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Fairhope Beach Management Plan

Recommendations for a Beach Management Plan for Fairhope's Two Main Beaches

September 30, 2016

Funding for this project provided by the Alabama Department of Conservation and Natural Resources, State Lands Division, Coastal Section, in part by a grant from the National Oceanic and Atmospheric Administration, Office of Ocean and Coastal Resource Management, Award #15NOS4190159.

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EXECUTIVE SUMMARY

A beach management plan has been developed that is based on sound coastal science and engineering and provides recommendations for restoring and maintaining Fairhope's two most popular sandy, bayshore beaches. These beaches are frequented recreationally by visitors and residents alike, and they provide valuable habitat to wildlife and storm protection to City infrastructure. This beach management plan focuses on the areas known as:

- Magnolia Beach Park (the sandy beach south of the public boat ramp extending past Trinity Presbyterian Church to the American Legion property beach), and
- North Beach Park (the sandy beach park north of the City pier extending to the end of the road around the duck pond)

Erosion of the City's beaches has been an ongoing concern for some time. In the past 10-15 years, beach erosion has threatened some of the City's infrastructure at the north end of Magnolia Beach Park and the City has been doing periodic, as-needed, beach nourishments in lieu of building a bulkhead to maintain that beach. Beach nourishment is the direct placement of beach quality sand on the beach to widen the beach. This report provides some original analysis/evaluation of the beach erosion issues as well as some future management recommendations.

Geologically, these bayshore beaches have historically been fed by sands eroded from bay bluffs in hurricanes and sands washed down the gullies in major rainfall events. Long-term background erosion of the area bay beaches has been primarily caused by slow sea level rise and has been occurring for centuries (e.g. the Ecor Rouge named by French mariners). The historic rate of erosion of bay bluffs and sand from the gullies has probably been reduced significantly in the past several decades by erosion prevention efforts along the shore and in the gullies. Seasonal shifts in shoreline position are apparent and combine with the long-term background erosion.

The City has restored the sand beach at the north end of Magnolia Beach Park with small beach nourishment projects on five occasions since 2004. In 2005, a timber headland structure was constructed there along with some sand placement. That structure and those nourishments have succeeded in better retaining the beach sand and width there. The beach west of the bathrooms/lift-station at the north end of Magnolia Beach Park was roughly 75 feet wider when this report was written (August 2016) than in 2004 when the City began its occasional nourishment projects. These coastal engineering efforts (the five nourishments and the structure) have essentially saved the roots of the old live oak tree near the boat ramp from erosion and have successfully protected the bathrooms/lift-station. However, the beach and bluff erosion in this area has become more problematic in the past several years and so a modified approach is recommended now.

Public outreach as part of this beach management plan development included two public meetings to discuss these issues and solicit feedback from the citizens of Fairhope. The primary feedback obtained at the first public meeting (March 24, 2016) was a strong public preference for sandy beaches instead of bulkhead walls. The public feedback encouraged the City to develop sandy beach solutions that incorporated some sand retention structures as needed to more permanently stabilize the beaches. That input was incorporated in the recommendations below.

Analysis of the wave and longshore sand transport climate in this report shows that the net movement of sand in this area is to the south but there are periods of reversal. The most important implication of this is that the sand nourishment placed at the north end of Magnolia Beach Park has just moved south to the public beaches toward the Presbyterian Church. Thus, the nourishment sand is still in the beach system of Magnolia Beach Park. The results of the wave and longshore sand transport climate analysis also are consistent with the seasonal (winter/summer) shifts in beach width found on these beaches. In response to more common waves from the north and northwest in the winter months, the beaches narrow (erode) significantly at the north end of both Magnolia Beach Park and North Beach Park at the same time they widen at the south end of those areas (e.g. the American Legion Beach). However, in the spring and summer months, in response to waves primarily from the southwest, the beaches widen at the north end of both Magnolia Beach Park and North Beach Park while narrowing at the south ends.

Beach profiles were established and surveyed as part of the development of this beach management plan. A total of 37 beach profiles were established at roughly 150 foot spacings at North Beach Park and Magnolia Beach Park. The primary purpose is to monitor future beach changes. The profile surveys provide quantitative documentation of the full beach and bluff conditions, including beach width. The profile surveys are used to make recommendations concerning minimum, target, beach width templates and vegetation plans in this report. Also, these profiles can, if they are maintained by some level of periodic resurveying, provide documentation of erosion after major future hurricanes.

Based on the analysis contained in this report, several recommendations are suggested for the future management of these two beaches:

- Pursuit of a shoreline stabilization project at the north end of Magnolia Beach Park that includes an offshore segmented breakwater system in conjunction with a major beach nourishment project. The purpose is to more permanently stabilize that highly visible sandy beach shoreline while providing better infrastructure protection.
- Continued monitoring of North Beach Park because that beach is beginning to experience some erosion problems (particularly at north end).
- Adoption of internal, target (minimum) beach design templates along both beaches for planning purposes. The purpose is to inform the City's decisions with regard to beach nourishment and could aid in qualifying for emergency assistance after major hurricanes.

- Vegetation plantings at the appropriate locations, essentially above +4 to +5 feet (MLLW) and in conjunction with the minimum beach template to emulate some of the existing areas, will reduce wind-blown sand issues. Species which are extremely salt-tolerant, e.g. sea oats, are probably not required above those elevations along the bay.
- Adoption of a formal periodic beach profile monitoring program which incorporates the profile locations surveyed this year. The purpose is to quantify the valuable beach sand resource better including quantifying beach losses after hurricanes.

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Acknowledgements

South Coast Engineers has developed this recommended beach management plan under contract with the City of Fairhope, Alabama. Partial funding for this project was provided by the Alabama Department of Conservation and Natural Resources, State Lands Division, Coastal Section, in part by a grant from the National Oceanic and Atmospheric Administration, Office of Ocean and Coastal Resource Management, Award #15NOS4190159.

The development of this plan incorporated input from the municipality and the residents of the City of Fairhope, Alabama, including, particularly, Public Works Director Jennifer Fidler. Mayor Timothy M. Kant and the Fairhope City Council are acknowledged for their vision and foresight to support the development of this beach management plan for the future enjoyment of the beaches by the public.

This beach management plan report solely represents the technical opinions and recommendations of South Coast Engineers. The authors of this report are Thomas "Beau" Buhring; Scott L. Douglass, PhD, PE, DCE; and Bret M. Webb, PhD, PE, DCE.

Introduction

Purpose of the Report

The purpose of this report is to develop recommendations for consideration by the City of Fairhope for the management of its beaches to prevent erosion, establish restoration measures, reduce storm damage, and protect and enhance vegetation. The beaches considered in this management plan are the two longest City owned beaches on Mobile Bay: Magnolia Beach Park, located along half a mile of shoreline south of the Pier Street boat launch, and North Beach Park, located along half a mile of coastline just north of the Fairhope Municipal Pier (Figure 1).

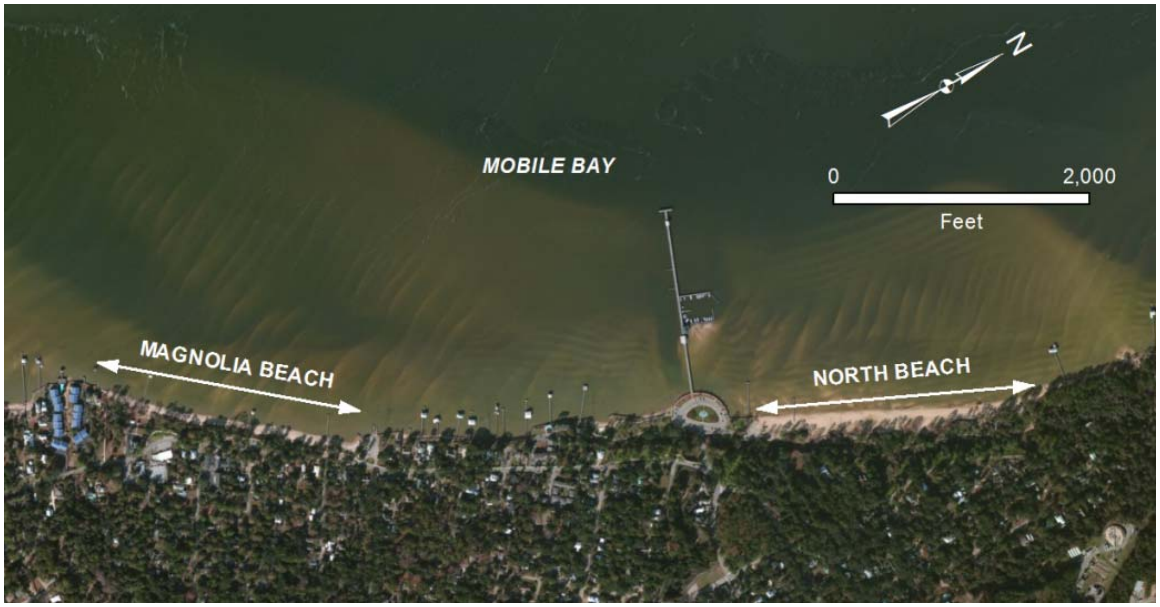

Figure 1: Magnolia Beach Park and North Beach Park location map.

Geological Framework and Beach Erosion Issues

Erosion is a natural process on the Eastern Shore of Mobile Bay, and the bay shoreline has probably been eroding in Fairhope for centuries. It is likely that the erosion has been reduced along the eastern shore by the construction of bulkheads in the past century. Historically, the presence of the "Ecor Rouge" area, so named three centuries ago for the red cliffs of Montrose, indicates that erosion is a long-term process. Farther south, the cape-like shape of Point Clear indicates that the area may have been formed, in part, by sand moving along the coast which eroded from the bluffs of Fairhope to the north. In the past century, mean sea level has slowly risen about 9 to 12 inches along the northern Gulf Coast including Mobile Bay. The high tides are about 9 to 12 inches higher than they were a century ago and the low tides are about 9 to 12 inches higher. The result is that most of the Eastern Shore is erosional geologically.

The primary natural source of sand for the beaches of the Fairhope is sand from erosion of the bluffs and the sand that flows out of the creek mouths during major rainfall events. This process continues today, where deposits of sand appear after significant storms at the mouths of the gullies and are spread by wave action along the beaches. Figure 2 shows a 1938 aerial photograph of this portion of the Fairhope coast which indicates that each of the creeks and gullies in the City was providing sand to the beaches.

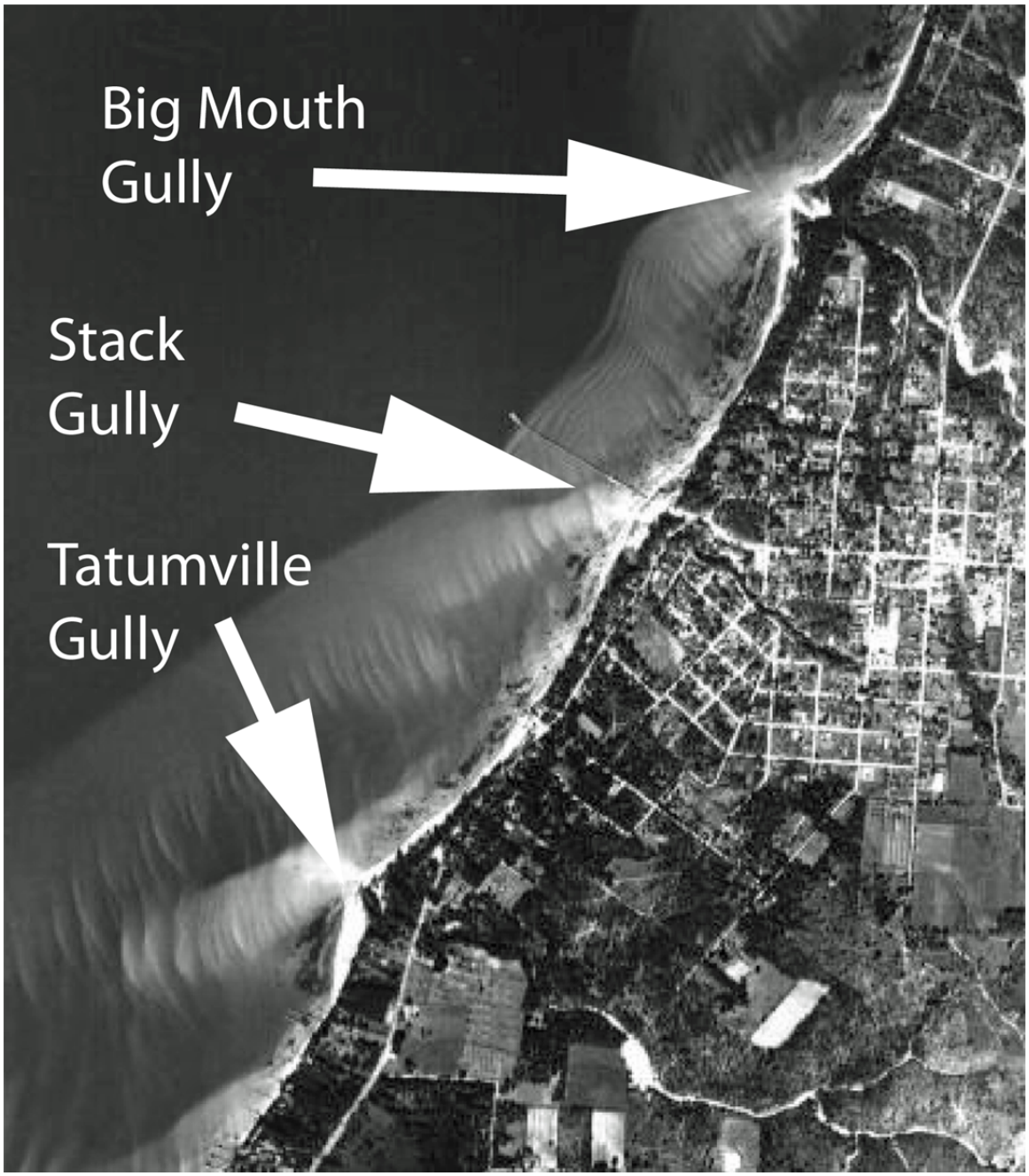

Figure 2: Aerial imagery of Fairhope's beaches (1938) showing major gullies entering Mobile Bay.

Both of these sources of beach sand, bluff erosion and gully/creek erosion, have likely been reduced due to man's recent development. The shorelines along most of the eroding bluffs have been stabilized with bulkheads to prevent erosion and land loss. The banks of many of the area creeks/drainages have also been stabilized to prevent land loss and reduce non-point source pollution. As Fairhope developed in the first half of the 1900's, it is likely that humans significantly increased the amount of sand on our beaches by inadvertently increasing the runoff down the un-vegetated gullies. In the past several decades though, humans have probably reduced the sand supply to the beaches with modern stormwater runoff regulations and by slowing bluff erosion with bulkheads.

In addition to the loss of sand sources, sand is also likely being moved around and off of Fairhope's beaches by other natural processes. Many of the day-to-day and month-to-month changes on these beaches are fairly well explained by wave driven longshore sand transport. When winds come from the south or southwest, breaking waves drive sand along the beach to the north. When winds come from the north or northwest however, breaking waves drive sand along the beach to the south. Sand is also transported cross-shore (or offshore) into sand bar formations. These bars sometimes migrate back onshore and off again, but long-term movement is likely to be offshore in response to storms and sea level rise. The exact movements of these bars and their causes have not been widely studied.

Description of Beach Management Concerns

The primary concerns for Fairhope's beaches are in dealing with the movement of sand. As described previously, these beaches are naturally erosional, and the erosion is particularly prominent at the north end of Magnolia Beach Park, near the Pier Street boat launch. This location has been of particular interest to the City for many years, as the erosion threatens trees and several pieces of public infrastructure, including a public bathroom and sewage lift-station.

The City's response to this erosion so far has been beach nourishment at the north end of Magnolia Beach Park. The primary alternatives to this approach are retreat or armoring. At this time, retreat from the shoreline is infeasible, due to the presence of municipal infrastructure (including a popular sidewalk and road) and private property immediately behind the road. Armoring the shoreline (as with a bulkhead) would likely cause the complete loss of any sandy beach as it has on many other parts of Mobile Bay. In fact, Fairhope has some of the last publicly-accessible sandy beaches anywhere on the bay. The City has an interest in maintaining these facilities, and the public input received as part of this project reflects that interest.

Another concern for the City and residents has been the issue of wind-blown sand. This causes maintenance issues for local roads and private property in addition to removing valuable sand from the beaches. The City has worked for years to mitigate the problem, usually with the construction of small dune-like features at North Beach Park and with sod plantings at the northern end of Magnolia Beach Park.

Recent History of Coastal Engineering and Storms

The majority of past coastal engineering efforts have been focused at the northern end of Magnolia Beach Park, where beach erosion has been an ongoing problem. Table 1 provides a timeline of coastal engineering efforts at Magnolia Beach Park since 2004. In 2004 erosion threatened both the roots of the large live oak tree near the boat ramp and the bathroom/lift-station at the northern end of the park.

The photographs in Figures 3 and 4 were taken in June 2004 and show that the erosion problem extends at least that far back in time. Figure 3 shows the eroding bluff taken from under the large live oak tree which still exists just south of the boat ramp. The low-hanging branches have made that tree a popular climbing tree for generations of Fairhope children. Figure 4 shows that the roots of that tree were being exposed by erosion flanking the southeast end of the bulkhead structure around the boat ramp in early summer 2004.

Hurricane Ivan struck the Alabama coast in September 2004 and caused significant bluff erosion along all of Magnolia Beach Park. Figure 5 is a photograph from October 2004 showing both the bluff erosion as well as indicating that some new sand had been brought in and placed around there as storm damage mitigation. It is worth noting that the smaller live oak tree on the bluff in the background of Figure 4 was subsequently destroyed by the bluff erosion caused by Hurricane Katrina in 2005 and is no longer there.

Table 1: History of coastal engineering at North end of Magnolia Beach Park, Fairhope, AL.

Year	Coastal Engineering
2004	Small (unknown quantity) amount of sand placed on beach to address beach and bluff erosion and cover roots of large live oak tree (after Hurricane Ivan)
2005	Construction of the existing timber headland-jetty structure and beach nourishment with 2,900 cy (cubic yards) of sand (after Hurricane Katrina)
2014	Beach nourishment with 3,300 cy of sand
2015	Beach nourishment with 350 cy of sand
2016	Beach nourishment with 900 cy of sand

Figure 3: Photograph from June 2004 showing that bluff erosion at the north end of Magnolia Beach Park was problematic in early 2004. This photograph was taken looking south through the overhanging limbs of the large live oak tree which is south of the boat ramp. (Note: In 2004, the roots of that tree in the center of this photograph were exposed by the erosion – see Figure 4).

Figure 4: Photograph from June 2004 showing exposed roots of the large live oak tree near the boat ramp. This beloved oak tree still exists today because of the beach nourishments and the timber headland-jetty structure constructed in 2005 to its immediate southwest

Figure 5: October 2004 photograph shows that some sand (unknown quantity) was mechanically placed on the beaches in the foreground at the northern end of Magnolia Beach Park after bluff erosion exacerbated by Hurricane Ivan (Also: note the small live oak tree on the bluff in the background on the left side of the photograph. That tree was destroyed a year later by bluff erosion caused by Hurricane Katrina)

In 2005, after Hurricane Katrina caused more significant bluff erosion a larger, 2,900 cubic yard beach nourishment was completed in conjunction with the installation of a timber headland-jetty structure that connects to the existing bulkhead south of the boat ramp (see the left side of Figure 16 for a photograph of this timber structure). The timber structure was designed to function like an artificial headland, holding the new sand around the roots of the threatened large live oak tree. The intention, which succeeded, was to use the principles of headland pocket beach design to shift the updrift diffraction point along this beach about 50 feet to the southwest. Essentially, this wooden structure successfully changed the signature curvature of the beach shoreline and, combined with the sand placed there in the nourishments summarized in Table 1, helped to protect the large live oak tree roots and the bathroom/lift-station for the next decade. However, by 2014, the long-term erosion processes required some more nourishment. Beach nourishment projects of 3,300 cubic yards, 350 cubic yards, and 900 cubic yards were required in 2014, 2015, and 2016 respectively. Figure 6 shows the sand being spread in the March 2016 beach nourishment.

All of the sand for the beach nourishment projects outlined in Table 1 has come from the same sand source. The “Layco” pit in Foley has a deposit of large grain, white sands that matches the grain size of the native beach sands in Fairhope well. The borrow sands are whiter than the native sands in color. The borrow pit sand is likely from a geologic

deposit similar to the white sands of the beaches of Gulf Shores. Trucks haul the sand to the beach site where it is spread along the beach as shown in Figure 6.

Figure 6: Photograph showing new sand being spread at Magnolia Beach Park in the 2016 beach nourishment (March 2016).

Most of the coastal engineering which has occurred at North Beach Park has been the placement of sand along the beach that was dredged from the nearby marina and its entrance channel. Sand has likely been dredged and placed along North Beach at least twice, initial construction and one maintenance dredging, in the past 40 years but no engineering records of those projects have been located.

Public Input

Two public meetings were scheduled specifically as part of this Beach Management Plan development. The first was held on March 24, 2016 at the Fairhope Public Library. The primary purpose of the meeting was to provide an avenue for the public to guide the direction of the Beach Management Plan. Two of the most significant pieces of public input were that the public preferred to maintain the sandy beach (instead of bulkhead) and the public encouraged the use of structural elements as needed to maintain the sandy beach. These considerations were taken into account, especially at the highly erosional north end of Magnolia Beach Park.

The second public meeting was held on September 21, 2016 for the purposes of presenting the results summarized in this report, including the recommendations, and listening to feedback from the attendees. These two public meetings are summarized in the Appendix to this report.

Coastal Analysis of Fairhope's Beaches

Beach Profile Surveys

As part of the development of this beach management plan, 37 beach profiles were established: 20 at Magnolia Beach Park and 17 at North Beach Park. The locations of those profile lines are shown in Figures 7 and 8. Eight of these were re-occupied profiles that were originally established prior to the 2014 beach nourishment project at Magnolia Beach Park and have been repetitively surveyed over the intervening two years. Distances between the beach survey profiles vary from 50 feet to roughly 150 feet, and the profiles were surveyed generally to a distance of 100 feet offshore. All surveys were conducted relative to the mean lower low water (MLLW) tidal datum based on local tidal observations from around Mobile Bay. A separate Beach Profile Data Report has been developed, in conjunction with this management plan report, which documents the profile baseline locations and includes plots of the measured profiles.

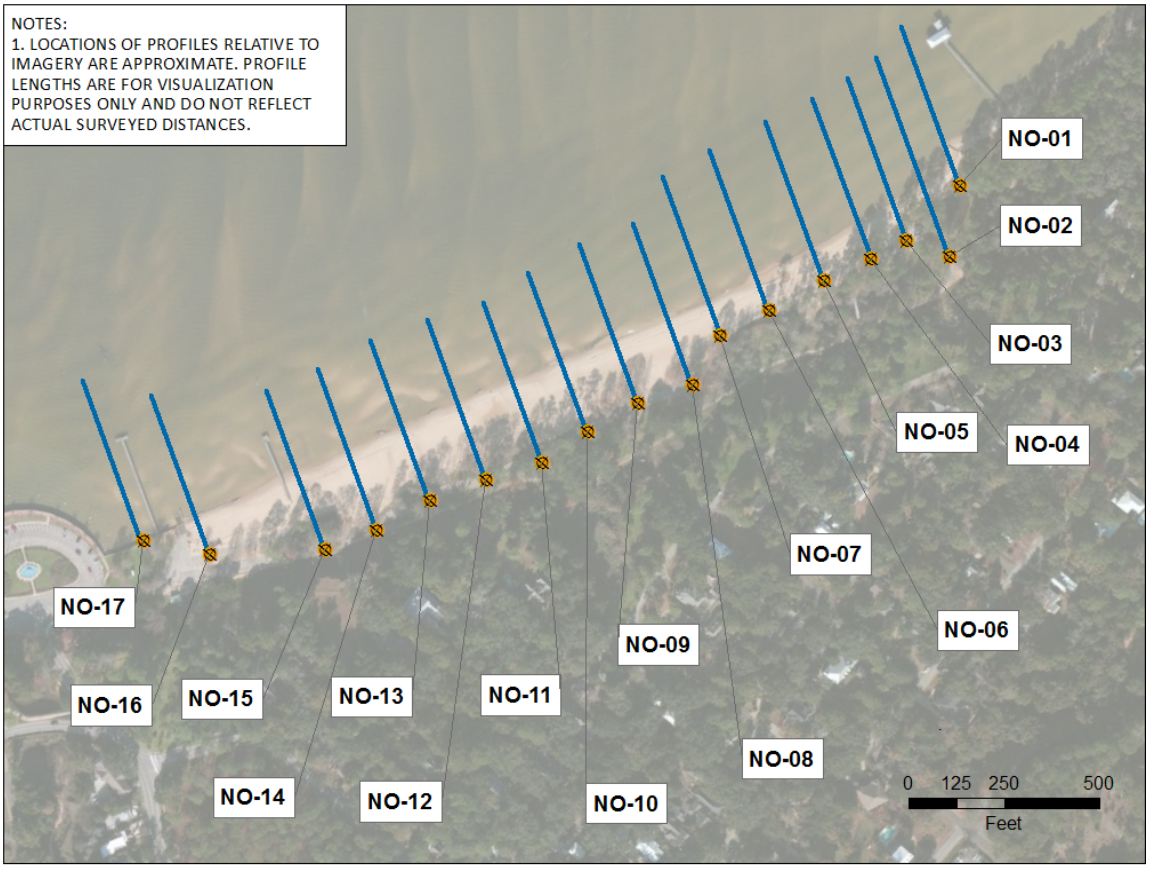

Figure 7: Beach profile locations for North Beach Park.

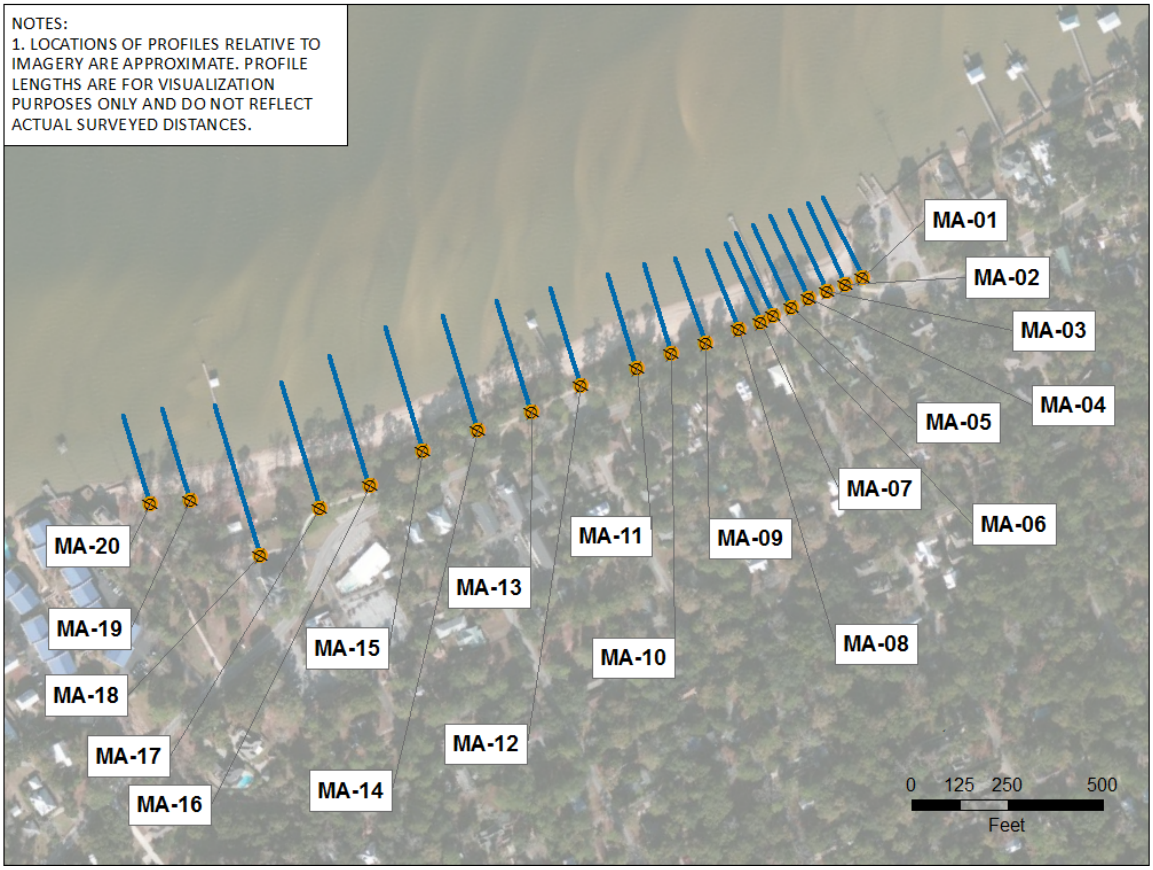

Figure 8: Beach profile locations for Magnolia Beach Park.

Magnolia Beach Profile "Template" Concepts

Analysis of the beach profile surveys provides important context for the recommendations related to shoreline stabilization, beach nourishment, and vegetation plans. An overlay of all the beach profiles from Magnolia Beach Park is shown in Figure 9. The figure overlays the 20 surveyed profiles shifted laterally to match at the waterline in order to illustrate similarities along that part of the beach. Every second profile is identified and the colors of the lines indicate the general area of the profiles from north to south. The northernmost profiles are shown in red, and the southernmost profiles are shown in purple. See Figure 8 for a map of these beach profile locations.

An interesting and important pattern emerges when the profiles are considered as shown in Figure 9. Near the shoreline, the beach slope is very consistent. Between about -1 ft and +3 ft MLLW all the profiles look very similar. There is a fairly consistent, flat slope to the active beach. It can be assumed that this planar beach slope is the equilibrium beach slope for this location and wave climate (and beach sand grain size). The main differences between profiles in Figure 9 are above the elevation of the planar beach. The width of the beach between +3 ft and +6 ft varies with location. In the areas that are considered more erosional (i.e. the northern end of Magnolia Beach), this width is very thin. In the areas that are considered less erosional, the flat beach below the bluff is

wider. Thus, the implication is that the more southern, stable profile shapes are a reasonable target for all the profiles. This general beach profile shape is emulated in the recommended beach profile template below.

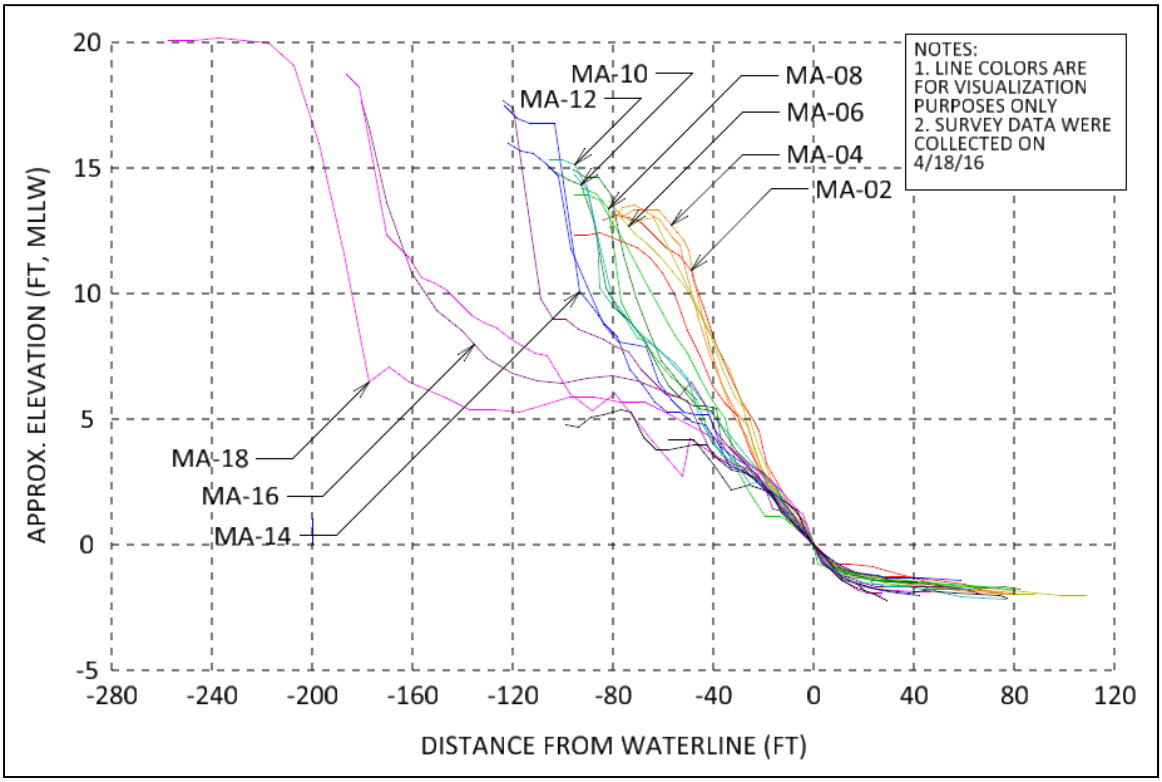

Figure 9: Plot showing all beach profiles for Magnolia Beach Park, relative to the waterline. Note: profiles are adjusted to a common station zero at the waterline.

Wind, Wave and Longshore Sand Transport Analysis

This section summarizes some complex coastal engineering analysis focused on estimating the rate and timing of longshore sand transport along the beaches of Fairhope. Much of the beach erosion signature for the past several decades and, particularly, the past few years, can be explained with this sort of analysis. Waves break and drive sand along our beaches almost daily. Sometimes the waves are coming from the south due to a south or southwest wind and at those times, sand is moving north. Sometimes the waves are coming from the north due to a north or northwest wind and sand is moving south. The potential longshore sand transport, also called littoral drift, is estimated in this report using standard coastal engineering tools. The most important result is that there is nearly a balance in the transport when averaged over an entire year, but sand transport does vary seasonally. In the late spring and summer, the northerly transport of sand dominates due to southerly winds. In the late fall and winter, southerly transport dominates due to the northerly winds. This pattern explains much of the erosion patterns seen at both Magnolia Beach Park and North Beach Park.

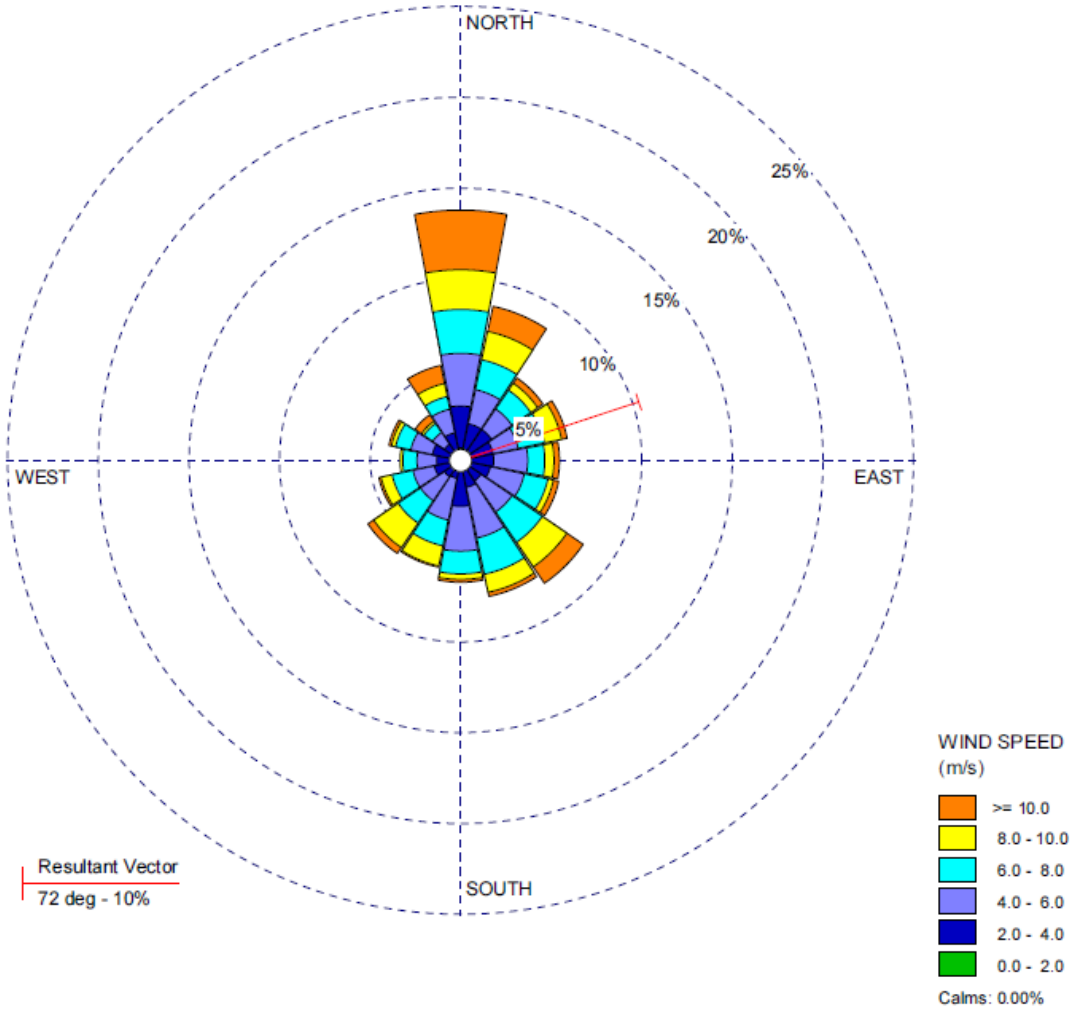

Figure 10: Wind rose plot for 2015 at Middle Bay Lighthouse. The banded colors represent intensities and distributions of wind from each direction.

Figure 10 shows a wind rose plot for the 2015 calendar year. Wind data were collected from the National Buoy Data Center for the station on Middle Bay Lighthouse. The wind rose plot describes the distribution of wind speeds at the lighthouse in various directions and intensities. Of the winds that would have generated waves affecting Fairhope beaches in 2015, southwest and north winds tended to dominate. Monthly or seasonal plots of these data (not shown here) indicate that the southwest winds, which cause northward sand transport, tend to prevail in the late spring and summer months. The north winds, which cause southward sand transport, tend to prevail in the late fall and winter months. This seasonality of winds is well known and controls the erosional signatures on the beaches to some extent.

The longshore sand transport analysis in this report focuses on the three year time period from May 2013 through May 2016. Wave heights for the corresponding meteorological data were developed using a shallow-water wave generation model which uses the US Army Corps of Engineers parametric wave generation equations for fetch-limited

situations. These wave heights were used to develop potential volumes of longshore sand transport for the period indicated using the US Army Corps of Engineers CERC Equation for longshore sand transport. It should be noted that the quantitative uncertainties with this modeling approach are great. The model develops a "potential" sediment transport rate, which assumes that sand is in sufficient quantity for transport and is not impeded by any obstructions. This methodology is most useful for evaluating the direction, general order of magnitude and the expected seasonality of the longshore sand transport climate along Fairhope's beaches. Over the three year period, this methodology suggests that the net sand transport has been to the south but with significant reversals in the summer. This result is consistent with the continuing erosion at the north end of Magnolia Beach: sands are driven southward by prevailing northerly winds.

The longshore sand transport results are shown in Figure 11. The monthly transport estimates are shown as bar graphs that represent northward (blue) and southward (purple) transport for each month. In months when the blue bar is larger than the purple bar, northward transport dominated, and vice-versa. For example, in June 2013, northward transport dominated. Inspection of Figure 11 shows a strong seasonal pattern. For example the months of October 2013 through April 2014 had dominant transport to the south followed by the months of June through August 2014 which had dominant transport to the north. The beach nourishment of 2014 (Table 1) was done in May-June 2014 in response to that winter of very strong southward transport. Thus, it appears that the sand transport modeling results are consistent with the timing of the major erosion events triggering the recent required beach nourishments at the north end of Magnolia Beach Park. Similar triggers, as shown in Figure 11, were the winter months of November 2014 through March 2015 and October 2015 through January 2016. Each of these time periods had dominant southward transport and triggered required beach nourishments (see Table 1).

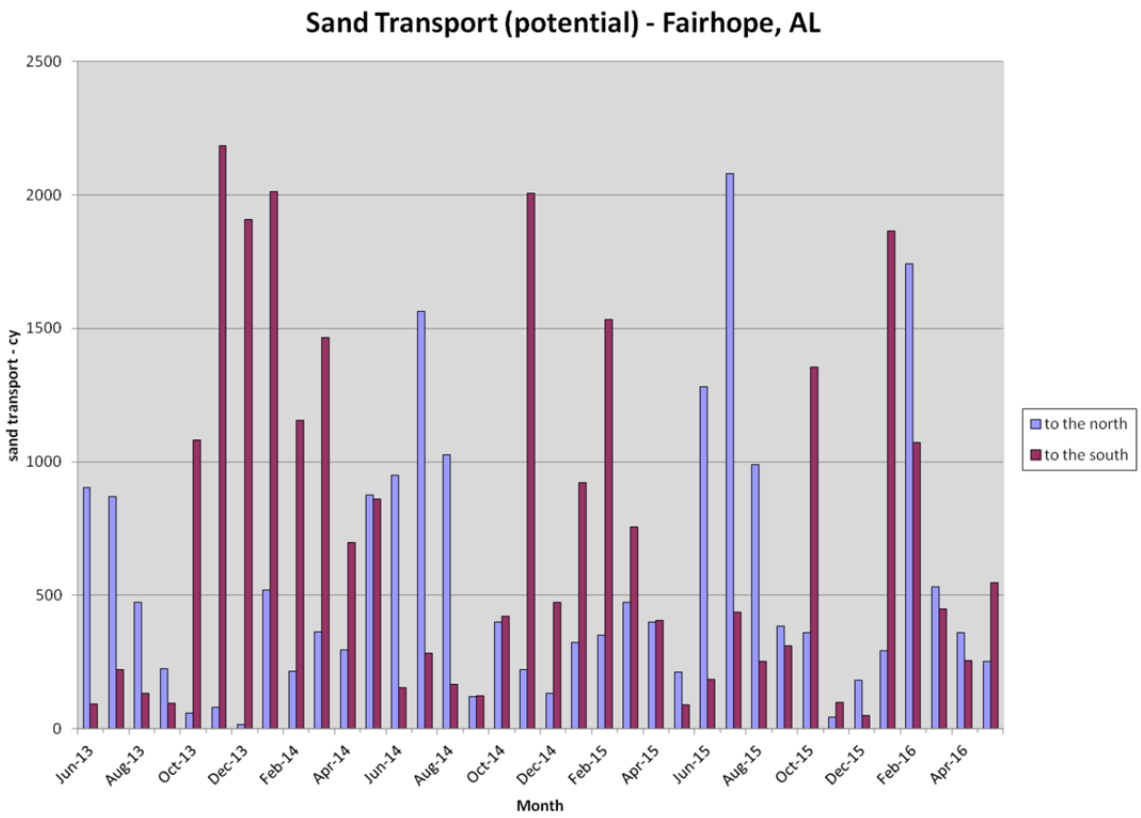

Figure 11: Plot showing monthly potential longshore sand transport along Fairhope's beaches from June 2013 to May 2016. The bars represent the gross volume of sand potentially moved either northward (blue) or southward (purple) in each month of the record. Months where the bars are about equal represent relatively balanced transport.

Littoral Cells and Longshore Sand Transport Patterns

Within the two major littoral cells considered for this analysis, the seasonal shifts of sand as previously discussed can be observed very clearly. The littoral cell at North Beach Park extends from the existing timber groins just north of the duck pond beach to the concrete bulkhead around the pier's parking lot. The littoral cell at Magnolia Beach Park extends from the timber bulkhead and wooden jetty-groin structure at the public boat ramp to the timber bulkheads protecting private property south of the American Legion beach. For instance, during the late fall and winter months when northerly winds prevail, the southern end of Magnolia Beach Park tends to accrete. This accretion appears as a piling up of sand at the south end of the beach, as seen in Figure 12. At the same time, the beaches at the northern end of Magnolia Beach tend to erode. This can be seen in Figure 13, where a representative curving shoreline has formed in response to the northerly-dominated wave climate.

Figure 12: Photograph (facing south) showing winter sand accretion at the southern end of Magnolia Beach Park, near the American Legion (April 2016).

Figure 13: Photograph (facing south) showing winter erosion at the northern end of Magnolia Beach Park, near the boat launch (February 2016).

Figures 14 and 15 show the ends of the Magnolia Beach Park littoral cell conditions in the late spring and summer months, when southerly winds dominate and waves drive sand to the north. Figure 14 shows the erosion of the beach south of the American Legion beach and shows the characteristic curved shoreline consistent with sand transport to the north. Note the very different beach conditions shown in Figure 12 (end of

winter/spring) and in Figure 14 (summer). Here the beach at the southern end is eroded, while the beach at the northern end has recovered. Figure 16 shows the wide beach at the northern end from another angle, where the darker native sands have filled in seaward of the new, white sand placed as part of the 2016 nourishment project.

Figure 14: Photograph (facing south) showing summer erosion at the southern end of Magnolia Beach Park, near the American Legion (July 2016).

Figure 15: Photograph (facing south) showing summer accretion at the northern end of Magnolia Beach Park, near the boat launch (July 2016).

Figure 16: Photograph (facing north) showing summer accretion at the northern end of Magnolia Beach Park, near the boat launch (August 24, 2016).

Existing Vegetation Patterns

The beach profile survey information also provides some interesting and important context concerning the existing vegetation patterns. There is very little to no vegetation below about +5 ft MLLW on any of the profiles. There is also a small build-up of sand about elevation +4 ft to +5 ft MLLW which is essentially a storm beach berm that is the limit of wave runup in storms with high tides. These patterns provide some guidance for the development of vegetation plans. It is also worth noting that above about +5 ft MLLW, the type of vegetation is not really controlled by the presence of the bay (i.e. not just salt-tolerant species like sea oats) but by whatever vegetation exists above that elevation. This is in contrast to the more dynamic saltwater shoreline typical of Gulf of Mexico beaches where the natural vegetation is controlled by the salt spray for significant distances inland. Apparently, the less dynamic bay shoreline processes allow for any upland vegetation to thrive down to an elevation around +5 ft MLLW. This idea can be used in the development of vegetation plans – that any healthy native vegetation can be used (it does not have to be sea oats).

In the central part of the Magnolia Beach Park littoral cell, from about Pecan Ave. to Laurel Ave., mature vegetation exists on the bluff that runs parallel to the roadway and stretches to the beach face down to just above +5 ft MLLW in elevation. Above the bluff, grass and trees are prevalent. Notably, wind-blown sand is not a serious problem in these areas. A representative cross-section view of one such area is shown in Figure 17.

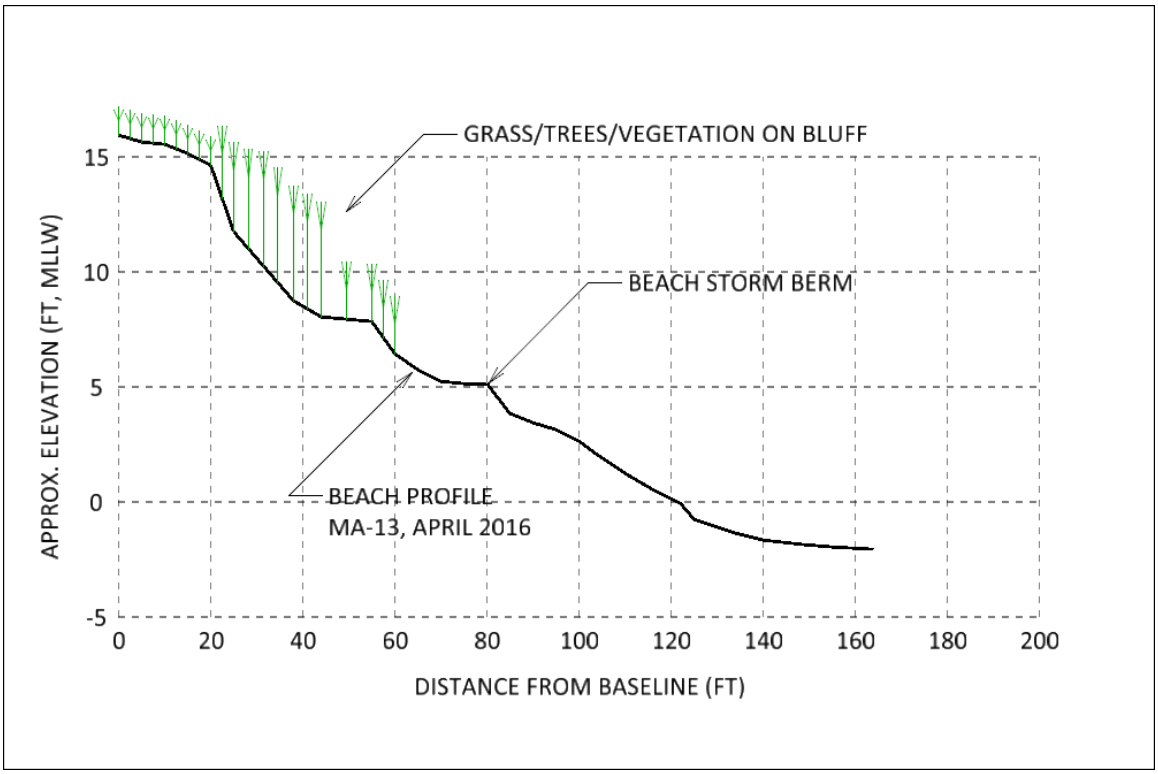

Figure 17: Plot showing existing vegetation near the center of Magnolia Beach Park (i.e. near the dolphin family statue). Here vegetation extends down the bluff and down to the beach face.

At the northern end of Magnolia Beach Park, where the beach has been heavily eroded, little vegetation persists. A representative cross-section view of one such area is shown in Figure 18. The only vegetation is sod grass near the top of the existing bluff which was planted by the City after the 2014 beach nourishment project. Because of the erosive nature of this bluff in the past several years, no other vegetation has naturally colonized below that sod. Note how much narrower the beach profile is between the bluff line and the storm beach berm in the profile shown in Figure 18 (the eroded north end of Magnolia Beach Park) compared to the profile shown in Figure 17. If the beach at the north end could be more permanently stabilized to the west (e.g. recommendation in Figure 19), then a wider bluff could be vegetated which would reduce wind-blown sand problems. Essentially, the southern end situation is a model for the northern end situation if the beach can be stabilized. It should be noted that lack of mature vegetation is common to the beaches at the ends of littoral cells with headlands, where the shoreline is likely to erode and accrete seasonally, preventing the maturation of new growth.

Some *phragmites* grasses are found behind the timber bulkhead at the north end of Magnolia Beach Park near the boat launch. While *phragmites* is considered an invasive species by some coastal ecologists, it does have some habitat value.

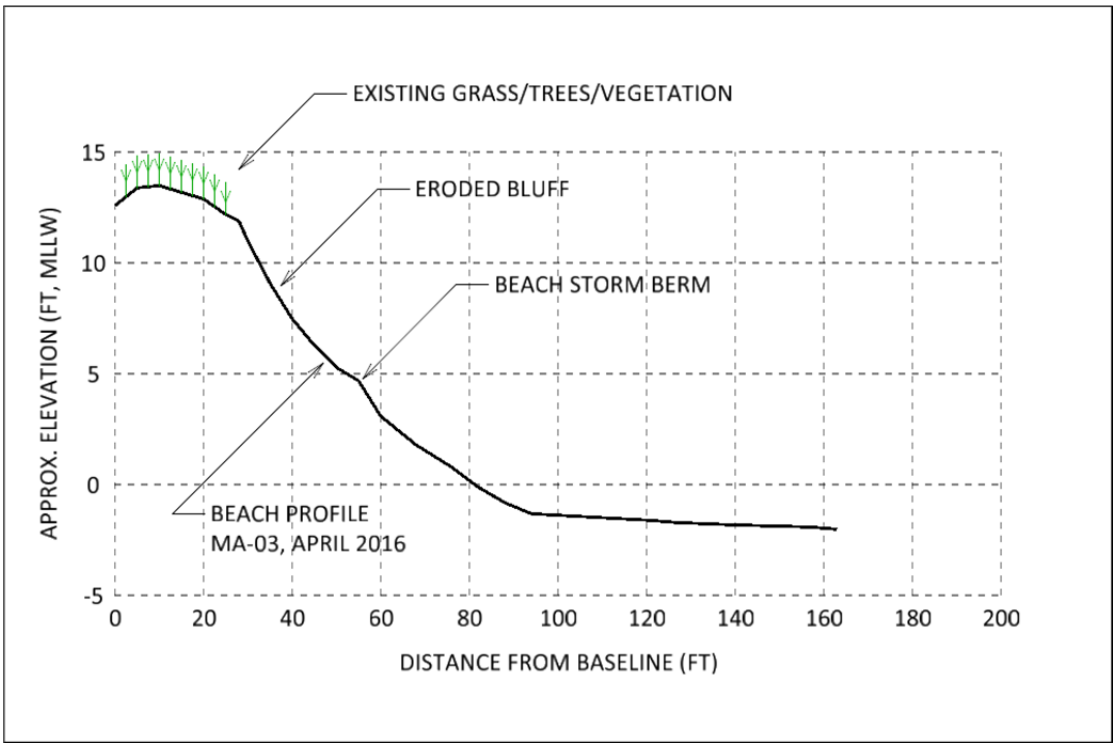

Figure 18: Plot showing existing vegetation at the northern end of Magnolia Beach Park. Here the bluff is actively eroding, and vegetation only survives above the eroding bluff.

At North Beach Park, the majority of mature vegetation is found east of the park access roadway. Trees and grass are found immediately adjacent to the roadways on all sides above about +6 ft MLLW, except where the road curves too closely to the bay's edge.

Beach Management Plan Recommendations

Several recommendations are suggested for the future management of Fairhope's two main public beaches. These recommendations are based on the above beach profile analysis, wave and longshore sand transport analysis, the input from the public, and our understanding of the overall coastal processes.

Magnolia Beach and Bluff Stabilization Recommendations

It is recommended that Fairhope modify its existing approach to the stabilization of the north end of Magnolia Beach Park. The existing management approach (periodic as-needed nourishments partially retained by the wooden structure built in 2005) has worked very well until recent years when the nourishments have been needed every spring. It is

now recommended that Fairhope consider the development of a shoreline stabilization approach which uses new coastal structures to stabilize the sandy beach.

A possible configuration of a proposed plan is shown in Figure 19 that includes the installation of two shore-parallel, rock breakwaters, with the intention of slowing erosion at that part of the beach and retaining the newly placed sand. The primary purpose of the rock breakwaters would be to stabilize a new sand fill in order to protect the small upland bluff in a more permanent configuration – one which would provide a wider beach in the form of small pocket beaches and stable slope up to the bluff elevations which can be vegetated to reduce wind-blown sand. It is envisioned that this project would involve the placement of a new beach nourishment (initially estimated at 3,000 – 4,000 cubic yards of clean, compatible, beach sand) within the northernmost 400-500 feet at Magnolia Beach Park. The rock material and configuration for the breakwaters would be selected based on a coastal engineering analysis of the site conditions and using headland pocket beach principles. There would be significant public outreach needs concerning the aesthetics of such a plan as well as significant coordination with resource agencies in the permit application and evaluation process.

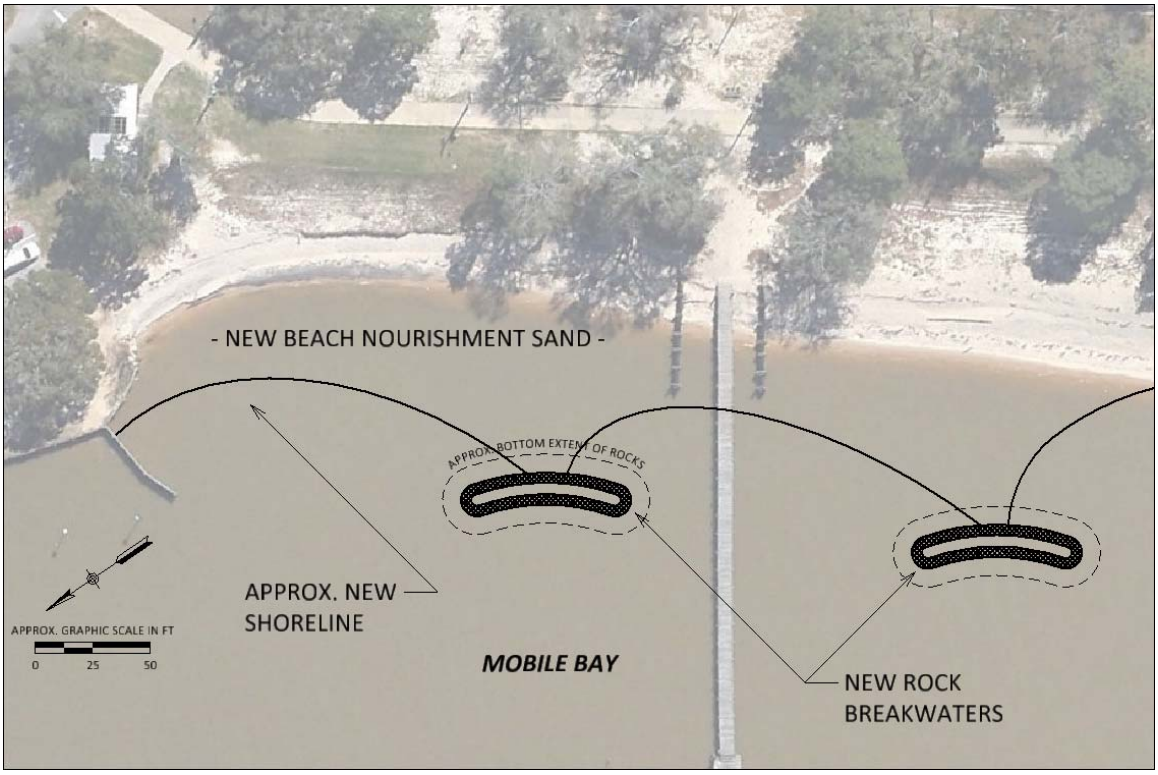

Figure 19: Plan view drawing showing a possible configuration of north Magnolia Beach Park improvements, including the installation of two, new rock breakwaters and the placement of a new beach nourishment project to more permanently stabilize this shoreline

It is recommended that Fairhope continue to monitor the beach widths at North Beach Park. The beaches at the north end of North Beach Park are narrow and future problems

related to the erosion may begin to be problematic. In particular, there is currently not much distance between the bay and the roadway around the duck pond as shown in Figure 20. At some point in the future, the City may want to consider engineering to address erosion related problems here also.

Figure 20: North end of North Beach Park showing narrowness of beach west of the road and vegetation on the dune-like feature.

Beach Profile Templates for Management

It is recommended that Fairhope adopt some desired, or target, beach profile template which will serve as the design goal of any beach nourishment projects and the basis for nourishment decisions. A suggested beach template has the following characteristics:

1. A nearly flat beach width, at or around elevation = +6.0 ft MLLW, of at least 25 feet landward of the crest of the beach berm.
2. A beach face with a slope of approximately 1:10 (V:H) with a width of at least 60 feet between the +6.0 ft MLLW and the +0.0 ft MLLW contours.

Figure 21 shows an example of this beach profile template as it might be implemented at north end of Magnolia Beach Park. The characteristic erosional bluff at Magnolia Beach is seen to the left of the figure. Maintenance of the beach profile template should be accomplished by the placement of clean, beach quality sand on the beach. This would provide a target for designing the headland pocket beaches as well as a target for the beach nourishment projects. The upper portion of this template will vary based on

location but the lower portion (below +6 ft MLLW) should be consistent across all profiles because that emulates that healthy beach profiles (see Figure 9).

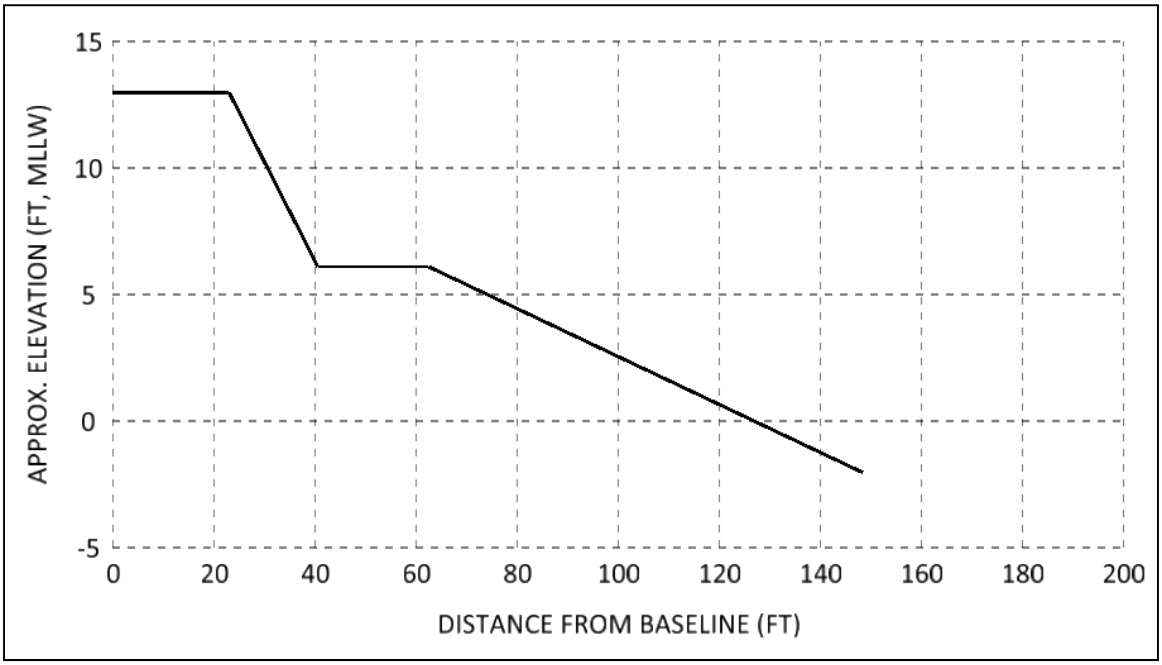

Figure 21: Plot showing an example beach profile template for Magnolia Beach Park.

In the event that one of the profiles recede to this level, either as a result of significant erosion during a storm event or due to day-to-day wave action, the City can use that as an indication to implement another round of maintenance beach nourishment project to re-establish the proposed beach template.

Vegetation Recommendations

Vegetation of the beach profiles above the +5 ft MLLW elevation zone is a nature-based recommendation to several issues that are prevalent along Fairhope's beaches. Plants contribute to the stability of higher portions of the beach in several ways. First, the vegetation protects the sand from wind-blown forces. This phenomenon is seen along the south portion of Magnolia Beach Park where a healthy stand of naturally colonized vegetation exists between the top of the bluff and the beach. Second, vegetation plantings can discourage public foot traffic through the area, which keeps the sand unvegetated and thus contributes to wind-blown sand issues.

Plants reduce and catch wind-blown sand, keeping sand on the beach and keeping it out of the adjacent streets and properties. The use of plants for wind-blown erosion control may reduce the need to create a small dune-like feature at North Beach Park. Vegetation can continue to be encouraged on the small dune-like features as shown in Figure 20.

Regular Beach Monitoring

For the purposes of better understanding the movement of sand along the City's beaches, the beaches should be monitored periodically. The beaches are a part of the City's infrastructure and most beach communities periodically monitor their beaches for management input. Cross-shore beach profiles across the entire width of the beach out to wading depth should be surveyed on some of the profiles on an annual or bi-annual basis at a minimum. The full suite of profiles measured in this report (essentially every 150-200 feet) do not need to be surveyed each year but a representative sample, say every third profile, should provide the general background information needed. Surveys of the beach should also be acquired immediately after major storm events. Reduced or localized surveys should also be conducted immediately pre-construction and post-construction of any beach renourishment efforts. In the event of significant storm damage to the beaches of Fairhope, the pre-storm survey conditions may serve as the restoration "goal."

It is recommended that North Beach Park be managed primarily through continued monitoring of the beach widths. North Beach Park is showing some signs of similar erosional patterns as Magnolia Beach Park (long-term losses most noticeable at the north end after winter waves move sand south) but at this point in time, these problems are not critical. The linear piles of sand located away from the roadway as small dunes could be removed to reduce wind-blown sand issues but they do provide some protection.

It is also recommended that the City retain a licensed land surveyor to document the survey profile locations established as part of this beach management plan. These profiles, particularly the location where each profile begins, the "benchmark" should be precisely established in terms of latitude, longitude, and elevation by a licensed land surveyor and provided to the City for future use. This documentation would allow for the same lines to be re-established and resurveyed after major hurricanes and major infrastructure improvements.

Appendix – Summary of Two Public Meetings

This appendix summarizes the two public meetings held as an integral part of this Beach Management Plan development.

An initial public meeting was held on March 24, 2016 at the Fairhope Public Library. The primary purpose of the meeting was to provide an avenue for the public to guide the direction of the Beach Management Plan. Public notice for the meeting for several weeks prior to the meeting included posting on the City's web-site. Specific notice was provided to the City's Environmental Advisory Board because of the relationship of the topic with their mission. Several news media outlets announced the meeting. The meeting was held in the Giddon Room of the library and was attended by about 20 people. The meeting was led by Fairhope Public Works Director Jennifer Fidler, the main presentation was given by Thomas "Beau" Buhring (South Coast Engineers) with the aid of a brief powerpoint presentation, and questions from the citizens were answered by Ms. Fidler, Mr. Buhring, and Dr. Bret Webb (South Coast Engineers). There were a significant number of questions and comments from the citizens. Two of the most significant pieces of input from the March 2016 meeting were that the public preferred to maintain the sandy beach (instead of a bulkhead) and the public encouraged the use of structural elements as needed to maintain the sandy beach. These considerations were taken into account, especially at the highly erosional north end of Magnolia Beach Park in the development of this report and its recommendations. Press coverage after the public meeting occurred in several local and regional media outlets.

The second public meeting was held on September 21, 2016 for the purposes of presenting the results summarized in this report, including the recommendations, and listening to feedback from the attendees. Public notice for the meeting for several weeks prior to the meeting included posting on the City's web-site both on the general calendar and the front-page "highlight." Specific notice was provided to the City's Environmental Advisory Board. Several news media outlets, including at least one local television news program, ran a story announcing the meeting. The meeting was held in the Giddon Room of the library and was attended by about 10 people. The meeting was led by Fairhope Public Works Director Jennifer Fidler, the main presentation was given by Thomas "Beau" Buhring with the aid of a powerpoint presentation that covered the written report, and questions from the citizens were answered by Ms. Fidler, Mr. Buhring, and Dr. Scott Douglass (South Coast Engineers). There were a number of questions and comments from the citizens. The most significant comments were supportive of the plan and there was discussion of the recommendations for the north end of Magnolia Beach Park with specific concerns related to the vegetation plans as well as a question concerning whether or not other beaches in the City could also be addressed. Press coverage after the public meeting occurred in at least one local media outlet.