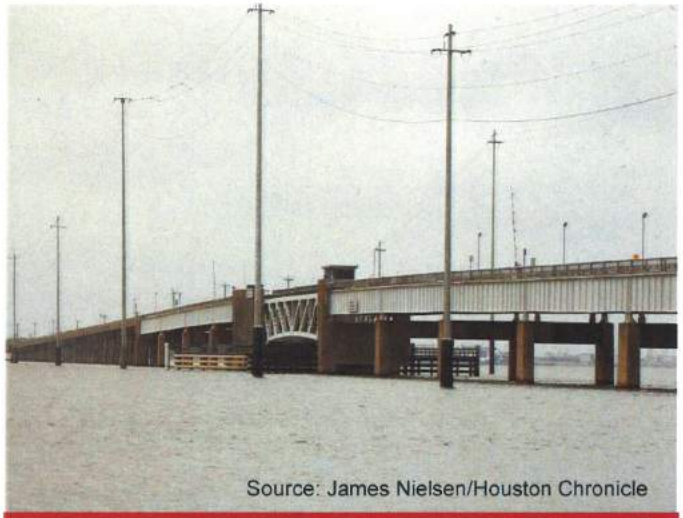

Source: James Nielsen/Houston Chronicle

Preliminary Engineering Report

Pelican Island Bridge Replacement

Phase 1

Galveston, TX
September 25, 2018

STATE OF TEXAS
K. L. OZUNA
65754
REGISTERED
PROFESSIONAL ENGINEER

PE
9-25-2018

PELICAN ISLAND BRIDGE
Replacement at Seawolf Parkway

4828 Loop Central Drive, Suite 800 | Houston, TX 77081 | Texas Reg. No. F-754

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Executive Summary

The purpose of this study is to evaluate various alignment options for the new Pelican Island Bridge. The Pelican Island Causeway is the only roadway access to Pelican Island. Located in Galveston County, Texas, the Pelican Island Causeway was constructed between 1955 and 1957 and opened to the public in 1958. The existing Pelican Island Bridge is historically significant because it is a bascule-type drawbridge, which uses a truss supporting an open deck that can be raised to an incline or vertical position, allowing vessels to pass. Bascule bridges were introduced in the 1890s but very few were built from 1945 to 1965. The Pelican Island Bridge is the only surviving bascule bridge in Texas from that period and one of only two known to have been built in Texas at that time. Due to its age and significance, the bridge has been deemed eligible for listing in the National Register of Historic Places. While this does not preclude its demolition and removal, compliance with the National Historic Preservation Act (NHPA) will be required.

Current Condition

The existing roadway typical section, inadequate by today's standards, does not accommodate pedestrian nor bicycle traffic. In addition, the bridge is load posted, forcing heavy loads going in and out of the island to be moved by barge instead of truck. Drawbridge operations during vessel passage cause significant traffic delays. Furthermore, over the last twenty years, there have been documented environmental distresses affecting the bridge, including corrosion and scour.

These ongoing issues create traffic, capacity, and operational and safety concerns. Replacing the Pelican Island Bridge would ensure that reliable access to the island is maintained and economic development is encouraged.

Project Goals

- Improve outdated and substandard design features
- Reduce ongoing annual maintenance, rehabilitation, and repair costs
- Provide reliable and secure pedestrian and bicycle access across the bridge
- Accommodate future heavy truck traffic and traffic growth
- Balance the environmental and transportation requirements to the extent practicable

Future Planning & Condition

Over the next few years, Texas A&M University-Galveston (TAMUG) campus expects a significant increase in the total number of students. Additionally, the Port of Galveston has signed an agreement with the Texas-Mexico & Pacific Railroad and Lexington Coal Co. to develop a coal export terminal on Pelican Island and build a railroad bridge and tracks.[1] Port of Houston owns significant land on the island that can be developed with this improved access in place. The new roadway design will accommodate the growing number of pedestrians and bicyclists (mostly students) and the increased vehicles per day (VPD) that would stem from future development and economic growth on the island.

Benefits

- Supports economic growth for various businesses on the island
- Accommodate TAMU Galveston's 3000+ student enrollment plan
- Improves emergency vehicle access
- Reduces maintenance costs
- Provides reliable access for pedestrian and bicycle traffic

Project Status

The development of conceptual options, Preliminary Engineering Report, and Environmental Studies are ongoing. TxDOT and Galveston County have been actively engaged in the project development. The public involvement process includes briefing elected officials, holding public meetings, and coordination with the property owners.

Preliminary Total Project Cost could range from approximately $15 million to $114 million depending on selected conceptual option.

[1] (Seedah, Harrison, Boske, Kruse, & Protopapas, 2013)Trade Flows and Texas Gulf Ports: Panama Canal Expansion and South American Markets, Austin Center for Transportation Research

1 Introduction

1.1 Overview & Scope

HDR Engineering, Inc. was retained by Galveston County to prepare the schematic design and Preliminary Engineering Report for the preliminary analysis of a new Pelican Island Bridge. The proposed bridge will replace the existing Herbert E. Schmidt Causeway (Pelican Island Causeway) that crosses the Galveston Ship Channel between Galveston and Pelican Island. The Pelican Island Causeway is owned and operated by Galveston County Navigation District No. 1. This Preliminary Engineering Report includes:

Report Overview

This report identifies and defines the project alignment options, cost estimates and screening evaluation process.

- analysis of alignment options
- environmental documentation
- public involvement
- coordination with the Texas Department of Transportation (TxDOT), City of Galveston, and other local, state, and federal governing agencies.

1.2 Project Location

Pelican Island is located in Galveston County, TX and is part of the City of Galveston. The island is located north of Galveston Island and is connected by Pelican Island Causeway, as seen in Figure 1-1. See Exhibit 1 - Project Vicinity Map for more details.

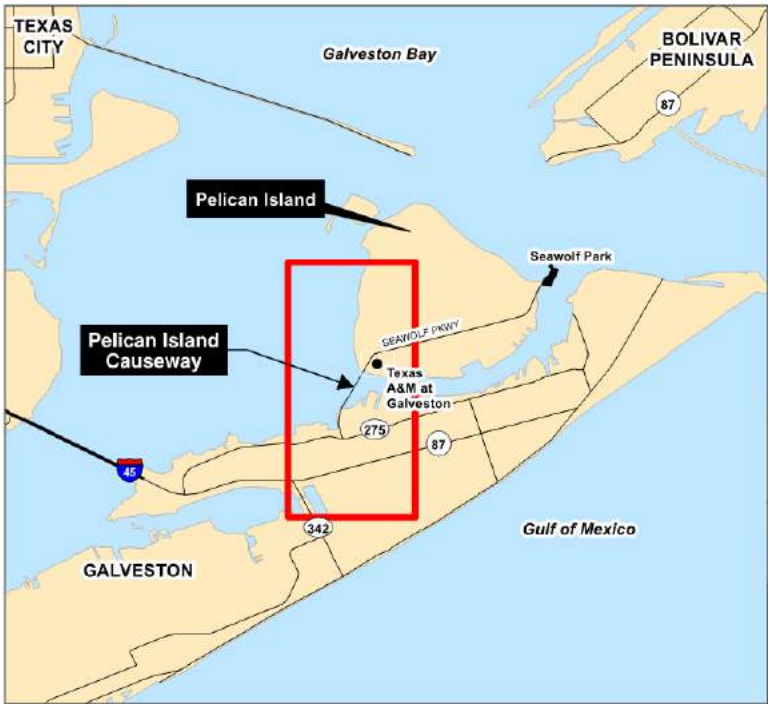

Figure 1-1: Project Location

1.3 Project Need & Goals

Through coordination with Galveston County, TAMU-Galveston, TxDOT, Galveston County Navigation District No. 1, various other public agencies, stakeholders, and the public, needs and goals for the replacement of the Pelican Island Bridge were established. The following list of factors drove the determination of the project's need and goals:

- outdated and substandard roadway, pedestrian, and cyclist design features
- high ongoing annual maintenance, rehabilitation, and repair costs
- existing load posted structure limits heavy truck access
- Current inspection ratings indicate a sufficiency rating classifying the bridge as "structurally deficient", indicating that the structure is in poor condition

The specific project goals are to:

- provide an alignment with a 45 mph design speed for a WB-67 design vehicle
- provide a structure with a 75 year service life
- minimize adverse environmental impacts
- provide 75-foot vertical clearance over Galveston Ship Channel
- provide reliable pedestrian and bicycle access across the bridge
- provide improved emergency response access
- reduce maintenance requirements
- provide a crossing that allows for future railroad corridor

1.4 Future Development & Economic Growth

A new bridge would bring immediate and long-term benefits to Pelican Island. The island is home to several businesses servicing the maritime and oil and gas industries, including Southwest Shipyard, Laredo Construction, Gulf Copper Dry Dock and Rig Repair, AET Offshore Services, Tiger Offshore Rental, and G&H Towing, among others. See Table 1-1: List of Establishments on the Pelican Island for a more complete list. A non-load posted bridge that allows heavy truck access is vital to future development and economic growth for these and future businesses on Pelican Island. Additionally, the Port of Galveston signed an agreement with the Texas-Mexico & Pacific Railroad and Lexington Coal Co. to develop a coal export terminal on Pelican Island and build a railroad bridge and tracks.[2]

Per the TAMU Galveston Campus Master Plan dated April 2009, the campus plans to accommodate an enrollment of 3000+ students in the future. Enhanced pedestrian, bicycle and emergency vehicle access are essential to advance this goal. With improved

[2] (Seedah, Harrison, Boske, Kruse, & Protopapas, 2013) http://library.ctr.utexas.edu/ctr-publications/0-6690-CTR-2.pdf

access in place, Port of Houston would be also able to develop the significant amount of unused property it owns on the island.

Table 1-1: List of Establishments on the Pelican Island

AET Offshore Services, Inc.
American Eagle Tankers
Chouest Southwest Holdings, LP
City of Galveston – Seawolf Park
Dresser Industries
G&H Towing Company
Galveston Terminals, Inc.
Gulf Copper
Halliburton Energy Services, Inc.
JAM Marine Services
KGBC AM Galveston
Laredo Construction, Inc.
Martin Midstream Partners, LP.
Martin Operating Partners, LP
OSG
Pelican Island Investments, LLC
Pelican Island Storage Terminal, LLC
Port of Houston Authority
Rolls Royce Marine Services
Schlumberger
Siga Broadcasting Corp
Southwest Shipyard
Southwestern Bell Telephone Company
Springob Enterprises, Inc.
SWS Holdings
T&T Offshore
TAMU Galveston Campus
Tetra Technologies

1.4.1 Future Railroad Accommodation

An important consideration for the alignment of the proposed Pelican Island Brie replacement is the accommodation of a future freight rail alignment from Galveston Island to Pelican Island (as sited in The Goodman Coorporation/HDR Engineering Inc.'s Pelican Island Rail and Vehicular Access Feasibility Study, Septemer 2015). A future railroad bridge to Pelican Island would spur economic development, especially for industrial land uses. The rail alignment would likely begin east of Pelican Island Causeway on Galveston Island and terminate north of TAMUG's Maritime Academy on Pelican Island. No specific alignment for a future railroad bridge was developed because this is outside the scope and purpose of this project.

2 Existing Conditions

2.1 Roadway Characteristics

Opened to the public in the year 1958, the Pelican Island Causeway is the only roadway access to Pelican Island, making it the only vehicular route to the TAMUG campus and to a number of establishments on the island. The causeway is approximately 3,235 linear feet (LF) and was built to accommodate railroad and highway traffic. The movable main span is operated by a continuously manned control station at the south bascule pier. The posted speed limit on the bridge is 35 mph. As seen in the Traffic Analysis Report in Appendix F by Cobb, Fendley, & Associates, Inc., the 2017 Average Daily Traffic (ADT) counts on the bridge total to be approximately 8,000 vehicles. This ADT warrants the widening of the bridge to four lanes, according to TxDOT's roadway and bridge design guidelines.

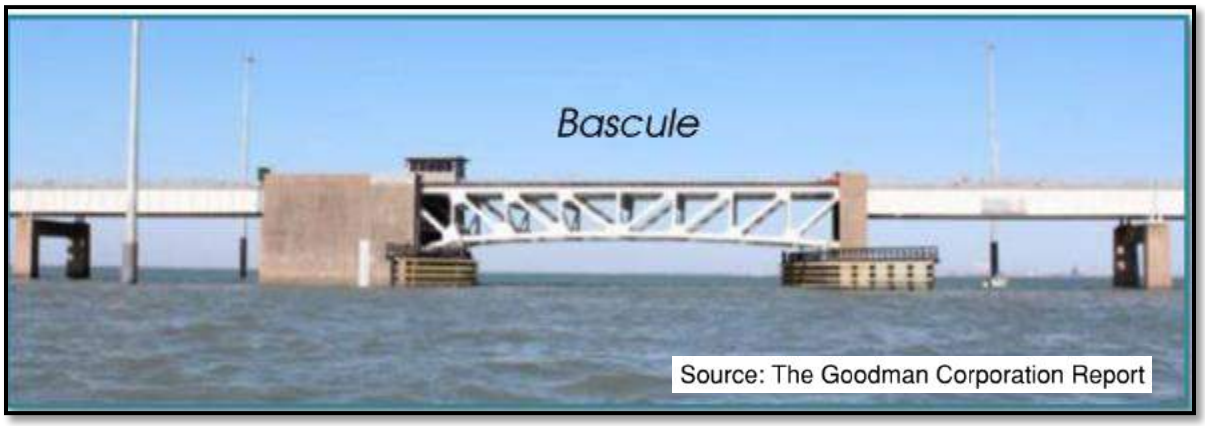

Figure 2-1: Existing lift mechanism bascule across Pelican Island Bridge

In the year 2016, there were approximately 2,300 openings for vessel crossings, as broken down in Figure 2-2 below. Due to rush hour traffic, bridge openings are not allowed during peak hours from 6:45 AM to 8:10 AM, 12:00 PM to 1:00 PM, and 4:15 PM to 5:15 PM. There are no opening restrictions on the weekends and holidays.[3]

[3] (Lone Star Harbor Safety Committee) http://www.lonestarhsc.org/docs/resources/Pelican%20Island%20Bridge%20-Info%20for%20Recreational%20Boaters.pdf

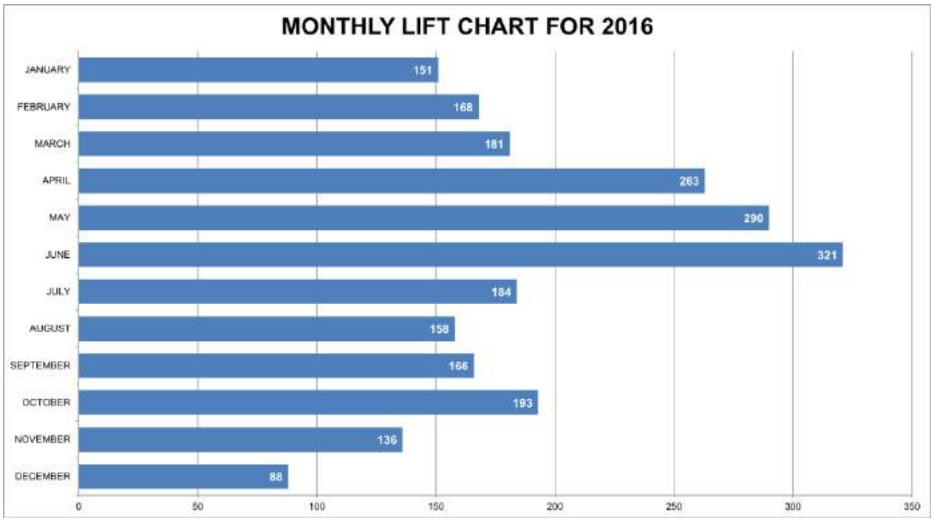

Figure 2-2: 2016 PIB Monthly Lift Chart

2.2 Typical Section

The existing roadway section is about 26 feet wide with two 13-foot travel lanes and approximately 3-foot- and 1.5-foot-wide curbs on the west and east sides, respectively. The railroad track on the east side of the causeway is 10.5 feet wide and has been abandoned; the majority of the track has been removed. The existing bridge provides a 120-foot horizontal clearance across Galveston Ship Channel. See Figure 2-3 or Exhibit 4 for a graphical representation of the existing typical section.

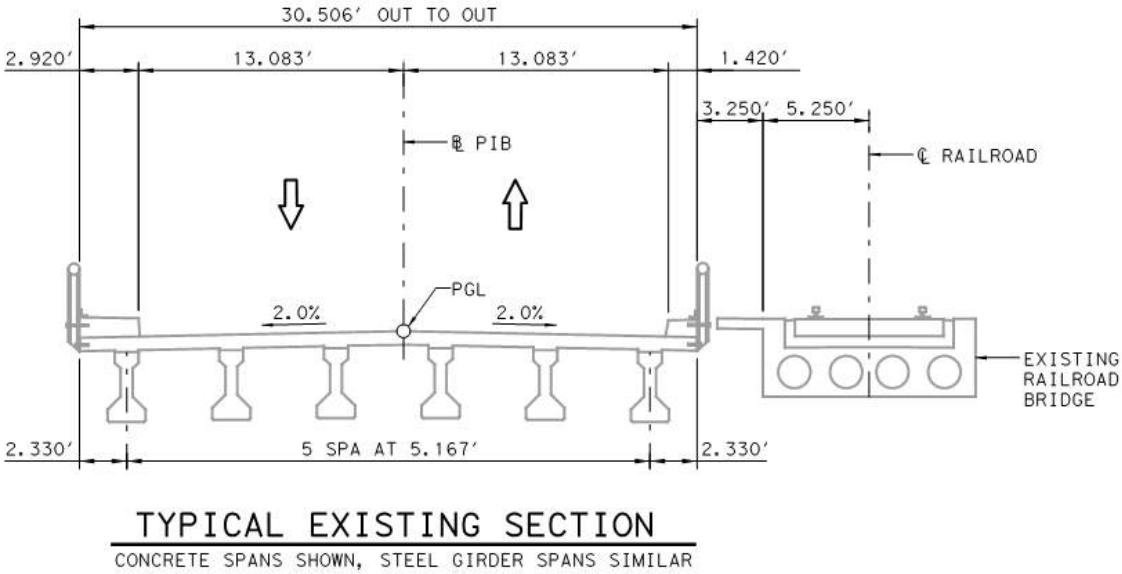

Figure 2-3: Existing Typical Section

2.3 Bridge

The existing bridge (NBI# 12-0-85B-007-90-001) is on a tangent segment of roadway and has a total length of 3,235.5 feet. The movable main span is a 215-foot long single leaf rolling lift bascule span with a control station. The bridge riding surface is crowned at

the roadway centerline. The bridge was originally built to carry both railroad and highway traffic, but portions of the track have been removed and there is currently no railroad use on the bridge.

The bridge consists of 42 individual 50-foot pre-stressed concrete beam approach spans on either end of the bascule bridge (1,000 feet south and 1,100 feet north). The parallel railroad spans on the east end of the bridge are only 25 feet long with additional independent bents constructed midway between the highway bents. Four and five steel girder approach spans of lengths averaging 102 feet flank the main bascule span on the south and north sides, respectively. The nine steel approach spans and main bascule span are founded on concrete footings supported by timber piles under the mud line. The concrete approach spans are supported on 24-inch square pre-stressed concrete pile trestle bents. The causeway deck is concrete, except for the bascule span which consists of aluminum grating. There is a painted steel railing on both sides of the causeway deck.

2.3.1 Bridge Condition

Summary of bridge rehab work done in 1995

Scoured footings with decaying timber piles were repaired by driving sheet piling around the perimeter of the footing and filling voids with concrete. Riprap was placed at the toe of sheet piling to reduce further scouring. Concrete piles with vertical open cracks below the water line were repaired by encasing the damaged portion in a concrete collar. Other structural repairs included patching spalled concrete with non-shrink grout, repairing bascule span deck grating connections and steel columns, and modifying bridge railing. Existing track girder was repaired by replacing the existing shoe castings and bushing parts. Underwater control cable and metal beam guard fence on approach roadway were also replaced.

Summary of bridge rehab work done in 2008-2009

The bridge was rehabilitated due to damage incurred from Hurricane Ike. The existing fender system, in the navigation channel, was replaced. The embankment, riprap, and south roadway approach were also repaired.

Summary of bridge rehab work done in 2011-2012

A bridge inspection was completed in the year 2010 and rehabilitation work began in August 2011.[4] Rehabilitation measures for this bascule bridge included piling repairs, slope protection, repairs to the damaged prestressed concrete beams, redesign of the toe locking mechanism, replacement of the original diesel power generator, and replacement of the electric submarine cable that crosses the navigation channel.[5]

[4] (Baughn) http://bridgehunter.com/tx/galveston/pelican-island/

[5] (LJA Engineering) https://www.ljaengineering.com/Public_Infra_Trans_Projects_Det.cfm?id=267

Summary of bridge rehab work done in 2014

Bridge inspection by TxDOT and the Federal Highway Administration (FHWA) determined that the “rocker segmental girder tracks” that allow the bridge to open and close were severely corroded. The United States Coast Guard (USCG) temporarily changed the operating schedule of the drawbridge for navigation to allow for major repairs on its mechanical components to improve operation and safety. Replacement parts were unavailable due to the advanced age of the bridge; instead, existing parts were removed and molds were made to manufacture replacement parts.[7] The temporary closure to vessel traffic by the Coast Guard of the drawbridge was effective from May 6, 2013 until July 8, 2014. The repairs to the bridge started in early October 2013 and the temporary channel closure by USCG was extended until the bridge repairs completion date. Bridge repairs were completed in early 2015 and opened for navigation traffic in the channel.

Summary of bridge rehab work scheduled in 2017-2018

Electrical components of the rolling lift bascule at the control station were scheduled to be replaced in September 2017 as part of bridge maintenance. Foundation repairs consisting of additional riprap are required due to scouring and are expected to take place in 2018.

[7] (Coast Guard, 2013) https://www.federalregister.gov/documents/2013/04/05/2013-07908/drawbridge-operation-regulations-pelican-island-causeway-galveston-channel-tx

2.4 Utilities

Because utility relocations could cause project delays and extra costs, it was important to consider possible utility conflicts when developing the replacement options. During a field visit on May 9, 2017, utility markers for Energy Transfer Pipeline and Southwestern Bell Company were found on the west side of Seawolf Parkway. Ground stakes for proposed water, sanitary and storm sewer lines were found at the northwest end of the bridge on Pelican Island near the first driveway. There are also overhead power transmission lines running parallel on either side of the existing bridge between Galveston and Pelican Islands. Photos of markers and existing utilities are shown in Figure 2-4.

Figure 2-4: Utilities In Project Area

The existing bridge has the following utilities embedded in the bridge deck: 2-inch diameter water line (abandoned), 1 ¼-inch diameter phone conduit, 3-inch diameter electrical conduit. Along with the embedded utilities, the bridge also externally carries at least 4 unknown conduits of various sizes on the southeast side of the bridge.

See Exhibit 2 for utility base map of the project area.

3 Environmental Review

The Goodman Corporation conducted a preliminary environmental assessment of the project area. Their findings are documented in the “Pelican Island Rail and Vehicular Access Feasibility Study” dated September 2015. This report contains a complete discussion of the environmental characteristics and the regulatory considerations.

The study area includes portions of Galveston Bay, City of Galveston, Galveston Port Authority, Galveston Ship Channel and Pelican Island.

Crouch Environmental Services, Inc. (CESI) conducted a site survey of the approximately 265-acre subject property in February 2017, which included a wetland delineation and threatened and endangered (T&E) species habitat assessment. In addition, a cultural resources desktop assessment was completed. The purpose of the wetland delineation was to determine if wetlands, watercourses, and/or bodies of water are present on the subject property and, if found, to establish whether those features would potentially fall under the jurisdiction of the U.S. Army Corps of Engineers (USACE) through their regulatory authority under Section 404 of the Clean Water Act (CWA) and Section 10 of the Rivers and Harbors Act (RHA). The USACE verified the wetland delineation on September 25, 2017. The T&E habitat assessment determined whether federally and state-listed T&E species and/or their critical habitat could exist within the Subject Property. The cultural resources assessment determined whether field surveys will be required to comply with Section 106 of the National Environmental Policy Act (NEPA). Summary of the results of the wetland delineation and USACE verification, T&E species habitat assessment, and cultural assessment are included in Appendix A.

3.1 Wetland Delineation Results Summary

As reflected in Table 3-1: below, five types of aquatic features were identified on the Subject Property, and later verified by the USACE, including one palustrine emergent (PEM) wetland area (13.24 acres), three palustrine scrub-shrub (PSS) wetland areas (totaling 6.83 acres), and two open water features (E2EM1Px, 1.01 acres and Galveston Bay, 192.63 acres). In addition, 0.26 acres of mudflats were identified, which are jurisdictional under Section 10 of the RHA. All of these features appear to have a significant nexus to Galveston Bay, a Traditionally Navigable Water (TNW); therefore, these areas are considered jurisdictional by the USACE.

Table 3-1: Aquatic Features Verified Within the Subject Property

Feature Name	Feature Type*	USACE Jurisdictional Status	Length (ft)	Size (ac)
PEM Wetland	PEM Wetland	Jurisdictional	N/A	13.24
PSS Wetland	PSS Wetland	Jurisdictional	N/A	6.83
Open Water	E2EM1Px	Jurisdictional	N/A	1.01
Open Water (Galveston Bay)	E1UBL	Jurisdictional	N/A	192.63
Mudflat	Special Aquatic Site	Jurisdictional	N/A	0.26
		TOTAL AQUATIC FEATURES	***N/A***	***236.11***
		Total Jurisdictional Waters of the U.S.	***N/A***	***236.11***
		Total Special Aquatic Sites	***N/A***	***0.26***

To delineate the wetlands on the Subject Property, CESI established transect lines and points across the Subject Property and recorded data at each transect point. The recorded data, in addition to field observations such as topographical changes, was used to identify boundaries between wetland and upland areas, which were mapped with a GPS. The mapped data was then used to calculate acreages of each wetland area and to create the 2015 Aerial Photograph with Delineated Aquatic Features is included Appendix A.

3.1.1 Wetland Delineation Recommendations

For an aquatic feature to be considered jurisdictional under the CWA, it must exhibit a direct surface water connection or significant nexus to a TNW. Aquatic features considered jurisdictional under Section 10 of the RHA are navigable waters and those under tidal influence. A Nationwide Permit (NWP) or Individual Permit (IP), depending on the total amount of impacts, under Section 404 of the CWA is required for the discharge of dredged or fill material into jurisdictional WOUS.

Based on the results of the USACE verification of the wetland delineation, all of the aquatic features identified within the Subject Property (PEM wetland areas, PSS wetland areas, open water areas, and mudflats) will be jurisdictional under the CWA and/or Section 10 of the RHA and impacts to these features will require a permit from the USACE.

Section 401 Water Quality Certification (WQC) from the Texas Commission on Environmental Quality (TCEQ), a compensatory mitigation plan for permanent impacts to Waters of the United States (WOUS) greater than 1/10 ac, and a Consistency Statement for the Texas General Land Office (GLO) Coastal Management Plan will be needed for permit approval. In addition, the USACE will require concurrence from the U.S. Fish and Wildlife Service (USFWS) and Texas Historic Commission (THC).

3.2 Threatened and Endangered Species Results Summary

3.2.1 Migratory Bird Treaty Act Review

In addition to the USFWS's region-specific list of birds protected by the Migratory Bird Treaty Act (MBTA) (generated in the USFWS Information for Planning and Consultation [IPaC Resource List), CESI reviewed Code of Federal Regulations 50 CFR 10.13, to verify all listed migratory bird species protected under the MBTA that may potentially occur on the Subject Property.

To supplement the migratory bird list generated by the USFWS IPaC Resource List, the National Audubon Society's eBird Field Checklist was reviewed to verify birds detected in the vicinity of the Subject Property. CESI biologists also used this eBird checklist to assist in making a determination of the potential for migratory bird species to occur on the Subject Property. The eBird list is a real-time, online checklist collaborative effort of citizen biologists' bird sightings and observations that go through a quality control, verification process before publication (National Audubon Society, 2017).

3.2.2 Existing On-site Habitat Types

The Subject Property consists of six habitat types, including PEM wetland, PSS wetland, estuarine open water, mudflats, upland, and urban. A 2015 Aerial Photograph with Habitat Types are located in Attachment A of Appendix A. Subject Property Photographs depicting each habitat type are located in Attachment B of Appendix A.

PEM Wetland

Two areas within the Subject Property were delineated as PEM wetland, totaling 13.23 acres. These areas are within the 100-year Federal Emergency Management Agency (FEMA) floodplain of Galveston Bay and exhibit thick herbaceous groundcover of bushy bluestem (*Andropogon* glomeratus), seashore dropseed (*Sporobolus virginicus*), and groundseltree (*Baccharis halimifolia*). This area likely provides habitat for species that require access to periodically wet areas with thick groundcover for breeding and foraging.

PSS Wetland

Three areas within the Subject Property were delineated as PSS wetland, totaling 6.82 acres. These areas are within the 100-year FEMA floodplain of Galveston Bay and exhibit a thick mixture of shrub and herbaceous species. Dominant vegetation includes yaupon (*Ilex vomitoria*), groundseltree (*Baccharis halimifolia*), and bushy bluestem (*Andropogon glomeratus*). This area likely provides habitat for species that require access to periodically wet areas with thick groundcover with woody species for breeding and foraging.

Estuarine Open Water

The estuarine open water area within the Subject Property includes Galveston Bay in the northern segment (214.98 acres). This area is tidally influenced. Galveston Bay is

directly connected to the Gulf of Mexico and provides habitat for multiple life stages of marine and estuarine species.

Open Water

The open water area within the Subject Property includes the roadside detention areas in the southern segment (1.20 acres). These tidally influenced areas appear to have intermittent tidal connectivity to Galveston Bay and are highly disturbed by abutting paved roads, adjacent commercial properties, and railroad tracks. Trash and debris was observed throughout these areas, which provide habitat for juvenile fish and semi-aquatic species.

Upland

The upland habitat (4.62 acres) consists of portions that are dominated by herbaceous species and portions dominated by shrub-scrub species. The upland areas dominated by shrub-scrub species are located throughout the north-central portion of Subject Property. They are relatively undisturbed and composed primarily of groundseltree *(Baccharis halimifolia),* yaupon *(Ilex vomitoria),* and erect prickly pear *(Opuntia stricta)*. This area provides habitat for species that require relatively dense and woody dry groundcover for breeding and foraging. The herbaceous-dominated uplands are located throughout the northeastern portion of Subject Property. They are relatively undisturbed and composed primarily of Carolina geranium *(Geranium carolinianum),* erect prickly pear *(Opuntia stricta),* and Indian paintbrush *(Castilleja coccinea)*. This area provides habitat for species that require dense dry groundcover for breeding and foraging.

Urban

Urban land use (23.58 acres) within the Subject Property is located primarily in the southern portion and includes areas such as public paved roads, a junkyard, an electric transmission facility, commercial buildings, and parking lots.

3.2.3 Review of Listed Species in Galveston County, Texas

Based on a preliminary evaluation of habitats and current land use on the Subject Property, the Texas Parks and Wildlife Department's (TPWD) Natural Diversity Database (NDD), and USFWS's IPaC database, one federal-listed endangered, two federal-listed threatened, five state-listed threatened, and seven state-listed rare species have potential to occur due to potentially suitable habitat within or adjacent to the Subject Property (Table 3-2). Species listed as rare by TPWD have no federal listing status by the USFWS and are not protected under state regulations. No occurrences of federal- or state-listed species or federal critical habitat exist within the limits of the Subject Property. No federal- or state-listed species individuals were observed within the Subject Property during the site survey.

There is also high potential for nesting migratory birds protected under the federal MBTA throughout all habitat types within the Subject Property other than the urban habitats.

Table 3-2: Federal- and State-Listed Species with Potential to Occur Within the Subject Property

Common Name	Scientific Name	State Status	Federal Status	Species Effect /Impact	Justification
Piping Plover	*Charadrius melodus*	T	LT	***May affect, but not likely to adversely affect***	Suitable beach shoreline habitat on western portion of property. Potential use for foraging as a transitory migrant and winter resident. Similar suitable habitat is present outside of Subject Property. A biological monitor is recommended if ground disturbance on the beach is anticipated during this species' wintering season (September through April).
Red Knot	*Calidris canutus rufa*	-	LT	***May affect, but not likely to adversely affect***	Suitable beach shoreline habitat on western portion of property. Potential use for foraging as a transitory migrant and winter resident. Similar suitable habitat is present outside of Subject Property. A biological monitor is recommended if ground disturbance on the beach is anticipated during this species' wintering season (September through April).
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*	E	LE	***May affect, but not likely to adversely affect***	Suitable beach habitat on western portion of property abutting Galveston Bay. Species has nested on Galveston Island in 2017 (5 nests found). A biological monitor is recommended if ground disturbance on the beach is anticipated during this species' breeding season (April through July).
Peregrine Falcon	*Falco peregrinus*	T	DL	No Impact	Suitable winter and stopover habitat present within the Subject Property. Anticipated that individuals present during ground clearing activities will relocate to identical adjacent habitat.
Reddish Egret	*Egretta rufescens*	T	-	***May Impact***	Suitable breeding and winter habitat present within the Subject Property. Anticipated that individuals present during ground clearing activities will relocate to identical adjacent habitat; however breeding individuals could be impacted due to lack of mobility. A biological monitor is recommended if ground disturbance within the Subject Property during this species' breeding season (March through August).
White-faced Ibis	*Plegadis chihi*	T	-	***May Impact***	Suitable breeding and winter habitat present within the Subject Property. Anticipated that individuals present during ground clearing activities will relocate to identical adjacent habitat; however breeding individuals could be impacted due to lack of mobility. A biological monitor is recommended if ground disturbance within the Subject Property during this species' breeding season (March through August).

White-tailed Hawk	*Buteo albicaudatus*	T	-	No Impact	Suitable winter and stopover habitat present within the Subject Property. No suitable nesting trees were observed within the Subject Property. Anticipated that individuals present during ground clearing activities will relocate to identical adjacent habitat.
Wood Stork	*Mycteria americana*	T	-	No Impact	Suitable winter and stopover habitat present within the Subject Property. Anticipated that individuals present during ground clearing activities will relocate to identical adjacent habitat. This species does not currently breed in Texas.
Southern Crawfish Frog	*Lithobates areolatus areolatus*	Rare	-	No Impact	Crawfish burrows observed within Subject Property, but lacks ideal habitat. This species is not afforded regulatory protection.
Black Rail	*Laterallus jamaicensis*	Rare	-	***May Impact***	Suitable breeding and winter habitat present within the Subject Property. Anticipated that individuals present during ground clearing activities will relocate to identical adjacent habitat; however breeding individuals could be impacted due to lack of mobility. This species is not afforded regulatory protection.
Brown Pelican	*Pelecanus occidentalis*	Rare	-	No Impact	Suitable habitat present within the Subject Property. Anticipated that individuals present during ground clearing activities will relocate to identical adjacent habitat; breeding individuals are not anticipated to be present. This species is not afforded regulatory protection.
Snowy Plover	*Charadrius alexandrines*	Rare	-	No Impact	Suitable winter and stopover habitat present within the Subject Property. Anticipated that individuals present during ground clearing activities will relocate to identical adjacent habitat. This species is not afforded regulatory protection.
American Eel	*Anguilla rostrata*	Rare	-	No Impact	Suitable habitat present within the Subject Property. Anticipated that individuals present during construction activities will relocate to identical adjacent habitat. This species is not afforded regulatory protection.
Plains Spotted Skunk	*Spilogale putorius interrupta*	Rare	-	No Impact	Suitable habitat present within the Subject Property. Anticipated that individuals present during ground clearing activities will relocate to identical adjacent habitat. This species is not afforded regulatory protection.
Texas Diamondback Terrapin	*Malaclemys terrapin littoralis*	Rare	-	No Impact	Suitable habitat present within the Subject Property. Anticipated that individuals present during ground clearing activities will relocate to identical adjacent habitat. This species is not afforded regulatory protection.

E & LE= Endangered; T & LT = Threatened; DL = Delisted Taxon

Threatened and Endangered Species Recommendations

CESI recommends that a biological monitor be present if ground clearing activities will occur during sensitive seasons for federal-and state-listed threatened and endangered species with potential to occur within the Subject Property.

3.2.4 Cultural Resource Desktop Assessment Results Summary

A desktop cultural resource assessment conducted by SWCA resulted in three maritime geophysical targets that were previously discovered using a probe and sonar. A previous magnetometer survey was also completed to clarify anomalies reported in the southern portion of the Subject Property.

It is recommended that TxDOT Historic Bridge Programmatic Section 4(f) Evaluation be initiated. If the single-leave rolling lift bascule main span is slated for demolition, full Historical American Engineering Record (HAER) documentation will be required to satisfy the Section 106 requirements.

4 Design Criteria

4.1 Geometric Criteria

Design criteria required by the U.S. Coast Guard and TxDOT criteria was used in the development of the horizontal and vertical alignments of the four options. Table 4-1: summarizes the geometric criteria used to design the Pelican Island Bridge replacement options.

Table 4-1: Geometric Design Criteria

Criteria	Value
Horizontal Clearance Envelope at the Channel	125’
Vertical Clearance Envelope at the Channel	75’
Design Speed	45 mph
Lane Widths	12’-14’
Sidewalk Width	6’
Functional Classification	Low Speed Urban Arterial
Minimum Radius	711’ (Table 2-5, TxDOT Roadway Design Manual)
Max Superelevation	6%
Horizontal Stopping Sight Distance	360’
Max Profile Grade	6% (Table 2-11, TxDOT Roadway Design Manual)
Min. Profile Grade	0.5%
K_{Sag}	79 (Figure 2-6, TxDOT Roadway Design Manual)
K_{Crest}	61 (Figure 2-5, TxDOT Roadway Design Manual)

4.2 Aesthetics & Lighting

Galveston County will ultimately determine the aesthetic scheme. Nearby projects use the Green Ribbon – Wave Scheme.

4.3 Geotechnical Characteristics

Geotest Engineering, Inc. conducted a preliminary geotechnical investigation to evaluate foundation and retaining wall types for this project. Their schematic work included sampling and analysis of two borings, near each existing abutment, and a review of previous soil data in the project vicinity. Geotechnical findings are documented in Appendix H Geotechnical Report dated December 6, 2017.

4.4 Drainage

A hydrology and hydraulics analysis was conducted for the project area and a memo detailing the findings can be found in Appendix I.

4.5 Permitting

Along with meeting design criteria, it should be noted that various permits will need to be obtained if a replacement bridge is to be built. Because this project crosses a body of water and may impact wetlands and mitigation sites, permits from the EPA, U.S. Army Corps of Engineers, U.S. Coast Guard, and TCEQ will need to be acquired. The proposed bridge is also at a much higher elevation than the existing bridge and within the glide path of a nearby airport so the need to obtain a permit from the Federal Aviation Agency (FAA) is possible. As design progresses, items may arise that require permits from more agencies.

5 Proposed Typical Section

A total of eight (8) typical section options, four 2-lane and four 4-lane configuration options were submitted to the County and TxDOT in April 2017 for their review and selection. The Traffic Analysis performed by Cobb Fendley & Associates, included in Appendix F, shows that a four-lane typical section is warranted for the new Pelican Island Bridge. Ultimately, the County selected a 4-lane configuration and the discussion is documented in Appendix M Meeting Minutes. See Exhibit 4 or Figure 5-1 for the proposed typical section.

The proposed typical section is 62 feet wide with two 12-foot inside lanes, two 14-foot outside lanes to accommodate bicycles, and a 6-foot sidewalk for pedestrian use.

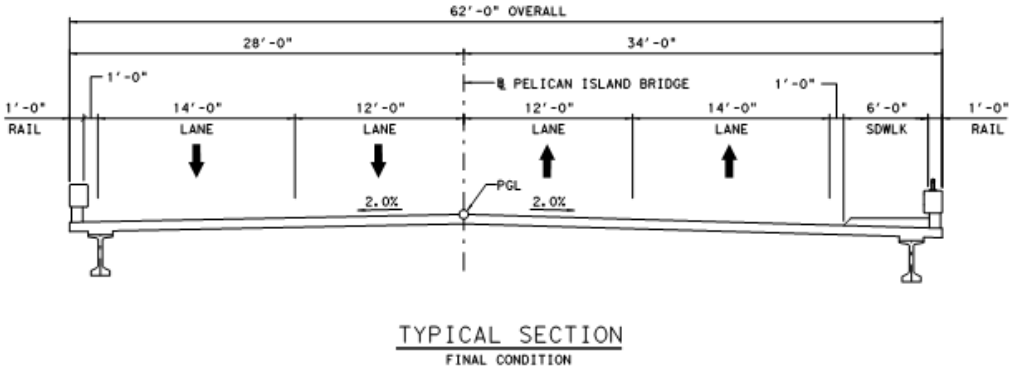

Figure 5-1: Proposed Typical Section

6 Corridor Options

For the purpose of this report, four alignment options were developed, each with a different set of profile grades and connections to the existing Seawolf Parkway and access to TAMUG campus. Each option was analyzed and evaluated against a set of criteria to meet the project goals and needs. The evaluation matrix of the options is included in Table 11-1: Evaluation Matrix for Alignment Options.

6.1 Option 0 – No-Build

A 'no-build' option assumes that the existing Pelican Island Bridge will not be replaced. Due to the 58-year-old drawbridge's deteriorating structural condition, costs include routine maintenance as well as rehabilitation costs associated with continued and increasing repair needs. The no-build option and its consequences will impede trade and industry growth on Pelican Island, which currently serves as home to area economic drivers.

6.1.1 Advantages

- No additional noise nor air quality impacts (except to maintain/rehabilitate existing bridge)
- No impacts to wetlands
- No environmental degradation or disruption to natural resources or threatened or endangered species (except to maintain/rehabilitate existing bridge)
- No additional impacts to Galveston Bay (except to maintain/rehabilitate existing bridge)
- No immediate construction costs
- Longest vertical stopping sight distance since bridge profile grades are low
- No additional ROW or utility relocations required

6.1.2 Disadvantages

- No pedestrian or bicycle accommodations on this roadway connector
- Does not improve access for emergency vehicles
- Continued and increasing annual maintenance and rehabilitation costs
- Load restriction and roadway width hinders economic growth for business establishments on the island
- Does not accommodate future traffic growth
- Does not separate truck traffic from TAMUG campus
- Does not improve accessibility to adjacent properties

6.1.3 Costs

Considering the service life of the existing Pelican Island Bridge is to end in 2030, the costs for a no build option only considers rehabilitation and maintenance costs for the next 13 years. The current annual operation and maintenance cost is about $600,000.00, which includes the labor cost of a continuously manned control station. Assuming one more rehabilitation project takes place before the bridge's end of service life, rehabilitation cost is approximately $5,850,000.00. The estimated total maintenance and rehabilitation cost for the remaining life of the bridge with a 10% contingency is about $15,015,000.00 . See Appendix B for a breakdown of costs.

6.2 Option 1

As seen in Figure 6-1, the alignment for Option 1 provides approximately 30 feet of horizontal clearance between the edge of the proposed bridge and eastern edge of the existing bridge. This option has compound horizontal curves with radii of 3,000 and 2,000 feet and a reverse curve with radius of 2,000 feet on the Galveston side. While holding the existing abutment locations, this option replaces the existing bridge with a 3.5% grade on the Galveston Island side and a 5.0% grade on the Pelican Island side, and meets the 75-foot vertical clearance from the mean high water level (MHWL) of the navigation channel (Galveston Ship Channel) criteria. The proposed roadway ties into the existing pavement about 150 feet prior to the TAMUG main entrance driveway. The total bridge length is about 3,800 feet and the roadway length is about 1,400 feet.

Figure 6-1 below shows bridge alignment Option 1 depicting the roadway portion with green shading and the bridge portion with orange shading. Exhibit 5 is a more complete exhibit of Option 1.

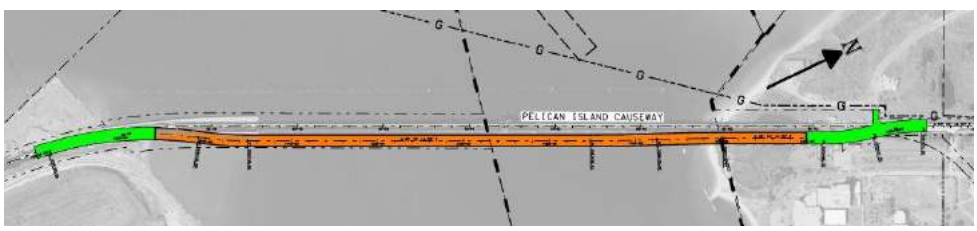

Figure 6-1: Option 1

6.2.1 Right-of-Way Impacts

This alternative will require right-of-way (ROW) from three parcels totaling 0.84 acres as detailed in Table 6-1.

Table 6-1: ROW needed for Option 1

Parcel ID	Owner	Property Type	ROW Needed (AC)
R220078	TAMU	Commercial	0.25
R293631	Sultex, Ltd	Industrial	0.22
122B	TGLO	Industrial	0.37

6.2.2 Impacts to Existing Conditions

A 1,400-foot portion of the existing overhead electric transmission lines may need to be relocated due to conflict with the proposed retaining walls and roadway alignment.

6.2.3 Advantages

- Minimal impacts to wetlands
- Shortest proposed roadway and bridge length
- Lowest construction cost among build options
- Least amount of ROW need among the build options
- Allows for pedestrian and bicycle access
- Improves access for emergency vehicles
- Accommodates future traffic growth
- Non-load posted bridge aids economic growth on the island
- Low future maintenance costs
- Alignment does not cross Alternate GIWW Channel, reducing coordination, including time and money, with USACE
- Alignment does not preclude a future railroad bridge

6.2.4 Disadvantages

- Possible conflicts with existing bridge foundations and bents
- Horizontal compound curves – which tend to produce erratic and dangerous vehicle operations.
- Higher utility relocation costs due to conflicts with existing overhead transmission lines
- Reduced speed of 25 mph after the TAMUG campus main entrance in existing conditions (due to the horizontal curve with a lower radius)
- Steeper profile with grade of 5%
- No explosive demolition allowed on the existing bridge due to its proximity to the proposed bridge; extending construction time since mechanical demolition is to be used
- Shorter stopping sight distance
- Truck traffic traveling through TAMUG campus
- Some impacts to Galveston Bay
- Some impacts to noise and air quality
- Impacts to threatened/endangered species and their habitats

- No increased direct access to bridge from any more properties

6.2.5 Cost

The estimated total construction cost for Option 1 is approximately $60,973,000. See Appendix B for the breakdown of cost.

6.3 Option 2

As Figure 6-2 below shows, Option 2's alignment provides approximately 50 feet of horizontal clearance between the edge of the proposed bridge and western edge of the existing bridge. This option has a horizontal curve with a 3,000 foot radius on the Galveston side. While holding the existing abutment locations, the alternative replaces the existing bridge with a 3.5% grade on the Galveston Island side, a 5.0% grade on the Pelican Island side, and a 75-foot vertical clearance from the MHWL of the navigation channel (Galveston Ship Channel). The proposed roadway ties into the existing pavement about 500 feet prior to the existing signalized pedestrian pathway for the TAMUG Maritime Academy. The total roadway length is about 3,185 feet, and the bridge length is about 4,900 feet.

Option 2 is unique in the way it connects the TAMUG campus traffic to and from the bridge. The design extends the Pelican Island Bridge and creates an underpass with a 16.5-foot clearance at the TAMUG Maritime Academy driveway. The underpass connects designated ramps for the TAMUG campus traffic to enter and exit the bridge.

See Exhibit 6 for a more complete exhibit of this option.

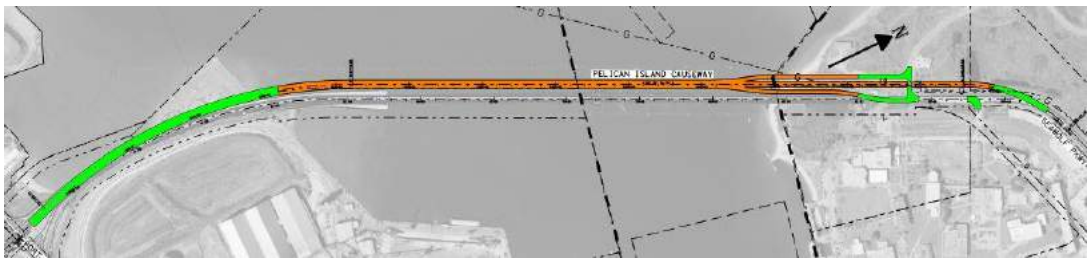

Figure 6-2: Option 2

6.3.1 Right-of-Way Impacts

Option 2 will require ROW acquisitions from four parcels totaling 9.86 acres as summarized in Table 6-2.

Table 6-2: ROW needed for Option 2

Parcel ID	Owner	Property Type	ROW Needed (AC)
R220078	TAMU	Commercial	2.73
R293637	Lamson Nguyen	Industrial	4.41
R388688	TAMU	Commercial	0.56
122B	TGLO	Industrial	2.16

6.3.2 Impacts to Existing Conditions

Because of the area required for the ramp alignments, there are many utility impacts for this option. The alignment conflicts with the existing underground petroleum pipeline control valve station located on the northwest corner of Seawolf Parkway and the TAMUG Maritime Academy driveway. A portion of the existing pipeline may need to be relocated due to conflicts with proposed retaining walls and roadway alignment.

6.3.3 Advantages

- Ramps create localized traffic circulation for TAMUG campus, separating TAMUG visitors from through traffic
- A horizontal curve with a larger radius near the TAMUG campus main entrance eliminates the need for a reduced speed zone of 25 mph
- Accommodates future traffic growth
- Non-load posted bridge aids economic growth on the island
- Low future maintenance costs
- Construction cost is relatively low
- Allows for pedestrian and bicycle access
- Improves access for emergency vehicles
- Truck traffic does not travel through TAMUG campus
- Easier access to the bridge from TAMUG campus
- Alignment does not cross Alternate GIWW Channel, reducing coordination, including time and money, with USACE
- Alignment does not preclude a future railroad bridge

6.3.4 Disadvantages

- Possible conflicts with existing bridge foundations
- Increased bridge deck and roadway area due to the ramps on the Pelican Island side
- Longer bridge length due to remaining elevated through TAMUG campus
- Higher impacts to wetlands
- More ROW needed
- Higher utility relocation costs due to conflicts with existing underground petroleum pipeline and control valve station
- Ramps will conflict with future TAMUG water treatment facility
- Steeper profile with grade of 5%
- Shorter stopping sight distance

- No explosive demolition will be allowed on the existing bridge due to its proximity to the proposed bridge; this extends construction time since mechanical demolition will need to be used.
- Some impacts to Galveston Bay
- Some impacts to noise and air quality
- Impacts to threatened/endangered species and their habitats

6.3.5 Cost

The estimated total construction cost for Option 2 is approximately $79,672,000. See Appendix B for a detailed cost breakdown.

6.4 Option 3

Figure 6-3 below depicts the alignment proposed by option 3. In this option, the alignment bypasses around TAMUG campus. A bridge west of the existing bridge is proposed with a 2.0% up and downgrades and a 75 foot vertical clearance from the MHWL of the navigation channel (Galveston Ship Channel). The total roadway length is about 3600 feet, and bridge length is about 7,800 feet. The alignment runs parallel to Seawolf Parkway at an offset of 1020 feet on the north side for about 2,200 feet, and ties to a proposed intersection at a 350 foot offset from the Texas Clipper Road intersection. See Exhibit 7 for a more complete exhibit of this option.

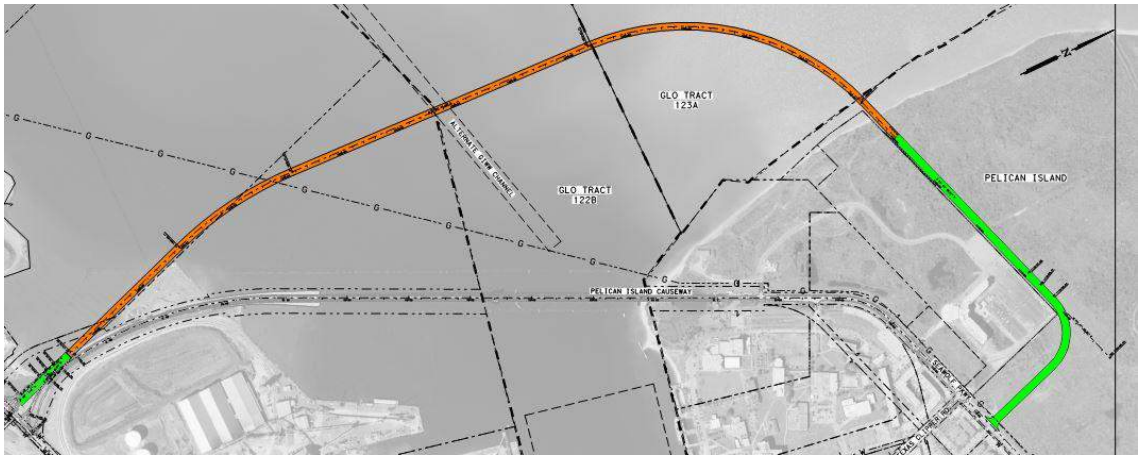

Figure 6-3: Option 3

6.4.1 Right-of-Way Impacts

This option will require ROW acquisitions from six parcels totaling 22.34 acres as summarized in Table 6-3 below.

Table 6-3: ROW Needed for Option 3

Parcel ID	Owner	Property Type	ROW needed (AC)
R293637	Lamson Nguyen	Industrial	3.84
R358923	PIB Corp	Industrial	2.90
R389428	Port of Houston Authority	Industrial	7.56
122B	TGLO	Industrial	2.86
123A	TGLO	Industrial	4.88
No ID (besides R293637)	Unknown	Industrial	0.30

6.4.2 Impacts to Existing Conditions

The alignment has a possible conflict with an existing underground petroleum pipeline at approximately 2,200 feet north of Galveston Island shore.

6.4.3 Advantages

- Minimal disruption to businesses and existing conditions during construction
- Lower utility relocation costs
- Flatter profile, close to existing conditions
- Potential use of explosive demolition on the existing bridge allows for an expedited construction schedule
- Allows for pedestrian and bicycle traffic
- Improves emergency vehicle access
- Longest stopping sight distance among the build options
- Truck traffic away from TAMUG campus
- Increased direct accessibility to the proposed bridge by increasing the number of properties adjacent to the facility
- Accommodates future traffic growth
- Non-load posted bridge aids economic growth on the island
- Low future maintenance costs
- Alignment does not preclude a future railroad bridge, however railroad would likely require lower design speed across the bridge.

6.4.4 Disadvantages

- Higher impacts to wetlands – mitigation is required
- Longest bridge and roadway lengths
- Extended reconstruction limits

- High construction cost
- Creates a new intersection/stop condition along Seawolf Parkway
- Highest ROW needs
- Greatest impacts to Galveston Bay
- Biggest impacts to noise and air quality
- Biggest impacts to threatened/endangered species and their habitats
- Alignment crosses Alternate GIWW Channel, increasing coordination, including time and money, with USACE

6.4.5 Cost

The estimated total construction cost for Option 3 is approximately $116,376,000. See Appendix B for a detailed cost breakdown.

6.5 Option 4

Figure 6-4 below shows an overview of the alignment for option 4. Option 4 originated from public comment during a public meeting. This option consists of a parallel bridge on the west side of the existing causeway with a 3.75% upgrade and downgrade and a 75-foot vertical clearance from the MHWL of the navigation channel (Galveston Ship Channel). About 800 feet west of the Pelican Island shore, the alignment veers north through TAMU property then loops around the TAMUG Maritime Academy Hall through Port of Houston Authority property to a new proposed intersection perpendicular to Seawolf Boulevard, 350 feet northeast of Texas Clipper Road. The roadway length for this option is about 6,350 feet and bridge length is 4,100 feet. For a more complete exhibit, see Exhibit 8.

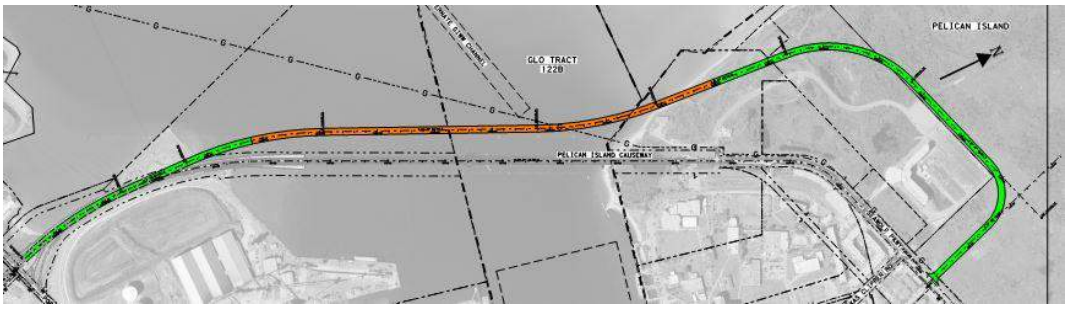

Figure 6-4: Option 4

6.5.1 Right-of-Way Impacts

Option 4 will require ROW acquisitions from six parcels totaling 18.12 acres as summarized in Table 6-4 below.

Table 6-4: ROW Needed for Option 4

Parcel ID	Owner	Property Type	ROW needed (AC)
R220078	TAMU	Commercial	2.66
R293637	Lamson Nguyen	Industrial	4.81
R389429	TAMU	Commercial	0.01
R381805	TAMU	Commercial	2.12
R389428	Port of Houston	Industrial	5.19
122B	TGLO	Industrial	3.33

6.5.2 Impacts to Existing Conditions

Option 4's alignment has a possible conflict with an existing underground petroleum pipeline at approximately 800 feet west of Pelican Island's shore as well as conflict with an overhead transmission line.

6.5.3 Advantages

- Least disruption to businesses and existing conditions during construction
- Lower utility relocation costs
- Second lowest construction cost among build options
- Allows for pedestrian and bicycle access
- Improves access for emergency vehicle
- Flatter profile
- Long stopping sight distance
- Truck traffic does not travel through TAMUG campus
- Increased direct accessibility to the proposed bridge by increasing the number of properties adjacent to the facility
- Accommodates future traffic growth
- Non-load posted bridge aids economic growth on the island
- Low future maintenance costs
- Alignment does not cross Alternate GIWW Channel, reducing coordination, including time and money, with USACE
- Alignment does not preclude a future railroad bridge

6.5.4 Disadvantages

- High impacts to wetlands - significant mitigation is required
- Long bridge and roadway lengths
- Extended reconstruction limits

- Creates a new intersection/stop condition along Seawolf Parkway
- High ROW needs
- No explosive demolition allowed on the existing bridge due to its close proximity to the proposed bridge leading to longer construction time
- Some impacts to Galveston Bay
- Some impacts to noise and air quality
- High impacts to threatened/endangered species and their habitats

6.5.5 Cost

The estimated total construction cost for Option 4 is approximately $73,363,000. See Appendix B for a detailed cost breakdown.

7 Right of Way Acquisition

The four proposed options will require acquisition of right-of-way and access easements. Viable access onto Pelican Island may impact properties owned by Port of Houston Authority (PHA) and Texas A&M University at Galveston (TAMUG). The new bridge would spur economic development and enhance the value of properties on the island. For TAMUG, the route around campus would enhance campus safety by not introducing industrial vehicle traffic through the campus.[9] Table 7-1: below summarizes the parcels impacted by each proposed option and Exhibit 3 depicts the parcels in the project area by parcel ID. Note that temporary construction easements will likely be necessary for all options, but these areas are not included at this stage of the project development.

Table 7-1: Parcel ID & Owner Information

Parcel ID	Owner Name	Property Type	Total Parcel Area (AC)	ROW Needed (AC)			
				Option 1	***Option 2***	***Option 3***	***Option 4***
R220078	State-Texas A&M University	Commercial	39.99	0.25	2.73		2.66
R293637	Lamson Nguyen	Industrial	66.03		4.41	3.84	4.81
R388688	State-Texas A&M University	Commercial	41.90		0.56		
R358923	5600 PIB Corp	Industrial	221.51			2.90	
R293631	Sultex, Ltd.	Industrial	112.19	0.22			
R389428	Port of Houston Authority	Industrial	286.01			7.56	5.19
R389429	State-Texas A&M University	Commercial	1.74				0.01
R381805	State-Texas A&M University	Commercial	37.06				2.12
Tract 122B	TGLO	Industrial		0.37	2.16	2.86	3.33
Tract 123A	TGLO	Industrial				4.88	
No ID_(beside R293637)	Unknown	Industrial				0.30	
			Total ROW needed	**0.84**	**9.86**	**22.34**	**18.12**

[9] (The Goodman Corporation & HDR Engineering, Inc., 2015)

8 Public Involvement

A public meeting was held on September 13th, 2017 to inform the public of the intent to find a replacement option for the Pelican Island Bridge and receive comments. A detailed summary of the presentation and comments received can be found in Appendix N - Public Meeting Summary Report. From the meeting, two notable developments emerged and are described below.

Several stakeholders expressed interest in a land bridge option as the replacement of the Pelican Island Causeway. HDR examined this concept and determined that there is much to consider for this option. Numerous analyses, studies, and permits would need to be completed before this option is considered feasible. HDR estimates that one approval can take between 3 to 7 years to obtain, pushing back the timeline of project completion significantly. See Appendix O-Landbridge Concept Technical Memo for details on some of the design and regulatory considerations that would need to be completed for a detailed assessment of the land bridge concept.

From the public meeting also came the development of the alignment for option 4. The meeting prompted a fourth alignment option to be generated that would avoid the alternate Gulf Intracoastal Waterway (GIWW) channel located north of the existing causeway. The alignment for option 4, described in section 6.5, was designed to keep the proposed bridge from crossing the alternate GIWW channel and then veer north when it got closer to the Pelican Island shoreline to loop around the TAMUG Maritime Academy.

Further public meetings will be conducted at the project progresses.

9 Funding

Funding sources and allocations will be delineated in the Advanced Funding Agreement between TxDOT and Galveston County and will likely not be finalized until mid-2018.

10 Preliminary Project Timeline

Stakeholder Workshop – July 27, 2017

Public Involvement / Meeting – September 13, 2017

Advanced Funding Agreement Signed – Anticipated End 2018

Schematic Layout Approval – Estimated End 2018

ROW Acquisition & Utility Relocations – Estimated 2020-2021

Final Construction Plans – Estimated March 2021

Construction NTP – Estimated June 2021

Open to traffic – Estimated December 2023

11 Evaluation Matrix

The conceptual option selection is based on multiple selection criteria, which are described below. Each option was assigned a rating value between (-15) and (+15) for each criterion. A weighted score (sum of Ratings x % Weight of each criteria) for each option was calculated and used in recommending the preferred alternative. The Option with the highest score was chosen as the recommended option. Table 11-1 shows the completed matrix with ratings and total scores for all options.

11.1.1 Safety

- **Emergency vehicle access**: The existing bridge width limits the access of emergency vehicles with one lane in each direction and no shoulders. This restricts the ability for the vehicles to move through traffic quickly. Also, since opening the bascule span of the existing bridge stops traffic during vessel crossings, emergency vehicles must wait for the bridge to be passable, lengthening their response time. All build options propose a 4-lane typical section and elimination of the bascule segment, which greatly improves emergency vehicle access.
- **Pedestrian/bicycle accommodation**: Because the TAMUG campus is located on Pelican Island, accommodating pedestrians and cyclist access is essential for the continued growth of the campus and future development on Pelican Island. Currently, the bridge does not have sidewalks or road space for bicyclists to safely use. The proposed typical section includes a sidewalk for pedestrians and wider outside lanes for cyclists to share with vehicle traffic.
- **Separates truck traffic from campus**: The TAMUG campus is split by Seawolf Parkway with the Maritime Academy on the North side and the main campus on the South side. This separation creates many pedestrian and bicycle crossings at Seawolf Parkway. The potential for serious accidents increases with the presence of truck traffic, so the separation of truck traffic from the TAMUG campus is considered in the evaluation.
- **Stopping sight distance**: Steep profile grades may be needed to meet navigational channel clearances and could cause stopping sight distance issues. Greater grade breaks create a shorter stopping sight distance and these effects were considered during evaluation. Since the conceptual options do not follow the existing bridge alignment, horizontal curves are required to veer away from the existing bridge. These horizontal curves can also create sight distance issues so options with curves of larger radii are preferred. To ensure ample consideration was given to these safety issues, the criteria was added to the assessment.

11.1.2 Environmental

- **Impacts to threatened/endangered species and their habitats**: To meet TxDOT (NEPA) policies and procedures, potential impacts to threatened and

endangered species and their habitats will be reviewed. The proposed conceptual options have varying degrees of impacts, potentially caused by construction and/or operation of the conceptual options, so this evaluation criterion has been included in the assessment matrix.

- **Minimize impacts on Galveston Bay**: To meet the TxDOT NEPA requirements and policies, environmental concerns, such as water quality, contaminated run-off, toxic substances, and sedimentation, that may affect Galveston Bay during construction and/or operation of the proposed options must be assessed. This criterion was added to the evaluation matrix to ensure impacts would be minimized to the extent practicable.
- **Minimize impacts on wetlands**: Existing wetlands located in the project area provide important ecological functions including protection of the bay, essential habitat, and improve water quality and productivity of the surrounding estuaries. To ensure potential impacts to wetlands are thoroughly considered and reviewed per NEPA regulations and policies, this criterion was added to the evaluation matrix.
- **Minimize noise/improve air quality**: To meet TxDOT standards related to noise and air quality, impacts caused by construction and/or operation of the proposed options were evaluated. These include, but were not limited to, pollution and noise impacts from construction activity, equipment, and vehicles.
- **Ranking of public opinion**: To meet TxDOT NEPA Public Involvement requirements and policies, each conceptual option was studied and presented to the affected public through a public meeting. From this meeting, valuable public feedback was gathered and used for evaluation of the options.

11.1.3 Mobility

- **Accommodates future traffic growth**: This project looks to accommodate economic development on Pelican Island and growth of TAMUG; both would bring an increase in traffic. Thus, accommodation of this traffic growth was considered in the selection process. The regulation of TAMUG campus traffic was also considered in this criteria.
- **Impact to adjacent land uses/encourages economic development**: A big driver for the completion of this project is the potential for economic growth on the island. Direct access to the roadway allows easier property access, increasing economic growth. For evaluation purposes, if an option provided more properties access to the bridge it was considered more desirable and obtained a higher rank.

11.1.4 Cost

- **Construction Costs**: Estimated construction costs, as determined in Appendix B, were considered as a criteria since funding for the project is limited and costs significantly factor in the decision of selecting an option.

- **Future Maintenance Costs**: With the advanced age of the existing bridge and manning a control station for the bascule span, annual maintenance costs have been high. As with any project, keeping future maintenance costs low is desirable as they are a large part of the overall cost of the bridge over its lifetime. For evaluation purposes, length and type of bridge, as well as overall project length were considered as they determine the amount of future maintenance that would be required.

Table 11-1: Evaluation Matrix for Alignment Options

	Criteria	Weight	Option 0	Option 1	Option 2	Option 3	Option 4
Safety (40%)	Emergency Vehicle Access	10.00%	-10	15	15	15	15
	Pedestrian/Bicycle Accommodation	10.00%	-15	10	10	10	10
	Separates Truck Traffic from campus	15.00%	-15	-15	5	15	15
	Stopping sight distance	5.00%	15	5	5	15	10
Environmental (25%)	Impacts to threatened/endangered species and their habitats	5.00%	0	-5	-5	-15	-15
	Minimize impacts on Galveston Bay	5.00%	0	-5	-5	-15	-10
	Minimize impacts on wetlands	5.00%	0	-5	-5	-15	-15
	Minimize noise/improve air quality	5.00%	0	-5	-10	-15	-10
	Ranking of Public Opinion	5.00%	-15	5	0	10	15
Mobility (20%)	Accommodates future traffic growth	10.00%	-15	5	10	15	15
	Impact to adjacent land uses/encourages economic development	10.00%	-15	5	5	15	15
Cost (15%)	Construction Costs	10.00%	0	-5	-10	-15	-10
	Future Maintenance Costs	5.00%	-15	15	10	5	5
	TOTAL SCORE		**-8.5**	**1**	**3.25**	**4.75**	**5.75**

Overall Ranking

-15	Most Negative impact/ doesn't meet criteria
-10	Medium Negative impact/ doesn't meet criteria
-5	Small Negative impact/ doesn't meet criteria
0	No impact/ neutral
5	Small Improvement over existing condition
10	Medium Improvement over existing condition
15	Most Improvement over existing condition

12 Recommendation

Upon evaluation of the criteria, HDR recommends option 4 as the preferred option for the replacement of the Pelican Island Bridge.

Comparing option 4 to option 3, the second highest scoring option, the advantages of option 4 include:

- Environmental benefit – the reduced length of Option 4 in the water lowers the environmental impacts to Galveston Bay.
- Environmental benefit – The reduced length of the project limits lowers the impacts of noise and air quality.
- Permitting and agency coordination benefit – Option 4 does not cross the Alternate GIWW channel – this may result in less stringent navigation clearance criteria and require less coordination with USACE than Option 3.
- Public opinion benefit – Option 4 is a direct result of stakeholder input to circumvent TAMUG campus for safety while lowering project cost when compared to Option 3.
- Construction cost – Option 4 has a lower estimated cost than Option 3.

Option 4 would provide a new bridge that will bring economic growth to the island while meeting essential safety standards and improving mobility in the area.

13 References

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Exhibits

Exhibit 1 - Project Vicinity Map

Exhibit 2 - Utility Base Map

Exhibit 3 - Right-of-Way/Parcel Map

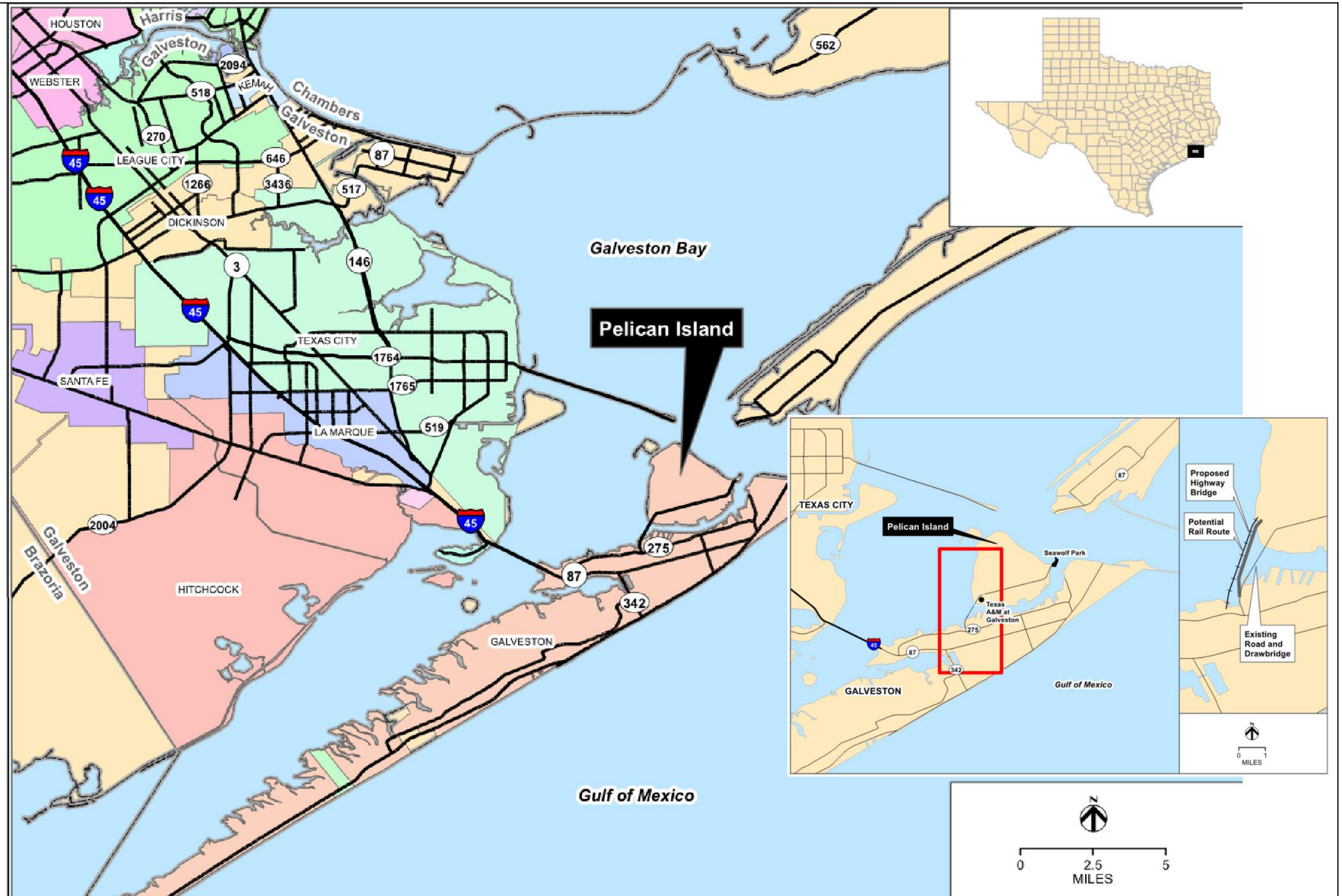
Exhibit 4 - Existing and Proposed Typical Sections

Exhibit 5 - Option 1

Exhibit 6 - Option 2

Exhibit 7 - Option 3

Exhibit 8 - Option 4



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DATE: 11/22/2017

GALVESTON COUNTY

PELICAN ISLAND BRIDGE
Replacement at Seawolf Parkway

HDR
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PELICAN ISLAND BRIDGE REPLACEMENT
EXHIBIT 1 - PROJECT VICINITY MAP

PRELIMINARY
SUBJECT TO CHANGE

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EXHIBIT 2 - UTILITY BASE MAP

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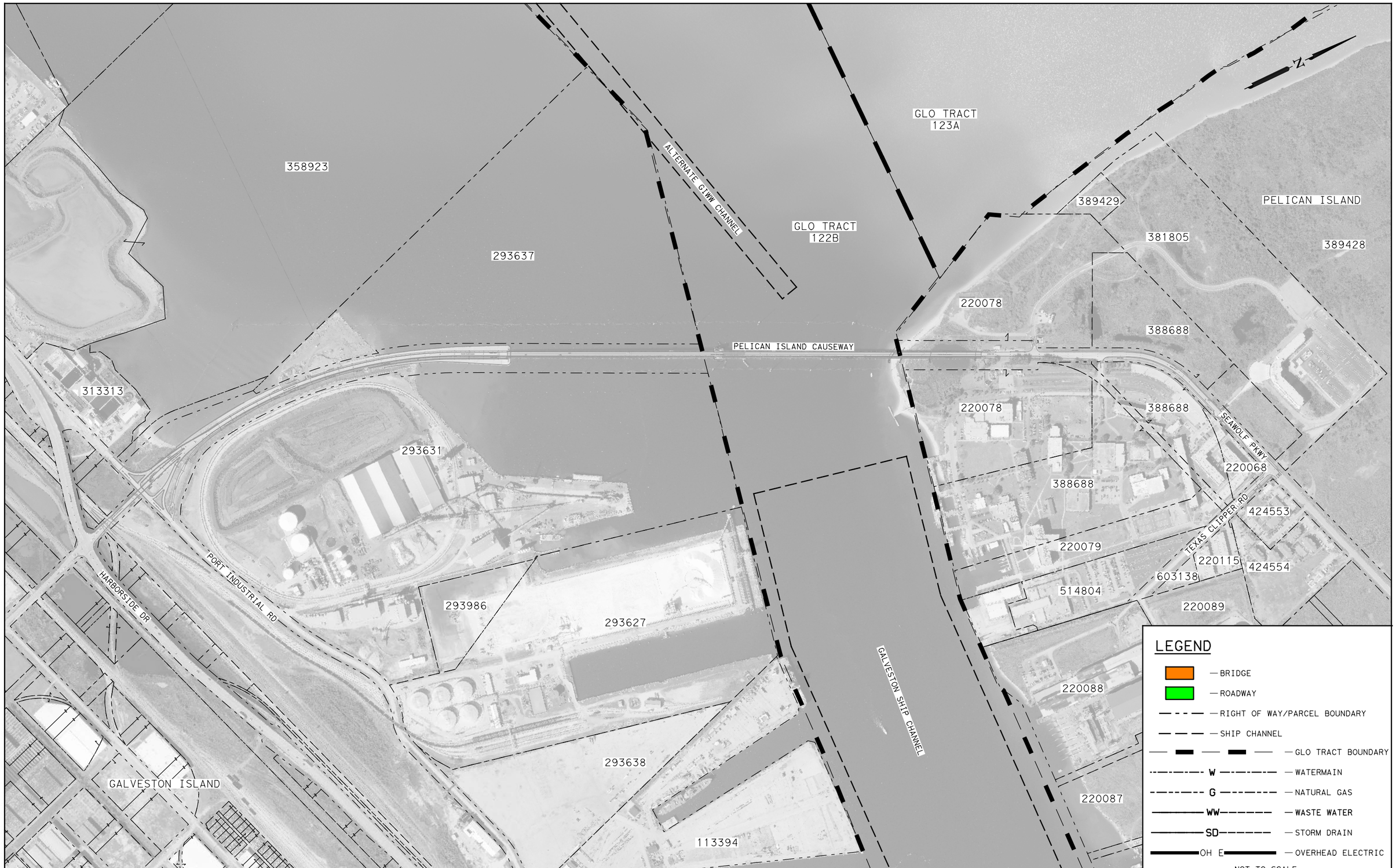

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EXHIBIT 3 - ROW/ PARCEL MAP

PRELIMINARY
SUBJECT TO CHANGE

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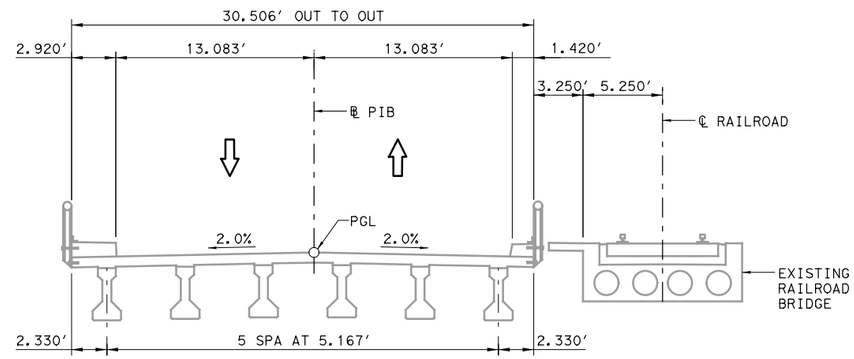

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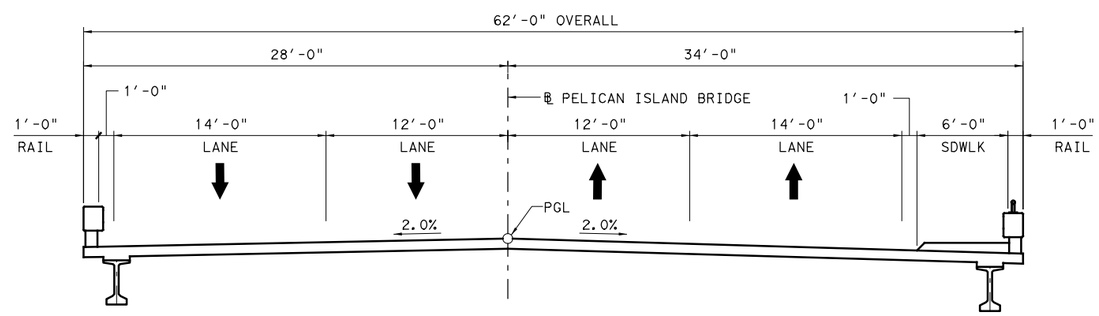
CONCRETE SPANS SHOWN, STEEL GIRDER SPANS SIMILAR



TYPICAL SECTION

FINAL CONDITION

0 5 10 15 20

SCALE

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PELICAN ISLAND BRIDGE REPLACEMENT
EXHIBIT 3 - EXISTING AND PROPOSED TYPICAL SECTIONS

PRELIMINARY
SUBJECT TO CHANGE

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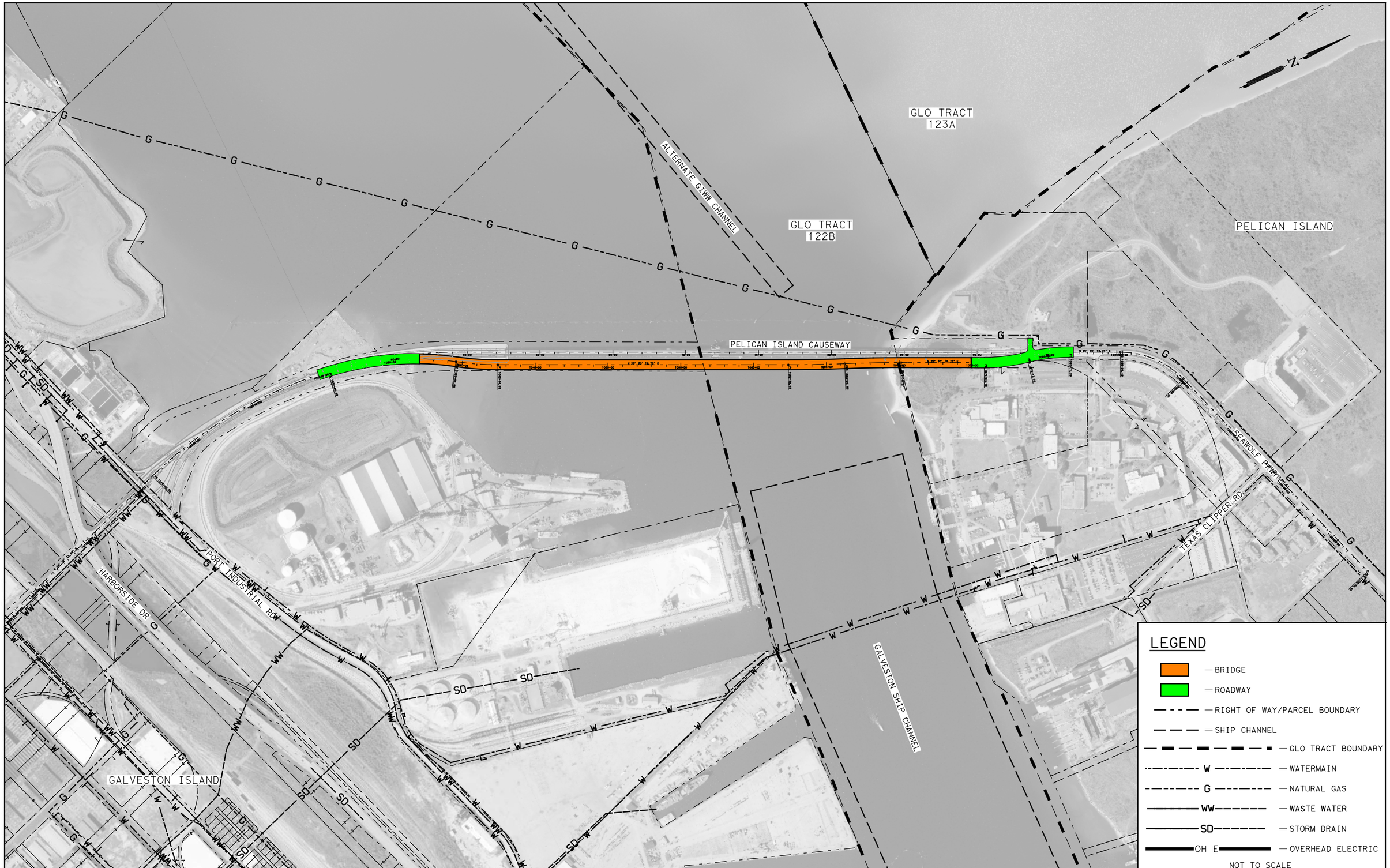

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PELICAN ISLAND BRIDGE REPLACEMENT
EXHIBIT 5 - OPTION 1

PRELIMINARY
SUBJECT TO CHANGE

1/1

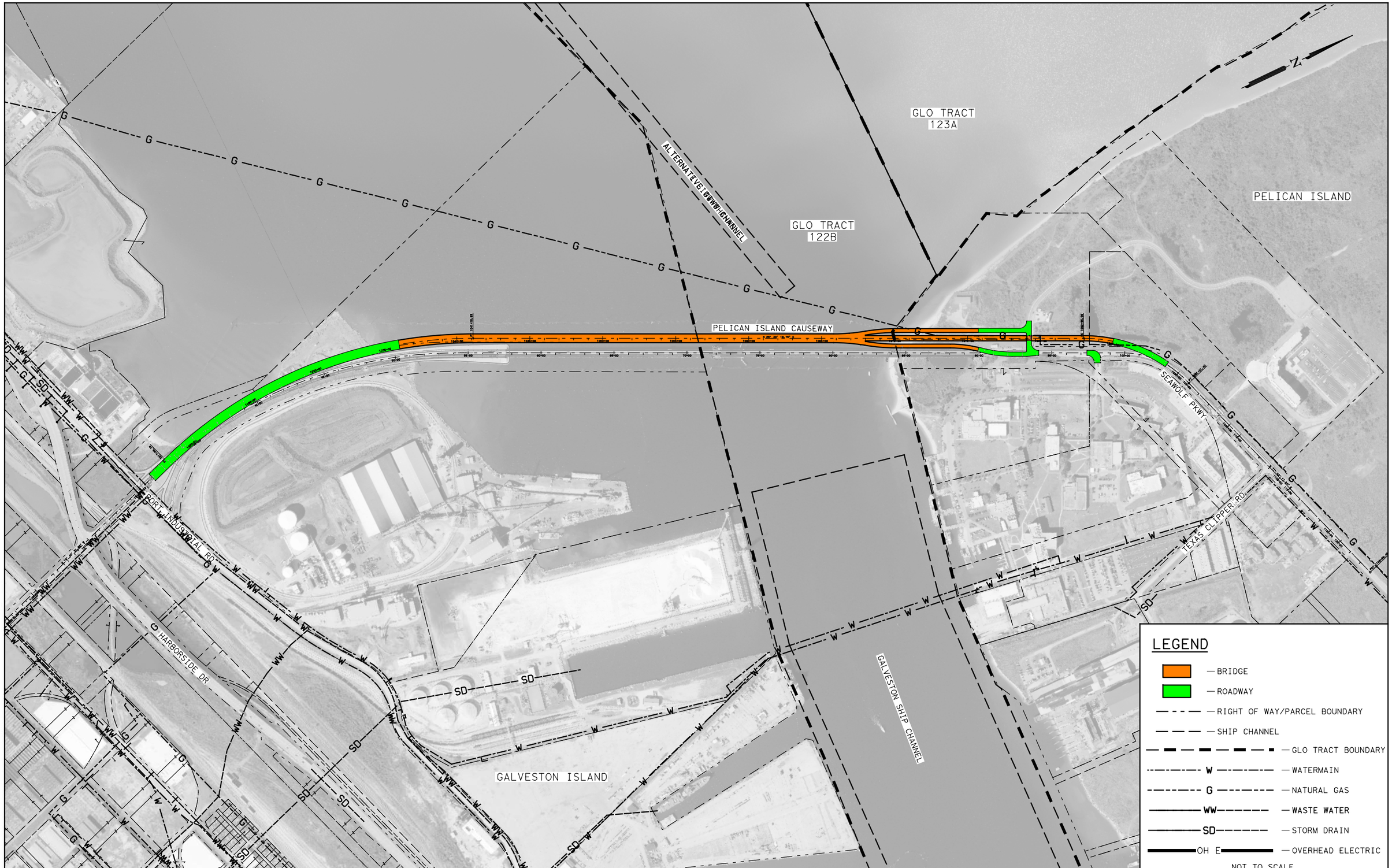

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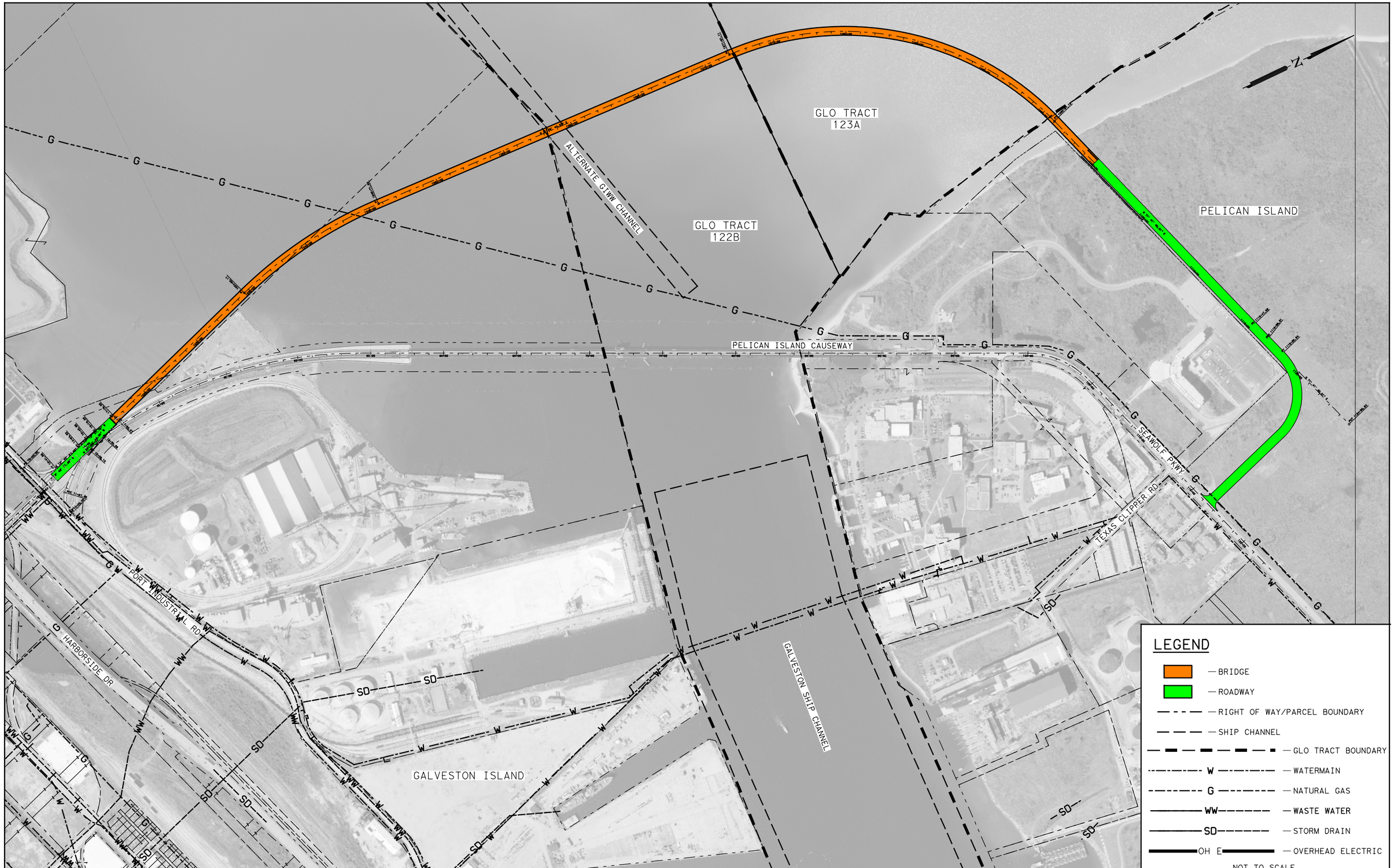
EXHIBIT 6 - OPTION 2

PRELIMINARY
SUBJECT TO CHANGE

1 / 1



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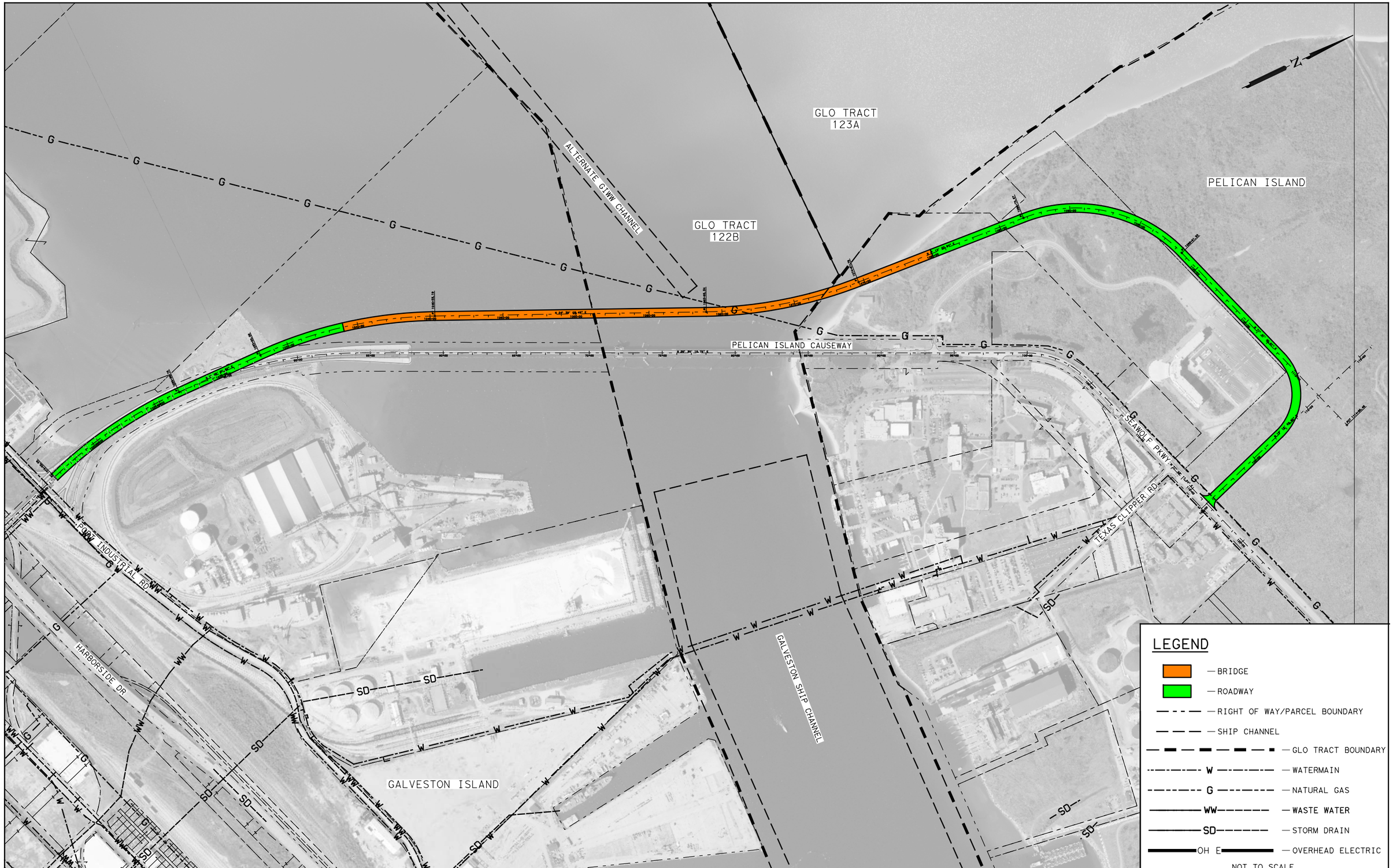
PELICAN ISLAND BRIDGE REPLACEMENT
EXHIBIT 7 - OPTION 3

PRELIMINARY
SUBJECT TO CHANGE

1 / 1



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PELICAN ISLAND BRIDGE REPLACEMENT
EXHIBIT 8 - OPTION 4

PRELIMINARY
SUBJECT TO CHANGE

1 / 1

Appendices

Appendix A. Environmental and Cultural Summary Report

Appendix B. Opinion of Probable Construction Cost

Appendix C. Bridge Type Study Report

Appendix D. Hydrodynamic Analysis Memo

Appendix E. Vessel Impact Study

Appendix F. Traffic Analysis Report

Appendix G. Survey Control Sheets

Appendix H. Geotechnical Report

Appendix I. Drainage Tech Memo

Appendix J. Photographs

Appendix K. As-builts for Existing Bridge

Appendix L. As-builts for Utilities

Appendix M. Meeting Minutes

Appendix N. Public Meeting Summary Report

Appendix O. Landbridge Concept Technical Memo

Appendix P. 11x17 Plots of Preferred Alternative

Appendix Q. Preliminary Bridge Layouts