SAND MANAGEMENT PLAN

1. INTRODUCTION

The City of Corpus Christi (City) conducts beach maintenance activities under Department of Army (DA) Permit No. SWG-2006-00647. This permit allows the movement of sand laterally (across-shore perpendicular to the shoreline) on the beach from the mean tide line (MTL)[1] to the toe of the dune and includes the following activities:

- Trench and bury seaweed above (landward of) the MTL and/or relocate seaweed and sand from the driving lanes to other areas above the MTL from April to November,
- Reposition sand from the toe of the dune line to the MTL across the beach, stopping short of the MTL in order to maintain clear driving lanes along the beach for public access from November to April,
- For a 4.17-mile section of beach located between Beach Marker #103 on the north side of Mustang Island State Park to Beach Marker #62 at the southern boundary of the City of Port Aransas, the City will also trench and bury seaweed below (seaward of) the MTL,
- Maintain a safety lane for the ingress and egress of emergency vehicles within a heavy tourist area between Newport Pass Beach Access Road and the north jetty of Packery Channel for 2 weeks every March (Spring Break) and 1 additional week between June 1 and September 15.

The City is requesting an amendment to this permit that would allow excess sand to be transported alongshore to another section of the beach within the originally defined project area[2] and shared littoral system. The purpose of this Sand Management Plan (Plan) is to provide recommendations on how, when, and where sand relocation occurs. Successful implementation of this plan will provide long-term opportunities for balancing public beach access and recreation, preservation of natural habitat, and coastal protection.

1.1 HISTORICAL BEACH WIDTH

As shown in Figure 1, beach width immediately north and south of the Packery Channel jetties increased 300 to 460 feet and 200 to 470 feet, respectively, between November 2004 and November 2019 (Texas A&M University – Corpus Christi Conrad Blucher Institute

[1] As referenced in Department of Army Permit No. SWG-2006-00647. The extension of time and amendment request include the Mean High Water (MHW) line as the Section 10 jurisdictional boundary and the annual High Tide Line (HTL) as the Section 404 jurisdictional boundary.
[2] Project area includes Placement Areas 4N and 4S defined in the *North Padre Island Storm Damage Reduction and Environmental Restoration Project Final Environmental Impact Statement* (USACE, 2003).

[TAMU-CC CBI], 2019). Jetty construction was completed in 2006. Net shoreline advance has been documented along two segments; 1) approximately 1,800 linear feet (LF) from Access Road 3A (located at the north end of the North Padre Island [NPI] Seawall) and the south jetty and 2) approximately 1,500 LF northward from the north jetty (2004-2019). Historical shoreline change rates from Paine and Caudle (2020) at the Bureau of Economic Geology (BEG) show a similar trend; for example, significant shoreline advance has occurred immediately north and south of Packery Channel from 1950 to 2019 (Figure 2).

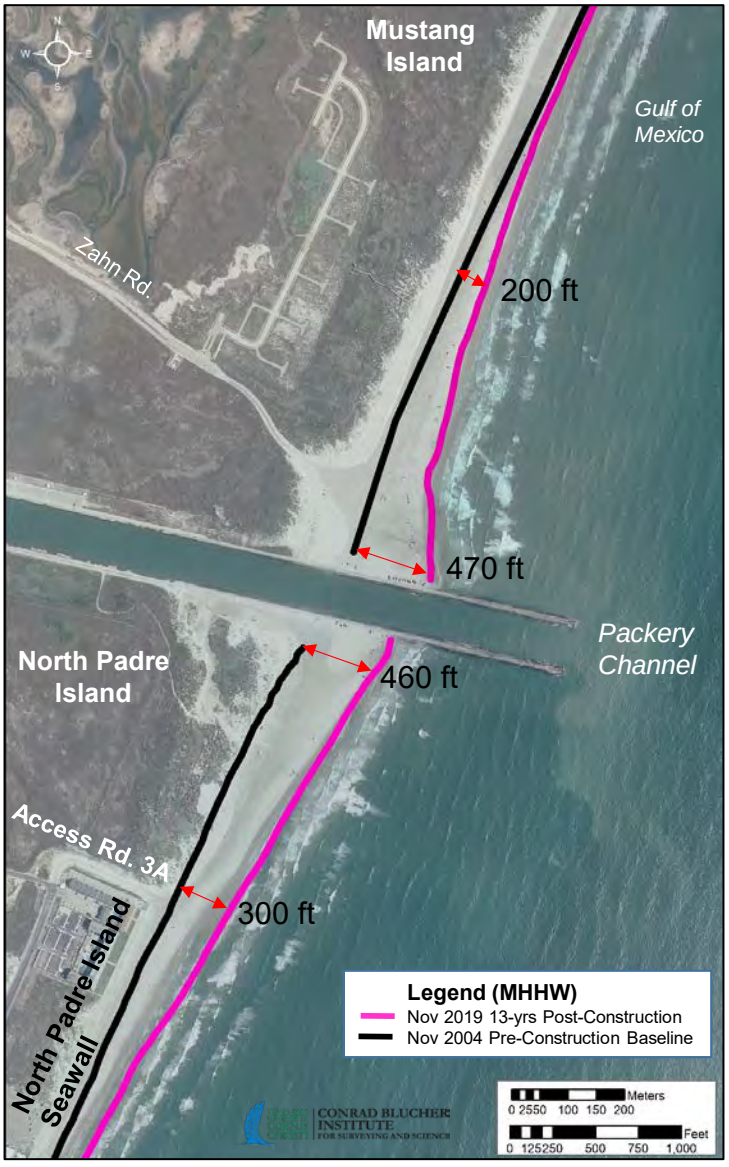

Figure 1. Shoreline Position between Novembers 2004 and 2019 (TAMU-CC CBI, 2019).

Figure 2. Shoreline Change Rate (ft/yr) from 1950 to 2019 (data from BEG [Paine and Caudle, 2020]).

Erosion has dominated along the beach located in front of the NPI Seawall and south to Access Road 4 since the seawall was constructed in the 1960's (Paine and Caudle, 2020; TAMU-CC CBI data [Williams, 2015]; HDR, 2009; Figure 3).

Figure 3. Historical Shoreline Change Rate (feet/year) at the NPI Seawall (data provided from BEG [Paine and Caudle, 2020]).

As discussed in HDR (2009), the beach along the seawall has historically eroded at an average rate of approximately 4 feet/year. In order to maintain safe public beach access for both pedestrians and vehicles, nourishing the beach along the seawall continues to be a high priority for the City. Maintaining a wide beach within this area also helps prevent structural damage to the NPI Seawall and other landward infrastructure (HDR, 2009).

1.2 DUNE PROTECTION AND BEACH ACCESS PLAN

The Texas Dune Protection Act and the Texas Open Beaches Act require local governments to adopt and implement programs for the protection of dunes and preservation of and access to public beaches. Under City Ordinance No. 028494 (City of Corpus Christi, 2010), and prior authorization by the General Land Office, vehicular traffic is restricted on the Gulf beach seaward of portions of the seawall when the width of the beach from the toe of the seawall to the mean high tide (MHT) line is less than 150 feet. The Ordinance also states that vehicular restrictions are expected to be short term due to planned renourishment of the beach that would maintain the beach to a minimum width of 200 feet.

Renourishment of the beach along the seawall was planned to occur primarily with dedicated sand sourcing from cyclic dredging of Packery Channel. This Beneficial Use of Dredged Material (BUDM) from Packery Channel is outlined in more detail in the *North Padre Island Storm Damage Reduction and Environmental Restoration Project Final Environmental Impact Statement* (U.S. Army Corps of Engineers [USACE], 2003). The narrow beach area that is a priority to the City is located within Placement Area (PA) 4S, an area identified in the Final Environmental Impact Statement (EIS) for the placement of material of high sand content from the construction and maintenance dredging of Packery Channel (USACE, 2003). The first beach nourishment within this area was completed during the construction of Packery Channel in 2005/2006. The second beach nourishment was completed during the 2012/2013 maintenance dredging event. The third beach nourishment has not yet occurred, but is planned for 2020 or 2021.

Postponement of the third beach nourishment has resulted in a beach width of less than 200 feet (TAMU-CC CBI, 2019). Without beach nourishment, the beach width in front of the NPI Seawall currently does not meet City Ordinance requirements and requires the installation of bollards to restrict vehicular access as a safety practice for recreational users. . Recent assessment by TAMU-CC CBI (2019) has determined that the volume of sand available for dredging in Packery Channel is not sufficient to meet the cyclic need of sand to maintain the beach at a 200-foot width along the NPI Seawall. Therefore, the alongshore redistribution of excess sand near the inlet is recommended as part of a long-term management solution to meet the need for a compatible supplementary sand source.

1.3 TEXAS ADMINISTRATIVE CODE

Per 31 Texas Administrative Code Section 15.4(c)(1)(B), sand may only be moved off-site from a Texas beach for the purpose of beach nourishment if the historical accretion rate is greater than two feet per year and the project does not cause any adverse effects on the sediment budget. The Texas General Land Office's (GLO's) Beach Access and Dune Protection Program is required to use the BEG's historical shoreline change rate data to determine if an area is eroding or accreting. According to the GLO, the historical time period required for determining erosion and accretion for all construction projects along the Texas coast is from the 1950s to 2012, even if there has been anthropogenic alteration to the site during the historical time period (M. Culver [GLO], personal communication, April 17, 2020).

Based on the historical shoreline change rates provided from the BEG (Paine and Caudle, 2020), the majority of beach in Nueces County is eroding, and GLO regulations would prevent this sand from being relocated offsite. However, upon further review of the shoreline change trends and additional discussion with the City, GLO has indicated that they may consider 1,500 linear feet of beach on either side immediately adjacent to Packery Channel, and beach from the north end of the NPI Seawall to Whitecap Boulevard, as one site (M. Culver [GLO], personal communication, April 17, 2020). As such, sand relocated within these beach reaches would not necessarily be moved off-site and may be considered appropriate by the GLO for sand removal and placement alongshore. The City proposes that an additional approximately 1,400 linear feet of beach from the south end of the NPI Seawall to Access Road 4 be considered one "on-site" location and included in the placement area for the proposed sand relocation described in more detail in Section 2. Previous placement of sand during BUDM nourishment has extended beyond the limit of the NPI seawall in order to gradually taper the fill so that the interface and change in shoreline position between the placement area and the unaltered beach beyond Access Rd. 4 to the south is gradual. Excluding this segment of beach from the sand management plan would limit the long-term success of the proposed ongoing restoration activities. The City has been coordinating the Sand Management Plan with the GLO in regards to their beach and dune requirements.

2. SAND REMOVAL AND BEACH NOURISHMENT

The City is proposing to relocate excess sand that accumulates immediately north and south of the Packery Channel jetties to supplement cyclic placement of BUDM from the channel along the historically eroding areas in front of the NPI Seawall and south to Access Road 4. The proposed Sand Removal Areas (SRAs) will include 1,500 LF of beach on either side of and immediately adjacent to Packery Channel, respectively SRA 1 (north) and SRA 2 (south) (Figure 4). No sand or other material would be removed seaward of the mean high water (MHW) line (Figure 5).

Figure 4. Proposed Sand Removal and Sand Placement Areas.

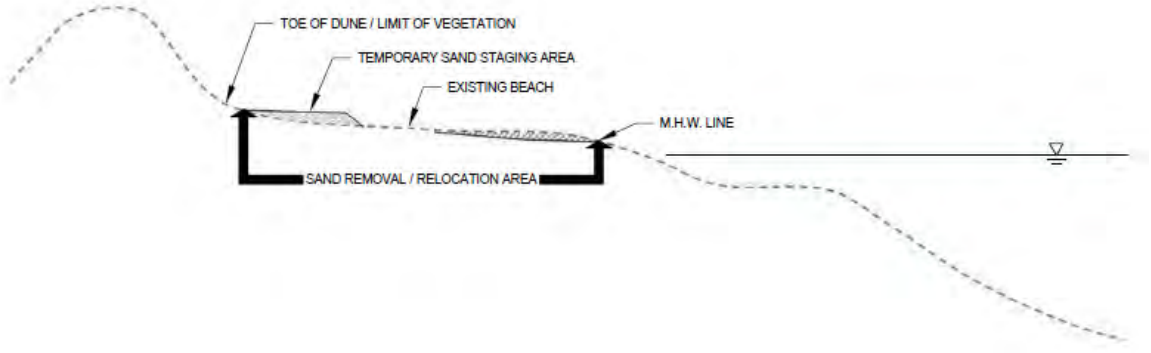

Figure 5. Typical Section of Sand Removal Areas.

Under DA Permit No. SWG-2006-00647, the City stages *Sargassum* and other natural vegetation (herein referred to as 'seaweed') and excess sand at the dune toe (April to November), and redistributes it across the beach to maintain safe driving lanes (November to April). Instead of only moving the sand across-shore, the City proposes to use the excess sand from SRA 1 and SRA 2 as beach nourishment material for placement along approximately 5,700 LF of eroding beach in front of the seawall and south to Access Road 4 (Sand Placement Area [SPA]). Relocation of accumulated sand to the SPA will mimic the natural longshore sand transport that occurred prior to jetty construction. The sand relocation process will help maintain the required beach width of 200 feet.

2.1 OPERATIONS PLAN

Current beach maintenance practice varies by season and beach conditions. Seaweed volumes are naturally higher in the Gulf of Mexico and on the Gulf beaches during the spring and early summer months, which is also when the Spring Break and summertime tourist seasons bring an increase in the number of recreational users (HDR, 2014). The City maintains safe driving conditions by repositioning sand and seaweed on the beach. Neither sand nor seaweed are removed from the beach system between the dunes and the surf. Similarly, the proposed relocation of staged sand will keep sand within the same beach system between the dunes /seawall and the surf. No sand will be taken offsite.

The City will continue to stage excess sand and seaweed at the toe of the dune in temporary staging areas, and will continue to redistribute staged sand across the beach within the SRAs to maintain safe driving conditions per their existing DA Permit (SWG-2006-00647). The City will continue to use 3.5 yard to 4 yard articulated front-end loaders and motor graders during a heavy *Sargassum* season (April to August) and 1 yard articulated front-end loaders that pull rakes when seaweed is lighter. Based on five years of monitoring,

there is no clear correlation between observed variations in beach profile and the City's beach maintenance practices (HDR, 2014). As such, the current beach maintenance activities that include the movement of seaweed and sand across the beach as described in DA Permit SWG-2006-00647 are not anticipated to adversely affect the beach profile.

The City is requesting to amend their permit to include moving some of the temporarily staged sand to the SPA. A total of up to approximately 11,000 cubic yards of beach quality sand that is compatible with existing material on the beach will be placed along an approximately a 5,700-foot stretch of beach in front of the seawall and south to Access Road 4 per year. The proposed design, in combination with cyclic placement of BUDM from Packery Channel, will support maintaining a beach width of 150 to 200 feet along the seawall for longer periods than relying on cyclic placement of BUDM alone (Figure 6).

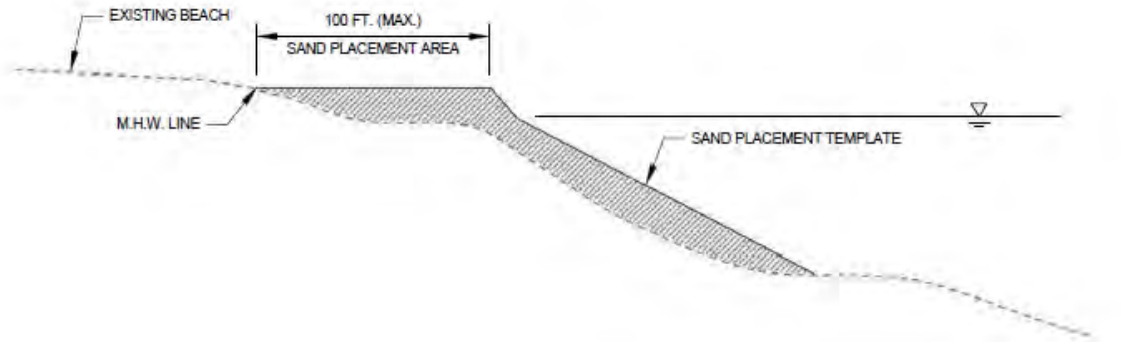

Figure 6. Proposed Sand Placement Beach Profile.

Total cubic yards of sand relocated from the SRAs to the SPA will differ each year based on environmental factors and how frequently dredged material is placed along the seawall. However, based on historical tends since jetty construction, the maximum amount of sand needed to accomplish the proposed design in any given year is estimated to be approximately 11,000 cubic yards, although higher losses can be experienced immediately following BUDM placement. The relative effectiveness of this proposed sand management plan on extending the lifespan of the BUDM placement depends, in part, on; 1) implemented upon completion of restoration of the beach to the design width of 200 feet, 2) following design placement criteria (effectiveness of placement strategy), and 3) absence of storms of significance. Therefore, monitoring has been designed to track the success of placement practices and support adaptable management strategies.

The City will monitor beach widths prior to the removal of staged sand from the SRAs (see Section 3. Monitoring Plan). Staged sand will not be removed if vegetation has begun to establish. No sand redistribution will occur if the beach width within the SRAs is less than or equal to 250 feet. A beach width threshold of 250 feet will allow for average 100-foot event and/or seasonal beach width recession while maintaining a minimum overall beach

width of 150 feet. Therefore, the proposed redistribution of sand from the SRAs to the SPA in front of the seawall is not anticipated to result in adverse impacts to the beach profile and will ultimately result in a net gain in beach width and increased stability over time.

The City will use dump trucks to haul staged sand from the SRAs to the SPA. Truck haul routes will include Zahn Road, TX-361, Park Road 22, Windward Drive, Access Road 3a, Whitecap Boulevard, and Access Road 4 (Figure 7). Sand will be relocated primarily during the winter season when beach recreation is lightest and beach conditions are optimal, but event driven relocation should be anticipated and planned for both due to high volume of excess sand and localized need due to erosion during the event. Sand relocation is expected to occur approximately one to three times per winter season. However, a high volume of excess sand or sand event can occur when persistent soft sand on the beach results in frequent driving hazards on the beach, including the inability of the public to access the beach using 2WD vehicles and potential to limit emergency access. Excess sand occurs across the beach profile and within staging areas where it can become infeasible to manage with traditional methods, and where it can encroach on emergency and public driving lanes. Localized accumulations of sand in excess of 2 feet can occur during these events. Additional sand removal would be performed during these sand events even if outside the winter season. The USACE and GLO will be notified prior to each relocation event.

The City will maintain active work areas on the beach within the SPA that are restricted from public access for safety reasons. Active work areas and construction access routes on the beach will be delineated by safety fencing and posted with warning signs to prevent incidental entry by public.

Figure 7. Temporary Truck Routes/Haul Roads for Sand Relocation.

3. MONITORING PLAN

The City will be responsible for monitoring and documenting conditions of the sand storage areas and beach widths within the SRAs and SPA. If conditions suitable to vegetative growth are imminent within SRAs, sand would be moved to the SPA. The motivation is to utilize excess sand beneficially in erosive areas before vegetation can initiate. If an area becomes vegetated, it would be documented by the City and left intact. Sand redistribution will not occur if the beach width within the SRAs is less than or equal to 250 feet. The City will document the recovery of the beach within the SRAs over multiple seasonal timeframes (e.g., March, July, and September) prior to reinstating sand redistribution. The City will also document the recovery of the beach within the SPA after nourishment activities.

The seasonal assessments will include:

1. Survey of the shoreline position (RTK GPS from waterline to toe of dune),
2. Tracking location of placement areas (topographic surveys),
3. Trend analysis,
4. Reporting of minimum beach width at northern and southern limits based on seasonal surveys,
5. Estimation of volume of temporary staging areas and relocated sand volume.

4. ADAPTIVE MANAGEMENT PLAN

Beach systems are dynamic with a multitude of natural and anthropogenic influences that can alter in the future. The purpose of this adaptive management plan is to use performance measures and thresholds to determine beach nourishment progress within the SPA and support decisions on the need to adjust the proposed sand redistribution plan to accomplish safe beach widths in front of the seawall while also sustaining the beach profile within the SRAs.

The proposed sand redistribution plan includes the smallest amount of fill material needed to combat erosional forces in front of the seawall and increase the beach width to one determined safe for vehicular access and recreational use. Analysis of shoreline and volumetric change since Packery Channel was constructed indicates that the beach fronting the NPI Seawall will continue to erode under forcing by natural coastal processes because the area is located outside of the sheltered area developed by the jetties at Packery Channel. Continued erosion along the NPI Seawall will require beach nourishment through BUDM from Packery Channel. However, supplemental sand will also be needed to offset the volume deficit caused by the increased time (as compared to initial estimates) between channel dredging events. The proposed use of excess sand from the SRAs is currently the most practicable and environmentally-sound sand source for the City. Additional sand from

future dredging of Packery Channel, upland sand sources, or other unforeseen projects/sources may be applicable in the future.

The City will coordinate with the GLO and USACE regarding the potential to expand the SRAs and SPA based on assessment of the survey data after a period of 5 years. Expansion of these areas is important to support adaptive management in the future.

5. REFERENCES

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