



BRAZORIA COUNTY EROSION RESPONSE PLAN



An Amendment to the Dune Protection and Beach Access Plans for:

**BRAZORIA COUNTY
VILLAGE OF SURFSIDE BEACH
TOWN OF QUINTANA
CITY OF FREEPORT**

April 16, 2012

Prepared by:

COAST & HARBOR ENGINEERING, INC.
3410 Far West Blvd., Austin, TX 78731
TEL: 512.342.9516 FAX: 512.342.9708
www.coastharboreng.com

Submitted to:



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Erosion Response Plan – County of Brazoria

Revision 1

April 16, 2012

1 INTRODUCTION

This Erosion Response Plan (ERP) was developed by Coast & Harbor Engineering, Inc. (CHE) under Brazoria County Contract No. 11-022-000-4320, pursuant to the authority granted by Texas Natural Resources Code, §33.607 for reducing public expenditures for erosion and storm damage losses to public and private property, including public beaches. It was developed in consultation with the Texas General Land Office (GLO) and establishes a building set-back line, explains criteria for construction seaward of the set-back line, identifies opportunities for mitigation and preservation of public beach access areas and dune system, describes criteria for acquiring property seaward of the set-back line, and identifies measures for post storm damage assessment to beach access infrastructure and critical dune areas. By implementing an ERP, Brazoria County and its coastal municipalities are in compliance with the GLO requirements and will continue to be eligible for GLO funding for Coastal Restoration and Protection Projects.

Brazoria County consists of approximately 30 miles of Gulf Coast shoreline, as shown in Figure 1. Three local governments have coastal jurisdiction within Brazoria County including the Village of Surfside Beach, Town of Quintana, and City of Freeport. Brazoria County has coastal jurisdiction for shoreline not included within these local communities. This ERP shall serve as an amendment to each of these local government's Dune Protection and Beach Access Plans.

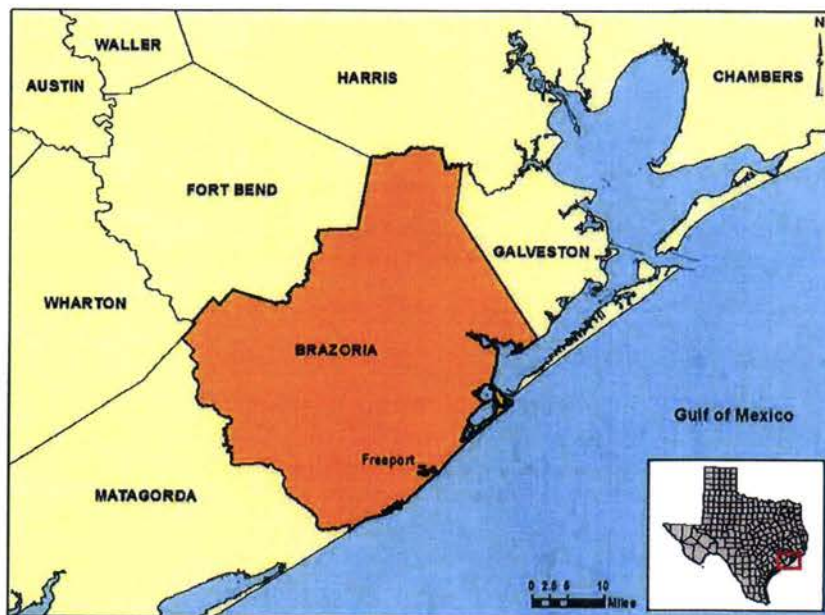


Figure 1. Vicinity Map of Brazoria County, Texas.

2 LOCAL GOVERNMENT JURISDICTION

The Village of Surfside Beach is located on the northeast side of the Freeport Channel, the Town of Quintana is located on the southwest side of the Freeport Channel, and City of Freeport has coastal Extraterritorial Jurisdiction (ETJ) located southwest of Bryan Beach Road and a small section northeast of the Village of Surfside Beach as shown in Figure 2. Brazoria County has coastal jurisdiction for shoreline not included within these local communities with the exception of shoreline within the Aransas National Wildlife Refuge and Justin Hurst Wildlife Management Area which is managed by the Texas Parks and Wildlife Department.

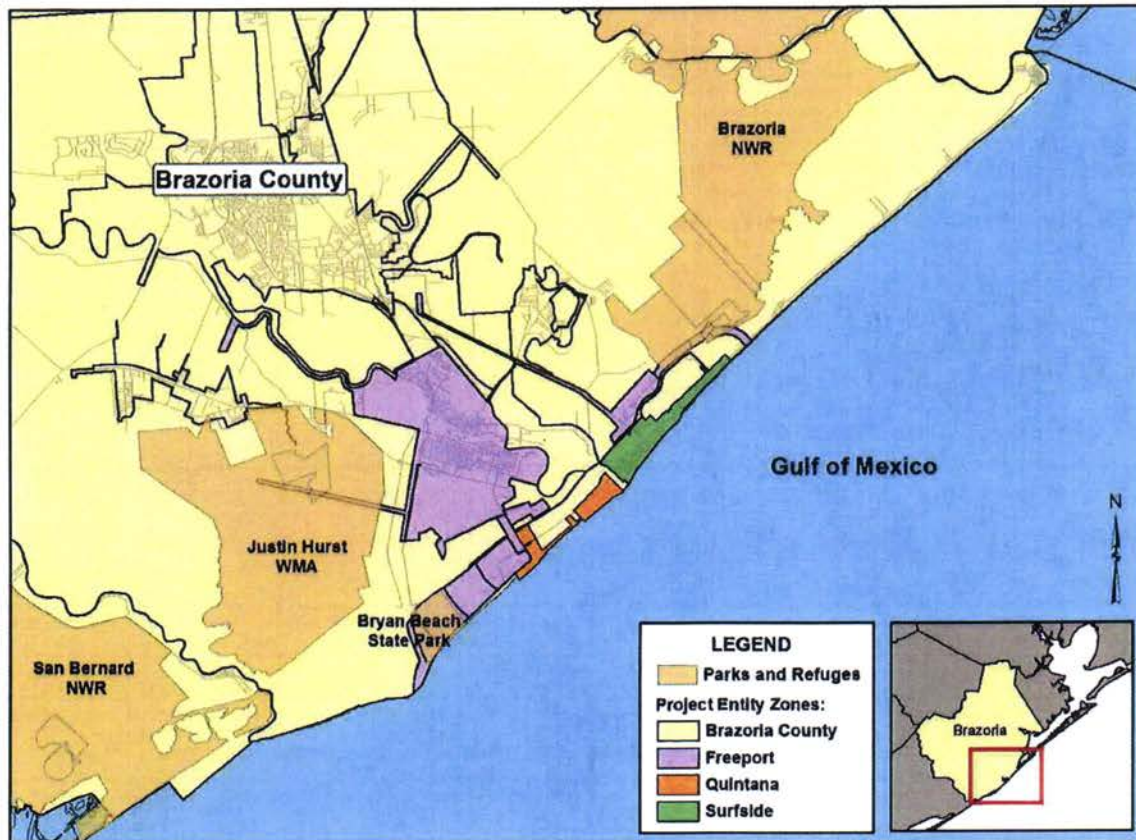


Figure 2. Coastal Jurisdiction within Brazoria County.

3 GEOMORPHOLOGY

3.1 Geomorphology

Regionally, the coastal area is composed of fluvial deltaic headlands (McGowen and others, 1976) with a series of marginal marine embayments separated from the Gulf by a system of sandy barrier islands and peninsulas (Lankford and Rehkemper, 1969). The southeastern shore of Texas is a microtidal, wave-dominated coast (Hayes 1979).

Coastal Brazoria is characterized as Quaternary (recent and Holocene) Alluvium containing thick deposits of clay, silt, sand, and gravel (Barnes et al., 1975, 1982) overlying the Pleistocene-age Beaumont Formation which is composed mostly of clay with silt, sand and gravel. The Alluvium outcrops in a belt approximately 70 to 90 miles wide paralleling the coastline.

Previous geotechnical investigations in the vicinity of the Freeport Jetties indicate that the sand on the upper beach is approximately 18 – 20 ft thick and is underlain by mud or the Beaumont Clay formation. The sand layer thins offshore to about 6 ft thick at the end of the jetties. Just offshore of the jetties, the sand layer disappears completely and the bottom is composed of silt and stiff Beaumont Clay.

The majority of the Brazoria County coast has experienced a general erosional trend over at least the past 100 years leading to shoreline retreat throughout most of the County shoreline with the exception of the shoreline southwest of the Brazos River mouth which has in general advanced.

The three main features influencing the shoreline morphology along the Brazoria County shoreline are the relic Brazos River Delta, the Freeport Jetties, and Freeport Channel. The Freeport Channel was the mouth of the Brazos River until the mouth was relocated 8 miles southwest in 1929 as the sediment carried by the river made maintenance of the Freeport Channel too expensive. Since the river mouth was relocated, the delta bottom (the sea bed offshore of the Brazoria County shoreline) has eroded and dropped more than 12 ft in the last 75 years; erosion is continuing and is expected to continue in the future. This lowering of the bottom allows higher wave energy to propagate closer to the shoreline which increases erosion and sediment transport along the shoreline.

The shape of the relic Brazos River Delta and the local wave climate cause a divergent node in the longshore transport at the Freeport Channel so the net sediment transport is away from the Channel. Net sediment transport moving along the Surfside shoreline is to the northeast, and net sediment transport along the Quintana shoreline is to the southwest. Due to these transport patterns and the presence of the Freeport Channel and Jetties, a deficit in the littoral system is present along the majority of the central Brazoria County shoreline which leads to erosion and shoreline retreat. Any increase in wave energy from the eroding offshore bottom (relic delta) will increase the volume of sediment being transported along the shoreline causing further erosion due to a lack of sediment supply.

At the same time, maintenance of the Freeport Channel removes approximately 2.6 million cy/yr from the channel, which is estimated to be composed of approximately 10% sand. The maintenance material is being permanently removed from the Brazoria County littoral system through deepwater disposal.

On the northern end of the County shoreline, San Luis Pass acts a sediment sink accumulating approximately 100,000 cy/yr and trapping sediment that would otherwise be available for transport along Follet's Island, which leads to shoreline retreat along most of that reach of shoreline. South of the Brazos River mouth, the shoreline is supplied with sediment from the Brazos River, and is generally stable or accretional, except the shoreline west of the San Bernard River.

The cumulative effects from relocation of the Brazos River, dams trapping sandy sediment inland, Freeport Channel improvement projects, and continued dredging of the navigation channel all lead to the two main causes of erosion: 1) an overall loss of sediment from the littoral system and 2) erosion of the relic delta which translates into shoreline erosion. These causes have worked together to form a positive feedback loop which accelerates the erosion and associated shoreline retreat along most of the Brazoria County shoreline. This system will continue to accelerate for the foreseeable future. Additionally, future efforts to deepen and/or widen the Port of Freeport Channel

are likely to have additional impact (increase) on the morphological system inertia and shoreline retreat (CHE 2008).

3.2 Erosion Rates

Texas has some of the highest erosion rates in the country. When the Texas coast erodes, homes are lost, property values decrease, tourism suffers, and local economies are negatively impacted. Additionally, without a healthy beach/dune system to protect the coast, the impact of major storms is more severe. Sixty-four percent of the Texas coast is eroding at an average (mean) rate of 5.9 feet/year with some areas experiencing greater than 30 feet/year (McKenna 2009).

Of the communities studied, average erosion rates are among the highest at West Galveston Island, Village of Surfside Beach, and in the City of South Padre Island, and these communities are the top three with the greatest value in land lost and structure damage (McKenna 2009).

In April 2011, the Bureau of Economic Geology (BEG) published long-term erosion rates for Brazoria County which are shown in Appendix A. These average erosion rates were calculated based on aerial photography from the 1930's to 2007, prior to Hurricane Ike. While these rates show the long-term erosion trends along the Gulf of Mexico shoreline in Brazoria County, they do not reflect accelerated erosion experienced along some sections of shoreline such as in Surfside Beach adjacent to the Freeport Jetties.

3.2.1 Village of Surfside Beach

The average long-term coastal erosion rate for the shoreline along the Village of Surfside Beach ranges from stable to 8 ft/yr with the most severe erosion within the pedestrian beach portion of the shoreline near the Freeport Jetties.

3.2.2 Town of Quintana

The average long-term erosion rate for the shoreline along the Town of Quintana is 6 to 15 ft/yr with erosion rates over the majority of the shoreline greater than 10 ft/yr.

3.2.3 City of Freeport

The average long-term erosion rate for the shoreline along the City of Freeport is 8 to 19 ft/yr with the highest erosion rates near the Brazos River mouth where washover and blowouts have occurred during recent hurricane events such as Rita and Ike.

3.2.4 Brazoria County

The average long-term erosion rate for the shoreline along the remainder of the county ranges from stable to 16 ft/yr with the most severe erosion rates on the northeast end of the county around Treasure Island.

4 DEVELOPMENT OF BUILDING SET-BACK LINE

The ERP, including the building set-back line, was developed in anticipation of coastal erosion and is intended to restore and enhance the critical dune system, protect and restore beach access infrastructure, and minimize loss to private and public infrastructure during storm events. The set-back line was established to provide guidelines for new construction seaward of the set-back line and reduce damage to these structures during storm events. Additionally, the building set-back line

may not be located further landward than the Dune Protection Line (DPL) and must encompass as much of the critical dune area as practicable. The criteria evaluated and utilized in the establishment of the building set-back are described below.

4.1 Criteria Considered

CHE collected data from the GLO, BEG, Texas Natural Resources Information System (TNRIS), as well as local governments in Brazoria County. A list of collected data is presented in Table 1.

Table 1. Data Collected and Used for Set-Back Line Development.

DATA	DETAILS	SOURCE
Aerial Photography	May 2010 Aerial Photography in UTM83z10m Coordinate System	Downloaded from Texas Natural Resources Information System (TNRIS).
Historical Erosion Rates	Analysis spans 1930 to September of 2007 (Pre-Ike). Results are Feet per Year Erosion	Bureau of Economic Geology: Shoreline Change Study Historical Erosion Results Released in April 2011.
Beach Access Plans	Brazoria County, Surfside, Quintana, & Freeport	Acquired from entity.
Dune Protection Line (DPL)	Brazoria County, Surfside, Quintana, & Freeport	CHE digitized the DPL based on each local government's Beach Access Plans.
Approximate Line of Vegetation	Based on May 2010 Aerial Photography	CHE delineated vegetation line.
Base Flood Elevation (BFE) Zones	Based on May 1992 Flood Insurance Rate Maps (FIRMS).	CHE received rectified FIRMS from Michael Baker Jr., Inc. (c/o Brazoria County) and digitized the BFE Zones
Mean Higher High Water (MHHW)	Based on April 2010 Lidar Data (NAVD88 Feet).	General Land Office (GLO)
Coastal Boundary Surveys (CBS)	Coverage Years varied from 2002 to 2010.	General Land Office (GLO)
Public Beach Access	Vehicular and Pedestrian Beach Access Points.	Verified by CHE on May 3 and May 24, 2011 Site Visit

4.1.1 Historical Erosion Rates

Historical erosion rates, as determined by the BEG Shoreline Change Study (2011), in conjunction with onsite observations by CHE coastal engineers, were reviewed and considered in the development of the set-back line. It should be noted that although the Shoreline Change Study is a recent release, erosion rates provided by the BEG in this study do not include data from Hurricane Ike or any data post-Ike. See Appendix A for the 2011 BEG long-term erosion rates for Brazoria County; erosion rates are given at approximately 175ft intervals along the shoreline.

4.1.2 Line of Vegetation

The Line of Vegetation (LOV) is the extreme seaward boundary of natural vegetation, which spreads continuously inland and is typically used to determine the landward extent of the public beach. A natural vegetation line, seen in Figure 3 and shown in Appendix A, is visible through portions of Brazoria County. CHE used ArcMap to manually delineate the visible vegetation line from the 5/3/2010 rectified aerial photography that was acquired by the National Agriculture Imagery Program (NAIP). In areas where the LOV was not present, the line was extrapolated from one existing point of vegetation to another and for the purposes of this plan will be referred to as the approximate LOV. The approximate LOV was visually verified during a site visit conducted in May of 2011. The approximate LOV presented in the maps of Appendix A is not intended to be used to identify, delineate, or fix the landward boundary of the public beach, but merely to be used as a reference point in determining the location of the building set-back line.

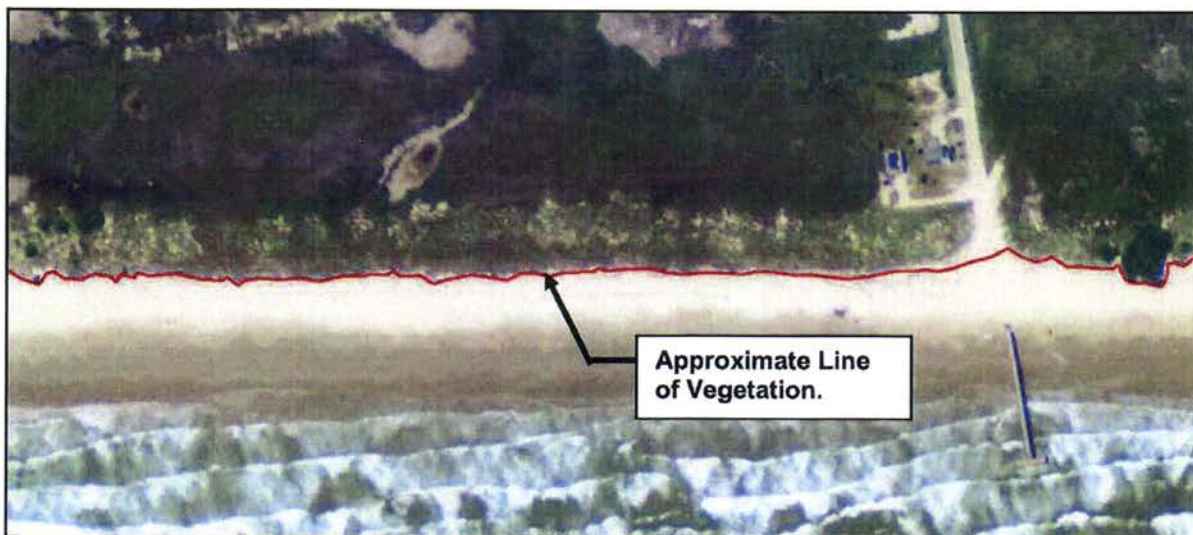


Figure 3. Approximate Vegetation Line based on 2010 Aerial Photography.

4.1.3 Mean High Tide

The Texas Gulf Coast experiences approximately two tidal cycles per solar day, referred to as a semidiurnal tide. The tide cycles through a high and low twice each day, with one of the two high tides being higher than the other and one of the two low tides being lower than the other. For the purpose of developing a set-back line, CHE used the Mean High Tide datum which is considered the average of the highest tide level in each day observed over the most recent National Tidal Datum Epoch, a 19 year period from 1983 to 2001. The name for this tidal mean (Mean High Tide) according to NOAA is the Mean Higher High Water or MHHW.

The MHHW line for Brazoria County was delineated on a 2010 topographic contour map provided by the GLO. The 2010 topographic contour map was created by the GLO from 2010 Lidar data which was collected in April 2010 by the BEG with Vertical Datum: NAVD88 Feet. CHE imported the 2010 GLO contours into AutoCAD and created a Surface and then extracted the 1.90ft MHHW contour line. See Appendix A for the location of MHHW along Brazoria County.

4.1.4 Coastal Boundary Surveys

Coastal Boundary Surveys (CBS) for Brazoria County were purchased from the GLO on March 22, 2011, but were not used for establishing the set-back line due to the following reasons:

- CBS were not available for the entire county.
- The CBS published dates were not consistent and varied from 2002 to 2010.
- The CBS coverage areas were not continuous from one area to the next for the entire County.

4.1.5 Dune Protection Line

Brazoria County and its local governments have established a DPL for the purpose of protecting critical dune areas. This line runs parallel and adjacent to the Gulf of Mexico and extends a distance landward of the MHHW. The DPLs within each entity are described below and depicted in Appendix A.

Village of Surfside

From the easterly town limit, the DPL follows Bluewater Highway west to HWY 332, then south on HWY 332 to Surf Drive, then west on Surf Drive to Whelk St., then south on Whelk St. to Seashell Dr., then west on Seashell Dr. to Texas St., then north on Texas St. to Surf Dr., and west on Surf Dr. to the westerly town limit.

Town of Quintana

The DPL in Quintana is a line running parallel to the beach 1,000ft landward of MHHW. The DPL was recently updated by the Town of Quintana in 2011 and is shown on the Appendix A maps.

City of Freeport

The DPL in the City of Freeport is a line running in a southwesterly direction parallel and adjacent to the Gulf of Mexico and 1,000ft landward of the MHHW between the northeasterly right-of-way of FM HWY 1495 and the bank of the Brazos River Diversion Channel.

Brazoria County

The Brazoria County DPL runs along the centerline of County Road 257, also known as Bluewater Highway. The location of this DPL was coordinated with Brazoria County and will be reflected in their newly updated Dune Protection and Beach Access Plan.

4.2 Established Set-Back Line

Shoreline retreat along the Brazoria County Gulf of Mexico shoreline is one of the highest in the state of Texas with the average long-term erosion rate ranging from stable to 19 feet per year (see Section 4.1.1). Based on the assessment of the high shoreline retreat rates and the location of the critical dune areas, the set-back line was established as far inland as allowed by the Texas Natural Resources Code, §33.607 which is the existing DPL for the entire County (See Appendix A for location of DPL/Set-Back Line). Additionally, site visits by CHE coastal engineers were performed to verify that the location of all dunes is seaward of the DPL. As a result, it was determined that all dunes 1,000 feet from mean high tide are included in the Critical Dune Area (seaward of the established DPL). A set-back line was not delineated along the San Bernard National Wildlife Refuge or along the shoreline adjacent to the Justin Hurst Management Area.

5 NEW CONSTRUCTION GUIDELINES

Guidelines for new construction shall be the same for all of Brazoria County including each local entity, except where noted within this section. To the maximum extent practicable, all structures should be constructed landward of the set-back line. Construction of structures landward of the set-back line must comply with mitigation sequence requirements for avoidance and minimization of effects on dunes and dune vegetation as specified in Texas Administrative Code (TAC) §15.4(f) Mitigation. The permittee is not exempt from compliance with compensatory mitigation requirements for unavoidable adverse effects on dunes and dune vegetation.

All jurisdictions will implement the new construction standards through the local Beach/Dune Plan and the local Dune/Beach Plan will be modified to reference the ERP as an appendix, thereby connecting both documents in the permitting process. Additionally, all jurisdictions within Brazoria County will ensure that public facilities are constructed landward of the set-back line or constructed in accordance with the requirements for exempt structures.

5.1 Exemption Considerations

Exemption from prohibition of construction seaward of the set-back line shall be the same for all of Brazoria County including each local entity, except as noted herein. Dune walkovers, beach access roadways, public parking, and associated public facilities constructed seaward of the set-back line shall be constructed in accordance with the GLO construction standards.

Brazoria County may consider exemptions from the prohibition of residential and commercial construction seaward of the set-back line for:

1. Properties for which the owner has demonstrated to the satisfaction of the local government that no practicable alternatives to construction seaward of the building set-back line exist. For purposes of this section, practicable means available and capable of being done after taking into consideration existing building practices, siting alternatives, and the footprint of the structure in relation to the area of the buildable portion of the lot, and considering the overall development scheme for the property;
2. Properties for which construction is permitted under a dune protection and beach access plan establishing a building set-back line certified by the General Land Office prior to the effective date of this section and if there are no changes from the originally permitted construction plans; and
3. Structures located seaward of the building set-back line prior to the effective date of this section for which modifications are sought that do not increase the footprint of the structure. However, structures seaward of the building set-back line that are damaged more than 50% or destroyed should be subject to ~~this section~~ before any repairs or reconstruction may be conducted.

new construction guidelines?
Standard 5

5.2 Construction Requirements for Exempt Properties

Where the local government allows an exemption from the prohibition for building seaward of the building set-back line, it should require the following conditions of construction:

1. Plans and certifications for the structure shall be sealed by a registered professional engineer licensed in the State of Texas providing evidence of the following:

- a. A minimum two-foot freeboard above the Federal Emergency Management Agency (FEMA)'s Base Flood Elevation (BFE);
 - b. No enclosures below BFE;
 - c. Consistency with the latest edition of specifications outlined in American Society of Civil Engineers, Structural Engineering Institute, Flood Resistant Design and Construction, ASCE 24-05;
 - d. That habitable structure will be feasible to relocate;
 - e. All construction will be designed to minimize impacts on natural hydrology.
2. Location of all construction should be landward of the landward toe of the foredune ridge, where practicable.

5.3 Variances of Construction Requirements for Exempt Properties

The following variances were developed by Brazoria County and the Village of Surfside. These variances are developed with the intent of reducing public expenditures due to erosion and storm damage losses and are described and justified below. There are no variances proposed by the City of Freeport or the Town of Quintana.

The Village of Surfside has developed the following variances to Section 5.2 of this document:

1. Owners of all front row construction, adjacent to the beach, will build their structure as landward as possible on the lot and provide a map delineating the location of the dune system within the property. If no dune exists on the property, the owner will submit a dune construction plan to be approved by the Village of Surfside as part of the permitting process. The dune plan must propose a 30ft base dune construction project that lies between the ~~proposed~~ property and the beach along the entire seaward edge of the property. The Village of Surfside will ensure that all construction seaward of the set-back line is not located within the public beach easement, including dune restoration projects. The proposed dune restoration requirements must identify a maximum seaward distance from the natural LOV (the rules require no farther than 20 feet seaward), but shall not interfere with the public's ability to use the beach at normal high tides.
2. The Village of Surfside proposes to lower the minimum two-foot freeboard above the BFE to a minimum one-foot freeboard above the BFE. The Village of Surfside is currently negotiating an insurance rate reduction with FEMA and has decided to use a minimum one-foot freeboard elevation for all construction within the city limits. By setting this requirement on all new construction within the city limits, a greater reduction of public expenditures for erosion and storm damage losses will be achieved.
3. Under FEMA construction guidelines, enclosures below the BFE are allowed as long as all walls for the enclosure are designed to breakaway under wind, surge, and wave impact to reduce impacts on water movement underneath and around the structure. Therefore, the Village of Surfside will allow a variance to the no enclosures below BFE rule as long as all walls of the enclosure are designed and constructed to breakaway under flood and wave action while minimizing impacts to hydrology. The Village of Surfside will limit the area of enclosures below BFE to 299 square feet.

Allowing enclosures below the BFE, with breakaway wall construction seaward of the set-back line, is a reasonable alternative in view of the fact that the set-back line for the entire County is located at the most landward point (the DPL) allowed by the rules and that this variance satisfies federal requirements by the NFIP. Allowing this variance will reduce the total footprint of structures thus reducing the potential impact to critical dune and natural ground cover.

Enclosures below BFE shall consist of breakaway construction to meet the requirements of the NFIP regulations for V zone construction codified in Title 44 Section 60.3(a)(3) of the Code of Federal Regulations. As defined by FEMA, a breakaway wall is not part of the structural support of the building and is intended through its design and construction to collapse under specific lateral loading forces without causing damage to the elevated portion of the building or supporting foundation system. Any walls below the lowest floor in a building in a V Zone should give way under wind and water loads without causing collapse, displacement, or other damage to the elevated portion of the building or the supporting pilings or columns.

4. Lots which span the set-back line will be considered as two separate lots with all of the construction requirements for exempt property listed in Section 5.2 and variances listed in Section 5.3 applying to the seaward portion of the lot.

Brazoria County has developed the following variances to Section 5.2 of this document:

1. Under FEMA construction guidelines, enclosures below the BFE are allowed as long as all walls for the enclosure are designed to breakaway under wind, surge, and wave impact to reduce impacts on water movement underneath and around the structure. Therefore, the County will allow a variance to the no enclosures below BFE rule as long as all walls of the enclosure are design and constructed to breakaway under flood and wave action while minimizing impacts to hydrology. The County will limit the area of enclosures below BFE to 299 square feet.

Allowing enclosures below the BFE, with breakaway wall construction, seaward of the set-back line is a reasonable alternative in view of the fact that the SBL for the entire County is located at the most landward point (the DPL) allowed by the rules and that this variance satisfies federal requirements by the NFIP. Allowing this variance will reduce the total footprint of structures thus reducing the potential impact to critical dune and natural ground cover.

Enclosures below BFE shall consist of breakaway construction to meet the requirements of National Flood Insurance Program (NFIP) regulations for V zone construction codified in Title 44 Section 60.3(a)(3) of the Code of Federal Regulations. As defined by FEMA a breakaway wall is not part of the structural support of the building and is intended through its design and construction to collapse under specific lateral loading forces, without causing damage to the elevated portion of the building or supporting foundation system. Any walls below the lowest floor in a building in a V Zone should give way under wind and water loads without causing collapse, displacement, or other damage to the elevated portion of the building or the supporting pilings or columns.

2. Lots which span the set-back line will be considered as two separate lots with all of the construction requirements for exempt property listed in Section 5.2 and variances listed in Section 5.3 applying to the seaward portion of the lot. This variance is considered reasonable in view of the fact that Brazoria County currently requires that all new construction within their coastal jurisdiction, seaward and landward of the set-back line, comply with a minimum two-foot freeboard above the FEMA's BFE.

6 PRESERVATION & RESTORATION

This section presents procedures for 1) preserving and enhancing the public's right of access to and use of the public beach from losses due to erosion and storm damage and 2) preserving, restoring, and enhancing critical dunes for natural storm protection and conservation purposes.

On May 3rd and 24th of 2011, a conditions assessment was performed to determine the existence, location, and condition of all vehicular and pedestrian beach access points along the Brazoria County shoreline. The beach access points were evaluated to determine their functionality, condition, and need for protection, enhancement, or restoration. A similar assessment was also performed for the existing dune system along the Gulf of Mexico shoreline in Brazoria County.

6.1 Evaluation of Beach Access Points

As erosion continues along most of the Brazoria County Gulf shoreline, damage to beach access points is expected. The assessment of beach access points performed by CHE in May 2011 gives a snapshot of the condition, location, and functionality of the accesses and serves as a starting point for planning the preservation and enhancement measures to be implemented by the County and local governments as funding becomes available. All local governments presently perform continual monitoring of beach access points and maintenance of these accesses was evident in the conditions assessment.

The conditions assessment consisted of a site visit by a CHE coastal engineer who evaluated, prioritized, indexed, and photographed all vehicular and pedestrian beach access points in Brazoria County. Table 2 lists all of the existing beach access points, jurisdiction, type of access, and location of site visit photograph within Appendix C. Appendix B shows the exact location in plan view of the access point.

The following section summarizes the conditions assessment of all access points within each local government jurisdiction and describes measures to improve and protect beach access in view of the ongoing erosion along Brazoria County. Improvements identified herein will be designed and constructed using methods that will reduce costs associated with repair, rebuilding, or replacement due to storm damage and erosion.

6.1.1 City of Freeport

There are two vehicular access points within the City of Freeport jurisdiction. Beach Access #2 at CR 241 is in good working condition and vehicular access onto the beach was easy. Beach Access #2 is angled to the beach and to the prevailing wind direction which may help reduce storm surge propagation inland during a storm. Beach Access #1 at CR 750 needs some improvement and will benefit from additional crushed limestone road base at the entrance to the beach. Additionally, this entrance is not perpendicular to the beach which helps reduce storm surge propagation. However,

Beach Access #1 could be improved to reduce potential storm surge propagation by increasing the elevation of the road at the dune location by an elevation of 4 feet. Any improved protection project would be subject to available funding.

6.1.2 Town of Quintana

There are two vehicular access points within the Town of Quintana. These access points are in good condition, allow easy driving onto the beach, and do not need any improvements at the present time. However, these roads are aligned to the prevailing wind direction and beach and could be avenues for storm surge propagation during a storm. These vehicular access points can be improved by increasing the elevation of the road by 4 feet at the dune location. Any improved protection project would be subject to available funding.

6.1.3 Village of Surfside Beach

There are five vehicular beach access points and twenty pedestrian beach access points within the Village of Surfside Beach.

Each of these access points were evaluated and it was determined that they are all in good condition and functioning properly. All pedestrian access points, which are dune walkovers, have a good entrance on the back of the dune and avoid impacts to the existing dune. The dune walkovers land on the upper beach just on the front toe of each dune without impacting the dune and on the upper beach as landward as possible so as to reduce interaction with the highest tide levels. Vehicular access points were determined to be in good condition and allow easy access for vehicles on to the beach. Access points in the Village of Surfside are optimally placed to eliminate impact to the dune and minimize damage from erosion. However, due to their orientation (perpendicular to the beach), the roads could act as avenues for storm surge propagation during a storm if the winds were in the direction of road alignment. All five vehicular access points in the Village of Surfside could benefit by increasing the elevation of the road by 4 feet at the location of the dune. Changing the alignment of the roads would require purchase of adjacent property and is therefore cost prohibitive. All of the access points were improved after Hurricane Ike with raised road elevation and increased road base

Stahlman Park, a publicly funded existing amenity in the Village of Surfside Beach, was completely rebuilt after Hurricane Ike and consists of a 4,000 sq ft conference center and wheelchair accessible beach access. These facilities are in good condition.

Note: Vehicular access at Hwy 332 will benefit from additional crushed limestone road base at the entrance to the beach. Due to its heavy use by the public, this entrance is in continual need of monitoring and maintenance to allow easy access onto the beach.

6.1.4 Brazoria County

There are seven vehicular beach access points and three pedestrian access points within the Brazoria County jurisdiction. Each of these access points were evaluated and is functioning properly. Based on the limitations of space and few alternatives available for protection, these access points are optimally placed to minimize their damage from erosion and storm surge; however, Beach Access #1 and #3 will benefit from additional crushed limestone road base at the entrance to the beach and raising their elevation by 4 feet at the dune location will mitigate storm surge propagation. Beach Access #4 has deep scour holes on each side of the road caused by Hurricane Ike. These scour holes

should be filled and stabilized with vegetation to improve safety to vehicles entering the beach through this road. Vehicular Beach Access points 1-6 are perpendicular to the beach and could be realigned to reduce storm damage. However, changing the angle of the roads to the beach would require the purchase of private property and may impact the secondary dune at some of the locations. Therefore, raising the elevation of the roads at the dune location as stated is the best solution to reduce storm surge propagation.

The pedestrian access point located at the Quintana Beach County Park is in adequate working conduction. Some repairs were being implemented at the time of the site visit to give higher elevation to the dune walkover which will improve access to the beach by pedestrians and will allow for natural development of the dune underneath the structure. These improvements were completed within a couple of months of the site visit.

Table 2. Beach Access Locations in Brazoria County.

INTERSECTION ROAD	TYPE	SITE PHOTOGRAPH
CITY OF FREEPORT		
Beach Access #2 at CR 241	Vehicular	Appendix C, Page 1, A
Beach Access #1 at CR 750	Vehicular	Appendix C, Page 1, B
TOWN OF QUINTANA		
16 th Street	Vehicular	Appendix C, Page 2, C
8 th Street	Vehicular	Appendix C, Page 2, D
VILLAGE OF SURFSIDE BEACH		
Jettyview Road	Vehicular & *Pedestrian	Appendix C, Page 3, F
Thunder Road	Pedestrian	n/a
Texas Street	Pedestrian	Appendix C, Page 4, G
Beach Drive	Pedestrian	Appendix C, Page 4, H
Oyster Street	Pedestrian	Appendix C, Page 5, I
Starfish Street	Vehicular & *Pedestrian	n/a
Hwy 332	Vehicular & *Pedestrian	Appendix C, Page 5, J
Francis Cove	Pedestrian	Appendix C, Page 6, K
Ocean Ave	Vehicular & *Pedestrian	Appendix C, Page 6, L
Driftwood Ct	Pedestrian	Appendix C, Page 7, M
Sand Dune Ct	Pedestrian	Appendix C, Page 7, N
Coral Ct	Pedestrian	Appendix C, Page 8, O
Gulfway Ct	Pedestrian	Appendix C, Page 8, P
Carlton Ave	Pedestrian	Appendix C, Page 9, Q
Howard Ave	Pedestrian	Appendix C, Page 9, R
Belanger Ave	Pedestrian	Appendix C, Page 10, S
Saltgrass Ave	Pedestrian	Appendix C, Page 10, T
Detenbech Ave	Pedestrian	Appendix C, Page 11, U
Yucca Ave	Vehicular	Appendix C, Page 11, V
Sandpiper Ave	Pedestrian	Appendix C, Page 12, W
Seagull Ave	Vehicular & *Pedestrian	Appendix C, Page 12, X
BRAZORIA COUNTY		
5 th Street	Pedestrian	Appendix C, Page 3, E
Beach Access #1 at Seagull Ave.	Vehicular	Appendix C, Page 12, X
Beach Access #2 at CR257 (side)	Vehicular	Appendix C, Page 13, Y
Beach Access #3 at CR257E	Vehicular	Appendix C, Page 13, Z
Beach Access #4 at Nacal Drive	Vehicular	Appendix C, Page 14, AA
Beach Access #5 at CR 257R	Vehicular	Appendix C, Page 14, BB
Beach Access #6 at CR 257S	Vehicular	Appendix C, Page 15, CC
Pedestrian #1 at Treasure Island	Pedestrian	Appendix C, Page 15, DD
Pedestrian #2 at Treasure Island	Pedestrian	n/a
Beach Access #7 at SLP Bridge	Vehicular	n/a

* Indicates Wheelchair Access

The prioritized improvements/repairs, location, and type of repair are listed in Table 3. The Table lists the projects in order of priority for construction, with the highest priority listed as number 1.

Priority levels for the access points were based upon usage, need of repair, and inability to provide safe access to the beach.

Table 3. Beach Access Locations in need of Repair.

PRIORITY	LOCATION	REPAIR
1	<i>Surfside:</i> Access at Hwy 332	Additional crushed limestone road base at the entrance to the beach and raising elevation by 4 ft.
2	<i>Brazoria County/Surfside:</i> Beach Access #1 at Seagull Ave	Additional crushed limestone road base at the entrance to the beach and raising elevation by 4 ft.
3	<i>Freeport:</i> Beach Access #1 at CR 750	Additional crushed limestone road base at the entrance to the beach and raising elevation by 4 ft.
4	<i>Brazoria County:</i> Beach Access #3 at CR257E	Additional crushed limestone road base at the entrance to the beach and raising elevation by 4 ft.
5	<i>Brazoria County:</i> Beach Access #4 at Nacal Drive	Scour holes need to be filled and stabilized with vegetation

6.1.5 Post-Storm Assessment Procedures

All publicly funded existing amenities and access points were inventoried to qualify for FEMA post-storm funding. Post-storm monitoring of the access points will be conducted by Brazoria County and local governments on a routine basis and within 72 hours after meteorological events of significance for compliance with the Dune Protection and Beach Access Plan and rules. A report will be generated detailing noncompliance and required repairs/replacements of parking, pedestrian and vehicular access, signage, etc. along with schedules for repair/replacement based on available local funding, claims, and grants.

Following a meteorological event, County staff will conduct the following measures to ensure public access to and use of the public beach:

- Conduct inspections of all designated beach access points to determine whether the public is able to access the beach.
- Compile a list of required repairs and replacements, including but not limited to parking areas, pedestrian pathways, vehicular access ways, and signage.
- Create schedules for access area repairs and replacements based on local funding and grant requests.

6.1.6 Beach Access Goals and Implementation Schedule

Short-term goals include addressing concerns listed in Table 3, as funding becomes available and to continually monitor and maintain existing accesses.

Long-term goals include upgrading access points as needed to adapt to changing environmental conditions, increases in localized erosion, increases in storm activity, and changes in development

in an attempt to mitigate impacts from erosion, minimize storm damage, and continue to provide realizable and safe beach accesses to the public.

As part of Brazoria County's continual commitment to public access, the County plans to construct a beach access park from CR 257 to the gulf beach on a 5 acre tract about 2 miles southwest of Treasure Island.

6.1.7 Publicly Funded Existing Amenities

The following is a list of publicly funded existing amenities included in the jurisdiction of Brazoria County and the Village of Surfside.

1. Surfside Jetty County Park - Jetty Park consists of paved parking, picnic areas, restrooms, jetty walkway, playground and a trail. The cost to replace this facility if it was destroyed by a tropical storm is approximately \$1,200,000. This estimate is based on current prices which can fluctuate depending on market conditions. Over the next several years, there will be additional facilities and improvements added at this location that could increase the cost of replacement by several thousand dollars.
2. Quintana Beach County Park - Quintana Beach County Park is a 51-acre beachfront park with paved full-service RV campsites, cabins, restrooms/showers, a day house, five covered pavilions, one covered screened pavilion, picnic tables, playground, volleyball court, horseshoe pits, paved trail, wooden lighted fishing pier, and paved parking. The cost to replace this facility if it was destroyed by a tropical storm is approximately \$2,500,000. This estimate is based on current prices which can fluctuate depending on market conditions. Over the next several years, there will be additional facilities and improvements added at this location that could increase the cost of replacement by several thousand dollars.
3. San Luis Pass County Park - San Luis Pass County Park is a 15-acre bay park with both day-use amenities and overnight facilities. The park features paved full service RV camping, cabins, a meeting room with kitchenette, interpretive center, restrooms, a playground, fish cleaning stations, paved parking, and a boat launch. The cost to replace this facility if it was destroyed by a tropical storm is approximately \$1,750,000. This estimate is based on current prices which can fluctuate depending on market conditions. Over the next several years there will be additional facilities and improvements added at this location that could increase the cost of replacement by several thousand dollars.
4. Stahlman Park - Stahlman Park is a Community Center that overlooks the beach. It is available to the public for rental for all sorts of functions and is typically booked a year in advance. Underneath the elevated structure is an area with picnic tables, shelter from the sun as well as restrooms and with a public shower for beach goers. The facility has a new parking lot open to the public as well as an area for volleyball. Attached to the building are walkovers that lead to the beach. The replacement cost on this is set at \$850,000.00. This was just recently assessed by a TML actuary.

In addition to the large facilities listed above, the amenities shown in Table 4 are also maintained by the jurisdictions within Brazoria County for beach users.

Table 4. List and Cost Breakdown of Amenities Within Each Jurisdiction.

JURISDICTION	AMENITY	COST
City of Freeport	2 Portable Toilets	\$500 each for a total of \$1,000
Town of Quintana	50 Disposable Receptacles	\$145 each for a total of \$7,205
	2 Dune Walkovers	\$1,750 each for a total of \$3,500
	6 Beach Signs	\$25 each for a total of \$150
	1 Portable Toilet	\$113
Village of Surfside	30 Disposable Receptacles	\$125 each for a total of \$3,750
	30 Picnic Tables/Cabanas	\$200 each for a total of \$6,000
	Crabbing Pier	\$10,000
	2 Public Restrooms>Showers	\$2,500 each for a total of \$5,000
	12 Walkovers	\$2,750 each for a total of \$33,000
Brazoria County	200 Disposable Receptacles	\$225 each for a total of \$45,000
	Beach Access Park Trails	\$200,000

6.2 Evaluation of Critical Dunes

Coastal dunes are an important component along of the Texas Gulf of Mexico shoreline and protect public and private property by serving as natural barriers from storm surge and waves, and serve as a sediment supply that reduces the impact of erosion on beachfront infrastructure. Wide beaches and high continuous dunes are a good defense against coastal storms. High and continuous dunes tend to block storm surge whereas lower and discontinuous dunes can be overtopped and breached by waves and storm surge and as a result flooding of low-lying areas occurs. (McKenna 2009). In Texas, critical dunes are those located within 1,000ft from the MHHW. In Brazoria County, the majority of coastal topography is composed of overwash terrace deposits and the dune system is classified as discontinuous to absent. The assessment of the condition of dunes, including prioritizing areas with the greatest need for restoration and/or revegetation are discussed below by jurisdiction and shown in Appendix B. See Appendix D for actual site photographs of each location.

6.2.1 City of Freeport

The dune system within the City of Freeport's jurisdiction is classified as discontinuous with numerous overwash terraces. All of the shoreline within the City of Freeport jurisdiction, such as Bryan Beach, is undeveloped. Locations along this length of shoreline that could benefit from filling in the gaps and restoring the critical dune where overwash and/or blowouts have occurred are depicted in Appendix B. All of the short-term dune restoration components for this shoreline are classified as low priority.

6.2.2 Town of Quintana

The dune system within the Town of Quintana is classified as discontinuous with numerous overwash terraces and the area is considered low-density development. Due to the high erosion rate and the location of infrastructure along the shoreline, high priority critical dune restoration elements are identified at South Lake Drive, the dune system west of Cortez Dr., and an overwash area between 16th Street and 8th Street. These locations are depicted in Appendix B. Several other locations along this length of shoreline could also benefit from filling in the gaps and restoring the critical dune where overwash and/or blowouts have occurred and are displayed as low priority.

6.2.3 Village of Surfside Beach

A dune system within the Village of Surfside Beach is mostly absent, particularly to the west of Hwy 332. The Village of Surfside is considered a high-density development area and due to the lack of dune, all public and private infrastructures are considered at high risk from storm and erosion impacts. The shoreline west of Hwy 332 does not have an active system and therefore; a dune restoration project along this section of shoreline is considered an immediate need. Since the Village of Surfside shoreline is critically eroding with historical erosion rates up to 8 ft/yr and the Gulf is continually encroaching on existing infrastructure, there is very limited space for dunes. Any dune restoration effort has to be accompanied by beach nourishment. East of Hwy 332, the shoreline is stable when looking at the long-term erosion rates. However, the dune system was severely damaged during Hurricane Ike and should be enhanced to protect infrastructure ~~from~~ future storms. The restoration of the dune system along this section of shoreline is considered a medium priority and short-term objective.

6.2.4 Brazoria County

The dune system along Brazoria County jurisdiction is discontinuous to absent. The dune restoration from Matagorda County in the southwest moving northeast up to the new Brazos River mouth is not a priority because it is undeveloped and not accessible by public road or ferry. The next section of dunes from the Village of Surfside Beach on Follett's Island northeast to Treasure Island has low to moderate density of development and is considered high priority for critical dune restoration due to the high erosion rates along this section of shoreline. Treasure Island on the northeastern end of the County is a medium to high priority for critical dune restoration. Locations along this length that could benefit from filling in the gaps and restoring the critical dune where overwash and/or blowouts have occurred are depicted in Appendix B. These areas were prioritized based the proximity of CR257 to the active beach system.

6.2.5 Dune Material Properties

Due to the lack of sand borrow areas near the Brazoria County shoreline and the estimated quantity of material needed for the execution of short and long-term dune restoration projects, the County will allow the use of a mixture of 60% sand and 40% fines for the construction of the core of the

dune protection projects proposed within this ERP. The proposed dunes will also have a minimum one-foot sand cover over the core.

This allowance will reduce the costs of implementing dune restoration projects and increase the potential for larger and longer dune construction projects. For example, if it cost \$25/cy to bring in sand with less than 10% fines to construct a 1,000 ft dune that contains 5cy of sand per linear foot, the total cost for the dune restoration project would be \$125,000. However, the cost for a 60/40 mixture per cubic yard is approximately \$15 due to its availability and proximity to the Gulf of Mexico shoreline. Therefore, the same dune project would cost \$75,000. Alternatively, a longer dune project could be constructed with a budget of \$125,000 if the 60/40 mix was allowed; the length of this project would be 1,667 ft. Execution of longer dune restoration projects due to the cost savings will provide better protection of public and private infrastructure and create more habitat for endangered species.

6.2.6 Vegetation Requirements

Vegetation is a critical component to the dune system. Mowing/cutting of dune vegetation seaward of the set-back line will not be allowed. Mitigation projects requiring dune vegetation shall include:

- bitter panicum (*Panicum amarum*),
- sea oats (*Uniola paniculata*), and
- marshhay cordgrass (*Spartina patens*).

Bitter panicum has proved to be the best species for dune stabilization on the Texas coast. This native beach plant has a higher salt tolerance than many other coastal species and is a hardy grower. Sea oats are less tolerant of salt spray than bitter panicum but grow rapidly enough to avoid being smothered in rapidly shifting sand. Interplanting sea oats and bitter panicum will reduce the risk of disease or pest infestation. Marshhay cordgrass is a small, wiry perennial, which spreads by rhizomes. This grass shall be planted on the landward side of dunes.

Beach morning glory and seagrape vines can form a dense cover on the seaward side of dunes within a few growing seasons. Low-growing plants and shrubs to be used on the backside of the dune include seacoast bluestem, cucumber leaf sunflower, rose ring gallardia, partridge pea, prickly pear, and lantana. The optimum time for transplanting in Brazoria County is February, March, or April. Standard slatted wood sand fencing is ideal for dune-building structures because it is inexpensive, readily available, easy to handle, and can be erected quickly.

6.2.7 Post-Storm Assessment Procedures

All critical dune areas were inventoried to qualify for FEMA post-storm funding. Post-storm monitoring of the dune system will be conducted by the County and local governments on a routine basis and within 72 hours after meteorological events of significance. A report will be generated detailing dune restoration needs along with schedules for repair based on available local funding, claims, and grants.

Each jurisdiction within Brazoria County will review the location of the DPL at least once every five years to determine whether the lines are adequately located to achieve their stated purposes. In addition, each jurisdiction will review the adequacy of the location of the DPL within 90 days after a tropical storm or hurricane affects the Brazoria County Gulf shoreline. Each jurisdiction will amend the dune and beach plan and ERP whenever necessary to achieve their stated purposes.

6.2.8 Critical Dune Goals and Implementation Schedule

Procedures and implementation priorities for restoring and enhancing critical dunes for natural storm protection and conservations purposes are presented in this section. Short-term and long-term implementation goals were developed to address immediate needs. The overall goal of dune restoration for the County is to have a continuous foredune ridge along the entire County. Since dunes along Brazoria County are very small or non-existent, the short-term goals focus on filling gaps in the existing dune system to match adjacent areas; these projects will be less costly and easier to implement than the long-term projects. The long-term projects will require identification of sand sources, acquisition of permits, and large-scale funding. All dune projects to be constructed in Brazoria County will follow the guidelines for dune construction presented in the Dune Protection and Improvement Manual for the Texas Gulf Coast, 5th Edition.

Short-Term Goals

Short-term goals include filling in gaps and blowouts in the foredune ridge and re-vegetating these areas. Gaps should be filled to match existing dune height and width. Appendix B illustrates the areas that would benefit from immediate restoration. Many areas along Brazoria County are devoid of a dune system altogether. Prioritization of these critical areas was based on the rate of erosion and the need to protect public and private property and infrastructure from erosion and storm damage. As illustrated in Appendix B, the highest priority levels for proposed dune restoration elements include dune areas located within the Town of Quintana, the Village of Surfside and Treasure Island, as well as portions along Follet's Island in Brazoria County such as those near private infrastructures and where CR 257 is in close proximity to the MHHW. Medium priority dune restoration components are identified along the most eastern portion of the Village of Surfside and some sections of dune along Follet's Island, Brazoria County jurisdiction, which received severe damage during Hurricane Ike. The critical areas within the City of Freeport are considered lowest priority.

Long-Term Goals

Long-term goals include promoting the formation of a continuous foredune ridge throughout the length of the County. The dune shall be 10.5 - 13.5ft in height (75% of the BFE depending on location), with a minimum base width of 100-ft measured perpendicular to the gulf beach and which contains at least 85% of vegetative cover. FEMA, thru the NFIP, has created flood zone determination maps that indicate a Velocity Zone or V- Zone. A V-Zone is an area predicted by FEMA that contains high velocity flowing floodwater during meteorological events. BFEs have been designated for coastal zones and the BFEs for Brazoria County are depicted in Appendix E. BFEs in Brazoria County range from 12 to 18 ft above mean sea level. The minimum dune height shall exceed 75% of the BFE height from mean sea level for all of the V-Zones in Brazoria County. It is recommended that dune restoration projects be designed to meet USACE standards as defined in Chapter 4 of the Coastal Engineering Manual (USACE, 2008).

Schedule

A schedule for implementation of goals is dependent upon the availability of funding and the procurement of grants. The County is continually pursuing opportunities and has identified current and potential projects to help meet these goals.

Current Dune Restoration Projects

- Dune Day – Brazoria County and Save Our Beach Association along with volunteers place Christmas trees in January of each year along the Brazoria County coastline in Quintana, Surfside, and along Follet's Island to trap sand to initiate dune creation. The County supplements this effort with sand fencing.
- Dune Revegetation – Brazoria County has planted 100,000 dune plants on the county beaches on Follett's Island and in front of the Quintana County Park with funds from a CMP grant.

Potential Dune Restoration Projects

- CR 257 Dune Restoration – Reconstruction of dunes along CR 257 will be completed with CIAP FY 09 funds.
- Quintana Beach and Dune Restoration – FEMA claims are pending from Hurricane Rita and Hurricane Ike for restoration of the Beach/Dune System.

Potential Funding Sources for Dune Restoration Projects

The following grant opportunities and funding programs were identified and are listed below. Some of these programs such as CMP, CIAP, and FEMA are currently being engaged to execute dune restoration projects in Brazoria County. Additional funds will be pursued from future funding cycles for CEPRA and CMP for long-term dune restoration projects.

- Coastal Impact Assistance Program (CIAP) 2010 Funding Cycle
- Coastal Management Program (CMP)
- Coastal Erosion Planning and Response Act (CEPRA)
- Federal Emergency Management Agency (FEMA)

7 ACQUISITION OF PROPERTY SEAWARD OF THE SET-BACK LINE

Brazoria County developed criteria for identifying properties for voluntary acquisition of fee simple title or a lesser interest acquisition. These properties have structures located entirely seaward of the building set-back line that experience severe damage during storms, impedes the development of a natural dune system and restrict/impact the public's ability to use the public beach. Criteria for acquisition includes:

- A structure that is entirely seaward of the building set-back line.
- Structures that impede beach access or impact the public's ability to use the public beach.
- A structure that is more than 25% on the public beach.
- A structure that affects hydrology of the public beach, adjacent property or along dune system, as determined by a registered professional geologist/engineer licensed in the State of Texas.
- A structure that is deemed a hazard to health and safety.
- A structure that is causing erosion of adjacent property, dunes, or public beach.
- A structure that affects public health and increases safety risks on the public beach, as stated in the Beach/Dune rules.

Property will be prioritized based on severity and amount of criteria met. Brazoria County or local government can implement a removal strategy on the most prioritized property. Acquisition strategy will consist of:

- Identification of potential property.
- Negotiation of acquisition.
- Funding procurement.
- Agreement execution
- Removal or relocation of structure.

8 PUBLIC OUTREACH

Brazoria County, Village of Surfside Beach, Town of Quintana, and City of Freeport conducted educational meetings to discuss the ERP prior to submitting this document to the GLO. These meetings were held at the date and times listed below. See Appendix F for the meeting attendee lists.

- Brazoria County - May 23, 2011, 5:00 PM, Public Meeting at Stalman Park.
- Village of Surfside Beach and Town of Quintana - May 24, 2011, 6:30 PM, Public Meeting at Stalman Park.
- City of Freeport – May 5, 2011, 9:00 AM, Conference Call/Meeting.

In accordance with TAC Title 31 Chapter 15 Rule §15.17, the local government's governing body will formally approve the ERP at formal hearings. The date, time, and location of these hearings have not been determined and will be finalized once comments from the GLO have been received and implemented into the final ERP.

9 REFERENCES

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Paine, J. G., Mathew, S., and Caudle, T., 2011, Long-term Texas gulf shoreline change rates, 1930 to 2007: Bureau of Economic Geology, The University of Texas at Austin, draft report and digital data prepared for the Texas General Land Office.



M. Village of Surfside Beach: Pedestrian Beach Access Point at Driftwood Ct. (IMG_0668.JPG)



N. Village of Surfside Beach: Pedestrian Beach Access Point at Sand Dune Ct. (IMG_0670.JPG)



O. Village of Surfside Beach: Pedestrian Beach Access Point at Coral Ct. (IMG_0672.JPG)



P. Village of Surfside Beach: Pedestrian Beach Access Point at Gulfway Ct. (IMG_0674.JPG)



Q. Village of Surfside Beach: Pedestrian Beach Access Point at Carlton Ave. (IMG_0678.JPG)



R. Village of Surfside Beach: Pedestrian Beach Access Point at Howard Ave. (IMG_0680.JPG)



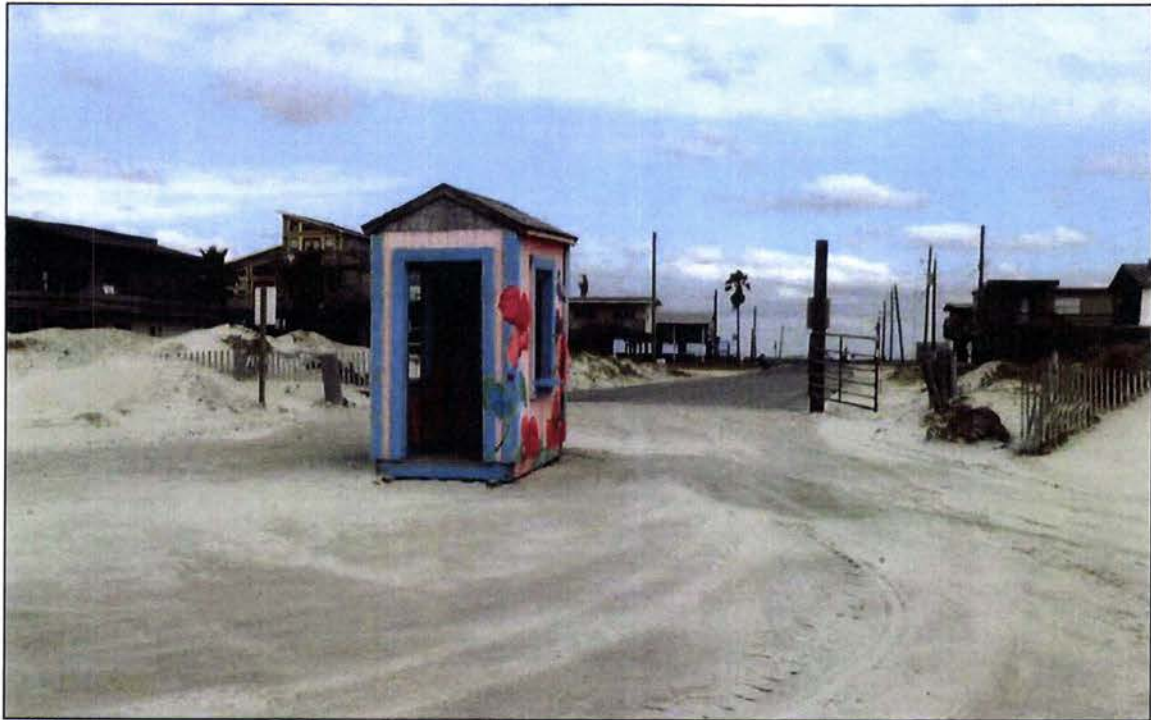
S. Village of Surfside Beach: Pedestrian Beach Access Point at Belanger Ave. (IMG_0682.JPG)



T. Village of Surfside Beach: Pedestrian Beach Access Point at Saltgrass Ave. (IMG_0684.JPG)



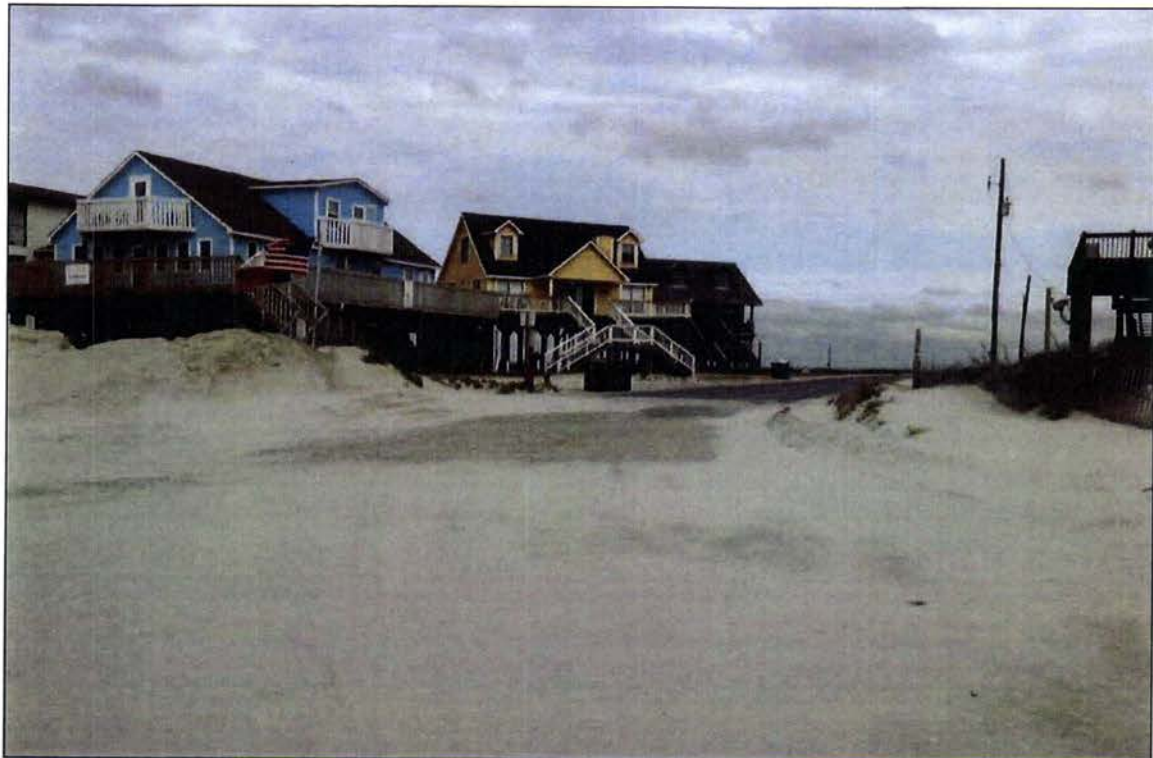
U. Village of Surfside Beach: Pedestrian Beach Access Point at Detenbeck Ave. (IMG_0686.JPG)



V. Village of Surfside Beach: Vehicle Beach Access Point at Yucca Ave. (DSCF0137.JPG)



(W) Village of Surfside Beach: Vehicle Beach Access Point at Sandpiper Ave. (IMG_0688.JPG)



(X) Brazoria County: Vehicle Beach Access – BA Point #1 at Seagull Drive. (DSCF0134.JPG)



Y. Brazoria County: Vehicle Beach Access – BA Point #2 at CR257 side street. (DSCF0132.JPG)



Z. Brazoria County: Vehicle Beach Access – BA Point #3 at 2nd Street/CR257E. (DSCF0128.JPG)



AA. Brazoria County: Vehicle Beach Access – BA Point #4 at Nacal Drive/257K. (DSCF0131.JPG)



BB. Brazoria County: Vehicle Beach Access – BA Point #5 at CR257R. (DSCF0123.JPG)



CC Brazoria County: Vehicle Beach Access – BA Point #6 at Amigo Ln/257S. (DSCN4447.JPG)



DD Pedestrian Beach Access Point. (DSCF0113.JPG)

Appendix D

Site Visit Photographs: Potential Dune Enhancement Areas



① Potential Short-term Dune Enhancement Area. (DSCF0097.JPG)



② Potential Short-term Dune Enhancement Area. (DSCF0099.JPG)



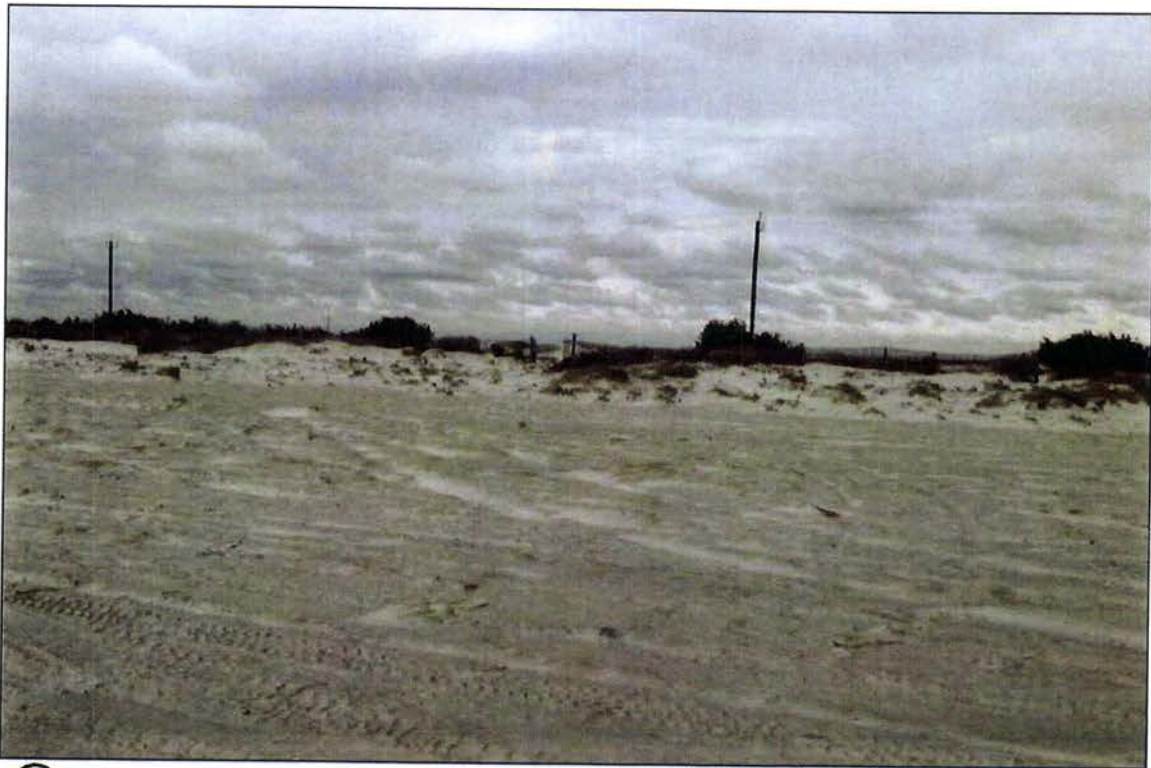
3. Potential Short-term Dune Enhancement Area. (DSCF0104.JPG)



4. Potential Short-term Dune Enhancement Area. (DSCF0109.JPG)



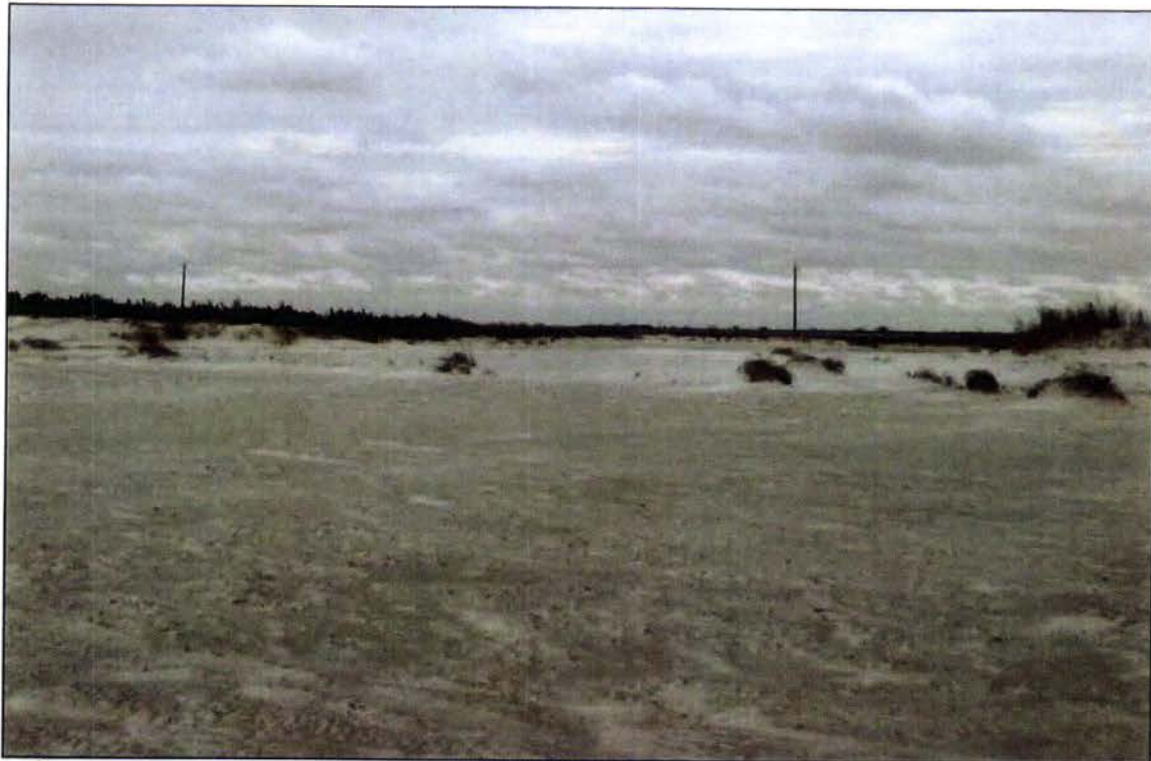
5. Potential Short-term Dune Enhancement Area. (DSCF0079.JPG)



6. Potential Short-term Dune Enhancement Area. (DSCF0122.JPG)



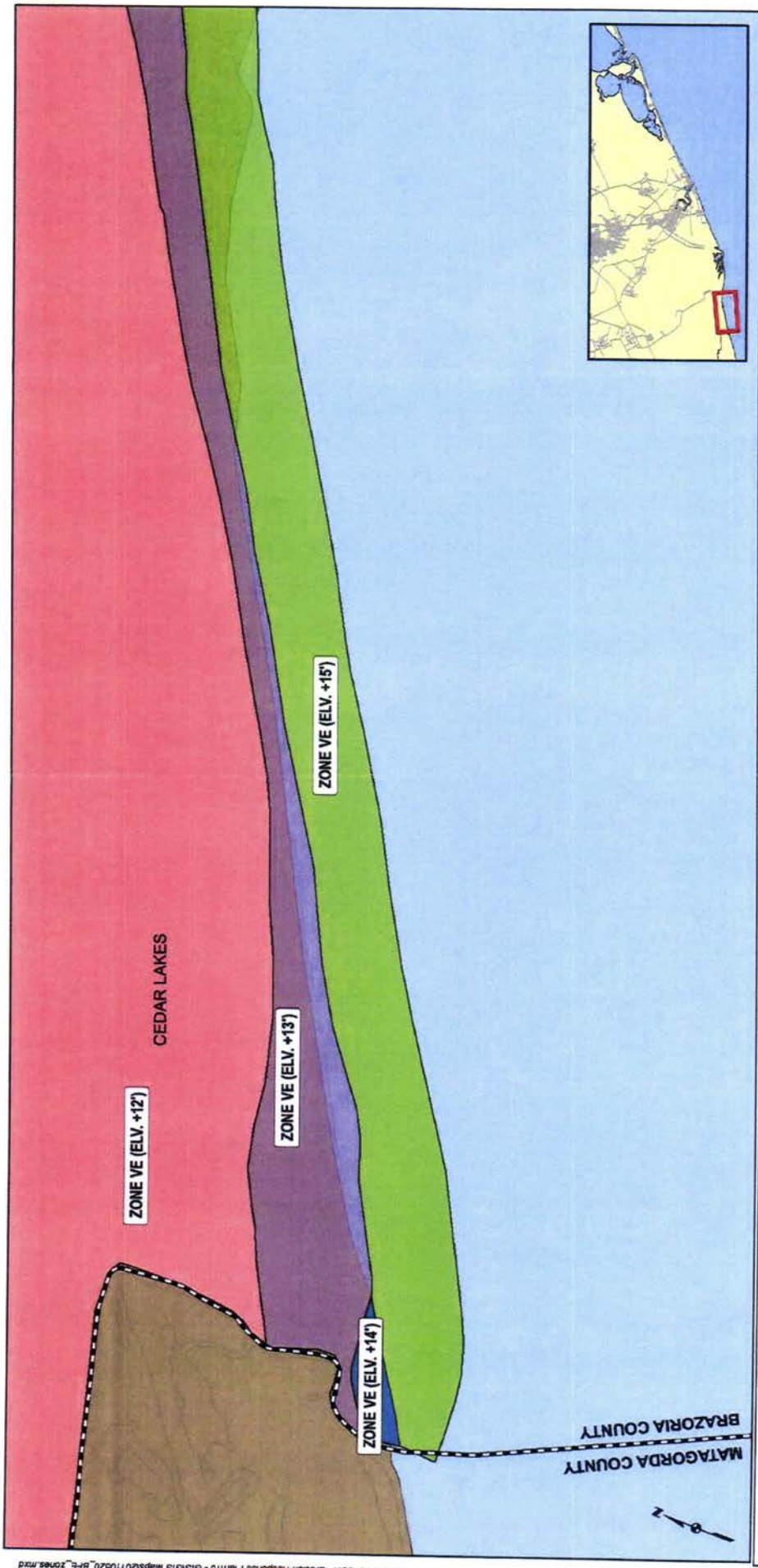
7. Potential Short-term Dune Enhancement Area. (DSCF0121.JPG)



8. Potential Short-term Dune Enhancement Area. (DSCF0117.JPG)

Appendix E

FEMA BFE Zones & Long-Term Critical Dune Typical Sections



Path: W:\0753A - Erosion Response Plan\10 - GIS\GIS Maps\20110520_BFE_zones.mxd

NOTE: BFE Zones Digitized from FEMA Flood Insurance Rate Maps (FIRMS) dated May, 1992. Elevations are Referenced to the National Geodetic Vertical Datum of 1929.



LEGEND

FEMA BFE Zones

[Pink Box]	VE (ELV. +11)
[Purple Box]	VE (ELV. +12)
[Green Box]	VE (ELV. +13)
[Blue Box]	VE (ELV. +14)
[Yellow Box]	VE (ELV. +15)
[Orange Box]	VE (ELV. +16)
[Red Box]	VE (ELV. +17)
[Dark Red Box]	VE (ELV. +18)



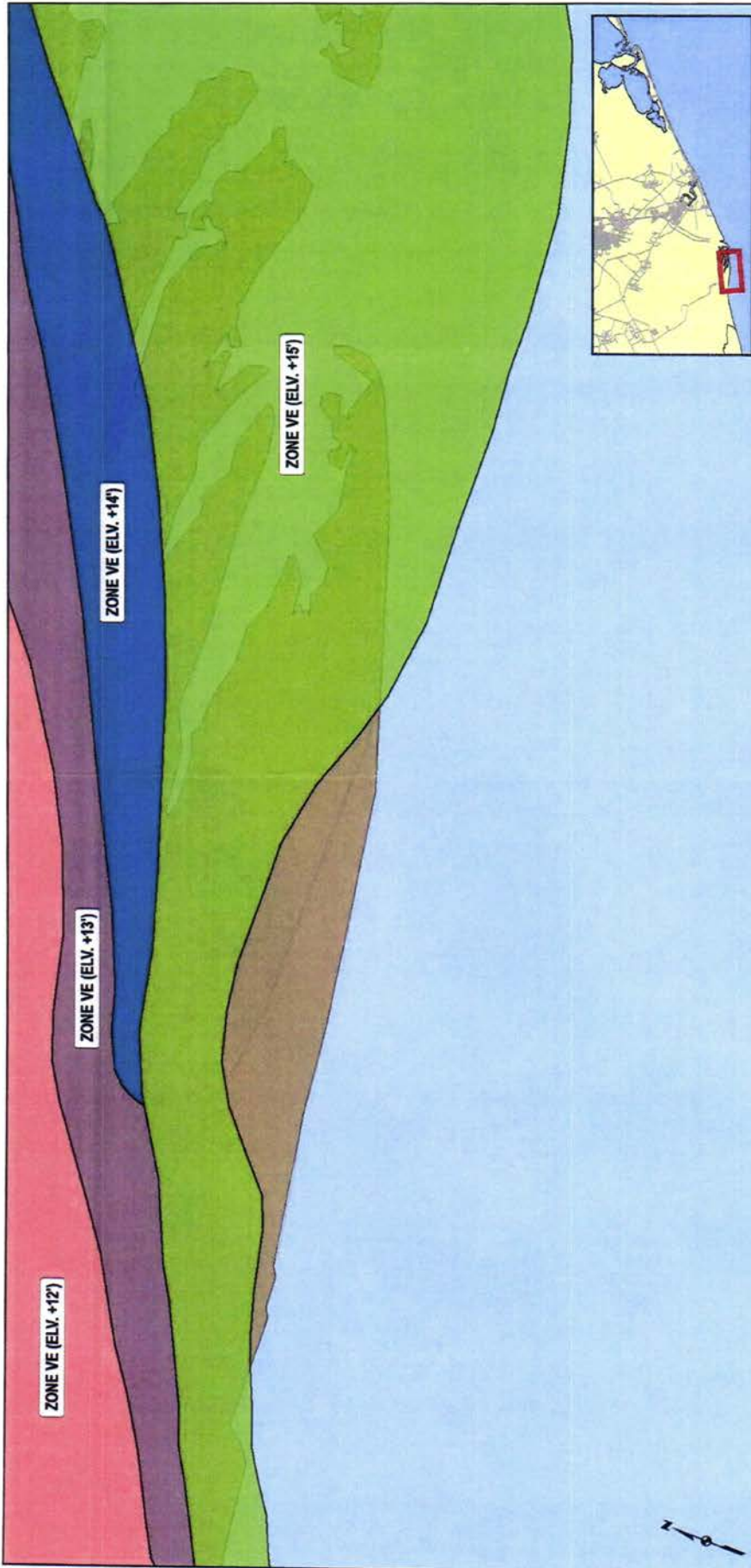
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EROSION RESPONSE PLAN
FEMA BFE Zones**

Date: 5/20/2011 Page 1 of 9



Pgm: W073A - Erosion Response Plan10 - GIS\GIS Maps\20110520_BFE_zones.mxd

NOTE: BFE Zones Digitized from FEMA Flood Insurance Rate Maps (FIRMS) dated May, 1992. Elevations are Referenced to the National Geodetic Vertical Datum of 1929.



LEGEND

FEMA BFE Zones

[Light Blue Box]	VE (ELV. +11')
[Light Green Box]	VE (ELV. +12')
[Light Purple Box]	VE (ELV. +13')
[Light Blue Box]	VE (ELV. +14')
[Light Green Box]	VE (ELV. +15')
[Light Yellow Box]	VE (ELV. +16')
[Light Orange Box]	VE (ELV. +17')
[Light Red Box]	VE (ELV. +18')

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Path: W:\073A - Erosion Response Plan\10 - GIS\GIS Maps\20110220_BFE_zones.mxd

NOTE: BFE Zones Digitized from FEMA Flood Insurance Rate Maps (FIRMS) dated May, 1992. Elevations are Referenced to the National Geodetic Vertical Datum of 1929.



LEGEND
FEMA BFE Zones

[Light Blue Box]	VE (ELV. +11')
[Light Purple Box]	VE (ELV. +12')
[Purple Box]	VE (ELV. +13')
[Blue Box]	VE (ELV. +14')
[Green Box]	VE (ELV. +15')
[Yellow Box]	VE (ELV. +16')
[Orange Box]	VE (ELV. +17')
[Red Box]	VE (ELV. +18')



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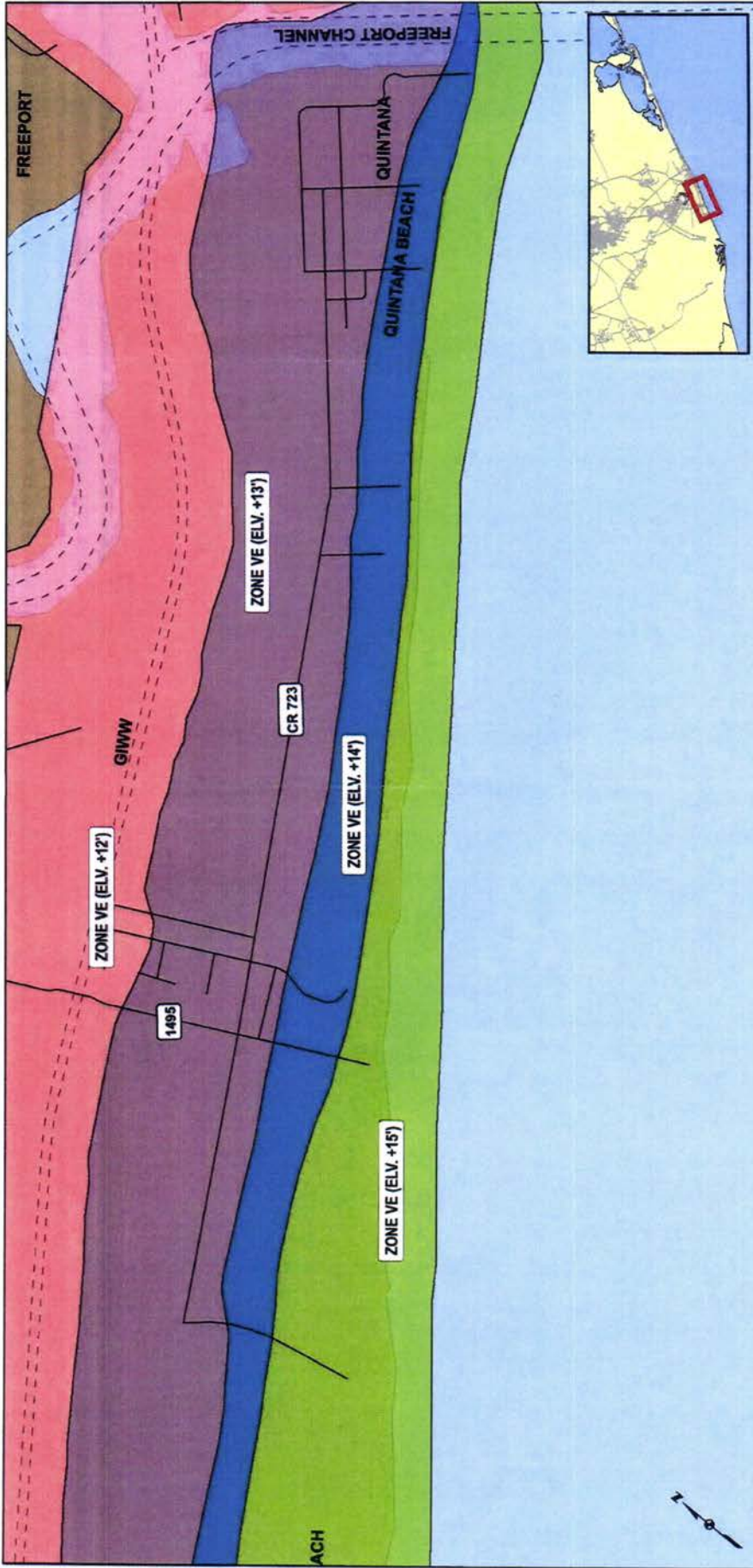


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Path: W:\073A - Erosion Response Plan\10 - GIS\GIS Maps\20110520_BFE_Zones.mxd



NOTE: BFE Zones Digitized from FEMA Flood Insurance Rate Maps (FIRMS) dated May, 1992. Elevations are Referenced to the National Geodetic Vertical Datum of 1929.



LEGEND

FEMA BFE Zones

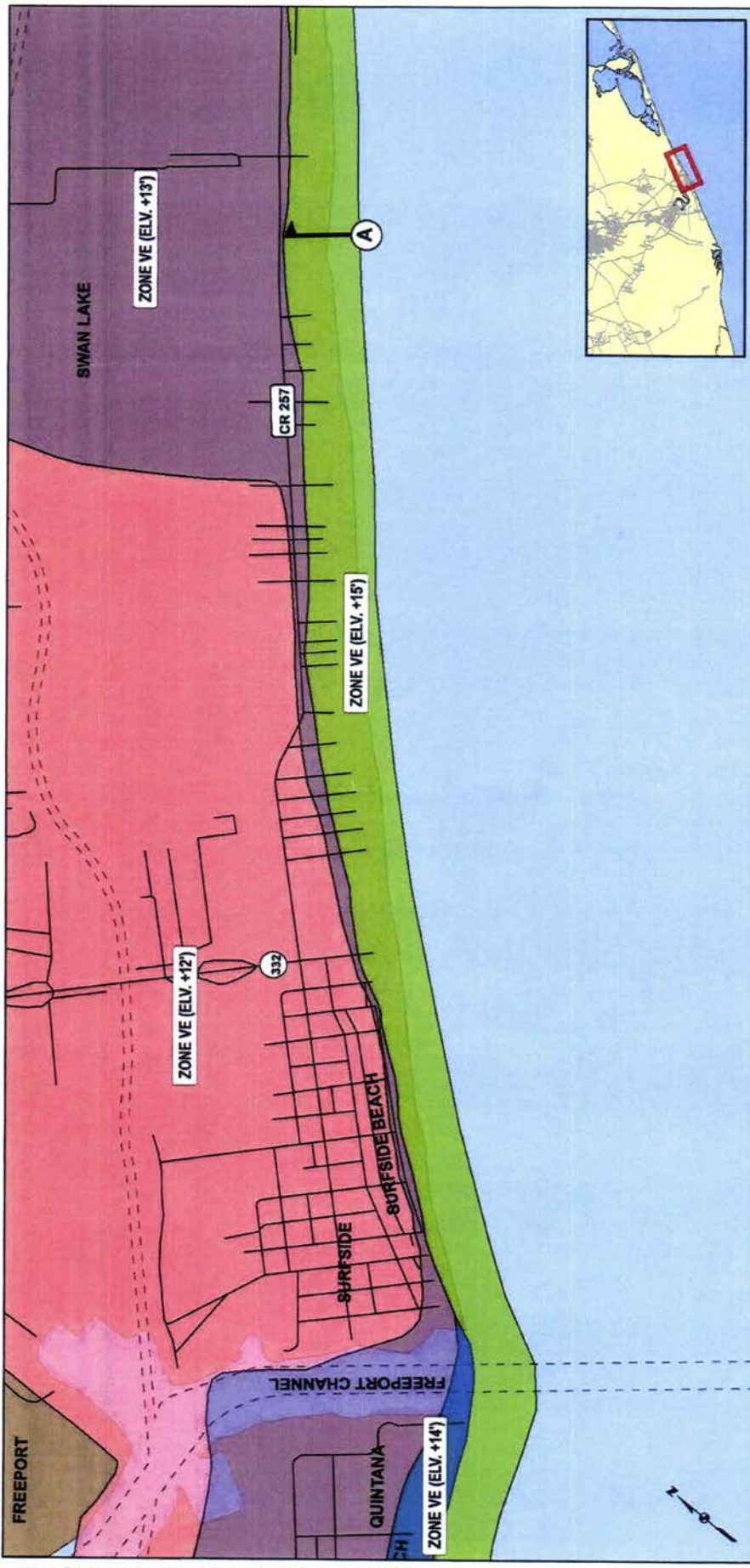
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[Light Green Box]	VE (ELV. +13')
[Light Yellow Box]	VE (ELV. +14')
[Light Orange Box]	VE (ELV. +15')
[Light Red Box]	VE (ELV. +16')
[Red Box]	VE (ELV. +17')
[Dark Red Box]	VE (ELV. +18')



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NOTE: BFE Zones Digitized from FEMA Flood Insurance Rate Maps (FIRMS) dated May, 1992. Elevations are Referenced to the National Geodetic Vertical Datum of 1928.



LEGEND

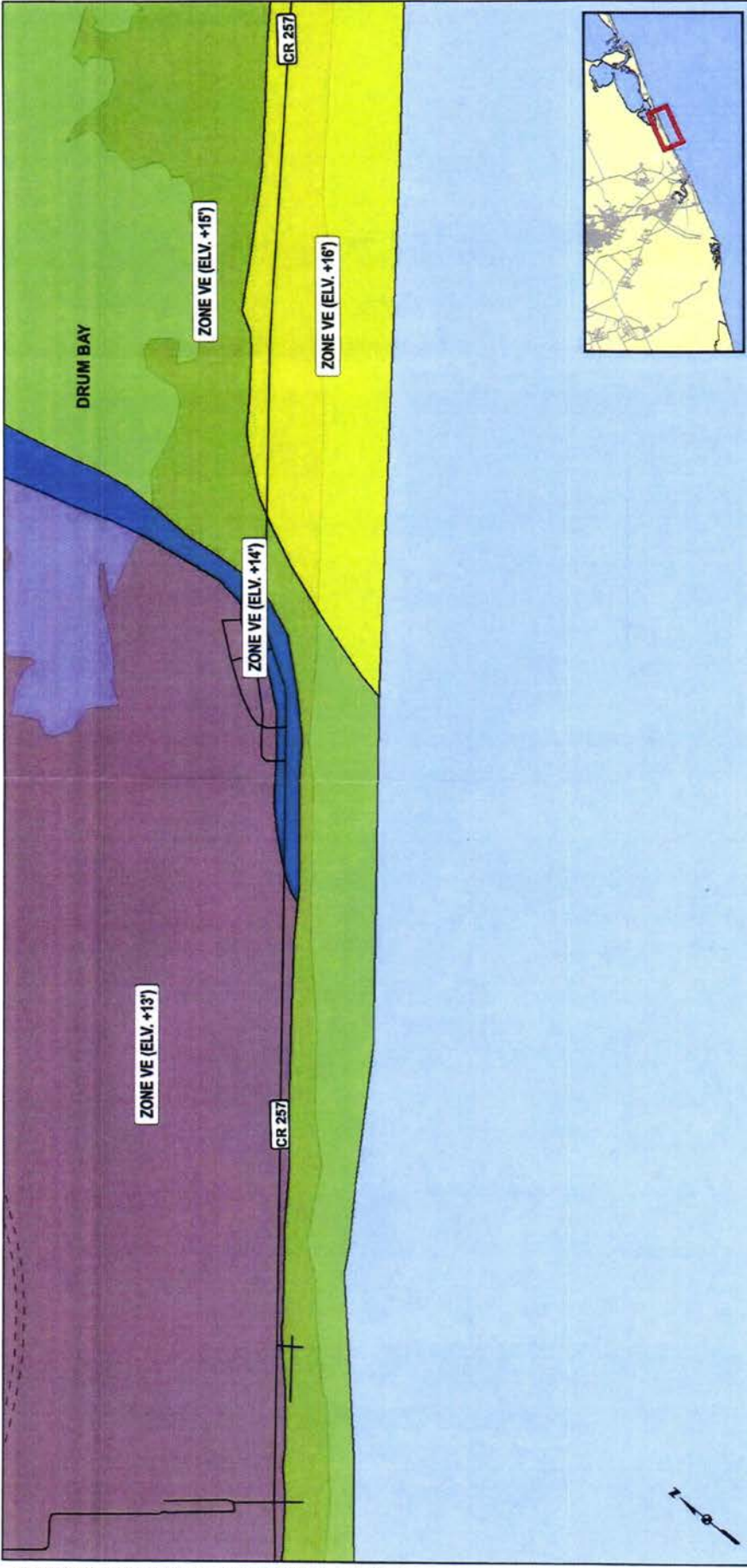
FEMA BFE Zones

[Light Blue Box]	VE (ELV. +11')
[Light Purple Box]	VE (ELV. +12')
[Light Green Box]	VE (ELV. +13')
[Light Yellow Box]	VE (ELV. +14')
[Light Orange Box]	VE (ELV. +15')
[Light Red Box]	VE (ELV. +16')
[Light Brown Box]	VE (ELV. +17')
[Light Grey Box]	VE (ELV. +18')

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FEMA BFE Zones
 Date: 5/20/2011 Page 5 of 9



NOTE: BFE Zones Digitized from FEMA Flood Insurance Rate Maps (FIRMS) dated May, 1992. Elevations are Referenced to the National Geodetic Vertical Datum of 1929.



LEGEND

FEMA BFE Zones

[Light Blue Box]	VE (ELV. +11')
[Light Green Box]	VE (ELV. +12')
[Light Purple Box]	VE (ELV. +13')
[Blue Box]	VE (ELV. +14')
[Green Box]	VE (ELV. +15')
[Yellow Box]	VE (ELV. +16')
[Orange Box]	VE (ELV. +17')
[Red Box]	VE (ELV. +18')

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CHRISTMAS BAY

FOLLETS ISLAND

ZONE VE (ELV. +15')

ZONE VE (ELV. +16')

ZONE VE (ELV. +17')

CR 257

B



LEGEND

FEMA BFE Zones

Light Blue	VE (ELV. +11')
Light Green	VE (ELV. +12')
Light Yellow	VE (ELV. +13')
Yellow	VE (ELV. +14')
Orange	VE (ELV. +15')
Light Orange	VE (ELV. +16')
Orange	VE (ELV. +17')
Dark Orange	VE (ELV. +18')

NOTE: BFE Zones Digitized from FEMA Flood Insurance Rate Maps (FIRMS) dated May, 1992. Elevations are Referenced to the National Geodetic Vertical Datum of 1929.

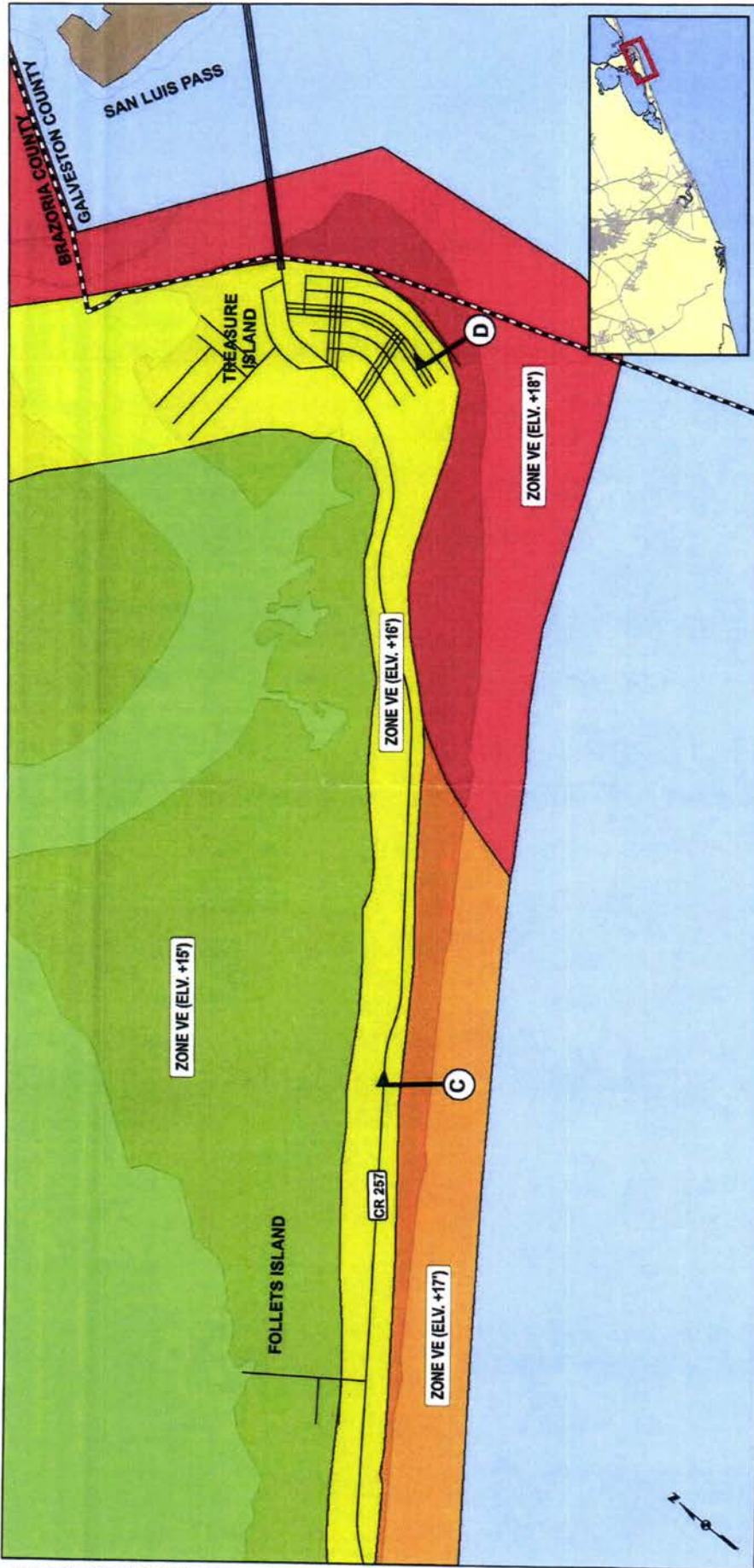


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PIN: W073A - Erosion Response Plan10 - GIS\GIS Maps\20110320_BFE_zones.mxd

NOTE: BFE Zones Digitized from FEMA Flood Insurance Rate Maps (FIRMS) dated May, 1992. Elevations are Referenced to the National Geodetic Vertical Datum of 1929.



LEGEND

FEMA BFE Zones

[Light Blue Box]	VE (ELV. +11')
[Light Green Box]	VE (ELV. +12')
[Light Yellow Box]	VE (ELV. +13')
[Light Orange Box]	VE (ELV. +14')
[Light Red Box]	VE (ELV. +15')
[Yellow Box]	VE (ELV. +16')
[Orange Box]	VE (ELV. +17')
[Red Box]	VE (ELV. +18')



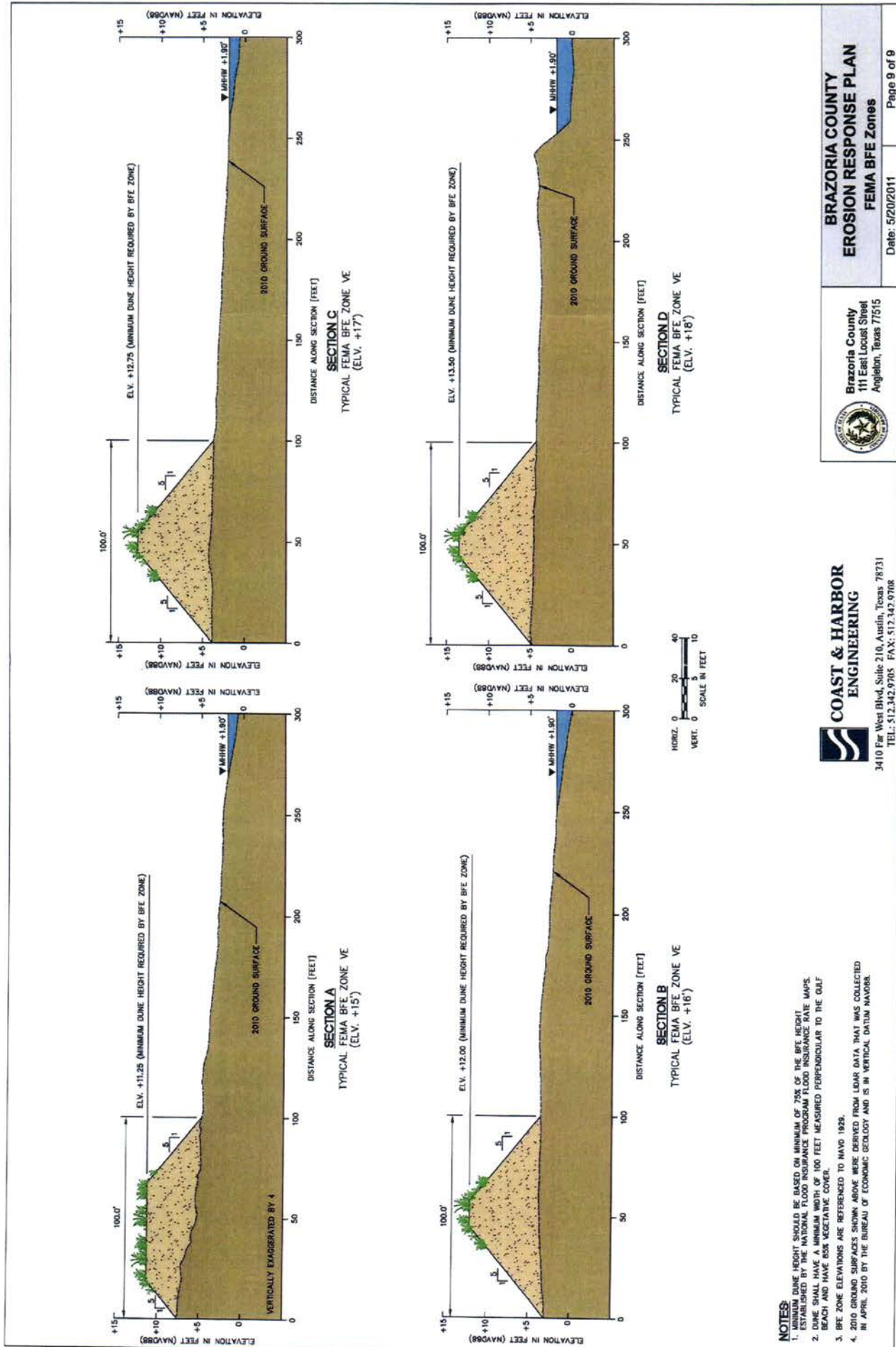
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EROSION RESPONSE PLAN
FEMA BFE Zones**

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NOTES:
 1. MINIMUM DUNE HEIGHT SHOULD BE BASED ON MINIMUM OF 75% OF THE BFE HEIGHT ESTABLISHED BY THE NATIONAL FLOOD INSURANCE PROGRAM FLOOD INSURANCE RATE MAPS.
 2. DUNE SHALL HAVE A MINIMUM WIDTH OF 100 FEET MEASURED PERPENDICULAR TO THE GULF BEACH AND HAVE 65% VEGETATIVE COVER.
 3. BFE ZONE ELEVATIONS ARE REFERENCED TO NAVD 1929.
 4. 2010 GROUND SURFACES SHOWN ABOVE WERE DERIVED FROM LIDAR DATA THAT WAS COLLECTED IN APRIL 2010 BY THE BUREAU OF ECONOMIC GEOLOGY AND IS IN VERTICAL DATUM NAVD83.



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**BRAZORIA COUNTY
EROSION RESPONSE PLAN
FEMA BFE Zones**

Date: 5/20/2011 Page 9 of 9

Appendix F

Meeting List of Attendees



BRAZORIA COUNTY "EROSION RESPONSE PLAN" PUBLIC MEETING

May 23, 2011 Meeting - SIGN IN SHEET

Name	Organization	Email
Gloria Millsap	ON BEHALF OF SENATOR HUFFMAN	
DUDE PARRIS	BRAZORIA Co Comm. Pct 1	cludep@brazoria-county.com
LARRY WURD	self (land owner)	LWURD@AOL.COM
BUDDY ORTEGO	COASTAL RESOURCES BIOLOGISTS	BUDCOBERTIDS@jmail.com
Katharine Winkerson	Capital Resources Prop. LLC	L.VILVINSUR@Yahoo.com
MARK FUQUA	TREASURE ISLAND	M.FUQUA@LASEARPTDISTRICT.COM
JEAN RIGENT	PROPERTY OWNER	JPAVANA5@earthlink.net
Nancy Shene	L.A. - Brazoria County	
Kerry Hamley	B.C. - Floodplain	

VILLAGE OF SURFSIDE BEACH and TOWN OF QUINTANA
EROSION RESPONSE PLAN - Public Meeting - 6:30 pm Stahlman Park - 2211 Bluewater Highway, Surfside

May 24, 2011 Meeting - SIGN IN SHEET

Name	Organization	Email
Gregg D Bissel	RESIDENT SURFSIDE	GIBSSO@AOL.COM
Harold Alaty	111 S. Fable Ave.	
Lee Fandrich	111 S. Fable Ave.	
Leon Contese	162 Center	
Gary Wilson	2503 Compass Ct.	gwilson@dir.lap4less.com
Ruthy Wilson	2503 Compass Ct.	
Johnny Kalle	3550 Deep Sea Dr	
MICHAEL JONES	1500 W. AME STREET	m.jones@freeparting.com
Llewellyn Brooks/Patri	614 Seashell Surfside County Center	
Erminia Minard	115 Santar Loop Surfside	eminard@erfw.net
Dennis Carrell	115 Santar Loop Surfside	eminie1@peoplepc.com
Andrew Meadows	Village of Surfside	andy@surfbidetx.org
Linda Sebesta	307 Seashell	
Ivan Vasquez	Quantum Table Shop	

VILLAGE OF SURFSIDE BEACH and TOWN OF QUINTANA
EROSION RESPONSE PLAN – Public Meeting – 6:30 pm Stahlman Park – 2211 Bluewater Highway, Surfside

May 24, 2011 Meeting – SIGN IN SHEET

Name	Organization	Email
LARRY DAVISON	Surfside city	
Chris Jeanrott	Surfside C.F.C.	
Jane-Jude Martin	Quintana 910 Dewey St.	martinjim48@yahoo.com
Dorothy Pekar	Surfside	dorothy@pekar.net
Henry Pekar	Surfside	Henry@pekar.net
Amanda Wilson	Surfside	mountfiddle.demon.co.uk
Harry Bland	Quintana	Harryobland@aol.com
Dorothy Bland	Surfside	
Bob Petty	Surfside	BobPetty@aol.com
JEFF MOHR	QUINTANA	JEFFMOHR57@GMAIL.COM
Bruce Jeanrott	Surfside Beach	Surfsidebeach@yahoo.com
Kelly Family	BC - Floodplain	

Appendix A

Brazoria County Base Maps



LEGEND

- BEG Erosion Rates [FT/YR] Released 04/2011
 - -15' to -20'
 - -10' to -15'
 - -5' to -10'
 - 0 to -5'
 - 0 to +5'
 - +5' to +10'
 - +10' +
- Set-Back Line / Dune Protection Line
- MHHW [Elev.+1.50FT NAVD88]
- Approximate Line of Vegetation [2010]
- Brazoria County Line

Coordinate System: NAD 1983 UTM Zone 16N
 Aerial Photography Shown was acquired on 5/3/2010 by the National Agriculture Imagery Program (NAIP)



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Brazoria County Erosion Response Plan

Date: 6/2/2011 Page 1 of 8



LEGEND

BEG Erosion Rates [FT/YR] Released 04/2011

- -15' to -20'
- -10' to -15'
- -5' to -10'
- 0 to -5'
- 0 to +5'
- +5' to +10'
- +10' +

— Salt-Back Line / Dune Protection Line

— MHHW [Elev.+1.50FT NAVD89]

— Approximate Line of Vegetation [2010]

▭ Brazoria County Line

Coordinate System: NAD 1983 UTM Zone 18N
 Aerial Photography Shown was acquired on 8/2010 by the National Agriculture Imagery Program (NAIP)


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LEGEND

BEG Erosion Rates [F\YR] Released 04/2011

- -15' to -20'
- -10' to -15'
- -5' to -10'
- 0 to -5'
- 0 to +5'
- +5' to +10'
- +10' +

- Set-Back Line / Dune Protection Line
- MHHW [Elev. +1.90FT NAVD83]
- Approximate Line of Vegetation [2010]
- Brazos County Line

Coordinate System: NAD 1983 UTM Zone 18N
 Aerial Photography Shown was acquired on 8/3/2010 by the National Agriculture Imagery Program (NAIP)

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Brazos County Erosion Response Plan

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Date: 6/2/2011

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LEGEND

- BEG Erosion Rates [FT/YR] Released 04/2011
 - -15' to 20'
 - -10' to -15'
 - -5' to -10'
 - 0 to -5'
 - 0 to +5'
 - +5' to +10'
 - +10' +
- Set-Back Line / Dune Protection Line
- MHHW [Elev.+1.90FT NAVD83]
- Approximate Line of Vegetation [2010]
- Brazoria County Line

Coordinate System: NAD 1983 UTM Zone 15N
 Aerial Photography Shown was acquired on 8/3/2010 by the National Agriculture Imagery Program (NAIP)

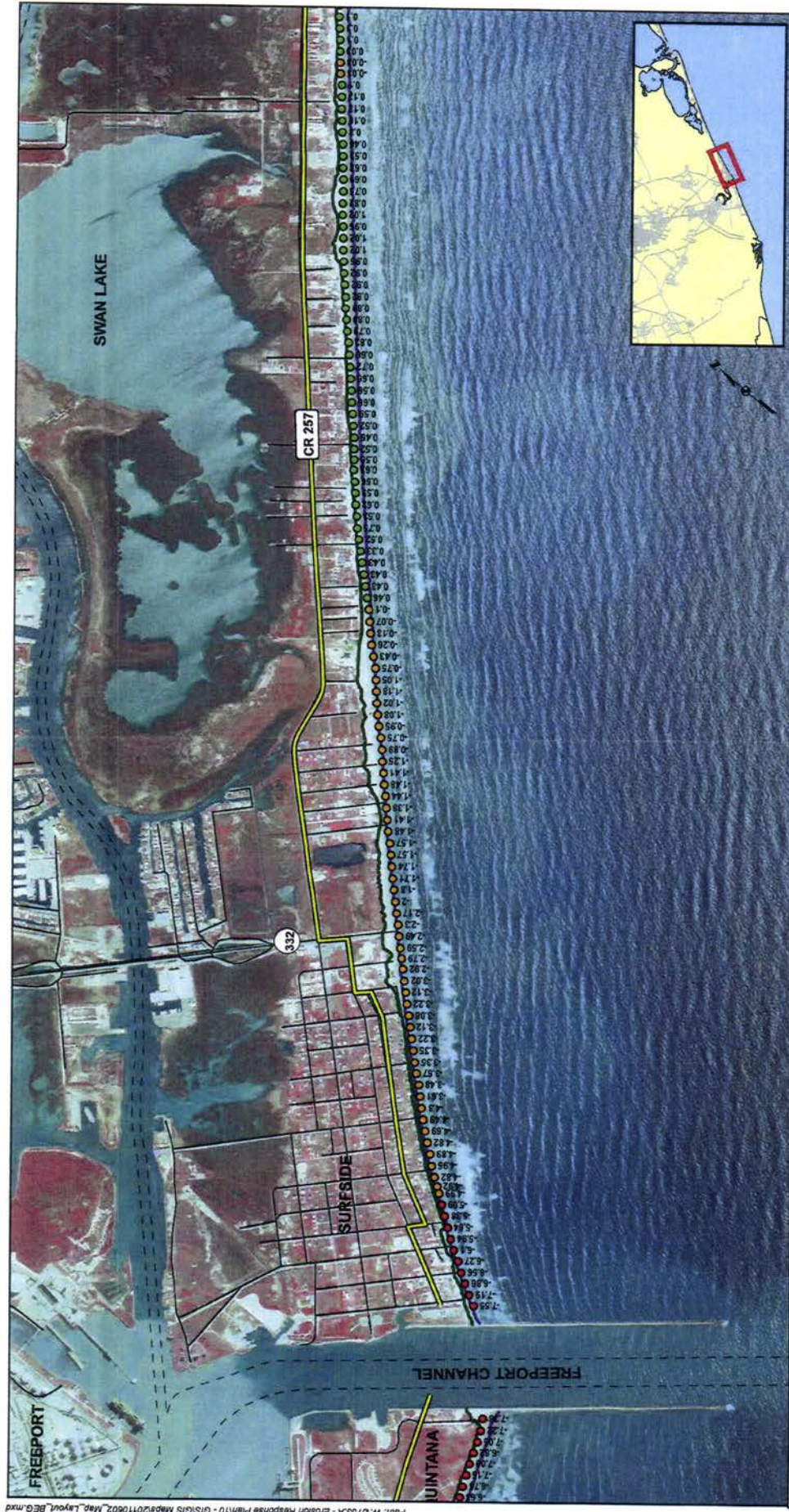


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 Date: 6/2/2011
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LEGEND

- REG Erosion Rates [FT/YR] Released 04/2011
 - 15 to -20'
 - 10 to -15'
 - 5 to -10'
 - 0 to -5'
 - 0 to +5'
 - +5 to +10'
 - +10' +
- Set-Back Line / Dune Protection Line
- MHHW [Elev. +1.90FT NAVD88]
- Approximate Line of Vegetation [2010]
- Brazoria County Line

Coordinate System: NAD 1983 UTM Zone 18N
 Aerial Photography Shown was acquired on 8/3/2010 by National Agriculture Imagery Program (NAIP)



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LEGEND

- BEG Erosion Rates [FT/YR] Released 04/2011
- 15' to -20'
- 10' to -15'
- 5' to -10'
- 0 to -5'
- 0 to +5'
- +5' to +10'
- +10' +

- Set-Back Line / Dune Protection Line
- MHHW [Elev. +1.90FT NAVD83]
- Approximate Line of Vegetation [2010]
- Brazoria County Line

Coordinate System: NAD 1983 UTM Zone 18N
 Aerial Photography Shown was acquired on 8/3/2010 by the National Agriculture Imagery Program (NAIP)



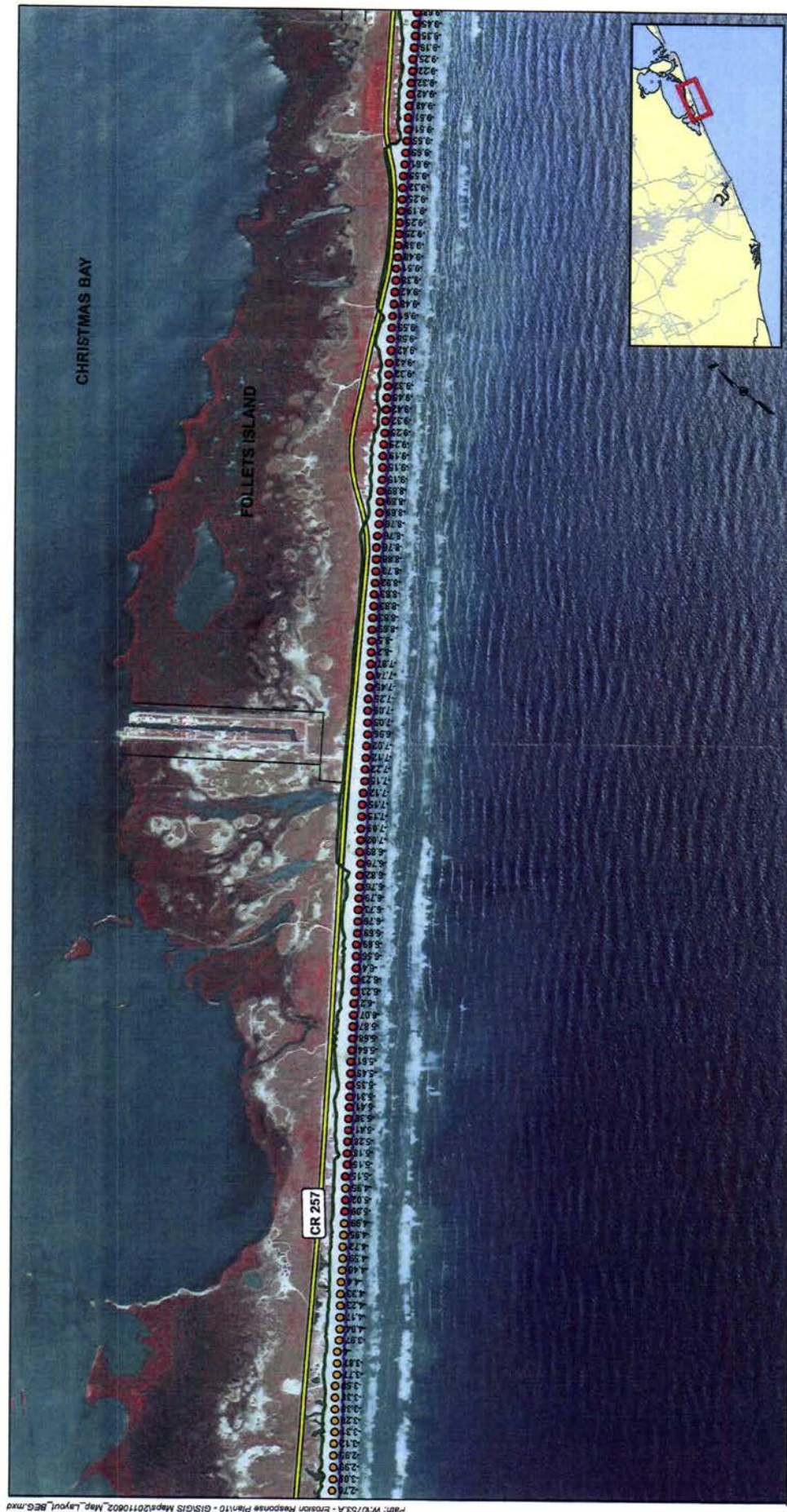
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LEGEND

BEG Erosion Rates [FT/YR] Released 04/2011

- -15' to -20'
- -10' to -15'
- -5' to -10'
- 0 to -5'
- 0 to +5'
- +5' to +10'
- +10' +

— Set-Back Line / Dune Protection Line

— MHHW [Elev: +1.90FT NAVD83]

— Approximate Line of Vegetation [2010]

▭ Brazoria County Line


Coordinate System: NAD 1983 UTM Zone 18N

Aerial Photography Shown was acquired on 03/2010 by the National Agriculture Imagery Program (NAIP)



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LEGEND

BEG Erosion Rates [FTYR] Released 04/2011

- -15' to -20'
- -10' to -15'
- -5' to -10'
- 0 to -5'
- 0 to +5'
- +5' to +10'
- +10' +

- Set-Back Line / Dune Protection Line
- MHHW (Elev.+1.30FT NAVD83)
- Approximate Line of Vegetation [2010]
- Brazoria County Line

Coordinate System: NAD 1983 UTM Zone 15N
 Aerial Photography Shown was acquired on 5/9/2010 by the National Agriculture Imagery Program (NAIP)

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Appendix B

Beach Access, Dune Enhancements, & Site Visit Photo Locations



LEGEND

- May 3, 2011 Site Photographs:
- Pedestrian Beach Access Points
 - Vehicular Beach Access Points
 - Potential Dune Enhancement Locations
 - Potential Short-Term Dune Enhancements
 - High Priority
 - Medium Priority
 - Low Priority

Site Visit Photographs were taken on May 3, 2011 and shown in Appendix C and D.
 Aerial Photography Shown was acquired on 5/3/2010 by the National Agriculture Imagery Program (NAIP)



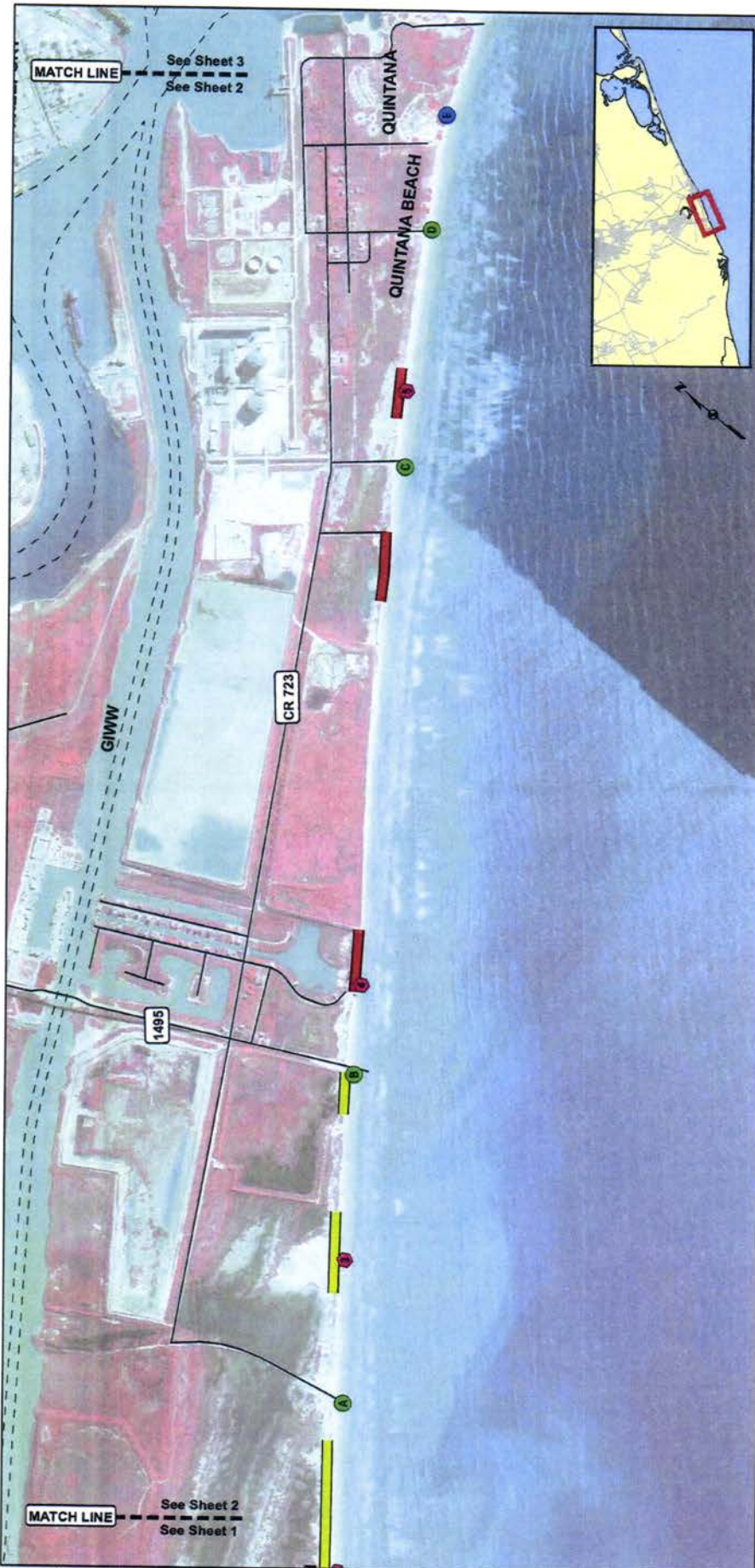
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**BRAZORIA COUNTY
EROSION RESPONSE PLAN**
 Beach Access & Dune Enhancement Areas

Date: 6/9/2011 Page 1 of 6



Part: W:\0763A - Erosion Response Plan\10 - GIS\GIS Maps\2011\0602_DuneArea_SitePhotos_Legs.mxd

LEGEND

May 3, 2011 Site Photographs:

- Pedestrian Beach Access Points
- Vehicular Beach Access Points
- Potential Dune Enhancement Locations
- Potential Short-Term Dune Enhancements
- High Priority
- Medium Priority
- Low Priority

Site Visit Photographs were taken on May 3, 2011 and shown in Appendix C and D.
 Aerial Photography Shown was acquired on 5/3/2010 by the National Agriculture Imagery Program (NAIP)



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**BRAZORIA COUNTY
EROSION RESPONSE PLAN**
 Beach Access & Dune Enhancement Areas

Date: 6/9/2011 Page 2 of 6



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LEGEND

May 3, 2011 Site Photographs:

- Pedestrian Beach Access Points
- Vehicular Beach Access Points
- Potential Dune Enhancement Locations

Potential Short-Term Dune Enhancements

- High Priority
- Medium Priority
- Low Priority

Site Visit Photographs were taken on May 3, 2011 and shown in Appendix C and D.
 Aerial Photography Shown was acquired on 5/3/2010 by the National Agriculture Imagery Program (NAIP)



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 Beach Access & Dune Enhancement Areas

Brazoria County
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Date: 6/9/2011 Page 3 of 6



LEGEND

May 3, 2011 Site Photographs:

- Pedestrian Beach Access Points
- Vehicular Beach Access Points
- Potential Dune Enhancement Locations
- Potential Short-Term Dune Enhancements
- High Priority
- Medium Priority
- Low Priority

Site Visit Photographs were taken on May 3, 2011 and shown in Appendix C and D.
 Aerial Photography Shown was acquired on 5/3/2010 by the National Agriculture Imagery Program (NAIP)

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 EROSION RESPONSE PLAN**
 Beach Access & Dune Enhancement Areas
 Date: 6/9/2011 Page 4 of 6



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LEGEND

May 3, 2011 Site Photographs:

- Pedestrian Beach Access Points
- Vehicular Beach Access Points
- Potential Dune Enhancement Locations
- Potential Short-Term Dune Enhancements
- High Priority
- Medium Priority
- Low Priority

Site Veil Photographs were taken on May 3, 2011 and shown in Appendix C and D.
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EROSION RESPONSE PLAN**
 Beach Access & Dune Enhancement Areas

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LEGEND

May 3, 2011 Site Photographs:

- Pedestrian Beach Access Points
- Vehicular Beach Access Points
- Potential Dune Enhancement Locations
- Potential Short-Term Dune Enhancements
- High Priority
- Medium Priority
- Low Priority

Site Visit Photographs were taken on May 3, 2011 and shown in Appendix C and D.
 Aerial Photography Shown was acquired on 5/3/2010 by the National Agriculture Imagery Program (NAIP)



**COAST & HARBOR
ENGINEERING**
 3410 Far West Blvd, Suite 210, Austin, Texas 78731
 TEL: 512.342.9705 FAX: 512.342.9708

Brazoria County
 111 East Locust Street
 Angleton, Texas 77515

**BRAZORIA COUNTY
EROSION RESPONSE PLAN**
 Beach Access & Dune Enhancement Areas
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Appendix C

Site Visit Photographs: Beach Access Areas



(A.) City of Freeport: Vehicle Beach Access Point at CR 241. *(DSCF0107.JPG)*



(B.) City of Freeport: Vehicle Beach Access Point at CR 750. *(DSCF0107.JPG)*



(C) Town of Quintana: Vehicle Beach Access Point at 16th Street. (DSCF0110.JPG)



(D) Town of Quintana: Vehicle Beach Access Point at 8th Street. (DSCF0087.JPG)



(E.) Town of Quintana: Pedestrian Beach Access Point. *(DSCF0089.JPG)*



(F.) Village of Surfside Beach: Vehicle Beach Access Point at Jettyview Road. *(DSCF0158.JPG)*



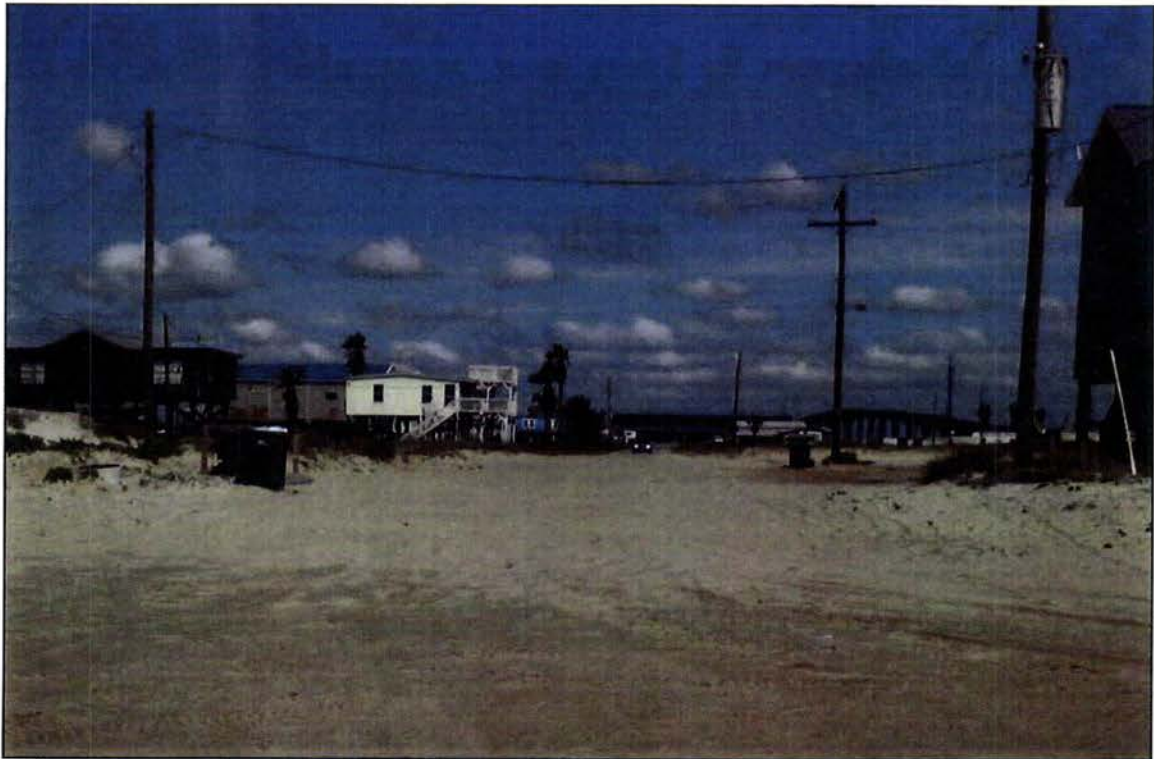
G. Village of Surfside Beach: Pedestrian Beach Access Point at Texas Street. *(DSCF0161.JPG)*



H. Village of Surfside Beach: Pedestrian Beach Access Point at Beach Drive.



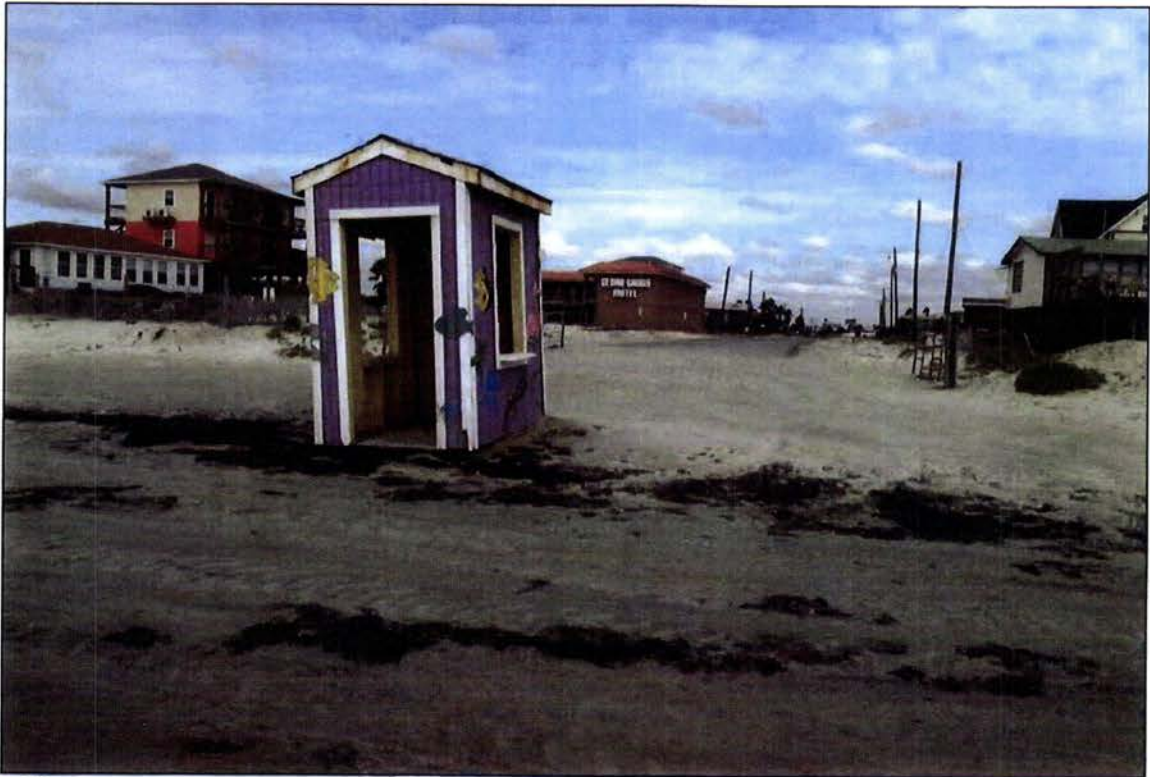
I. Village of Surfside Beach: Pedestrian Beach Access Point at Oyster Street. *(DSCF0142.JPG)*



J. Village of Surfside Beach: Vehicle Beach Access Point at Hwy 332. *(DSCF0141.JPG)*



(K.) Village of Surfside Beach: Pedestrian Beach Access Point at Francis Cove. (IMG_0664.JPG)



(L.) Village of Surfside Beach: Vehicle Beach Access Point at Ocean Ave. (DSCF0138.JPG)