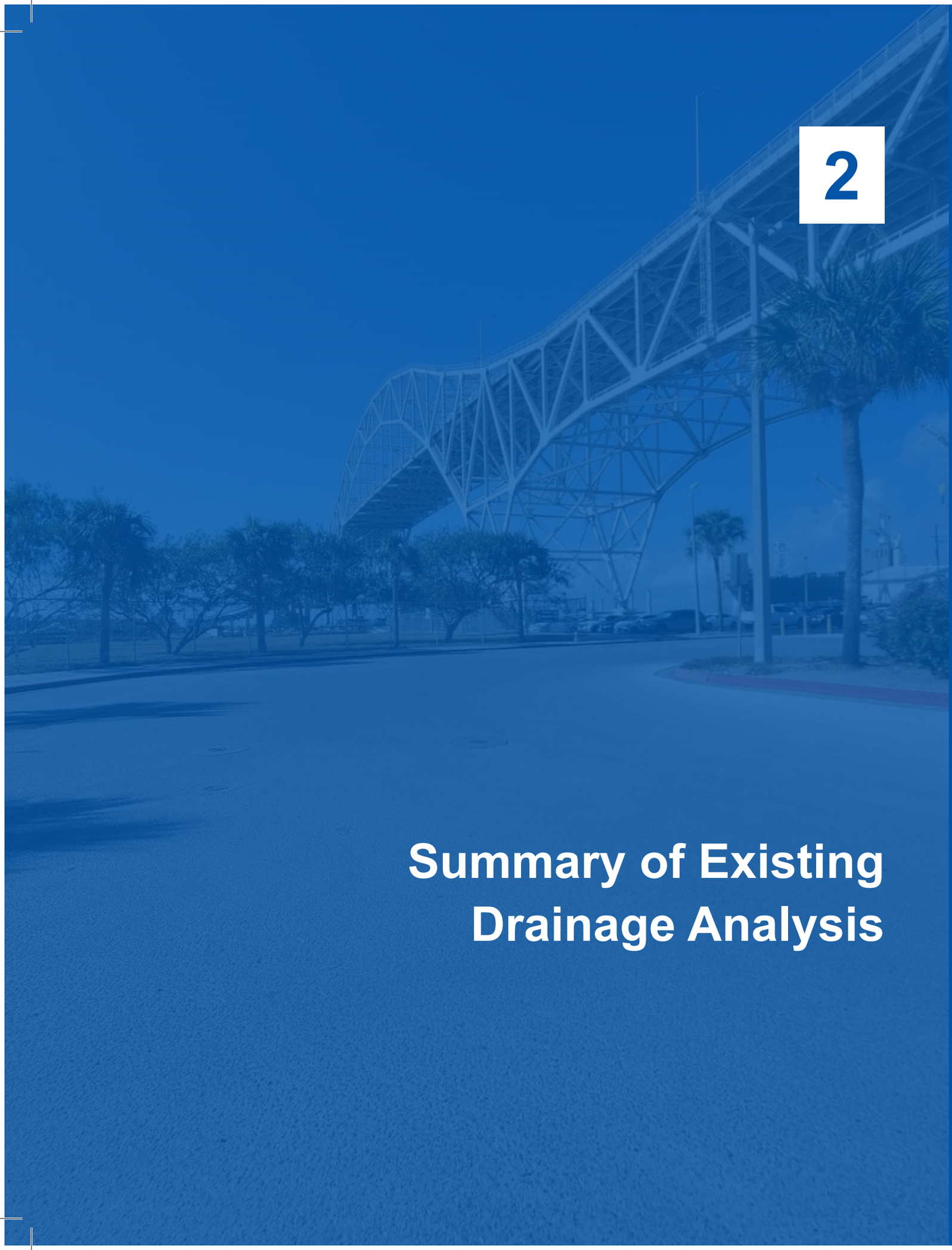

2

Summary of Existing Drainage Analysis

2 Summary of Existing Drainage Analysis

LAN performed a drainage analysis of North Beach Peninsula, located in the City of Corpus Christi. This low-lying coastal community experiences frequent flooding due to tidal fluctuations in the bay during moderate to severe storm events.

The purpose of this drainage analysis was to evaluate the existing drainage conditions and analyze the drainage performance of a proposed navigable canal. Previous studies performed by Urban Engineering (2018) indicated that the construction of a navigable canal alongside Surfside and Timon Boulevard would provide for improved drainage conditions. LAN investigated the feasibility of a navigable canal and expanded on the study with the development of two design options.

Additional detail can be found in the Hydrology and Hydraulics Technical Memorandum (Appendix A).

2.1 Existing Topography

The lidar topographic elevations for the area indicate that the elevations in this low-lying coastal area range between 1' to 6' above the mean sea level and are susceptible to frequent inundation from the rainfall as well as the backwaters from the bay.

The average natural ground elevation is 4.25-feet North American Vertical Datum, 1988 (NAVD-88).

Exhibit 1A and 1B – Existing Topographic Maps, demonstrate the range of elevations for the North Beach Peninsula. Figure 2-1 below is a snapshot of the topographic relief map showing existing grades (feet, NAVD-88):

Figure 2-1 – Topographic Map Snapshot

2.2 Existing Drainage System

Currently, the drainage system for the North Beach area consists mostly of underground pipes and culverts that connect to roadside storm water inlets. There are two underground systems alongside the peninsula that were installed in the 1970s (circled in blue in Figure 2-2 below). TXDOT has recently upgraded the drainage system along the western edge of the project area, specifically with a new drainage system under US181 which drains westward to the Rincon Canal. It is important to note that the TXDOT system was not part of LAN's analysis since it does not influence any future navigable canal development.

Although efficient many years ago, the submerged pipes remain underwater due to their flowline elevations of 4 feet and 5 feet below sea level.

Reference Exhibits 2A and 2B for the existing drainage area maps.

Figure 2-2 – Existing Drainage Systems

It is important to note that the duration of flood inundation is a significant factor when analyzing the drainage patterns of the North Beach Peninsula. These extended periods of inundation, which can last days and sometimes weeks, are heavily driven by tidal characteristics rather than rainfall itself. A combined coastal and local drainage system dynamic hydraulic model is required to accurately analyze the duration of flood inundation, and although this was not scoped for the purposes of this study, the effects of flood depth and inundation duration were documented for a feasibility assessment conducted by HDR, Inc. in a report titled "Feasibility Assessment – North Beach TXDOT Culvert Flooding Mitigation Project (E17111)" (July 2018). Localized, short term ponding is driven by rainfall events, however, the more problematic longer term ponding is driven entirely by tidal influences.

2.3 Design Criteria & Starting Tailwater

The objective of this drainage study is to advance the concepts of the previously identified navigable canal and analyze its hydraulic performance. Two types of data (input) were necessary to analyze drainage systems: Hydrologic Data (Rainfall) and Hydraulic Data (Size/Shape of Conveyance Systems and Tailwater Elevations.

Detailed methodologies and model results can be found in Appendix A.

2.3.1 Rainfall / Design Storms

The City of Corpus Christi Drainage Manual criteria was used for the hydrologic analysis. The manual divides drainage systems into three categories: Minor, Intermediate, and Major systems, depending on the contributing drainage area.

As instructed, LAN analyzed the North Beach Navigable Canal as a major drainage system. Per the City's drainage manual, major systems are designed for a 25-year design storm and checked for the 100-year design storm.

2.3.2 Tailwater Conditions

In order to perform a hydraulic drainage analysis, a downstream elevation (tailwater) must be first assumed at the outfall of the pipe or canal. North Beach is unique in that the existing and proposed systems do not outfall into a creek or river; they outfall into Corpus Christi Bay.

For the purposes of our models, two tailwater elevations were used for the hydraulic analysis: Mean Sea Level (MSL) and Highest Observed Tide (HOT). The Lexington gauge data was used to obtain this data.

The Mean Sea-Level at the gauge is +0.76-feet NAVD88 (North American Vertical Datum).

The highest observed tide used for the hydraulic models model was +3.30 feet NAVD88 (North American Vertical Datum).

2.4 Existing Inundations

Both the existing system and the proposed canal options were analyzed using 1D and 2D methods (see detailed drainage analysis in Appendix A). Hydraulic grade line computations were computed for the existing closed conduit system. Rational method was used to compute flows and HGL's were determined using a spreadsheet and checked with HEC-RAS software. The HEC-RAS 2D rain on mesh model was also used to check the drainage patterns of the existing drainage system.

Both 1D and 2D capabilities of HEC-RAS were used to analyze the proposed canal to analyze and map the inundation boundaries. To graphically illustrate how much of North Beach could be inundated during existing conditions, LAN mapped three inundation conditions or water surface elevations (NAVD88 Datum): 2-feet, 3.5-feet, and 6.5-feet.

Please note that these are not water depths but water surface elevations (WSE) according to the North American Vertical Datum, measured at the Lexington gauge.

For reference, since natural ground is roughly on average 4-feet (NAVD88), only those areas with ground elevations below 4-foot would be inundated under the first two conditions.

2.4.1 2-feet (NAVD88) Water Surface Elevation

Exhibits 3A and 3B illustrate the areas of North Beach that could be potentially inundated if the water surface elevation (tide or rainfall generated), were 2-feet (NAVD88).

Areas inundated would include Tourist Avenue between the US181 feeder road and Seagull Boulevard. Seagull Boulevard between Surfboard and Gulfspray, and the existing wetlands areas on the north end of the peninsula. Figure 2-3 below are two snapshots of Exhibit 3A & B.

Figure 2-3 shows approximately 25 acres, mostly wetlands, inundated in blue.

2.4.2 3.5-feet (NAVD88) Water Surface Elevation

Exhibits 3C and 3D illustrate the areas of North Beach that would be under water if the water surface elevation (tide or rainfall generated), were 3.5-feet (NAVD88); or slightly higher than the Highest Observed Tide (HOT).

Numerous areas would be inundated including most beach parks, Shoreline Boulevard in front of the Lexington, most east-west cross streets from Golf Place (Fajitaville) to the Jetties, and Seagull Boulevard and cross street on the west side of the proposed canal.

Figure 2-4 below shows two snapshots of Exhibit 3C & D. Approximately 100 acres are inundated in blue.

Figure 2-3 – Snapshot of Inundation with 2-foot WSE

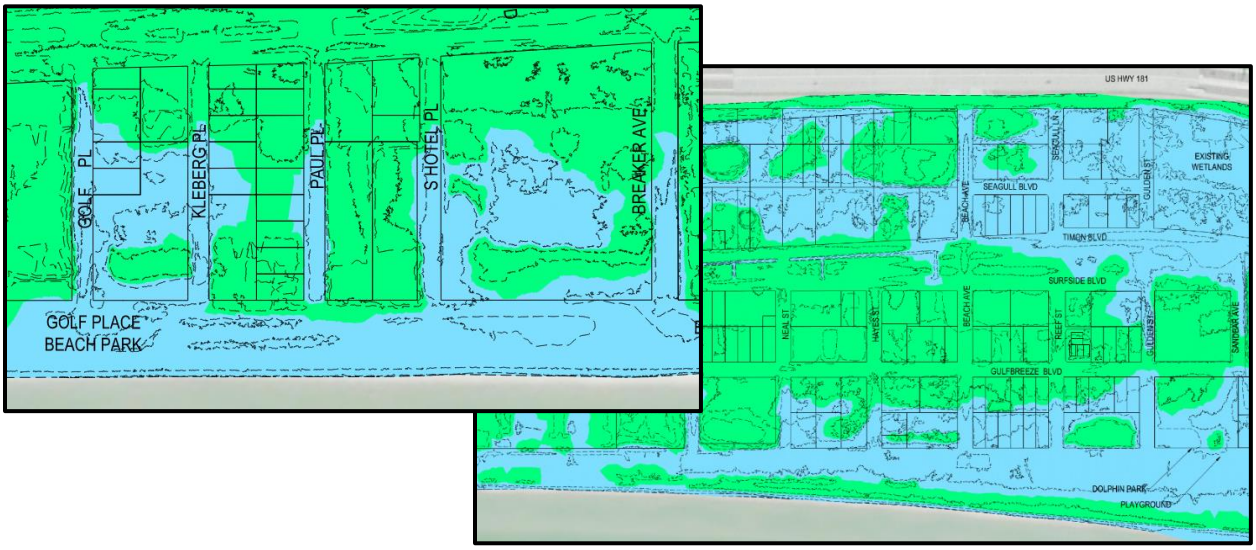

Figure 2-4 – Snapshot of Inundation with 3.5-foot WSE

Figure 2-5 – High Tide related flooding at Gulfspray Avenue Parking Lot

Figure 2-6 – High Tide related flooding at Bridgeport Avenue

2.4.3 6.5-feet (NAVD88) Water Surface Elevation

Exhibits 3E and 3F illustrate the areas of North Beach that would be inundated if the water surface elevation (tide or rainfall generated), were 6.5-feet (NAVD88). Only four areas would remain above the water surface elevation in this case. These areas are illustrated in green below:

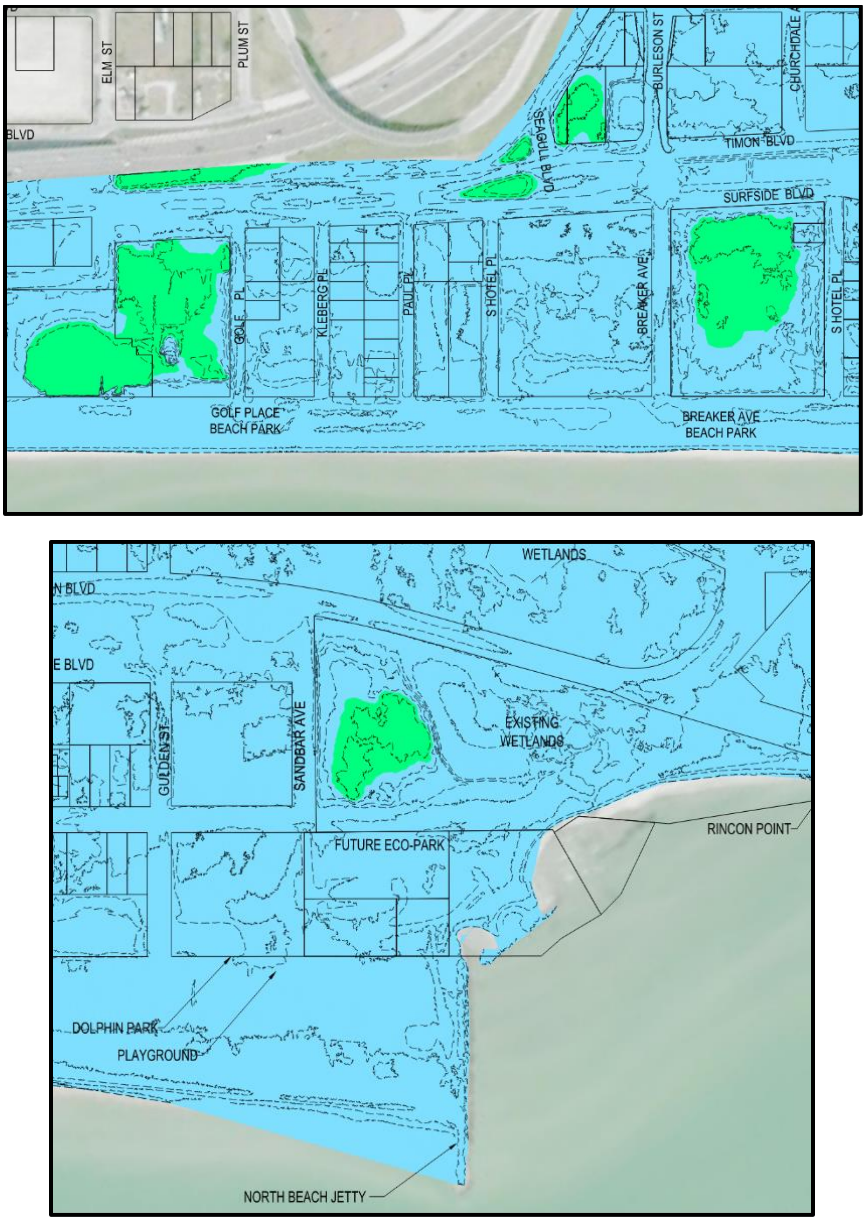

Figure 2-5 – Snapshot of Inundation with 6.5-foot WSE

2.4.4 Storm Surge Considerations

The purpose of this study was to analyze the existing conditions / topography and the proposed major drainage canal, based on established drainage criteria under normal highest observed tide conditions to determine if the proposed canal could address / improve drainage on North Beach.

LAN analyzed the North Beach Navigable Canal as a major drainage system using the 25-year design storm and 100-year design storm events. Additionally, Mean Sea Level and High Observed Tide (HOT) elevations were used to establish the tailwater conditions for the model.

LAN did not analyze the existing drainage system or the proposed navigable canal for storm surge events. An analysis of this type would potentially be required for the design of a flood protection structure, such as a seawall, levee, or floodwall.

For reference, during Hurricane Hanna, from July 23rd to July 27th 2020, storm surge elevations at the Lexington gauge reached approximately 5.5 feet NAVD88. Water was observed over most roadways and properties on North Beach. This is consistent with LAN's models and the inundation maps referenced in the sections above.

Below is an example of the inundation occurring at Burleson Street and Seagull Boulevard during tropical storm event (Hurricane Hanna, July 2020).

Figure 2-6 – Extreme event inundations

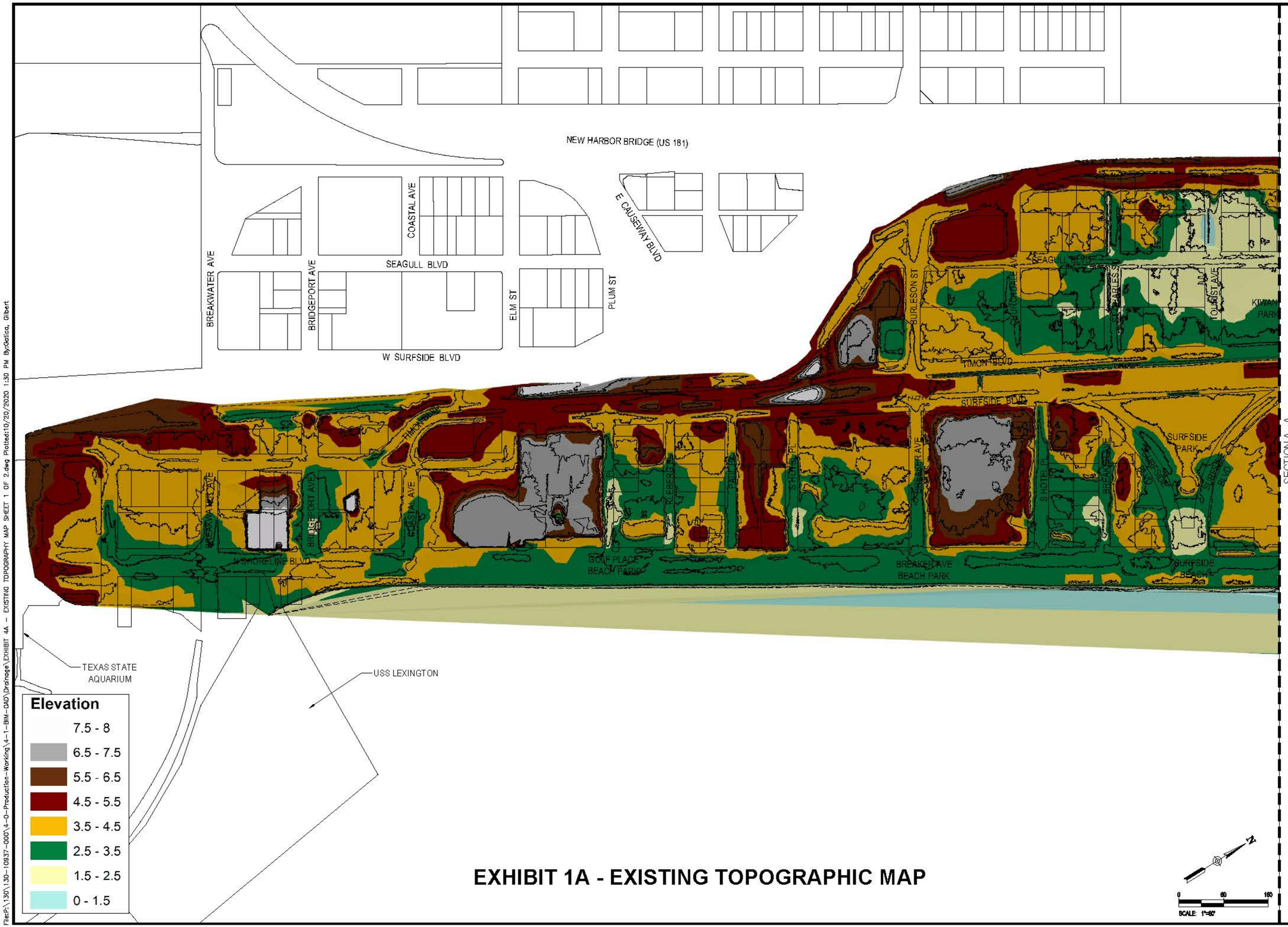

EXHIBIT 1A - EXISTING TOPOGRAPHIC MAP

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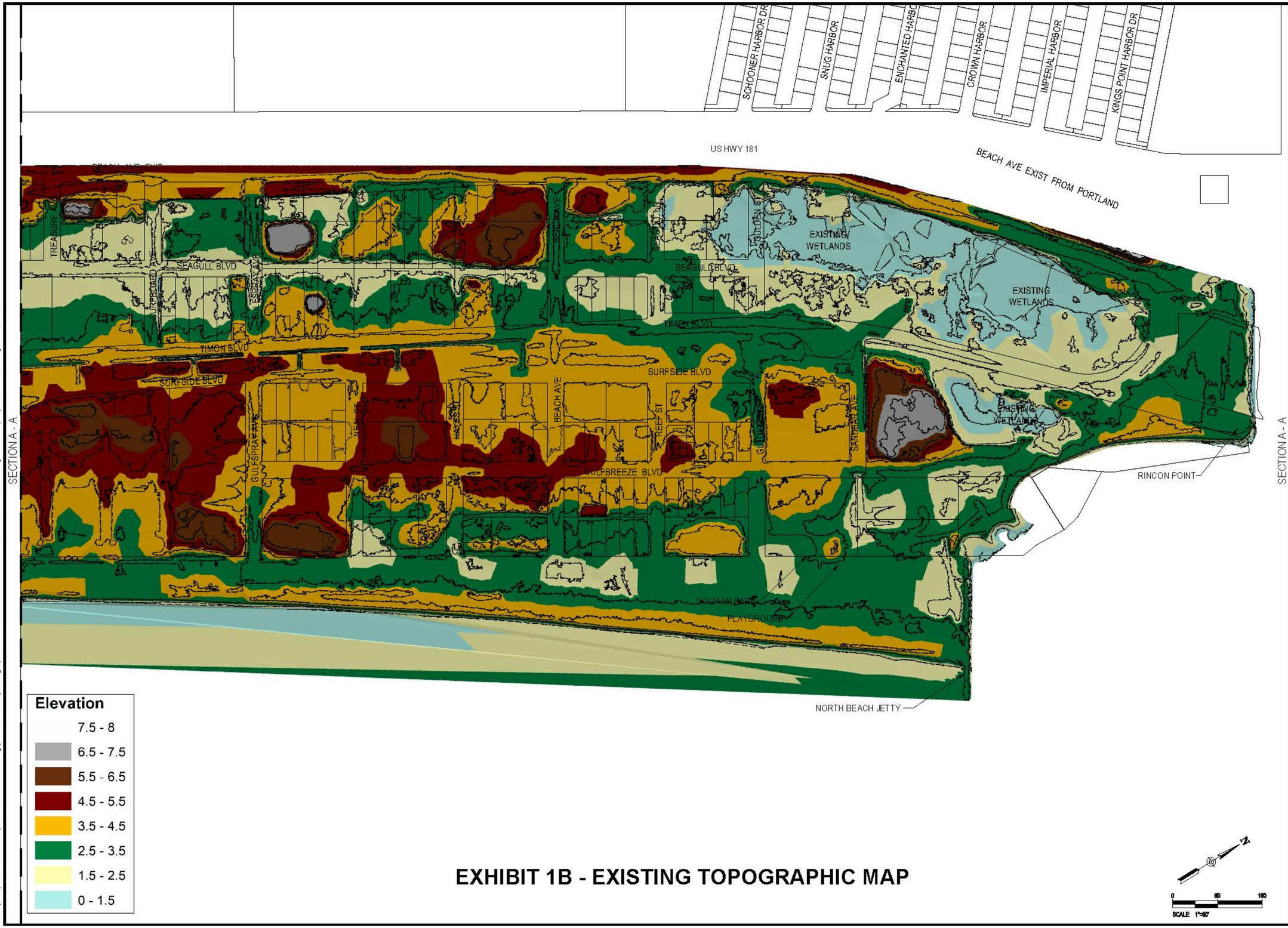

EXHIBIT 1B - EXISTING TOPOGRAPHIC MAP

SECTION A - A

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S-1	1.3	7.89	11.40
S-2	3.9	22.34	32.33
S-3	4.3	22.27	32.31
S-4	10.5	50.77	73.80
S-5	3.9	18.22	26.51
S-6	2.4	10.80	15.73
S-7	2.8	12.20	17.78
S-8	4.0	16.64	24.28
S-9	7.5	28.77	42.08
S-10	3.9	14.41	21.11
S-11	3.4	12.15	17.81
S-12	5.3	18.39	26.98
S-13	4.9	16.58	24.35
S-14	2.5	8.33	12.24
N-1	4.4	22.77	33.04
N-2	6.3	30.57	44.44
N-3	5.2	23.55	34.30
N-4	5.9	25.33	36.95
N-5	5.8	23.80	34.76
N-6	6.0	23.45	34.28
N-7	6.3	23.48	34.37
N-8	6.3	22.93	33.59
N-9	5.5	18.62	27.34

EXHIBIT 2A - EXISTING DRAINAGE AREA MAP (SOUTH)

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S-2	3.9	22.34	32.33
S-3	4.3	22.27	32.31
S-4	10.5	50.77	73.80
S-5	3.9	18.22	26.51
S-6	2.4	10.80	15.73
S-7	2.8	12.20	17.78
S-8	4.0	16.64	24.28
S-9	7.5	28.77	42.08
S-10	3.9	14.41	21.11
S-11	3.4	12.15	17.81
S-12	5.3	18.39	26.98
S-13	4.9	16.58	24.35
S-14	2.5	8.33	12.24
N-1	4.4	22.77	33.04
N-2	6.3	30.57	44.44
N-3	5.2	23.55	34.30
N-4	5.9	25.33	36.95
N-5	5.8	23.80	34.76
N-6	6.0	23.45	34.28
N-7	6.3	23.48	34.37
N-8	6.3	22.93	33.59
N-9	5.5	18.62	27.34

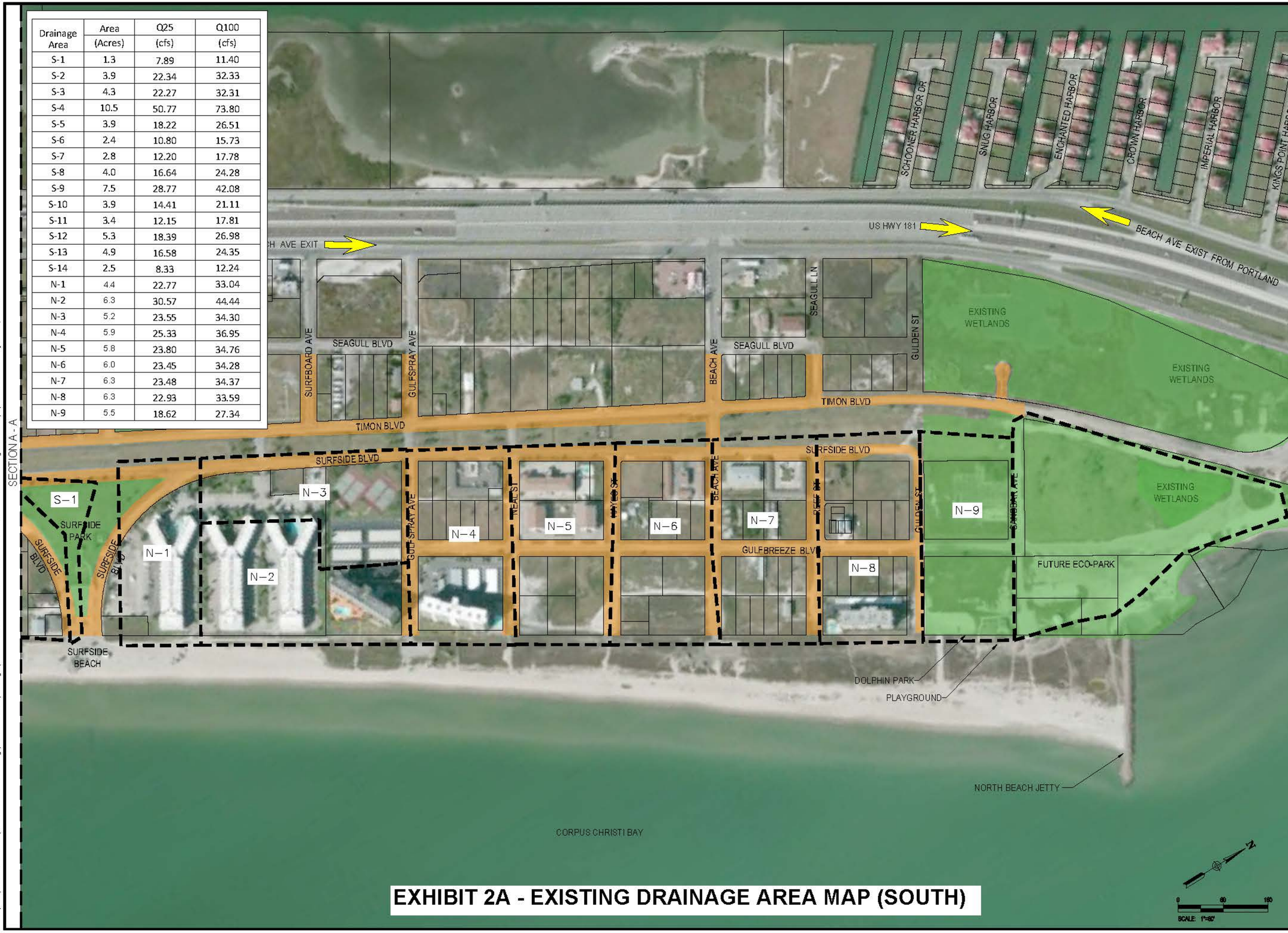

EXHIBIT 2A - EXISTING DRAINAGE AREA MAP (SOUTH)

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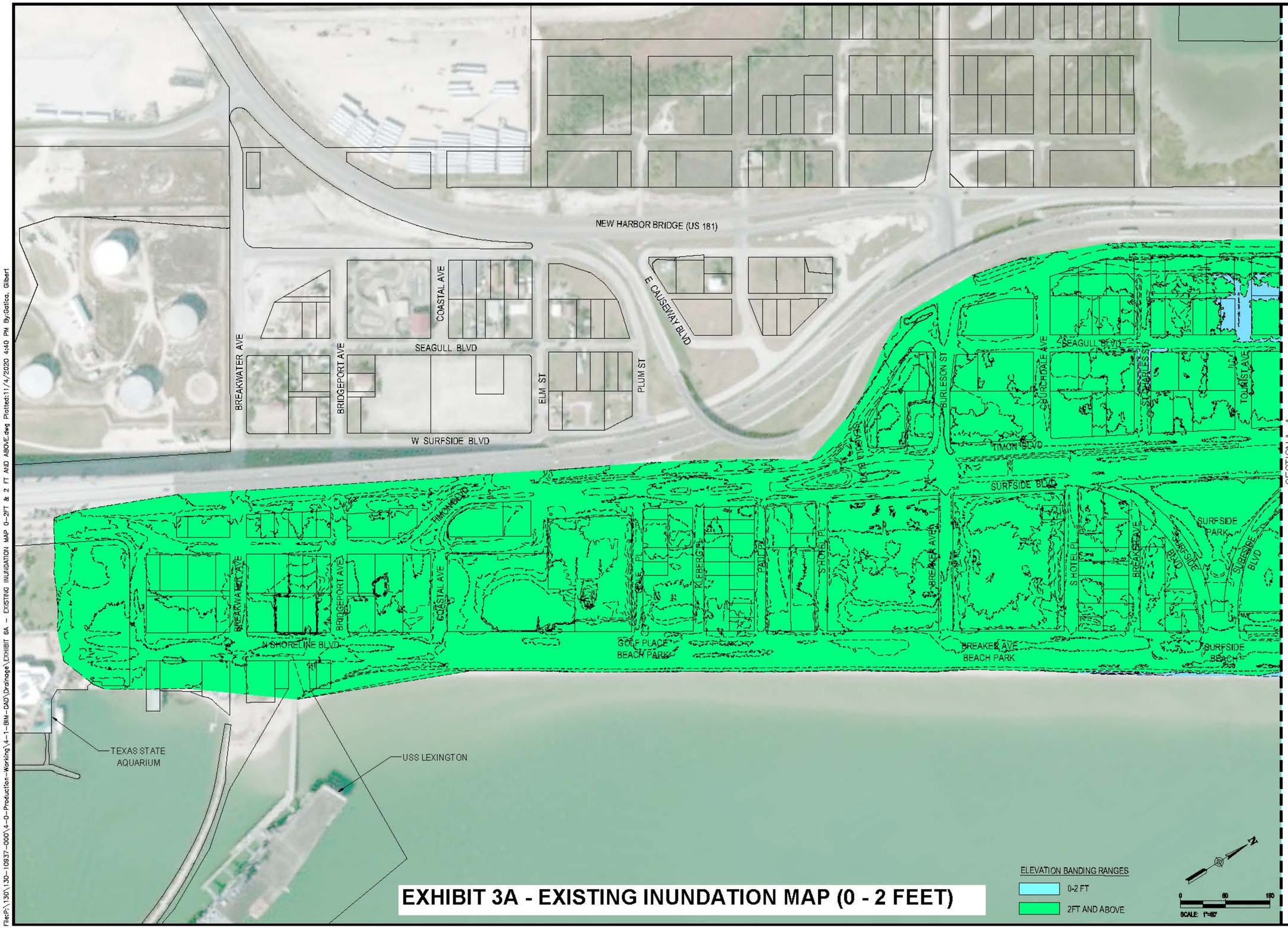

EXHIBIT 3A - EXISTING INUNDATION MAP (0 - 2 FEET)

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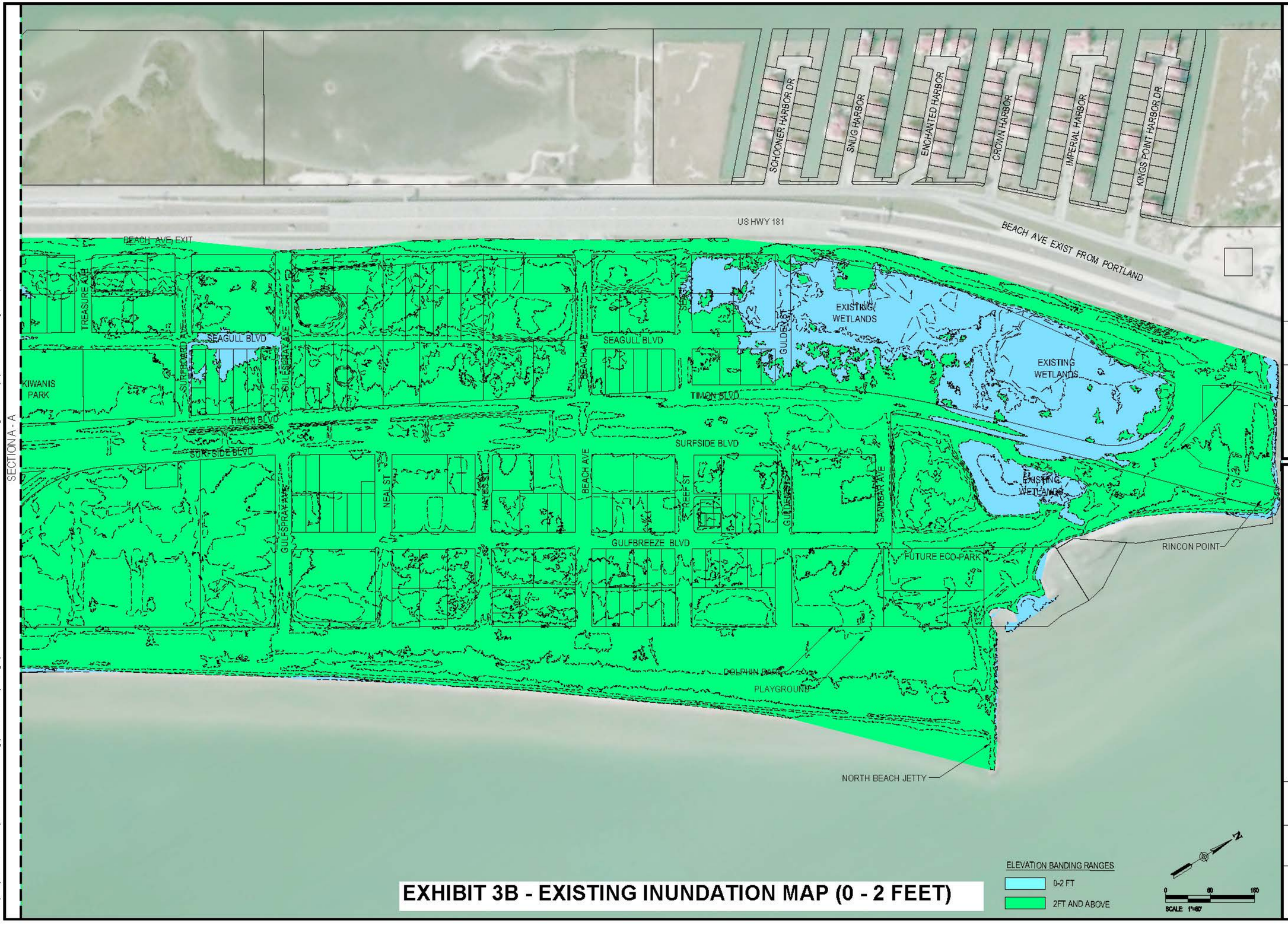

EXHIBIT 3B - EXISTING INUNDATION MAP (0 - 2 FEET)

SECTION A - A

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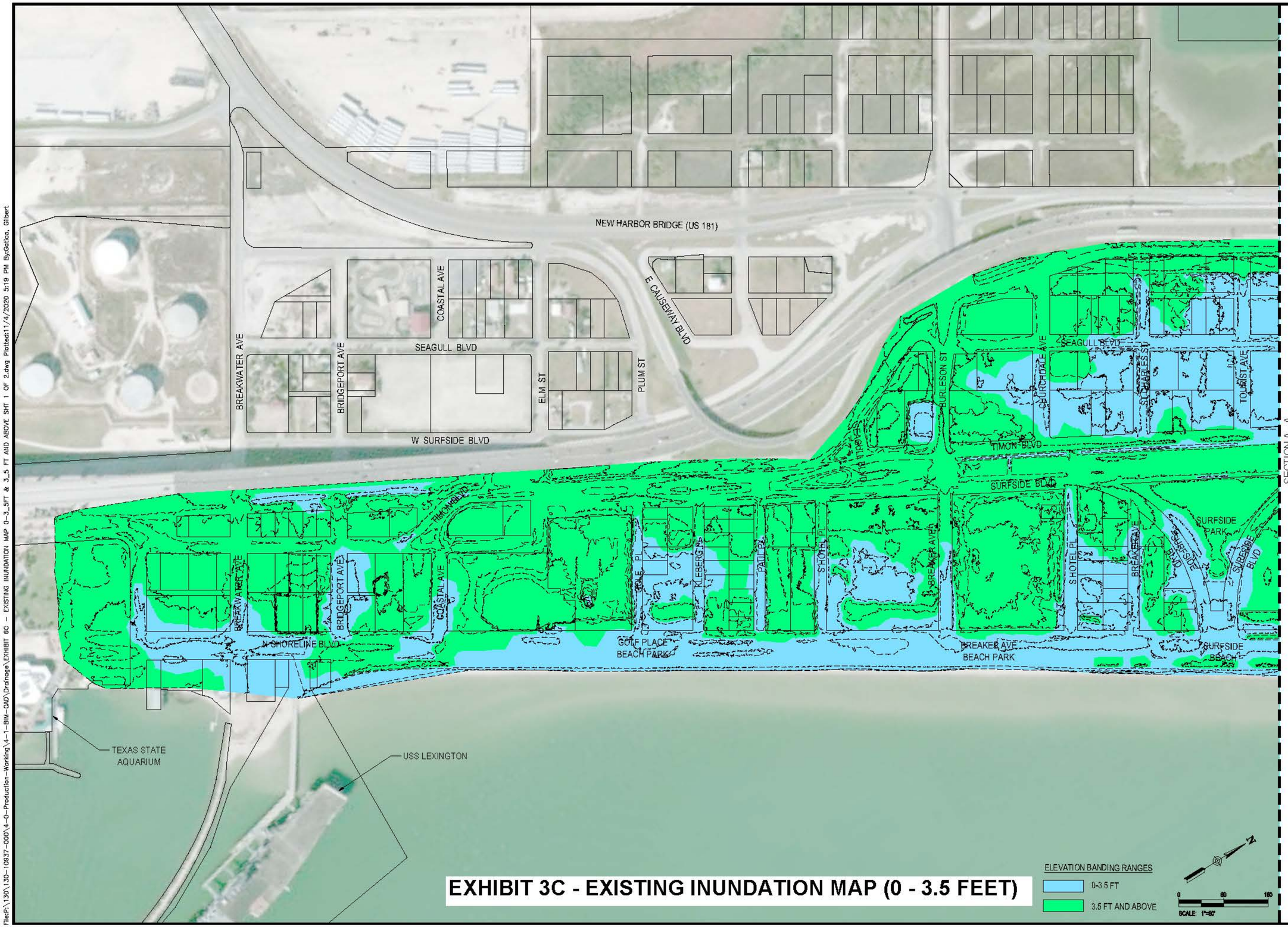

EXHIBIT 3C - EXISTING INUNDATION MAP (0 - 3.5 FEET)

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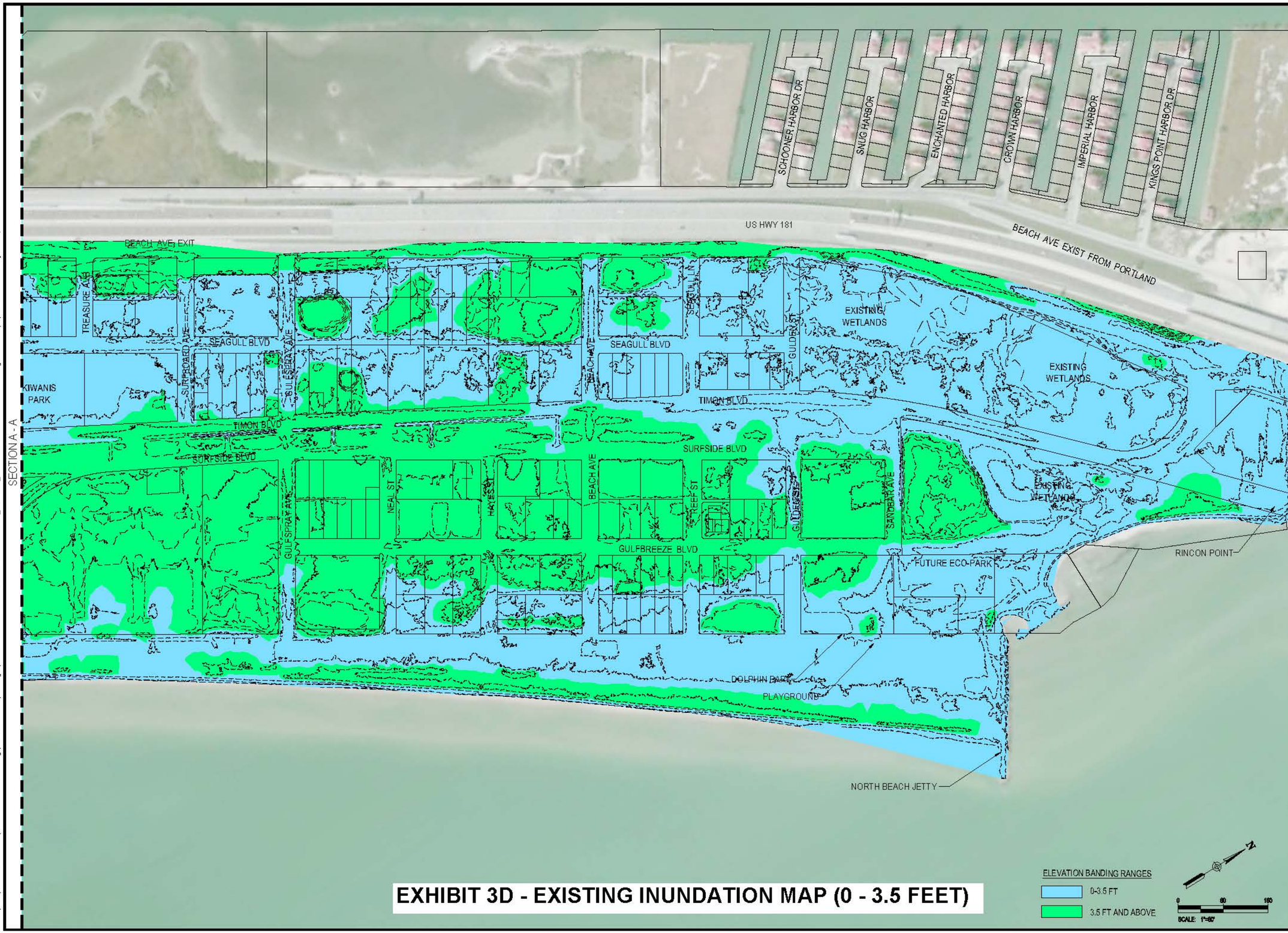

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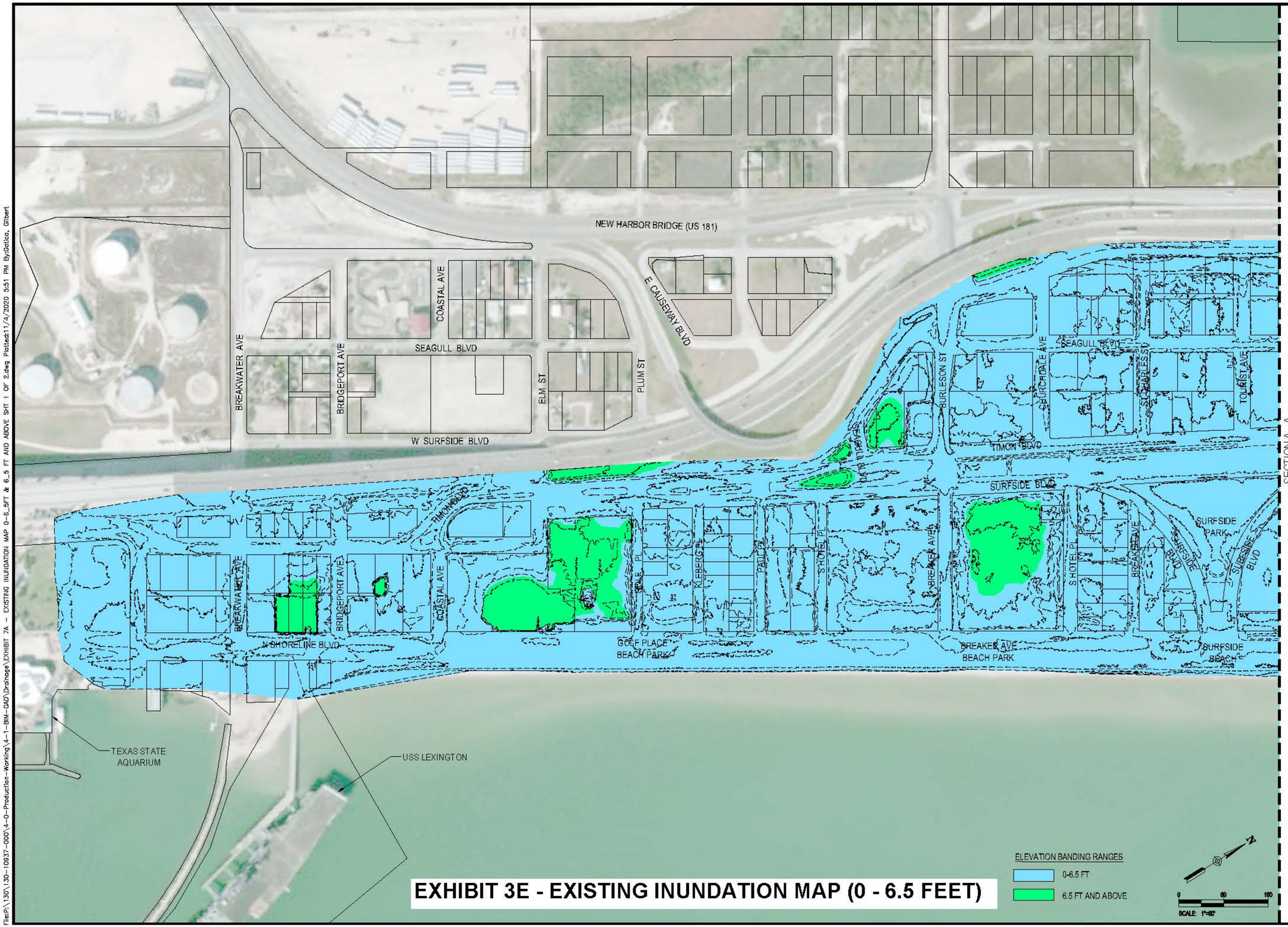

EXHIBIT 3E - EXISTING INUNDATION MAP (0 - 6.5 FEET)

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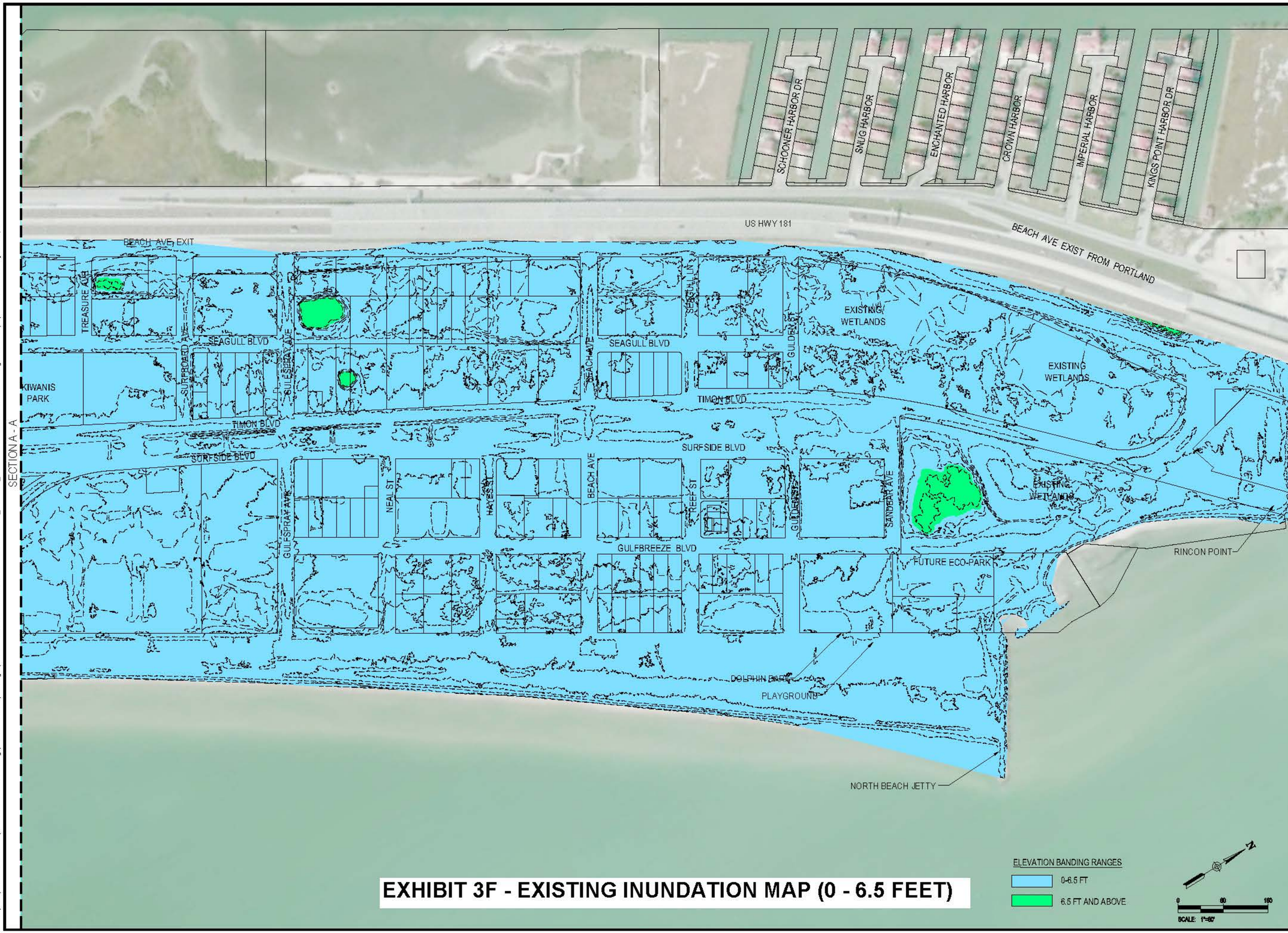

EXHIBIT 3F - EXISTING INUNDATION MAP (0 - 6.5 FEET)

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