW CHEMICAL
BRAZORIA COUNTY, TX

#	DATE	DESCRIPTION	BY

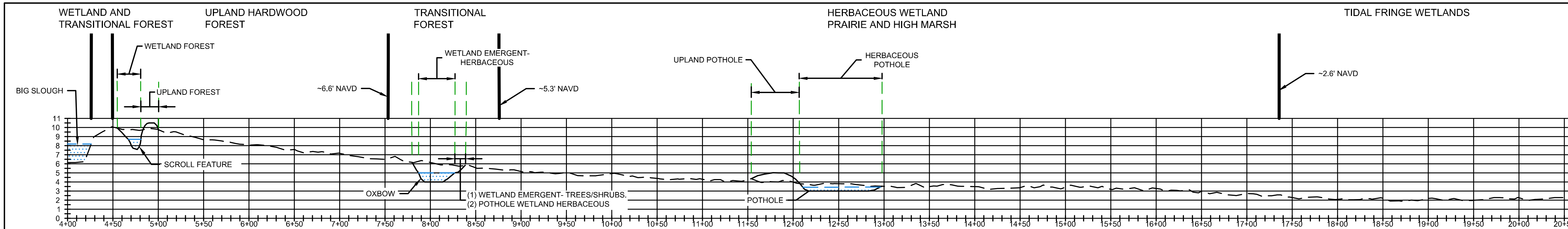
PRELIMINARY NOT FOR CONSTRUCTION

DATE	JANUARY 2021
DRAWN	FA/LE/JC
DESIGNED	DE/LE/FA
CHECKED	DE/SM/BJ
PROJECT #	E515018116

SHEET TITLE
SITE PLAN 7

SHEET NUMBER
14

LAND USE # ---



VEGETATION COMMUNITY TYPES PROFILE

10X VERTICAL EXAGGERATION
N.T.S

A
15

LEGEND

- TYPICAL WATER LEVEL
- EG FROM LIDAR SURFACE
- PROPOSED GRADE
- OVERALL COMMUNITY TYPE BORDER
- DETAILED COMMUNITY TYPE BORDER
- WATER
- INDICATES BELOW EG SURFACE

NOTES:

1. THE PLANT COMMUNITY PROFILE WAS DRAWN ON A REPRESENTATIVE SECTION FROM BIG SLOUGH TO SALT BAYOU ON THE SOUTH SIDE OF THE PROJECT SITE.
2. OVERALL COMMUNITY TYPE BORDERS INDICATE A DOMINANT TRANSITION IN PLANT COMMUNITIES CAUSED BY LANDSCAPE LEVEL ELEVATION CHANGE.
3. DETAILED COMMUNITY TYPE BORDERS INDICATE A CHANGE IN VEGETATION TYPE FROM MICRO-TOPOGRAPHIC FEATURES SUCH AS SCROLLS, POTHOLES, AND PONDS. THESE BORDERS CAN EXIST WITHIN AN OVERALL PLANT COMMUNITY ZONE.
4. OVERALL PLANT COMMUNITY ZONES SHOULD BE USED TO SELECT PLANTING ENHANCEMENT TYPE IN ANY AREA NOT ALREADY SPECIFIED IN THE DETAILED PLAN SHEETS (08-14) OR WETLAND FEATURE DETAIL SHEETS (17-18).
5. PLANTING DENSITY FOR HERBACEOUS SPECIES IS MEASURED IN PERCENT COMPOSITION BY WEIGHT FOR EACH SPECIES. THE WEIGHT IS RELATIVE TO 25LBS OF TOTAL SEED MIX APPLIED PER PLANTED ACRE.

60% PLANS

Plot Stamp: 3/3/2023 9:04:27 AM - Gorden, Jeremy
File: Z:\Sam Waltman\20221005\BIG SLOUGH- DETAILS.dwg, Tab: 20 PLANTING SCHEDULE

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PLANTING SCHEDULE
BIG SLOUGH MITIGATION SITE
DOW CHEMICAL
BRAZORIA COUNTY, TX

#	DATE	DESCRIPTION	BY

PRELIMINARY NOT FOR CONSTRUCTION

DATE	JANUARY 2021
DRAWN	FA/LE/JC
DESIGNED	DE/LE/FA
CHECKED	DE/SM/BJ
PROJECT #	E515018116

SHEET TITLE
PLANTING SCHEDULE
SHEET NUMBER
15
LAND USE # ----

TABLE 4. EMERGENT WETLAND PLANTING (TYPE 4)

SPECIES COMMON NAME	SCIENTIFIC NAME	NWPL INDEX CODE	PLANTING DENSITY
TREES			#/ACRE
OVERCUP OAK	QUERCUS LYRATA	OBL	50
WATER HICKORY	CARYA AQUATICA	OBL	50
SOUTHERN BALD-CYPRESS	TAXODIUM DISTICHUM	OBL	50
BLACK WILLOW	SALIX NIGRA	OBL	50
TOTAL			**200**
UNDERSTORY / SHRUBS			
COMMON BUTTONBUSH	CEPHALANTHUS OCCIDENTALIS	OBL	150
EASTERN SWAMP-PRIVET	FORESTIERA ACUMINATA	OBL	150
TOTAL			**300**
HERBACEOUS			% OF SEED MIX BY WEIGHT
CHEROKEE SEDGE	CAREX CHEROKEENSIS	FACW	2
SLENDER WOOD-OATS	CHASMANTHIUM LAXUM	FACW	2
CROWFOOT SEDGE	CAREX CRUS-CORVI	OBL	2
DELTA ARROWHEAD	SAGITTARIA PLATYPHYLLA	OBL	16
FLOATING PRIMROSE-WILLOW	LUDWIGIA PEPLOIDES	OBL	2
GRASS-LEAF ARROWHEAD	SAGITTARIA GRAMINEA	OBL	2
LIZARD'S-TAIL	SAURURUS CERNUUS	OBL	2
LITTLE DUCKWEED	LEMNA OBSCURA	OBL	2
GULF SWAMPWEED	HYGROPHILA LACUSTRIS	OBL	2
PICKEREL WEED	PONTEDERIA CORDATA	OBL	16
BEAKED SPIKERUSH	ELEOCHARIS ROSTELLATA	OBL	2
COMMON SPIKERUSH	ELEOCHARIS PALUSTRIS	OBL	2
DWARF SPIKERUSH	ELEOCHARIS PARVULA	OBL	2
SQUARESTEM SPIKERUSH	ELEOCHARIS QUADRANGULATA	OBL	2
MOUNTAIN SPIKERUSH	ELEOCHARIS MONTANA	OBL	2
HORNED BEAK SEDGE	RHYNCHOSPORA CORNICULATA	OBL	2
COASTAL WATER HYSSOP	BACOPA MONNIERI	OBL	2
LEMON BACOPA	BACOPA CAROLINIANA	OBL	2
THINSCALE SEDGE	CAREX HYALINOLEPIS	OBL	2
CREEPING BURRHEAD	ECHINODORUS CORDIFOLIUS	OBL	2
COMMON RUSH	JUNCUS EFFUSUS	OBL	2
BULLTONGUE ARROWHEAD	SAGITTARIA LANCIFOLIA	OBL	16
GULF CORDGRASS	SPARTINA SPARTINAE	OBL	2
CRIMSON-EYED ROSE MALLOW	HIBISCUS MOSCHEUTOS	OBL	2
HALBERT-LEAF HIBISCUS	HIBISCUS LAEVIS	OBL	2
MUD PLANTAIN	HETERANTHERA LIMOSA	OBL	2
SPIDER LILY	HYMENOCALLIS LIRIOSME	OBL	2
POWDERY ALLIGATOR FLAG	THALIA DEALBATA	OBL	2
DROPSEED PASPALUM	PASPALUM VAGINATUM	OBL	2
TOTAL			**100**

TABLE 5. WETLAND FOREST PLANTING (TYPE 5)

SPECIES COMMON NAME	SCIENTIFIC NAME	NWPL INDEX CODE	PLANTING DENSITY
OVERSTORY - CANOPY			**(#/ACRE)**
AMERICAN ELM	ULMUS AMERICANA	FAC	30
GREEN ASH	FRAXINUS PENNSYLVANICA	FACW	60
OVERCUP OAK	QUERCUS LYRATA	OBL	15
NUTTALL OAK	QUERCUS TEXANA	FACW	25
WATER HICKORY	CARYA AQUATICA	OBL	25
SOUTHERN BALD-CYPRESS	TAXODIUM DISTICHUM	OBL	10
AMERICAN SYCAMORE	PLATANUS OCCIDENTALIS	FACW	10
CEDAR ELM	ULMUS CRASSIFOLIA	FAC	40
WILLOW OAK	QUERCUS PHELLOS	FACW	15
BLACK TUPELO	NYSSA SYLVATICA	FAC	15
SUGAR-BERRY	CELTIS LAEVIGATA	FACW	40
EASTERN COTTONWOOD	POPULUS DELTOIDES	FAC	10
DRUMMOND RED MAPLE	ACER RUBRUM DRUMMONDII	FAC	20
SWEET-GUM	LIQUIDAMBAR STYRACIFLUA	FAC	15
WATER OAK	QUERCUS NIGRA	FAC	25
BOTTOM-LAND POST OAK	QUERCUS SIMILIS	FACW	15
LAUREL OAK	QUERCUS LAURIFOLIA	FACW	15
BLACK WILLOW	SALIX NIGRA	OBL	15
TOTAL			**400**
UNDERSTORY - SHRUBS			
PARSLEY HAWTHORN	CRATAEGUS MARSHALLII	FAC	75
DOWNY HAWTHORN	CRATAEGUS MOLLIS	FAC	75
ROUGH-LEAF DOGWOOD	CORNUS DRUMMONDII	FAC	100
YAUPON	ILEX VOMITORIA	FAC	350
SUGAR HACKBERRY	CELTIS LAEVIGATA	FACW	350
AMERICAN BUCKWHEATVINE	BRUNNICHIA OVATA	FACW	50
CATBIRD GRAPE	VITIS PALMATA	FACW	50
DECIDUOUS HOLLY	ILEX DECIDUA	FACW	300
COMMON BUTTONBUSH	CEPHALANTHUS OCCIDENTALIS	OBL	75
EASTERN SWAMP-PRIVET	FORESTIERA ACUMINATA	OBL	75
TOTAL			**1500**
HERBACEOUS			**% OF SEED MIX BY WEIGHT**
LONG-LEAF WOOD-OATS	CHASMANTHIUM SESSILIFLORUM	FAC	2
INDIAN WOOD-OATS	CHASMANTHIUM LATIFOLIUM	FAC	2
LONG-LEAF BASKET GRASS	OPLISMENUS HIRTELLUS	FAC	10
STRAGGLER DAISY	CALYPTOCARPUS VIALIS	FAC	3
CHEROKEE SEDGE	CAREX CHEROKEENSIS	FACW	10
SLENDER WOOD-OATS	CHASMANTHIUM LAXUM	FACW	3
SOUTHERN CUT GRASS	LEERSIA HEXANDRA	OBL	3
CROWFOOT SEDGE	CAREX CRUS-CORVI	OBL	2
DELTA ARROWHEAD	SAGITTARIA PLATYPHYLLA	OBL	2
FLOATING PRIMROSE-WILLOW	LUDWIGIA PEPLOIDES	OBL	2
GRASS-LEAF ARROWHEAD	SAGITTARIA GRAMINEA	OBL	2
LIZARD'S-TAIL	SAURURUS CERNUUS	OBL	2
LITTLE DUCKWEED	LEMNA OBSCURA	OBL	5
GULF SWAMPWEED	HYGROPHILA LACUSTRIS	OBL	2
PICKEREL WEED	PONTEDERIA CORDATA	OBL	2
BEAKED SPIKERUSH	ELEOCHARIS ROSTELLATA	OBL	2
COMMON SPIKERUSH	ELEOCHARIS PALUSTRIS	OBL	2
DWARF SPIKERUSH	ELEOCHARIS PARVULA	OBL	2
SQUARESTEM SPIKERUSH	ELEOCHARIS QUADRANGULATA	OBL	2
MOUNTAIN SPIKERUSH	ELEOCHARIS MONTANA	OBL	2
HORNED BEAK SEDGE	RHYNCHOSPORA CORNICULATA	OBL	2
COASTAL WATER HYSSOP	BACOPA MONNIERI	OBL	3
LEMON BACOPA	BACOPA CAROLINIANA	OBL	2
THINSCALE SEDGE	CAREX HYALINOLEPIS	OBL	2
CREEPING BURRHEAD	ECHINODORUS CORDIFOLIUS	OBL	2
COMMON RUSH	JUNCUS EFFUSUS	OBL	2
BULLTONGUE ARROWHEAD	SAGITTARIA LANCIFOLIA	OBL	2
GULF CORDGRASS	SPARTINA SPARTINAE	OBL	10
CRIMSON-EYED ROSE MALLOW	HIBISCUS MOSCHEUTOS	OBL	2
HALBERT-LEAF HIBISCUS	HIBISCUS LAEVIS	OBL	2
MUD PLANTAIN	HETERANTHERA LIMOSA	OBL	2
POWDERY ALLIGATOR FLAG	THALIA DEALBATA	OBL	2
DROPSEED PASPALUM	PASPALUM VAGINATUM	OBL	5
TOTAL			**100**

TABLE 6. FOREST TRANSITION PLANTING (TYPE 6)

SPECIES COMMON NAME	SCIENTIFIC NAME	NWPL INDEX CODE	PLANTING DENSITY
OVERSTORY: UPPER SLOPE			#/ACRE
AMERICAN ELM	ULMUS AMERICANA	FAC	30
AMERICAN HORNBEAM	CARPINUS CAROLINIANA	FAC	15
CEDAR ELM	ULMUS CRASSIFOLIA	FAC	30
EASTERN COTTONWOOD	POPULUS DELTOIDES	FAC	10
RED MAPLE	ACER RUBRUM	FAC	15
SWEET-GUM	LIQUIDAMBAR STYRACIFLUA	FAC	15
WATER OAK	QUERCUS NIGRA	FAC	25
CAROLINA LAUREL CHERRY	PRUNUS CAROLINIANA	FACU	50
OVERSTORY: LOWER SLOPE			
SWAMP CHESTNUT OAK	QUERCUS MICHAUXII	FAC*	25
AMERICAN SYCAMORE	PLATANUS OCCIDENTALIS	FACW	10
POST OAK	QUERCUS STELLATA	FACW	25
GREEN ASH	FRAXINUS PENNSYLVANICA	FACW	25
LAUREL OAK	QUERCUS LAURIFOLIA	FACW	25
SUGAR-BERRY	CELTIS LAEVIGATA	FACW	50
NUTTALL OAK	QUERCUS TEXANA	FACW	25
WILLOW OAK	QUERCUS PHELLOS	FACW	25
TOTAL			**400**
UNDERSTORY - SHRUBS			
SOUTHERN WAX MYRTLE	MORELLA CERIFERA	FAC	270
SUGAR HACKBERRY	CELTIS LAEVIGATA	FACW	270
YAUPON	ILEX VOMITORIA	FAC	270
ROUGH-LEAF DOGWOOD	CORNUS DRUMMONDII	FAC	75
LITTLE-HIP HAWTHORN	CRATAEGUS SPATHULATA	FAC	75
UPLAND SWAMP-PRIVET	FORESTIERA LIGUSTRINA	FAC	150
PARSLEY HAWTHORN	CRATAEGUS MARSHALLII	FAC	50
DOWNY HAWTHORN	CRATAEGUS MOLLIS	FAC	50
GREEN HAWTHORN	CRATAEGUS VIRIDIS	FACW	50
HERCULES CLUB	ZANTHOXYLUM CLAVA-HERCULIS	FAC	50
CAROLINA BUCKTHORN	FRANGULA CAROLINIANA	FACU	55
WOODY VINES			
MUSCADINE	VITIS ROTUNDIFOLIA	FAC	15
PEPPERVINE	AMPELOPSIS ARBOREA	FAC	15
ALABAMA SUPPLEJACK	BERCHEMIA SCANDENS	FAC	15
TRUMPET-CREEPER	CAMPSIS RADICANS	FAC	15
CAROLINA CORALBEAD	COCCULUS CAROLINUS	FAC	15
HORSEBRIER	SMILAX ROTUNDIFOLIA	FAC	15
SUMMER GRAPE	VITIS AESTIVALIS	FACU	15
AMERICAN BUCKWHEATVINE	BRUNNICHIA OVATA	FACW	15
MUSCADINE	VITIS ROTUNDIFOLIA	FAC	15
TOTAL			**1500**
HERBACEOUS			**% OF SEED MIX BY WEIGHT**
BROWNSEED PASPALUM	PASPALUM PLICATULUM	FAC	5
GULF MUHLY	MUHLENBERGIA CAPILLARIS	FAC	3
JUMPSEED	PERSICARIA VIRGINIANA	FAC	4
BROWNSEED PASPALUM	PASPALUM PLICATULUM	FAC	4
GULF MUHLY	MUHLENBERGIA CAPILLARIS	FAC	3
PURPLETOP TRIDENS	TRIDENS FLAVUS	FACU	4
ARROWWOOD VIBURNUM	VIBURNUM DENTATUM	FACU*	8
SLENDER WOOD-OATS	CHASMANTHIUM LAXUM	FACW	15
POSSUMHAW VIBURNUM	VIBURNUM NUDUM	FACW	5
SLENDER SPIKERUSH	ELEOCHARIS TENUIS	FACW	8
SAND SPIKERUSH	ELEOCHARIS MONTEVIDENSIS	FACW	11
MARSH HAY CORDGRASS	SPARTINA PATENS	FACW	11
EGG-LEAF INDIAN-PLANTAIN	ARNOGLOSSUM OVATUM	FACW	4
BUSHY BLUESTEM	ANDROPOGON GLOMERATUS	FACW	15
TOTAL			**100**

60% PLANS

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SEATTLE
801 SECOND AVE, STE 1150, SEATTLE, WA 98104
TEL: (206) 269-0104 FAX: (206) 269-0098
www.cardno.com

PLANTING SCHEDULE
BIG SLOUGH MITIGATION SITE
DOW CHEMICAL
BRAZORIA COUNTY, TX

#	DATE	DESCRIPTION	BY

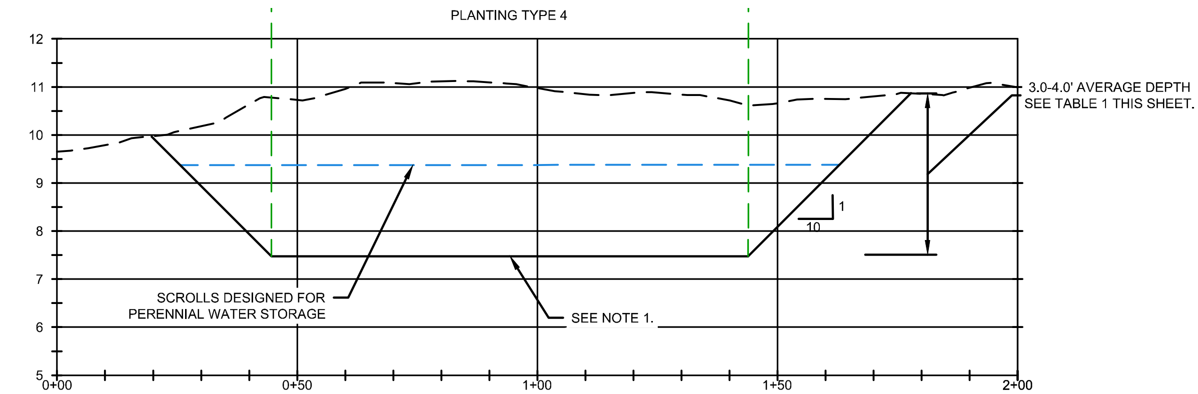
PRELIMINARY NOT FOR CONSTRUCTION

DATE	JANUARY 2021
DRAWN	FA/LE/JC
DESIGNED	DE/LE/FA
CHECKED	DE/SM/BJ
PROJECT #	E515018116

SHEET TITLE
PLANTING SCHEDULE
SHEET NUMBER
16
LAND USE # ----

Plot Stamp: 3/3/2023 9:04:31 AM - Gorden, Jeremy
File: Z:\Sam Waltman\2022100\BIG SLOUGH- DETAILS.dwg, Tab: 16 PLANTING SCHEDULE

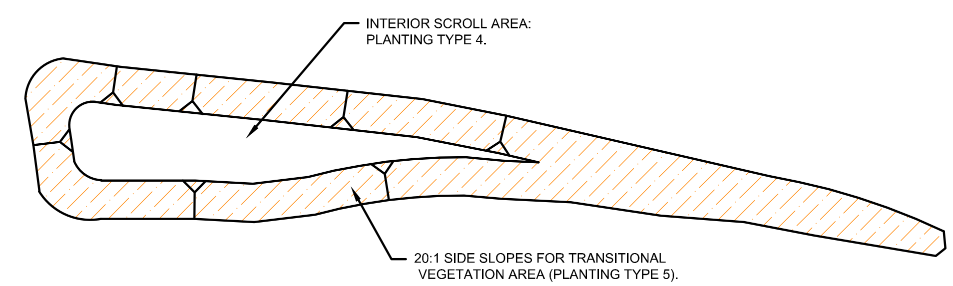
SCROLLS



TYPICAL SCROLL SECTION
10X VERTICAL EXAGGERATION
N.T.S
C 11

LEGEND

- TYPICAL WATER LEVEL
- EG FROM LIDAR SURFACE
- CROSS SECTION PROPOSED GRADE
- CONSTRUCTION DAYLIGHT LINE
- PLANT ZONE BORDER
- OXBOW BANK AREA
- SCROLL BANK AREA



TYPICAL SCROLL PLAN VIEW
N.T.S
D 11

NOTES:
1. EXCAVATE BOTTOM OF OXBOWS AND SCROLLS AT VARYING DEPTHS FOR A HETEROGENEOUS MICRO-TOPOGRAPHY. DO NOT EXCAVATE >1.5' BELOW PROPOSED AVERAGE DEPTH. REFER TO TABLES 1 AND 2 THIS SHEET.
2. COMPACT SOILS IN ALL LOCATIONS EXCAVATED DEEPER THAN PROPOSED AVERAGE DEPTH. THIS WILL REDUCE WETLAND FEATURE WATER LOSS.
3. NO PLANTING WILL BE IMPLEMENTED IN THESE DEEP COMPACTED AREAS.
4. FOR PLANTING TYPE DESCRIPTIONS REFER TO PLANTING SCHEDULE SHEET 15.
5. FOR AREAS DESIGNATED WITH TWO PLANTING TYPES, REFER TO DETAIL A ON SHEET 15 AND 16 FOR DESCRIPTION OF WHICH SPECIES MIX TO USE.

TABLE 11. SCROLL DETAILED GEOMETRY

SCROLL ID NUMBER	AREA (ACRE)	AVERAGE DEPTH (FT)	TOTAL CUT VOLUME (CY)
SB4-1	0.5	3	2589
SB4-2	0.6	3.5	3468
SB4-3	1.6	3	7558
SB4-4	1.6	3	7904
SB4-8	0.9	3.5	4917
SB5-21	0.5	3.5	3093
SB7-8	1.0	3	4917
SB7-9	2.6	3	12460
SB8-7	1.0	3	4937
SB9-6	4.0	3.5	22564
SB9-21	2.1	3.5	11992
SB9-22	3.1	4	20108
TOTAL	**19.6**	**3.3**	**106506**

Plot Stamp: 3/3/2023 9:04:38 AM - Gorden, Jeremy
File: Z:\Sam Waltman\20221005\BIG SLOUGH- DETAILS.dwg, Tab: 17 DETAILS- OXBOWS AND SCROLLS

60% PLANS

Stantec
SEATTLE
801 SECOND AVE, STE 1150, SEATTLE, WA 98104
TEL: (206) 269-0104 FAX: (206) 269-0098
www.cardno.com

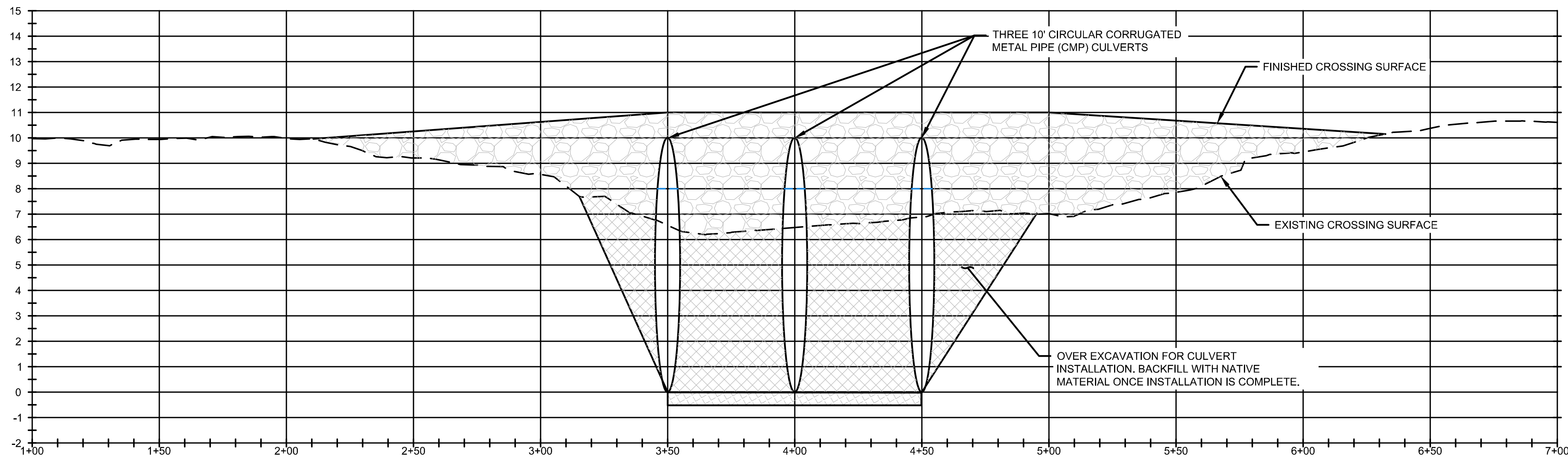
DETAILS- OXBOWS AND SCROLLS
BIG SLOUGH MITIGATION SITE
DOW CHEMICAL
BRAZORIA COUNTY, TX

#	DATE	DESCRIPTION	BY

PRELIMINARY NOT FOR CONSTRUCTION

DATE	JANUARY 2021
DRAWN	FA/LE/JC
DESIGNED	DE/LE/FA
CHECKED	DE/SM/BJ
PROJECT #	E515018116

SHEET TITLE
OXBOWS AND SCROLLS
SHEET NUMBER
17
LAND USE #



LEGEND

- WATER SURFACE ELEVATION
- TYPICAL EXISTING GRADE
- PROPOSED CROSSING SURFACE
- SECTION LINE
- NATIVE SOIL BACKFILL
- OVEREXCAVATION AREA
- NATIVE SOIL BACKFILL

CROSSING BS-5 SECTION

N.T.S

A
12

NOTES:

1. WATER MANAGEMENT AND TEMPORARY EROSION AND SEDIMENT CONTROL NEEDED DURING INSTALLATION OF THE CULVERTS.
2. NATIVE MATERIAL SHALL BE USED TO REFILL THE OVEREXCAVATED AREAS.
3. STRUCTURE LOCATION WILL BE MARKED IN THE FIELD BY ENGINEER.
4. PROPOSED CULVERTS SHALL BE 30 FEET LONG.

60% PLANS

Stantec
SEATTLE
801 SECOND AVE, STE 1150, SEATTLE, WA 98104
TEL: (206) 269-0104 FAX: (206) 269-0098
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DETAILS- CULVERT
BIG SLOUGH MITIGATION SITE
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BRAZORIA COUNTY, TX

#	DATE	DESCRIPTION	BY

PRELIMINARY
NOT FOR
CONSTRUCTION

DATE	JANUARY 2021
DRAWN	FA/LE/JC
DESIGNED	DE/LE/FA
CHECKED	DE/SM/BJ
PROJECT #	E515018116

SHEET TITLE
CULVERT DETAIL

SHEET NUMBER
18

LAND USE # ----

Attachment 5
Functional Assessments

Stream Condition Assessment Report for the Dow Harris Reservoir Expansion Project in Brazoria County, Texas

USACE File No. SWG-2016-01027

NOVEMBER 2019

PREPARED FOR

Dow Chemical Company

PREPARED BY

SWCA Environmental Consultants

STREAM CONDITION ASSESSMENT REPORT FOR THE DOW HARRIS RESERVOIR EXPANSION PROJECT IN BRAZORIA COUNTY, TEXAS

Prepared for

Dow Chemical Company
Texas Innovation Center
332 SH 332 E
Lake Jackson, Texas 77566

Prepared by

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SWCA Project No. 52827

November 2019

CONTENTS

Appendices

Tables

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1 INTRODUCTION

At the request of Dow Chemical Company, SWCA Environmental Consultants (SWCA) conducted Level I and Level II Stream Condition Assessments per the guidelines of the U.S. Army Corps of Engineers (USACE) Galveston District for the proposed Dow Harris Reservoir Expansion Project (Project), an approximately 2,529-acre tract in Brazoria County, Texas. The tract is 2,300 feet northwest of Otey, Texas, and is 4.28 miles south of the intersection of Farm-to-Market Road (FM) 521 and FM 34 (Figure 1, Appendix A). The site is located inside the U.S. Geological Survey (USGS) 7.5-minute quadrangles for Otey, Texas. The approximate center of the project is located at latitude 29.268˚ north and longitude 95.550˚ west (Figure 1, Appendix A). The tract extends between the Brazos River and Oyster Creek. Please refer to the figures in Appendix A for the location and setting of the survey area.

To facilitate the increasing water demands of their Texas Operations facilities in Freeport, Texas, Dow Chemical Company plans to expand their existing reservoir impoundment complex that currently lies immediately south of the project area. The project area is adjacent to both the Brazos River and Oyster Creek and would be used for surface water diversion. Additional reservoir facilities, including intake and pump stations, inlets, outlets, and spillways would be constructed for the proposed Project.

SWCA collected data for a Level I Stream Condition Assessment on 31 ephemeral channels while data for the Level II Stream Condition Assessment was collected on the three intermittent channels, (i.e., SA001, SA003, and SX014) within the project area on September 17, 20, 23, 24, and 25, 2019.

2 METHODS

As described by USACE guidelines, the fundamental unit for evaluating a stream's condition is the stream assessment transect (USACE 2013, 2014). To simplify the process of establishing transects, a fixed transect length of 350 feet was placed within set intervals along the assessed reaches. Table 1 provides the number of transects evaluated per channel under the Level I Stream Condition Assessment, while Table 2 provides the number of transects evaluated per channel under the Level II Stream Condition Assessment. Please refer to the Vicinity Map (Figure 1, Appendix A) and Stream Assessment Maps (Figures 2, 3, and 4, Appendix A) for a depiction of the project area and the channels being assessed under the Level I Stream Condition and Level II Stream Condition Assessments (Figures 3 and 4, Appendix A, respectively).

Each transect was evaluated under the Level I Stream Condition Assessment and scored based on the following criteria (USACE 2013):

- Channel Condition (CV) – describes the stream channel's evolutionary process and stability.
- Riparian Buffer (BV) – qualifies the vegetation community's ability to prevent the nutrients from entering the channel system.
- Aquatic Use (UV) – examines surface water health and quality.
- Channel Alteration (AV) – assesses direct impacts to the channel from anthropogenic sources that may disrupt the channel's natural conditions.

The Level II Stream Assessment splits the UV criteria into two parameters which are used to indicate long-term water quality and are only assessed within perennial pools, perennial streams, and wadeable rivers (USACE 2014). These parameters include the following:

- Rapid In-Stream Macroinvertebrate Observation (MV) – evaluates the tolerances of benthic macroinvertebrate species as a surrogate for water quality.

- Regionalized Index of Biotic Integrity for Fish (FV) – quantifies the fish community's biological integrity.

The Level I Stream Assessment assigns a score for each criterion at each transect ranging from Severe (1) to Optimal (5) based on direct visual observation. The Level I Stream Assessment Data Forms are provided in Appendix B. A summary of the results is provided in Table 1 following the Results discussion.

The Level II Stream Assessment assigns a score for each criterion at each transect as well; however, these ranges vary, as listed below.

- The CV ranges from Extreme (1) to Very Low (6)
- The BV ranges from Severe (1) to Optimal (5)
- The AV ranges from Severe (1) to Negligible (5)
- The MV ranges from Severe (1) to Optimal (5)
- The FV ranges from Severe (1) to Exceptional (5)

The Level II Stream Assessment Data Forms are provided in Appendix C. A summary of the results is provided in Table 2 following the results discussion.

3 RESULTS

3.1 Level I Stream Condition Assessment

3.1.1 Channel Condition (CV)

The Level I Stream Condition Assessment determines the CV score by analyzing the evolutionary process of the cross section and to make a correlation to the current state of stream stability, whether it be degrading, aggrading, healing, or stable. The CV scores ranged from Severe (1.00) to Optimal (5.00) throughout all the transects for the assessed channels. As most of the channels are ephemeral agricultural ditches manipulated into depressional areas within upland areas, evidence of artificial widening is present.

3.1.2 Riparian Buffer (BV)

The Level I Stream Condition Assessment BV score considers the qualitative evaluation of the land cover types surrounding the assessed transects at 100 feet from the ordinary high watermark along the transects' left and right banks. This criteria reflects the channel's effectiveness of removing nutrients by influencing retention through plant sequestration or removal through microbial denitrification. The Level I Stream Condition Assessment emphasizes the benefit of wetland areas with unmaintained native woody vegetation within the riparian buffer areas. The BV scores ranged from Severe (1.00) to Low (4.38) throughout all the transects for the assessed channels. The majority of the riparian buffers consist of a mixed land use between herbaceous land maintained by grazing and conventional row crops. However, areas dominated by woody vegetation also parallel some assessed channels (i.e., SB003).

3.1.3 Aquatic Use (UV)

Under the Level I Stream Condition Assessment, the UV score is based off of the Texas Surface Water Quality Standards (TSWQS) as defined by the Texas Commission on Environmental Quality (TCEQ) (TCEQ 2018). However, for channels which are not classified in the TSWQS, the UV score is presumed based on the stream flow type, which is the case for each channel assessed within the project area. The UV scores resulted as Severe (1.00) throughout all the transects for the Level I assessed channels as they were all identified as ephemeral channels.

3.1.4 Channel Alteration (AV)

The AV criteria is considerably similar in both the Level I and Level II Stream Condition Assessments, with the only difference being the split between the resulting score to the percentage of impact along the transects as well as the resulting score labels. The AV scores ranged from Severe (1.00) to Optimal (5.00) throughout all the transects for the assessed channels. The majority of the channels assessed exhibit evidence of past alteration through channelization and impacts by culverts and hoof shear, while some also exhibit stream stability and recovery from these impacts. The variation in AV scores primarily results in the percentage of the channel with these impacts, where the higher the percentage of impacted area, the lower the AV score.

3.2 Level II Stream Condition Assessment

3.2.1 Channel Condition (CV)

According to the *Galveston District Interim Level 2- Stream Conditional Assessment Procedur*e (USACE 2014):

> "…[CV] is assessed based on the *A Practical Method of Computing Streambank Erosion Rate* (Rosgen 2001), which involves collecting field data on streambank characteristics to calculate a bank erosion hazard index (BEHI). The BEHI procedure consists of five metrics: 1) bank height ratio; 2) root depth ratio 3) root density, in percent; 4) bank angle, in degrees; and 5) surface protection, in percent. Each of these five metrics are used to compute an erosion risk index, and then the individual erosion risk indices are summed to provide a total erosion risk index for use in identifying the [CV]."

After calculating these metrics, SA003 exhibited a CV of Moderate (4.00). However, the transects within SA001 ranged from High (3.00) to Low (5.00) and SX014 ranged from High (3.00) to Moderate (4.00) as the majority of the transects showed some evidence of alteration but exhibited notable recovery within the banks.

3.2.2 Riparian Buffer (BV)

Under the Level II Stream Condition Assessment, BV is determined similarly to the Level I Stream Condition Assessment criteria except that the Level II assessment considers all native plant species in the community, rather than just the native woody vegetation species within the community. The BV scores ranged from Severe (1.00) to Low-Suboptimal (4.38) across all the transects surveyed. All three assessed channels resulted in an average BV score of Severe to Poor, where SA001 averaged 2.86, SA003 averaged 2.00, and SX014 averaged 1.00. The majority of the riparian buffers consisted of areas dominated by herbaceous plant communities maintained by grazing or conventional row crops; however, the presence of native woody community species varies throughout the project area. Forested wetland areas occur more often along the southwestern portions of the project area, affecting the southern transects of SA001.

3.2.3 Channel Alteration (AV)

The AV criteria is, again, considerably similar in both the Level I and Level II Stream Condition Assessments, with the only difference being the split between the resulting score to the percentage of impact along the transects as well as the resulting score labels. All of the transects assessed varied from scores of Severe (1.00) to Low-Minor (4.00). SA001's transects ranged from Severe (1.00) to Low-Minor (4.00) and averaged at a score of High-Moderate (3.36). SA003's and SX014's transects both ranged from Severe (1.00) to Low-Moderate (2.00) and averaged at a score of Severe (1.67 and 1.87, respectively).

3.2.4 Rapid In-Stream Macroinvertebrate Observation (MV)

The MV assessment evaluates the biological integrity of a channel by rapidly sampling and identifying benthic macroinvertebrate species. The macroinvertebrate population of a channel demonstrates the complexity and extent of the food web as well as documenting the presence of water pollution within the channel, while also being relatively easy to collect via kicknet or snag sampling procedures (USACE 2014). The MV sampling assessment is calculated using the Hilsenhoff Biotic Index (HBI); specifically, by relating the relative abundance of taxa to an assigned pollution tolerance level. The equation to this calculation is:

$$HBI = \sum(t_i \times x_i) \div N$$

where,

t_i = tolerance value for an individual taxon
x_i = number of individuals in that taxon for all samples
N = total number of individuals in all samples

The resulting HBI value determines the MV score for that transect (USACE 2014). The MV scores ranged from Severe (1.00) to Optimal (5.00) throughout all the transects for the assessed waterbodies. The average MV score for SA001 resulted as Poor (2.71), while SA003 and SX014 resulted as Severe (1.17 and 1.07, respectively). Tables D-1–D-3 in Appendix D summarize the macroinvertebrate species count, tolerance values, HBI values, and resulting MV score. Note that certain transects present no collected data as no water was present within the transect. For stream transects lacking water, a score of Severe (1.00) was assumed.

3.2.5 Regionalized Index of Biotic Integrity for Fish (FV)

The FV assessment evaluates the biotic integrity of the fish community present within the channel by calculating the relative abundances of fishes collected via seines, electrofishing, and/or simultaneously collected during the kicknet or snag sampling procedures performed for the MV sampling. Sampling method techniques are described within the *Galveston District Interim Level 2- Stream Conditional Assessment Procedure* (USACE 2014). The results of the In-Stream Fish Observations are available in Tables E-1–E-3 in Appendix E.

After the sampled fish are identified, their aquatic life score is calculated following metrics based on the Level III ecoregion in which they were sampled. The project area is encompassed within the Western Gulf Coastal Plains Level III Ecoregion (Ecoregion 34) (Griffith et al. 2004). Ecoregion 34 provides 11 scoring metrics to assess the channel's fish community, as indicated in Tables F-1–F-3 within Appendix F. The first metric, "Total number of fish species" requires the project area's watershed basin size in square kilometers to determine its scoring criteria (Appendix F). To derive watersheds, SWCA used the "Watershed" tool found in the ArcGIS Ready-To-Use online toolbox within the hydrology toolset (ESRI

2019). After each transect watershed and species composition is determined, as exhibited within Figure 5 of Appendix A, the MV score is defined (USACE 2014).

The MV scores ranged from Severe (1.00) to Intermediate (3.00) within SA001, while SA003 and SX014 ranged from Severe (1.00) to Limited (2.00). The average FV score for SA001, SA003, and SX014 all resulted as Severe (1.96, 1.17, and 1.07, respectively). As with the benthic macroinvertebrates scores, certain transects present no collected data as no water was present within the transect from which to sample. For stream transects lacking water, a score of Severe (1.00) was assumed.

3.3 Condition Index (CI) and Reach Condition Index (RCI)

The four criteria of the Level I Stream Assessment were used to calculate the Condition Index (CI) for each transect, using the following equation:

$$CI = (CV + BV + UV + AV) \div 4$$

The five criteria of the Level II Stream Assessment were used to calculate the Condition Index (CI) for each transect, using the following equation:

$$CI = (CV + BV + AV + MV + FV) \div 5$$

After the CI was calculated for each transect, the overall Reach Condition Index (RCI) was calculated for the existing and proposed conditions using the following equation:

$$RCI = \left(\sum_{n=1}^{Y} CIn\right) \div Y$$

Table 1. Summary of Level I Stream Assessment Data for Channels

Channel ID	Transect	CV	BV	UV	AV	CI	RCI
SB002	1	1.00	2.00	1.00	1.00	1.25	1.250
	2	1.00	2.00	1.00	1.00	1.25	
SB003	1	5.00	3.88	1.00	4.00	3.47	3.240
	2	5.00	3.38	1.00	4.00	3.35	
	3	5.00	4.38	1.00	4.00	3.60	
	4	5.00	3.88	1.00	4.00	3.47	
	5	2.00	4.25	1.00	2.00	2.31	
SB004	1	1.00	2.00	1.00	1.00	1.25	1.250
	2	1.00	2.00	1.00	1.00	1.25	
	3	1.00	2.00	1.00	1.00	1.25	
	4	1.00	2.00	1.00	1.00	1.25	
	5	1.00	2.00	1.00	1.00	1.25	
	6	1.00	2.00	1.00	1.00	1.25	
SB005	1	1.00	2.00	1.00	1.00	1.25	1.270
	2	1.00	2.13	1.00	1.00	1.28	

Channel ID	Transect	CV	BV	UV	AV	CI	RCI
	3	1.00	2.13	1.00	1.00	1.28	
SB006	1	1.00	2.00	1.00	1.00	1.18	2.215
	2	1.00	1.70	1.00	1.00	1.25	
SB007	1	1.00	2.50	1.00	1.00	1.38	1.380
SB013	1	3.00	1.50	1.00	3.00	2.00	2.130
SB014	1	1.00	1.00	1.00	1.00	1.00	1.071
	2	1.00	1.00	1.00	1.00	1.00	
	3	1.00	1.00	1.00	1.00	1.00	
	4	1.00	1.00	1.00	1.00	1.00	
	5	2.00	1.00	1.00	1.00	1.25	
	6	2.00	1.00	1.00	1.00	1.25	
	7	1.00	1.00	1.00	1.00	1.00	
SC005	1	3.00	1.00	1.00	5.00	2.50	2.500
SC016	1	4.00	3.50	1.00	5.00	3.38	3.380
SD016	1	1.00	2.00	1.00	1.00	2.25	1.250
SD017	1	1.00	2.00	1.00	1.00	1.25	1.250
SX003	1	1.00	2.00	1.00	1.00	1.25	1.256
	2	1.00	2.00	1.00	1.00	1.25	
	3	1.00	2.38	1.00	1.00	1.25	
	4	1.00	2.19	1.00	1.00	1.30	
	5	1.00	2.19	1.00	1.00	1.30	
	6	1.00	2.00	1.00	1.00	1.23	
	7	1.00	1.96	1.00	1.00	1.24	
	8	1.00	1.93	1.00	1.00	1.23	
SX004	1	1.00	2.13	1.00	1.00	1.28	1.287
	2	1.00	2.30	1.00	1.00	1.33	
	3	1.00	2.13	1.00	1.00	1.28	
	4	1.00	2.06	1.00	1.00	1.27	
	5	1.00	2.13	1.00	1.00	1.28	
	6	1.00	2.13	1.00	1.00	1.28	
SX005	1	1.00	2.00	1.00	1.00	1.25	1.250
	2	1.00	2.00	1.00	1.00	1.25	
	3	1.00	2.00	1.00	1.00	1.25	
	4	1.00	2.00	1.00	1.00	1.25	
	5	1.00	2.00	1.00	1.00	1.25	
SX006	1	1.00	2.00	1.00	1.00	1.25	1.250

Channel ID	Transect	CV	BV	UV	AV	CI	RCI
	2	1.00	2.00	1.00	1.00	1.25	
SX007	1	1.00	1.13	1.00	1.00	1.03	1.036
	2	1.00	1.15	1.00	1.00	1.04	
	3	1.00	1.20	1.00	1.00	1.05	
	4	1.00	1.15	1.00	1.00	1.04	
	5	1.00	1.08	1.00	1.00	1.02	
SX008	1	1.00	1.00	1.00	1.00	1.00	1.000
	2	1.00	1.00	1.00	1.00	1.00	
	3	1.00	1.00	1.00	1.00	1.00	
SX009	1	1.00	1.00	1.00	1.00	1.00	1.000
	2	1.00	1.00	1.00	1.00	1.00	
	3	1.00	1.00	1.00	1.00	1.00	
SX010	1	1.00	1.10	1.00	1.00	1.03	1.033
	2	1.00	1.10	1.00	1.00	1.03	
	3	1.00	1.10	1.00	1.00	1.03	
	4	1.00	1.15	1.00	1.00	1.04	
SX011	1	1.00	1.35	1.00	1.00	1.09	1.090
SX012	1	1.00	1.00	1.00	1.00	1.00	1.000
	2	1.00	1.00	1.00	1.00	1.00	
	3	1.00	1.00	1.00	1.00	1.00	
	4	1.00	1.00	1.00	1.00	1.00	
	5	1.00	1.00	1.00	1.00	1.00	
	6	1.00	1.00	1.00	1.00	1.00	
	7	1.00	1.00	1.00	1.00	1.00	
SX013	1	1.00	1.00	1.00	1.00	1.00	1.000
	2	1.00	1.00	1.00	1.00	1.00	
	3	1.00	1.00	1.00	1.00	1.00	
	4	1.00	1.00	1.00	1.00	1.00	
	5	1.00	1.00	1.00	1.00	1.00	
	6	1.00	1.00	1.00	1.00	1.00	
	7	1.00	1.00	1.00	1.00	1.00	
	8	1.00	1.00	1.00	1.00	1.00	
SX015	1	1.00	1.18	1.00	1.00	1.05	1.010
	2	1.00	1.00	1.00	1.00	1.00	
	3	1.00	1.00	1.00	1.00	1.00	
	4	1.00	1.00	1.00	1.00	1.00	
	5	1.00	1.00	1.00	1.00	1.00	
SX016	1	1.00	1.00	1.00	1.00	1.00	1.000

Channel ID	Transect	CV	BV	UV	AV	CI	RCI
SX017	1	1.00	1.00	1.00	1.00	1.00	1.000
	2	1.00	1.00	1.00	1.00	1.00	
	3	1.00	1.00	1.00	1.00	1.00	
	4	1.00	1.00	1.00	1.00	1.00	
SX018	1	1.00	1.00	1.00	1.00	1.00	1.000
	2	1.00	1.00	1.00	1.00	1.00	
	3	1.00	1.00	1.00	1.00	1.00	
	4	1.00	1.00	1.00	1.00	1.00	
SX019	1	1.00	1.25	1.00	1.00	1.00	1.060
	2	1.00	1.25	1.00	1.00	1.00	
	3	1.00	1.25	1.00	1.00	1.00	
	4	1.00	1.25	1.00	1.00	1.00	
SX020	1	1.00	1.20	1.00	1.00	1.05	1.050
SX021	1	2.50	1.00	1.00	1.00	1.38	1.380
SX022	1	1.00	1.00	1.00	1.00	1.00	1.109
	2	1.00	1.00	1.00	1.00	1.00	
	3	1.00	1.00	1.00	1.00	1.00	
	4	1.00	1.00	2.00	1.00	1.25	
	5	1.00	1.25	2.00	1.00	1.31	
	6	1.00	1.25	2.00	1.00	1.31	
	7	1.00	1.00	1.00	1.00	1.00	
	8	1.00	1.00	1.00	1.00	1.00	

CV = Channel Condition
BV = Riparian Buffer
UV = Aquatic Use
AV = Channel Alteration
CI = Condition Index
RCI = Reach Condition Index

Table 2. Summary of Level II Stream Assessment Data for Channels

Channel ID	Transect	CV	BV	AV	MV	FV	CI	RCI
SA001	1	4.00	2.10	4.00	1.00	1.00	2.42	2.96
	2	4.00	3.55	4.00	4.00	2.00	3.51	
	3	4.00	3.55	4.00	4.00	2.00	3.51	
	4	4.00	3.66	4.00	5.00	2.00	3.73	
	5	4.00	3.63	4.00	4.00	2.00	3.53	
	6	4.00	3.75	4.00	2.00	2.00	3.15	
	7	4.00	4.38	4.00	3.00	2.00	3.48	
	8	4.00	4.00	4.00	2.00	2.00	3.20	
	9	4.00	2.50	3.00	2.00	2.00	2.70	
	10	5.00	2.88	3.00	2.00	2.00	2.98	
	11	4.00	2.55	4.00	3.00	3.00	3.31	
	12	4.00	2.55	4.00	3.00	3.00	3.31	
	13	4.00	2.43	4.00	2.00	3.00	3.09	
	14	4.00	2.30	4.00	3.00	2.00	3.06	
	15	4.00	2.40	4.00	3.00	2.00	3.08	
	16	4.00	2.35	3.00	2.00	1.00	2.47	
	17	4.00	2.70	3.00	2.00	2.00	2.74	
	18	4.00	2.85	3.00	3.00	3.00	3.17	
	19	4.00	2.68	4.00	3.00	3.00	3.34	
	20	4.00	2.53	3.00	3.00	3.00	3.11	
	21	4.00	2.05	3.00	3.00	1.00	2.61	
	22	3.00	2.25	3.00	3.00	1.00	2.45	
	23	3.00	2.80	3.00	3.00	1.00	2.56	
	24	3.00	2.60	3.00	3.00	3.00	2.92	
	25	4.00	2.55	2.00	2.00	2.00	2.51	
	26	4.00	2.90	2.00	1.00	1.00	2.18	
	27	4.00	2.60	3.00	1.00	1.00	2.32	
	28	4.00	3.00	1.00	4.00	1.00	2.60	
SA003	1	4.00	2.00	1.00	2.00	2.00	2.20	2.00
	2	4.00	2.00	2.00	1.00	1.00	2.00	
	3	4.00	2.00	2.00	1.00	1.00	2.00	
	4	4.00	2.00	2.00	1.00	1.00	2.00	
	5	4.00	2.00	2.00	1.00	1.00	2.00	
	6	4.00	2.00	1.00	2.00	2.00	2.20	
	7	4.00	2.00	2.00	1.00	1.00	2.00	
	8	4.00	2.00	2.00	1.00	1.00	2.00	
	9	4.00	2.00	2.00	1.00	1.00	2.00	
	10	4.00	2.00	1.00	1.00	1.00	1.80	
	11	4.00	2.00	2.00	1.00	1.00	2.00	
	12	4.00	2.00	1.00	1.00	1.00	1.80	
SX014	1	4.00	1.00	2.00	1.00	1.00	1.80	1.76
	2	4.00	1.00	2.00	1.00	1.00	1.80	
	3	4.00	1.00	2.00	1.00	1.00	1.80	
	4	4.00	1.00	1.00	1.00	1.00	1.60	
	5	4.00	1.00	2.00	1.00	1.00	1.80	
	6	4.00	1.00	2.00	1.00	1.00	1.80	
	7	4.00	1.00	2.00	1.00	1.00	1.80	
	8	4.00	1.00	2.00	1.00	1.00	1.80	

Channel ID	Transect	CV	BV	AV	MV	FV	CI	RCI
	9	3.00	1.00	2.00	1.00	1.00	1.60	
	10	3.00	1.00	2.00	1.00	1.00	1.60	
	11	3.00	1.00	2.00	1.00	1.00	1.60	
	12	4.00	1.00	1.00	2.00	2.00	2.00	
	13	4.00	1.00	2.00	1.00	1.00	1.80	
	14	4.00	1.00	2.00	1.00	1.00	1.80	
	15	4.00	1.00	2.00	1.00	1.00	1.80	

CV = Channel Condition

BV = Riparian Buffer

AV = Channel Alteration

MV = Rapid In-Stream Macroinvertebrate Observation

FV = Regionalized Index of Biotic Integrity for Fish

CI = Condition Index

RCI = Reach Condition Index

4 CONCLUSION

SWCA performed a Level I Stream Condition Assessment on 31 ephemeral channels while data for the Level II Stream Condition Assessment was collected on the three intermittent channels, (i.e., SA001, SA003, and SX014) within the proposed Dow Harris Reservoir Expansion Project, on September 17, 20, 23, 24, and 25, 2019. The Level I Stream Condition Assessment RCI calculations revealed SC016 to have the highest overall RCI with a score of 3.380. SX008, SX009, SX012, SX013, SX016, SX017, and SX018, were found to have the lowest overall RCI scores at 1.000. Overall, RCI scores averaged around a score of Severe (1.387). The Level II Stream Condition Assessment RCI calculations revealed SA001 to have the highest overall RCI with a score of 2.96, and SX014 was found to have the lowest overall RCI score at 1.76. Overall, RCI scores averaged around a score of 2.23.

5 LITERATURE CITED

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________. 2014. *Galveston District Interim Level 2- Stream Conditional Assessment Procedure.*

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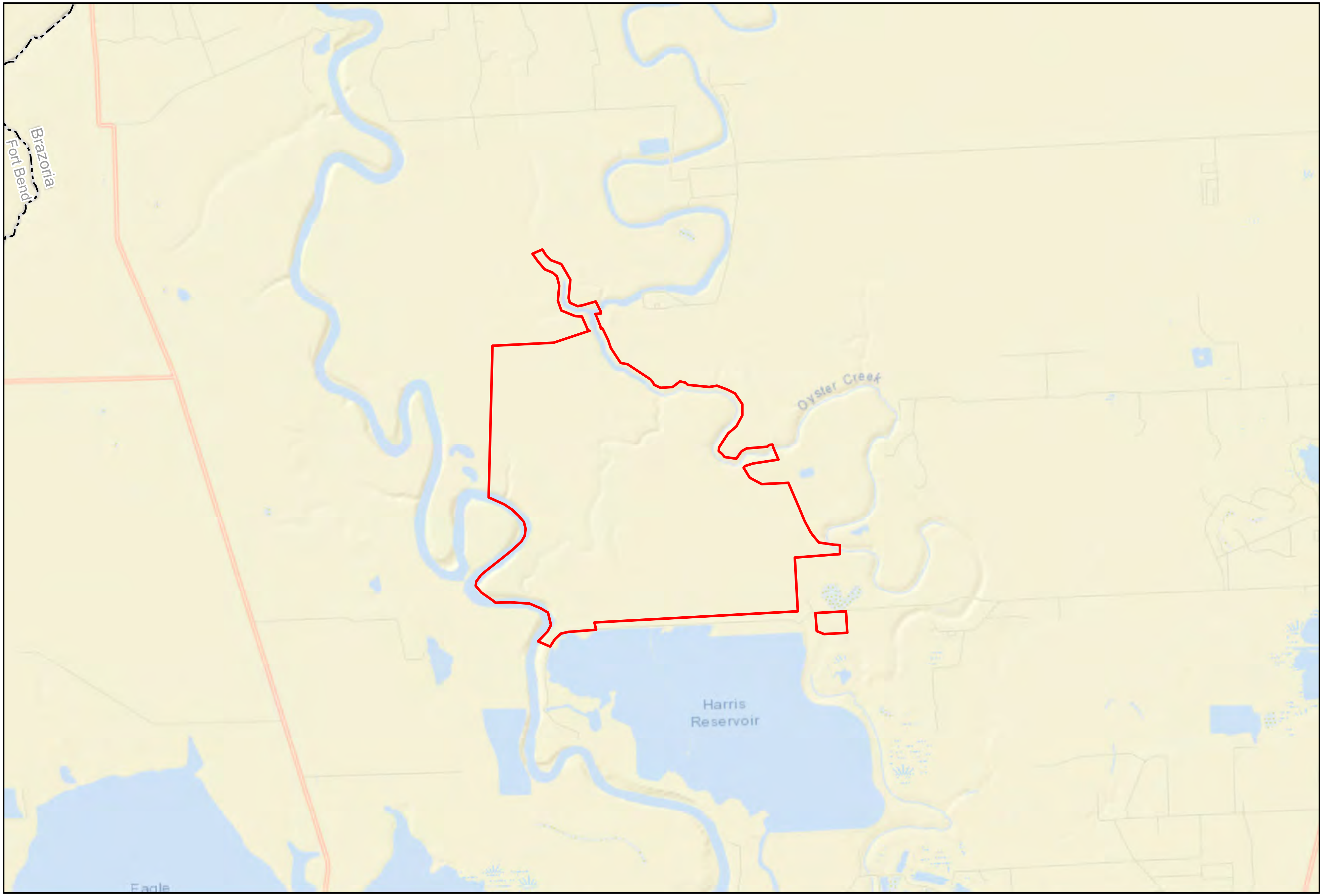
APPENDIX A

Maps

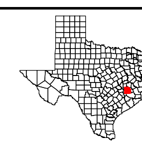


SWCA®
ENVIRONMENTAL CONSULTANTS

DOW CHEMICAL HARRIS RESERVOIR EXPANSION PROJECT
VICINITY MAP
BRAZORIA COUNTY, TEXAS

FIGURE 1

Project Boundary
County Boundary



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Project Number: 52872
Date: 10/31/2019
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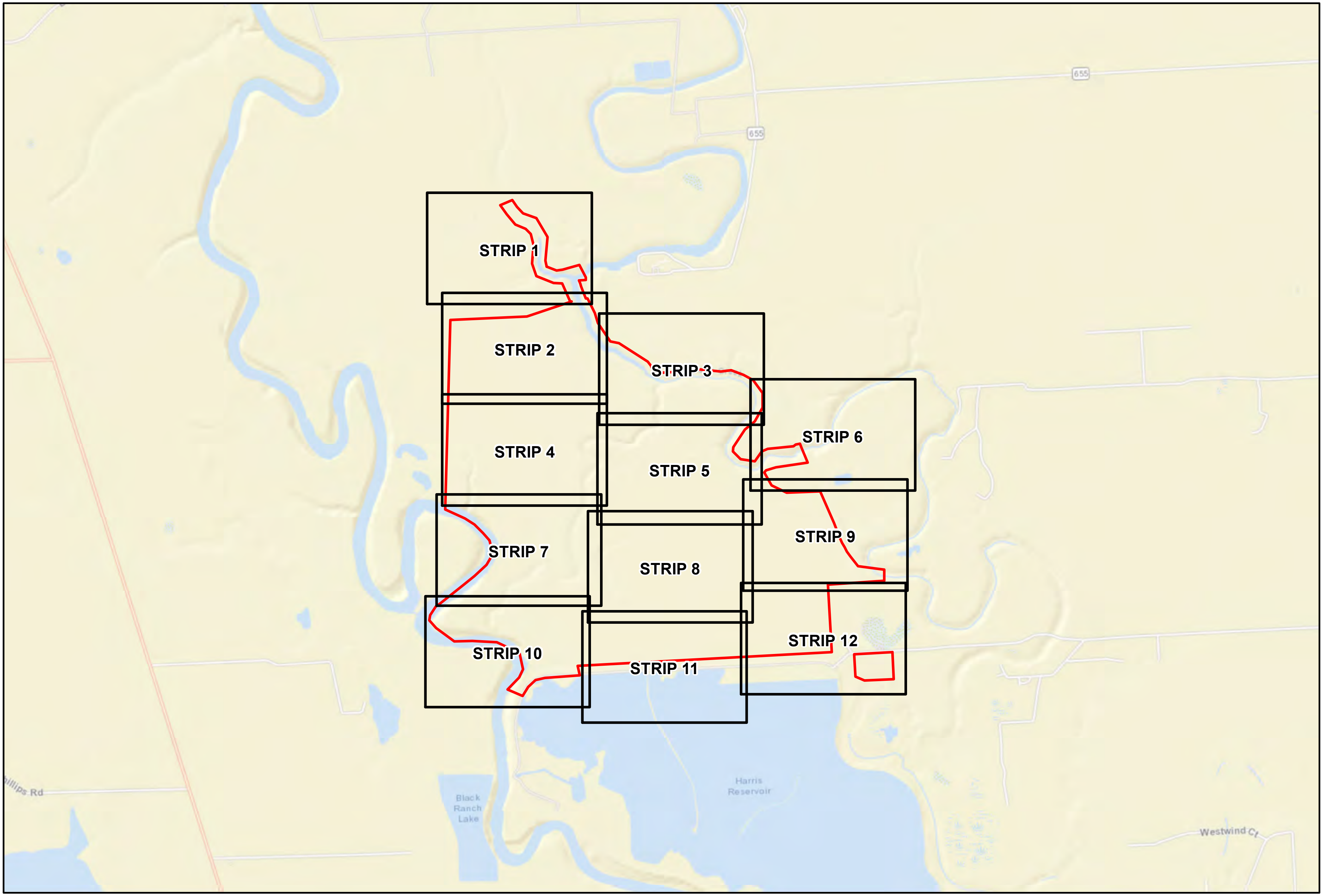
0 1,000 2,000 3,000 4,000 Feet
0 300 600 900 1,200 Meters



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DOW CHEMICAL HARRIS RESERVOIR EXPANSION PROJECT

INDEX MAP

BRAZORIA COUNTY, TEXAS

FIGURE 2

Project Boundary

Mapbook Index

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Created By: K. Shields
Project Number: 52872
Date: 11/4/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

0 1,000 2,000 3,000 4,000 Feet

0 300 600 900 1,200 Meters

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DOW CHEMICAL HARRIS RESERVOIR EXPANSION PROJECT

LEVEL I STREAM ASSESSMENT MAP

BRAZORIA COUNTY, TEXAS

SHEET 1 OF 12

FIGURE 3

Project Boundary
Stream Transect
Stream Assessment Survey
Ephemeral Waterbody
Intermittent Waterbody
Perennial Waterbody
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland

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Created By: K. Shields
Project Number: 52872.10
Date: 11/12/2019
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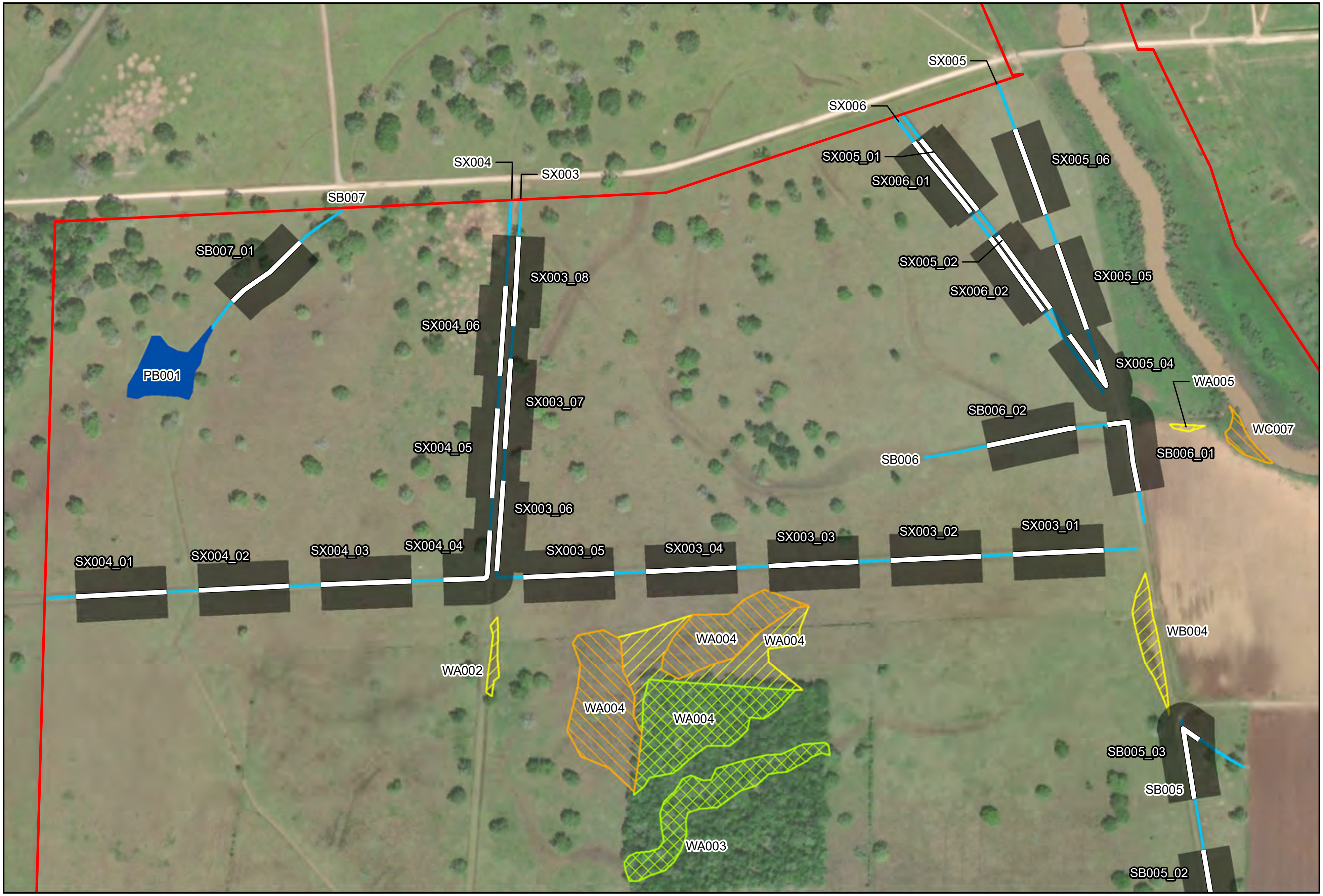
0 30 60 90 120 150 Meters



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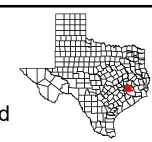
DOW CHEMICAL HARRIS RESERVOIR EXPANSION PROJECT

LEVEL I STREAM ASSESSMENT MAP
BRAZORIA COUNTY, TEXAS

SHEET 2 OF 12

FIGURE 3

Project Boundary
Stream Transect
Stream Assessment Survey
Ephemeral Waterbody
Intermittent Waterbody
Perennial Waterbody
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland



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Project Number: 52872.10
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0 30 60 90 120 150 Meters

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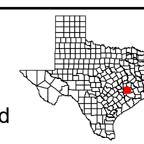
DOW CHEMICAL HARRIS RESERVOIR EXPANSION PROJECT

LEVEL I STREAM ASSESSMENT MAP
BRAZORIA COUNTY, TEXAS

SHEET 3 OF 12

FIGURE 3

Project Boundary
Stream Transect
Stream Assessment Survey
Ephemeral Waterbody
Intermittent Waterbody
Perennial Waterbody
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland



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Created By: K. Shields
Project Number: 52872.10
Date: 11/12/2019
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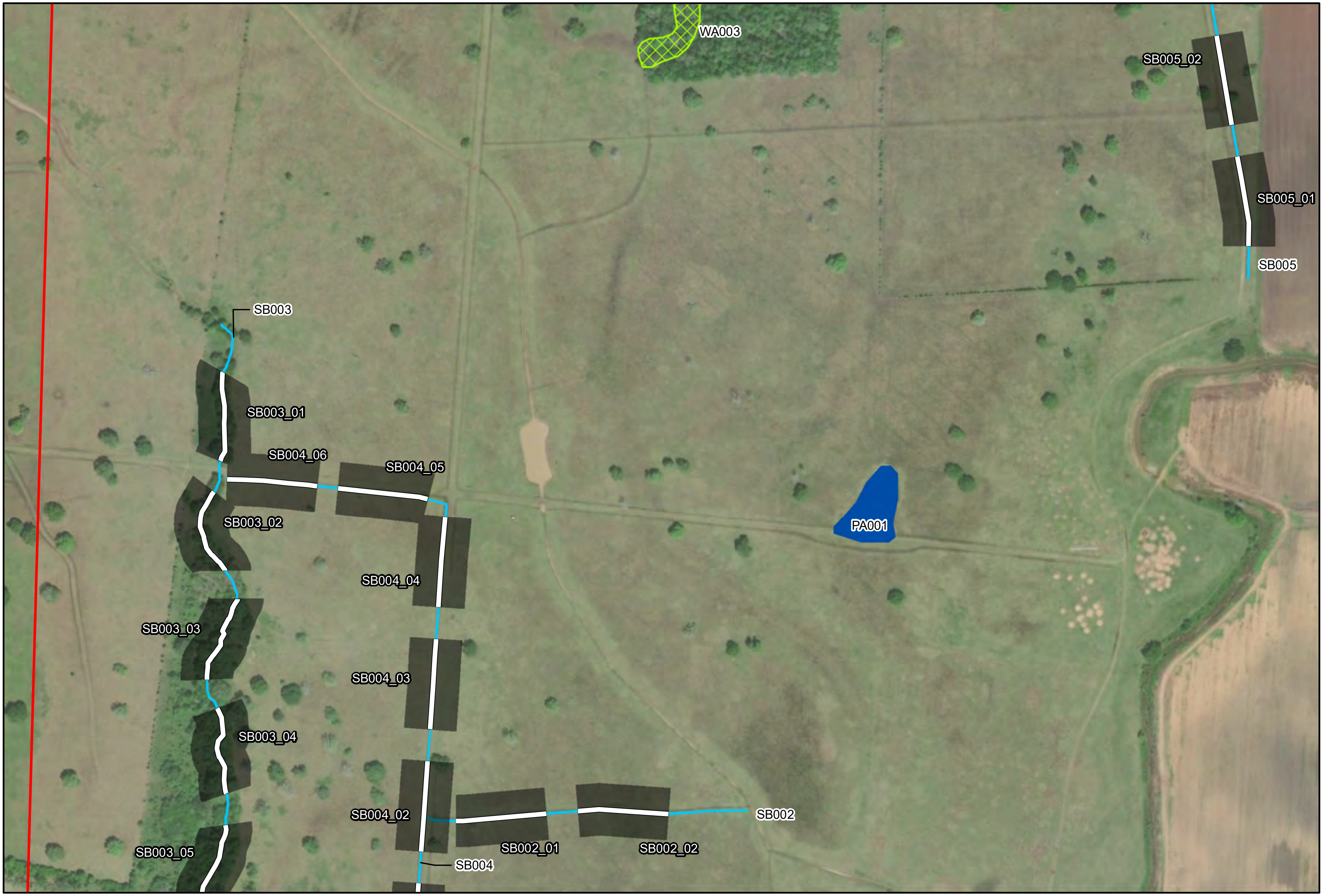

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DOW CHEMICAL HARRIS RESERVOIR EXPANSION PROJECT

LEVEL I STREAM ASSESSMENT MAP
BRAZORIA COUNTY, TEXAS

SHEET 4 OF 12

FIGURE 3

Project Boundary
Stream Transect
Stream Assessment Survey
Ephemeral Waterbody
Intermittent Waterbody
Perennial Waterbody
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland

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Created By: K. Shields
Project Number: 52872.10
Date: 11/12/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

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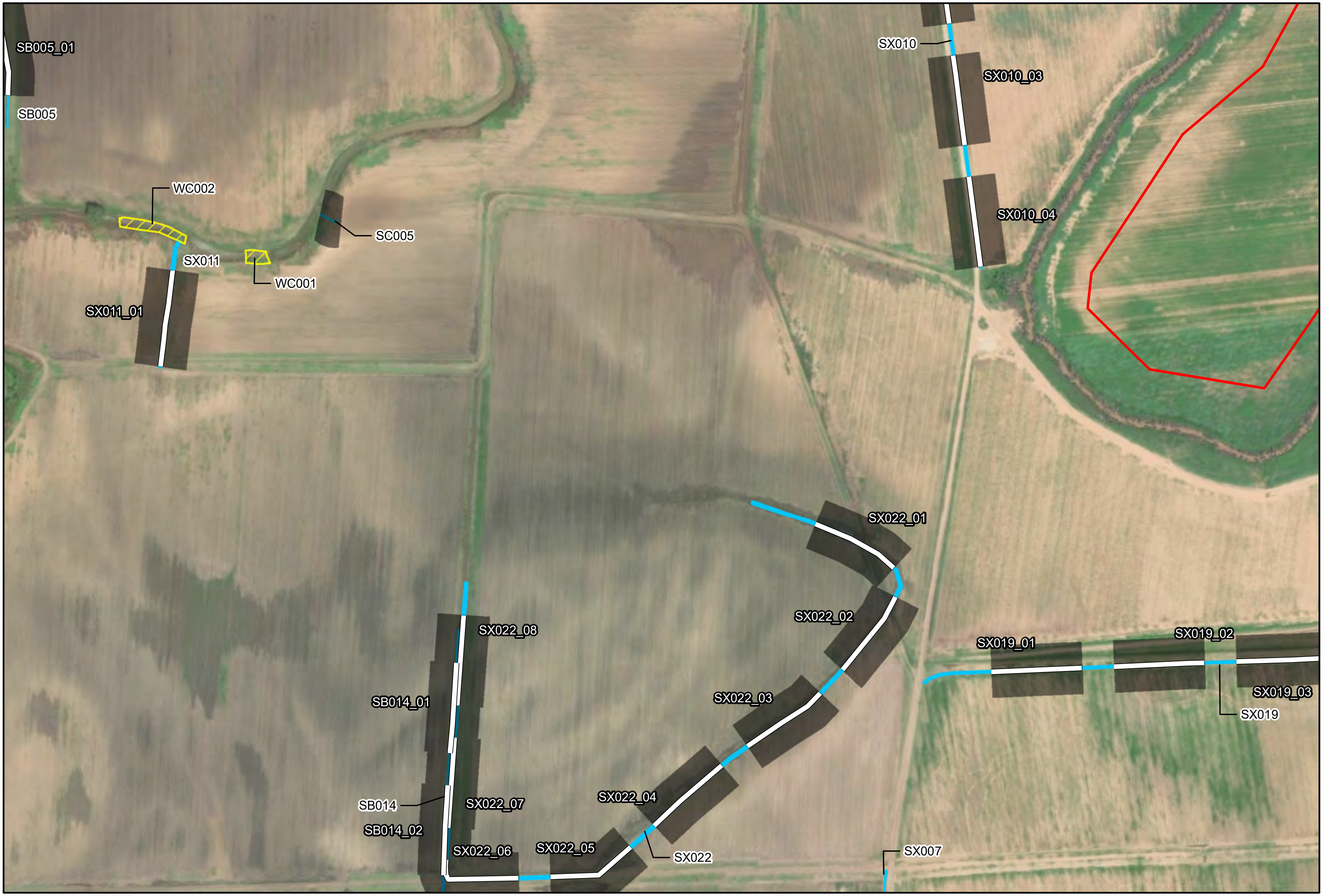
0 100 200 300 400 500 Feet

0 30 60 90 120 150 Meters



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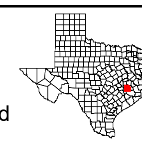
DOW CHEMICAL HARRIS RESERVOIR EXPANSION PROJECT

LEVEL I STREAM ASSESSMENT MAP
BRAZORIA COUNTY, TEXAS

SHEET 5 OF 12

FIGURE 3

Project Boundary
Stream Transect
Stream Assessment Survey
Ephemeral Waterbody
Intermittent Waterbody
Perennial Waterbody
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland



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Created By: K. Shields
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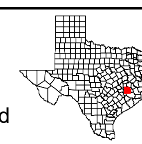

DOW CHEMICAL HARRIS RESERVOIR EXPANSION PROJECT

LEVEL I STREAM ASSESSMENT MAP
BRAZORIA COUNTY, TEXAS

SHEET 6 OF 12

FIGURE 3

Project Boundary	Emergent Wetland
Stream Transect	Forested Wetland
Stream Assessment Survey	Scrub-Scrub Wetland
Ephemeral Waterbody	
Intermittent Waterbody	
Perennial Waterbody	

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Created By: K. Shields
Project Number: 52872.10
Date: 11/12/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

0 100 200 300 400 500 Feet
0 30 60 90 120 150 Meters

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DOW CHEMICAL HARRIS RESERVOIR EXPANSION PROJECT

LEVEL I STREAM ASSESSMENT MAP
BRAZORIA COUNTY, TEXAS

SHEET 7 OF 12

FIGURE 3

Project Boundary
Stream Transect
Stream Assessment Survey
Ephemeral Waterbody
Intermittent Waterbody
Perennial Waterbody
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland

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Created By: K. Shields
Project Number: 52872.10
Date: 11/12/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

0 100 200 300 400 500 Feet
0 30 60 90 120 150 Meters

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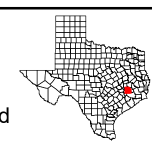
DOW CHEMICAL HARRIS RESERVOIR EXPANSION PROJECT

LEVEL I STREAM ASSESSMENT MAP
BRAZORIA COUNTY, TEXAS

SHEET 8 OF 12 FIGURE 3

Project Boundary
Stream Transect
Stream Assessment Survey
Ephemeral Waterbody
Intermittent Waterbody
Perennial Waterbody
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland



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Project Number: 52872.10
Date: 11/12/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

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0 30 60 90 120 150 Meters

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DOW CHEMICAL HARRIS RESERVOIR EXPANSION PROJECT

LEVEL I STREAM ASSESSMENT MAP
BRAZORIA COUNTY, TEXAS

SHEET 9 OF 12

FIGURE 3

Project Boundary	Ephemeral Waterbody	Emergent Wetland
Stream Transect	Intermittent Waterbody	Forested Wetland
Stream Assessment Survey	Perennial Waterbody	Scrub-Scrub Wetland

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Created By: K. Shields
Project Number: 52872.10
Date: 11/12/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

0 100 200 300 400 500 Feet
0 30 60 90 120 150 Meters

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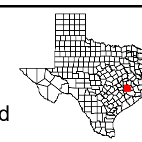
DOW CHEMICAL HARRIS RESERVOIR EXPANSION PROJECT

LEVEL I STREAM ASSESSMENT MAP
BRAZORIA COUNTY, TEXAS

SHEET 10 OF 12 FIGURE 3

Project Boundary
Stream Transect
Stream Assessment Survey
Ephemeral Waterbody
Intermittent Waterbody
Perennial Waterbody
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland



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Created By: K. Shields
Project Number: 52872.10
Date: 11/12/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

0 100 200 300 400 500 Feet
0 30 60 90 120 150 Meters

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DOW CHEMICAL HARRIS RESERVOIR EXPANSION PROJECT

LEVEL I STREAM ASSESSMENT MAP
BRAZORIA COUNTY, TEXAS

SHEET 11 OF 12

FIGURE 3

- Project Boundary
- Stream Transect
- Stream Assessment Survey
- Ephemeral Waterbody
- Intermittent Waterbody
- Perennial Waterbody
- Emergent Wetland
- Forested Wetland
- Scrub-Scrub Wetland

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Created By: K. Shields
Project Number: 52872.10
Date: 11/12/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

0 100 200 300 400 500 Feet

0 30 60 90 120 150 Meters

DOW CHEMICAL HARRIS RESERVOIR EXPANSION PROJECT

LEVEL I STREAM ASSESSMENT MAP
BRAZORIA COUNTY, TEXAS

SHEET 12 OF 12

FIGURE 3

SWCA ENVIRONMENTAL CONSULTANTS

Project Boundary
Stream Transect
Stream Assessment Survey
Ephemeral Waterbody
Intermittent Waterbody
Perennial Waterbody
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland

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Created By: K. Shields
Project Number: 52872.10
Date: 11/12/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

0 100 200 300 400 500 Feet
0 30 60 90 120 150 Meters

SWCA ENVIRONMENTAL CONSULTANTS

DOW CHEMICAL HARRIS RESERVOIR EXPANSION PROJECT

LEVEL II STREAM ASSESSMENT MAP
BRAZORIA COUNTY, TEXAS

SHEET 1 OF 12

FIGURE 4

Project Boundary
Stream Transect
Stream Assessment Survey
Ephemeral Waterbody
Intermittent Waterbody
Perennial Waterbody
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland

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Created By: K. Shields
Project Number: 52872.10
Date: 11/12/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

0 100 200 300 400 500 Feet

0 30 60 90 120 150 Meters

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DOW CHEMICAL HARRIS RESERVOIR EXPANSION PROJECT

LEVEL II STREAM ASSESSMENT MAP
BRAZORIA COUNTY, TEXAS

SHEET 2 OF 12 FIGURE 4

Project Boundary	Ephemeral Waterbody
Stream Transect	Intermittent Waterbody
Stream Assessment Survey	Perennial Waterbody
Emergent Wetland	
Forested Wetland	
Scrub-Scrub Wetland	

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Created By: K. Shields
Project Number: 52872.10
Date: 11/12/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

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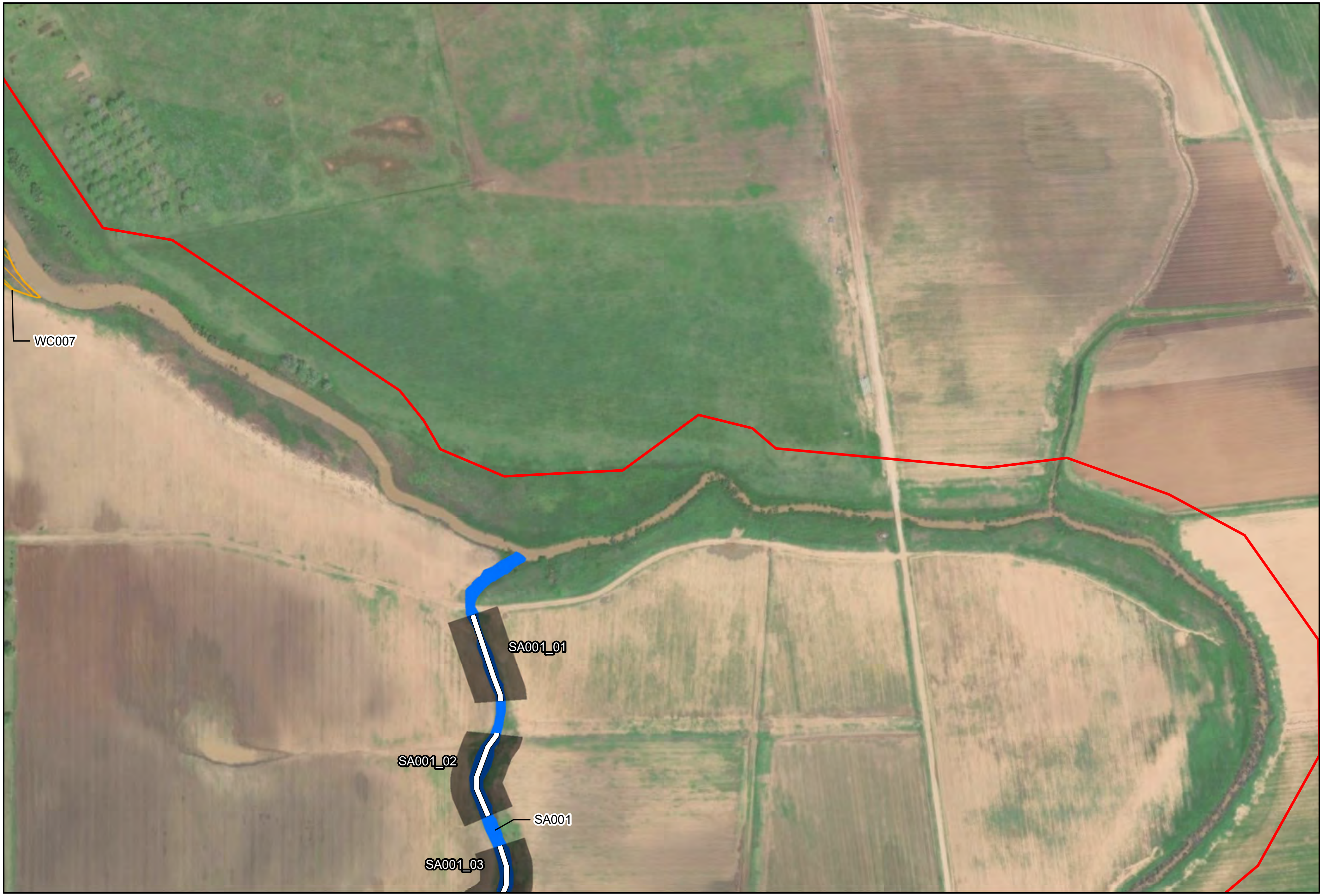
0 30 60 90 120 150 Meters



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DOW CHEMICAL HARRIS RESERVOIR EXPANSION PROJECT

LEVEL II STREAM ASSESSMENT MAP
BRAZORIA COUNTY, TEXAS

SHEET 3 OF 12

FIGURE 4

Project Boundary
Stream Transect
Stream Assessment Survey
Ephemeral Waterbody
Intermittent Waterbody
Perennial Waterbody
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland

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Created By: K. Shields
Project Number: 52872.10
Date: 11/12/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

0 100 200 300 400 500 Feet
0 30 60 90 120 150 Meters

SWCA ENVIRONMENTAL CONSULTANTS

DOW CHEMICAL HARRIS RESERVOIR EXPANSION PROJECT

LEVEL II STREAM ASSESSMENT MAP
BRAZORIA COUNTY, TEXAS

SHEET 4 OF 12 FIGURE 4

Project Boundary
Stream Transect
Stream Assessment Survey
Ephemeral Waterbody
Intermittent Waterbody
Perennial Waterbody
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland

1:6,000

Created By: K. Shields
Project Number: 52872.10
Date: 11/12/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

0 100 200 300 400 500 Feet

0 30 60 90 120 150 Meters

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DOW CHEMICAL HARRIS RESERVOIR EXPANSION PROJECT

LEVEL II STREAM ASSESSMENT MAP
BRAZORIA COUNTY, TEXAS

SHEET 5 OF 12 FIGURE 4

- Project Boundary
- Stream Transect
- Stream Assessment Survey
- Ephemeral Waterbody
- Intermittent Waterbody
- Perennial Waterbody
- Emergent Wetland
- Forested Wetland
- Scrub-Scrub Wetland

1:6,000

Created By: K. Shields
Project Number: 52872.10
Date: 11/12/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

0 100 200 300 400 500 Feet
0 30 60 90 120 150 Meters

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DOW CHEMICAL HARRIS RESERVOIR EXPANSION PROJECT

LEVEL II STREAM ASSESSMENT MAP
BRAZORIA COUNTY, TEXAS

SHEET 6 OF 12 FIGURE 4

Project Boundary
Stream Transect
Stream Assessment Survey
Ephemeral Waterbody
Intermittent Waterbody
Perennial Waterbody
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland

1:6,000

Created By: K. Shields
Project Number: 52872.10
Date: 11/12/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

0 100 200 300 400 500 Feet
0 30 60 90 120 150 Meters

SWCA® ENVIRONMENTAL CONSULTANTS

DOW CHEMICAL HARRIS RESERVOIR EXPANSION PROJECT

LEVEL II STREAM ASSESSMENT MAP
BRAZORIA COUNTY, TEXAS

SHEET 7 OF 12 FIGURE 4

Project Boundary
Stream Transect
Stream Assessment Survey
Ephemeral Waterbody
Intermittent Waterbody
Perennial Waterbody
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland

1:6,000

Created By: K. Shields
Project Number: 52872.10
Date: 11/12/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

0 100 200 300 400 500 Feet
0 30 60 90 120 150 Meters

SWCA ENVIRONMENTAL CONSULTANTS

DOW CHEMICAL HARRIS RESERVOIR EXPANSION PROJECT

LEVEL II STREAM ASSESSMENT MAP
BRAZORIA COUNTY, TEXAS

SHEET 8 OF 12 FIGURE 4

Project Boundary
Stream Transect
Stream Assessment Survey
Ephemeral Waterbody
Intermittent Waterbody
Perennial Waterbody
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland

1:6,000

Created By: K. Shields
Project Number: 52872.10
Date: 11/12/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

0 100 200 300 400 500 Feet
0 30 60 90 120 150 Meters

SWCA ENVIRONMENTAL CONSULTANTS

DOW CHEMICAL HARRIS RESERVOIR EXPANSION PROJECT

LEVEL II STREAM ASSESSMENT MAP
BRAZORIA COUNTY, TEXAS

SHEET 9 OF 12 FIGURE 4

Project Boundary
Stream Transect
Stream Assessment Survey
Ephemeral Waterbody
Intermittent Waterbody
Perennial Waterbody
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland

1:6,000

Created By: K. Shields
Project Number: 52872.10
Date: 11/12/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

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0 100 200 300 400 500 Feet
0 30 60 90 120 150 Meters

DOW CHEMICAL HARRIS RESERVOIR EXPANSION PROJECT

LEVEL II STREAM ASSESSMENT MAP
BRAZORIA COUNTY, TEXAS

SHEET 10 OF 12

FIGURE 4

SWCA ENVIRONMENTAL CONSULTANTS

Project Boundary
Stream Transect
Stream Assessment Survey
Ephemeral Waterbody
Intermittent Waterbody
Perennial Waterbody
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland

1:6,000

Created By: K. Shields
Project Number: 52872.10
Date: 11/12/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

0 100 200 300 400 500 Feet
0 30 60 90 120 150 Meters

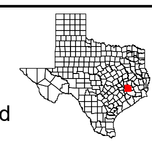
SWCA ENVIRONMENTAL CONSULTANTS

DOW CHEMICAL HARRIS RESERVOIR EXPANSION PROJECT

LEVEL II STREAM ASSESSMENT MAP
BRAZORIA COUNTY, TEXAS

SHEET 11 OF 12 FIGURE 4

Project Boundary
Stream Transect
Stream Assessment Survey
Ephemeral Waterbody
Intermittent Waterbody
Perennial Waterbody
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland



1:6,000

Created By: K. Shields
Project Number: 52872.10
Date: 11/12/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

0 100 200 300 400 500 Feet
0 30 60 90 120 150 Meters

SWCA®
ENVIRONMENTAL CONSULTANTS

DOW CHEMICAL HARRIS RESERVOIR EXPANSION PROJECT

LEVEL II STREAM ASSESSMENT MAP
BRAZORIA COUNTY, TEXAS

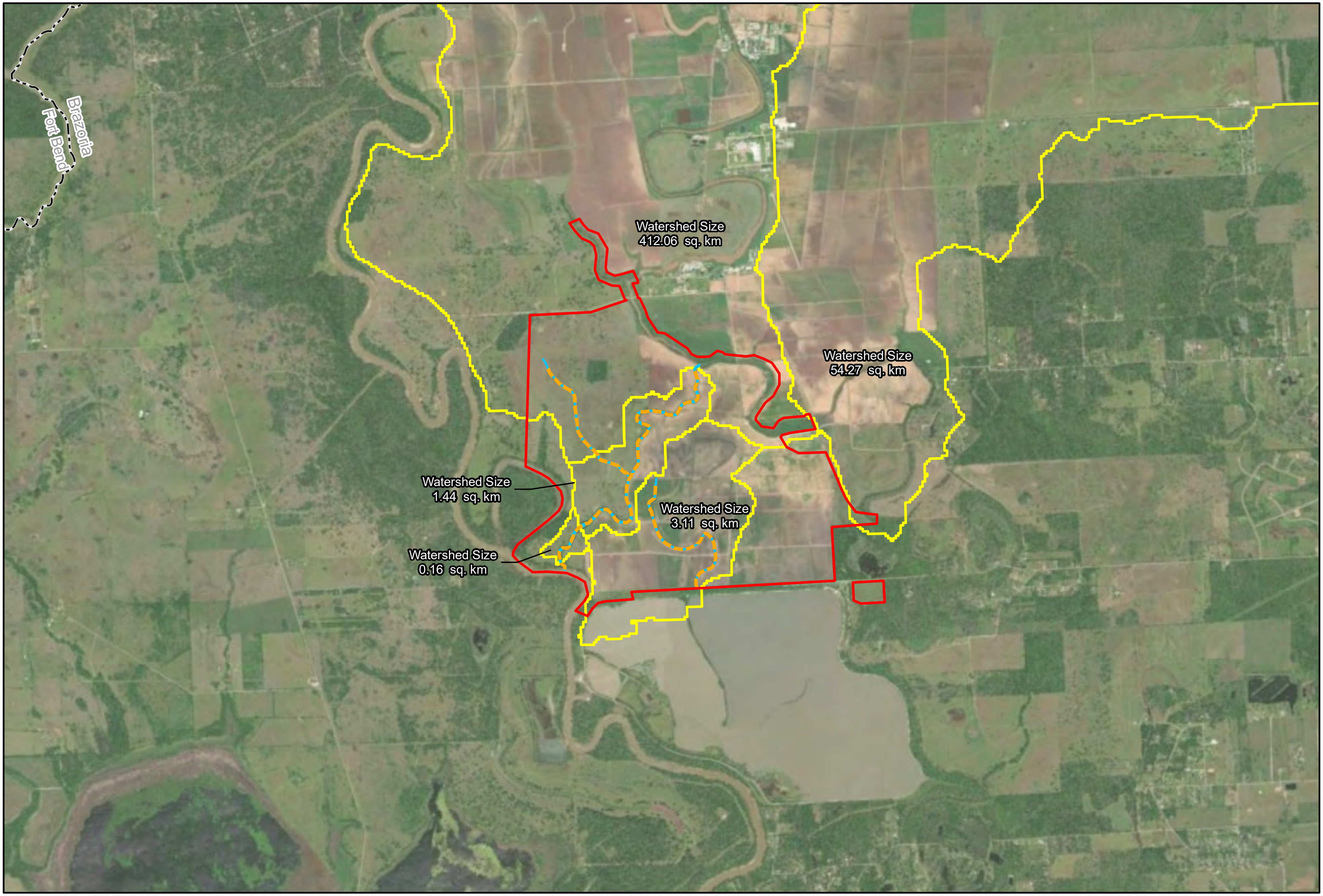
SHEET 12 OF 12 FIGURE 4

Project Boundary
Stream Transect
Stream Assessment Survey
Ephemeral Waterbody
Intermittent Waterbody
Perennial Waterbody
Emergent Wetland
Forested Wetland
Scrub-Scrub Wetland

1:6,000

Created By: K. Shields
Project Number: 52872.10
Date: 11/12/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

0 100 200 300 400 500 Feet
0 30 60 90 120 150 Meters



SWCA® ENVIRONMENTAL CONSULTANTS

DOW CHEMICAL HARRIS RESERVOIR EXPANSION PROJECT

WATERSHED MAP
BRAZORIA COUNTY, TEXAS
FIGURE 5

Project Boundary
Stream Transect
Level II Assessment Stream
Watershed Boundary
County Boundary

1:60,000

Created By: K. Shields
Project Number: 52872.10
Date: 11/12/2019
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

0 1,000 2,000 3,000 4,000 Feet
0 300 600 900 1,200 Meters

Attachment 6
Credit/Debit Calculations

	FORESTED WETLAND CREDITS		NON-FORESTED WETLAND CREDITS	
Category	**Needed**	**Proposed**	**Needed**	**Proposed**
Temporary Storage of Water (FCU)	4.8	5.4	7.0	8.9
Plant & Animal Community (FCU)	4.9	9.4	7.8	8.1
Removal of Elements and Compounds (FCU)	4.9	5.4	6.9	7.9
Total (FCU)	**14.6**	**20.3**	**21.6**	**24.8**

Riverine Forested HGMi

WAA	DP-ID	Acreage	Vdur	Proposed Vdur	Vfreq	Proposed Vfreq	Vtopo	Proposed Vtopo	Actions	Vcwd	Proposed Vcwd	Vwood	Proposed Vwood	Vtree	Proposed Vtree	Actions	Vrich	Proposed Vrich	Actions	Vbasal	Proposed Vbasal	Vdensity	Proposed Vdensity
WET-B-2	DP-B-10	12.6597	0.25	0.25	0.75	0.75	0.1	0.4	Pothole excavation	0.5	0.5	0.75	0.75	0.3	1	Remove tallow, implement wetland forest planting type.	0.4	1	Plant a diverse number of species.	0.6	0.6	0.6	0.6

WAA	Vmid	Proposed Vmid	Vherb	Proposed Vherb	Actions	Vdetritus	Proposed Vdetritus	Actions	Vredox	Propsoed Vredox	Vsorpt	Proposed Vsorp	Vconnect	Proposed Vconnect	Actions	Temporary storage of water (FCU)	Proposed Temporary storage of water	Maintain Plant & Animal Community	Proposed Maintain Plant & Animal Community	Removal of Element and Compounds	Proposed Removal of Element and Compounds	Total Existing (FCU)	Total Proposed (FCU)	**LIFT (FCU)**
WET-B-2	0.5	0.5	0.3	0.5	Wetland forest planting type.	0.5	1	Remove grazing animals, revegetate and mulch ground.	0.1	0.1	1	1	0.5	0.75	Restore to hardwood forest with diverse plant communities.	5.588	6.178	5.697	9.178	6.921	7.596	18.206	22.952	**4.75**

	Existing	**Proposed**	**LIFT**
Total Temporary Storage of Water (FCU)	**5.59**	**6.18**	**0.59**
Total Plant & Animal Community (FCU)	**5.70**	**9.18**	**3.48**
Total Removal of Elements and Compounds (FCU)	**6.92**	**7.60**	**0.68**
Total (FCU)	**18.21**	**22.95**	**4.75**

LEGEND	
	WAA Index Totals
	Proposed Lift Actions
	Total Lift

Riverine Forested HGMi

WAA	DP-ID	Acreage	Vdur	Proposed Vdur	Vdur Action	Vfreq	Proposed Vfreq	Vfreq Action	Vtopo	Proposed Vtopo	Vtopo Action	Vcwd	Proposed Vcwd	Vwood	Proposed Vwood	Vtree	Proposed Vtree	Actions	Vrich	Proposed Vrich	Actions	Vbasal	Proposed Vbasal	Actions
SB4-3	Scroll	1.56	0.1	0.5	Create pothole or pond feature designed to hold water for at least 1 month out of the year	0.25	1	Excavate feature designed to pond annually	0.4	1	Excavate potholes, ponds, oxbows with heterogenous topography.	0.3	0.3	0.5	0.5	0.3	1	Remove tallow, implement wetland forest planting type.	0.4	1	Plant a diverse number of species.	0.4	1	Planting wetland type trees to increase basal area
SB4-8	Scroll	0.87	0.1	0.5	Create pothole or pond feature designed to hold water for at least 1 month out of the year	0.25	1	Excavate feature designed to pond annually	0.4	1	Excavate potholes, ponds, oxbows with heterogenous topography.	0.3	0.3	0.5	0.5	0.3	1	Remove tallow, implement wetland forest planting type.	0.4	1	Plant a diverse number of species.	0.4	1	Planting wetland type trees to increase basal area
SB8-7	Scroll	1.02	0.1	0.5	Create pothole or pond feature designed to hold water for at least 1 month out of the year	0.25	1	Excavate feature designed to pond annually	0.4	1	Excavate potholes, ponds, oxbows with heterogenous topography.	0.3	0.3	0.5	0.5	0.3	1	Remove tallow, implement wetland forest planting type.	0.4	1	Plant a diverse number of species.	0.4	1	Planting wetland type trees to increase basal area
SB9-6	Scroll	4.00	0.1	0.5	Create pothole or pond feature designed to hold water for at least 1 month out of the year	0.25	1	Excavate feature designed to pond annually	0.4	1	Excavate potholes, ponds, oxbows with heterogenous topography.	0.3	0.3	0.5	0.5	0.3	1	Remove tallow, implement wetland forest planting type.	0.4	1	Plant a diverse number of species.	0.4	1	Planting wetland type trees to increase basal area

WAA	Vdensity	Proposed Vdensity	Actions	Vmid	Proposed Vmid	Vmid Action	Vherb	Proposed Vherb	Vdetritus	Proposed Vdetritus	Vdetritus Action	Vredox	Proposed Vredox	Vsorpt	Proposed Vsorpt	Vconnect	Proposed Vconnect	Vconnect Action	Temporary storage of water (Existing FCU)	Temporary storage of water (Proposed FCU)	Maintain Plant & Animal Community (Existing FCU)	Maintain Plant & Animal Community (Proposed FCU)	Removal of Elements and Compounds (Existing FCU)	Removal of Elements and Compounds (Proposed FCU)	Total Existing (FCU)	Total Proposed (FCU)	**LIFT (FCU)**
SB4-3	0.4	1	Planting wetland type trees to increase tree density	0.25	0.25	Forested planting types	0.75	0.75	0.5	1	Remove grazing species.	0.1	0.1	1	1	0.75	1	Create new habitat type	0.393	1.017	0.690	1.249	0.557	1.031	1.639	3.30	**3.30**
SB4-8	0.4	1	Planting wetland type trees to increase tree density	0.25	0.25	Forested planting types	0.75	0.75	0.5	1	Remove grazing species.	0.1	0.1	1	1	0.75	1	Create new habitat type	0.219	0.567	0.385	0.697	0.311	0.575	0.914	1.84	**1.84**
SB8-7	0.4	1	Planting wetland type trees to increase tree density	0.25	0.25	Forested planting types	0.75	0.75	0.5	1	Remove grazing species.	0.1	0.1	0.5	0.5	0.75	1	Create new habitat type	0.257	0.664	0.451	0.816	0.330	0.639	1.037	2.12	**2.12**
SB9-6	0.4	1	Planting wetland type trees to increase tree density	0.25	0.25	Forested planting types	0.75	0.75	0.5	1	Remove grazing species.	0.1	0.1	0.5	0.5	0.75	1	Create new habitat type	1.005	2.603	1.765	3.197	1.292	2.504	4.062	8.30	**8.30**

	Existing	**Proposed**	**LIFT**
Total Temporary Storage of Water (FCU)	**NA**	**4.85**	**4.85**
Total Plant & Animal Community (FCU)	**NA**	**5.96**	**5.96**
Total Removal of Elements and Compounds (FCU)	**NA**	**4.75**	**4.75**
Total (FCU)	**NA**	**15.56**	**15.56**

LEGEND	
	WAA Index Totals
	Proposed Lift Action
	Total Lift

Riverine Herbaceous/Shrub HGMi

WAA (Subbasin Index)	DP-ID	Acreage	Vdur	Proposed Vdur	Vdur Action	Vfreq	Proposed Vfreq	Vfreq Action	Vtopo	Proposed Vtopo	Vtopo Action	Vwood	Proposed Vwood	Vmid	Proposed Vmid	Vherb	Proposed Vherb	Vdetritus	Proposed Vdetritus	Vdetritus Action
SB4-1	Scroll	0.53	0.1	0.5	Create pothole or pond feature designed to hold water for at least 1 month out of the year	0.25	1	Excavate feature designed to pond annually	0.4	1	Excavate potholes, ponds, oxbows with heterogenous topography.	0.5	0.5	0.25	0.25	0.75	0.75	0.5	1	Remove grazing species.
SB4-2	Scroll	0.61	0.1	0.5	Create pothole or pond feature designed to hold water for at least 1 month out of the year	0.25	1	Excavate feature designed to pond annually	0.4	1	Excavate potholes, ponds, oxbows with heterogenous topography.	0.5	0.5	0.25	0.25	0.75	0.75	0.5	1	Remove grazing species.
SB4-4	Scroll	1.63	0.1	0.5	Create pothole or pond feature designed to hold water for at least 1 month out of the year	0.25	1	Excavate feature designed to pond annually	0.4	1	Excavate potholes, ponds, oxbows with heterogenous topography.	0.5	0.5	0.25	0.25	0.75	0.75	0.5	1	Remove grazing species.
SB5-21	Scroll	0.55	0.1	0.5	Create pothole or pond feature designed to hold water for at least 1 month out of the year	0.25	1	Excavate feature designed to pond annually	0.4	1	Excavate potholes, ponds, oxbows with heterogenous topography.	0.5	0.5	0.25	0.25	0.75	0.75	0.5	1	Remove grazing species.
SB7-8	Scroll	1.02	0.1	0.5	Create pothole or pond feature designed to hold water for at least 1 month out of the year	0.25	1	Excavate feature designed to pond annually	0.4	1	Excavate potholes, ponds, oxbows with heterogenous topography.	0.5	0.5	0.25	0.25	0.75	0.75	0.5	1	Remove grazing species.
SB7-9	Scroll	2.57	0.1	0.5	Create pothole or pond feature designed to hold water for at least 1 month out of the year	0.25	1	Excavate feature designed to pond annually	0.4	1	Excavate potholes, ponds, oxbows with heterogenous topography.	0.5	0.5	0.25	0.25	0.75	0.75	0.5	1	Remove grazing species.
SB9-21	Scroll	2.12	0.1	0.5	Create pothole or pond feature designed to hold water for at least 1 month out of the year	0.25	1	Excavate feature designed to pond annually	0.4	1	Excavate potholes, ponds, oxbows with heterogenous topography.	0.5	0.5	0.25	0.25	0.75	0.75	0.5	1	Remove grazing species.
SB9-22	Scroll	3.12	0.1	0.5	Create pothole or pond feature designed to hold water for at least 1 month out of the year	0.25	1	Excavate feature designed to pond annually	0.4	1	Excavate potholes, ponds, oxbows with heterogenous topography.	0.5	0.5	0.25	0.25	0.75	0.75	0.5	1	Remove grazing species.

WAA (Subbasin Index)	Vredox	Proposed Vredox	Vsorpt	Proposed Vsorpt	Vconnect	Proposed Vconnect	Vconnect Action	Temporary storage of water (Existing FCU)	Temporary storage of water (Proposed FCU)	Maintain Plant & Animal Community (Existing FCU)	Maintain Plant & Animal Community (Proposed FCU)	Removal of Elements and Compounds (Existing FCU)	Removal of Elements and Compounds (Proposed FCU)	Total Existing (FCU)	Total Proposed (FCU)	**LIFT (FCU)**
SB4-1	0.1	0.1	0.5	0.5	0.75	1	Create new habitat type	0.14	0.39	0.31	0.36	0.18	0.34	0.63	**1.09**	**1.09**
SB4-2	0.1	0.1	0.5	0.5	0.75	1	Create new habitat type	0.16	0.45	0.36	0.41	0.21	0.39	0.73	**1.25**	**1.25**
SB4-4	0.1	0.1	1	1	0.75	1	Create new habitat type	0.44	1.19	0.95	1.09	0.60	1.10	1.99	**3.38**	**3.38**
SB5-21	0.1	0.1	1	1	0.75	1	Create new habitat type	0.15	0.40	0.32	0.37	0.20	0.37	0.67	**1.13**	**1.13**
SB7-8	0.1	0.1	0.5	0.5	0.75	1	Create new habitat type	0.27	0.74	0.59	0.68	0.34	0.65	1.21	**2.07**	**2.07**
SB7-9	0.1	0.1	0.5	0.5	0.75	1	Create new habitat type	0.69	1.87	1.50	1.72	0.87	1.65	3.06	**5.24**	**5.24**
SB9-21	0.1	0.1	0.5	0.5	0.75	1	Create new habitat type	0.57	1.55	1.24	1.42	0.71	1.36	2.52	**4.32**	**4.32**
SB9-22	0.1	0.1	0.5	0.5	0.75	1	Create new habitat type	0.83	2.27	1.82	2.08	1.05	1.99	3.70	**6.34**	**6.34**

	Existing	**Proposed**	**LIFT**
Total Temporary Storage of Water (FCU)	**NA**	**8.86**	**8.86**
Total Plant & Animal Community (FCU)	**NA**	**8.11**	**8.11**
Total Removal of Elements and Compounds (FCU)	**NA**	**7.85**	**7.85**
Total (FCU)	**0.00**	**24.82**	**24.82**

LEGEND	
	WAA Index Totals
	Proposed Lift Action
	Total Lift

Attachment 7
Liens, Easements, or Encumbrances

UC5

Page 204 Deed Records of Brazoria County, Texas.

TO HAVE AND TO HOLD the said premises, together with all and singular the rights, privileges and appurtenances thereto in any manner belonging unto the said John J. Cosgrove and Minnie D. Cosgrove, his wife their heirs and assigns, forever, so that neither they the said John J. Cosgrove and Minnie D. Cosgrove, his wife nor their heirs, nor any person or persons claiming under them shall, at any time hereafter, have, claim, or demand any right, or title to the aforesaid premises or appurtenances, or any part thereof.

WITNESS our hands at Kansas City Mo this 2nd day of April A. D. 1946

Witnesses at Request of Grantor: John J. Cosgrove

Byron I. Mentohye Minnie D. Cosgrove

John C. Nipp

THE STATE OF MISSOURI)

COUNTY OF JACKSON)

BEFORE ME, the undersigned, a Notary Public in and for said County and State, on this day personally appeared John J. Cosgrove and Minnie D. Cosgrove, his wife, both known to me to be the persons whose names are subscribed to the foregoing instrument, and acknowledged to me that they each executed the same for the purposes and consideration therein expressed, and the said Minnie D. Cosgrove, wife of the said John J. Cosgrove having been examined by me privily and apart from her husband, and having the same fully explained to her, she, the said Minnie D. Cosgrove acknowledged such instrument to be her act and deed, and she declared that she had willingly signed the same for the purposes and consideration therein expressed, and that she did not wish to retract it.

GIVEN under my hand and seal of office this the 22nd day of April A. D. 1946.

(SEAL) Mary Phillips Notary Public in and for Jackson County, Mo.

My Commission Expires Feb. 28, 1947

Filed for Record at 8:58 o'clock A. M. Jun 14 194 6 J. R. Monarch Clerk County Court, Brazoria County, Texas By M. A. Gupton Deputy

---OOO---

4439

IN THE DISTRICT COURT OF THE UNITED STATES
FOR THE SOUTHERN DISTRICT OF TEXAS
GALVESTON DIVISION

UNITED STATES OF AMERICA
Petitioner,
v. Civil Action No. 360

CERTAIN TRACTS OF LANDS
IN BRAZORIA COUNTY, TEXAS,
and DOW CHEMICAL COMPANY,
ET AL.,
Defendants.

JUDGMENT ON DECLARATION OF TAKING

This cause coming on to be heard upon the motion of petitioner, United States of America, to enter a judgment on the Declaration of Taking filed in this cause on Jun - 6, 1946, and upon consideration thereof and of the Petition in Condemnation, and the first amendment to Petition in Condemnation, filed herein, said Declaration of Taking, the statutes in such cases made and provided, and it appearing to the satisfaction of the Court:

I.

That the United States of America is entitled to acquire property by eminent domain for the purposes as set out and prayed in said Petition and the amendments thereto.

II.

That the Petition in Condemnation and the amendments thereto were filed at the request of the Secretary of the Reconstruction Finance Corporation, the authority empowered to acquire lands described in said pleadings, and also under the authority of the Attorney

General of the United States, and that heretofore on May 10, 1945, and May 25, 1945, respectively, this Court entered and filed orders granting to the United States of America immediate possession of the hereinafter described property.

III.

That said Petition and the amendments thereto, and said Declaration of Taking, state the authority under which and the public uses for which said lands were taken. That the Secretary and the Assistant Treasurer of the Reconstruction Finance Corporation are duly authorized and empowered by law to acquire lands and interests in lands such as are described in the Petition, and the amendments thereto, and in the Declaration of Taking. That the Attorney General of the United States is the person authorized by law to direct the Institution of such condemnation proceedings.

IV.

That a proper description of the lands in which an interest or estate is sought to be taken, sufficient for identification thereof, is set out in said Declaration of Taking.

V.

That said Declaration of Taking contains a statement of the interests or estates in said lands taken for said public use.

VI.

That a plat, or plats, showing the lands in which the interests or estates are taken is incorporated in said Declaration of Taking.

VII.

That a statement is contained in said Declaration of Taking of a sum of money estimated by said acquiring authority to be just compensation for said interests or estates in said lands, and that said sum was deposited in the registry of this Court for the use of the persons entitled thereto upon and at the time of the filing of said Declaration of Taking.

VIII.

That a statement is contained in said Declaration of Taking that the amount of the ultimate award of compensation for the taking of said property, in the opinion of the acquiring authority, will be within any limits prescribed by Congress as to the price to be paid therefor.

IT IS, THEREFORE, ORDERED, ADJUDGED and DECREED by the Court that upon the filing of said Declaration of Taking and the depositing in the registry of the Court of the sum of the estimated compensation, there vested in the United States of America:

(1) The absolute fee simple title (minerals and mineral leases excepted, provided, however, that the surface of said land shall not be used for the purpose of prospecting for or extracting gas, oil or other minerals in a manner which will interfere with the use, occupation and operation of a water storage reservoir or of any improvements constructed or erected or to be constructed or erected in or upon said land) in and to the lands described in the following Paragraph or Section (A).

(2) The absolute fee simple title (minerals and mineral leases excepted, provided, however, that the surface of said land shall not be used for the purpose of prospecting for or extracting gas, oil or other minerals in a manner which will interfere with the use, occupation and operation of improvements constructed or erected or to be constructed or erected in or upon said land) in and to the lands described in the following Paragraph or Section (B).

(3) A perpetual easement and right to use, maintain and repair the bed, banks and channel of that section or part of Oyster Creek in Fort Bend County and Brazoria County, Texas, passing through and traversing the land described in the following Paragraphs or Sections (C) and (D) for the purpose of conveying, transporting, flowing and delivering water,

without hindrance, interruption, obstruction or interference of any kind or nature; together with the right to keep the said bed, banks and channel of said section or part of Oyster Creek free from silt and mud deposits, debris and/or any and all other obstructions of any kind whatsoever; together with the right to place and dispose of spoil upon the bank and banks of said section or part of Oyster Creek; together with the right of ingress and egress to and from said section or part of Oyster Creek and all incidental rights for the purposes aforesaid.

That the lands in and to which the above enumerated estates or interests have vested in the United States of America are more fully described as follows:

EXHIBIT "A"

The lands which are the subject matter of this condemnation are situate in Fort Bend County and Brazoria County, State of Texas, and are more particularly described (and the estate taken therein) as follows:

Otep (A) The fee simple title, minerals and mineral leases excepted, to the following described land in Brazoria County, Texas; provided, however, that the surface of said land shall not be used for the purpose of prospecting for or extracting gas, oil or other minerals in a manner which will interfere with the use, occupation and operation of a water storage reservoir or of any improvements constructed or erected or to be constructed or erected in or upon said land:

WM. PARKER LEAGUE
ABSTRACT NUMBER 104
AND
WM. HARRIS LEAGUE
ABSTRACT NUMBER 71
BRAZORIA COUNTY, TEXAS

Perimeter Description of Water
Reservoir Site West of Chenango, Texas
(See Map #1 - Exhibit "C")

All those certain tracts or parcels of land in the Wm. Parker League, Abstract Number 104, between the Brazos River and Oyster Creek and in the Southwest part of the Wm. Harris League, Abstract Number 71, all in Brazoria County, Texas, and being more particularly described as follows:

Beginning at the Southwest corner of the Wm. Parker League, Abstract Number 104, being also the Northwest corner of the Shubael Marsh One and One-Fourth Leagues, Abstract Numbers 81 and 82, on the East high bank of the Brazos River;

Thence S. 89° 39' 20" E. along the South line of the said Wm. Parker League, Abstract Number 104, at 20 feet pass an oak post 8 inches in diameter from which a 12-inch dead pecan marked X bears N. 18° 56' E. 25.2 feet, at 100 feet pass a concrete monument, at 1195.6 feet pass the center line of a clearing for the Texas Pipe Line Company Right-of-Way, at 1644.6 feet pass the center line of a slough, at 6370.08 feet pass a concrete monument, and in all at 6470.08 feet to a stake for corner in the west waters edge of Oyster Creek;

Thence along the West waters edge of Oyster Creek with the following meanders; N. 82°46' E. 51.18 feet; N. 75°59' E. 501.24 feet; N. 85°07' E. 192.84 feet; N. 89°45' E. 196.71 feet; S. 83°42' E. 196.14 feet; S. 70°50' E. 206.66 feet; S. 80°43' E. 200.91 feet; N. 86°57' E. 98.90 feet; S. 86°11' E. 310.26 feet; S. 79°25' E. 294.03 feet; N. 86°07' E. 100.18 feet; N. 74°51' E. 117.94 feet; N. 30°06' E. 130.65 feet; N. 11°23' E. 105.31 feet; N. 41°55' W. 333.24 feet; N. 22°03' W. 102.60 feet; N. 43°39' W. 114.11 feet; N. 64°13' W. 886.48 feet; N. 79°23' W. 204.80 feet; S. 89°39' W. 104.40 feet; N. 82°33' W. 205.71 feet; N. 72°09' W. 182.96 feet; N. 61°55' W. 184.57 feet; N. 46°57' W. 181.72 feet; N. 42°40' W. 209.15 feet; N. 37°46' W. 100.60 feet; N. 27°43' W. 175.53 feet; N. 18°47' W. 100.04 feet; N. 15°01' W. 206.03 feet; N. 6°32' W. 130.44 feet; N. 5°37' W. 355.63 feet; N. 1°57' W. 100.13 feet; N. 0°09' W. 197.53 feet; N. 3°12' W. 198.32 feet; N. 8°59' W. 101.43 feet; N. 2°23' E. 100.04

feet; N. 12°17' W. 257.02 feet; N. 10°30' W. 148.24 feet; N. 15°54' W. 398.66 feet; N. 21°13' W. 386.70 feet; N. 34°31' W. 123.24 feet; N. 30°10' W. 412.97 feet; N. 54°38' W. 292.55 feet; N. 23°36' W. 121.42 feet; N. 4°31' E. 183.07 feet; N. 43°15' W. 56.37 feet; N. 54°50' W. 208.26 feet; S. 80°58' W. 404.04 feet; S. 82°51' W. 200.02 feet; S. 86°06' W. 200.41 feet; N. 82°45' W. 88.18 feet; N. 75°58' W. 195.09 feet; N. 64°55' W. 99.79 feet; N. 50°33' W. 78.12 feet; N. 31°29' W. 190.82 feet; N. 18°08' W. 192.56 feet; N. 5°45' W. 100.03 feet; N. 5°20' E. 185.77 feet; N. 12°49' E. 178.97 feet to a stake in the North line of the Wm. Parker League, Abstract Number 104, and the South line of the Wm. Harris League, Abstract Number 71;
Thence N. 34°33' 10" E. 215.71 feet to a stake for corner in the West line of the Ed Antwine 150-acre tract and in the East line of the Dow Chemical Company 344.85-Acre tract;

Thence with Ed Antwine's West line N. 0°17' 30" E. at 100 feet pass a concrete monument, at 1040.42 feet pass a concrete monument in the Southeast corner of the Homer Walker, et al., 244.85-Acre tract, at 2155.51 feet a concrete monument for corner;
Thence S. 89°38'40" East at 2546.6 feet pass a concrete monument, in all 3111.8 feet to a concrete monument for corner;
Thence N. 0°21'20" E. 100 feet to a concrete monument for corner, said monument being the Northeast corner of the M. & J. Griffin tract;
Thence N. 89°38'40" W. at 565.2 feet pass a 3-inch iron pipe in the Northeast corner of the Ed Antwine 150-Acre tract, at 3111.9 feet pass a concrete monument in the Northwest corner of the said Antwine tract and also being the Northeast corner of the Homer Walker, et al. tract, at 11,888.9 feet a concrete monument in the Northwest corner of the Homer Walker, et al. tract, being also in the South line of the Prison Commission of Texas 1926-Acre tract, at 12,991.16 feet pass a concrete monument and in all at 13,291.15 feet a stake for corner in the East bank of the Brazos River, said stake being the Northwest corner of the Dow Chemical 344.85-Acre tract and Southwest corner of the Prison Commission of Texas 1926-Acre tract;
Thence along the East bank of the Brazos River with the following meanders: S. 29°13'30" W. 771.28 feet; S. 31°55' E. 156.38 feet; S. 26°19'20" W. 479.92 feet; S. 4°24' W. 528.32 feet; S. 3°43'E. 662.84 feet to a stake in the Southwest corner of the Wm. Harris League, Abstract Number 714 ; and being also the northwest corner of the Wm. Parker League, Abstract Number 104; Thence continuing the meanders of the Brazos River; S. 8°14'E. 303.25 feet; S. 9°05' W. 588.17 feet; S. 13°54' W. 1162.81 feet; S. 10° 22'W. 368.24 feet; S. 18°48' E. 305.76 feet; S. 47°14' E. 200.80 feet; N. 78°22' E. 286.56 feet; N. 57°43' E. 673.16 feet; N. 87°57' E. 447.55 feet; S. 80°27' E. 163.36 feet; S. 50°46' E. 427.61 feet; S. 32°32' E. 598.98 feet; S. 43°40' E. 725.52 feet; S. 62°18' E. 500.54 feet; S. 65°49' E. 842.33 feet; S. 73°05' E. 397.74 feet; S. 77°43' E. 855.54 feet; S. 64°11' E. 562.58 feet; S. 63°31' E. 359.43 feet; S. 39°21' E. 623.78 feet; S. 29°31' E. 562.43 feet; S. 23°59' E. 413.55 feet to the place of beginning and containing 2,111.72 acres of land more or less. The above 2,111.72 Acres comprised of the following tracts: L. D. Viemann, et al., 1,514.87 Acres; Dow Chemical Company, 344.85 acres; Homer Walker, et al., 244.85 Acres; Ed Antwine, 5.85 Acres and M. & J. Griffin, 1.30 Acres, which individual tracts are described as follows:
Description

Wm. PARKER LEAGUE
ABSTRACT NUMBER 104
BRAZORIA COUNTY, TEXAS

L. D. Viemann, et al
(See Map # 1 - Exhibit "C")

All that certain tract or parcel of land in the Wm. Parker League, Abstract Number 104, Brazoria County, Texas, lying between the Brazos River and Oyster Creek, and being more particularly described as follows: Beginning at the Southwest corner of the Wm. Parker League, Abstract Number 104, being also the Northwest corner of the Shubael Marsh One and One-Fourth Leagues, Abstract Numbers 81 and 82, on the East high bank of the Brazos River;
Thence S. 89°39'20" E. along the South line of said Wm. Parker League, Abstract Number 104,

at 20 feet pass an oak post 8 inches in diameter from which a 12-inch dead pecan marked X bears N. 18°56' E. 25.2 feet, at 100 feet pass a concrete monument, at 1195.6 feet pass the center line of a clearing for the Texas Pipe Line Company Right-of-Way, at 1644.6 feet pass the center line of a slough, at 6370 .08 feet pass a concrete monument, and in all at 6470.08 feet to a stake for corner in the West waters edge of Oyster Creek;

Thence along the West waters edge of Oyster Creek with the following meanders: N. 82°46' E. 51.18 feet; N. 75°59' E. 501.24 feet; N. 85°07' E. 192.84 feet; N. 89°45' E. 196.71 feet; S. 83°42' E. 196.14 feet; S. 70°50' E. 206.66 feet; S. 80°43' E. 200.91 feet; N. 86°57' E. 98.90 feet; S. 86°11' E. 310.26 feet; S. 79°25' E. 294.03 feet; N. 86°07' E. 100.18 feet; N. 74°51' E. 117.94 feet; N. 30°06' E. 130.65 feet; N. 11°23' E. 105.31 feet; N. 41°55' W. 333.24 feet; N. 22°03' W. 102.60 feet; N. 43°39' W. 114.11 feet; N. 64°13' W. 886.48 feet; N. 79°23' W. 204.80 feet; S. 89°39' W. 104.40 feet; N. 82°33' W. 205.71 feet; N. 72°09' W. 182.96 feet; N. 61°55' W. 184.57 feet; N. 46°57' W. 181.72 feet; N. 42°40' W. 209.15 feet; N. 37°46' W. 100.60 feet; N. 27°43' W. 175.53 feet; N. 18°47' W. 100.04 feet; N. 15°01' W. 206.03 feet; N. 6°32' W. 130.44 feet; N. 5°37' W. 355.63 feet; N. 1°57' W. 100.13 feet; N. 0°09' W. 197.53 feet; N. 3°12' W. 198.32 feet; N. 8°59' W. 101.43 feet; N. 2°23' E. 100.04 feet; N. 12°17' W. 257.02 feet; N. 10°30'W 148.24 feet; N. 15°54' W. 398.66 feet; N. 21°13' W. 386.70 feet; N. 34°31' W. 123.24 feet; N. 30°10' W. 412.97 feet; N. 54°38' W. 292.55 feet; N. 23°36' W. 121.42 feet; N. 4°31' E. 183.07 feet; N. 43°15' W. 56.37 feet; N. 54°50' W. 208.26 feet; S. 80°58' W. 404.04 feet; S. 82°51' W. 200.02 feet; S. 86°06' W. 200.41 feet; N. 82°45' W. 88.18 feet; N. 75°58' W. 195.09 feet; N. 64°56' W. 99.79 feet; N. 50° 33' W. 78.12 feet; N. 31°29' W. 190.82 feet; N. 18°08' W. 192.56 feet; N. 5°45' W. 100.03 feet; N. 5°20' E. 185.77 feet; N. 12°49' E. 178.97 feet to a stake for corner in North line of the Wm Parker League, Abstract Number 104, being also in the South line of the Wm. Harris League, Abstract Number 71;

Thence N. 89°36' 30" W. along the said North line of the Wm. Parker League, Abstract Number 104, at 100 feet pass a concrete monument at 10,449.65 feet pass another concrete monument, in all 10,549.65 feet to a stake in the East high bank of the Brazos River, said stake being the Northwest corner of the Wm. Parker League, Abstract Number 104, and the Southwest corner of the Wm. Harris League, Abstract Number 71;

Thence along the East high bank of the Brazos River with the following meanders: S. 8°14' E. 303.25 feet; S. 9°05' W. 588.17 feet; S. 13°54' W. 1162.81 feet; S. 10°22' W. 368.24 feet; S. 18°48' E. 305.76 feet; S. 47°14' E. 200.80 feet; N. 73°22' E. 286.56 feet; N. 57°43' E. 673.16 feet; N. 87°57' E. 447.55 feet; S. 80°27' E. 163.36 feet; S. 50°46' E. 427.61 feet; S. 32°32' E. 598.98 feet; S. 43°40' E. 725.52 feet; S. 62°18' E. 500.54 feet; S. 65°49' E. 842.33 feet; S. 73°05' E. 397.74 feet; S. 77°43' E. 855.54 feet; S. 64°11' E. 562.58 feet; S. 63°31' E. 359.43 feet; S. 39°21' E. 623.78 feet; S. 29°31' E. 562.43 feet; S. 23°59' E. 413.55 feet to the place of beginning and containing 1514.87 Acres of land more or less.

Names and Addresses of Purported Owners:

L. D. Vieman Estate
c/o M. B. Vieman, Dickenson, Texas

Mrs. Laura C. Walker (widow of Robert Walker, dec'd)
c/o M. B. Vieman Dickenson, Texas

Estimated Just Compensation: $45,971.75

Description:

Wm. HARRIS LEAGUE
ABSTRACT NUMBER 71
BRAZORIA COUNTY, TEXAS

Dow Chemical Company
(See Map # 1 - Exhibit "C")

All that certain tract or parcel of land lying in the Southwest part of the Wm. Harris League, Abstract Number 71, Brazoria County, Texas, being more particularly described as follows:

Beginning at the Southwest corner of the Wm. Harris League, Abstract Number 71, on the East high bank of the Brazos River, being also the Northwest corner of the Wm. Parker League, Abstract Number 104; Thence S. 89°36'30" E. along the South line of said Wm. Harris League, Abstract Number 71, at 100 feet pass a concrete monument, at 10,449.65 feet pass another concrete monument in all 10,549.65 feet to a stake for corner in the west waters edge of Oyster Creek; Thence with the West waters edge of Oyster Creek N. 34°33'10" E. 215.71 feet to a stake for corner, said stake being in the West line of the Ed Antwine 150-Acre tract; Thence with Ed Antwine's West line N. 0°17'30" E. at 100 feet pass a concrete monument, and in all 1040.42 feet to another concrete monument for corner; Thence N. 89°38'40" W. 8778.36 feet to a stake set for corner; Thence N. 0°21'20" E. 1215.09 feet to a concrete monument for corner, said monument being in the South line of the Prison Commission of Texas 1926-Acre tract, also being the Northwest corner of the Homer Walker, et al. tract; Thence N. 89°38'40" W. at 1102.26 feet pass a concrete monument and in all 1402.26 feet to a stake for corner in the East high bank of the Brazos River; Thence along the East high bank of the Brazos River with the following meanders; S. 29°13'30" W. 771.28 feet; S. 31°55' E. 156.38 feet; S. 26°19'20" W. 479.92 feet; S. 4°24' W. 528.32 feet; S. 3°43' E.662.84 feet to the place of beginning and containing 344.85 Acres of land more or less.

Name and Address of Purported Owner: Dow Chemical Company
Midland, Michigan

Estimated Just Compensation: $9,371.25

Description:

WM. HARRIS LEAGUE
ABSTRACT NUMBER 71
BRAZORIA COUNTY, TEXAS

Homer Walker, et al.
(See Map # 1 - Exhibit "C")

All that certain tract of land in the Wm. Harris League, Abstract Number 71, Brazoria County, Texas, and lying South of the Prison Commission of Texas 1926-Acre tract, being more particularly described as follows:

Beginning at a concrete monument set in the Northwest corner of this tract, said monument being in the South line of the Prison Commission of Texas 1926-Acre Tract; Thence S. 0°21'20" W. 1215.09 feet to a stake for corner; Thence S. 89°38'40" E. 8778.36 feet to a concrete monument for corner in the West line of the Ed Antwine 150-Acre tract; Thence N. 0°17' 30" E. 1215.09 feet to a concrete monument for corner, said monument being the Northwest corner of the Ed Antwine 150-Acre tract from which a 3-inch iron pipe in the Northeast corner of said 150-Acre tract bears S. 89°38'40" E. 2546.7 feet; Thence N. 89°38'40" W. 8777.0 feet to the place of beginning and containing 244.85 Acres of land more or less.

Names and Addresses of Purported Owners:

Homer Walker
Dodge City, Ford Co., Kansas

Emma Obenhaus (widow of Chas. Obenhaus, Dec'd.)
Herman, Gasconade Co., Missouri

Herbert Langendoerfer
Herman, Gasconade Co., Missouri

Julia E. Walker (widow of A. B. Walker, Dec'd)
Herman, Gasconade Co., Missouri

Estimated Just Compensation: $6,496.25

Description:

WM. HARRIS LEAGUE
ABSTRACT NUMBER 71
BRAZORIA COUNTY, TEXAS

Ed Antwine
(See Map #1 - Exhibit "C")

All that certain parcel of land out of the North part of the Ed Antwine 150-Acre tract, lying in the Wm. Harris League, Abstract Number 71, Brazoria County, Texas, being more particularly described as follows:

Beginning at a concrete monument set in the South line of the Mrs. E. M. Corbett 159-Acre tract, also being the Northeast corner of the Homer Walker, et al. tract;

Thence S. 0°17'30" W. 100 feet to concrete monument for corner; Thence S. 89°38'40" E. 2546.6 feet to concrete monument for corner; Thence N. 0°21'20" E. 100 feet to 3-inch iron pipe for corner, also being the Northeast corner of the Ed Antwine original 150-Acre tract; Thence N. 89°38'40" W. 2546.7 feet to the place of beginning and containing 5.85 Acres of land more or less.

Names and Addresses of Purported Owners:

West 75 acres of 150 acres - Ed Antwine and wife Route 1 Angleton, Texas

East 75 acres of 150 acres - Ed Antwine Route 1 Angleton, Texas

Dr. G. W. Antoine Houston, Texas

Willie Volbaum Route 1 Angleton, Texas

Estimated Just Compensation: $392.50

Description:

WM. HARRIS LEAGUE
Abstract Number 71
BRAZORIA COUNTY, TEXAS
&
M. J. Griffin
(See Map #1 - Exhibit "C")

All that parcel of land out of the North part of the M. & J. Griffin tract, lying in the Wm. Harris League, Abstract Number 71, Brazoria County, Texas, being more particularly described as follows: Beginning at a 3-inch iron pipe in the Northeast corner of the Ed Antwine 150-Acre tract and being the Northwest corner of the M. & J. Griffin tract; Thence S. 0°21'20" W. 100 feet to a concrete monument for corner; Thence S. 89°38'40" E. 565.2 feet to a concrete monument set for corner; Thence N. 0°21'20" E. 100 feet to concrete monument set for corner, also being the Northeast corner of the Griffin original tract; Thence N 89° 38'40" W. 565.2 feet to the place of beginning and containing 1.30 acres of land more or less.

Names and Addresses of Purported Owners:

Jerry Griffin and Mary Griffin, his wife
Route 1 Angleton, Texas

Estimated Just Compensation: $565.00

(B) The fee simple title, minerals and mineral leases excepted, to the following described land in Brazoria County, Texas; provided, however, that the surface of said land shall not be used for the purpose of prospecting for or extracting gas, oil or other minerals in a manner which will interfere with the use, occupation and operation of improvements, constructed or erected or to be constructed or erected in or upon said land:

Description: 4.95 ACRE TRACT AT OYSTER CREEK DAM SITE
(See Exhibit "D" and Map No. 2, Pg. 6 - Exhibit "E-6")

A tract of land being a portion of Retrieve State Prison Farm 2405.27-Acre Tract out of Jared E. Groce Five Leagues Grant, Abstract Number 66, Brazoria County, Texas, and being more particularly described as follows:

Beginning at a point which bears South 66°52' West 4250.61 feet from a concrete monument on top bank of Oyster Creek, said concrete monument being in the East line of said 2405.27-Acre Tract; Thence South 43°38' East 541.8 feet to the water edge of Oyster Creek;

Thence along the water edge of Oyster Creek with the following meanders, South 88°03' West 121.9 feet to a stake; Thence South 89°11' West 93.7 feet to a stake; Thence North 82°02' West 199.3 feet to a stake; Thence North 66°06' West 131.4 feet to a stake; Thence North 34°14' West 259.0 feet to a stake; Thence North 21°07' West 128.6 feet to a stake;

Thence North 3°30' West 90.8 feet to a stake; Thence North 24°03' East 99.9 feet to a stake; Thence North 38°29' East 91.8 feet to a stake; Thence South 43°38' East 375.0 feet with the Northeast line of this tract to the point of beginning and containing 4.95 Acres of land more or less.

Name and Address of Purported Owner:

State of Texas
(Texas Prison Commission)

Estimated Just Compensation: $247.00

DESCRIPTION OF TRACTS FOR FRESH WATER CANAL
(See Map No. 3 - Exhibit "F" and Maps - 3003376 - "F-1")

Tracts Nos. 374. 368, 340, 339, 338, 276, 209, 208, 201, and 202 of Brazos Coast Investment Company Subidvision No. 15 in the S. F. Austin Five Leagues Grant, Abstract Number 19, Brazoria County, Texas

Tract No.	Names and Addresses of Purported Owners	Estimated Just Compensation
374	J. H. Parker Baston, Texas	$200.00
368	Alexander P. Olivey ---	200.00
340	C. G. Goezler andH. H. Mage B. H. Autrey Velasco, Texas	200.00
339	Nettie C. Billups --- Daniel C. Mosley ---	200.00
338	J. R. Gayle, Jr. Angleton, Texas Mrs. Nannie M. Stringfellow Freeport, Texas	200.00
276	Austin Sartain ---	200.00
209	Lillian M. Keep Jennings, Louisiana	200.00
208	Louis F. Blankenbaker 2429 Emil Avenue Louisville, Ky.	200.00
202	J. R. Gayle, Jr. Angleton, Texas Mrs. Nannie M. Stringfellow Freeport, Texas	200.00
201	J. R. Gayle, Jr. Angleton, Texas Mrs. Nannie M. Stringfellow Freeport, Texas	200.00

Tracts Nos. 47, 46, 45, 44, 43, and 42, fronting on the East bank of the Brazos River and being described in the Decree of Partition in Cause No. 20,500 in the District Court of Brazoria County, Texas, styled E. D. Dorchester et al. v. E. F. Simms et al.

Tract No.	Names and Addresses of Purported Owners	Estimated just Compensation
42, 44, 46	E. D. Dorchester Velasco, Texas E. D. Dorchester, Jr. Galveston, Texas Mary Merial McGinnis (Wife of H.D. McGinnis) c/o E.D. Dorchester Velasco, Texas	

Tract No.	Names and Addresses of Purported Owners	Estimated Just Compensation
43, 45, 47	B. H. Carlton Velasco, Texas	
	R. G. Carlton Freeport, Texas	$2,596.20 (covers tracts 42, 44, 46 and also 43, 45, and 47.)
	E. D. Dorchester, Jr. 4910 Wharton Drive Galveston, Texas	

Description: (See Map No. B27-3376 - Exhibit "F-2")

A tract of land out of the Erna Seaburn 18-acre tract in the S. F. Austin Five Leagues Grant, Abstract Number 19, Brazoria County, Texas, and being more particularly described as follows:

Beginning at a point in the East line of said Seaburn Tract, same being also the East line of said S. F. Austin Five Leagues Grant, Abstract Number 19, and the West line of the Alexander Calvit League, Abstract Number 49, of Brazoria County; said beginning point bears South 1°14'53" East along said League line a distance of 811.79 feet from the Northeast corner of said Seaburn Tract, said corner being also the most Northerly Southeast corner of the Brazos Coast Investment Company Subdivision No. 15 out of said S. F. Austin Five Leagues Grant, Abstract Number 19;

Thence North 73°11'40" West 969.28 feet; Thence North 84°55'00" West 1,111.90 feet to intersection with the West line of said Seaburn Tract, same being also the East line of Tract No. 130 of said Subdivision No. 15; said point of intersection bears North 1°14' 53" West, at 58.5 feet pass the Northeast corner of Tract No. 130 and the Southeast corner of Tract No. 129, and continue a total distance of 388.5 feet to the Northwest corner of said Seaburn Tract and an interior corner of said Subdivision No. 15;

Thence from said point of intersection South 1°14'53" East along the West line of said Seaburn Tract 201.2 feet;

Thence South 84°55'00" East 1069.2 feet;

Thence South 73°11'40" East 1013.88 feet to intersection with the East line of said Seaburn Tract;

Thence North 1°14'53" West along the East line of said Seaburn Tract 210.4 feet to the place of beginning and containing 9.56 acres of land more or less.

Names and Addresses of Purported Owners:

A. S. Bowers
Port Lavaca, Texas

Mabel Bowers Chilton
c/o A. S. Bowers
Port Lavaca, Texas

Estelle S. Rudersdorf
3412 Garrott Houston, Texas

Ernest Cockrell
1503 Esperson Building Houston, Texas

Mrs. Mary Lee Hudgins
Velasco, Texas

Chesley Hall
Houston, Texas

Estimated Just Compensation: $573.60

Tracts Nos. 36 and 37, fronting on the Brazos River and being described in the Decree of Partition in Cause No. 20,500 in the District Court of Brazoria County, Texas, styled E.D. Dorchester et al. v. E. F. Simms et al.

Tract No. 36

Names and Addresses of Purported Owners: E. D. Dorchester, Velasco, Texas
E. D. Dorchester, Jr., Galveston, Texas

Mary Merial McGinnis
c/o E. D. Dorchester, Velasco, Texas

Estimated Just Compensation: $643.80

Tract No. 37 (See Map A-29-3376 - Exhibit "F-3")

Description:

A portion of Tract No. 37 of the partition of the Dorchester and Simms 300-foot Reservation along the North and East bank of the Brazos River and being out of the Anthony R. Clarke Labor, Abstract Number 54, of Brazoria County, Texas, and being more particularly described as follows:

Beginning at a point in the West line of said Tract 37, said West line being the common line between the S. F. Austin Five Leagues Grant, Abstract Number 19, and the Anthony R. Clarke Labor, Abstract Number 54, said beginning point bears South 1°14'53" East 811.79 feet from the Northwest corner of Tract No. 479 of the Brazos Coast Investment Company Subdivision No. 14; Thence South 93°11'40" East 206.63 feet to a point for corner;

Thence South 53°28'40" East 667.60 feet to a point for corner in the East line of said Tract No. 37 and in the West line of Tract No. 481 of said Subdivision No. 14;

Thence South 16°53'25" East 9.4 feet along the above mentioned West line of said Tract No. 481 to the Southwest corner of Tract 481;

Thence South 7°33'05" West along the East line of said Tract No. 37 and the West line of Tract 482 of said Subdivision No. 14, 403.83 feet to the Southeast corner of said Tract No. 37, said Southeast corner bears North 7°33'05" East 10.0 feet from a concrete monument marking the Southwest corner of the above mentioned Tract No. 482;

Thence North 76°50' West along the common line between Tracts Nos. 37 and 36 of the above mentioned 300-foot Reservation 686.56 feet to a point in the common line between the said S. F. Austin Five Leagues Grant, Abstract Number 19, and Anthony R. Clarke Labor, Abstract Number 54, said point being the Southwest corner of said Tract No. 37;

Thence North 1°14'53" West 710.0 feet to the place of beginning and containing 9.686 acres of land more or less.

Names and Addresses of Purported Owners: B. H. Carlton, Velasco, Texas
R. G. Carlton, Freeport, Texas
E. D. Dorchester, Jr.,
4910 Wharton Drive, Galveston, Texas

Estimated Just Compensation: $581.16

Description: (See Map No. A-28-3376 - Exhibit "F-4")

A tract of land out of the L. R. Bryan 100-acre tract in the Anthony R. Clarke Labor, Abstract Number 54, Brazoria County, Texas, and being more particularly described as follows:

Beginning at the Northwest corner of said Bryan Tract, said corner being also an interior corner of Brazos Coast Investment Company Subdivision No. 14;

Thence North 88°45'07" East along the North line of said Bryan Tract, at 137.3 feet pass the Southwest corner of Tract No. 488 of said Subdivision No. 14, and continue a total distance of 808.3 feet to a point for corner, said point bearing North 88°45'07" East 69.33 feet to the Northeast corner of said Bryan Tract;

Thence South 81°15'30" East 70.4 feet to intersection with the East line of said Bryan Tract; Thence South 1°14'53" East along the East line of the Bryan Tract and the West line of Tract No. 489 of said Subdivision No. 14, at 181.5 feet pass the Southwest corner of Tract No. 489, and continue a total distance of 203.1 feet to a point for corner;

Thence North 81°15'30" West 891.2 feet to intersection with the West line of said Bryan Tract, said point bears South 89°00' West 30 feet, thence South 1°14'53" East 62.08 feet to a concrete monument marking the Southeast corner of Tract No. 482, thence South 89° 10'10" West 514.13 feet along the South line of Tract No. 482 to a concrete monument marking the Southwest corner of Tract No. 482 and being in the East line of the Dorchester and Simms 300-foot river front reservation along the former East bank of the Brazos River;

Thence North 1°14'53" West along the West line of said Bryan Tract 60.7 feet to the place of beginning and containing 2.77 acres of land more or less.

Names and Addresses of Purported Owners:

Estate Lewis R. Bryan, Dec'd
W. W. Searcy
Thos. C. Clay
C. C. Garrott
R. R. Brown, Jr.
J. G. Sloan
W. J. Sloan

Mrs. J. P. Thorn
Lide Kirk Dillen
A. W. Kirk
B. C. Kirk
All c/o Lewis R. Bryan, Jr., Second National Bank, Houston, Texas.

Estimated Just Compensation: $277.00

Tract No. 490 of Brazos Coast Investment Company Subdivision No. 14 in the J.E. A. Phelps Labor Number Three, Abstract Number 115, Brazoria County, Texas.

Name and Address of Purported Owner:

Mrs. Nannie M. Stringfellow Freeport, Texas.

Estimated Just Compensation: $500.00

Start

(C) A perpetual easement and right to use, maintain and repair the bed, banks and channel of that section or part of Oyster Creek in Brazoria County, Texas, passing through and traversing the land hereinafter described, for the purpose of conveying, transporting, flowing and delivering water, without hindrance, interruption, obstruction or interference of any kind or nature; together with the right to keep the said bed, banks and channel of said section or part of Oyster Creek free from silt and mud deposits, debris and/or any and all other obstructions of any kind whatsoever; together with the right to place and dispose of spoil upon the bank and banks of said section or part of Oyster Creek, said land being more particularly described as follows:

OYSTER CREEK CHANNEL FROM THE WM. PARKER LEAGUE, ABSTRACT NUMBER 104 DOWNSTREAM TO DOW DIVERSION POINT NO. 2 ON OYSTER CREEK NEAR THE EXTERIOR SOUTHWEST CORNER OF THE JARED E. GROCE FIVE LEAGUES GRANT, ABSTRACT NUMBER 66.

(See Map B-3376 - Exhibit "E" and Map No. 2, Sheets 1 through 6 - Exhibits "E-1" through "E-6")

Beginning at an intersection of the North line of the Wm. Parker League, Abstract Number 104, and Oyster Creek; thence downstream with the meanders of Oyster Creek through the following: Wm. Parker League, Abstract Number 104; Shubael Marsh One and One-Fourth Leagues, Abstract Numbers 81 and 82; George Robinson League, Abstract Number 126; John Bradley League, Abstract Number 45; Wm. Roberts League, Abstract Number 124; Cornelius Smith League, Abstract Number 129; Asa Mitchell League, Abstract Number 96; S. F. Austin Five Leagues Grant, Abstract Number 19; and Jared E. Groce Five Leagues Grant, Abstract Number 66; and to Dow Diversion Point No. 2 on Oyster Creek near the exterior Southwest corner of the Jared E. Groce Five Leagues Grant, Abstract Number 66, covering a distance along said Oyster of 27.7 miles, more or less.

together with the right of ingress and egress to and from said section or part of Oyster Creek and all incidental rights for the purposes aforesaid.

Descriptions	Names and Addresses of Purported Owners
WM. PARKER LEAGUE ABSTRACT NUMBER 104	
338 acres	
100 acres	W. B. Munson 119 West Courtland St. San Antonio, Texas
11 acres out of 58 acres	Estate Mrs. Alice Deuzeb (5/9 int.) c/o W. P. Hamblen 1654 Harold Street Houston, Texas Ownership of other 4/9ths interest unknown. (Note: Unless the owner is Nelle B. Norton who conveyed the above 5/9ths interest to Mrs. Alice Deuzeb Estate)
58 acres	Robert Stoner Estate c/o Susie Stoner Route 1 Angleton, Texas Conveyed by Pinkie Stoner, widow of Robert Stoner to the following:

	Sarah Harris, Louella Moon, Nellie Harris, Isabelle Williams, Elizabeth Stoner, Susie Stoner, Josephine Nerocker.
183 acres	R. H. Carr Route 1 Angleton, Texas
647 acres and 877.16 acres	L. D. Vieman Estate 13/15ths c/o M. B. Vieman, Dickenson, Texas Mrs. Laura C. Walker (widow of Robert Walker) 2/15ths c/o M. B. Vieman, Dickenson, Texas
DESCRIPTIONS	Names and Addresses of Purported Owners

SHUBAEL MARSH ONE AND ONE-FOURTH LEAGUES
ABSTRACT NUMBERS 81 and 82

171 acres = Lot 12 Marsh Partition (160 acres & 11 acres)	Mrs. Minnie McMillan Holland Route 1 Angleton, Texas
111.6 acres = W½ Lot 13 Marsh Partition	T. J. McMillan Estate c/o Charles D. McMillan 2045 West Main Street Houston, Texas
163.3 acres being Lot 6 Stern S/D	Lorenzo D. Vieman Estate c/o M. B. Vieman Dickenson, Texas Heirs of L. D. Vieman: M. B. Vieman Mrs. Henrietta Vieman R. W. Vieman Mrs. Fannie Vieman Mattox (husband - W. B. Mattox)
35 acres - Lot 7 30 acres - Lot 8 Kincaid S/D	Jacob Nawrocki Route 1 Angleton, Texas
136.5 acres in Lot 8 Marsh Partition	R. J. Worrell Route 1, Angleton, Texas
2.5 acres in Lot 8 Marsh Partition E.50 acres Lot 9 Marsh Partition	John Nawrocki Route 1 Angleton, Texas
W. 121 acres of Lot 9 Marsh Partition	Lorenzo D. Vieman Estate c/o M. B Vieman Dickenson, Texas Heirs of L. D. Vieman; M. B. Vieman Mrs. Henrietta Vieman R. W. Vieman Mrs. Fannie Vieman Mattox (husband - W. B. Mattox)

GEORGE ROBINSON LEAGUE
ABSTRACT NUMBER 126

26 acres	Minnie J. McMillan Holland Route 1, Angleton, Texas
21.19 acres	Estate of L. B. Jamison, Dec'd. Mrs. Ella Jamison, Widow Angleton, Texas
900 acres	Thos. W. Masterson, Jr. Mrs. Beatrice Yerly Mary Lee Masterson Horace T. Masterson c/o Thos. W. Masterson 601 National Bank of Commerce Building San Antonio, Texas
445 acres being all the upper middle 1/4 lying between the Brazos and Oyster Creek	Frank K. Stevens Angleton, Texas H. R. Stevens Angleton, Texas
Description	Names and Addresses of Purported Owners
	Mrs. Gladys Terrell (N.J. Terrell, hsb.) 2014 Rosewood Street Houston, Texas
	Lillie Crenz Portanova Agnes Cullen Arnold Margaret R. Cullen Wilhelmina D. Cullen H. R. Cullen, Guardian c/o R. H. Cullen Houston, Texas

111 acres	T. J. McMillan Estate c/o Charles D. McMillan 2045 West Main Street Houston, Texas
914 acres	Stanolind Oil & Gas Co. P. O. Box 3092 Houston, Texas Gulf Building

JOHN BRADLEY AND GEORGE ROBINSON LEAGUES
Abstract Numbers 45 and 126

Tract 4, Allcorn:

N. 20 acres West of Creek	Estate H. Masterson or South Texas Development Co.
S. 7 acres West of Creek	South Texas Development Co.
N. 30 acres East of Creek	Est. H. Masterson or South Texas Development Co. Lester Bruner, Mitchell Brunner, Estella Bruner Jamison, wife of Joe Jamison and Viola Bruner Nevill, wife of Frank Nevill.
S. 30 acres East of Creek	Lester Bruner et al. and Mrs. C. L. Loper, wife of W. R. Loper.

JOHN BRADLEY LEAGUE
Abstract Number 45

68.5 acres	Miss Dula Jamison Angleton, Texas
68.5 acres	J. W.Nelson Mathis, Texas
735 acres East of Creek	Edgar H. Niedringhaus Angleton, Texas
	Fannie E. Niedringhaus St. Louis, Missouri
	Mrs. Lyde M. Jenks, widow Houston, Texas
435 acres	A. R.Rucks Angleton, Texas
	J. H. Tigner Angleton, Texas
20 acres	Josephine Shelton
Description	Names and Addresses of Purported Owners
64.5 acres (part of 94 acres out of 127.7 acres)	George Mirant Estate Possible Heirs of George Mirant: Sam Mirant (wife Julia) Rosa Clemons (husband, Hiram) Zenie Fleming (husband, Ed) Pennie Milligan (husband, Aaron) Henrietta Mirant (feme sole) Alice Jones Sam Milligan Bessie Mae Waiters Lewis Milligan, Jr. Leroy Milligan Floyd Milligan Clara Milligan Grace Milligan Leola Milligan Emmit Jones Joe Jones, Jr. Charles Jones Idella Milligan The above parties can probably be reached through Rosa Clemons c/o T.W. Williams Route 1, Angleton, Texas
8.5 acres called Lot A out of Tr. #4 Childs partition	Julia Rogers (C.D. Rogers, husband)
8.5 acres called Lot B out of Tr. #4 Childs partition	Nick Murchison (wife, Bertha) The above parties can probably be reached through Alex Murchison Route 1 Angleton, Texas

WILLIAM ROBERTS LEAGUE
Abstract Number 124

819 acres	Mrs. Ella M. Corbett 424 Southern Standard Life Building Houston, Texas

147.72 acres	Mrs. Susie Knight c/o J. A. Knight Voth, Texas
50 acres	J. G. Jackson Angleton, Texas
South 201.1 acres	F. D. Murrey Angleton, Texas
North 201.1 acres	J. Lee Murrey Angleton, Texas
154.91 acres, East part of Lot 3	Mrs. Ella M. Corbett 424 Southern Standard Building Houston, Texas
37.95 acres, S½ 75.9 acres	S. J. Haller Angleton, Texas
37.95 acres, N½ 75.9 acres (from East part Lot 4)	Preston McBeth Route 1 Angleton, Texas
Description	Names and Addresses of Purported Owners
228.26 acres	D. B. Shutt Lambert, Oklahoma W. A. Shutt Lambert, Oklahoma Lillie Shutt Lambert, Oklahoma Ola Carpenter (wife of Wm.) Lambert, Oklahoma (only heir of Ida Shutt)

CORNELIUS SMITH LEAGUE
Abstract Number 129

200 acres	Estate of Mary Collins Willy Heirs are: John B. Willy Ruben Willy Rebecca Willy Goff (wife of F.A. Goff) Angleton, Texas Eugenia Willy Yntriago (wife of Emilio Untriago) Frederick Willy Edward F. Willy Heirs of Richard Willy, deceased: Eleanor Thomas Willy (widow of Richard) Katy M. Willy 17 Norwood, Houston, Texas Daisy Willy Smith (wife of Louis E.) Maggie Willy Mathews (wife of H. L.) Angleton, Texas Allen P. Willy Angleton, Texas Alice Willy Bower (wife of Harold H.) Richard M. Willy.
106.1 acres	Mrs. Pearl Jamison Rucks Angleton, Texas
59 acres	B. M. Jamison Angleton, Texas
60 acres (shows 90 on map)	J. T. Jamison 101 East Craig Place, San Antonio, Texas
460.21 acres and 25 acres West of creek and 4 acre cemetery	Mary J. Jamison Estate: B. M. Jamison, Angleton, Texas James T. Jamison, San Antonio, Texas Pearl Jamison Rucks, Angleton, Texas D. B. Jamison Estate: Mrs. Ella Jamison, Angleton, Texas Mrs. Dorene Pence, Houston, Texas Mrs. Lizzie I. Williams Estate: Mrs. Lillie Mae Burkhart, Angleton, Texas Mrs. Marie Tigner, Angleton, Texas Mrs. Dora Campbell, Spur, Texas Estate of Weber Williams, dec'd Spur, Texas Mrs. Flora Mae Williams, Exrx.) John A. Williams, Angleton, Texas J. E. Williams, Angleton, Texas

Description	Names and Addresses of Purported Owners
71.93 acres	D. B. Jamison Estate Mrs. Ella Jamison (widow) Angleton, Texas
	Mrs. Doreen Pence 2050 Banks, Houston, Texas
205.4 acres	Mrs. Lizzie I. Williams Estate Mrs. Lillie Mae Burkhart (widow) Angleton, Texas
	Mrs. Marie Tigner (wife of J.H.) Angleton, Texas
	Mrs. Dora Campbell (wife of W. S.) Spur, Texas
	Estate of Weber B. Williams, Dec'd. Flora Mae Williams, Ind. Executrix Spur, Texas
	John A. Williams Angleton, Texas
	J. E. Williams Angleton, Texas
73.5 acres and 10 acres	L. R. Johnson Angleton, Texas
251.66 acres	Mrs. Laura C. Walker 403 Schilder Street Herman, Missouri
	Kitty McMillan Stancliff Houston, Texas
	Morris B. Vieman Dickson, Texas
278.32 acres and 5 acres	Marie B. Nickell Waukesha, Wisconsin

ASA MITCHELL LEAGUE
Abstract Number 96

Description	Names and Addresses of Purported Owners
1978 acres	H. E. Abrums and Carrie Bell Garnett 6008 Del Rio Street Houston, Texas
96.62 acres	St. L. B. & M. Ry Co. W. L. Holder, Tax Commissioner 708 T & P Building Dallas, Texas
10 acres	T. P. Lister Box 502 Angleton, Texas
100 acres	Mrs. Dena Sproles, widow Angleton, Texas
	W. S. Sproles, Jr. Angleton, Texas
	Mrs. Carrie Lee Rich (wife of R. C.)

Description	Names and Addresses of Purported Owners
36 acres and 52.2 acres	Mrs. E. A. Weems, widow Alvin, Texas
	Mrs. Minnie Brightwell, widow Alvin, Texas
	Mrs. Cecil W. Stanger, widow Alvin, Texas
	Mrs. John Douglas Faickney (wife of R. F., Jr.) Angleton, Texas
	Mrs. Elizabeth Loggins (wife of R.B.) 5505 Chenevert, Houston, Texas
570 acres	H. W. Munson Angleton, Texas
40 acres	H. W. Munson Angleton, Texas
234.9 acres and 257 acres	Mrs. Pearl J.Rucks Angleton, Texas
40 acres	Mrs. Ella Jamison, widow Angleton, Texas

	Mrs. Doreen J. Fence, widow 2050 Banks, Houston, Texas
42 acres	William Williams Estate c/o P. S. Wilkinson 1011 Delaware Street San Antonio, Texas

S. F. AUSTIN FIVE LEAGUES GRANT
Abstract Number 19

5043 acres	State of Texas (Texas Prison Commission)

JARED E. GROCE FIVE LEAGUES GRANT
Abstract Number 66

2405.27 acres	State of Texas (Texas Prison Commission)
Estimated Just Compensation	$17,728.00

(D) A perpetual easement and right to use, maintain and repair the bed, banks and channel of that section or part of Oyster Creek in Fort Bend County and Brazoria County, Texas, passing through and traversing the land hereinafter described, for the purpose of conveying, transporting, flowing and delivering water, without hindrance, interruption, obstruction or interference of any kind or nature; together with the right to keep the said bed, banks and channel of said section or part of Oyster Creek free from silt and mud deposits, debris and/or any and all other obstructions of any kind whatsoever; together with the right to place and dispose of spoil upon the bank and banks of said section or part of Oyster Creek, said land being more particularly described as follows:

OYSTER CREEK CHANNEL FROM A POINT IN THE WILLIAM PETTUS LEAGUE, ABSTRACT NUMBER 68 IN FORT BEND COUNTY, TEXAS, DOWNSTREAM TO THE NORTH LINE OF THE WM. PARKER LEAGUE, ABSTRACT NUMBER 104 IN BRAZORIA COUNTY, TEXAS: ALSO, THAT PORTION OF OYSTER CREEK CHANNEL WHICH CURVES THROUGH THE NORTHERLY PART OF THE SAID WM. PARKER LEAGUE, ABSTRACT NUMBER 104 AND THEN RE-ENTERS AND MEANDERS THROUGH THE WM. HARRIS LEAGUE, ABSTRACT NUMBER 71, IN BRAZORIA COUNTY, TEXAS, TO THE NORTH LINE OF THE SAID WM. PARKER LEAGUE, ABSTRACT NUMBER 104:
(See Map No. C-40-3376 - Exhibit "G")

Beginning at the intersection of the right of way of the South Texas Water Company canal with Oyster Creek in the William Pettus League, Abstract Number 68 in Fort Bend County, Texas;

Thence downstream with the meanders of Oyster Creek to the South line of the William Pettus League, Abstract Number 68 in Fort Bend County, Texas, said line being the common line between Fort Bend and Brazoria Counties;

Thence continuing downstream with the meanders of Oyster Creek through the following leagues in Brazoria County, Texas; Francis Biggam League, Abstract Number 43, Archiles McFarlan League, Abstract Number 86, David Tally League, Abstract Number 130, Chester S. Gorbet League, Abstract Number 64, Edward R. Bradley League, Abstract Number 44, Andrew Robinson One and One-Half Leagues, Abstract Number 125, J. W. Hall League, Abstract Number 68, J. W. Hall League, Abstract Number 67, Stephen F. Austin Two and One-Sixth Leagues, Abstract Number 25, Stephen Richardson League, Abstract Number 122, Wm. Harris League, Abstract Number 71, said Creek enters the Wm. Parker League, Abstract Number 104, and then re-enters the Wm. Harris League, Abstract Number 71; thence with the meanders of Oyster Creek to the North Line of the Wm. Parker League, Abstract Number 104.

together with the right of ingress and egress to and from said section or part of Oyster Creek and all incidental rights for the purposes aforesaid.

Description	Names and Addresses of Purported Owners

WILLIAM PETTUS LEAGUE
Abstract Number 68

294.4 acres	Russell Brown 3104 Main Street, Houston, Texas

Description	Names and Addresses of Purported Owners
409.83 and 99.29	J. E. Foster, M.D. 219 West Alabama, Houston, Texas
597.01 acres	F. W. Neuhaus 4215 Mt. Vernon Houston, Texas
491.55 acres	So. Live Stock Co. 5120 Mont Rose c/o A. M. Miller Houston, Texas

WILLIAM PETTUS LEAGUE
Abstract Number 714
(Lies in Fort Bend and Brazoria Counties)

280.9 acres	Russell Brown
W. 300 acres of 712.03 acres	H. G. Tigner of Harris Co. Sam W. Tigner of Harris Co. Edwin B. Tigner of Harris Co.
E. 412.03 acres of 712.03 acres	Unknown

FRANCIS BIGGAM LEAGUE
Abstract Number 43

Description	Names and Addresses of Purported Owners
967 acres	Geo. H. Bingham Rosharon, Texas
1049 acres	Joseph B. Bingham Estate Mrs. Mary P. Bingham (widow) Anchor, Texas
	Mrs. Betty Bingham Munson (wife of Armour Munson) Angleton, Texas
890 acres (partly in the A. McFarlan League, Abstract No. 86)	Sarah M. Caldwell, widow Juliff, Texas
157.7 acres	Estate of Joe B. Bingham Mrs. Mary-P. Bingham (widow) Anchor, Texas
	Mrs. Betty Bingham Munson (wife of Armour Munson) Angleton, Texas
188 acres	Mrs. Mamie P. Bingham Anchor, Texas
3279 acres Darrington State Farm	State of Texas (Prison Commission) Austin, Texas

ARCHILES MCFARLAN LEAGUE
Abstract Number 86

157.7 acres	Estate of Joseph B. Bingham, Dec'd Mrs. Mary P. Bingham (widow) Anchor, Texas
	Mrs. Betty Bingham Munson (daughter) (wife of Armour Munson) Angleton, Texas
188 acres	Mrs. Mamie P. Bingham Anchor, Texas
3279 acres Darrington State Farm	State of Texas (Prison Commission) Austin, Texas

DAVID TALLY LEAGUE
Abstract Number 130

2522.8 acres Darrington State Farm	State of Texas (Prison Commission) Austin, Texas

CHESTER S. GORBET LEAGUE
Abstract Number 64

200 acres	Florence Cleveland, feme sole Galveston, Texas
2 acres	Trustees Common School District #8 (negro school)
764.6 acres	Curtis L. Mowery Sandy Point, Texas
334.6 acres	Estate of Joe Cleveland, NCM Rusk State Hospital
330 acres	Geo. H. Bingham Rosharon, Texas

62.5 acres	Rosie L. and Leroy English Sandy Point, Texas
12 acres	Ray W. Tyler Sandy Point, Texas
Description	Names and Addresses of Purported Owners
10 acres	Jeff Lundy c/o Lee Lundy Route 1 Velasco, Texas
19.55 acres	Andrew Payne Estate Andrew W. Payne Sandy Point, Texas Gabriel Payne Wm. M. Payne Loretta P. Miles (wife of Sims Miles) Adam Payne
30 acres	Chris Love Sandy Point, Texas
	Joe Collyer Estate
	W. G. Stewart Angleton, Texas
35 acres	Chris Love Sandy Point, Texas
19.58 acres	Elmer M. Cannon Route 1 Angleton, Texas

EDWARD R. BRADLEY LEAGUE
Abstract Number 44

280.42 acres	Elmer M. Cannon Route 1, Angleton, Texas
1472.22 acres	American National Insurance Co. Galveston, Texas
1230 acres	W. N. Blanton Commerce Building Houston, Texas
	J. V. Scott 1132 Bissonnet
100 acres	Geo. H. Bingham Rosharon, Texas

ANDREW ROBINSON ONE AND ONE-HALF LEAGUES
Abstract Number 125

100 acres 29.5 acres 73 acres	George H. Bingham Rosharon, Texas
873.4 acres	J. C. and Isabel Moyle Estate Ray D. Moyle and wife, Marie C. Moyle Route 1 Angleton, Texas
	Mabel H. McKenna, a feme sole
	Myrtle L. Smith (wife of Hilton Smith)
400 acres	W. E. Schweinle c/o Frank R. Guinn Shell Building, Houston, Texas
395.2 acres	J. A. Fite 4917 Milam, Houston, Texas
260 acres	Sadie U. Lochridge Lochridge, Texas
Description	Names and Addresses of Purported Owners

J. W. HALL LEAGUE
Abstract Number 68

12.5 acres	John Faultry
	Unknown heirs of Conway Dade Corine Hatter Cecil R. Glass
48.5 acres	Emma Dawson, wife of James Dawson Rosharon, Texas
2473.4 acres (Ramsey State Farm)	State of Texas (Prison Commission) Austin, Texas

857.83 acres	State of Texas (Prison Commission) Austin, Texas
242 acres	Hazel A. Barnes, wife of Geo. I. Barnes c/o C. Lauderson P. O. Box 83 Bellaire, Texas

J. W. HALL LEAGUE
Abstract Number 67

1507 acres 1426.6 acres 105.13 acres (Ramsey State Farm)	State of Texas (Prison Commission) Austin, Texas

STEPHEN F. AUSTIN TWO AND ONE-SIXTH LEAGUES
Abstract Number 25

5364.18 acres 65 acres 65 acres (Ramsey State Farm)	State of Texas (Prison Commission) Austin, Texas
75 acres	Estate of Ethel Tunstall Drought H. P. Drought, Individually H. P. Drought, Trustee for H. L. Drought F. T. Drought H. P. Drought 1011 Frost Bank Building San Antonio, Texas
	Frances Smith Weaver
	Carile Belton Smith
	Neta Hawley Ellis, wife of Howard Ellis
	Lucile Eldredge, wife of L. W. Eldredge, Jr.

STEPHEN RICHARDSON LEAGUE
Abstract Number 122

608 acres (Ramsey State Farm)	State of Texas (Prison Commission) Austin, Texas
107 acres	Texas City National Bank, Tr. Texas City, Texas
	J. W. Butler Texas City, Texas
93 acres	State of Texas (Prison Commission) Austin, Texas

Description	Names and Addresses of Purported Owners
150.38 acres	Willie Pagenton
	Maggie L. Montanye, wife of Charles L.
	Orie J. Whitson
	Cordelia Clare Smith, wife of Loran E.
	Delia Esther Mathews, wife of Chesley
	Ira D. Murray
	W. Earl Murray
	Sadie M. Boots
	Lauria Boots Long, wife of Geo. O.
	Grace Boots
	Estelle Boots McNeil, wife of James E.
	Clyde H. Boots
	Effie Yost Smithline, wife of Ross F.
	Virginia Yost AnDyke, wife of Glen U.
	Minnie Yost Bailey, wife of Robert Silas
	George Sutton Yost
	Ernest L. Yost
	Rita Yost Weldon, wife of Wm. J.
	Fannie Yost Dean, wife of Charles John
	Frank Leslie Yost

	O. W. Weber
	James E. McNeil) W. Earl Murray) Trs. Charles M. Montanye)
	Willie Pagenton
	All of above parties of Linn County, Kansas
85.3 acres 156.9 acres 93.39 acres	State of Texas (Prison Commission) Austin, Texas
65 acres	Henrietta Franklin Estate Moses Scott Daisey Bowers and husband, Thos. Christina Wells and husband, K.C.
	Moses Scott and wife, Ella 3009½ Drew Avenue Houston
W. 20 acres of 31 acres	Estella Murray Angleton, Texas
Description	Names and Addresses of Purported Owners
100 acres	Estate of Jesse Alexander Dan Alexander, Sr., Executor Angleton, Texas
	Alex Jackson, Executor
	Heirs of Jesse Alexander Alex Jackson and wife, Ruby Jesse Jackson and wife, Rubye Dan Alexander, Sr. Mat Alexander Dan Alexander, Jr. Solomon Alexander and wife, Elsie Ike Alexander and wife, Winnie Iona Stewart, feme sole Andrew Stewart and wife, Nora Abner Stewart and wife, Daisey Belle Roxy Blower, widow Lorena Tankersley, feme sole Melia Edwards, widow Alice Sims, widow Reed Jackson and wife, Cornelia Claborn Miller and wife, Martha Sam Wallace and wife, Cornelia Thomas Cooksey and wife, Fannie Willis Cooksey Frank Cooksey Thomas Cooksey

WM. HARRIS LEAGUE
Abstract Number 71

1926 acres (Ramsey State Farm)	State of Texas (Prison Commission) Austin, Texas
23¾ acres 33-1/3 acres 50 acres	George W. Antoine Houston, Texas
	Ed Antwine Route 1, Angleton, Texas
	Willie Volbaum
3.8 acres	Sun Oil Company
43.7 acres	Mrs. Vera M. Ehlert, feme sole B. Ehlert, Jr. Charlie Ehlert Angleton, Texas
20 acres	Mrs. A. C. Johnson Estate Julia C. Collom 1/4 interest sold to Wm. Wacker, now dec'd. Heirs unknown. Remaining heirs unknown - 3/4 interest. Annette Curtis (adverse claim) Route 1, Angleton, Texas
24.6 acres	Lincoln Perry Route 1, Angleton, Texas
	Estate of Nancy Robbins Route 1, Angleton, Texas Essie A. Lockett, wife of W. L. W. C. Robbins Mittie R. Hill, wife of Reed Nellie B. Thomas, wife of J. B. Lossie C. Robbins, feme sole J. C. Robbins Mary Ida Scott, wife of C. C.

Description	Names and Addresses of Purported Owners
	Vesta Hines, wife of R. L.
23 acres	Estate of Archie Griffin, Angleton, Texas Jerry Griffin, Jr. and wife, Elneta Jake Williams, Jr. and wife, Irene Millie Jackson, widow All of Angleton, Texas Murry Jackson and wife, Alean
119.4 acres	R. H. Carr Angleton, Texas
18 acres	Gabriel Adams and wife, Amanda Clute, Texas
North 47 acres	Sam Simon and wife, Ollie Route 1, Angleton, Texas Will Simon 3016 McHenry, Houston, Texas Dave Simon
South 47 acres	Steve Smith Angleton, Texas
	Dan Moody (adverse claim as to 22 acres) Houston, Texas
74 acres	Joseph Clemens Estate Route 1, Angleton, Texas Irvin Franklin Rosa Franklin, wife of Irvin Estate of Maggie Clemons Milton Kinder - 1/3 interest sold to Hines Clemons; other 2/3 interest not known. Estate of Adam Clemens Irvin Franklin
	Hiram Clemens Route 1 Angleton, Texas
	Ward Clemens
	Jobe Clemens Route 1, Angleton, Texas
	Josey Clemens Route 1, Angleton, Texas
	Other unknown heirs of Joseph Clemens.
159 acres	Ella M. Corbett Houston, Texas
2.5 acres	Mary Griffin, wife of Jerry Route 1, Angleton, Texas (Chenango)
20 acres	Ben Coleman Estate, c/o Miles Bowens Route 1, Angleton, Texas Delia Coleman Stoner, dec'd. Robert Stoner, c/o Susie Stoner Angleton, Texas Moses Stoner Ellen Stoner Ellis, wife of Albert Billy Barnes, husband of Edna Stoner, dec'd. Ed Antwine Millie Volbaum Geo. W. Antwine Alex Coleman Matilda Johnson, wife of Major Collie Coleman Ollie Simon, wife of Sam

Description	Names and Addresses of Purported Owners
	Alex Coleman Mary Coleman Griffin Ben Coleman, Jr. Estate Pinkie Coleman Charlie Coleman Leola Coleman feme sole Emma Coleman feme sole
14 acres	Alex Coleman Route 1, Angleton, Texas
3.5 acres	Jerry and Mary Griffin Route 1 Angleton, Texas (Chenango)
6.5 acres	Jane Clemons, wife of Henry 603 Wichmon Houston, Texas
15.5 acres	Heirs of Ben Coleman, Jr. c/o Miles Bowens Route 1, Angleton, Texas

	Pinkie Coleman Charlie Coleman Leola Coleman Emma Coleman
16.5 acres	Collie Coleman and wife, Annett Route 1, Angleton, Texas (Chenango)
75 acres E½ of 150 acres	Geo. W.Antwine Houston, Texas
	Ed Antwine Route 1, Angleton, Texas (Chenango)
	Willie Volbaum Route 1, Angleton, Texas (Chenango)
75 acres W½ of 150 acres	Ed Antwine Route 1 Angleton, Texas (Chenango)
570 acres in SW corner	100 acres from the West end and S½ of remainder owned by Dow Chemical Company
	The North ½ of the remainder after deducting the West 100 acres of the tract is owned as follows:
	Homer Walker 1/2 Int. Dodge City,Ford Co.,Kansas
	Emma Obenhaus 1/8 Int. (widow of Chas. Obenhaus) Herman, Gasconade Co., Missouri
	Herbert Langendoerfer 1/8 Int. Herman, Gasconade Co., Missouri
	Julia E. Walker 1/4 Int. (widow of A.B. Walker) Herman, Gasconade Co., Missouri
Estimated Just Compensation:	$16,192.00

It is further ORDERED by the Court that said interests or estates in said lands, as hereinabove set out, are deemed to have been condemned and taken for the use of the United States of America, and the right to just compensation for the property taken, upon the filing of said Declaration of Taking and the making of said deposit, vested in the persons entitled thereto, and the amount of compensation shall be ascertained and awarded in this proceeding and established by judgment herein pursuant to law; and

That the United States of America having heretofore taken possession of the above described lands and premises under orders of possession heretofore duly entered in this proceeding, this cause is held open for such other and further orders, judgments and decrees as may be necessary in the premises.

ORDERED at Galveston, Texas, this 12 day of June, 1946.

H. J. M. Kennerly
United States District
Judge

ENDORSED: Civil Action No. 360 In the District Court of the United States for the Southern District of Texas, Galveston Division United States of America, Petitioner, v Certain Tracts of Lands in Brazoria County, Texas, and Dow Chemical Company, et al., Defendants JUDGMENT ON DECLARATION OF TAKING Filed 13 day of June, 1946 Hal V. Watts, Clerk, By R. M. Berly Deputy.

A true copy I certify.

(SEAL)

ATTEST: Hal V. Watts, Clerk,

By R. M. Berly
Deputy.

Filed for Record at 9:17 o'clock A. M. Jun 14 1946 J. R. Monarch Clerk County Court, Brazoria County, Texas By M. A. Gupton Deputy

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VINSON & ELKINS
ATTORNEYS AT LAW
FIRST CITY NATIONAL BANK BUILDING
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CABLE VINELKINS LONDON W. I.-TELEX 24140

AUSTIN NATIONAL BANK TOWER
AUSTIN, TEXAS 78701
TELEPHONE 512 478-5356

1101 CONNECTICUT AVE. N.W., SUITE 900
WASHINGTON, D.C. 20036
TELEPHONE 202 862-6500
CABLE VINELKINS · TELEX 89680

October 15, 1979

FIFTH SUPPLEMENTAL TITLE OPINION

RE: Title to 5,008.24188 acres of land, more or less, situated in Brazoria County, Texas, being the same tract of land described in and covered by a deed of conveyance from Ernest H. Cockrell, et al, as Grantors, to The Dow Chemical Company, as Grantee, dated January 3, 1975, recorded in Volume 1231, Page 874, Deed Records, Brazoria County, Texas, said land as described in said deed consisting of the following tracts or parcels, to-wit:

TRACT 1: A tract of 2,957.22 acres of land, more or less, in the J. E. Groce Five League Grant, Abstract No. 66; LESS AND EXCEPT 774.67812 acres described in and covered by a deed of conveyance from The Dow Chemical Company, as Grantor, to Ernest H. Cockrell, et al, dated January 3, 1975, recorded in Volume 123, Page 859, Deed Records, Brazoria County, Texas; and amendment thereto between said parties dated August 29, 1978, recorded in Volume 1419, Page 689, Deed Records, Brazoria County, Texas;

TRACT 2: That portion of the S. F. Austin 1/2 League, A-21, lying North of Oyster Creek, composed of a tract of 227 acres, more or less, in the Northwest part of said survey and a tract of 296 acres, more or less, in the Northeast part of said survey;

TRACT 3: A tract of 2,302.50 acres of land, more or less, in the Austin & Williams Survey, A-145.

The three tracts of land hereinabove referred to, in addition to other land, is the same land conveyed by Guy M. Bryan to Henry C. Seaburn, by deed dated July 12, 1883, recorded in Volume V, Page 305, Deed Records, Brazoria County, Texas.

The Dow Chemical Company
Texas Division
Freeport, Texas 77541

Gentlemen:

We have heretofore rendered our Original Title Opinion dated October 22, 1964 and supplements thereto dated November 9, 1964, November 20, 1967, November 28, 1967 and September 10, 1974, all of which was based upon various documents and abstracts certified to cover the period of time from the sovereignty of the soil to July 2, 1974 at 5:00 P.M.

We have since examined the following:

(1) Supplemental Abstract No. 67030, prepared by Brazoria County Abstract Company, containing 67 pages, including the certificate, certified from July 2, 1974 at 5:00 P.M. to February 12, 1976 at 5:00 P.M.;

(2) Supplemental Abstract No. 67638, prepared by Brazoria County Abstract Company, containing 83 pages, certified from February 12, 1976 at 5:00 P.M. to March 9, 1978 at 5:00 P.M.;

(3) Supplemental Abstract No. 67722, prepared by Brazoria County Abstract Company, containing 61 pages, including the certificate, certified from March 9, 1978 at 5:00 P.M. to July 25, 1978 at 5:00 P.M.;

(4) Supplemental Abstract No. 68018, prepared by Brazoria County Abstract Company, containing 27 pages, including the certificate, certified from July 25, 1978, at 5:00 P.M. to September 13, 1979, at 5:00 P.M.: and

(5) Proceedings in connection with the Estate of Kate L. Bowers, Deceased, which are reflected in Supplemental Abstract No. 66,066, prepared by the Brazoria County Abstract Company.

All title requirements reflected in our prior title opinions which have not been satisfied and such additional title requirements and comments which we deem necessary will be hereinafter referred to or set out in this opinion.

Basing our opinion upon the foregoing and subject to the objections and comments hereinafter set out, we find title to surface and minerals in and to the captioned land to be vested as follows:

SURFACE

The Dow Chemical Company, a Delaware corporation	All

MINERALS

Tract 1

1,000 acres of land, more or less, (being a part of Tract 3 referred to in the captioned hereof) out of the Austin & Williams Survey, as described in the mineral deed dated February 8, 1930, recorded in Volume 219, Page 470, Deed Records, Brazoria County, Texas, from Ernest Seaburn to Eagle Oil Company

The Dow Chemical Company	.707332%
R. H. Goodrich	.072602%
Harris Underwood	.053030%
P. M. Frost	.019530%
Elaine S. White, wife of Alfred T. White, formerly the wife of C. H. Frost	.038061%

Houston National Bank, as Trustee for Vernon W. Frost, Jr., Robert S. Frost, Ann Frost Wersebe and Betty Frost McAlleer, Trusts	.026475%
Georgia Tolar, widow of H. L. Tolar	.015151%
J. M. Frost, III, Marion S. Frost (Mrs. W. H. Keenan), Walter Scott Frost, W. H. Keenan, Trustee for William Howard Keenan, Jr., W. H. Keenan, Trustee for Carolyn Frost Keenan, Walter Scott Frost, Trustee for Julia Frost, Kathryn Frost and James Browne Frost	.067819%

Tract 2

170 acres of land, more or less (being a part of Tract 2 referred to in the captioned hereof), out of the Jared E. Groce Five League Survey, as described in mineral deed dated June 2, 1928, recorded in Volume 209, Page 221, Deed Records, Brazoria County, Texas, from Ernest Seaburn to Alf H.H. Tolar and Jacob Dannenbaum, SAVE AND EXCEPT the Sam Bryant 35-acre tract lying within the metes and bounds of said 170-acre tract.

Vacuum Oil Company, Inc.	.750000%
The Dow Chemical Company	.250000%

Tract 3

310 acres of land (being a part of Tract 3 referred to in the captioned hereof), out of the Austin & Williams Survey, as described in mineral deed dated October 14, 1931, recorded in Volume 230, Page 328, Deed Records, Brazoria County,

Texas, from Lula Aycock and husband, R. L. Aycock to C. M. Frost and J. M. Frost, Jr.

The Dow Chemical Company	.875003%
R. H. Goodrich	.024306%
Harris Underwood	.020833%
P. M. Frost	.008376%
Elaine S. White, wife of Alfred T. White, formerly the wife of C. H. Frost	.016752%
J. M. Frost, III, Marion S. Frost (Mrs. W. H. Keenan), Walter Scott Frost, W. H. Keenan, Trustee, for William Howard Keenan, Jr., W. H. Keenan, Trustee, for Carolyn Frost Keenan, Walter Scott Frost, Trustee for Julia Frost, Kathryn Frost and James Browne Frost	.025521%
Houston National Bank, as Trustee for Vernon W. Frost, Jr., Robert S. Frost, Ann Frost Wersebe and Betty Frost McAllen Trust.	.029209%

Tract 4

268 acres of land, more or less, (being a part of Tract 3 referred to in the captioned hereof), out of the Austin & Williams Survey, as described in a Judgment rendered November 26, 1928, in consolidated Causes No. 14,850, styled Eliza Kempner, et al vs. Ernest Seaburn, et al and No. 16,447, styled M. L. O'Connell, et al, v. J. W. Proctor, et al, a certified copy of said decree being recorded in Volume 211, Page 361, Deed Records, Brazoria County, Texas

Eliza Kempner, Individually
and as survivor in community
of the Estate of H. Kempner,
Deceased

An Undivided Interest of 15.87 acres

Lois Lovit, Paul Lovit, Joseph
Lovit, Edgar Lovit, Bertha
Lovit Wilson and husband,
Hunter L. Wilson

An Undivided Interest of 93.80 acres

W. H. Winningham, Trustee

An Undivided Interest of 13.98 acres

F. K. Stevens

An Undivided Interest of 110.54 acres

A. R. Rucks

An Undivided Interest of 33.81 acres

According to the above-mentioned Decree, the mineral estate in the 268 acres was awarded to the persons above named in the amount set opposite their respective names. The Supplemental Abstract which we have examined are not certified to cover the mineral estate in the above-mentioned 268 acres of land subsequent to the date of the vesting of said minerals in said named parties under the Decree above mentioned. The foregoing is pointed out solely for your information.

Tract 5

735 acres (being a part of Tract 3 referred to in the captioned hereof) out of the Austin & Williams Survey and being all of the land in said survey, SAVE AND EXCEPT tracts 1, 3 and 4 above described.

The Dow Chemical Company	.916669%
R. H. Goodrich	.024306%
Harris Underwood	.020833%
P. M. Frost	.004904%
Elaine S. White, wife of Alfred T. White, formerly the wife of C. H. Frost	.009808%
Houston National Bank, as Trustee, for Vernon W. Frost, Jr., Robert S. Frost and Frost Wersebe and Betty Frost McAlleer Trust	.011848%
J. M. Frost, III, Marian S. Frost (Mrs. W. H. Keenan), Walter Scott Frost, W. H. Keenan, Trustee for William Howard Keenan, Jr., W. H. Keenan, Trustee for Carolyn Frost Keenan, Walter Scott Frost, Trustee for Julia Frost, Katherine Frost and James Browne Frost.	.011632%

Tract 6

227 acres of land, more or less, out of the S. F. Austin 1/2 League Grant, A-21, and 296 acres of land, more or less, out of said S. F. Austin Survey, SAVE AND EXCEPT the North 50 acres of the East 100 acres of the West 198 acres of the said 296-acre tract, said tracts being more fully described in mineral deed dated June 11, 1953, recorded in Volume 564, Page 624, Deed Records, Brazoria County, Texas from Chesley L. Hall to E. Cockrell, Jr.

The Dow Chemical Company	1.000000%

Tract 7

The North 50 acres of the East 100 acres of the West 198 acres of 296 acres, more or less, out of the S. F. Austin, 1/2 League Grant, A-21, and being the second tract described in a mineral deed dated November 16, 1929, recorded in Volume 219, Page 557, Deed Records, Brazoria County, Texas, from Ernest Seaburn to Alf H. H. Tolar

The Dow Chemical Company	.500000%
Sun Oil Company	.500000%

Tract 8

1,024.07188 acres of land, more or less, in the J. E. Groce Five League Grant, being all of Tract 1 referred to in the captioned hereof as containing 2,957.22 acres of land, more or less, SAVE AND EXCEPT the 774.67812 excepted tract referred to under Tract 1 in the caption hereof and SAVE AND EXCEPT 1,158.47 acres of land, more or less, being composed of 17 tracts containing from 12.5 acres to 250 acres, as described in mineral deeds recorded in Volume 227, Page 35; Volume 218, Page 204; Volume 227, Page 38; Volume 218, Page 208; Volume 218, Page 212; Volume 219, Page 557; Volume 218, Page 216; and Volume 209, Page 221, respectively, of the Deed Records of Brazoria County, Texas

The Dow Chemical Company	1.000000%

Tract 9

305.47 acres of land, more or less, in the Jared E. Groce Five League Grant, consisting of four tracts containing 50 acres, 70 acres, 75 acres and 110.47 acres, respectively, as more fully described in a mineral deed dated February 6, 1930, recorded in Volume 219, Page 540 of the Deed Records, Brazoria County, Texas

The Dow Chemical Company	.500000%

Atlantic Richfield Company	.500000%

Tract 10

50 acres of land, more or less, out of the Jared E. Groce Five League Grant, being the first tract described in a mineral deed dated November 16, 1929, recorded in Volume 119, Page 557, Deed Records, Brazoria County, Texas, from Ernest Seaburn to Alf H. H. Tolar and being the South 50 acres of 300 acre tract described as Tract "Two" and a release recorded in Volume 191, Page 630 of the Deed Records, Brazoria County, Texas

The Dow Chemical Company	.500000%
Sun Oil Company	.500000%

Tract 11

210 acres of land, more or less, out of the Jared E. Groce Five League Grant, consisting of six tracts, containing 25 acres, 60 acres, 37-1/2 acres, 50 acres, 12-1/2 acres and 25 acres, respectively, as more fully described in a mineral deed January 16, 1931, recorded in Volume 227, Page 35 of the Deed Records, Brazoria County, Texas, from R. L. Aycock and wife, Lula Aycock to Eagle Oil Company; and 423 acres of land, more or less, out of the Jared E. Groce Survey, consisting of 4 tracts of land, containing 73 acres, 50 acres, 50 acres and 250 acres, as more particularly described in a mineral deed dated January 16, 1931, recorded in Volume 227, Page 38 of the Deed Records, Brazoria County, Texas, from R. L. Aycock and wife, Lula Aycock, to Eagle Oil Company

The Dow Chemical Company	.916667%
P. M. Frost	.010416%
Elaine S. White, wife of Alfred T. White, formerly the wife of C. H. Frost	.020833%

Houston National Bank, as Trustee for Vernon W. Frost, Jr., Robert S. Frost, Ann Frost Wersebee and Betty Frost McAlleer, Trust	.010417%
J. M. Frost, III, Marian S. Frost (Mrs. W. H. Keenan), Walter Scott Frost, W. H. Keenan, Trustee for William Howard Keenan, Jr., W. H. Keenan, Trustee for Carolyn Frost Keenan, Walter Scott Frost, Trustee for Julia Frost, Katherine Frost and James Browne Frost	.041667%

ROYALTY RESERVATIONS

In our opinions addressed to you dated November 9, 1964 and November 20, 1967, we advised you that some of the mineral interest tabulated in this opinion are subject to various nonparticipating royalty interests which are set out fully in said opinions. In our Fourth Supplemental Title Opinion dated September 10, 1974, we further advised you as to certain royalty reservations made in three separate deeds of conveyances, to-wit:

(a) Deed dated November 28, 1967, recorded in Book 987, Page 900, Deed Records, Brazoria County, Texas, from Mary Lee Seaburn Hudgins to First City National Bank of Houston, Trustee;

(b) Deed dated April 1, 1971, recorded in Book 1107, Page 912, Deed Records, Brazoria County, Texas, from Thurman Lamar McMullen to The Dow Chemical Company; and

(c) Deed dated May 24, 1972, recorded in Book _______, Page __________, Deed Records, Brazoria County, Texas, filed under County Clerk's File No. 9733 from Sidney Katherine Bowers Stiba, Individually and as Trustee, and Albert Sidney Bowers, III, to The Dow Chemical Company.

The Deeds hereinabove referred to cover and relate to Tracts 1, 3, 5, 6, 7, 8, 9, 10 and 11 hereinabove tabulated.

Your attention is again directed to each of the foregoing conveyances and to the prior nonparticipating royalty reservations hereinabove referred to.

Subsequent to the date of our last opinion, the following additional royalty reservations have been made under a deed from Ernest H. Cockrell, et al, to The Dow Chemical Company, dated January 3, 1975, recorded in Volume 1231, Page 874, Deed Records, Brazoria County, Texas, being the same deed referred to in the opening paragraph in the caption of this opinion.

The deed makes reference to three wells, in addition to certain oil, gas and mineral leases, and the grantors in said deed reserved and excepted therefrom all of the Grantors' rights and interests in oil, gas and other hydrocarbons in, on and under and being produced from said wells together with the equipment and facilities used in connection therewith for so long as Grantors continue to produce oil and gas from the zones in which they are presently completed or from any zone in which said wells are recompleted in the present well bores above the total depth to which said wells were originally drilled but such rights to continue to produce said wells and to recomplete the zones shall only continue so long as the respective oil and gas leases upon which said wells are situated are maintained in full force and effect by such production or such recompletion operations under the presently existing terms and provisions of said leases. In no event shall the above-described rights reserved by Grantors in said leasehold estates in said wells continue in effect for a period longer than ten years from the date of the conveyance. At the end of said ten-year period or prior thereto in the event any of the above-described leasehold estate shall for any reason become cancelled or forfeited Grantor shall execute and record valid releases of said leasehold estates.

The foregoing reservations are pointed out for your information.

COMMENTS AND REQUIREMENTS

1.

The following Requirements made in our prior title opinions have not been satisfied and are carried forward in this opinion, to-wit:

(a) Requirement No. 2(5) of our opinion dated October 22, 1964, called for Affidavits of Use and Occupancy and for a survey of the captioned property. The plat made from such survey should also show each of the mineral tracts tabulated herein as well as the 774.67812 excepted tract in Tract 1 of the caption of this opinion.

(b) Requirement No. 2 of our opinion dated November 20, 1967, required the determination of whether or not Mrs. Mary Lee Seaburn Hudgins and Mrs. W. O. Hudgins are one and the same person.

(c) It was stated in our opinion dated November 9, 1964, that Austin Y. Bryan, Jr., owned certain royalty and overriding royalty interests in some of the properties described in the caption hereof. Requirement No. 7 of our opinion dated November 20, 1967, stated that Austin Y. Bryan, Jr., was deceased and required certified copies of all probate proceedings in connection with his estate in order to show the ownership of the interests formerly owned by AUstin Y. Bryan, Jr., Deceased. If it is determined that Austin Y. Bryan, Jr., died intestate, then you should obtain an Affidavit of Heirship from a disinterested person containing full and complete heirship information relating to the said Austin Y. Bryan, Jr., Deceased.

(d) Requirement No. 10 of our opinion dated November 20, 1967, required proof that Amelia Hall and Amelia Hall Bray are one and the same person.

(e) Requirement No. 11 of our opinion dated November 20, 1967, stated that in order to set out the interest formerly owned by J. M. Frost, Jr. (being a mineral interest only), it would be necessary for us to be furnished with certified copies of all instruments in the probate proceedings had in connection with his estate.

(f) Requirement No. 12 of our opinion dated November 20, 1967, required that we be furnished with a certified copy of a Deed dated August 10, 1957, recorded in Volume 692, Page 457 of the Deed Records of Brazoria County, Texas, from R. L. Christian, Administrator of the Estate of L. C. Christian, to B. L. Anderson and C. S. Conrad, Jr.

(g) Requirement No. 2 of our opinion dated November 20, 1967, stated that Alf H. Tolar and Jacob Dannenbaum reserved certain royalty interests in Mineral Tract No. 2 tabulated herein, containing 170 acres (less the Sam Bryant 35-acre tract). It was also stated that in order to set forth the ownership of the royalty interest formerly owned by Jacob Dannenbaum, Deceased, we should be furnished with various instruments referred to in this Will.

2.

In our prior title opinions, we made reference to the fact that there were numerous oil, gas and mineral leases covering all of various portions of the captioned land, which leases have been set forth in our prior opinions. We further advise you that some of the leases had been released of record, others partially released of record, and other have not been released of record as of the date of said opinion.

We further advised you in our opinion of September 10, 1974 as to an Oil, Gas and Mineral Lease dated March 18, 1968, recorded in Book 1021, Page 141 of the Deed Records, Brazoria County, Texas, executed by Sidney K. Bowers Stiba, Individually and as Executrix of the Estate of Kate L. Bowers, Deceased, and husband Ben F. Steba, as the Lessors, to Mobil Oil Corporation, as the Lessee, covering 2,045 acres of land, more or less, fully described in said lease.

This lease was for a primary term of five years from its date and as long thereafter as oil, gas or other minerals are produced from said land or lands with which said land is pooled.

From our examination of the abstracts as tabulated in this opinion, we find the following Oil, Gas and Mineral Leases, to-wit:

(a) From Jim H. Underwood, et al, Trustees of Harris Underwood Trust, as Lessors to Texaco, Inc., as Lessee, dated September 27, 1977, recorded in Volume 1368, Page 350, Deed Records, Brazoria County, Texas, covering 100 acres of land, located within the Austin & Williams Survey, Abstract 145, Brazoria County, Texas, and being for a primary term of three years from its date. Said lease was amended under instrument dated January 16, 1978, from the Lessors therein named to Texaco, Inc., the Lessee, said amendment being recorded in Volume 1378, Page 538, Deed Records, Brazoria County, Texas;

(b) The Dow Chemical Company, as Lessor, to Ernest H. Cockrell, et al, as Lessee, dated April 14, 1978, recorded in Volume 1392, Page 676, Deed Records, Brazoria County, Texas, covering the 72-acre tract of land out of the J. E. Groce Five League Grant, A-66, as described in said lease and being for a primary term of three months from the date of said lease and as long thereafter as oil or gas is produced from said land or as long as said lease is maintained in force and effect, as provided for therein;

The abstracts, as tabulated in this opinion, also reflect the following declaration of oil and gas lease, to-wit:

(c) Dated April 25, 1978 between Elaine S. White, joined by her husband, Alfred T. White, referred to as Lessor, and Ernest H. Cockrell and Carol Cockrell Jennings, referred to as Lessee, granting to the Lessee exclusive right to investigate, explore the prospect and drill and produce oil and gas in, on and from 250 acres of land, more or less, in the Jared E. Groce Five League Grant, A-66, as described therein, and being for a term of one year from the date called primary term, and as long thereafter as oil or gas are produced from said land, all in accordance with the terms and provisions of an unrecorded oil and gas lease of even date between the parties.

(d) Dated April 28, 1978 between P. M. Frost, as the Lessor, and the same Lessee as above named, covering similar terms and provisions as the declaration last above referred to, said declaration being recorded in Volume 1409, Page 47, Deed Records, Brazoria County, Texas;

(e) Dated May 5, 1978 by and between J. M. Frost, III, as Lessor, and the same named Lessees recorded in Volume 1409, Page 52, Deed Records, Brazoria County, Texas, being for a similar terms covering the same acreage as the declaration above commented upon;

(f) Dated May 5, 1978 by and between J. M. Frost, III, as Lessor, and the same named Lessees, recorded in Volume 1409, Page 52, Deed Records, Brazoria County, Texas, being for a similar term and covering the same acreage as the declaration above commented upon;

(g) Dated May 16, 1978 between Houston National Bank, a national banking association, as Trustee, and Vernon Frost, Jr. and Robert S. Frost, as Co-Trustees of the Trust Agreement established December 29, 1976 by Vernon W. Frost and wife, Inez S. Frost, as Lessor, and the same named Lessees above referred to, said instrument being recorded in Volume 1409, Page 56, Deed Records, Brazoria County, Texas, containing similar terms and provisions and covering the same acreage as the declaration above commented upon;

(h) Dated May 18, 1978, recorded in Volume 1409, Page 54, Deed Records, Brazoria County, Texas, between W. Scott Frost, Individually and as Trustee for Julia Frost Stewart, Katheryn Frost, James Browne Frost, Mrs. W. H. Keenan, W. H. Keenan, Trustee, for the W. Howard Keenan, Jr. and Carolyn F. Keenan Trust, as the Lessors, and the same named Lessees covering the same acreage and containing similar terms and provisions as the declaration hereinabove commented upon.

In order to make a complete determination as to the ownership of the leasehold estate, the royalty interest and overriding royalties, relating to the lands covered by this opinion, it would be necessary that all the curative matter called for in our prior opinions be furnished in addition to curative matter called for in this opinion. Also, an investigation should be made as to the status of each lease the number of well producing, location of each such well, all of which together with the abstracts heretofore examined would again be reviewed prior to rendering a supplemental opinion covering the said leasehold estate, royalty and overriding royalty interest.

3.

In our opinion of September 10, 1974, we set forth two "Location Agreements" being as follows, to-wit:

(a) Agreement by and between The Dow Chemical Company, Lessor, and Trans-State Outdoor Advertising, Inc., Lessee, dated March 3, 1970, recorded in Deed Book 1055, Page 660, Brazoria County, Texas; and

(b) Agreement by and between E. Cockrell, Jr., et al, Lessors, and Trans-State Outdoor Advertising, Inc., Lessee, dated April 2, 1970, recorded in Deed Book 1057, Page 813, Brazoria County, Texas.

The foregoing is pointed out solely for your information.

4.

In our opinion of September 10, 1974, we set forth the following leases, to-wit:

(a) Grazing Lease from The Dow Chemical Company, as Lessor, to W. O. Hudgins, as Lessee, dated February 20, 1968, recorded in Book 995, Page 175 of the Deed Records, Brazoria County, Texas, as amended on January 1, 1972, and on January 1, 1973. This lease, as amended, covers an undivided 83.33% interest in and to the surface of the captioned land. This lease is given for ranching and grazing purposes only and the term thereof is from year-to-year. The lease may be terminated by Dow at any time by giving the Lessee thirty (30) days' prior notice in writing.

(b) Grazing Lease from The Dow Chemical Company, as Lessor, to W. H. Shanks, as Lessee, dated January 1, 1971, recorded in Book 1078, Page 41 of the Deed Records of Brazoria County, Texas. This lease covers an undivided 1/12th interest in and to the surface of the captioned land. This lease covers an undivided 1/12th interest in and to the surface of the captioned land. This lease is given for grazing purposes only and the term thereof is from year-to-year. The lease may be terminated by Dow as to any or all of the lands covered thereby at any time it desires to do so by giving the Lessee notice in writing of its desire to terminate, and Lessee shall vacate the premises within four (4) days after receipt of such notice.

(c) Grazing Lease from Carol Cockrell Jennings, et al, as Lessors, to L. L. Rhodes, as Lessee, dated November 1, 1973, recorded in Book 1178, Page 295 of the Deed Records, Brazoria County, Texas. This lease covers all of the Lessors' undivided interest in the surface of the captioned property, and is given for the sole purpose of pasturing livestock. This lease is to terminate at midnight, October 31, 1978, but the Lessors reserve the right to cancel the lease by giving the Lessee thirty (30) days' written notice in advance.

In addition to the leases hereinabove set forth, the abstracts tabulated in this opinion reflect the following grazing leases, to-wit:

(d) Grazing lease from The Dow Chemical Company, as the Lessor, to L. L. Rhodes, as the Lessee, dated January 1, 1976, recorded in Volume 1281, Page 604, Deed Records, Brazoria County, Texas, covering 1288 acres of land, and being for term of one year, beginning January 1, 1976, ending December 31, 1976 and from year-to-year thereafter upon the payment of rentals provided for in said lease unless cancelled by the Lessor therein named.

(e) Grazing Lease from The Dow Chemical Company, as Lessor, to W. O. Hudgins, as Lessee, dated January 1, 1976, recorded in Volume 1281, Page 610, Deed Records, Brazoria County, Texas, covering 3,693 acres of land, more or less, for grazing purposes, being for a term of January 1, 1976 ending December 31, 1976 and continuing from year-to-year thereafter upon payment of the rentals as provided for in said lease unless said lease is cancelled by the Lessor therein named.

(f) Surface Lease from The Dow Chemical Company to Village of Oyster Creek dated July 26, 1978, recorded in Volume 1417, Page 70, Deed Records, Brazoria County, Texas.

The foregoing leases are pointed out solely for your information and consideration.

5.

Under our opinion dated September 10, 1974, we set forth a surface lease agreement dated June 26, 1973, recorded in Volume 1175, Page 926, Deed Records, Brazoria County, Texas, from The Dow Chemical Company unto Walter Garland, a specified location for the purpose of maintaining a residence thereon. The lease is from year-to-year and Lessor reserves the right to terminate the lease at any time upon notice.

The foregoing is again pointed out for your information and consideration.

6.

The captioned property is subject to certain easements and rights-of-way described in or referred to in our prior opinions to you and to that certain right-of-way dated May 1, 1969, recorded in Book 1032, Page 177, Deed Records, Brazoria County, Texas, from Sidney Kathryn Bowers Stiba, Individually and as Trustee for Albert Sidney Bowers, III, and husband Ben F. Stiba, to Houston Lighting and Power Company.

The abstracts tabulated in this opinion contain the following easements and rights-of-way, to-wit:

(a) From The Dow Chemical Company to Houston Lighting and Power Company, dated July 3, 1975, recorded in Volume 1258, Page 678, Deed Records, Brazoria County, Texas, being the easement and right-of-way upon, over and across the captioned land, containing a total of 99.9722 acres of land, for the purpose of constructing, altering, repairing, maintaining, inspecting, operating and removing electrical transmission lines;

(b) From The Dow Chemical Company to Houston Pipeline Company, dated February 10, 1976, being an easement and right-of-way to construct, operate and maintain a pipeline upon, over and across a portion of the captioned property; and

(c) From The Dow Chemical Company to Dow Bodische Company, dated July 11, 1977, recorded in Volume 1352, Page 858, Deed Records, Brazoria County, Texas, being an easement and right-of-way for the construction, operation and maintenance of a four inch pipeline upon, over and across a portion of the captioned land.

The foregoing easements and rights-of-way are again pointed out for your information and consideration.

7.

As indicated by our Original Title Opinion dated October 22, 1964, an Application to Purchase, dated April 27, 1951, recorded in Volume 1, Page 212 of the Records in the County Surveyor's Office of Brazoria County, Texas, was filed by Fagan Dickson, whereby the said Fagan Dickson applied to purchase the following-described areas believed to be unsurveyed land belonging to the Public Free School Fund. The tract of land mentioned in said Application is stated to be situated in Brazoria County, Texas, above 11 miles southeast of Angleton, and is bounded as follows, to-wit:

On the North by the L.M.H. Washington Survey;

On the East by the Nathan Wade Survey;

On the South by the Nathan Wade, John Martin and Weaver Survey; Abstracts Nos. 674, 331, and 381, respectively; and

On the West by the Weaver (Abstract No. 381) and Austin Survey (Abstract No. 145).

The abstracts which we have examined contain the following statement:

"This abstract does not purport to cover title to any survey with which the Austin & Williams Survey, Abstract 145, may be in conflict on its north, east or south sides."

We have not been furnished with a plat and field notes of the captioned land made by a licensed surveyor; however, we have examined office maps of The Dow Chemical Company. It would appear that the portion of the captioned land which could be affected by a possible vacancy or conflict in survey lines would be that portion lying in the southerly part of the 1,000 acres described as Tract 1 in the mineral tabulation herein.

An investigation should be made at the General Land Office of the State of Texas to determine what action, if any, was taken with respect to this Application to Purchase. Upon our being furnished with the results of such investigation, we will be able to further advise you in this matter.

8.

Page 21 of the Abstract No. 68018, as tabulated in this opinion contains an affidavit relating to a Mechanic's and Materialman's Lien, dated September 10, 1979, filed September 10, 1979 at 3:11 P.M. and recorded in Volume 176, Page 149 of the M&M Lien Records of Brazoria County, Texas. Said affidavit was filed by Aucoin & Miller Electric, Co., a Texas corporation, for the purpose of perfecting a lien in the amount of $24,219.24. The affidavit sets forth facts to the effect that Dow Chemical Company is the owner of the property, as well as the improvements on which materials were furnished by the claimant, to Delta Electric Company, an electrical contractor on said job, pursuant to a contract with said parties.

An investigation should be made to ascertain the present status of the existing lien and the indebtedness of Delta Electric Company should be paid to the Claimant hereinabove named and said Claimant should executed a full release of the M&L Lien, all of which should be filed for record in Brazoria County, Texas.

9.

From our examination of the probate proceedings filed in connection with the Estate of Kate L. Bowers, reflected in the abstracts, we find that she was a resident of Calhoun County, Texas, at the time of her death which occurred in the City of Houston, Harris County, Texas, on or about October 22, 1966.

Kate L. Bowers, the Deceased, appears to have been vested with an undivided 5/36 interest in and to the minerals in, on and under Tract 1 an undivided 7/36 interest in and to the minerals in, on and under Tracts 3, 5, 6, 8 and 11 and an undivided 1/12th interest in and to the minerals in, on and under Tracts 7, 9 and 10 of the properties set forth in the caption of this opinion.

Under the General Warranty Deed to The Dow Chemical Company from Sidney Katherine Bowers Stiba, et al, dated May 24, 1972, filed for record with the County Clerk of Brazoria County, Texas, on May 24, 1972 under File No. 9733, The Dow Chemical Company acquired all of the undivided mineral interest of the said Sidney Katherine Bowers Stiba, which was a .0925925% of the mineral interest, as above vested in The Dow Chemical Company under Tract 1 and a .1296296% of the mineral interest as so vested in The Dow Chemical Company under Tracts 3, 5, 6, 8 and 11 above and an undivided .0555555% of the mineral interest so vested in The Dow Chemical Company under Tracts 7, 9 and 10 in this opinion.

Under Article IV of the Last Will and Testament of the said Kate L. Bowers, she devised and bequeathed unto her daughter Sidney Katherine Bowers Stiba an undivided 2/3 interest in and to all of the rest, residue and remainder of the estate of which the deceased died ceased and possessed in fee simple and forever, which would consist of an undivided 2/3 interest in and to the undivided mineral interest which the deceased was so vested at the time of her death in, on and under the tracts hereinabove referred to.

A portion of Article VII of the will of the said Kate L. Bowers also provides "However, should my daughter, the said Sidney Katherine Bowers Stiba, predecease my grandson, the said Albert Sidney Bowers, III, subsequent to the termination of the trust provided for under Article V hereof, then the same shall pass to and vest in my grandson for and during his natural life, with the remainder over to the child or children surviving him, share and share alike, in fee simple and forever; provided, however, that should my grandson die without leaving a child or children surviving him, then in such event, such property shall pass to and vest in the Lady of the Gulf Catholic Church of Port Lavaca, Texas, in fee simple and forever."

The undivided 2/3 mineral interest devised to Sidney Katherine Bowers Stiba in Article IV of the will above referred to could possibly be rendered a defeasible fee due to the language in Article VII above quoted.

It could also be argued that the quoted language, along with other language in Article VII is in derogation of the outright grant of the fee simple interest to Sidney Katherine Bowers Stiba in Article IV of the Will. Also, since the testatrix devised and bequeathed the interest to Stiba in Article IV and Article VII only states that the bequest shall lapse, it could be argued that if Article VII is to be given effect, then, if Stiba predeceases her son, only the bequest of personalty would be lapsed but not the devise of realty.

The arguments in the foregoing paragraph that Sidney Stiba's undivided interest in the realty should be deemed a fee simple interest and not a defeasible fee, are not the only arguments which can be made for that proposition. The Will of Kate Bowers is not entirely clear on this point. We point out these specific arguments to illustrate that the Will is unclear. It cannot be stated with absolute certainty whether the undivided devise to Sidney Stiba was a fee simple interest or a defeasible fee. This question could only be finally determined by a Declaratory Judgment proceeding in the proper Court construing the meaning of the Will of Kate Bowers.

TAXES

You should satisfy yourself that all ad valorem taxes assessed against the captioned land have been paid up to and including the year of 1978.

This opinion does not cover such matters as discrepancies in area, conflicts in boundary lines or survey lines, rights of parties, if any, in possession, rules, regulations, restrictions, orders or ordinances of governmental agencies having or asserting jurisdiction (or compliance or noncompliance therewith) not reflected within the material examined in connection with this opinion.

Yours very truly,

38:55J

Vinson & Elkins

COMMITMENT FOR TITLE INSURANCE T-7
Issued by
OLD REPUBLIC NATIONAL TITLE INSURANCE COMPANY

THE FOLLOWING COMMITMENT FOR TITLE INSURANCE IS NOT VALID UNLESS YOUR NAME AND THE POLICY AMOUNT ARE SHOWN IN **SCHEDULE A,** AND OUR AUTHORIZED REPRESENTATIVE HAS COUNTERSIGNED BELOW.

We (Old Republic National Title Insurance Company) will issue our title insurance policy or policies (the Policy) to You (the proposed insured) upon payment of the premium and other charges due, and compliance with the requirements in Schedule B and Schedule C. Our Policy will be in the form approved by the Texas Department of Insurance at the date of issuance, and will insure your interest in the land described in Schedule A. The estimated premium for our Policy and applicable endorsements is shown on Schedule D. There may be additional charges such as recording fees, and expedited delivery expenses.

This Commitment ends ninety (90) days from the effective date, unless the Policy is issued sooner, or failure to issue the Policy is our fault. Our liability and obligations to you are under the express terms of this Commitment and end when this Commitment expires.

Issued through the Office of:
Anna Melass
Old Republic National Title Insurance Company
777 Post Oak Blvd. Ste 100
Houston, TX 77056
Phone: 713-552-7362
Fax: 281-271-8996
Email: amelass@oldrepublictitle.com

Anna Melass
Authorized Signatory

OLD REPUBLIC NATIONAL TITLE INSURANCE COMPANY
A Stock Company
400 Second Avenue South, Minneapolis, Minnesota 55401
(612) 371-1111

By Mark A Bilbrey President

Attest David Wold Secretary

SCHEDULE A

Anna Melass
PC/ TD: A122, 71, 25
Effective Date: February 28, 2018, 8:00 A.M.

G.F. No. or File No**. 18000747**

Issued Date: March 12, 2018

1. The policy or policies to be issued are:

   (a) OWNER'S POLICY OF TITLE INSURANCE (Form T-1)
   (Not applicable for improved one-to-four family residential real estate)
   Policy Amount:
   PROPOSED INSURED:

   (b) TEXAS RESIDENTIAL OWNER'S POLICY OF TITLE INSURANCE
   ONE-TO-FOUR FAMILY RESIDENCES (Form T-1R)
   Policy Amount:
   PROPOSED INSURED:

   (c) LOAN POLICY OF TITLE INSURANCE (Form T-2)
   Policy Amount:
   PROPOSED INSURED:
   Proposed Borrower:

   (d) TEXAS SHORT FORM RESIDENTIAL LOAN POLICY OF TITLE INSURANCE (Form T-2R)
   Policy Amount:
   PROPOSED INSURED:
   Proposed Borrower:

   (e) LOAN TITLE POLICY BINDER ON INTERIM CONSTRUCTION LOAN (Form T-13)
   Binder Amount:
   PROPOSED INSURED:
   Proposed Borrower:

   (f) OTHER
   Policy Amount:
   PROPOSED INSURED:

2. The interest in the land covered by this Commitment is: Fee Simple

3. Record title to the land on the Effective Date appears to be vested in: Volume 145, Page 307

   THE PRISON COMMISSION OF THE STATE OF TEXAS

4. Legal description of land:

   TRACT I:

ALL THAT CERTAIN 253.9424 ACRE tract of land situated in the Stephen Richardson League, Abstract 122 and the Stephen F. Austin League Number 8, Abstract 25, Brazoria County Texas, being a portion of that certain 2682 acre tract conveyed by deed on January 1, 1918, from Bassett Blakely and wife, Bonnie Blakely to the Prison Commission of the State of Texas, as recorded in Volume 145, Page 304, Brazoria County Deed Records (B.C.D.R.), also based on the map of the Ramsey State Farm showing a survey by R. J. McMahon for the Texas Prison System dated January 1934 and indexed as Map Counter Number 62997 in the Texas General Land office, said 253.9424 acre tract being more particularly described by metes and bounds using survey terminology which refers to the Texas State Plane Coordinate System, South Zone (NAD83), in which the directions are Lambert grid bearings and the distances are surface level horizontal lengths (S.F. = 0.99991812946) as follows:

COMMENCING at a concrete post found marking the southeast corner of all that certain called 2200.00 acre tract conveyed by deed on December 15, 2011 from the State of Texas to Dow Chemical Company as recorded in Cleric's File No. 2011-051639 of the Brazoria County Official Records (B.C.O.R.), the southwest corner of all that certain called 159 acre tract conveyed by deed on July 13, 2010 from the William Jackson Palmer Trust to the Ellen Taylor Palmer Trust and the David Kerr Palmer Trust, as recorded in Clerk's File No. 2010-031523 of the B.C.O.R., located on the northern boundary line of all that certain called 2111.72 acre tract conveyed by deed on May 17, 1949 from the United States of American (Reconstruction Finance Corporation) to the Dow Chemical Company as recorded in Volume 453, Page 607 of the B.C.D.R., said *Point of Commencement* being located at Texas State Plane coordinate position X=3074709.49 and Y=13655895.34;

THENCE North 3°10'58" West, coincident with the eastern boundary line of said Dow Chemical Company called 2200.00 acre tract, same being the western boundary line of said Ellen Taylor Palmer Trust and the David Kerr Palmer Trust called 159 acre tract, a distance of 2095.42 feet to a Prison Fann concrete monument (broken) found marking the northwest corner of said Ellen Taylor Palmer Trust and the David Kerr Palmer Trust called 159 acre tract, for an angle corner of said Dow Chemical called 2200 acre tract, at position X=3074593.17 and Y=13657987.25;

THENCE North 5°16'24" East, coincident with the eastern boundary line of said Dow Chemical Company called 2200.00 acre tract, a distance of 1927.75 feet to a concrete monument stamped "H.R. RPLS 3987" found marking an angle corner of said Dow Chemical called 2200.00 acre tract, at position X=3074770.32 and Y=13659906.58;

THENCE North 22°01'56" West, coincident with the eastern boundary line of said Dow Chemical Company called 2200.00 acre tract, a distance of 1050.13 feet to a concrete monument stamped "H.R. RPLS 3987" found marking the most easterly northeast corner of said Dow Chemical Company called 2200.00 acre tract, at position X=3074376.44 and Y=13660879.89;

THENCE South 87°46'24" West, coincident with the northern boundary line of said Dow Chemical Company called 2200.00 acre tract, a distance of 1065.19 feet to the southeast corner and the **POINT OF BEGINNING** of the herein described 253.9424 acre tract, said *Point Of Beginning* being located at Texas State Plane coordinate position X=3073312.20 and Y=13660838.51;

THENCE South 87°46'24" West, coincident with the northern boundary line of said Dow Chemical Company called 2200.00 acre tract, a distance of 2357.28 feet to a concrete monument stamped "H.R. RPLS 3987" found marking an angle corner of said Dow Chemical called 2200.00 acre tract, for an angle corner of the herein described 253.9459 acre tract, at position X=3070957.01 and Y=13660746.93;

THENCE North 20°03'13" West, coincident with the eastern boundary line of said Dow Chemical Company called 2200.00 acre tract, a distance of 1861.84 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3070318.67 and Y=13662495.66;

THENCE North 3°42'51" East, coincident with the eastern boundary line of said Dow Chemical Company called 2200.00 acre tract, at a distance of 1853.49 feet pass a concrete monument stamped "H.R. RPLS 3987" found for reference, continuing a total distance of 1965.42 feet to a point located in the center of Oyster Creek, for an angle corner of the herein described 253.9459 acre tract, at position X=3070445.97 and Y=13664456.69;

THENCE North 86°48'17" West, coincident with the center of said Oyster Creek, same being the eastern boundary line of said Dow Chemical Company called 2200.00 acre tract, a distance of 95.56 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3070350.57 and Y=13664462.02;

THENCE North 50°20'27" West, coincident with the center of said Oyster Creek, same being the eastern boundary line of said Dow Chemical Company called 2200.00 acre tract, a distance of 167.89 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3070221.34 and Y=13664569.15;

THENCE South 58°57'29" West, coincident with the center of said Oyster Creek, same being the eastern boundary line of said Dow Chemical Company called 2200.00 acre tract, a distance of 231.94 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3070022.64 and Y=13664449.57;

THENCE South 64°56'06" West, coincident with the center of said Oyster Creek, same being the eastern boundary line of said Dow Chemical Company called 2200.00 acre tract, a distance of 200.81 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3069840.77 and Y=13664364.50;

THENCE South 71^{0}27'25" West, coincident with the center of said Oyster Creek, same being the eastern boundary line of said Dow Chemical Company called 2200.00 acre tract, a distance of 167.54 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3069681.95 and Y=13664311.23;

THENCE South 72°26'51" West, coincident with the center of said Oyster Creek, same being the eastern boundary line of said Dow Chemical Company called 2200.00 acre tract, a distance of 163.69 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3069525.89 and Y=13664261.87;

THENCE North 65°25'18" West, coincident with the center of said Oyster Creek, same being the eastern boundary line of said Dow Chemical Company called 2200.00 acre tract, a distance of 616.31 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3068965,50 and Y=13664518.18;

THENCE North 25°33'14" West, coincident with the center of said Oyster Creek, same being the eastern boundary line of said Dow Chemical Company called 2200.00 acre tract, a distance of 127.46 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3068910.52 and Y=13664633.16;

THENCE North 40°17'50" West, coincident with the center of said Oyster Creek, same being the eastern boundary line of said Dow Chemical Company called 2200.00 acre tract, a distance of 91.09 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3068851.62 and Y=13664702.62;

THENCE North 57°02'38" West, coincident with the center of said Oyster Creek, same being the eastern boundary line of said Dow Chemical Company called 2200.00 acre tract, a distance of 593.09 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3068354.03 and Y=13665025.22;

THENCE North 57°05'03" West, coincident with the center of said Oyster Creek, same being the eastern boundary line of said Dow Chemical Company called 2200.00 acre tract, a distance of 431.11 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3067992.17 and Y=13665259.46;

THENCE North 85°03'03" West, coincident with the center of said Oyster Creek, same being the eastern boundary line of said Dow Chemical Company called 2200.00 acre tract, a distance of 347.11 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3067646.41 and Y=13665289.40;

THENCE North 33°31'34" West, coincident with the center of said Oyster Creek, same being the eastern boundary line of said Dow Chemical Company called 2200.00 acre tract, a distance of 417.72 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3067415.72 and Y=13665637.58;

THENCE North 30°51'45" West, coincident with the center of said Oyster Creek, same being the eastern boundary line of said Dow Chemical Company called 2200.00 acre tract, a distance of 339.42 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3067241.63 and Y=13665928.90;

THENCE North 19°07'25" West, coincident with the center of said Oyster Creek, same being the eastern boundary line of said Dow Chemical Company called 2200.00 acre tract, a distance of 292.69 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3067145.76 and Y=13666205.40;

THENCE North 20°23'27" West, coincident with the center of said Oyster Creek, same being the eastern boundary line of said Dow Chemical Company called 2200.00 acre tract, a distance of 59.87 feet to an angle corner of the herein described 253,9459 acre tract, at position X=3067124.90 and Y=13666261.51;

THENCE North 26°32'45" West, coincident with the center of said Oyster Creek, same being the eastern boundary line of said Dow Chemical Company called 2200.00 acre tract, a distance of 590.11 feet the northeastern corner of said Dow Chemical Company called 2200.00 acre tract, for an angle corner of the herein described 253.9459 acre tract, at position X=3066861.21 and Y=13666789.34;

THENCE South 85°57'59" West, coincident with the northern boundary line of said Dow Chemical Company called 2200.00 acre tract, at a distance of 157.48 feet pass a concrete monument stamped "H.R. RPLS 3987" found for reference, at a distance of 221.59 fee pass a concrete monument stamped "H.R. RPLS 3987" found marking an angle corner of said Dow Chemical Company called 2200.00 acre tract, continuing for a total distance of 286.89 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3066575.07 and Y=13666769.16;

THENCE North 21°28'49" West, a distance of 606.80 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3066352.90 and Y=13667333.73;

THENCE North 87°18'20" West, a distance of 276.15 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3066077.09 and Y=13667346.71;

THENCE North 67°35'27" West, a distance of 567.95 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3065552.10 and Y=13667563.20;

THENCE North 20°13'42" West, a distance of 408.36 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3065410.93 and Y=13667946.32;

THENCE North 5°11'02" East, a distance of 537.92 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3065459.52 and Y=13668481.97;

THENCE North 0°19'33" East, a distance of 66.25 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3065459.90 and Y=13668548.21;

THENCE North 14°46'28" West, a distance of 336.05 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3065374.21 and Y=13668873.11;

THENCE North 43°53'34" West, a distance of 220.37 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3065221.45 and Y=13669031.90;

THENCE North 66°50'16" West, a distance of 353.76 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3064896.25 and Y=13669171.02;

THENCE North 41°21'11" West, a distance of 410.23 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3064625.25 and Y=13669478.92;

THENCE North 34°07'59" West, a distance of 341.30 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3064433.77 and Y=13669761.38;

THENCE North 65°56'20" East, a distance of 406.57 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3064804.96 and Y=13669927.13;

THENCE South 34°42'38" East, a distance of 261.92 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3064954.09 and Y=13669711.85;

THENCE South 42°39'25" East, a distance of 274.76 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3065140,24 and Y-13669509.81;

THENCE South 70°43'34" East, a distance of 433.96 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3065549.83 and Y=13669366.58;

THENCE South 30°08'44" East, a distance of 686.43 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3065894.50 and Y=13668773.07;

THENCE South 5°24'33" West, a distance of 736.16 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3065825.12 and Y=13668040.29;

THENCE South 14°49'31" East, a distance of 183.32 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3065872.02 and Y=13667863.09;

THENCE South 67°44'24" East, a distance of 335.22 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3066182.22 and Y=13667736.13;

THENCE North 82°14'32" East, a distance of 180.83 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3066361.37 and Y=13667760.53;

THENCE North 74°19'52" East, a distance of 546.37 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3066887.37 and Y=13667908.07;

THENCE South 26°33'33" East, a distance of 431.41 feet to an angle corner of the herein described 253.9459 acre tract, at

position X=3067080.24 and Y=13667522.24;

THENCE South 1°22'22" East, a distance of 82.04 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3067082.20 and Y=13667440.24;

THENCE South 87°04'45" West, a distance of 235.69 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3066846.84 and Y=13667428.23;

THENCE South 3°13'28" East, a distance of 99.57 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3066852.44 and Y=13667328.83;

THENCE North 86°14'37" East, a distance of 57.88 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3066910.20 and Y=13667332.63;

THENCE South 20°31'17" East, a distance of 494.29 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3067083.45 and Y=13666869.77;

THENCE North 90°00'00" East, a distance of 59.69 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3067143.13 and Y=13666869,77;

THENCE South 25°58'34" East, a distance of 508.16 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3067365.67 and Y=13666413.01;

THENCE South 17°47'44" East, a distance of 315.51 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3067462.08 and Y=13666112.63;

THENCE South 33°38'11" East, a distance of 694.53 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3067846.75 and Y=13665534.46;

THENCE South 80°12'37" East, a distance of 272.18 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3068114.92 and Y=13665488,19;

THENCE South 56°31'49" East, a distance of 1057.94 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3068997.31 and Y=13664904.82;

THENCE South 38°30'32" East, a distance of 150.57 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3069091.05 and Y=13664787.01;

THENCE South 30°00'34" East, a distance of 127.42 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3069154.77 and Y=13664676.69;

THENCE South 66°49'16" East, a distance of 273.11 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3069405,80 and Y=13664569.20;

THENCE North 87°10'49" East, a distance of 453.47 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3069858,67 and Y=13664591.51;

THENCE North 53°34'25" East, a distance of 368.03 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3070154.75 and Y=13664810.01;

THENCE South 75°53'38" East, a distance of 215.10 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3070363.34 and Y=13664757.59;

THENCE South 49°29'08" East, a distance of 120.32 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3070454.80 and Y=13664679.44;

THENCE South 84°43'50" East, a distance of 823.89 feet to an angle corner of the herein described 253.9459 acre tract, at

position X=3071275.09 and Y=13664603.78;

THENCE North 82°56'01" East, a distance of 310.94 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3071583,63 and Y=13664642.03;

THENCE South 70°18'48" East, a distance of 419.14 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3071978.22 and Y=13664500.85;

THENCE South 61°46'42" East, a distance of 333.88 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3072272.36 and Y=13664342.99;

THENCE South 35°13'46" East, a distance of 497.48 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3072559.30 and Y=13663936.68;

THENCE South 0°15'29" East, a distance of 446.76 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3072561,31 and Y=13663489.99;

THENCE South 29°02'20" West, a distance of 490.79 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3072323.11 and Y=13663060.95;

THENCE South 49°49'44" West, a distance of 406,62 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3072012.45 and Y=13662798.69;

THENCE South 33°20'01" West, a distance of 643.40 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3071658.94 and Y=13662261.21;

THENCE South 6°14'43" West, a distance of 139.18 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3071643.80 and Y=13662122.88;

THENCE South 45°27'54" East, a distance of 336.40 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3071883.56 and Y=13661886.98;

THENCE South 80°41'12" East, a distance of 451.89 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3072329,44 and Y=13661813.85;

THENCE North 34°45'09" East, a distance of 372.23 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3072541.59 and Y=13662119.64;

THENCE North 63°14'47" East, a distance of 203.72 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3072723.48 and Y-13662211.34;

THENCE North 85°06'35" East, a distance of 808.25 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3073528.68 and Y=13662280.23;

THENCE North 44°23'54" East, a distance of 87.28 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3073589.74 and Y=13662342.58;

THENCE North 80°42'32" East, a distance of 134.62 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3073722.58 and Y=13662364.32;

THENCE South 22°27'25" East, a distance of 630.36 feet to an angle corner of the herein described 253.9459 acre tract, at position X=307396333 and Y=13661781.83;

THENCE South 81°17'59" West, a distance of 1003.16 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3072971.85 and Y=13661630.11;

THENCE South 73°23'56" West, a distance of 321.83 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3072663.48 and Y=13661538.18;

THENCE South 34°33'45" West, a distance of 82.03 feet to an angle corner of the herein described 253.9459 acre tract, at position X=3072616.95 and Y=13661470.64;

THENCE South 30°04'25" East, a distance of 458.86 feet to an angle corner of the herein described 253,9459 acre tract, at position X=3072846.86 and Y=13661073.60;

THENCE South 63°11'48" East, a distance of 521.42 feet to an angle corner of the herein described 253.9459 acre tract, to the **POINT OF BEGINNING,** containing 253.9459 acres of land, more or less.

TRACT II:

ALL THAT CERTAIN 31.1845 ACRE tract of land situated in the William Harris League, Abstract 71, Brazoria County Texas, being a portion of that certain 2682 acre tract conveyed by deed on January 1, 1918, from Bassett Blakely and wife, Bonnie Blakely to the Prison Commission of the State of Texas, as recorded in Volume 145, Page 304, Brazoria County Deed Records (B.C.D.R.), also based on the map of the Ramsey State Farm showing a survey by R. J. McMahon for the Texas Prison System dated January 1934 and indexed as Mao Counter Number 62997 in the Texas General Land office, said 31.1845 acre tract being more particularly described by metes and bounds using survey terminology which refers to the Texas State Plane Coordinate System, South Zone (NAD83), in which the directions are Lambert grid bearings and the distances are surface level horizontal lengths (S.F. = 0.99991812946) as follows:

COMMENCING at a concrete post found marking the southeast corner of all that certain called 2200.00 acre tract conveyed by deed on December 15, 2011 from the State of Texas to Dow Chemical Company as recorded in Clerk's File No. 2011-051639 of the Brazoria County Official Records (B.C.O.R.), the southwest corner of all that certain called 159 acre tract conveyed by deed on July 13, 2010 from the William Jackson Palmer Trust to the Ellen Taylor Palmer Trust and the David Kerr Palmer Trust, as recorded in Clerk's File No. 2010-031523 of the B.C.O.R., located on the northern boundary line of all that certain called 2111.72 acre tract conveyed by deed on May 17, 1949 from the United States of American (Reconstruction Finance Corporation) to the Dow Chemical Company as recorded in Volume 453, Page 607 of the B.C.D.R., said *Point of Commencement* being located at Texas State Plane coordinate position X=3074709.49 and Y=13655895.34;

THENCE North 3°10'58" West, coincident with the eastern boundary line of said Dow Chemical Company called 2200.00 acre tract, same being the western boundary line of said Ellen Taylor Palmer Trust and the David Kerr Palmer Trust called 159 acre tract, a distance of 2095.42 feet to a Prison Farm concrete monument (broken) found marking the northwest corner of said Ellen Taylor Palmer Trust and the David Kerr Palmer Trust called 159 acre tract, for an angle corner of said Dow Chemical called 2200 acre tract and the POINT OF BEGINNING of the herein described 31.1845 acre tract, at position X=3074593.17 and Y=13657987.25;

THENCE North 5°16'24" East, coincident with the eastern boundary line of said Dow Chemical Company called 2200.00 acre tract, a distance of 1927.75 to a concrete monument stamped "H.R. RPLS 3987" found marking an angle corner of said Dow Chemical called 2200.00 acre tract, at position X=3074770.32 and Y=13659906.58;

THENCE South 22°40'14" East, a distance of 517.53 feet to an angle coiner of the herein described 31.1845 acre tract, at position X=3074969.76 and Y=13659429,10;

THENCE South 24°54'08" East, a distance of 152.45 feet to an angle corner of the herein described 31.1845 acre tract, at position X=3075033.95 and Y=13659290.84;

THENCE South 27°37'07" East, a distance of 155.64 feet to an angle corner of the herein described 31.1845 acre tract, at position X=3075106.09 and Y=13659152.95;

THENCE South 30°15'14" East, a distance of 152.69 feet to an angle corner of the herein described 31.1845 acre tract, at position X=3075183.01 and Y=13659021.08;

THENCE South 33°01'39" East, a distance of 155.73 feet to an angle corner of the herein described 31.1845 acre tract, at position X=3075267.88 and Y=13658890.53;

THENCE South 35°32'11" East, a distance of 153.15 feet to an angle corner of the herein described 31.1845 acre tract, at

position X=3075356.88 and Y=13658765.92;

THENCE South 38°30'16" East, a distance of 155.49 feet to an angle corner of the herein described 31.1845 acre tract, at position X=3075453.67 and Y=13658644.25;

THENCE South 40°58'51" East, a distance of 115.66 feet to an angle corner of the herein described 31.1845 acre tract, at position X=3075529.51 and Y=13658556.95;

THENCE South 83°11'20" East, a distance of 818.95 feet to an angle corner of the herein described 31.1845 acre tract, at position X=3076342.57 and Y=13658459.84;

THENCE South 0°00'00" East, a distance of 351.48 feet a point located on the southern boundary line of said , same being the western boundary line of said Ellen Taylor Palmer Trust and the David Kerr Palmer Trust called 159 acre tract, to an angle corner of the herein described 31.1845 acre tract, at position X=3076342.57 and Y=13658108.41

THENCE South 85°57'40" West, a distance of 238,81 feet to an angle corner of the herein described 31,1845 acre tract, at position X=3076104.38 and Y=13658091.59;

THENCE South 86°03'01" West, a distance of 1515.01 feet to the **POINT OF BEGINNING,** containing 31,1845 acres of land, more or less.

NOTE: The company is prohibited from insuring the area or the quantity of the land described herein. Any statement in the above legal description of the area or quantity of land is not a representation that such area or quantity is correct, but is made only for informational and/or identification purposes, and does not override Item 2 of Schedule “B” hereof.

G.F. No. **18000747**

COMMITMENT FOR TITLE INSURANCE

SCHEDULE B

EXCEPTIONS FROM COVERAGE

In addition to the Exclusions and Conditions and Stipulations, your Policy will not cover loss, costs, attorneys' fees, and expenses resulting from:

1. ~~The following restrictive covenants of record itemized below (We must either insert specific recording data or delete this exception):~~

2. Any discrepancies, conflicts, or shortages in area or boundary lines, or any encroachments or protrusions, or any overlapping of improvements.

3. Homestead or community property or survivorship rights, if any, of any spouse of any insured. (Applies to the Owner's Policy only).

4. Any titles or rights asserted by anyone, including, but not limited to, persons, the public, corporations, governments or other entities,
   a. to tidelands, or lands comprising the shores or beds of navigable or perennial rivers and streams, lakes, bays, gulfs or oceans, or
   b. to lands beyond the line of harbor or bulkhead lines as established or changed by any government, or
   c. to filled-in lands, or artificial islands, or
   d. to statutory water rights, including riparian rights, or
   e. to the area extending from the line of mean low tide to the line of vegetation, or the rights of access to that area or easement along and across that area.

   (Applies to the Owner's Policy only.)

5. Standby fees, taxes and assessments by any taxing authority for the year 2018, and subsequent years; and subsequent taxes and assessments by any taxing authority for prior years due to change in land usage or ownership, but not those taxes or assessments for prior years because of an exemption granted to a previous owner of the property under Section 11.13, *Texas Tax Code*, or because of improvements not assessed for a previous tax year. (If Texas Short Form Residential Loan Policy of Title Insurance (T-2R) is issued, that policy will substitute "which become due and payable subsequent to Date of Policy" in lieu of "for the year 2018 and subsequent years.")

6. The terms and conditions of the documents creating your interest in the land.

7. Materials furnished or labor performed in connection with planned construction before signing and delivering the lien document described in Schedule A, if the land is part of the homestead of the owner. (Applies to the Loan Title Policy Binder on Interim Construction Loan only, and may be deleted if satisfactory evidence is furnished to us before a binder is issued.)

8. Liens and leases that affect the title to the land, but that are subordinate to the lien of the insured mortgage. (Applies to Loan Policy (T-2) only.)

9. The Exceptions from Coverage and Express Insurance in Schedule B of the Texas Short Form Residential Loan Policy of Title Insurance (T-2R). (Applies to Texas Short Form Residential Loan Policy of Title Insurance (T-2R) only.) Separate exceptions 1 through 8 of this Schedule B do not apply to the Texas Short Form Residential Loan Policy of Title Insurance (T-2R).

10. The following matters and all terms of the documents creating or offering evidence of the matters (We must insert matters or delete this exception.):

a. Rights of parties in possession. (Owners Policy Only)

b. Terms and provisions of any and all leases, together with rights of Lessees thereunder.

c. Any encroachment, encumbrance, violation, variation, or adverse circumstance affecting the Title that would be disclosed by an accurate and complete land survey of the Land. The term "encroachment" includes encroachments of existing improvements located on the Land onto adjoining land, and encroachments onto the Land of existing improvements located on adjoining land. (This exception will be deleted upon receipt and review of a satisfactory qualifying survey. The Company expressly reserves the right to take specific exception to any adverse matters reflected thereon.)

d. All leases, grants, exceptions or reservations of coal, lignite, oil, gas and other minerals, together with all rights, privileges, and immunities relating thereto, appearing in the Public Records whether listed in Schedule B or not. There may be leases, grants, exceptions or reservations of mineral interest that are not listed. **(Pursuant to Procedural Rule P-50.1 the above exception must appear on any corresponding policy issued if a T-19.2 or T-19.3 endorsement that meets underwriting standards is requested by the proposed insured.)**

e. Any portion of subject property that lies within the boundaries of any public or private roadway or used in connection therewith.

f. Pipeline right of way easement in favor of The Texas Pipe Line Company, as set forth in instrument recorded in Volume 326, Page 258, of the Deed Records of Brazoria County, Texas. (As to Abstract 71)

g. Right of way easement granted to Southwestern Bell Telephone Company as set forth by instrument recorded in Volume 434, Page 281 of the Deed Records of Brazoria County, Texas.

h. Terms conditions and stipulations as set forth in that certain Agreement filed for record in Volume 115, Page 195 of the Deed Records of Brazoria County, Texas.

i. Railroad right of way, as evidenced in deed filed for record in Volume 143, Page 132 of the Deed Records of Brazoria County, Texas.

j. Pipeline right of way easement 50 feet in width in favor of Phillips Pipe Line Company, a Delaware corporation, as set forth in instrument recorded in Volume 652, Page 217, of the Deed Records of Brazoria County, Texas. (As to Abstract 71 and Abstract 122)

k. Pipeline right of way easement 20 feet in width in favor of Phillips Petroleum Company, a Delaware corporation, as set forth in instrument recorded in Volume 951, Page 233, of the Deed Records of Brazoria County, Texas. (As to Abstracts 25, 71 and 122)

l. Pipeline right of way easement 33 feet in width in favor of Phillips Petroleum Company, as set forth in instrument recorded in Volume 1456, Page 990 , of the Deed Records of Brazoria County, Texas. (As to Abstract 71, Abstract 122 and Abstract 25)

m. Easement for electric distribution system 10 feet in width granted to Houston Lighting & Power Company as set forth in instrument filed for record under Brazoria County Clerk's File No. 94-005381. (As to Abstract 71)

n. Existing H.L. & P. Co. easements as shown on Sketch No. 93-352 attached to instrument filed for record under Brazoria County Clerk's File No. 94-005381. (As to Abstract 71)

o. Pipeline right of way easement 75 feet in width in favor of Texas Eastern Transmission Corporation as set forth in instrument recorded in Volume 678, Page 242 of the Deed Records of Brazoria County, Texas. (As to Abstract 25 and Abstract 122)

p. Pipeline right of way easement in favor of The Texas Pipe Line Company, as set forth in instrument recorded in

Volume 424, Page 203 of the Deed Records of Brazoria County, Texas. (as to Abstract 25)

q. Pipeline right of way easement of undisclosed location in favor of Tennessee Gas Transmission Company, as set forth in instrument recorded in Volume 625, Page 139 of the Deed Records of Brazoria County, Texas. (as to Abstract 25)

r. Pipeline right of way easement of undisclosed width and location in favor of Tennessee Gas Transmission Company, as set forth in instrument recorded in Volume 646, Page 587 of the Deed Records of Brazoria County, Texas. (as to Abstract 25)

s. Valve site easement in favor of Texas Eastern Transmission Corporation, as set forth in instrument recorded in Volume 88554, Page 267, of the Official Records of Brazoria County, Texas, renewed and extended by instrument filed for record under Brazoria County Clerk's File No. 97 43925. (As to Abstract 25)

t. All the oil, gas and other minerals, and all other elements not considered a part of the surface estate, the royalties, bonuses, rentals and all other rights in connection with same all of which are expressly excepted therefrom and not insured hereunder, as the same are set forth in instrument recorded in Volume 720, Page 500, of the Deed Records of Brazoria County, Texas. (Said interest not investigated subsequent to date of reservation or conveyance.) (As to a portion of Abstract 122)

u. All the oil, gas and other minerals, and all other elements not considered a part of the surface estate, the royalties, bonuses, rentals and all other rights in connection with same all of which are expressly excepted therefrom and not insured hereunder, as the same are set forth in instrument recorded in Volume 756, Page 523, of the Deed Records of Brazoria County, Texas. (Said interest not investigated subsequent to date of reservation or conveyance.) (As to a portion of Abstract 122)

v. The terms, conditions and stipulations of that certain Mineral Lease dated February 11, 1955, from W. Earl Murray and Julia M. Murray, et al, as Lessor, to John A. Newman, as Lessee, recorded in Volume 614, Page 99, of the Deed Records of Brazoria County, Texas. (The above lease not checked subsequent to date.) (As to a portion of Abstract 122)

w. The terms, conditions and stipulations of that certain Mineral Lease dated May 21, 1954, from Estella M. Southwell and husband, John H. Southwell, as Lessor, to John A. Newman, as Lessee, recorded in Volume 617, Page 82, of the Deed Records of Brazoria County, Texas. (The above lease not checked subsequent to date.) (As to a portion of Abstract 122)

x. The terms, conditions and stipulations of that certain Mineral Lease dated August 3, 1961, from Estella May Southwell and husband, John H. Southwell, as Lessor, to W. L. K. Trotter, as Lessee, recorded in Volume 816, Page 312, of the Deed Records of Brazoria County, Texas. (The above lease not checked subsequent to date.) (As to a portion of Abstract 122)

y. The terms, conditions and stipulations of that certain Mineral Lease dated December 9, 1976, from Bob Armstrong, Commissioner of the General Land Office of the State of Texas, as Lessor, to Geological Research Corporation, as Lessee, recorded in Volume 1326, Page 672, of the Deed Records of Brazoria County, Texas. (The above lease not checked subsequent to date.) (As to Tract Nos. 2-1, 3-1, F and H, Ramsey State Farm, Abstracts 71, 122 and 25)

z. The terms and provisions of those certain Mineral Leases to Prairie Producing Co, recorded in Volume 1492, Page 516, Volume 1492, Page 519 and Volume 1492, Page 522 of the Deed Records of Brazoria County, Texas. (The above leases not checked subsequent to date.) (As to a portion of Abstract 122)

aa. The terms and provisions of those certain Mineral Leases to Prairie Producing Co, recorded in Volume 1492, Page 525, of the Deed Records of Brazoria County, Texas. (The above leases not checked subsequent to date.) (As to a portion of Abstract 122)

bb. The terms and provisions of those certain Mineral Leases to Prairie Producing Co, recorded in Volume 1492, Page

499, Volume 1492, Page 503, Volume 1492, Page 505 , Volume 1492, Page 507, Volume 1492, Page 509, Volume 1492, Page 511, Volume 1492, Page 513, Volume 1495, Page 548 and Volume 1496, Page 655, of the Deed Records of Brazoria County, Texas. (The above leases not checked subsequent to date.) (As to a portion of Abstract 25)

cc. The terms, conditions and stipulations of that certain Mineral Lease dated effective October 17, 1979, from Bob Armstrong, Commissioner of the General Land Office of the State of Texas, as Lessor, to Davis Oil Company, as Lessee, recorded in Volume 1500, Page 105, of the Records of Brazoria County, Texas. (The above lease not checked subsequent to date.) (as to Tract D, Ramsey State Farm, Abstract 71)

dd. The terms, conditions and stipulations of that certain Mineral Lease dated June 8, 1981, from Bob Armstrong, Commissioner of the General Land Office of the State of Texas, as Lessor, to Davis Oil Company, as Lessee, recorded in Volume 1576, Page 744 , of the Records of Brazoria County, Texas. (The above lease not checked subsequent to date.) (As to Tract D, Ramsey State Farm, Abstract 71)

ee. The terms, conditions and stipulations of that certain Mineral Lease dated April 3, 1984, from Garry Mauro, Commissioner of the General Land Office of the State of Texas, as Lessor, to Spartan Petroleum Corporation, as Lessee, recorded in Volume 84 23, Page 826 the Official Records of Brazoria County, Texas. (The above lease not checked subsequent to date.) (As to Tract D of the Ramsey Unit, Abstract 71)

ff. The terms, conditions and stipulations of that certain Mineral Lease dated effective April 3, 1984, from Garry Mauro, Commissioner of the General Land Office of the State of Texas and the Board for Lease of Texas Department of Corrections, as Lessor, to Spartan Petroleum Corporation, as Lessee, recorded in Volume 84 32, Page 569, of the Official Records of Brazoria County, Texas. (The above lease not checked subsequent to date.) (As to Tract 2 of the Ramsey Unit, Abstract 25 and Abstract 122)

gg. The terms, conditions and stipulations of those certain Mineral Leases to Spartan Petroleum Corporation, as Lessee, recorded in Volume 84 36, Page 284, Volume 84 60, Page 969, Volume 84 60, Page 971and Volume 85114, Page 142, of the Official Records of Brazoria County, Texas. (The above leases not checked subsequent to date.) (As to a portion of Abstract 25)

hh. The terms, conditions and stipulations of those certain Mineral Leases to Spartan Petroleum Corp., as Lessee, recorded in Volume 84 63, Page 6, Volume 84 68, Page 638, Volume 84 68, Page 640, Volume 84 68, Page 642, Volume 84 68, Page 644, Volume 84 68, Page 648, Volume 84 68, Page 650, Volume 84 68, Page 653, Volume 84 72, Page 247 , Volume 84 72, Page 883, Volume 84 72, Page 885 , Volume 84 72, Page 887, Volume 84 72, Page 889, Volume 84 72, Page 891, Volume 84 72, Page 895, Volume 85 91, Page 251, Volume 86342, Page 41, Volume 86345, Page 340 , Volume 86345, Page 702, Volume 86349, Page 940 , Volume 86341, Page 561, Volume 86351, Page 518, Volume 86351, Page 520, Volume 86351, Page 522, Volume 86351, Page 524, Volume 86352, Page 604, Volume 86352, Page 606, Volume 86352, Page 608, Volume 86352, Page 610, Volume 86352, Page 612, Volume 86352, Page 614, Volume 86358, Page 160, Volume 86358, Page 162, Volume 86358, Page 164, Volume 86365, Page 643 and Volume 87372, Page 735 of the Official Records of Brazoria County, Texas. (The above lease not checked subsequent to date.) (As to a portion of Abstract 122)

ii. The terms, conditions and stipulations of that certain Mineral Lease dated September 16, 1986, from John Robert Evanhoe, as Lessor, to Spartan Petroleum, as Lessee, recorded in Volume 86341, Page 555, Volume 86341, Page 558 and Volume 86341, Page 561, of the Official Records of Brazoria County, Texas. (The above lease not checked subsequent to date.) (As to a portion of Abstract 122)

jj. The terms, conditions and stipulations of those certain Mineral Leases to Spartan Petroleum Corporation, as Lessee, filed for record under Brazoria County Clerk's File No. 93-039720, 93-039721, 93-039722, 93-039723and 93-039724, inclusive. (The above leases not checked subsequent to date.) (As to a portion of Abstract 122)

kk. The terms, conditions and stipulations of that certain Mineral Lease dated October 19, 1993, from Garry Mauro, Commissioner of the General Land Office of the State of Texas, as Lessor, to Eagle Oil & Gas Co., as Lessee, filed for record under Brazoria County Clerk's File No. 93-045084. (The above lease not checked subsequent to date.) (As to Tract K, Ramsey Unit, Abstract 122) ll. The terms, conditions and stipulations of that certain Mineral Lease dated December 16, 1994, from Garry Mauro, Commissioner of the General Land Office of the State of Texas, as Lessor, to Alamo Natural Resources, Inc., as Lessee, filed for record under Brazoria County Clerk's File No. 96-039283. (The above lease not checked subsequent to date.) (As to Tract D, Ramsey Unit, Abstract 71)

mm. The terms, conditions and stipulations of that certain Mineral Lease dated March 27, 2007, from Jerry E. Patterson, Commissioner of the General Land Office of the State of Texas, as Lessor, to Vinland Energy Capital I, L.P., as Lessee, filed for record under Brazoria County Clerk's File No. 2007021404. (The above lease not checked subsequent to date.) (As to Tract K, Ramsey Unit, Abstract 122)

nn. The terms and provisions of those certain Mineral Leases to Ressie Oil & Minerals Corporation, filed for record under Brazoria County Clerk's File No(s). 2008006500, 2008006501, 2008006502, 2008006503, 2008006504, 2008006505 , 2008006506, 2008006507, 2008006508, 2008006509, 2008006510, 2008006511, 2008006512, 2008006513, 2008006514, 2008006515, 2008006516, 2008006517, 2008006518 and 2008006519. (The above leases not checked subsequent to date.) (As to a portion of Abstract 122)

oo. Rights of the railroad company servicing the railroad siding located on insured premises in and to the ties, rails and other properties constituting said railroad siding, or, in and to the use thereof.

pp. It appears that the subject property has no means of access to any public road; accordingly, any policy issued will contain the following exceptions:

To The Owner Policy:
"Lack of a right of access to and from the land. Insuring provision Number Four (4) is hereby deleted."

To The Mortgagee Policy:
"Lack of a right of access to and from the land. Insuring provision Number Three (3) is hereby deleted."

qq. This Company shall have no liability for, nor responsibility to defend, any part of the property described herein against any right, title, interest, or claim (valid or invalid) of any character, had or asserted by the State of Texas, or by any other government or governmental authority, or by the public generally, in or to any portions of the herein described property that may be within the bed of Oyster Creek, or any easement along or abutting the same; or any filled-in portion thereof, artificial island therein, riparian or littoral rights pertaining thereto, and any areas affected by changes thereof due to erosion, evulsion or accretion.

G.F. No. **18000747**

COMMITMENT FOR TITLE INSURANCE

SCHEDULE C

Your Policy will not cover loss, costs, attorneys' fees, and expenses resulting from the following requirements that will appear as Exceptions in Schedule B of the Policy, unless you dispose of these matters to our satisfaction, before the date the Policy is issued:

1. Documents creating your title or interest must be approved by us and must be signed, notarized and filed for record.

2. Satisfactory evidence must be provided that:

   - no person occupying the land claims any interest in that land against the persons named in paragraph 3 of Schedule A,

   - all standby fees, taxes, assessments and charges against the property have been paid,

   - all improvements or repairs to the property are completed and accepted by the owner, and that all contractors, sub-contractors, laborers and suppliers have been fully paid, and that no mechanic's, laborer's or materialmen's liens have attached to the property,

   - there is legal right of access to and from the land,

   - (on a Loan Policy only) restrictions have not been and will not be violated that affect the validity and priority of the insured mortgage.

3. You must pay the seller or borrower the agreed amount for your property or interest.

4. Any defect, lien or other matter that may affect title to the land or interest insured, that arises or is filed after the effective date of this Commitment.

5. NOTE: We find no outstanding voluntary liens of record affecting the subject property. Inquiry should be made concerning the existence of any recorded or unrecorded lien or other indebtedness which could give rise to any security interest claim in the subject property.

6. We require compliance with Section 496.0021 of the Texas Government Code.

7. NOTE: This Commitment for Title Insurance (Form T-7) was prepared on the basis of an ordinary sales transaction. Should the transaction change, in any manner, including but not limited to a construction loan or a pass through transaction, the Company's examination personnel must be notified and the commitment amended accordingly.

8. We must be furnished with a current plat of survey containing the correct metes and bounds description of the property to be insured, made by a Licensed Public Surveyor of the State of Texas, acceptable to this Company. When same is submitted, it is to be returned to the Examiner for inspection and approval.

9. Subject property lies within the boundaries of Brazoria County Emergency Services District No. 3. (FOR INFORMATION PURPOSES ONLY)

NOTE TO ALL BUYERS, SELLERS BORROWERS, LENDERS AND ALL PARTIES INTERESTED IN THE TRANSACTION COVERED BY THIS COMMITMENT. THE FOLLOWING CONSTITUTES A MAJOR CHANGE IN THE PROCEDURES AND REQUIREMENTS FOR DISBURSEMENT OF FUNDS BY THE TITLE AGENT. TEXAS DEPARTMENT OF INSURANCE HAS ADOPTED PROCEDURAL RULE P-27 WHICH WILL REQUIRE THAT "GOOD FUNDS" BE RECEIVED AND DEPOSITED BEFORE A TITLE AGENT MAY DISBURSE FROM ITS TRUST FUNDS ACCOUNT. "GOOD FUNDS" IS DEFINED AS:

a. Cash or wire transfers;
b. Cashier's check. For purposes of this Rule, a cashier's check is defined to mean a check that is (1) drawn on a financial institution; (2) signed by an officer or employee of the financial institution on behalf of the financial institution as drawer; (3) a direct obligation of the financial institution; and (4) provided to a customer of the financial institution or acquired from the financial institution for remittance purposes.
c. Certified check. For purposes of this Rule, a certified check is defined to mean a check with respect to which the drawee financial institution certifies by signature on the check of an officer or other authorized employee of the financial institution that: (1) the signature of the drawer on the check is genuine; (2) the financial institution has set aside funds that are equal to the amount of the check and will be used to pay the check; or (3) the financial institution will pay the check upon presentment.
d. Teller's check. For purposes of this Rule, a teller's check is defined to mean a check (1) provided to a customer of a financial institution or acquired from a financial institution for remittance purposes, (2) that is drawn by the financial institution, and (3) is drawn on another financial institution or payable through or at a financial institution.
e. Any other instrument that has been determined by the Board of Governors of the Federal Reserve System to be the functional equivalent of a cashier's, certified or teller's check.
f Uncertified funds in amounts less than $1,500, including checks, traveler's checks, money orders, and negotiable orders of withdrawal; provided multiple items shall not be used to avoid the $1,500 limitation;
g. Uncertified funds in amounts of $1,500 or more, drafts, and any other items when collected by the financial institution;
h. State of Texas Warrants;
i. United States Treasury Checks;
j. Checks drawn on an insured financial institution and for which a transaction code has been issued pursuant to, and in compliance with, a fully executed Immediately Available Funds Procedure Agreement or a fully executed Immediately Available Funds Procedure Agreement (Agent Designation for Federally-insured Lender) with such financial institution;
k. Checks by city and county governments located in the State of Texas.

COMMITMENT FOR TITLE INSURANCE
SCHEDULE D

G.F. No. or File No. 18000747
Effective Date: February 28, 2018,

Pursuant to the requirements of Rule P-21, Basic Manual of Rules, Rates and Forms for the writing of Title Insurance in the State of Texas, the following disclosures are made:

1. The following individuals are directors and/or officers, as indicated, of the Title Insurance Company issuing this Commitment

DIRECTORS OF OLD REPUBLIC NATIONAL TITLE INSURANCE COMPANY

HARRINGTON BISCHOF	JOHN M. DIXON	STEVE R. WALKER
JAMES HELLAUER	ARNOLD L. STEINER	A. C. ZUCARO
DENNIS P. VAN MIEGHEM	JIMMY A. DEW	FREDERICKA TAUBITZ
RANDE K. YEAGER	CHARLES F. TITTERTON	SPENCER LEROY, III
STEVEN J. BATEMAN	GLENN W. REED	

OFFICERS OF OLD REPUBLIC NATIONAL TITLE INSURANCE COMPANY

MARK A. BILBREY, President	RANDE K. YEAGER, Chairman and CEO
CURTIS J. HOFFMAN, Executive Vice President	JEFFERY J. BLUHM, Executive Vice President
DANA C. SOLMS, Executive Vice President	MARK M. BUDZINSKI, Executive Vice President
DANIEL M. WOLD, Executive Vice President, Secretary, General Counsel	PATRICK A. CONNOR, Executive Vice President
GARY J. HORN, Executive Vice President	MIKE TARPEY, Vice President, Treasurer
CAROLYN J. MONROE, Executive Vice President	ROGER A. GAIO, Executive Vice President
CHERYL JONES, Executive Vice President	ROBERT E. ZELLAR, Executive Vice President
CHRIS G. LIESER, Executive Vice President	MICHAEL B. SKALKA, Executive Vice President

Shareholders owning, controlling or holding, either personally or beneficially, 10% or more of the shares of Old Republic National Title Insurance Company as of the last day of the year preceding the date herein above set forth are as follows: Old Republic Title Insurance Companies, Inc.-100%, a wholly owned subsidiary of Old Republic National Title Holding Company, a wholly owned subsidiary of Old Republic Title Insurance Group, Inc., a wholly owned subsidiary of Old Republic International Corporation.

2. The following disclosures are made by the Title Insurance Agent issuing this commitment:

OLD REPUBLIC NATIONAL TITLE INSURANCE COMPANY

(a) A listing of each shareholder, owner, partner or other person having, owning or controlling one (1%) or more of the Title Insurance Agent that will receive a portion of the premium as follows: Old Republic Title Insurance Companies, Inc.—100%

(b) A listing of each shareholder, owner, partner, or other person having, owning, or controlling ten percent (10%) or more of an entity that has, owns, or controls one percent (1%) or more of the Title Insurance Agent that will receive a portion of the premium are as follows. Same as Section 1.

(c) If the Agent is a corporation: (i) the name of each director of the Title Insurance Agent, and (ii) the names of the President, the Executive or Senior Vice-President, the Secretary and the Treasurer of the Title Insurance Agent. Directors: Same as Section 1

MARK A. BILBREY, President	JEFFERSON C. WEBB, Vice President, Houston Div. Manag
CURTIS HOFFMAN, Executive Vice President, SW Regional Mg	
AMY RODRIGUEZ, Vice President, DFW Manager	

3. You are entitled to receive advance disclosure of settlement charges in connection with the proposed transaction to which this commitment relates. Upon your request, such disclosure will be made to you. Additionally, the name of any person, firm or corporation receiving a portion of the premium from the settlement of this transaction will be disclosed on the closing or settlement statement.

You are further advised that the estimated title premium* is:

Owners Policy
Loan Policy
Total

Of this total amount: 15% will be paid to the policy issuing Title Insurance Company: 85% will be retained by the issuing Title Insurance Agent; and the remainder of the estimated premium will be paid to other parties as follows:

Amount	To Whom	For Services

*The estimated premium is based upon information furnished to us as of the date of this Commitment for Title Insurance. Final determination of the amount of the premium will be made at closing in accordance with the Rules and Regulations adopted by the Commissioner of Insurance.

This commitment is invalid unless the insuring provisions and Schedules A, B, and C are attached.

TEXAS TITLE INSURANCE INFORMATION

Title insurance insures you against loss resulting from certain risks to your title.	El seguro de titulo le asegura en relacion a perdidas resultantes de ciertos riesgos que pueden afectar el titulo de su propiedad.
The Commitment for Title Insurance is the title insurance company's promise to issue the title insurance policy. The Commitment is a legal document. You should review it carefully to completely understand it before your closing date.	El Compromiso para Seguro de Titulo es la promesa de la compania aseguradora de titulos de emitir la poliza de seguro de titulo. El Compromiso es un documento legal. Usted debe leerio cuidadosamente y entendario completamente antes de la fecha para finalizar su transaccion.

Your Commitment for Title Insurance is a legal contract between you and us. The Commitment is not an opinion or report of your title. It is a contract to issue you a policy subject to the Commitment's terms and requirements.

Before issuing a Commitment for Title Insurance (the Commitment) or a Title Insurance Policy (the Policy), the Title Insurance Company (the Company) determines whether the title is insurable. This determination has already been made. Part of that determination involves the Company's decision to insure the title except for certain risks that will not be covered by the Policy. Some of these risks are listed in Schedule B of the attached Commitment as Exceptions. Other risks are stated in the Policy as Exclusions. These risks will not be covered by the Policy. The Policy is not an abstract of title nor does a Company have an obligation to determine the ownership of any mineral interest.

-MINERALS AND MINERAL RIGHTS may not be covered by the Policy. The Company may be unwilling to insure title unless there is an exclusion or an exception as to Mineral and Mineral Rights in the Policy. Optional endorsements insuring certain risks involving minerals, and the use of improvements (excluding lawns, shrubbery and trees) and permanent buildings may be available for purchase. If the title insurer issues the title policy with an exclusion or exception to the minerals and mineral rights, neither this Policy, nor the optional endorsements, ensure that the purchaser has title to the mineral rights related to the surface estate.

Another part of the determination involves whether the promise to insure is conditioned upon certain requirements being met. Schedule C of the Commitment lists these requirements that must be satisfied or the Company will refuse to cover them. You may want to discuss any matters shown on Schedules B and C of the Commitment with an attorney. These matters will affect your title and your use of the land.

When your Policy is issued, the coverage will be limited by the Policy's Exceptions, Exclusions and Conditions, defined below.

- EXCEPTIONS are title risks that a Policy generally covers but does not cover in a particular instance. Exceptions are shown on Schedule B or discussed in Schedule C of the Commitment. They can also be added if you do not comply with the Conditions section of the Commitment. When the Policy is issued, all Exceptions will be on Schedule B of the Policy.

- EXCLUSIONS are title risks that a Policy generally does not cover. Exclusions are contained in the Policy but not shown or discussed in the Commitment.

- CONDITIONS are additional provisions that qualify or limit your coverage. Conditions include your responsibilities and those of the Company. They are contained in the Policy but not shown or discussed in the Commitment. The Policy Conditions are not the same as the Commitment Conditions.

You can get a copy of the policy form approved by the Texas Department of Insurance by calling the Title Insurance Company at 1-888-678-1700 or by calling the title insurance agent that issued the Commitment. The Texas Department of Insurance may revise the policy form from time to time.

You can also get a brochure that explains the policy from the Texas Department of Insurance by calling 1-800-252-3439.

Before the Policy is issued, you may request changes in the Policy. Some of the changes to consider are:

- Request amendment of the "area and boundary" exception (Schedule B, paragraph 2). To get this amendment, you must furnish a survey and comply with other requirements of the Company. On the Owner's Policy, you must pay an additional premium for the amendment. If the survey is acceptable to the Company and if the Company's other requirements are met, your Policy will insure you against loss because of discrepancies or conflicts in boundary lines, encroachments or protrusions, or overlapping of improvements. The Company may then decide not to insure against specific boundary or survey problems by making special exceptions in the Policy. Whether or not you request amendment of the "area and boundary" exception, you should determine whether you want to purchase and review a survey if a survey is not being provided to you.

- Allow the Company to add an exception to "rights of parties in possession." If you refuse this exception, the Company or the title insurance agent may inspect the property. The Company may except to and not insure you against the rights of specific persons, such as renters, adverse owners or easement holders who occupy the land. The Company may charge you for the inspection. If you want to make your own inspection, you must sign a Waiver of Inspection form and allow the Company to add this exception to your Policy.

The entire premium for a Policy must be paid when the Policy is issued. You will not owe any additional premiums unless you want to increase your coverage at a later date and the Company agrees to add an Increased Value Endorsement.

CONDITIONS AND STIPULATIONS

1. If you have actual knowledge of any matter which may affect the title or mortgage covered by this Commitment, that is not shown in Schedule B, you must notify us in writing. If you do not notify us in writing, our liability to you is ended or reduced to the extent that your failure to notify us affects our liability. If you do notify us, or we learn of such matter, we may amend Schedule B, but we will not be relieved of liability already incurred.

2. Our liability is only to you, and others who are included in the definition of Insured in the Policy to be issued. Our liability is only for actual loss incurred in your reliance on this Commitment to comply with its requirements or to acquire the interest in the land. Our liability is limited to the amount shown in Schedule A of this Commitment and will be subject to the following terms of the Policy: Insuring Provisions, Conditions and Stipulations and Exclusions.

OLD REPUBLIC TITLE

rev. 07/2016

FACTS	WHAT DOES OLD REPUBLIC TITLE DO WITH YOUR PERSONAL INFORMATION?

Why?	Financial companies choose how they share your personal information. Federal law gives consumers the right to limit some but not all sharing. Federal law also requires us to tell you how we collect, share, and protect your personal information. Please read this notice carefully to understand what we do.
What?	The types of personal information we collect and share depend on the product or service you have with us. This information can include: • Social Security number and employment information • Mortgage rates and payments and account balances • Checking account information and wire transfer instructions When you are *no longer* our customer, we continue to share your information as described in this notice.
How?	All financial companies need to share customers' personal information to run their everyday business. In the section below, we list the reasons financial companies can share their customers' personal information; the reasons Old Republic Title chooses to share; and whether you can limit this sharing.

Reasons we can share your personal information	Does Old Republic Title share?	Can you limit this sharing?
For our everyday business purposes - such as to process your transactions, maintain your account(s), or respond to court orders and legal investigations, or report to credit bureaus	**Yes**	**No**
For our marketing purposes - to offer our products and services to you	**No**	**We don't share**
For joint marketing with other financial companies	**No**	**We don't share**
For our affiliates' everyday business purposes - information about your transactions and experiences	**Yes**	**No**
For our affiliates' everyday business purposes - information about your creditworthiness	**No**	**We don't share**
For our affiliates to market to you	**No**	**We don't share**
For non-affiliates to market to you	**No**	**We don't share**

Questions	Go to www.oldrepublictitle.com (Contact Us)

Old Republic National Title Insurance Company

Who we are	
Who is providing this notice?	Companies with an Old Republic Title name and other affiliates. Please see below for a list of affiliates.

What we do	
How does Old Republic Title protect my personal information?	To protect your personal information from unauthorized access and use, we use security measures that comply with federal law. These measures include computer safeguards and secured files and buildings. For more information, visit http://www.OldRepublicTitle.com/newnational/Contact/privacy.
How does Old Republic Title collect my personal information?	We collect your personal information, for example, when you: • Give us your contact information or show your driver's license • Show your government-issued ID or provide your mortgage information • Make a wire transfer We also collect your personal information from others, such as credit bureaus, affiliates, or other companies.
Why can't I limit all sharing?	Federal law gives you the right to limit only: • Sharing for affiliates' everyday business purposes information about your creditworthiness • Affiliates from using your information to market to you • Sharing for non-affiliates to market to you State laws and individual companies may give you additional rights to limit sharing. See the "Other important information" section below for your rights under state law.

Definitions	
Affiliates	Companies related by common ownership or control. They can be financial and nonfinancial companies. • *Our affiliates include companies with an Old Republic Title name, and financial companies such as Attorneys' Title Fund Services, LLC, Lex Terrae National Title Services, Inc., Mississippi Valley Title Services Company, and The Title Company of North Carolina.*
Non-affiliates	Companies not related by common ownership or control. They can be financial and non-financial companies. • *Old Republic Title does not share with non-affiliates so they can market to you*
Joint marketing	A formal agreement between non-affiliated financial companies that together market financial products or services to you. • *Old Republic Title doesn't jointly market.*

Other Important Information

Oregon residents only: We are providing you this notice under state law. We may share your personal information (described on page one) obtained from you or others with non-affiliate service providers with whom we contract, such as notaries and delivery services, in order to process your transactions. You may see what personal information we have collected about you in connection with your transaction (other than personal information related to a claim or legal proceeding). To see your information, please click on "Contact Us" at www.oldrepublictitle.com and submit your written request to the Legal Department. You may see and copy the information at our office or ask us to mail you a copy for a reasonable fee. If you think any information is wrong, you may submit a written request online to correct or delete it. We will let you know what actions we take. If you do not agree with our actions, you may send us a statement.

Affiliates Who May be Delivering This Notice

American First Abstract, LLC	**American First Title & Trust Company**	**American Guaranty Title Insurance Company**	**Attorneys' Title Fund Services, LLC**	**Compass Abstract, Inc.**
eRecording Partners Network, LLC	**Genesis Abstract, LLC**	**Kansas City Management Group, LLC**	**L.T. Service Corp.**	**Lenders Inspection Company**
Lex Terrae National Title Services, Inc.	**Lex Terrae, Ltd.**	**Mara Escrow Company**	**Mississippi Valley Title Services Company**	**National Title Agent's Services Company**
Old Republic Branch Information Services, Inc.	**Old Republic Diversified Services, Inc.**	**Old Republic Exchange Company**	**Old Republic National Title Insurance Company**	**Old Republic Title and Escrow of Hawaii, Ltd.**
Old Republic Title Co.	**Old Republic Title Company of Conroe**	**Old Republic Title Company of Indiana**	**Old Republic Title Company of Nevada**	**Old Republic Title Company of Oklahoma**
Old Republic Title Company of Oregon	**Old Republic Title Company of St. Louis**	**Old Republic Title Company of Tennessee**	**Old Republic Title Information Concepts**	**Old Republic Title Insurance Agency, Inc.**
Old Republic Title, Ltd.	**Republic Abstract & Settlement , LLC**	**Sentry Abstract Company**	**The Title Company of North Carolina**	**Title Services, LLC**
Trident Land Transfer Company, LLC				

DELETION OF ARBITRATION PROVISION

(Not Applicable to the Texas Residential Owner's Policy)

ARBITRATION is a common form of alternative dispute resolution. It can be a quicker and cheaper means to settle a dispute with your Title Insurance Company. However, if you agree to arbitrate, you give up your right to take the Title Insurance Company to court and your rights to discovery of evidence may be limited in the arbitration process. In addition, you cannot usually appeal an arbitrator's award.

Your policy contains an arbitration provision (shown below). It allows you or the Company to require arbitration if the amount of insurance is $2,000,000 or less. If you want to retain your right to sue the Company in case of a dispute over a claim, you must request deletion of the arbitration provision before the policy is issued. You can do this by signing this form and returning it to the Company at or before the closing of your real estate transaction or by writing to the Company.

The Arbitration provision in the Policy is as follows:

> Either the Company or the Insured may demand that the claim or controversy shall be submitted to arbitration pursuant to the Title Insurance Arbitration Rules of the American Land Title Association (“Rules”). Except as provided in the Rules, there shall be no joinder or consolidation with claims or controversies of other persons. Arbitrable matters may include, but are not limited to, any controversy or claim between the Company and the Insured arising out of or relating to this policy, any service in connection with its issuance or the breach of a policy provision, or to any other controversy or claim arising out of the transaction giving rise to this policy. All arbitrable matters when the Amount of Insurance is $2,000,000 or less shall be arbitrated at the option of either the Company or the Insured, unless the Insured is an individual person (as distinguished from an Entity). All arbitrable matters when the Amount of Insurance is in excess of $2,000,000 shall be arbitrated only when agreed to by both the Company and the Insured. Arbitration pursuant to this policy and under the Rules shall be binding upon the parties. Judgment upon the award rendered by the Arbitrator(s) may be entered in any court of competent jurisdiction.

I request deletion of the Arbitration provision.

Signature	Date

Old Republic National Title Insurance Company

IMPORTANT NOTICE

To obtain information or make a complaint:

You may contact (Old Republic National Title Insurance Company 713-682-4144).

You may call Old Republic National Title Insurance Company's toll-free telephone number for information or to make a complaint at:

1-888-678-1700

You may also write to Old Republic National Title Insurance Company at:

400 Second Avenue South
Minneapolis, Minnesota 55401
Attn: Claims Department

You may contact the Texas Department of Insurance to obtain information on companies, coverages, rights or complaints at:

1-800-252-3439

You may write the Texas Department of Insurance:

P. O. Box 149104
Austin, TX 78714-9104
Fax: (512) 475-1771
Web: http://www.tdi.state.tx.us
E-mail: ConsumerProtection@tdi.state.tx.us

PREMIUM OR CLAIM DISPUTES:
Should you have a dispute concerning your premium or about a claim you should contact the Old Republic National Title Insurance Company first. If the dispute is not resolved, you may contact the Texas Department of Insurance.

ATTACH THIS NOTICE TO YOUR POLICY
This notice is for information only and does not become a part or condition of the attached document.

AVISO IMPORTANTE

Para obtener informacion o para someter una queja:

Puede cominicarse con su (Old Republic National Title Insurance Company 713-682-4144).

Usted puede llamar al numero de telefono gratis de Old Republic National Title Insurance Company para informacion o para someter una queja al:

1-888-678-1700

Usted tambien puede escribir a Old Republic National Title Insurance Company:

400 Second Avenue South
Minneapolis, Minnesota 55401
Attn: Claims Department

Puede comunicarse con el Departamento de Seguros de Texas para obtener informacion acerca de companies, coberturas, derechos o quejas al:

1-800-252-3439

Puede escribir al Departament de Seguros de Texas:

P. O. Box 149104
Austin, TX 78714-9104
Fax: (512) 475-1771
Web: http://www.tdi.state.tx.us
E-mail: ConsumerProtection@tdi.state.tx.us

DISPUTAS SOBRE PRIMAS O RECLAMOS:
Si tiene una disputa concerniente a su prima o a un reclamo, debe comunicarse con Old Republic National Title Insurance Company primero. Si no se resuelve la disputa, puede entonces comunicarse con el departmento (TDI).

UNA ESTE AVISO A SU POLIZA: Este aviso es solo para proposito de information y no se convierte en parte o condicion del documento adjunto.

AN "OUT-OF-COUNTY TITLE COMPANY" IS DEFINED TO BE A TITLE INSURANCE COMPANY, TITLE INSURANCE AGENT, OR ANY REPRESENTATIVE OR AGENT THEREOF, WHICH HAS NOT CONTRACTED WITH TITLE DATA TO ACCESS THE TITLE PLANT USED TO PREPARE A TITLE INSURANCE COMMITMENT. A LIST OF TITLE DATA'S SUBSCRIBERS IS AVAILABLE AT WWW.TITLEDATA.COM BY SELECTING THE *RESTRICTIONS* OPTION. THIS COVER LETTER *MUST* ACCOMPANY A TITLE INSURANCE COMMITMENT PROVIDED TO AN OUT-OF-COUNTY TITLE COMPANY

Required Language for a Title Insurance Commitment Cover Letter

The attached title insurance commitment contains information which has been obtained or derived from records and information owned by Title Data, Inc. or one of its subsidiaries (collectively "Title Data"). Title Data owns and maintains land title plants for Harris, Brazoria, Chambers, Fort Bend, Galveston, Jefferson, Liberty, Montgomery and Waller counties, Texas, and has granted our company a license to use one or more of these title plants.

Our company's right to access and use Title Data's title plants is governed by the agreement we have with Title Data. This agreement restricts who can receive and/or use a title insurance commitment which is based, in whole or in part, upon Title Data's records and information.

We are permitted by Title Data to provide your company with this title insurance commitment *if and only if* (i) your company is not licensed as a Texas title insurance agent or direct for the county to which this title insurance commitment pertains (unless you are licensed by virtue of a contract with Title Data to access its title plant for this county), (ii) your company is not under contract to a non-Title Data title plant service for the county to which this title insurance commitment pertains, (iii) your company does not maintain a "business presence" (as defined below) in the county to which this title insurance commitment pertains, and (iv) you use this title insurance commitment only for the purpose of your company closing a bona fide real estate transaction which, in your genuine belief, will result in the issuance of a title insurance policy (the foregoing collectively referred to herein as the "Eligibility Requirements"). In the event your company does not satisfy *all* of the Eligibility Requirements, immediately return this title insurance commitment to our company without reviewing, copying, or otherwise utilizing in any way the information contained therein.

Per our agreement with Title Data, a "business presence" is established when a company conducts a real estate closing using its own employees, its agents or its representatives. PLEASE NOTE: sign-ups, witness-only closings, accommodation closings, courtesy closings and similar activities (collectively referred to herein as a "sign-up") are considered to be a "real estate closing" per our agreement with Title Data, and mobile notaries and signing services are considered to be your "agent or representative."

In the event your company already has a business presence in the county to which this title insurance commitment pertains, or will have a business presence by virtue of the real estate transaction associated with this title insurance commitment, immediately return it to our company without reviewing, copying, or otherwise utilizing in any way the information contained therein.

In the event your company elects to conduct a real estate closing (including a sign-up) within the physical boundaries of the county to which this title insurance commitment pertains (either using your own employees, an agent or a representative), such conduct would constitute an automatic violation by our company of the terms and conditions of our agreement with Title Data, subjecting us to the assessment of liquidated damages by Title Data.

Therefore, as an express condition for us providing you with the attached title insurance commitment and your acceptance and use thereof, you specifically agree (i) that your company meets the Eligibility Requirements, (ii) the consummation of the real estate transaction associated with this title insurance commitment will not result in a violation of such Eligibility Requirements, (iii) not to furnish this title insurance commitment (or any copies thereof) to any title insurance company or agent, and (iv) to indemnify and hold harmless our company from and against any liquidated damages assessed against us by Title Data and all other liabilities, losses or damages incurred by us relating to, or arising out of, our company's providing this title insurance commitment to you.

IN THE EVENT YOUR COMPANY IS UNABLE OR UNWILLING TO COMPLY WITH THESE CONDITIONS, IMMEDIATELY RETURN THIS TITLE INSURANCE COMMITMENT TO OUR COMPANY, WITHOUT REVIEWING, COPYING, OR OTHERWISE UTILIZING IN ANY WAY THE INFORMATION CONTAINED THEREIN.

OLD REPUBLIC NATIONAL TITLE INSURANCE COMPANY

Important Notice

The attached title insurance commitment contains information which has been obtained or derived from records and information owned by Title Data, Inc. or one of its subsidiaries (collectively "Title Data"). Title Data owns and maintains land title plants for various Texas counties. Title Data created its title plants through the investment of extensive time, labor, skill and money. **The information contained in the title plants is protected by federal copyright law and Texas common law on trade secrets and contract**.

Title Data has granted our company a license to use one or more of its title plants. Our company's right to access and use Title Data's title plants is governed by our contract with Title Data. Our contract with Title Data restricts who can receive and/or use a title insurance commitment which is based, in whole or in part, upon Title Data's records and information.

Under the terms of our contract with Title Data, we are permitted to provide you with the attached title insurance commitment **for limited use and distribution only**. Specifically, you are sublicensed to deliver, exhibit, or furnish the attached title insurance commitment (or any copies thereof) **ONLY** to your bona fide employees and a third party who is playing a bona fide role in this proposed real estate transaction, including a lawyer, a lender, a surveyor, a real estate broker or agent, and the parties to this proposed transaction.

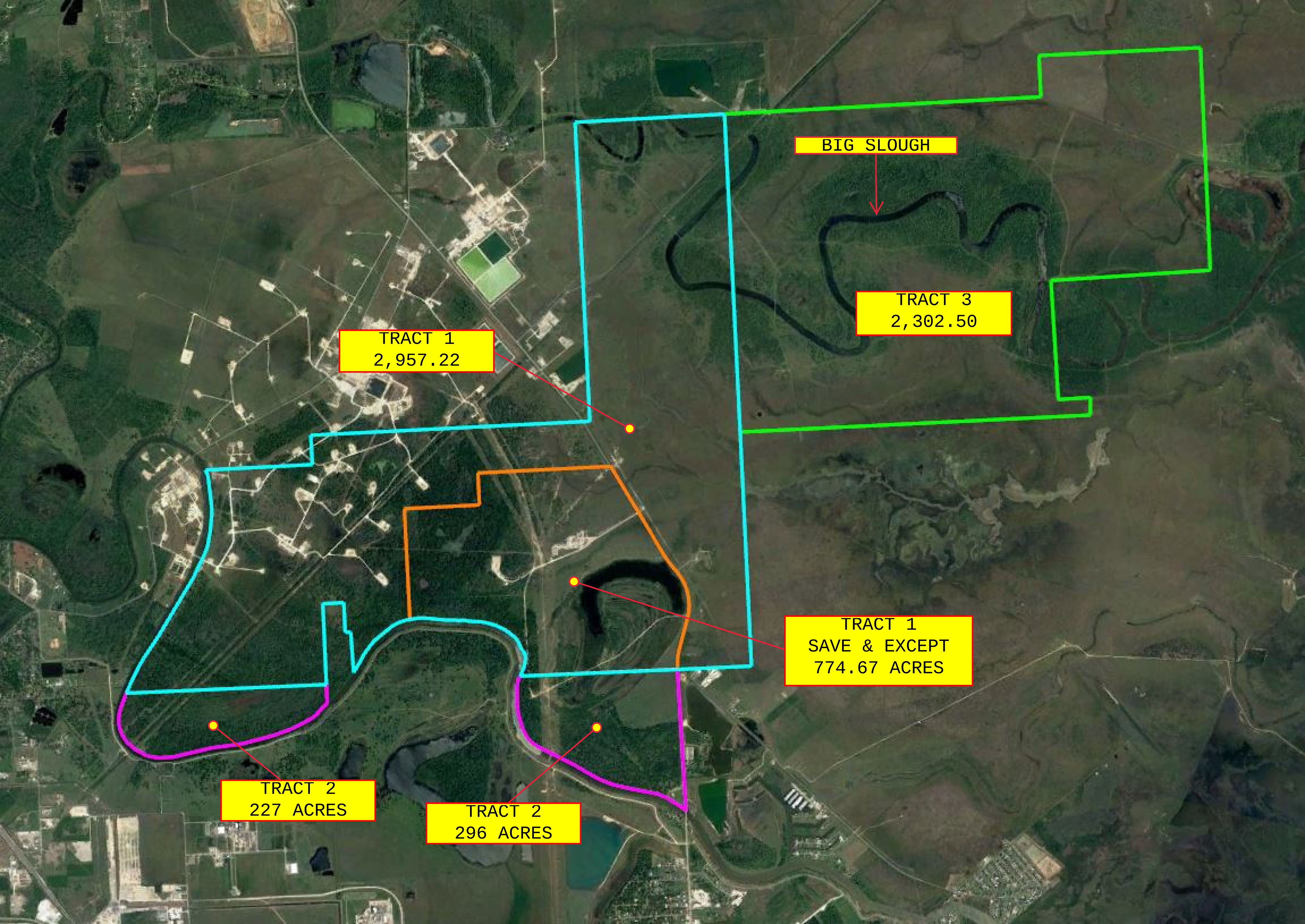
For purposes of our agreement with Title Data, "deliver, exhibit, or furnish" includes, without limitation, copying this title insurance commitment (whether such copying be by means of a photocopier, facsimile machine, another electronic scanning device, or any other method of reproduction) and providing such copy to any third party.

Your furnishing of the attached title insurance commitment to anyone not specifically enumerated above is not permitted by our contract with Title Data and constitutes a breach of our sublicense to you. Your furnishing of the attached title insurance commitment to anyone not specifically enumerated above is also a violation of federal copyright law and Texas common law.

Therefore, as an express condition of us providing you with the attached title insurance commitment, you specifically agree to limit its uses to those set forth herein, and to provide a copy of this letter to any party to whom you deliver, exhibit, or furnish the attached title insurance commitment (or any copies thereof).

In the event you are unable or unwilling to comply with these conditions, immediately return the attached title insurance commitment to our company, without reviewing, copying, or otherwise utilizing in any way the information contained therein.

A COPY OF THIS LETTER MUST ACCOMPANY THE ATTACHED TITLE INSURANCE COMMITMENT AT ALL TIMES. ALL DOWNSTREAM RECIPIENTS MUST PROVIDE A COPY OF THIS LETTER TO ANY OTHER AUTHORIZED USERS OF THE ATTACHED TITLE INSURANCE COMMITMENT.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SAVE & EXCEPT
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TRACT 2
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