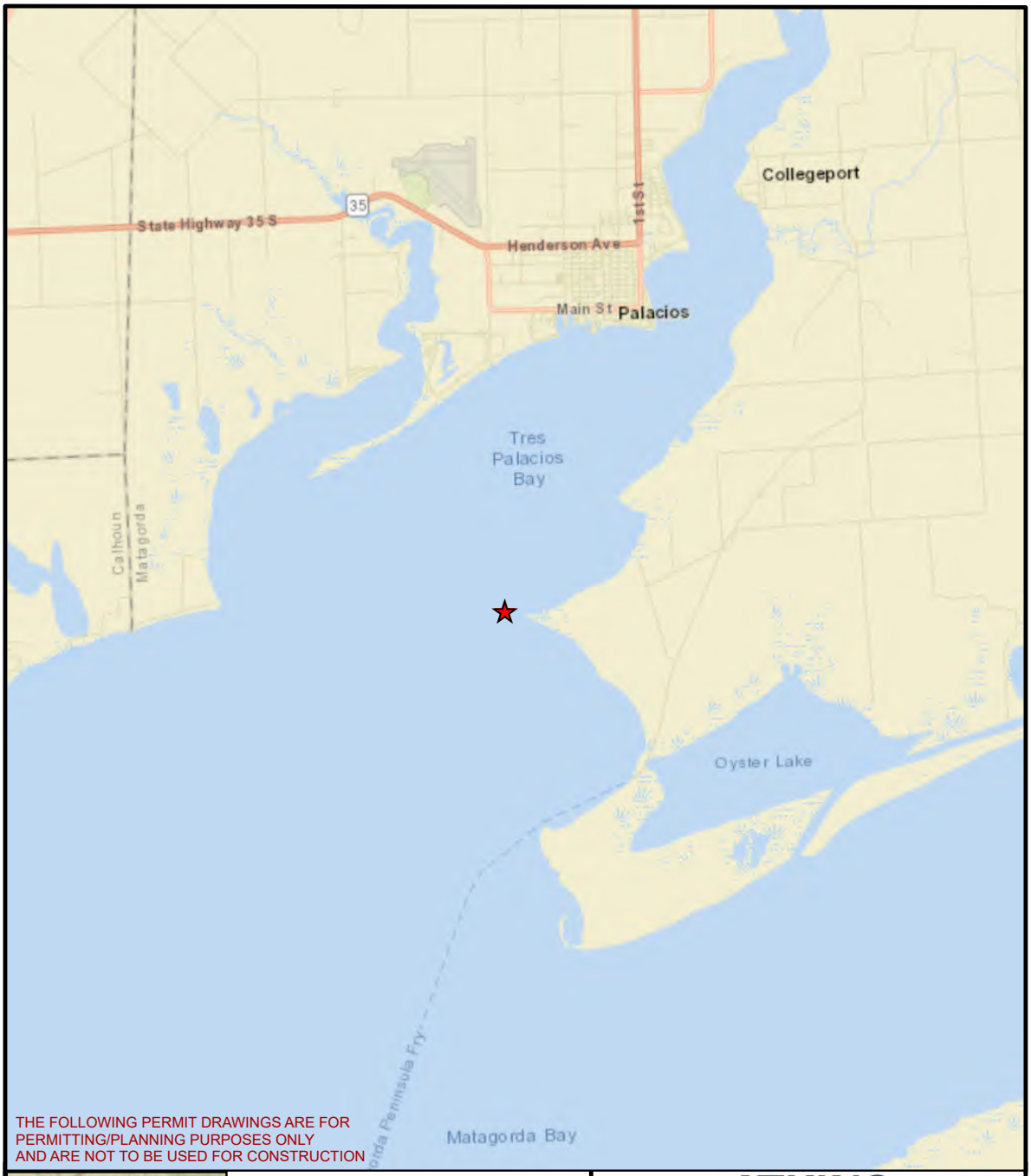

Project Location is
28.643607 Latitude
-96.241559 Longitude
Turtle Point and Palacios Quadrangles
NAD 83 State Plane Texas South Central

★ Project Area

Datum: NAD 1983
Projection: State Plane Texas South Central
Units: Feet
Basemap: ESRI Streets

0 1 2 Miles

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Sheet 1 of 20
Vicinity Map

Oliver Point/Oliver Reef Restoration Project

TXGLO, Matagorda Bay Foundation, and US Fish and Wildlife Service
Matagorda County, Texas

Job No.: 100076548	Scale: 1 " = 2 miles
Prepared By: ATKINS/WHIT6392	Date: Apr 06, 2023

N:\Clients\G_H\GLO\100076548\geo\figs\permit\permit_vicinity.aprx

Esri, DeLorme, HERE, USGS, Intermap, iPC, NRCAN, METI, TomTom. World Street Map. Sept. 2020.
1:126,720; generated by Atkins; using ArcMap. <http://server.arcgisonline.com/ArcGIS/rest/services/World_Street_Map/MapServer> (06 April 2023)

1. ENGINEER OF RECORD IS THE ENGINEER RESPONSIBLE FOR THE DESIGN OF THE PROJECT:
   CONTACT: CHRISTIN PERKINSON, P.E.
   ATKINS NORTH AMERICA, INC. 100
   PARAMOUNT DRIVE, STE 207 SARASOTA,
   FLORIDA 34232
   EMAIL: CHRISTIN.PERKINSON@ATKINSGLOBAL.COM
   PHONE: (941) 225-4828

2. ALL ELEVATIONS ARE IN FEET AND ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).

3. GRID COORDINATES ARE IN FEET, AND ARE REFERENCED TO THE STATE PLANE TEXAS SOUTH CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983 (NAD83).

4. MAGNETOMETER AND BATHYMETRIC SURVEY DATA SHOWN PROVIDED BY: T.BAKER SMITH, LLC AND TAKEN FROM JUNE 22 - 24, 2022. REFERENCE CONTROL MONUMENTS INCLUDED:
   '877 3156 90034 H'
   NORTH: 13,447,551.1 EAST: 2,855,991.4 ELEV: 11.2

5. GEOTECHNICAL BORINGS COLLECTED BY TOLUNAY-WONG ENGINEERS, INC. IN OCTOBER 2022.

6. MEAN HIGHER HIGH WATER (MHHW), MEAN HIGH WATER (MHW), MEAN LOW WATER (MLW), AND MEAN LOWER LOW WATER (MLLW), BASED ON THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION STATION 8773701 IN PORT O'CONNOR, TX.

WATER LEVELS, FT (NAVD88) PORT O'CONNOR, TX STATION ID: 8773701	
MHHW	+1.10
MHW	+1.09
MLW	+0.40
MLLW	+0.38

7. ARMOR STONE WITH A BULK SPECIFIC GRAVITY OF AT LEAST 2.58, MEDIAN DIAMETER OF 2.0 FEET, AND MINIMUM UNIT WEIGHT OF 165 PCF.

8. BEDDING STONE MUST HAVE A MINIMUM UNIT WEIGHT OF 165 PCF AND A MEDIAN DIAMETER OF 0.25 FEET. MINIMUM BEDDING STONE LAYER THICKNESS OF 1.0 FEET OR AS SHOWN ON DESIGN DRAWINGS.

9. CURRENT STRUCTURE LAYOUTS ARE BASED ON THE CURRENT BEST AVAILABLE SURVEY DATA AND MAY CHANGE BASED ON FUTURE SURVEY DATA.

10. AERIAL PHOTOGRAPH IS REPRESENTATIVE OF THE CONDITIONS AT THE TIME.

11. PERMITTED FOOTPRINT TO ACCOUNT FOR VARIATIONS IN SITE CONDITIONS AT THE TIME OF CONSTRUCTION.

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Sheet 2 of 20
Notes/Information

Oliver Point/Oliver Reef Restoration Project

TXGLO, Matagorda Bay Foundation,and US Fish and Wildlife Service
Matagorda County, Texas

Job No.: 100076548	Scale: Not to Scale
Prepared By: Atkins/WHIT6392	Date: Apr 06, 2023

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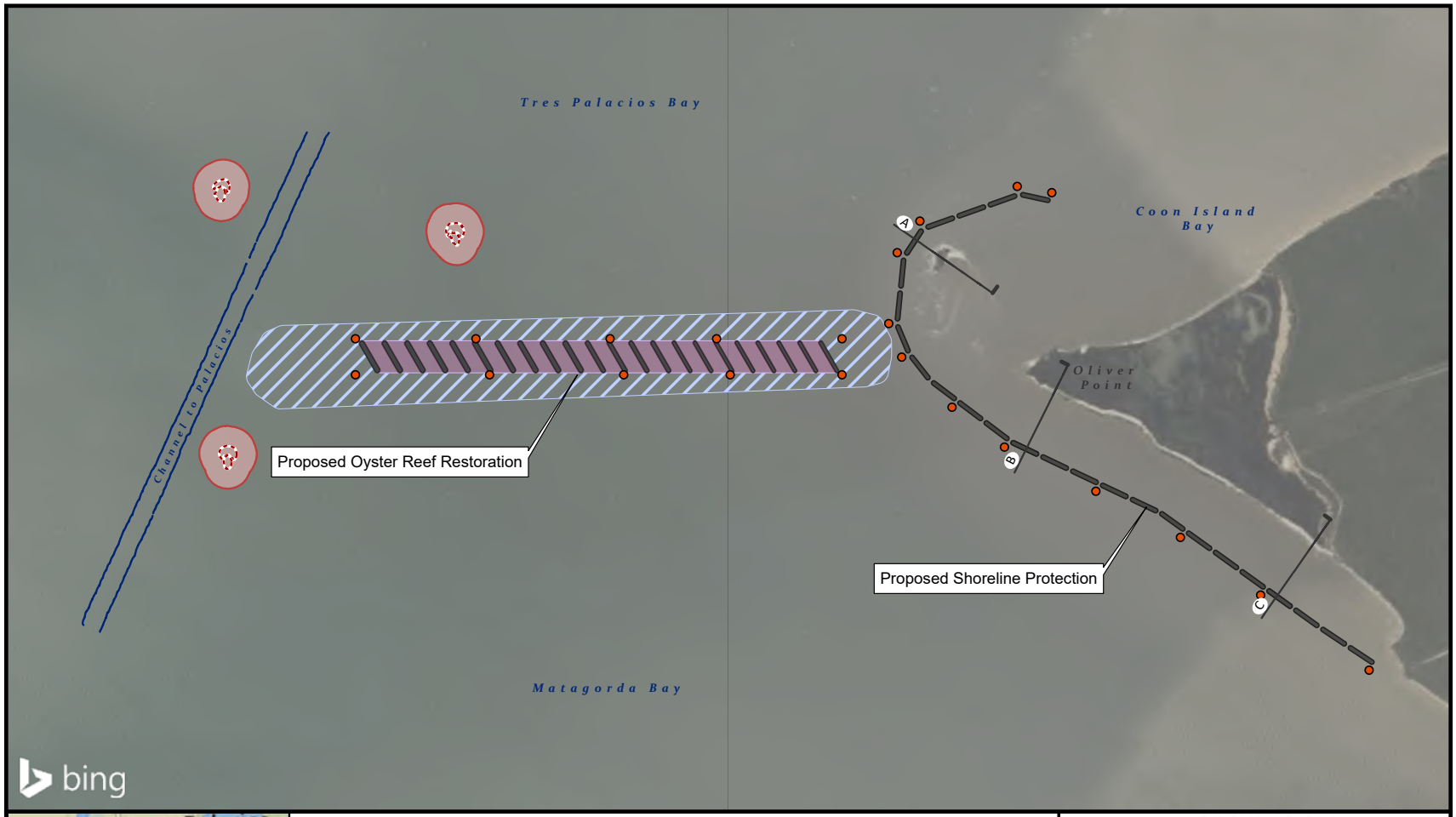

- Warning Sign Location
- Cross Section (X)
- Magnetometer Anomaly Avoidance Feature
- Magnetometer Anomaly Avoidance Buffer (50 m)
- Proposed Cultch Placement Between Structures
- Proposed Structure Footprint
- Staging/Temporary Access*

*Area adjacent to Oliver Reef may be used for staging barges, temporary access.

0 600 1,200 Feet

Datum: NAD 1983
Projection: State Plane Texas Central
Units: Feet
Basemap: Bing Maps Aerial

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Sheet 3 of 20
Proposed Site Plan

Oliver Point/Oliver Reef Restoration Project

TXGLO, Matagorda Bay Foundation,and US Fish and Wildlife Service
Matagorda County, Texas

Job No.: 100076548	Scale: 1 " = 1,200 feet
Prepared By: Atkins/WHIT6392	Date: Apr 25, 2023

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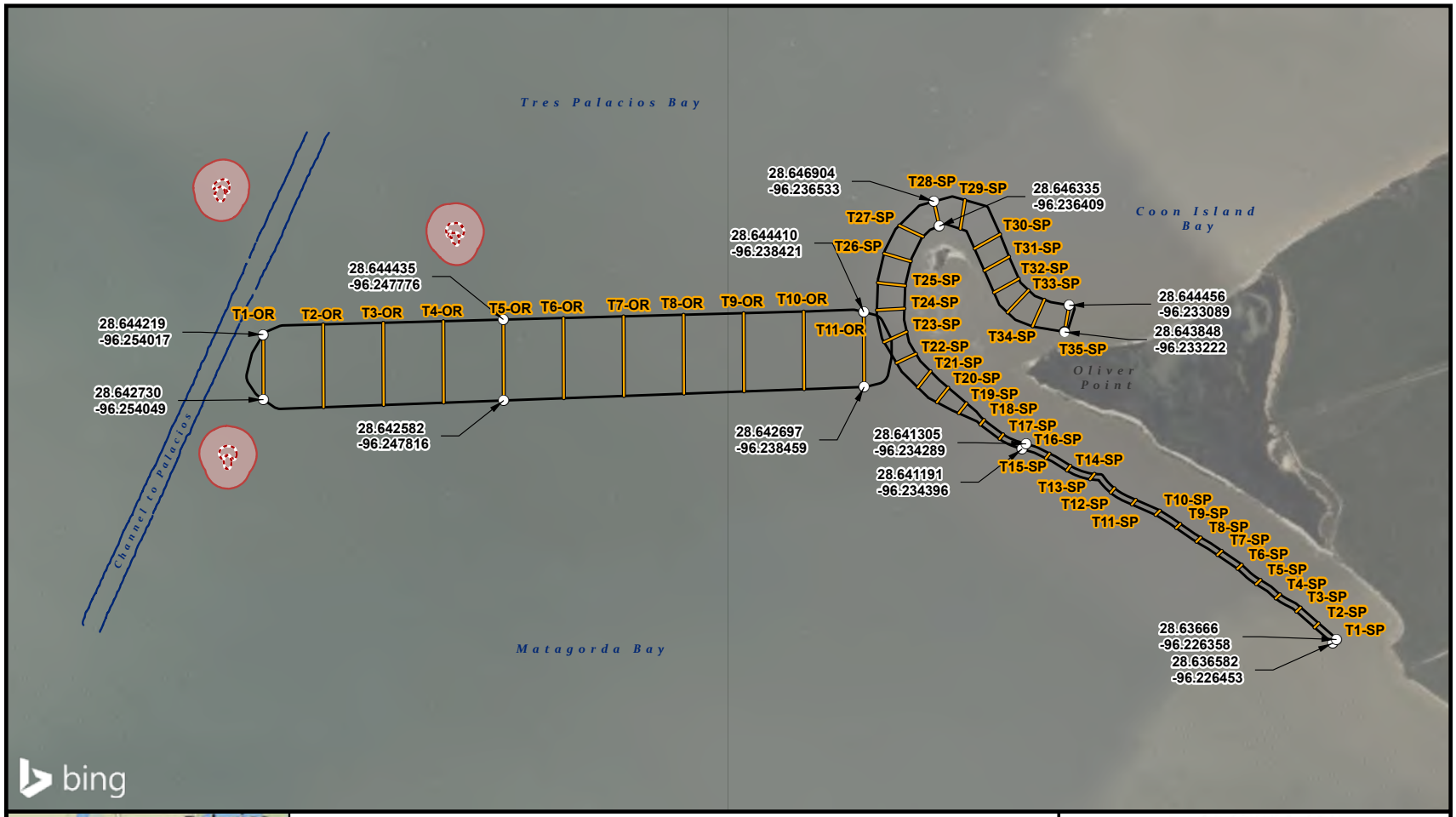

- Survey Area Coordinate
- Transect Line
- Magnetometer Anomaly Avoidance Feature
- Magnetometer Anomaly Avoidance Buffer (50 m)
- Survey Area

(OR = Oyster Reef, SP = Shore Protection)

0 600 1,200 Feet

Datum: NAD 1983
Projection: State Plane Texas Central
Units: Feet
Basemap: Bing Maps Aerial

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Sheet 4 of 20
Oyster, Wetland, and SAV Survey

Oliver Point/Oliver Reef Restoration Project

TXGLO, Matagorda Bay Foundation,and US Fish and Wildlife Service
Matagorda County, Texas

Job No.: 100076548	Scale: 1 " = 1,200 feet
Prepared By: Atkins/WHIT6392	Date: Apr 25, 2023

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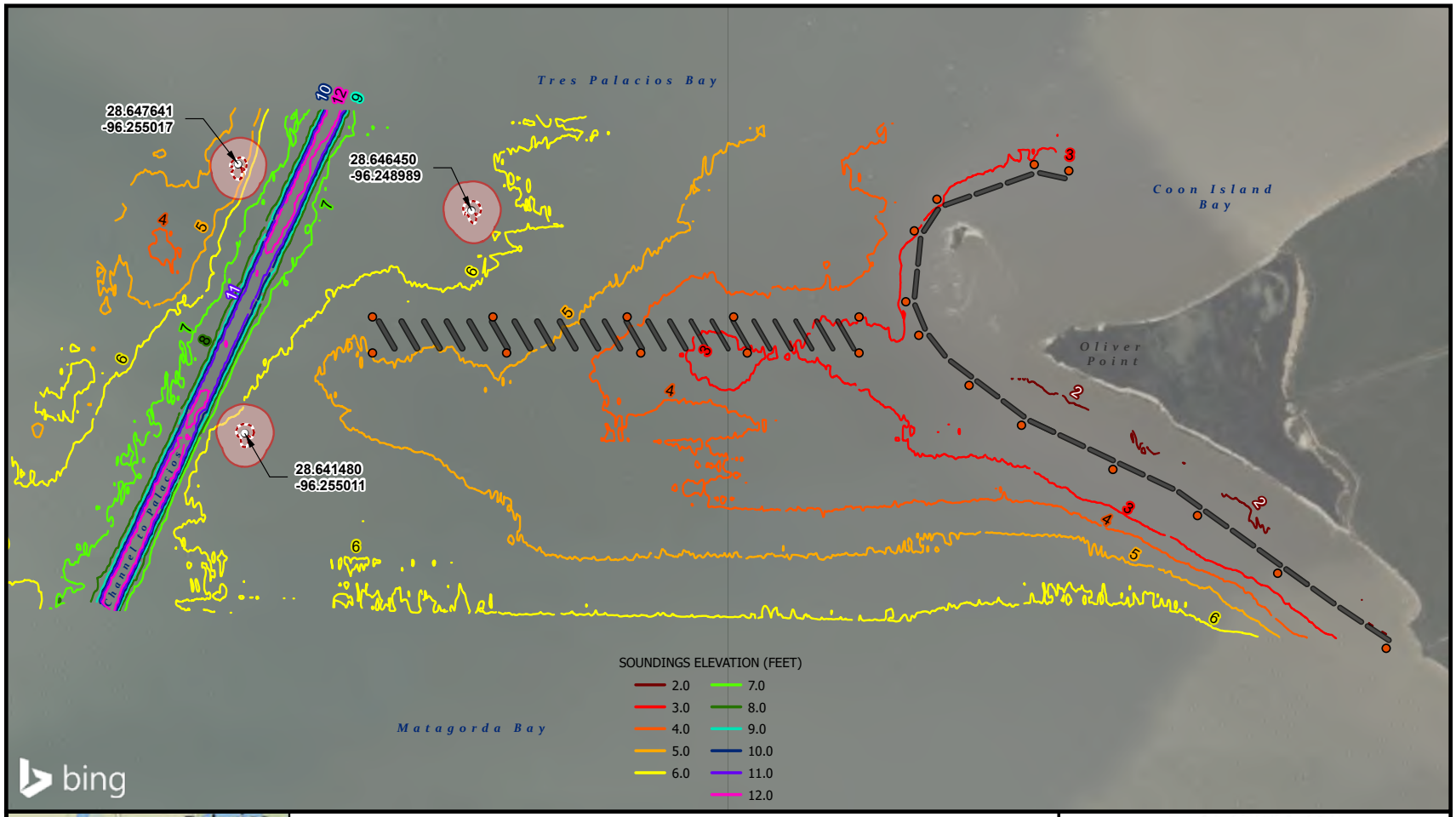

- Proposed Warning Sign Location
- Magnetometer Anomaly Coordinate
- Magnetometer Anomaly Avoidance Feature
- Magnetometer Anomaly Avoidance Buffer (50 m)
- Proposed Structure Footprint

NOTES:
1. SOUNDINGS AND MAGNETOMETER SURVEY WERE RECORDED BY T. BAKER SMITH ON 22-24 JUNE, 2022. SEA FLOOR CONDITIONS ARE SUBJECT TO CHANGE.
2. HORIZONTAL DATUM: NAD83 (2011), TEXAS SOUTH CENTRAL ZONE. ALL DISTANCES ARE U.S. SURVEY FEET (GRID).
3. VERTICAL: NAVD88 (GEOID 18)

0 600 1,200 Feet

Datum: NAD 1983
Projection: State Plane Texas Central
Units: Feet
Basemap: Bing Maps Aerial

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Sheet 5 of 20
Bathymetry and Magnetometer Anomalies

Oliver Point/Oliver Reef Restoration Project

TXGLO, Matagorda Bay Foundation,and US Fish and Wildlife Service
Matagorda County, Texas

Job No.: 100076548	Scale: 1 " = 1,200 feet
Prepared By: Atkins/WHIT6392	Date: Apr 06, 2023

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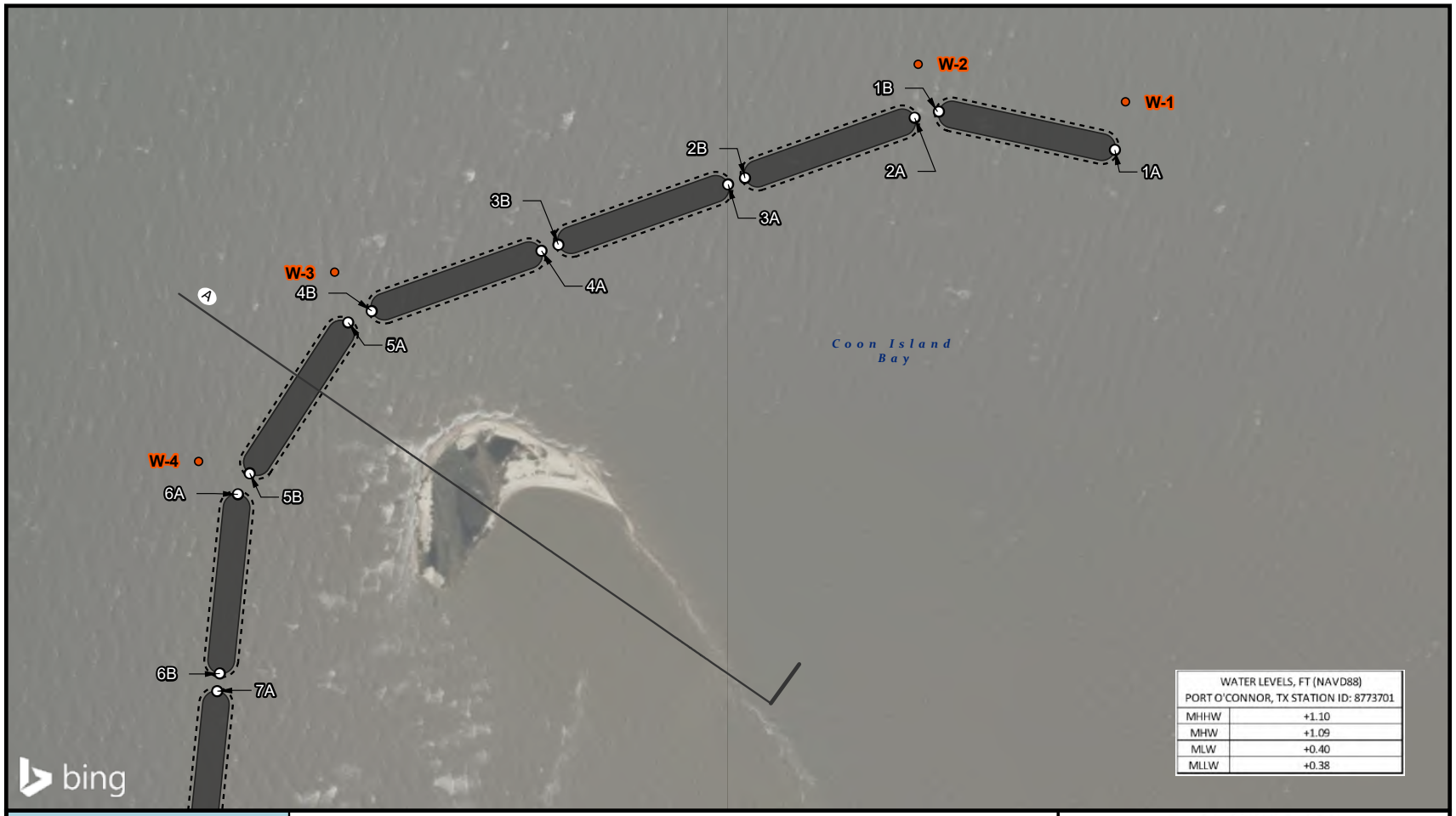

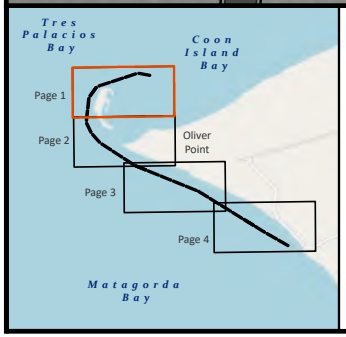

- Breakwater Centerline Point
- Warning Sign Location
- Cross Section (X)
- Proposed Structure Footprint

NOTES:
Breakwater armor and bedding stone: 34,919 CY
Breakwater footprint area: 6.7 acres
Surface area below MHW for spat settlement: 2.58 acres

0 100 200 Feet

Datum: NAD 1983
Projection: State Plane Texas Central
Units: Feet
Basemap: Bing Maps Aerial

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Sheet 6 of 20
Shoreline Protection

Oliver Point/Oliver Reef Restoration Project

TXGLO, Matagorda Bay Foundation,and US Fish and Wildlife Service
Matagorda County, Texas

Job No.: 100076548	Scale: 1 " = 200 feet
Prepared By: Atkins/WHIT6392	Date: Apr 25, 2023

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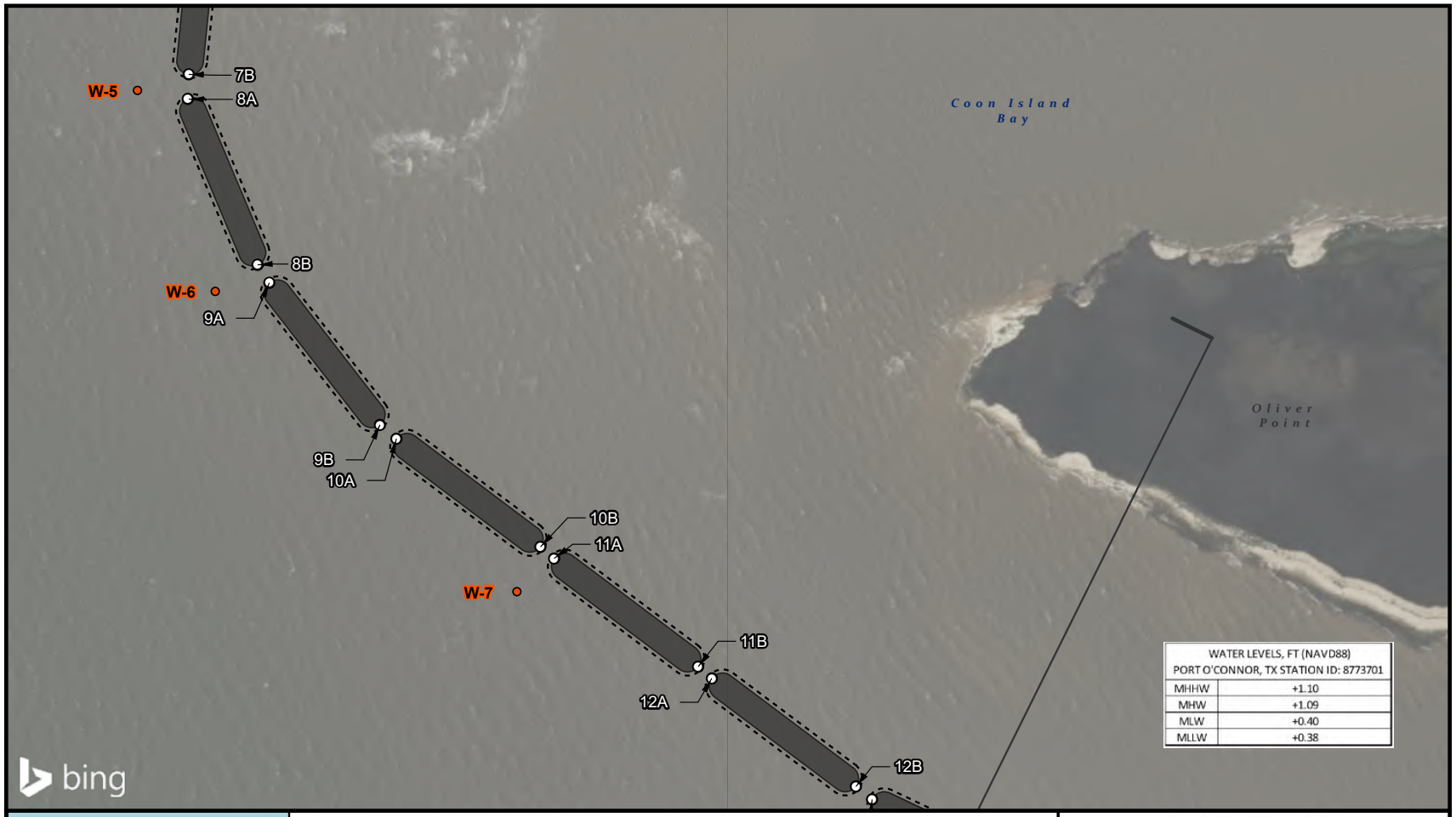
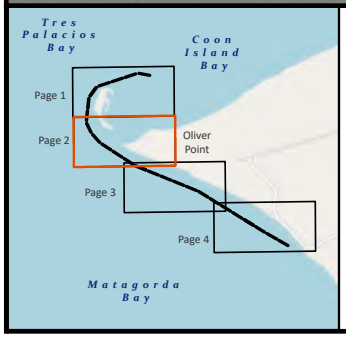
Microsoft Corporation, Earthstar Geographics LLC, GeoEye, Harris Corporation, NASA, and DigitalGlobe. Bing Maps Aerial. 2018.
1:1:2,400; generated by Atkins; using ArcMap. < http://www.bing.com/maps> (25 April 2023)





- Breakwater Centerline Point
- Warning Sign Location
- Cross Section (X)
- Proposed Structure Footprint

NOTES:
Breakwater armor and bedding stone: 34,919 CY
Breakwater footprint area: 6.7 acres
Surface area below MHW for spat settlement: 2.58 acres

0 100 200 Feet

Datum: NAD 1983
Projection: State Plane Texas Central
Units: Feet
Basemap: Bing Maps Aerial

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Sheet 7 of 20
Shoreline Protection

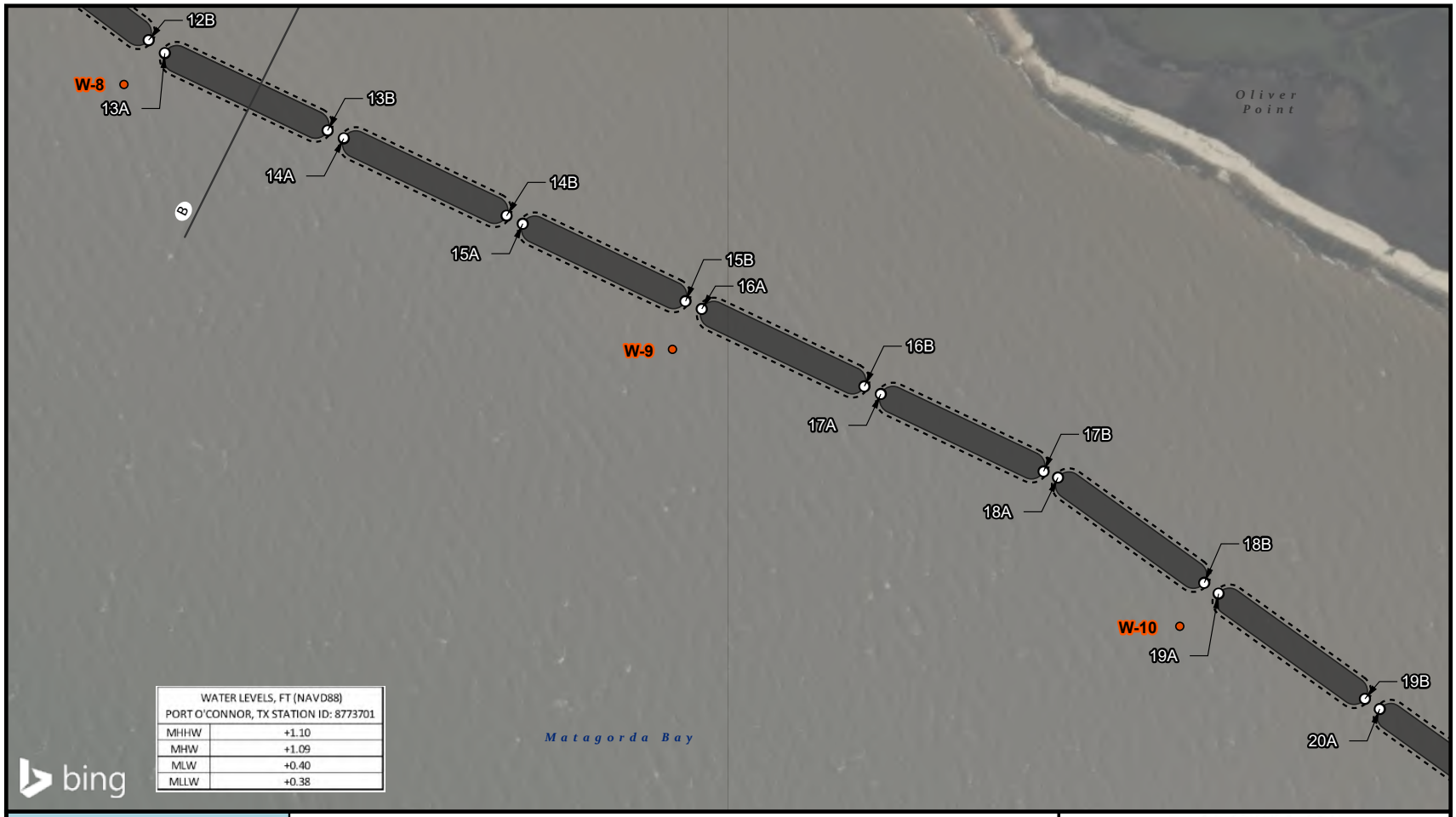
Oliver Point/Oliver Reef Restoration Project

TXGLO, Matagorda Bay Foundation,and US Fish and Wildlife Service
Matagorda County, Texas

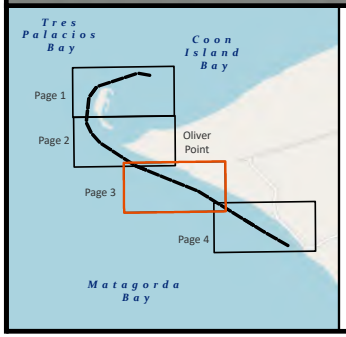
Job No.: 100076548	Scale: 1 " = 200 feet
Prepared By: Atkins/WHIT6392	Date: Apr 25, 2023

N:\Clients\G_H\GLO\100076548\geo\figs\permit\permit_bw_englarged.aprx

Microsoft Corporation, Earthstar Geographics LLC, GeoEye, Harris Corporation, NASA, and DigitalGlobe. Bing Maps Aerial. 2018. 1:1:2,400; generated by Atkins; using ArcMap. < http://www.bing.com/maps> (25 April 2023)



WATER LEVELS, FT (NAVD88) PORT O'CONNOR, TX STATION ID: 8773701	
MHHW	+1.10
MHW	+1.09
MLW	+0.40
MLLW	+0.38



- Breakwater Centerline Point
- Warning Sign Location
- Cross Section (X)
- Proposed Structure Footprint

NOTES:
Breakwater armor and bedding stone: 34,919 CY
Breakwater footprint area: 6.7 acres
Surface area below MHW for spat settlement: 2.58 acres

0 100 200 Feet

Datum: NAD 1983
Projection: State Plane Texas Central
Units: Feet
Basemap: Bing Maps Aerial

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Sheet 8 of 20
Shoreline Protection

Oliver Point/Oliver Reef Restoration Project

TXGLO, Matagorda Bay Foundation,and US Fish and Wildlife Service
Matagorda County, Texas

Job No.: 100076548	Scale: 1 " = 200 feet
Prepared By: Atkins/WHIT6392	Date: Apr 25, 2023

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Microsoft Corporation, Earthstar Geographics LLC, GeoEye, Harris Corporation, NASA, and DigitalGlobe. Bing Maps Aerial. 2018.
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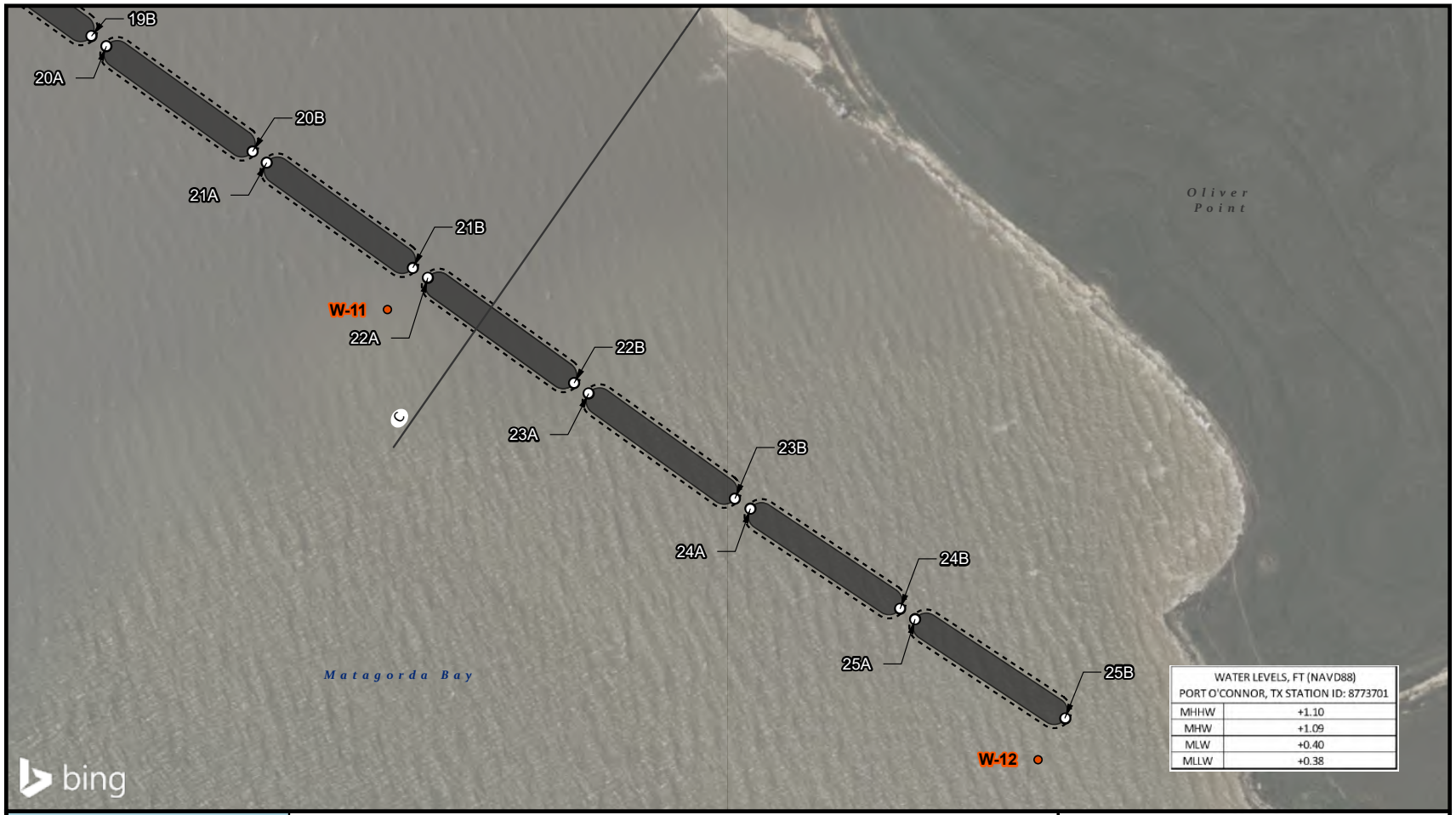
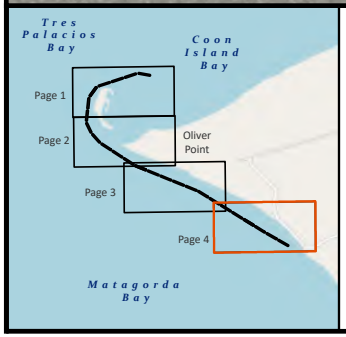


WATER LEVELS, FT (NAVD88) PORT O'CONNOR, TX STATION ID: 8773701	
MHHW	+1.10
MHW	+1.09
MLW	+0.40
MLLW	+0.38



- Breakwater Centerline Point
- Warning Sign Location
- Cross Section (X)
- Proposed Structure Footprint

NOTES:
Breakwater armor and bedding stone: 34,919 CY
Breakwater footprint area: 6.7 acres
Surface area below MHW for spat settlement: 2.58 acres

0 100 200 Feet

Datum: NAD 1983
Projection: State Plane Texas Central
Units: Feet
Basemap: Bing Maps Aerial

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Sheet 9 of 20
Shoreline Protection

Oliver Point/Oliver Reef Restoration Project

TXGLO, Matagorda Bay Foundation,and US Fish and Wildlife Service
Matagorda County, Texas

Job No.: 100076548	Scale: 1 " = 200 feet
Prepared By: Atkins/WHIT6392	Date: Apr 25, 2023

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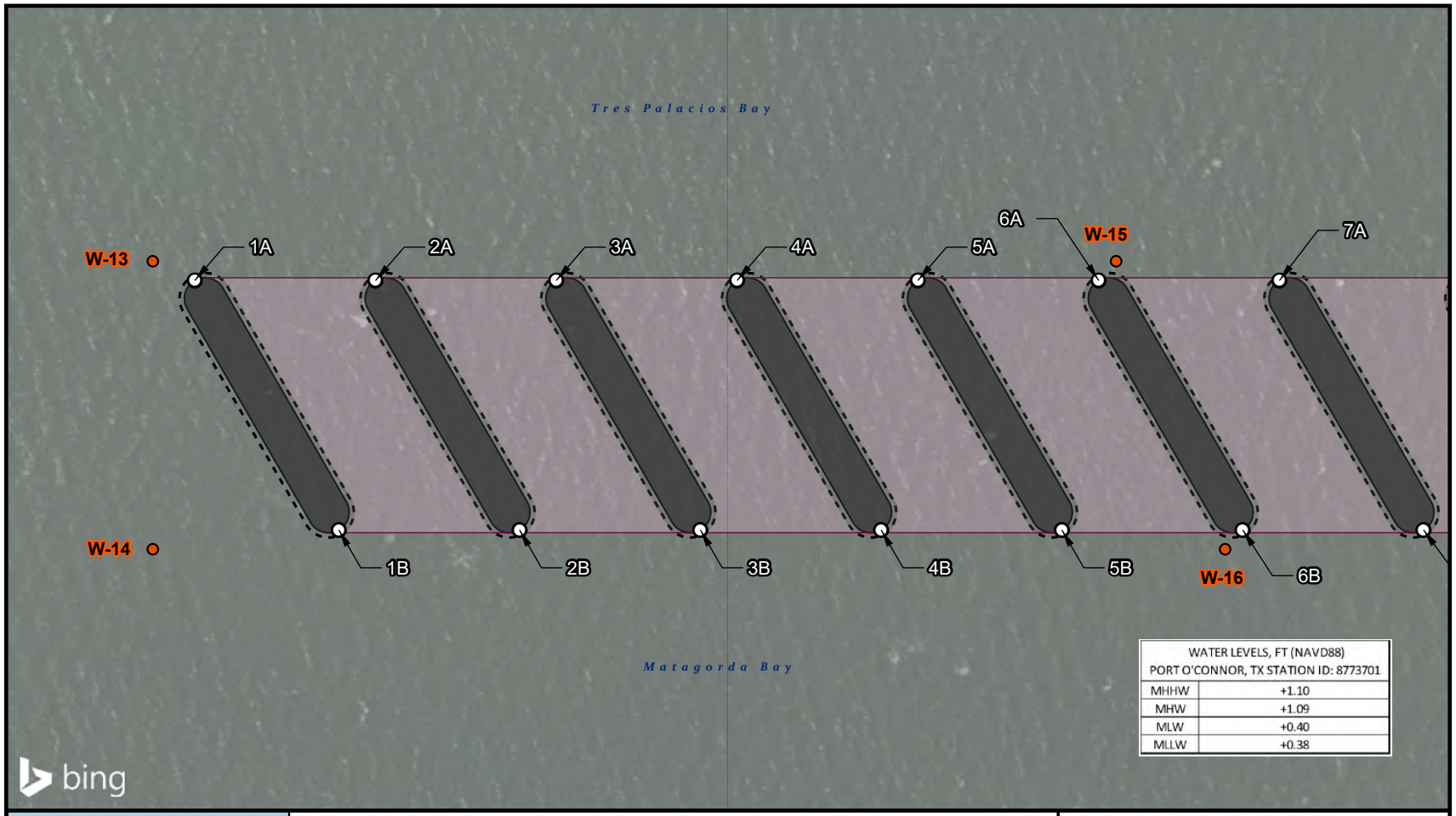
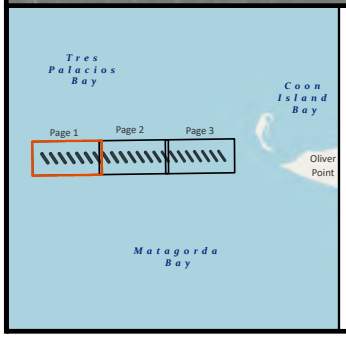
Microsoft Corporation, Earthstar Geographics LLC, GeoEye, Harris Corporation, NASA, and DigitalGlobe. Bing Maps Aerial. 2018.
1:1:2,400; generated by Atkins; using ArcMap. < http://www.bing.com/maps> (25 April 2023)



WATER LEVELS, FT (NAVD88) PORT O'CONNOR, TX STATION ID: 8773701	
MHHW	+1.10
MHW	+1.09
MLW	+0.40
MLLW	+0.38



- Oyster Reef Centerline Point
- Warning Sign Location
- Proposed Cultch Placement Between Structures
- Proposed Structure Footprint

NOTES:
Reef row armor and bedding stone: 37,390 CY
Reef row footprint area: 7.2 acres
Surface area below MHW
for spat settlement: 4.12 acres
Cultch: 13,317 CY
Cultch area (includes spat settlement): 16.5 acres
Total Oyster Reef area: 23.7 acres

0 75 150 Feet

Datum: NAD 1983
Projection: State Plane
Texas Central
Units: Feet
Basemap: Bing Maps Aerial

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Sheet 10 of 20
Oyster Reef Restoration

Oliver Point/Oliver Reef Restoration Project

TXGLO, Matagorda Bay Foundation,and US Fish and Wildlife Service
Matagorda County, Texas

Job No.: 100076548	Scale: 1 " = 150 feet
Prepared By: Atkins/WHIT6392	Date: Apr 25, 2023

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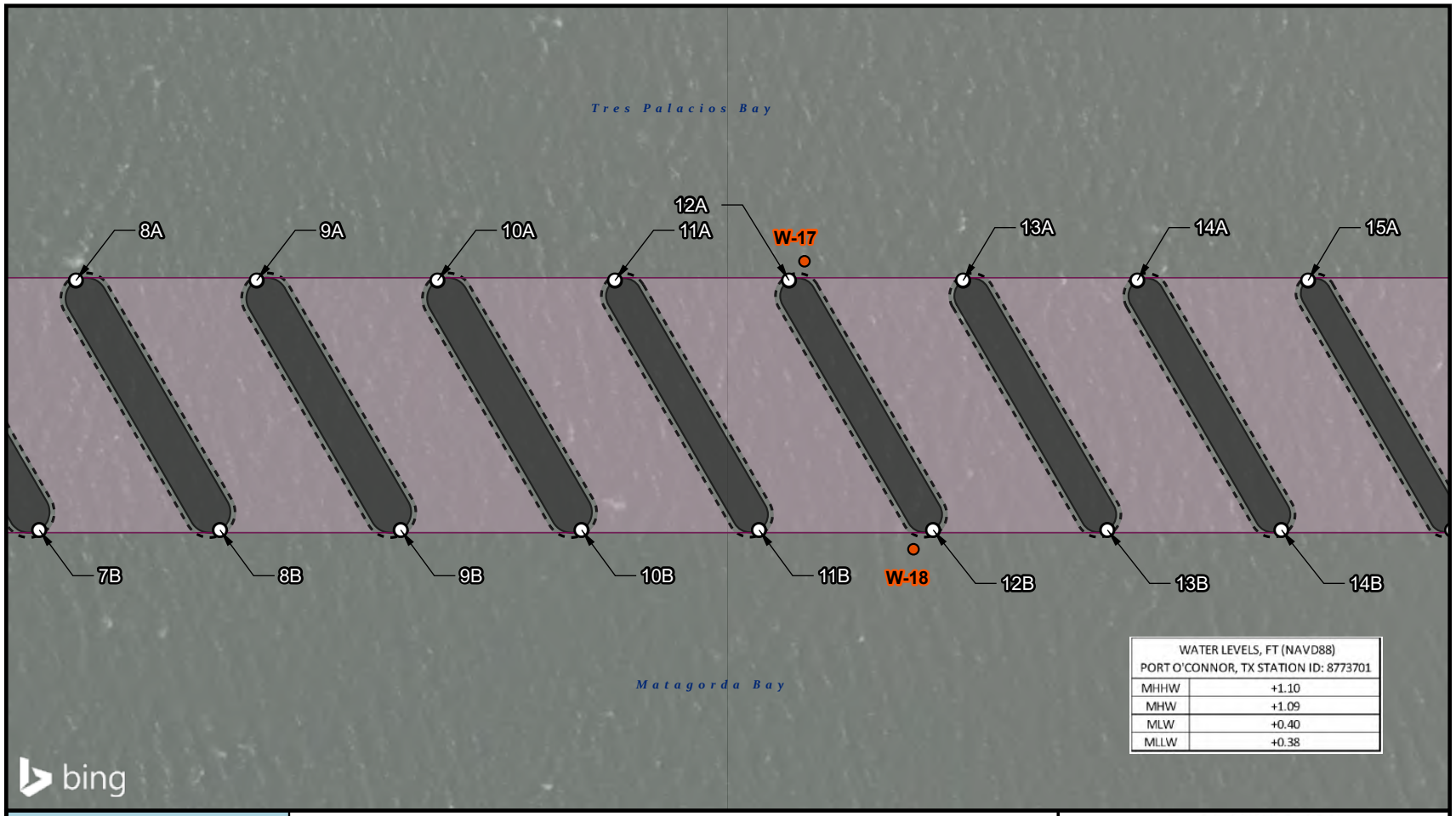
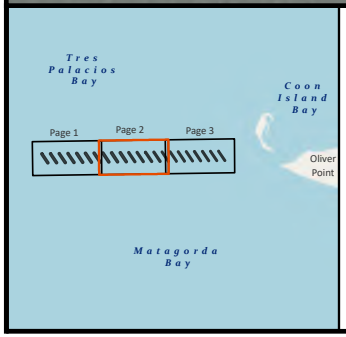
Microsoft Corporation, Earthstar Geographics LLC, GeoEye, Harris Corporation, NASA, and DigitalGlobe. Bing Maps Aerial. 2018.
1:1:1,800; generated by Atkins; using ArcMap. < http://www.bing.com/maps> (25 April 2023)



WATER LEVELS, FT (NAVD88) PORT O'CONNOR, TX STATION ID: 8773701	
MHHW	+1.10
MHW	+1.09
MLW	+0.40
MLLW	+0.38



- Oyster Reef Centerline Point
- Warning Sign Location
- Proposed Cultch Placement Between Structures
- Proposed Structure Footprint

NOTES:
Reef row armor and bedding stone: 37,390 CY
Reef row footprint area: 7.2 acres
Surface area below MHW
for spat settlement: 4.12 acres
Cultch: 13,317 CY
Cultch area (includes spat settlement): 16.5 acres
Total Oyster Reef area: 23.7 acres

0 75 150 Feet

Datum: NAD 1983
Projection: State Plane
Texas Central
Units: Feet
Basemap: Bing Maps Aerial

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Sheet 11 of 20
Oyster Reef Restoration

Oliver Point/Oliver Reef Restoration Project

TXGLO, Matagorda Bay Foundation,and US Fish and Wildlife Service
Matagorda County, Texas

Job No.: 100076548	Scale: 1 " = 150 feet
Prepared By: Atkins/WHIT6392	Date: Apr 25, 2023

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Microsoft Corporation, Earthstar Geographics LLC, GeoEye, Harris Corporation, NASA, and DigitalGlobe. Bing Maps Aerial. 2018.
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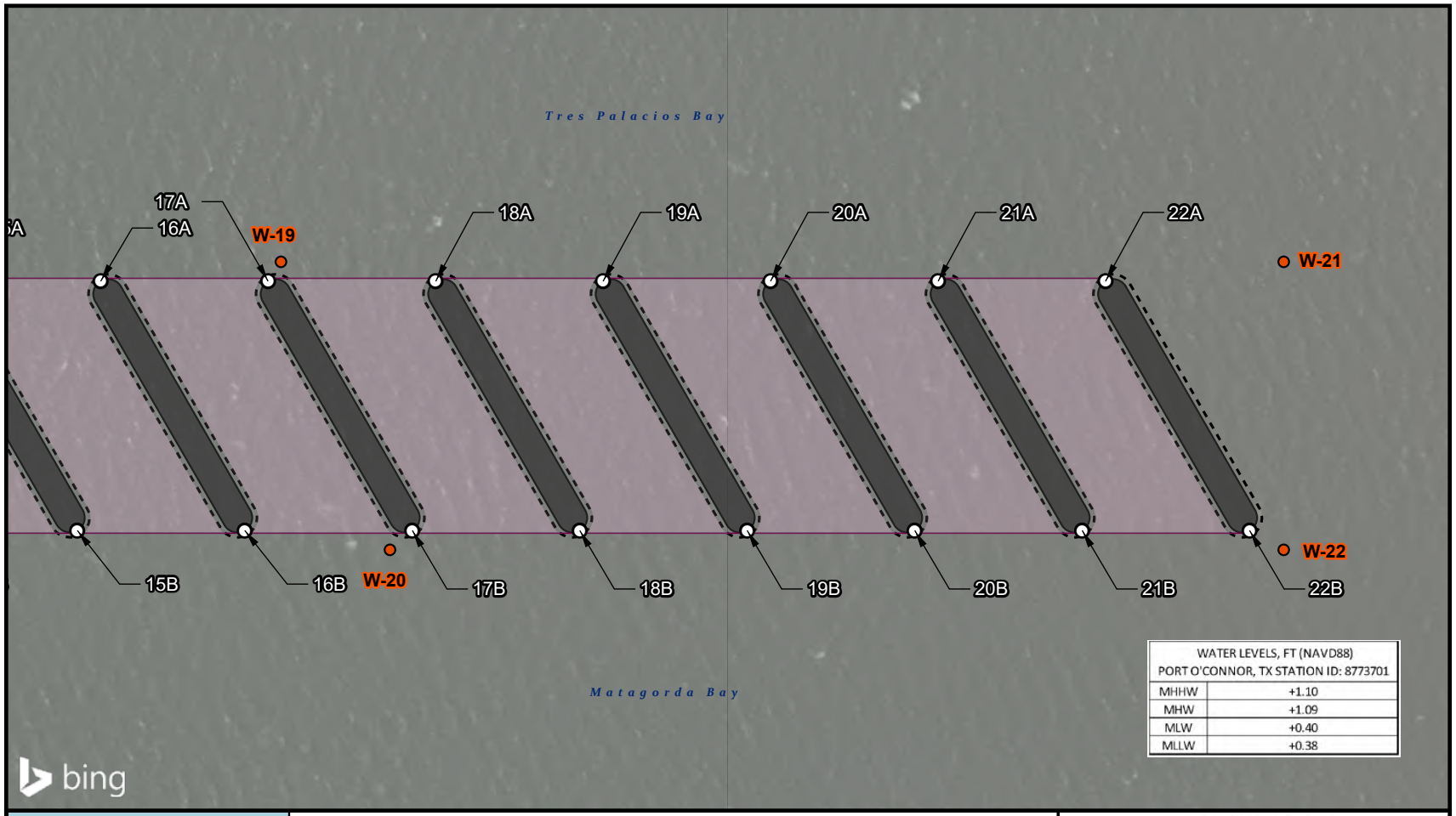
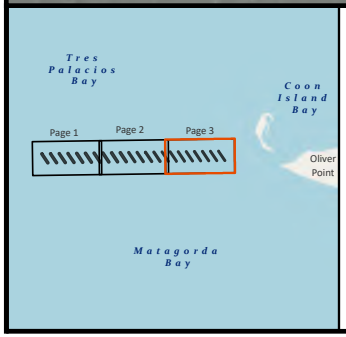


WATER LEVELS, FT (NAVD88) PORT O'CONNOR, TX STATION ID: 8773701	
MHHW	+1.10
MHW	+1.09
MLW	+0.40
MLLW	+0.38



- Oyster Reef Centerline Point
- Warning Sign Location
- Proposed Cultch Placement Between Structures
- Proposed Structure Footprint

NOTES:
Reef row armor and bedding stone: 37,390 CY
Reef row footprint area: 7.2 acres
Surface area below MHW
for spat settlement: 4.12 acres
Cultch: 13,317 CY
Cultch area (includes spat settlement): 16.5 acres
Total Oyster Reef area: 23.7 acres

0 75 150 Feet

Datum: NAD 1983
Projection: State Plane
Texas Central
Units: Feet
Basemap: Bing Maps Aerial

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Sheet 12 of 20
Oyster Reef Restoration

Oliver Point/Oliver Reef Restoration Project

TXGLO, Matagorda Bay Foundation,and US Fish and Wildlife Service
Matagorda County, Texas

Job No.: 100076548	Scale: 1 " = 150 feet
Prepared By: Atkins/WHIT6392	Date: Apr 25, 2023

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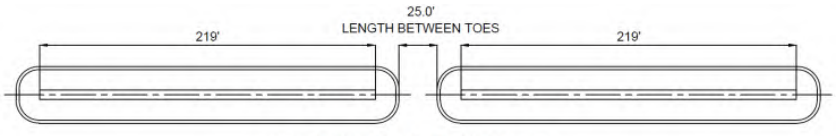
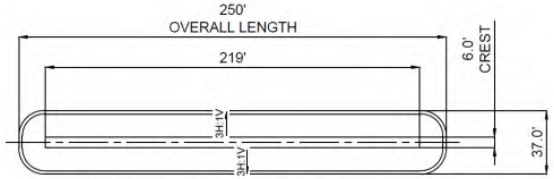
Microsoft Corporation, Earthstar Geographics LLC, GeoEye, Harris Corporation, NASA, and DigitalGlobe. Bing Maps Aerial. 2018.
1:1:1,800; generated by Atkins; using ArcMap. < http://www.bing.com/maps> (25 April 2023)

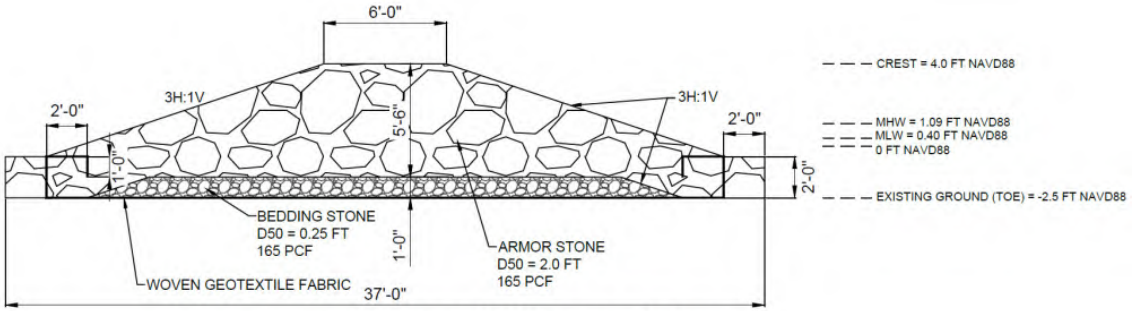


BREAKWATER SPACING PLAN
NTS

WATER LEVELS, FT (NAVD88) PORT O'CONNOR, TX STATION ID: 8773701	
MHHW	+1.10
MHW	+1.09
MLW	+0.40
MLLW	+0.38



TYPICAL BREAKWATER PLAN
NTS



TYPICAL BREAKWATER ELEVATION

NOTES:
1. 25 breakwaters that are 250 feet long at the toe and spaced 25 feet apart between structure toes.
2. Breakwater centerlines located at the approximate -2.5-foot NAVD88 elevation.
3. All breakwaters are recommended to have 3H:1V side slopes.
4. Stone with unit weight of approximately 165 lbf/ft3.
5. Armor stone and bedding stone median diameters of 2.0 feet, and 0.25 feet, respectively.
6. Armor stone minimum layer thickness of 4.0 feet, except as otherwise specified in design drawings.
7. Bedding stone minimum layer thickness of 1.0 feet.
8. Crest width design of three times the median armor stone diameter (6.0 feet).
9. Constructed crest elevation of +4.0 feet NAVD88 with a post-settlement design crest elevation of +2.8 feet NAVD88.
10. Toe berm with a design of two times the median armor stone diameter in width (4.0 feet) and two times the median armor stone diameter in height (4.0 feet).
11. Woven geotextile fabric will be placed below the entire length of the structure and will key in around the armor stone at the toe berm.

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Sheet 13 of 20
Typical Breakwater Structure Details

Oliver Point/Oliver Reef Restoration Project

TXGLO, Matagorda Bay Foundation,and US Fish and Wildlife Service
Matagorda County, Texas

Job No.: 100076548	Scale: Not to Scale
Prepared By: Atkins/WHIT6392	Date: Apr 06, 2023

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BREAKWATER CENTERLINE LOCATION COORDINATE POINTS				
POINT NO.	NORTHING	EASTING	LATITUDE	LONGITUDE
1A	13429635.16	2855738.60	28° 38' 48.42" N	96° 14' 00.74" W
1B	13429688.38	2855494.33	28° 38' 49.01" N	96° 14' 03.47" W
2A	13429679.73	2855460.73	28° 38' 48.93" N	96° 14' 03.85" W
2B	13429596.06	2855225.15	28° 38' 48.15" N	96° 14' 06.52" W
3A	13429587.41	2855201.69	28° 38' 48.07" N	96° 14' 06.78" W
3B	13429503.73	2854966.11	28° 38' 47.30" N	96° 14' 09.45" W
4A	13429495.09	2854942.65	28° 38' 47.22" N	96° 14' 09.71" W
4B	13429411.42	2854707.07	28° 38' 46.45" N	96° 14' 12.38" W
5A	13429395.46	2854674.31	28° 38' 46.30" N	96° 14' 12.75" W
5B	13429186.17	2854537.58	28° 38' 44.26" N	96° 14' 14.34" W
6A	13429156.81	2854521.24	28° 38' 43.97" N	96° 14' 14.53" W
6B	13428908.07	2854496.18	28° 38' 41.51" N	96° 14' 14.88" W
7A	13428883.46	2854492.51	28° 38' 41.27" N	96° 14' 14.93" W
7B	13428634.72	2854467.45	28° 38' 38.82" N	96° 14' 15.27" W
8A	13428600.69	2854466.21	28° 38' 38.48" N	96° 14' 15.30" W
8B	13428370.21	2854563.04	28° 38' 36.18" N	96° 14' 14.27" W
9A	13428345.28	2854579.35	28° 38' 35.92" N	96° 14' 14.09" W
9B	13428147.97	2854732.87	28° 38' 33.94" N	96° 14' 12.42" W
10A	13428128.72	2854755.72	28° 38' 33.74" N	96° 14' 12.17" W
10B	13427978.59	2854955.63	28° 38' 32.21" N	96° 14' 09.97" W
11A	13427962.34	2854974.68	28° 38' 32.04" N	96° 14' 09.76" W
11B	13427812.21	2855174.59	28° 38' 30.51" N	96° 14' 07.56" W
12A	13427795.97	2855193.65	28° 38' 30.34" N	96° 14' 07.35" W
12B	13427645.84	2855393.55	28° 38' 28.81" N	96° 14' 05.14" W

BREAKWATER CENTERLINE LOCATION COORDINATE POINTS				
13A	13427627.79	2855416.01	28° 38' 28.63" N	96° 14' 04.90" W
13B	13427520.45	2855641.79	28° 38' 27.51" N	96° 14' 02.39" W
14A	13427509.53	2855664.28	28° 38' 27.40" N	96° 14' 02.14" W
14B	13427402.20	2855890.07	28° 38' 26.28" N	96° 13' 59.64" W
15A	13427391.28	2855912.56	28° 38' 26.17" N	96° 13' 59.39" W
15B	13427283.94	2856138.35	28° 38' 25.05" N	96° 13' 56.88" W
16A	13427273.03	2856160.84	28° 38' 24.94" N	96° 13' 56.63" W
16B	13427165.69	2856386.62	28° 38' 23.83" N	96° 13' 54.13" W
17A	13427155.09	2856409.34	28° 38' 23.72" N	96° 13' 53.88" W
17B	13427047.75	2856635.13	28° 38' 22.60" N	96° 13' 51.37" W
18A	13427039.18	2856655.07	28° 38' 22.51" N	96° 13' 51.15" W
18B	13426893.22	2856858.04	28° 38' 21.02" N	96° 13' 48.91" W
19A	13426878.04	2856877.92	28° 38' 20.86" N	96° 13' 48.69" W
19B	13426732.08	2857080.89	28° 38' 19.37" N	96° 13' 46.45" W
20A	13426718.03	2857101.57	28° 38' 19.23" N	96° 13' 46.23" W
20B	13426572.07	2857304.54	28° 38' 17.73" N	96° 13' 43.99" W
21A	13426556.45	2857324.10	28° 38' 21.02" N	96° 13' 48.91" W
21B	13426410.49	2857527.07	28° 38' 20.86" N	96° 13' 48.69" W
22A	13426396.58	2857547.86	28° 38' 19.37" N	96° 13' 46.45" W
22B	13426250.63	2857750.83	28° 38' 19.23" N	96° 13' 46.23" W
23A	13426236.14	2857771.06	28° 38' 17.73" N	96° 13' 43.99" W
23B	13426090.18	2857974.03	28° 38' 12.81" N	96° 13' 36.60" W
24A	13426076.40	2857995.60	28° 38' 12.67" N	96° 13' 36.37" W
24B	13425937.30	2858203.33	28° 38' 11.24" N	96° 13' 34.07" W
25A	13425923.08	2858224.21	28° 38' 11.09" N	96° 13' 33.84" W
25B	13425785.05	2858432.66	28° 38' 09.68" N	96° 13' 31.54" W

Typical Breakwater Structure Coordinates

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Member of the SNC-Lavalin Group

Sheet 14 of 20
Typical Breakwater Structure Coordinates

Oliver Point/Oliver Reef Restoration Project

TXGLO, Matagorda Bay Foundation,and US Fish and Wildlife Service
Matagorda County, Texas

Job No.: 100076548	Scale: Not to Scale
Prepared By: Atkins/WHIT6392	Date: Apr 06, 2023

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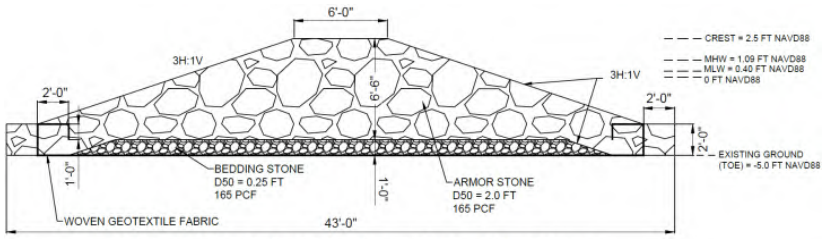
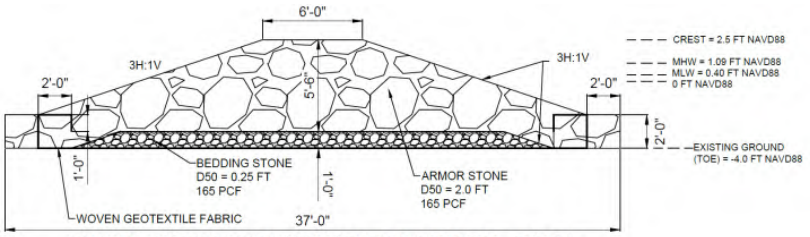
WATER LEVELS, FT (NAVD88) PORT O'CONNOR, TX STATION ID: 8773701	
MHHW	+1.10
MHW	+1.09
MLW	+0.40
MLLW	+0.38



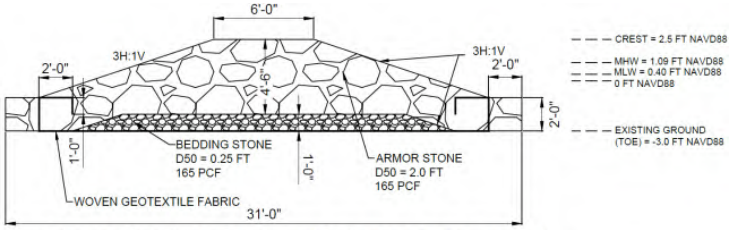
TYPICAL OYSTER REEF STRUCTURE ELEVATION - TYPE A

SCALE: 3/16" = 1'-0"



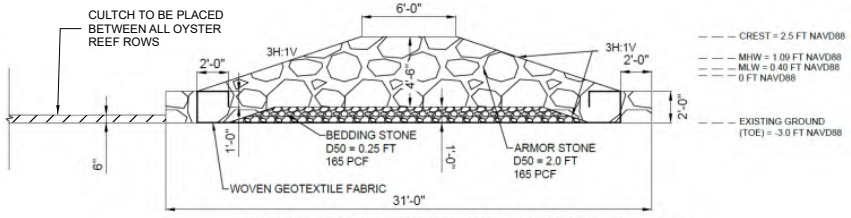
TYPICAL OYSTER REEF STRUCTURE ELEVATION - TYPE B

SCALE: 3/16" = 1'-0"



TYPICAL OYSTER REEF STRUCTURE ELEVATION - TYPE C

SCALE: 3/16" = 1'-0"



TYPICAL OYSTER REEF ROW WITH CULTCH - TYPE C

SCALE: 3/16" = 1'-0"

NOTES:
1. 22 oyster reef rows that are 300 feet long at the toe, spaced 120 feet apart between structure toes, and have a NNW-SSE orientation.
2. Oyster reef row centerlines located at the approximate -3.0-foot, -4.0-foot, and -5.0-foot NAVD88 elevations.
3. All oyster reef rows are recommended to have 3H:1V side slopes.
4. Stone with unit weight of approximately 165 lbf/ft3.
5. Armor stone and bedding stone median diameters of 2.0 feet, and 0.25 feet, respectively.
6. Armor stone minimum layer thickness of 4.0 feet, except as otherwise specified in design drawings.
7. Bedding stone minimum layer thickness of 1.0 feet.
8. Crest width design of three times the median armor stone diameter (6.0 feet).
9. Constructed crest elevation of +2.5 feet NAVD88 with an anticipated post-settlement design crest elevation of +1.6 feet NAVD88.
10. Toe berm with a design of two times the median armor stone diameter in width (4.0 feet) and two times the median armor stone diameter in height (4.0 feet).
11. Woven geotextile fabric will be placed below the entire length of the structure and will key in around the armor stone at the toe berm.

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Sheet 15 of 20
Typical Oyster Reef Structure Details

Oliver Point/Oliver Reef Restoration Project

TXGLO, Matagorda Bay Foundation,and US Fish and Wildlife Service
Matagorda County, Texas

Job No.: 100076548	Scale: Not to Scale
Prepared By: Atkins/WHIT6392	Date: Apr 25, 2023

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OYSTER REEF STRUCTURE CENTERLINE LOCATION COORDINATE POINTS					
POINT NO.	NORTHING	EASTING	LATITUDE	LONGITUDE	STUCTURE TYPE
1A	13428466.10	2850000.64	28° 38' 38.45" N	96° 15' 05.37" W	TYPE A
1B	13428206.29	2850150.64	28° 38' 35.85" N	96° 15' 03.75" W	
2A	13428466.10	2850188.85	28° 38' 38.41" N	96° 15' 03.26" W	TYPE A
2B	13428206.29	2850338.85	28° 38' 35.80" N	96° 15' 01.64" W	
3A	13428466.10	2850377.07	28° 38' 38.37" N	96° 15' 01.14" W	TYPE A
3B	13428206.29	2850527.07	28° 38' 35.76" N	96° 14' 59.53" W	
4A	13428466.10	2850565.29	28° 38' 38.32" N	96° 14' 59.03" W	TYPE A
4B	13428206.29	2850715.29	28° 38' 35.72" N	96° 14' 57.42" W	
5A	13428466.10	2850753.50	28° 38' 38.28" N	96° 14' 56.92" W	TYPE A
5B	13428206.29	2850903.50	28° 38' 35.67" N	96° 14' 55.30" W	
6A	13428466.10	2850941.72	28° 38' 38.23" N	96° 14' 54.81" W	TYPE A
6B	13428206.29	2851091.72	28° 38' 35.63" N	96° 14' 53.19" W	
7A	13428466.10	2851129.94	28° 38' 38.19" N	96° 14' 52.70" W	TYPE A
7B	13428206.29	2851279.94	28° 38' 35.58" N	96° 14' 51.08" W	
8A	13428466.10	2851318.15	28° 38' 38.15" N	96° 14' 50.58" W	TYPE A
8B	13428206.29	2851468.15	28° 38' 35.54" N	96° 14' 48.97" W	
9A	13428466.10	2851506.37	28° 38' 38.10" N	96° 14' 48.47" W	TYPE A
9B	13428206.29	2851656.37	28° 38' 35.50" N	96° 14' 46.86" W	
10A	13428466.10	2851694.58	28° 38' 38.06" N	96° 14' 46.36" W	TYPE A
10B	13428206.29	2851844.58	28° 38' 35.45" N	96° 14' 44.75" W	
11A	13428466.10	2851879.34	28° 38' 38.02" N	96° 14' 44.29" W	TYPE B
11B	13428206.29	2852029.34	28° 38' 35.41" N	96° 14' 42.67" W	
12A	13428466.10	2852060.62	28° 38' 37.97" N	96° 14' 42.25" W	TYPE B
12B	13428206.29	2852210.62	28° 38' 35.37" N	96° 14' 40.64" W	

OYSTER REEF STRUCTURE CENTERLINE LOCATION COORDINATE POINTS					
13A	13428466.10	2852241.88	28° 38' 37.93" N	96° 14' 40.22" W	TYPE B
13B	13428206.29	2852391.94	28° 38' 35.32" N	96° 14' 38.60" W	
14A	13428466.10	2852423.17	28° 38' 37.89" N	96° 14' 38.18" W	TYPE B
14B	13428206.29	2852573.23	28° 38' 35.28" N	96° 14' 36.57" W	
15A	13428466.10	2852601.02	28° 38' 37.85" N	96° 14' 36.19" W	TYPE C
15B	13428206.29	2852751.02	28° 38' 35.24" N	96° 14' 34.57" W	
16A	13428466.10	2852775.37	28° 38' 37.81" N	96° 14' 34.23" W	TYPE C
16B	13428206.29	2852925.40	28° 38' 35.20" N	96° 14' 32.62" W	
17A	13428466.10	2852949.73	28° 38' 37.77" N	96° 14' 32.28" W	TYPE C
17B	13428206.29	2853099.76	28° 38' 35.16" N	96° 14' 30.66" W	
18A	13428466.10	2853124.09	28° 38' 37.73" N	96° 14' 30.32" W	TYPE C
18B	13428206.29	2853274.12	28° 38' 35.12" N	96° 14' 28.71" W	
19A	13428466.10	2853298.46	28° 38' 37.68" N	96° 14' 28.36" W	TYPE C
19B	13428206.29	2853448.46	28° 38' 35.08" N	96° 14' 26.75" W	
20A	13428466.10	2853472.82	28° 38' 37.64" N	96° 14' 26.41" W	TYPE C
20B	13428206.29	2853622.82	28° 38' 35.04" N	96° 14' 24.79" W	
21A	13428466.10	2853647.18	28° 38' 37.60" N	96° 14' 24.45" W	TYPE C
21B	13428206.29	2853797.18	28° 38' 35.00" N	96° 14' 22.84" W	
22A	13428466.10	2853821.54	28° 38' 37.56" N	96° 14' 22.49" W	TYPE C
22B	13428206.29	2853971.54	28° 38' 34.96" N	96° 14' 20.88" W	

Typical Oyster Reef Row Coordinates

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Sheet 16 of 20
Typical Oyster Reef Row Coordinates

Oliver Point/Oliver Reef Restoration Project

TXGLO, Matagorda Bay Foundation,and US Fish and Wildlife Service
Matagorda County, Texas

Job No.: 100076548	Scale: Not to Scale
Prepared By: Atkins/WHIT6392	Date: Apr 06, 2023

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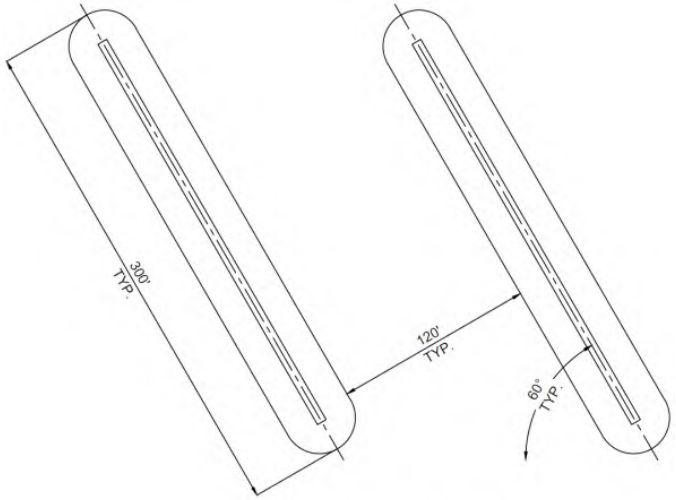
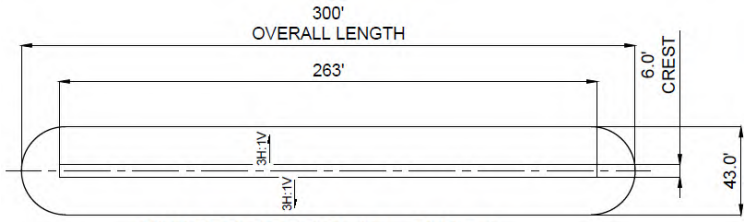
NOTES:
Reef row armor and bedding stone: 37,390 CY
Reef row footprint area: 7.2 acres
Surface area below MHW for spat settlement: 4.12 acres
Cultch: 13,317 CY
Cultch area (includes spat settlement): 16.5 acres
Total Oyster Reef area: 23.7 acres

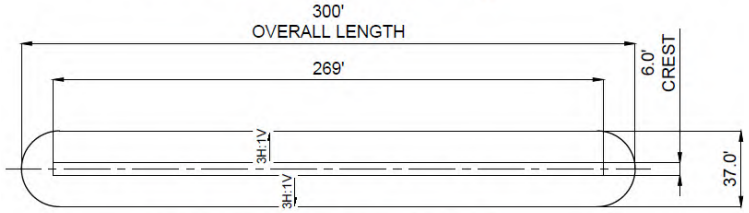


OYSTER REEF SPACING PLAN
NTS

WATER LEVELS, FT (NAVD88) PORT O'CONNOR, TX STATION ID: 8773701	
MHHW	+1.10
MHW	+1.09
MLW	+0.40
MLLW	+0.38



OYSTER REEF PLAN - TYPE A
NTS



OYSTER REEF PLAN - TYPE B
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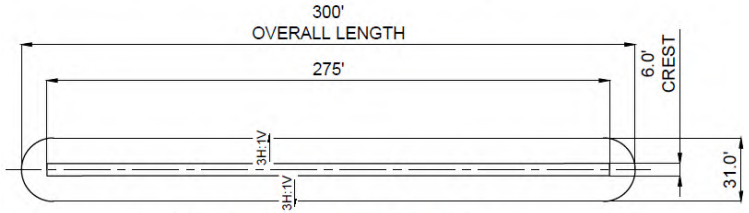

OYSTER REEF PLAN - TYPE C
NTS

NOTES:
1. 22 oyster reef rows that are 300 feet long at the toe, spaced 120 feet apart between structure toes, and have a NNW-SSE orientation.
2. Oyster reef row centerlines located at the approximate -3.0-foot, -4.0-foot, and -5.0-foot NAVD88 elevations.
3. All oyster reef rows are recommended to have 3H:1V side slopes.
4. Stone with unit weight of approximately 165 lbf/ft3.
5. Armor stone and bedding stone median diameters of 2.0 feet, and 0.25 feet, respectively.
6. Armor stone minimum layer thickness of 4.0 feet, except as otherwise specified in design drawings.
7. Bedding stone minimum layer thickness of 1.0 feet.
8. Crest width design of three times the median armor stone diameter (6.0 feet).
9. Constructed crest elevation of +2.5 feet NAVD88 with an anticipated post-settlement design crest elevation of +1.6 feet NAVD88.
10. Toe berm with a design of two times the median armor stone diameter in width (4.0 feet) and two times the median armor stone diameter in height (4.0 feet).
11. Woven geotextile fabric will be placed below the entire length of the structure and will key in around the armor stone at the toe berm.

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Sheet 17 of 20
Typical Oyster Reef Row Details

Oliver Point/Oliver Reef Restoration Project

TXGLO, Matagorda Bay Foundation,and US Fish and Wildlife Service
Matagorda County, Texas

Job No.: 100076548	Scale: Not to Scale
Prepared By: Atkins/WHIT6392	Date: Apr 25, 2023

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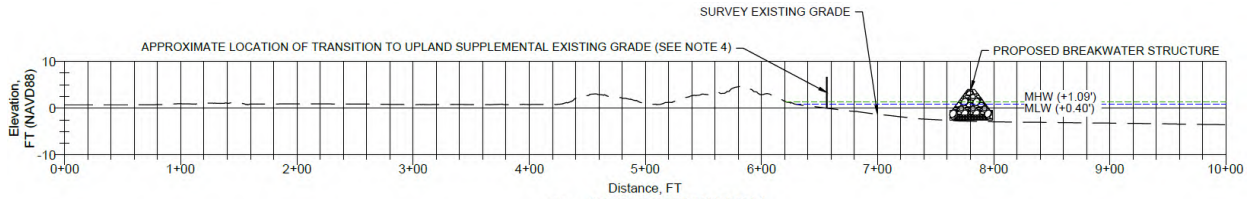
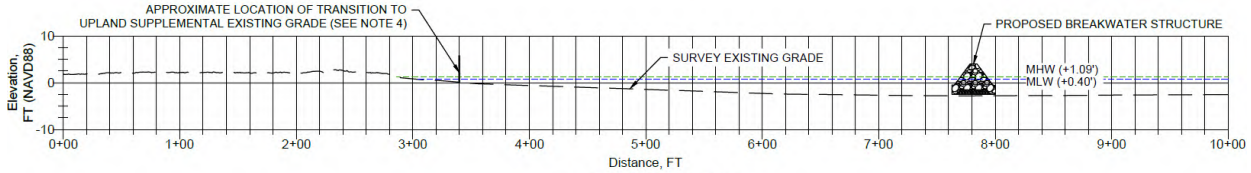
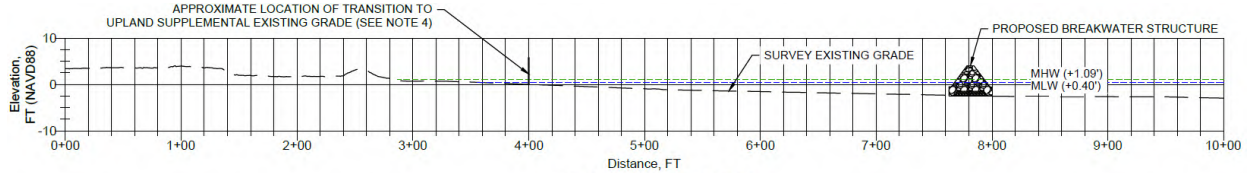


A CROSS SECTION

NOTES:
Breakwater armor and bedding stone: 34,919 CY
Breakwater footprint area: 6.7 acres
Surface area below MHW for spat settlement: 2.58 acres



B CROSS SECTION



C CROSS SECTION

WATER LEVELS, FT (NAVD88) PORT O'CONNOR, TX STATION ID: 8773701	
MHHW	+1.10
MHW	+1.09
MLW	+0.40
MLLW	+0.38

NOTES:
1. 25 breakwaters that are 250 feet long at the toe and spaced 25 feet apart between structure toes.
2. Breakwater centerlines located at the approximate -2.5-foot NAVD88 elevation.
3. All breakwaters are recommended to have 3H:1V side slopes.
4. Stone with unit weight of approximately 165 lbf/ft3.
5. Armor stone and bedding stone median diameters of 2.0 feet, and 0.25 feet, respectively.
6. Armor stone minimum layer thickness of 4.0 feet, except as otherwise specified in design drawings.
7. Bedding stone minimum layer thickness of 1.0 feet.
8. Crest width design of three times the median armor stone diameter (6.0 feet).
9. Constructed crest elevation of +4.0 feet NAVD88 with a post-settlement design crest elevation of +2.8 feet NAVD88.
10. Toe berm with a design of two times the median armor stone diameter in width (4.0 feet) and two times the median armor stone diameter in height (4.0 feet).
11. Woven geotextile fabric will be placed below the entire length of the structure and will key in around the armor stone at the toe berm.

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Sheet 18 of 20
Breakwater Cross-Sections

Oliver Point/Oliver Reef Restoration Project

TXGLO, Matagorda Bay Foundation,and US Fish and Wildlife Service
Matagorda County, Texas

Job No.: 100076548	Scale: Not to Scale
Prepared By: Atkins/WHIT6392	Date: Apr 25, 2023

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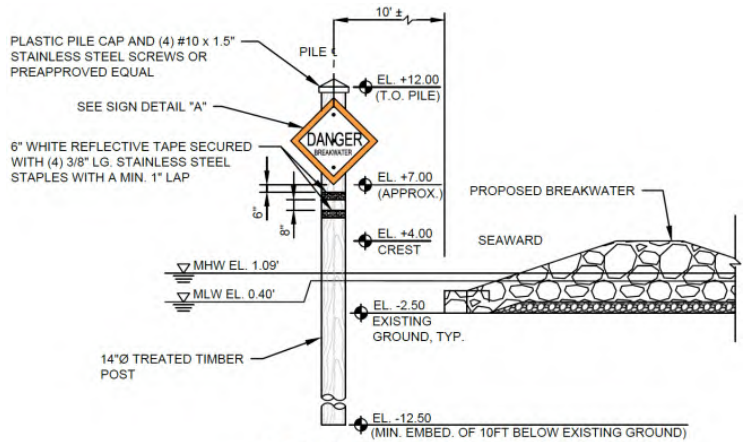
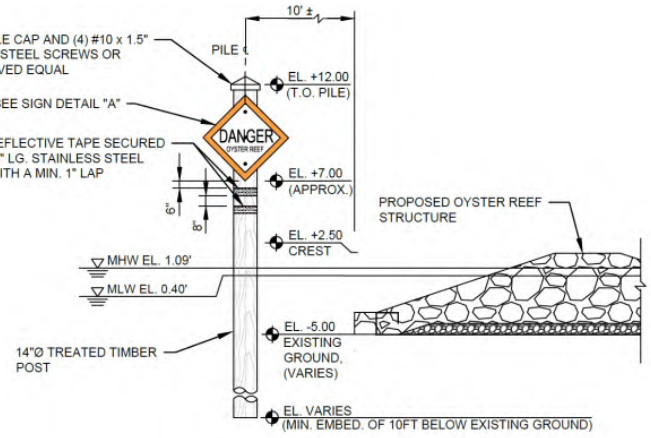
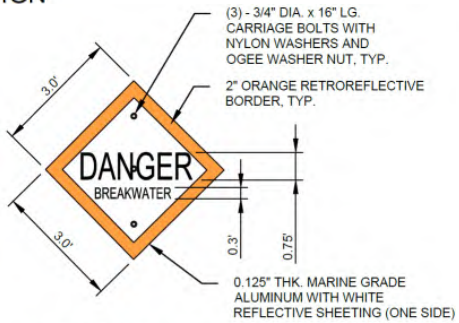


TYPICAL BREAKWATER SIGN



TYPICAL OYSTER REEF SIGN
NTS



NOTE: ALL HARDWARE SHALL BE GRADE 18-8 STAINLESS STEEL

SIGN DETAIL "A"
NTS

WATER LEVELS, FT (NAVD88) PORT O'CONNOR, TX STATION ID: 8773701	
MHHW	+1.10
MHW	+1.09
MLW	+0.40
MLLW	+0.38

Warning Sign Details

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Sheet 19 of 20
Warning Sign Details

Oliver Point/Oliver Reef Restoration Project

TXGLO, Matagorda Bay Foundation,and US Fish and Wildlife Service
Matagorda County, Texas

Job No.: 100076548	Scale: Not to Scale
Prepared By: Atkins/WHIT6392	Date: Apr 06, 2023

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WARNING SIGN LOCATION COORDINATE POINTS					
POINT NO.	NORTHING	EASTING	LATITUDE	LONGITUDE	STRUCTURE
W-1	13429702.07	2855753.25	28° 38' 49.08" N	96° 14' 00.56" W	BREAKWATER
W-2	13429754.15	2855465.50	28° 38' 49.66" N	96° 14' 03.78" W	BREAKWATER
W-3	13429465.48	2854655.49	28° 38' 47.00" N	96° 14' 12.94" W	BREAKWATER
W-4	13429202.55	2854466.65	28° 38' 44.44" N	96° 14' 15.13" W	BREAKWATER
W-5	13428612.42	2854396.27	28° 38' 38.61" N	96° 14' 16.08" W	BREAKWATER
W-6	13428333.31	2854504.23	28° 38' 35.82" N	96° 14' 14.94" W	BREAKWATER
W-7	13427916.36	2854922.98	28° 38' 31.60" N	96° 14' 10.35" W	BREAKWATER
W-8	13427584.42	2855359.23	28° 38' 28.21" N	96° 14' 05.55" W	BREAKWATER
W-9	13427216.97	2856120.22	28° 38' 24.40" N	96° 13' 57.10" W	BREAKWATER
W-10	13426832.78	2856824.05	28° 38' 20.43" N	96° 13' 49.31" W	BREAKWATER
W-11	13426352.58	2857491.70	28° 38' 15.52" N	96° 13' 41.95" W	BREAKWATER
W-12	13425727.88	2858394.81	28° 38' 09.12" N	96° 13' 31.98" W	BREAKWATER
W-13	13428486.19	2849957.02	28° 38' 38.40" N	96° 15' 05.92" W	OYSTER REEF
W-14	13428186.19	2849957.02	28° 38' 35.43" N	96° 15' 06.00" W	OYSTER REEF
W-15	13428486.19	2850959.90	28° 38' 38.16" N	96° 14' 54.67" W	OYSTER REEF
W-16	13428186.19	2851073.39	28° 38' 35.17" N	96° 14' 53.48" W	OYSTER REEF
W-17	13428486.19	2852076.64	28° 38' 37.90" N	96° 14' 42.14" W	OYSTER REEF
W-18	13428186.19	2852190.13	28° 38' 34.91" N	96° 14' 40.94" W	OYSTER REEF
W-19	13428486.19	2852963.06	28° 38' 37.70" N	96° 14' 32.19" W	OYSTER REEF
W-20	13428186.19	2853076.55	28° 38' 34.70" N	96° 14' 31.00" W	OYSTER REEF
W-21	13428486.19	2854007.02	28° 38' 37.45" N	96° 14' 20.48" W	OYSTER REEF
W-22	13428186.19	2854007.02	28° 38' 34.48" N	96° 14' 20.56" W	OYSTER REEF

Warning Sign Coordinates

ATKINS
Member of the SNC-Lavalin Group

Sheet 20 of 20
Warning Sign Coordinates

Oliver Point/Oliver Reef Restoration Project

TXGLO, Matagorda Bay Foundation,and US Fish and Wildlife Service
Matagorda County, Texas

Job No.: 100076548	Scale: Not to Scale
Prepared By: Atkins/WHIT6392	Date: Apr 06, 2023

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