City of Isle of Palms
Request for Qualifications (RFQ 2025-02) for
Beach Management- Alternatives Analysis

BACKGROUND

The city is requesting qualifications from firms that specialize in managing beaches that suffer from erosion to provide City Council with guidance on specific beach erosion and management practices, plans and policies. This analysis will inform council's long-range planning as it considers ways to preserve the planned 2026 major renourishment project.

The city has engaged with multiple professional firms already and those firms have identified a number of options that could be considered to help slow down erosion on the two ends of the island. Based on prior experience of dealing with eroded conditions and the future cost of beach renourishment, the city would like to have a comprehensive analysis performed on specific beach management practices and methods including, but not limited to:

- Stepping away from active beach management on all or part of the island's beaches
- Beach renourishment only
- Beach renourishment plus adding shore perpendicular groins at key locations
- Beach renourishment plus adding breakwaters at key locations
- Beach renourishment plus adding geo-tubes at key locations
- Beach renourishment plus creative shoal manipulation to minimize damage of future approaching shoals
- Projects focused on modifying the conditions within Breach Inlet and/or Dewee's Inlet to alleviate erosional currents (channel realignment, forced bypassing or other effort to physically change inlet)
- Any combination of the above methods and any others deemed worthy of consideration

Each of the items listed above has considerations including but not limited to physically changing the look and feel of the beach, initial cost, ongoing maintenance cost, likelihood of being granted state and federal permits, likelihood of being successfully implemented, impacts to wildlife and habitat, impacts to tourism, legal ramifications and negative downdrift impacts.

The city would like to engage a firm to analyze and provide guidance on each of the identified methods, and others deemed viable but not listed. This request for qualifications is the first step in the process of engaging a firm to provide such a report.

SCOPE AND DELIVERABLE OF ALTERNATIVES ANALYSIS

The chosen firm will be expected to:

1. Review of existing data and information, including:
    a. Reports and recommendations from Beach Ad Hoc Committee
    b. Second Opinion from Foth Olson dated 9/29/2025
    c. Prior beach management efforts
    d. Planned future projects, including USACE projects on the southern end
    e. Beach monitoring reports and surveys
    f. Existing imagery to understand inlet shoal bypass events
    g. See more here: https://www.iop.net/administration/beach-restoration

h. Meet with the US Army Corps of Engineers and gain an understanding of future plans

2. Provide a written report that includes:
    a. Opinions on the feasibility of each practice and method listed above
    b. Opinions on possible benefits and detriments of each of the identified alternatives
    c. Opinions on the probability of successfully permitting and constructing
    d. Opinions on the probable cost (initial and 20 years into the future) of each of the identified alternatives
    e. Opinions on lifespan of each of the identified alternatives before complete replacement is necessary
    f. Conceptual renderings or photographs of real-life examples of what the alternatives would look like from the ground
    g. Expected financial benefit or expense each alternative would achieve over the course of ten years or other meaningful timeline

3. Present the findings, opinions, and recommendations to City Council and be prepared to answer questions (expectation would be that this would be an in-person meeting and last up to two hours, possibly longer).

REQUEST FOR QUALIFICATIONS SUBMITTAL INSTRUCTIONS

Consistent with the purchasing procedures specified in Section 1-10-7 of the city code, the city is requesting qualifications based on demonstrated competence and qualifications.

By the close of business on **Friday, December 5th, 2025,** please provide a document via email to dkerr@iop.net that illustrates the firm's qualifications and includes:

- No more than 6 pages
- A cover letter introducing the firm
- A description of the firm's qualifications
- A description of the key personnel that would be involved in the project and a description of their areas of expertise
- Examples of similar projects including references

EVALUATION PROCESS AND CRITERIA

To choose a firm to provide these services, a city committee (expected to be the Beach Preservation Committee) or City Council will evaluate the qualifications of each firm that responds and develop a method to determine an order of preference of which firm to engage. The city may choose to interview firms as part of the process. The preferred firm will be contacted, and an attempt will be made to negotiate a fair and reasonable cost for the project. If a satisfactory cannot be negotiated with the firm considered to be most qualified, negotiations with that firm shall be formally terminated and negotiations with the next most preferred firm will begin and this process will repeat until an agreement is reached or the process is terminated or modified.

Beach Preservation Ad Hoc Committee Report

January 2025

Committee Members:

Residents:

Tim Ahmuty

Dan Slotchiver

Cindi Solomon

Andrew Vega

City Council:

Katie Miars

Scott Pierce

Phillip Pounds

Beach Preservation Ad Hoc Committee Report

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City of Isle of Palms, SC
Beach Preservation Ad Hoc Committee Report

1-7-25

Introduction

The Beach Preservation Ad Hoc Committee was established by the City Council on January 23, 2024. Its members include Mayor Phillip Pounds, Councilmember Scott Pierce, Councilmember Katie Miars, and island residents Andrew Vega, Dan Slotchiver, Cindi Solomon, and Tim Ahmuty. Councilmember Elizabeth Campsen was also part of the committee before her resignation from the Isle of Palms City Council in August.

The committee's operations were supported by City Administrator Desirée Fragoso, Deputy City Administrator Douglas Kerr, and Steven Traynum from Coastal Science and Engineering.

Throughout the year, the committee convened 24 times, engaging with a range of stakeholders, including representatives from state and federal permitting agencies, as well as staff and elected officials from other beach communities facing similar challenges.

The goals and tasks of this committee were to

1) Review overall beach restoration policies,
2) Develop recommendations for a more proactive response to beach erosion, and
3) Develop new and consistent funding mechanisms for future needs and projects.

Recommendations

The following recommendations are being presented to City Council for consideration:

1) Beach Restoration Policies

Recommendation	**Consensus (75% +)**	**General Agreement (50%-75%)**	**Divided (Less than 50%)**
Establish a minimum healthy beach volume profile per Exhibit 1, Figure 5, page 10 of this report (approx. 600 cy per foot within the unstabilized inlet zones and 380 cy per foot elsewhere on the beach)	X		
Establish triggers for when Council should consider authorizing construction of mid-scale and large-scale projects (See Exhibit 2)	X		
Consider becoming a US Army Corps of Engineers (USACE) managed beach	X		
Repeal ordinance prohibiting hard erosion control structures 250' of mean high water		X	
Modify ordinance prohibiting hard erosion control structures 250' of mean high water			X

City performs emergency work (sand scraping, trucking in sand and/or placement of sandbags)		X	
Establish property owner's responsibilities for maintaining dune system within private property (Folly Beach model see Exhibit 5)	X		
Prohibit construction of new pools seaward of the maximum building line	X		
Consider seeking second opinion on emergency protective actions, future beach nourishment program and other beach protection options (groins, sandbag installation and review of emergency protective actions taken during the last 2 years)	X		

2) Proactive Response to Beach Erosion

Recommendation	Consensus	General Agreement	Divided
Accelerate and increase frequency of large-scale dredging beach nourishment projects from every 10 years to every 8 years	X		
Initiate permitting for large scale nourishment projects two years after completion of a large-scale nourishment project	X		
Coordinate construction of large-scale nourishment projects on both unstabilized inlet zones to occur at the same time	X		
Hire full time employee tasked with overseeing resilience efforts, including beach management	X		
Establish an ongoing Beach Preservation Committee made up of 5 Residents and 2 Council members	X		
Increase the frequency of beach monitoring surveying from annual to semi annual	X		

3) New and Consistent Funding Mechanisms for Future Needs and Projects

Recommendation	Consensus	General Agreement	Divided
Establish separate accounts for 1) emergency beach restoration work, and 2) large-scale beach nourishment projects and 3) other beach related projects	X		
Consider raising revenue to cover the proposed proactive beach nourishment schedule (See Exhibit 3 funding sheet)	X		
Engage state and federal lobbyists/legislators to secure funding for beach nourishment	X		

Engage state lobbyists/legislators to amend state law to allow beach nourishment to be added to Municipal Improvements Act (MID) to allow City to establish special purpose tax district	X		
Engage state lobbyists/legislators to amend state law to provide coastal communities ability/flexibility to raise revenue for beach nourishment (i.e. real estate transfer fees or additional atax)	X		
Establish a cost-sharing plan with Wild Dunes for projects along areas that do not meet public access requirements based on WD contributions to the Beach Preservation Fund (see Exhibit 4 for financial assumptions)	X		

Isle of Palms Beach Management Planning Scenarios

BACKGROUND

Isle of Palms (IOP) is a classic "drumstick" barrier island (Hayes 1979), with a bulbous updrift end at the northeast, and a narrow recurve spit on the southwest (Figure 1). Generally, sand comes to the island via shoal bypassing at Dewees Inlet and then migrates south, maintaining a historically stable shoreline along the central portion of the island. Sand eventually accumulates along the southern spit of the island and then into the shoals of Breach Inlet. The shorelines near the inlets are highly dynamic and are classified as "unstabilized inlet erosion zones" by SCDHEC–OCRM due to the episodic fluctuations in the shorelines. Figure 2 provides a map of the monitoring stations referenced herein.

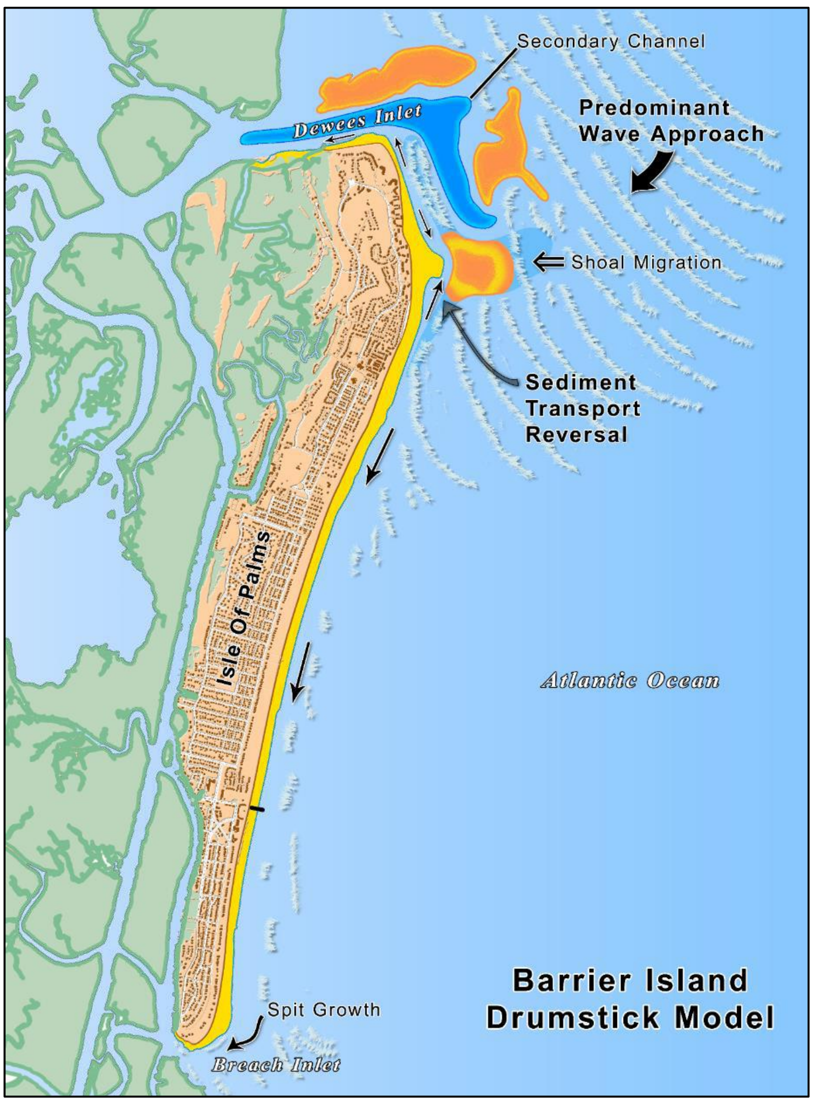


FIGURE 1. "Drumstick" barrier island model developed from Hayes (1979).

EXHIBIT 1

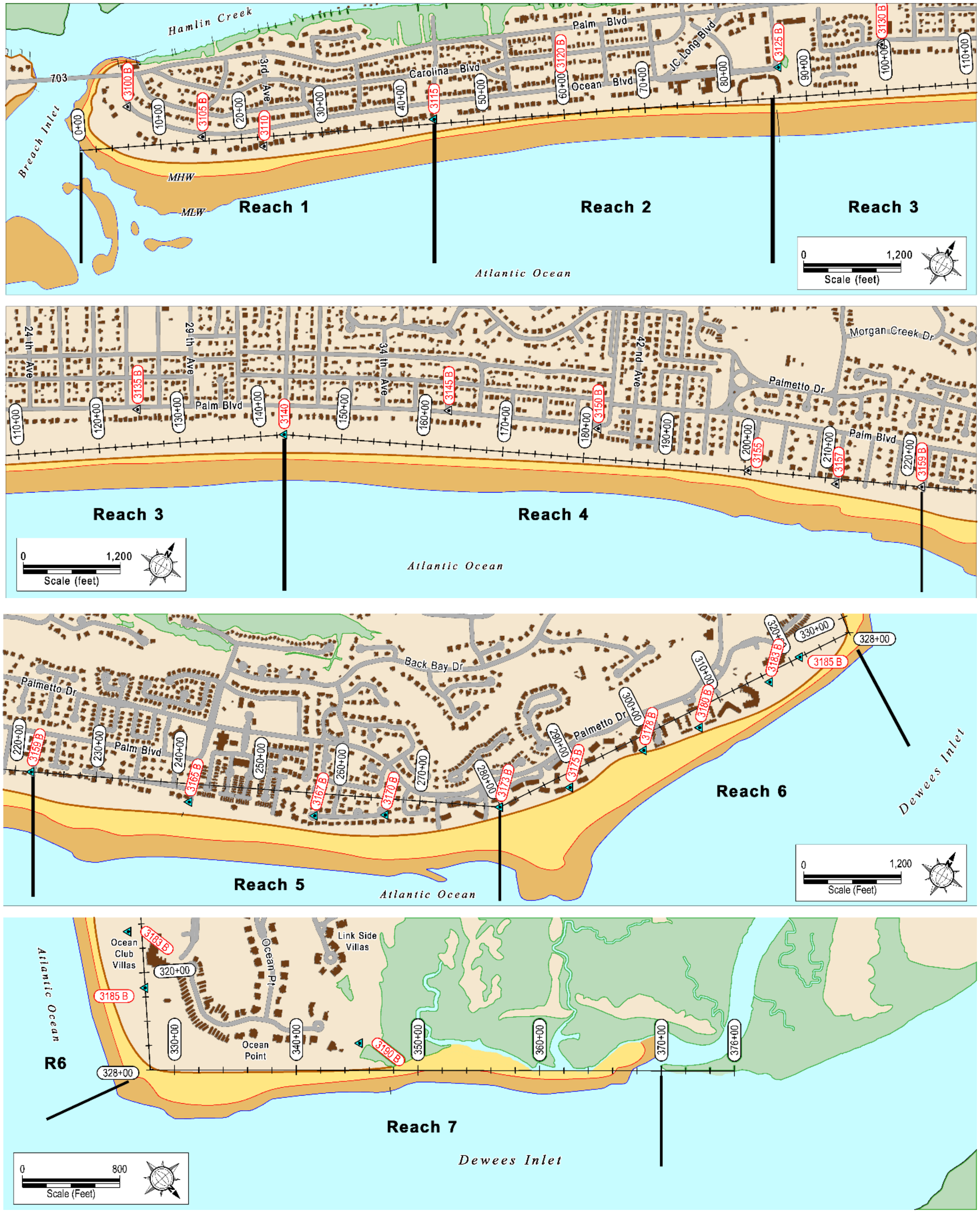


FIGURE 2. Station and reach map showing the monitoring profiles and reaches used in prior beach monitoring efforts.

Studies show that major shoal bypass events affect the eastern end of the island every ~7 years (Guadiano 1998); however, they can occur more frequently. Generally, smaller events occur on a more rapid timescale, while large events may impact the shoreline for ten years or more (ie, 1940–1950's attachment). These attachment events create localized areas of erosion and accretion that can see the shoreline change by up to 200 feet (ft) in one year. After attachment, the trend can reverse. The episodic nature of these events makes it difficult to predict shoreline trends and requires flexible solutions to deal with short-term erosion as well as long-term solutions for large-scale sand losses. While each shoal event adds sand to the system, monitoring efforts sponsored by the City of IOP show that there is a net loss of sand from the north end. This loss necessitates periodic additions of sand via offshore nourishment projects. Most of the sand added to the north end via shoals and nourishment projects shifts downcoast to maintain the remainder of the island, while the balance is eventually recycled back into Dewees Inlet to feed future shoals.

At the south end, the beach had accreted significantly in recent history despite minor fluctuations in volume from year to year and impacts from storms; however, erosion has accelerated over the past two years leaving portions of the beach critically eroded. While the condition appears to have largely stabilized in 2024, additional erosion is still a threat, and the existing beach condition is insufficient for storm protection. In CSE's opinion, the rapid erosion occurring in 2022–2023 is not likely to persist in the future. That being said, there has been a significant increase in storm activity since 2015, and sea level rise appears to be accelerating. These factors may increase the long-term erosion rate along the south end, turning the area from accretional to erosional. Until nature proves otherwise, the City should anticipate a need for projects to supplement the sand supply to the south end.

This summary of alternatives is prepared at the request of the City of Isle of Palms to outline information necessary to plan for long-term beach management along the beach. While the analysis focuses on the erosional areas at the ends of the island, the entire beach will be assessed. The summary outlines:

- Alternatives for a minimum healthy beach profile
- Determination of existing volume deficits
- Summary of recent erosion rates
- Discussion of triggers
- Cost opinion for restoration alternatives

The summary herein includes impacts of the beach restoration efforts at the east end including two large-scale nourishments, two shoal management projects, various emergency measures and a planned USACE project at the south end that is currently in the initial phase of construction.

BEACH VOLUME

The condition of the beach is determined by the volume of sand in the beach profile. This includes all sand between the reference line along the landward boundary and a point offshore where little or no measurable elevation change occurs. The landward boundary can be at the crest of the primary dune or from a point of significance, such as a structure. For developed beaches, the beach volume seaward of structures is typically the main interest. The seaward boundary is referred to as the “closure depth,” and is a unique depth for every beach determined by sediment grain size, tide, and wave climate. Larger waves increase the depth of closure as the higher energy allows sand to be moved at greater depths. At Isle of Palms, the typical depth of closure is ~–13 ft NAVD (note 0 ft NAVD is approximately equal to mean sea level) (Figure 3).

Within the active beach profile, sand can shift in the cross-shore direction from varying weather conditions, with larger wave periods moving sand from the dune to underwater sandbars, and calmer weather moving sand higher in the profile. Generally, summertime weather conditions promote growth of the dry sand beach, while stormier winter conditions show narrower beaches with more gentle slopes and sandbars. Beach volumes are typically reported as cubic yards of sand per linear foot of beach (cy/ft), which is the total quantity of sand between the dunes and closure depth in every linear foot of alongshore beach. Repetitive surveys measure changes in profile volume from year to year, providing total beach volume change using the average-end-area method for quantifying sand volume between monitoring stations.

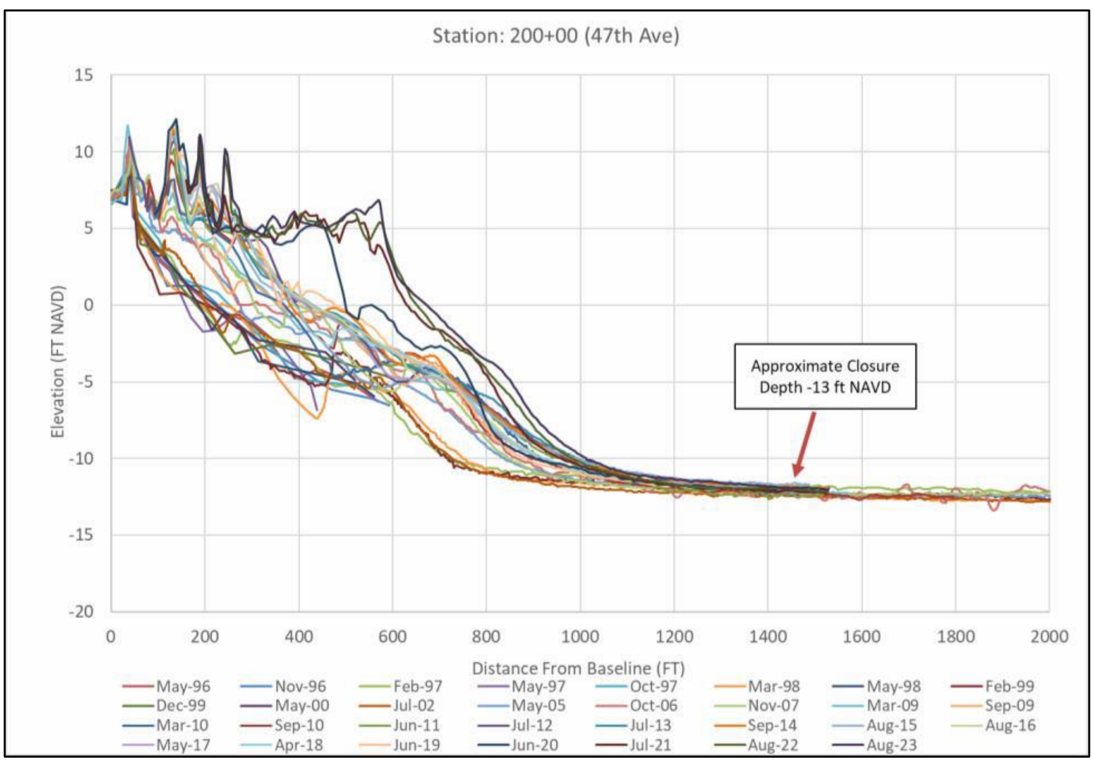


FIGURE 3. Example of "Closure Depth" at Isle of Palms. Repetitive surveys eventually overlap near –13 ft NAVD, which is considered the limit of measurable profile change.

Cross-shore movement of sand within a profile can occur without any net change in beach volume. Sand also moves alongshore due to currents and waves approaching the beach at an angle. This can result in net gains or losses of sand to a given area, resulting in accretion or erosion. Sediments arriving from adjacent sections of a shoreline often control whether a beach is gaining or losing sand, and changes to the sediment supply can create temporary or long-term changes in erosion rates. There are other mechanisms for changing beach volumes, including shoal bypassing, inlet dynamics, nourishment, and storms. When considering short and long-term changes to the beach volume, each of these factors need to be considered to determine the principal cause of erosion and identify appropriate alternatives for restoration.

Figure 4 shows a schematic of beach volumes for various beach conditions along the Isle of Palms in 2023. The profiles show the shape of the beach seaward of the structure line (0 ft on the x-axis). The beach conditions at the various locations represent areas that are eroded (Beachwood East), have a minimum healthy beach profile (9th Ave), and have an excess quantity of sand (Citadel House). The profile at Beachwood presently holds about 340 cy of sand per linear foot and is in a highly eroded condition. Note the volume would be even lower except for additional sand in the lower profile from an approaching shoal. The profile at 9th Ave holds ~380 cy/ft of sand, which is sufficient to hold a modest dune field and dry sand beach at this location. This volume can be considered the minimal healthy beach volume at this location. The profile at Citadel House holds over 700 cy/ft of sand, which is a surplus resulting from sand spreading from the nourishment projects and shoal attachments in Wild Dunes.

Comparison of beach profile volumes aids in beach management planning by providing quantitative erosion rates, determining the required volume to maintain a healthy beach profile, and providing forecasts of beach conditions. The minimum healthy beach volume is a measure of the required sand volume to maintain a healthy beach profile that includes a dune capable of withstanding a significant storm event and a dry sand beach that can accommodate seasonal weather changes without impacting the dune. This volume is site-specific based on beach slope, dune size, and closure depth. Regional closure depths are typically similar, but can be impacted by inlets and shoals, as these features alter the beach slope and wave climate reaching the beach.

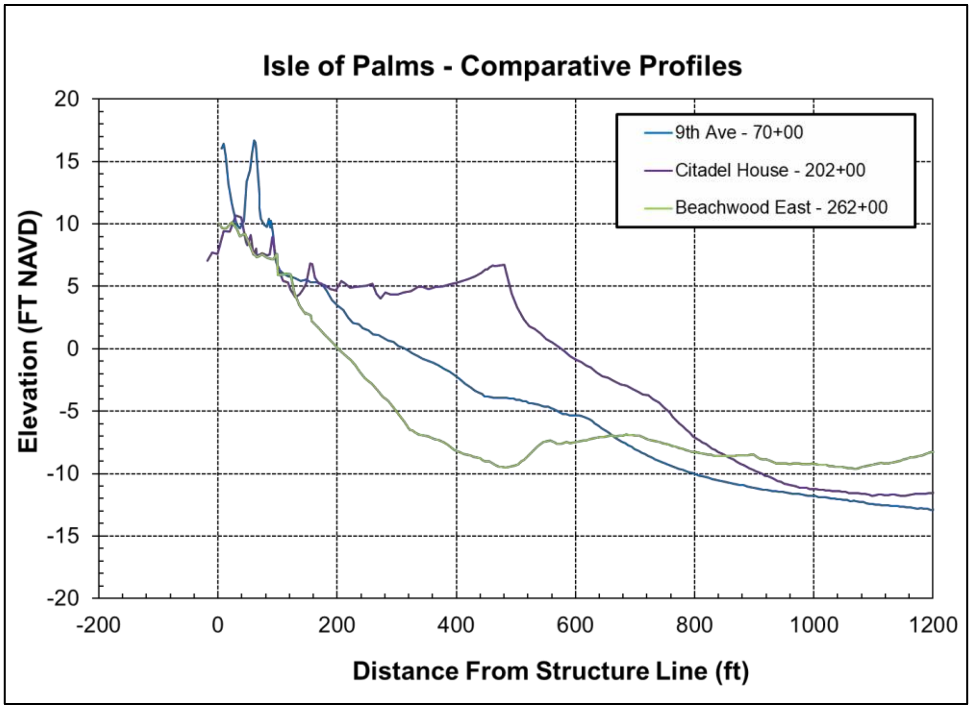


FIGURE 4. Comparative profiles along Isle of Palms showing eroded, healthy, and surplus sand volume conditions.

At Isle of Palms, the minimal healthy beach volume for the areas away from inlets is ~380–400 cy/ft when measured from the structure line to a depth of −13 ft NAVD. This value is based on the equilibrium shape of the beach, dune volume, and historical conditions.

Figure 5 shows the historical beach volume envelope for the Isle of Palms (not including the Dewees Inlet shoreline). The plot shows the maximum and minimum beach volumes measured since 2008, as well as the current volume and average volume between 2008 and 2023/2024. The plot shows the beach volume seaward of the structure line, which results in areas with greater setbacks having higher volumes, and structures that protrude beyond adjacent properties having lower volumes. This means that the volumes may not necessarily reflect erosion trends, but do show relative levels of dune protection across the island. In addition, it's important to note that the localized erosion patterns are highly dynamic near the inlets, and areas that are relatively healthy now may quickly change due to shoal-induced erosion.

The figure includes a line showing the minimum healthy beach volume across the island. At Breach Inlet, the value is higher due to the constant presence of sand in the shallow underwater profile from the northern shoal of Breach Inlet. This increases the total sand volume in the profile measured to −13 ft NAVD. The minimum profile volume decreases at the northern tip of the island, as the sheltering effects of the Dewees Inlet delta create a steeper beach slope, reducing the volume necessary to maintain a healthy profile. Away from the inlets, the minimum healthy profile is ~380 cy/ft.

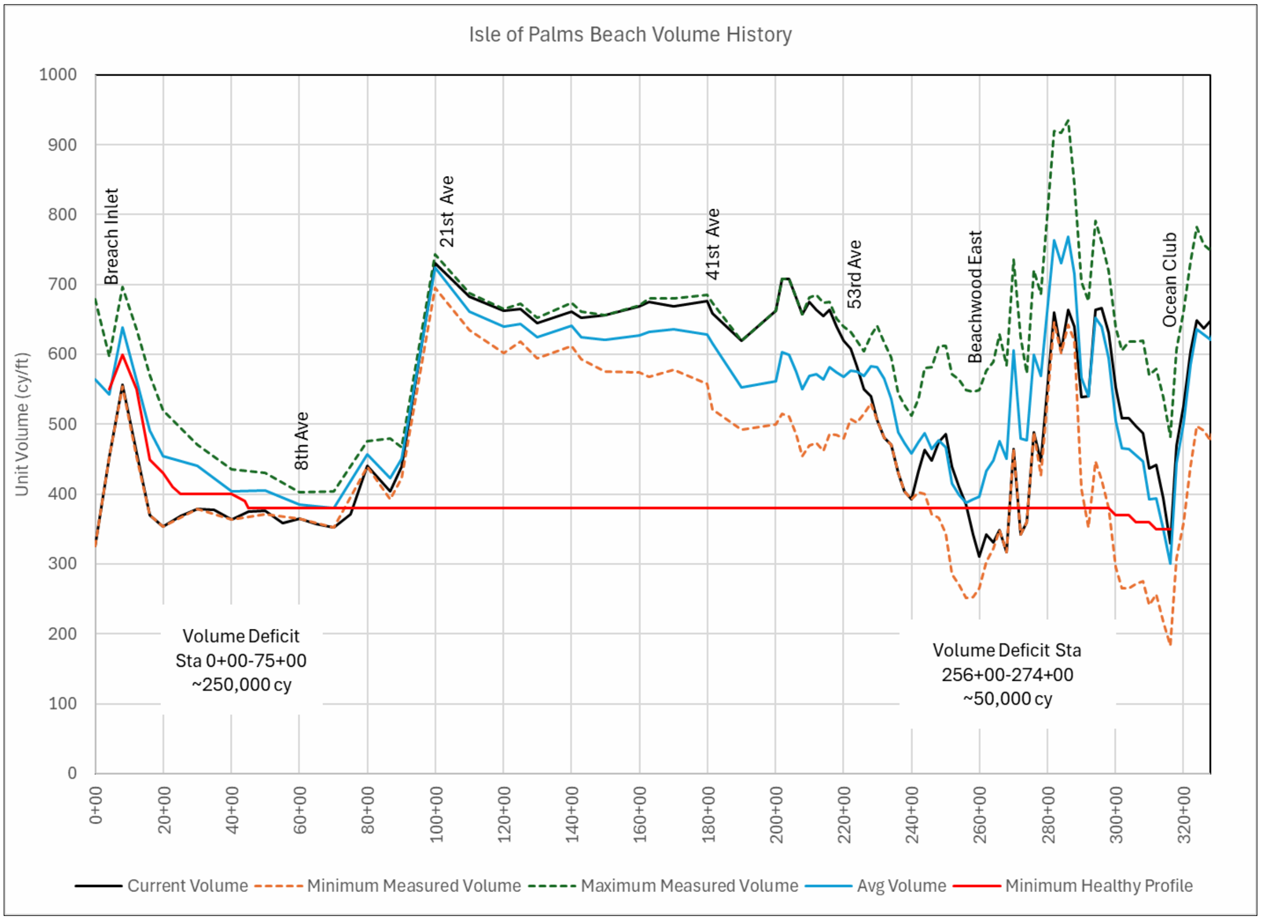


FIGURE 5. Volume summary for Isle of Palms 2009–2024. Note where the current condition (black line) is near the most eroded (orange line) or the healthiest (green line). The red line shows a site-specific minimum healthy beach volume.

The graph shows that the current beach condition is near the minimum measured volume south of the county park. The volume is near the maximum measured volume from the county park to 53rd Ave, and varies north of 53rd Ave as a result of shoal processes. Presently, ~7,500 linear feet (lf) of beach between Breach Inlet and 9th Ave is at or below the minimum ideal volume, as well as ~1,600 lf around Seagrove and Beachwood East in Wild Dunes. The station fronting the Ocean Club building is also just below the threshold volume.

Within the southern erosional area, there is a total sand deficit of ~250,000 cy to reach the minimum healthy condition at all stations. Along the northern erosional area, the current deficit is ~51,000 cy. These volumes would be required to bring the affected beach areas to the minimum healthy volume (this is commonly referred to as the “deficit volume” or “base volume”). Additional volume is required to account for future erosion over the design life of a project to protect this minimally healthy beach. This additional volume is generally referred to as “advance fill.” A beach nourishment project volume is the sum of the deficit volume and advance fill volume.

Figure 6 shows unit volumes for monitoring stations along the southern end of IOP since 2015. The bars show the beach volume for each year at each station, and the variability in erosion and accretion trends is apparent through 2021. Beginning in 2022, an erosional event was beginning, decreasing beach volumes at stations south of 50+00. The erosion accelerated from 2022–2023, leaving stations 8+00–50+00 (Breach Inlet to 6th Ave) below the healthy beach condition. Additional erosion was present in many stations as of March 2024.

The data in Figure 6 are useful in trying to predict future volume change where erosional patterns are generally consistent. It is more difficult to predict when a beach may reach the minimum healthy volume when erosion patterns vary, as in the case of the south end of IOP. Volumes fluctuate up and down from year to year before falling off dramatically in 2023. Figure 7 shows a similar graphic from beach monitoring at Edisto Beach, SC. Here, the areas represented by Reaches 1–4 are the main project area and show relatively consistent erosion trends since the last nourishment was constructed in 2017. This makes forecasting future beach conditions easier, as annual losses can be projected with more confidence.

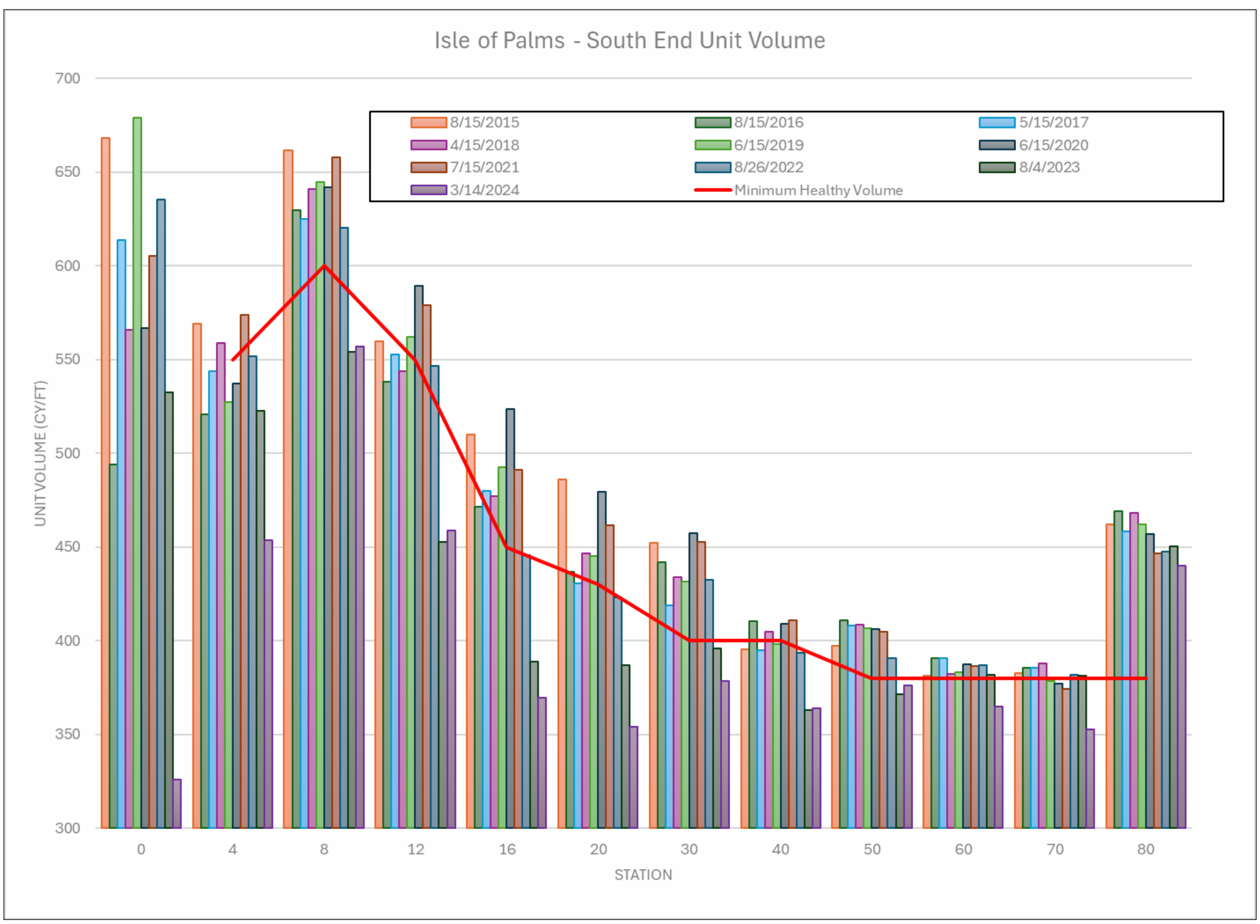


FIGURE 6. Beach Unit Volumes for the southern area of Isle of Palms. The local minimum healthy beach condition is shown in red. Note the dynamic trend south (left) of station 50 due to effects of Breach Inlet. Volume trends become more consistent away from the inlet (Stations 50–80).

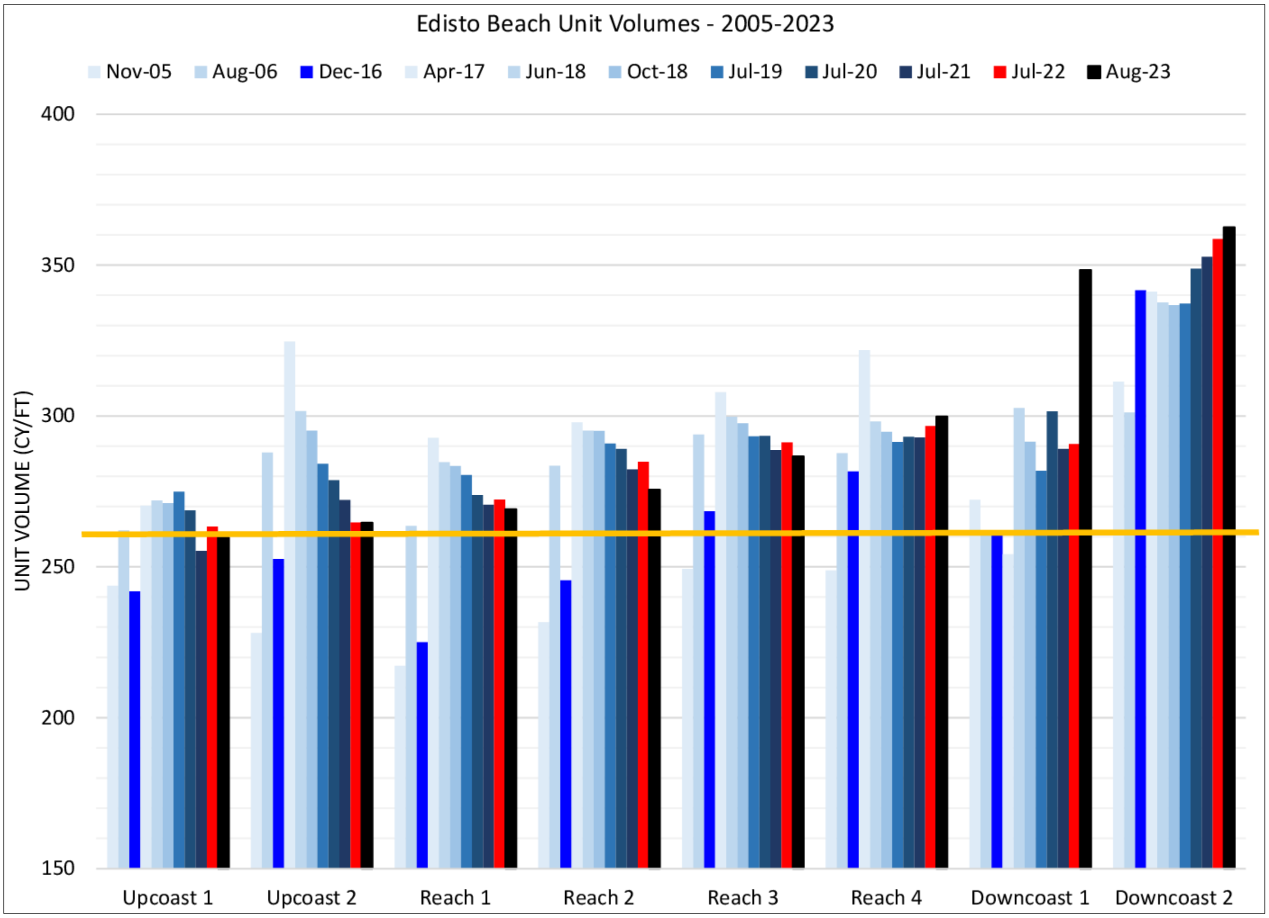


FIGURE 7. Beach Unit Volumes along Edisto Beach. Here, Reaches Upcoast 2 - Reach 3 represent the shoreline away from inlets and erosional trends are fairly consistent and predictable.

Figure 8 shows beach volumes combined into monitoring reaches used in prior reports to the City. The plot includes the minimum healthy beach volume for each reach. Assessing beach volumes by reach simplifies volume trends by eliminating highly localized spatial and temporal changes, but can mask erosional hotspots if the reaches include areas of varying beach condition. For example, Reach 5 includes healthy sections of beach north of 53rd Ave, as well as eroded sections near Beachwood East. The total volume may indicate a healthy beach, but areas within the reach may have less volume. The plot shows that Reach 1 is well under the minimum healthy volume, and Reach 2 is trending towards the minimum volume from 2018 to 2023, with a substantial decrease observed from August 2023 to March 2024, bringing the volume to below the minimum healthy condition. Along the center portions of the island (Reaches 3 and 4), the volumes have trended up since 2007, with only a few instances of annual decreases observed. At reaches 5 and 6 (north of 53rd Ave), the beach volumes decrease rapidly, then increase with nourishment (2008 and 2018). Note the volume increase from 2014 to 2016 in Reach 6 resulting from a large shoal attachment. For these reaches, a review of individual station volumes provides a better assessment of volume deficits.

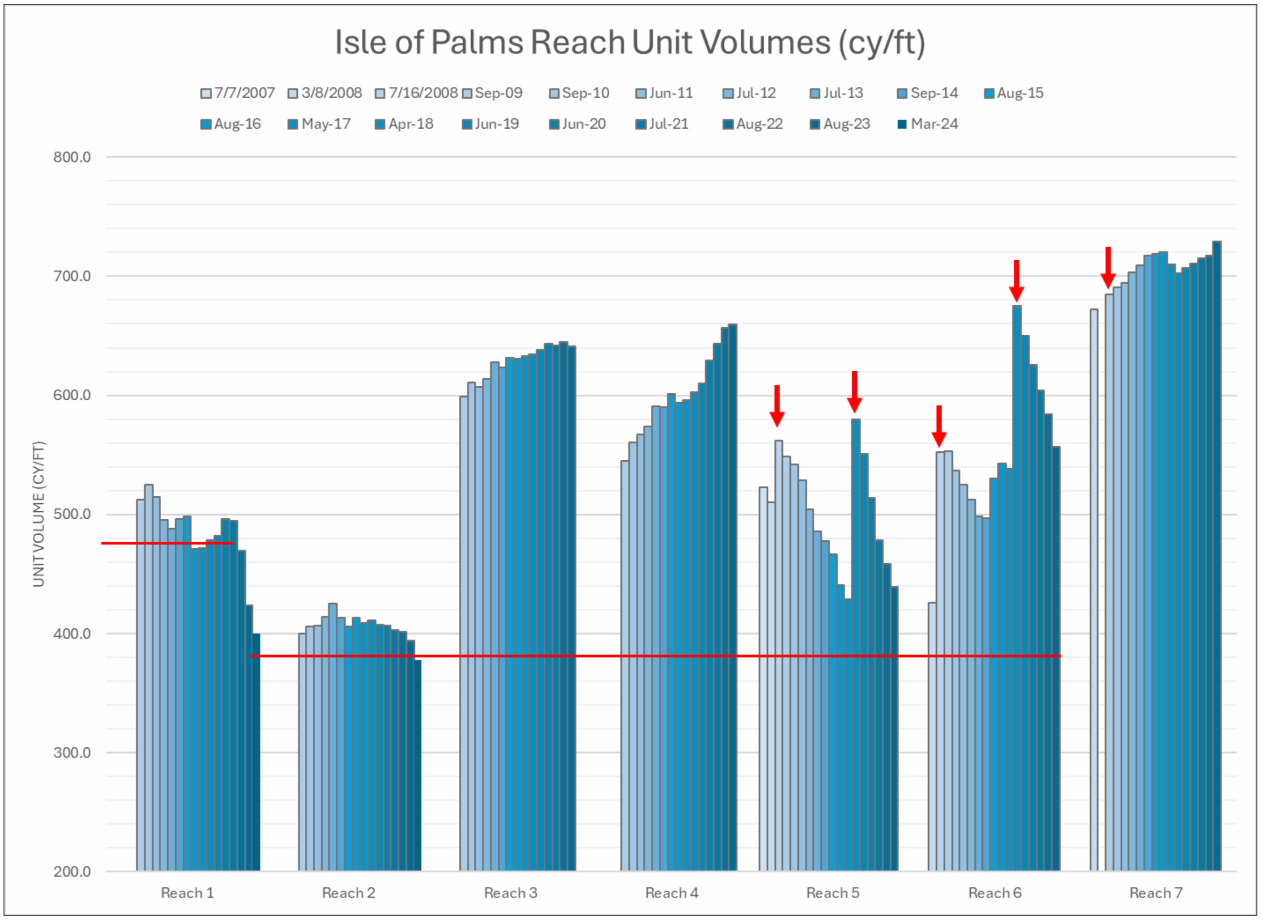


FIGURE 8. Reach Unit Volumes at Isle of Palms. Minimum healthy beach volumes are shown in the red line.

Table 1 shows erosion measures for the south end of Isle of Palms, covering the time period from 2018–2024. As mentioned previously, erosion has accelerated over the past two years, which has significantly increased erosion rates compared to historical averages. Collectively, the area south of station 80+00 has lost an average of 68,000 cy each year since 2018. This compares to a loss of 13,500 cy per year between 2009 and 2018. Should this level of erosion persist, artificial nourishment of 680,000 cy every ten years would be required to maintain the shoreline position. CSE believes the recent rates will return closer to the historical average, but with additional sea-level rise, there is a probability that future rates will be greater than the 2009–2018 rate.

At the north end, erosion has averaged ~250,000 cy per year since nourishment in 2018. This has been a very high rate of loss; however, much of the volume loss is attributable to the loss of shoal sand as well as nourishment, and much of the 2018 project area remains in good condition. A new shoal is nearing attachment, which will reduce erosion rates over the next two years. A better indication of long-term changes that include periodic shoal attachments can be estimated by comparing losses occurring from 2008–2017. This period represents the post-2008 nourishment to the pre-2018 condition and includes erosion of project sand and attachment of multiple shoal events. Over that time, reaches 5–6 lost a total of 865,000 cy of sand, or ~98,000 cy per year. This is a more realistic long-term erosion rate for the north end; however, the variability and dependence on shoals cannot be understated.

Presently, the area between the northern end of the Grand Pavilion and Dunecrest Lane has lower volumes than the minimum healthy beach volume. The City is pursuing a shoal-management permit to mitigate erosion in this area.

TABLE 1. Volume change measures for the south end of Isle of Palms.

Station	Deficit Vol (cy/ft)	Erosion Rate 2018-2023/24 (cy/ft per year)	Annual Losses (cy/yr)	Total Deficit Vol (cy)	10-yr erosion volume (cy)
3100					
3105					
0					
4	−96.3	−17.78	−6,398	−27,860	63,976
8	−43	−14.21	−5,708	−26,820	57,082
12	−91.1	−14.33	−6,492	−34,280	64,923
16	−80.3	−18.13	−6,749	−31,260	67,491
20	−76	−15.61	−6,153	−26,875	61,535
25	−31.5	−9.00	−4,582	−13,225	45,819
30	−21.4	−9.33	−4,332	−10,825	43,319
35	−21.9	−8.00	−3,732	−14,500	37,321
40	−36.1	−6.93	−3,607	−10,375	36,071
45	−5.4	−7.50	−3,248	−2,325	32,480
50	−3.9	−5.49	−2,373	−6,225	23,730
55	−21	−4.00	−1,735	−9,050	17,351
60	−15.2	−2.94	−1,735	−9,600	17,351
65	−23.2	−4.00	−2,483	−12,650	24,828
70	−27.4	−5.93	−2,733	−9,200	27,328
75	−9.4	−5.00	−2,450	−2,350	24,498
80		−4.80	−1,608	0	16,077
Total			**−67,993**	**−247,420**	**679,927**

NOURISHMENT REQUIREMENTS

Beach monitoring efforts show that the total sand quantity along the Isle of Palms increased by 854,000 cy between 2008 (pre-nourishment) and 2023. This includes the placement of ~900,000 cy in 2008 and 1.6 million cy in 2018. Without these two projects, the volume change along IOP would be a net loss of ~1.7 million cy. Reaches 3, 4, (Sea Cabins Pier to 53rd Ave), and 6 and 7 (north of WD Property Owners Beach House) currently have more sand than the pre-2008 condition, while reaches 1–2 (south of Sea Cabins Pier) show a net loss of ~736,000 cy and Reach 5 (53rd Ave to Property Owners Beach House) has lost 424,000 cy.

The values above show that localized erosion trends within certain areas of the Isle of Palms can be distinct from total island changes. While the north end is more dynamic, with periods of erosion and accretion and high spatial variability within the reaches, the south end has had high erosion rates over the past two years. Despite the gains in the upcoast areas, insufficient sand has moved south from the central part of the island to compensate for losses to Breach Inlet.

To keep pace with erosion rates observed since 2018, the City will need to supplement an average of ~68,000 cy of sand per year along the south end, and ~100,000 cy of sand per year at the north end. Over a 10-year period, these loss rates translate into 680,000 and 1,000,000 cy projects, assuming there is a minimal healthy beach volume at the start of the project. Any deficit volume would be added to these values to bring all sections of the beach up to the same condition at project completion.

CSE recommends the City plan for nourishment projects at 8–10 year intervals based on current erosional trends, the performance of prior projects, and a general desire to limit the number of mobilizations and construction impacts. The City can establish triggers to aid in decision-making on when to move forward with a project; however, CSE recommends that any trigger allow for flexibility to accommodate the unique beach condition at the time, stage of shoal attachments, dredger availability, and storm impacts. Example triggers could be when a certain length of beach is projected to reach the minimum healthy beach condition within the next 12–24 months, a project would be considered. This could include separate triggers to aid in determining whether to move forward with a shoal management project, or a large-scale project at the north end.

A shoal project could be triggered by a smaller length of affected beach (on the order of 1,500–2,000 ft), with a caveat that the beach and shoal conditions meet permit conditions for buffers. A large-scale project could be triggered by a larger length of beach reaching a set volume above the minimum healthy profile. One example would be if 5,000 ft of beach at the east end averaged less than 430 cy/ft (50 cy/ft above minimum), then a large-scale project could be pursued (again, with a caveat that the specific conditions at the time would need to be considered).

The pending USACE project will add ~500,000 cy of sand to the southern end of IOP, restoring the deficit volume and providing an additional ~4 years' worth of erosion at recent rates. CSE is optimistic that this project will restore a dry sand beach to all areas south of the pier and allow for future dune growth following the City's supplemental efforts in connection with the USACE project. For cost projections, CSE assumes that the USACE project will accomplish restoring the existing deficit volume at the south end.

Nourishment costs are driven by several factors, summarized below:

1) Mobilization – Mobilization of an ocean-certified dredge can range from $3–5 million or more depending on the amount of pipe required (distance to borrow area and length of shore pipe), dredge proximity, fleet availability, season, and local factors such as equipment access
2) Efficiency of borrow area – closer borrow areas with deeper available cuts, high-quality sand, and efficient layout can reduce costs. Reduced uncertainties about sediment quality and weather allow for better confidence and lower costs
3) Fill density – Larger fill volumes are typically more efficient to construct on the beach
4) Season – Typically, the summer season provides better weather conditions and more fleet availability; however, sea turtle concerns may impact permitting
5) Contract requirements – Insurance, wage, tolerances, or other requirements placed on contractors may increase costs

At Isle of Palms, prior nourishment projects have generally been bid at lower unit volumes compared to other projects in the state. For example, the unit cost for the 2018 project was $6.15 per cy, along with mobilization of ~$3.5 million. Comparable projects at nearby areas have cost $11–12 per cy (Pawleys Island 2020, Edisto Beach 2017, DeBordieu Beach 2022). For planning purposes, and with considerations for inflation and higher construction prices over the past few years, CSE anticipates unit pumping costs for the next five years at IOP to be $10–12 per cy with mobilization of $4–5 million.

CSE recommends the City pursue a plan that allows for concurrent nourishment of the north and south ends (if necessary) to greatly reduce mobilization costs compared to separate projects. A joint project would require the dredge equipment to shift from one end of the island to the other, and would likely require a separate borrow area for the south end; however, these types of shifts are common to offshore dredging projects and would not result in a significant increase in mobilization costs. Constructing the projects separately would require full mobilization costs for each project.

Table 2 provides a 30-year example of a nourishment scenario, assuming the erosion losses discussed above. It includes a 3% inflation factor for mobilization and sand placement. CSE would recommend a contingency volume to account for storm events or higher-than-normal erosional periods to modify any particular project. In addition, should a major storm impact the beach, FEMA may reimburse the City to replace losses caused by the storm. For a combined project, CSE estimates that an initial project for both ends of the island would cost ~22 million dollars. Future project costs are shown assuming the 3% inflation.

TABLE 2. Example cost scenario for joint offshore projects at the north and south end over a 30-year period. A 3% inflation factor is assumed.

	Unit Cost	Volume (cy)	Total Cost - Year	Year 10	Year 20	Year 30
Mobilization	$ 5,000,000.00		$ 5,000,000.00	$ 6,719,581.90	$ 9,030,556.17	$ 12,136,312.36
North End Placement	$ 10.00	1,000,000	$ 10,000,000.00	$ 13,439,163.79	$ 18,061,112.35	$ 24,272,624.71
South End Placement	$ 10.00	680,000	$ 6,800,000.00	$ 9,138,631.38	$ 12,281,556.40	$ 16,505,384.80
Total Project		1,680,000	$ 21,800,000.00	$ 29,297,377.07	$ 39,373,224.92	$ 52,914,321.87

Funding plans should consider potential partnerships with the state, as all the south end, and a portion of the north end would qualify for state beach nourishment assistance, if available. Note that presently, there are little remaining funds in the state's beach nourishment fund. Additionally, private funding from the Wild Dunes community may be available for cost-sharing of work completed within Wild Dunes.

Nourishment via offshore dredge with placement at both ends of the island provides the most cost-effective, large-scale alternative for long-term beach management. These projects allow for predictable planning schedules, costs, and outcomes (with the caveat that periodic maintenance shoal projects may be required at the east end). The only other alternative for large-scale nourishment (>400,000 cy) at the south end is a project that would dredge sand from the shoals of Breach Inlet. This project could have lower pumping costs due to a shorter pump distance; however, it would still require high mobilization costs for an "ocean-certified" dredge. While altering the inlet could alleviate some of the present morphologic conditions that are drawing sand off the south end, there may be unintended consequences of large-scale alterations of the inlet to both Isle of Palms and Sullivan's Island. Also, after permitting and funding are secured, natural changes in the inlet system may create conditions where relocating a channel is not as effective as if it were constructed today.

There may be several opportunities for modest-scale projects via beneficial use projects from the Intracoastal Waterway and/or adjacent creeks, especially at the south end. The USACE intends to place sand directly from the waterway in future years if the upcoming project proves successful and the material is beach-compatible. This may add several hundred thousand yards of sand whenever the waterway is dredged. If federal funds are not available, the City can partner with the USACE to sponsor a project for the benefit of IOP. A modest-scale waterway project may cost $3–6 million, with the high range due to variable volume scenarios. The upcoming USACE project will be constructed for just under $10 million, but involves a larger volume than typical waterway dredging and involves clearing deposition basins and the double handling of material. More typical waterway dredging projects would cost less.

Should the erosion rate along the south end return to historical trends, it's likely that the beach can be maintained with infrequent smaller-scale projects. Future monitoring will be critical for determining the necessary mitigation plan. Ultimately, analysis of the unit cost for the different alternatives should be considered. Due to economies of scale, and mobilization being required for offshore projects at the east end, nourishment via offshore dredging likely has similar or lower unit cost as smaller-scale beneficial use projects (if not paid for by the USACE).

CSE recommends that the City seek permits well in advance of potential construction windows to allow for as much flexibility as possible. Permits can take 12–18 months to receive after submission of all necessary documentation. Engineering and sand searches may take 6–12 months prior to submission of an application. Initial planning for an offshore dredging permit should start 3–4 years after the last project is completed so that a permit is issued in year 5 or 6. With a 5-year life, the permit would allow for construction to occur anytime between years ~6 and 11, which allows for flexibility to account for unexpected changes in erosion trends, storm impacts, shoal attachments, and contractor availability.

REFERENCES

Gaudiano, DJ. 1998. Shoal bypassing in South Carolina tidal inlets: geomorphic variables and empirical predictions for nine inlets. Technical Report, Dept. Geol., Univ. South Carolina, Columbia, 182 pp.

Hayes, MO. 1979. Barrier island morphology as a function of tidal and wave regime. In S Leatherman (ed), Barrier Islands, Academic Press, New York, NY, pp 1-26.

North End Annual Erosion Rate	150,000	cy/yr								
South End Annual Erosion Rate	70,000	cy/yr								
Inflation Rate	1.03									
		Interval (yr)	**Volume (cy)**	**Cost Year 0**	**Year 8**	**Year 16**	**Year 24**	**Year 32**	**Total Cost ($)**	**Total Sand Volume Placed**
Mobilization	5,000,000	8		5,000,000	6,333,850	8,023,532	10,163,971	12,875,414	42,396,767	
North End Placement	10	8	1,200,000	12,000,000	15,201,241	19,256,477	24,393,529	30,900,993	101,752,241	6,000,000
South End Placement	10	8	560,000	5,600,000	7,093,912	8,986,356	11,383,647	14,420,463	47,484,379	2,800,000
Total Project		Total	1,760,000	22,600,000	28,629,004	36,266,366	45,941,147	58,196,870	191,633,386	8,800,000

North End Annual Erosion Rate	150,000	cy/yr								
South End Annual Erosion Rate	70,000	cy/yr								
Inflation Rate	1.03									
		Interval (yr)	**Volume (cy)**	**Cost Year 0**	**Year 10**	**Year 20**	**Year 30**		**Total Cost ($)**	**Total Sand Volume Placed**
Mobilization	5,000,000	10		5,000,000	6,719,582	9,030,556	12,136,312		32,886,450	
North End Placement	10	10	1,500,000	15,000,000	20,158,746	27,091,669	36,408,937		100,159,351	6,000,000
South End Placement	10	10	700,000	7,000,000	9,407,415	12,642,779	16,990,837		46,741,031	2,800,000
Total Project		Total	2,200,000	27,000,000	36,285,742	48,765,003	65,536,087		179,786,832	8,800,000

Note volume requirements are based on the annual loss rate multiplied by the time interval between nourishments.

City of Isle of Palms, SC
Beach Preservation Ad Hoc Committee
Recommended Triggers to Initiate Consideration by Council

EXHIBIT 2

The Beach Preservation Ad Hoc Committee suggested City Council consider implementing different scale projects as follows:

1. City Council should consider implementing midscale projects (sand recycling, shoal management or other):

    a. when beach monitoring forecasts show 1500 linear feet of beach is projected to reach the Minimum Healthy Beach Volume within the next 12 months (see Figure 5, page 10 of this report)

    b. when beach monitoring forecasts show 1500 linear feet of beach is projected to have a dune width of 75' within the next 12 months.

    c. always have permits in hand when this need arises

2. City Council should consider implementing large-scale offshore dredging renourishment projects:

    a. when beach monitoring forecasts show one mile of beach is projected to reach the Minimum Healthy Beach Volume within the next 12 months

    b. when beach monitoring forecasts show the beach is projected to have a dune width of 50' within the next 12 months.

    c. always have permits in hand when this need arises

EXHIBIT 2

Isle of Palms Beach Nourishment
Potential Revenue Opportunity Summary
Draft for Discussion Only
As of September 26, 2024

Summary of Beach Nourishment Revenue Sources by Category
EXHIBIT 3

	ARPU	Units	FY24 Forecast Baseline	Assumption	Input	Potential Revenue	Notes/Comments
Net Revenue from Beach Nourishment Fund @ 1% of ATAX (excludes Grant)			$ 732,595			$ 732,595	Based on FY2024 Revenue Forecast
[green] = Input							
Sub-Total Existing IOP Funding			$ 732,595			$ 732,595	
Increase Parking Lot Fees	$ 1,485	493	$ 732,003	15% Increase	15%	$ 109,800	Based on FY2024 Forecast, Units from LBMP
Increase Parking Meter Fees	$ 4,049	155	$ 627,594	15% Increase	15%	$ 94,139	Based on FY2024 Forecast, Units from LBMP
Charge for Parking in Beach District			$ -	Add New Spots	300	$ 222,719	Uses 50% of ARPU In Parking Lots (not meter)
Property Tax Increase			$ 4,336,509	Rollback Assumption (3yr)	$ 782,000	$ 782,000	$91 increase for 4%, $166 increase for 6% per $1M Assessment - IOP
Increase Building Permit Fees			$ 569,519	15% Increase	15%	$ 85,428	Based on FY2024 Revenue Forecast
Increase Business License Fees (2048 Licenses)			$ 2,581,385	15% Increase	15%	$ 387,208	Based on FY2024 Revenue Forecast
Increase Short Term Rental License Fees (1,800 Licenses)			$ 1,869,052	15% Increase	15%	$ 280,358	Based on FY2024 Revenue Forecast
On-Beach Business Franchise Fees			$ -			$ 50,000	
Establish Beach Service or User Fee per Sec 6-1-330			4610	$150 fee per dwelling	150	$ 691,500	4,610 dwellings per Charleston County records 2023
Sub-Total IOP City Council Controllable - New Revenue			$ 10,716,062			$ 2,011,652	Assumes all new revenue increases are allocated to future beach projects
Re-allocation of existing tourism revenue for beach projects							
Allocation % of State ATAX (Non-30% $) to Beach Preservation Fund			$ 2,371,945	5% Allocation	5%	$ 118,597	Based on FY2024 Revenue Forecast
Allocation % of Muni ATAX to Beach Preservation Fund			$ 2,455,590	5% Allocation	5%	$ 122,780	Based on FY2024 Revenue Forecast
Allocation % of Hospitality Tax to Beach Preservation Fund			$ 1,551,058	5% Allocation	5%	$ 77,553	Based on FY2024 Revenue Forecast
Sub-Total of Re-allocation of existing tourism revenue for beach projects			$ 6,378,593			$ 318,930	
Wild Dunes Beach Nourishment Funding			$ -	TBD	0	$ -	No formal cost share agreement in place. City covered 18% in 2008 and 14% in 2018.
Sub-Total Wild Dunes Controllable			$ -			$ -	
REQUIRES CHANGES TO STATE LAW. SOURCES NOT CURRENTLY AVAILABLE							
Establish Statewide Beach Nourishment Fund			$ 850,000	Replenish Fund/Spend	$ 850,000	$ 850,000	Requires change to state law. Based on SCPRT grant received in FY24.
Cap % state atax used for tourism promo (currently 30%)			$ 1,094,744	Capped at 30% Share	70%	$ 766,321	Requires change to state law
Request Specific State Funds for IOP (PRT/Campsen $)			$ -	Same Every Year	$ 1,000,000	$ 1,000,000	Based on FY2025 approved state budget allocation. Requires state action during budget process.
Additional 1% local ATAX $ 1,758,152 (FY25 Budget 1% Muni Atax)			$ -	1%	$ 1,758,152	$ 1,758,152	Based on FY25 Muni ATAX. Increase requires change to state law
Establish Municipal Improvement District (MID)			$ -	TBD	TBD		Requires change to state law
Real Estate Transfer Fee (Total RE sales 2023 $457,563,099)			$ -	0.25%	$ 457,563,099	$ 1,143,908	Requires change to state law. Currently, Hilton Head only community w real estate trasfer fee
Sub-Total State Controllable			$ 1,944,744			$ 5,518,381	
REQUIRES FEDERAL GOVMT. APPROVAL. SOURCES NOT CURRENTLY AVAILABLE							
Pursue USACE Federal Assistance			$ -	TBD	TBD	$ -	Depend on either becoming federal funded beach or receiving FEMA funds after named storm (Cat. G eligibility)
Federal Beach Nourishment Assistance - Federal Lobbyists/Legilature			$ -	TBD	TBD	$ -	Need House/Senate Rep Assistance
Sub-Total Federal Controllable			$ -				
Total of Potential Revenue Opportunity Categories - Short/Long Term			$ 19,771,994			$ 7,848,962	

EXHIBIT 3

City of Isle of Palms, SC
Beach Preservation Ad Hoc Committee
Beach Nourishment Planning Model Assumptions

EXHIBIT 4

The Beach Preservation Ad Hoc Committee suggested City Council consider using the following assumptions in the financial planning for future nourishment projects:

- The Beach Preservation Fee Fund nets about $700K annually
- Frequency of large-scale nourishment projects - every 8 years for 32 years
- City's cost share of projects in Wild Dunes should equal WD's contribution to the Beach Preservation Fund (45% in 2024)
- No state or federal grants
- Revenue growth assumption 2% and expenses growth assumption at 3%.
- Project cost assumes 3% increase
- Does not include cost or frequency of small-scale shoal management projects
- Maintain $2M in Fund Balance

EXHIBIT 4

Financial Model Assumptions – Pages 2-4

1. Project timing & frequency – 2026 through 2050, 8-year cadence
2. Project funding type – Cash
3. Project cost growth rate – 3% annual
4. Beach preservation fund expenditures growth rate – 3% annual
5. Beach Preservation fund revenue growth rate – 2% annual
6. Wild Dunes/City cost share (mobilization/demobilization and north end project)– 55% (WD), 45% (Cit)
7. Beach Preservation Fund Balance – $2M target
8. No state or federal funding/grants
9. No additional city revenue.

   *Pages 29-30 show fund balance projections with assumption of additional city revenue of $1M starting in 2026 with a 2% growth rate starting in 2028 +

City of Isle of Palms, SC

Beach Renourishment Planning Model

Dashboard

Projects Under Consideration

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
On/Off	Description	Current Amount	Timing (FY)	Inflation Rate	Inflated Amount	City %	Wild Dunes %	Grant %	Net City Funding Amount	Funding Type	Structure	Term	Principal Deferral	Rate
On	**Project 1**								-					
On	Large Offshore Beach Inlet	5,600,000	2026	0.00%	5,600,000	100.00%	0.00%	0.00%	5,600,000	Cash	Level D/S	8	0	4.00%
On	Large Offshore MOB / DEMOB	5,000,000	2026	0.00%	5,000,000	45.00%	55.00%	0.00%	2,250,000	Cash	Level D/S	8	0	4.00%
On	Wild Dunes Offshore	12,000,000	2026	0.00%	12,000,000	45.00%	55.00%	0.00%	5,400,000	Cash	Level D/S	8	0	4.00%
Off									-					
On	**Project 2**								-					
On	Large Offshore Beach Inlet	5,600,000	2034	3.00%	7,093,912	100.00%	0.00%	0.00%	7,093,912	Cash	Level D/S	8	0	4.00%
On	Large Offshore MOB / DEMOB	5,000,000	2034	3.00%	6,333,850	45.00%	55.00%	0.00%	2,850,233	Cash	Level D/S	8	0	4.00%
On	Wild Dunes Offshore	12,000,000	2034	3.00%	15,201,241	45.00%	55.00%	0.00%	6,840,558	Cash	Level D/S	8	0	4.00%
Off									-					
On	**Project 3**								-					
On	Large Offshore Beach Inlet	5,600,000	2042	3.00%	8,986,356	100.00%	0.00%	0.00%	8,986,356	Cash	Level D/S	8	0	4.00%
On	Large Offshore MOB / DEMOB	5,000,000	2042	3.00%	8,023,532	45.00%	55.00%	0.00%	3,610,589	Cash	Level D/S	8	0	4.00%
On	Wild Dunes Offshore	12,000,000	2042	3.00%	19,256,477	45.00%	55.00%	0.00%	8,665,415	Cash	Level D/S	8	0	4.00%
Off									-					
On	**Project 4**								-					
On	Large Offshore Beach Inlet	5,600,000	2050	3.00%	11,383,647	100.00%	0.00%	0.00%	11,383,647	Cash	Level D/S	8	0	4.00%
On	Large Offshore MOB / DEMOB	5,000,000	2050	3.00%	10,163,971	45.00%	55.00%	0.00%	4,573,787	Cash	Level D/S	8	0	4.00%
On	Wild Dunes Offshore	12,000,000	2050	3.00%	24,393,529	45.00%	55.00%	0.00%	10,977,088	Cash	Level D/S	8	0	4.00%
Off									-					
Off									-					
Off									-					
Off									-					
Off									-					
Off									-					

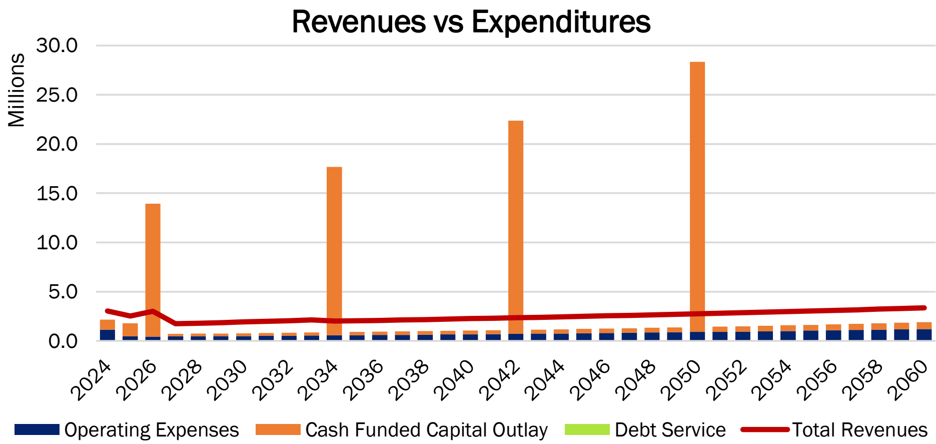
City of Isle of Palms, SC

Beach Renourishment Planning Model

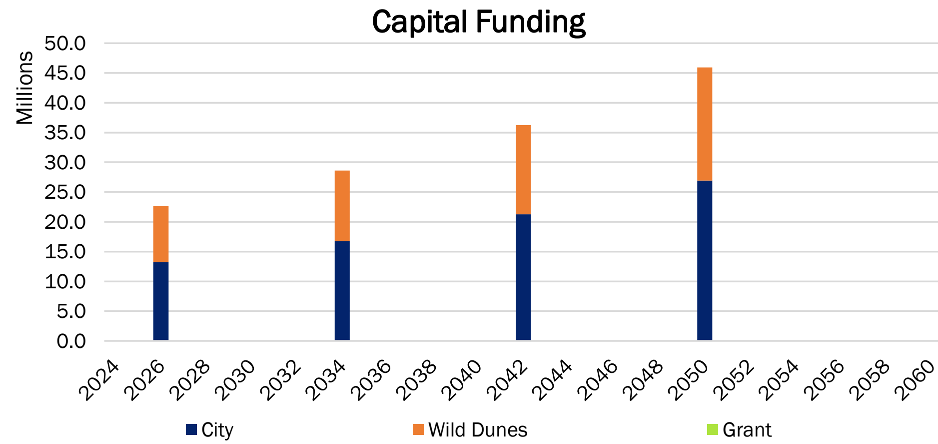
Dashboard

	Fund Balances		Debt Service Coverage
Target		2,000,000	1.00x
16	17	18	19
FY	Annual Surplus (Deficit)	Fund Balance	Debt Service Coverage
Total			
2024	868,787	9,214,510	-
2025	732,596	9,947,106	-
2026	(10,947,055)	(999,948)	-
2027	1,033,338	33,389	-
2028	1,060,799	1,094,188	-
2029	1,101,086	2,195,275	-
2030	1,142,433	3,337,708	-
2031	1,184,861	4,522,569	-
2032	1,228,390	5,750,959	-
2033	1,273,042	7,024,000	-
2034	(15,655,580)	(8,631,580)	-
2035	1,142,942	(7,488,638)	-
2036	1,156,773	(6,331,865)	-
2037	1,170,610	(5,161,255)	-
2038	1,184,446	(3,976,809)	-
2039	1,198,270	(2,778,539)	-
2040	1,212,075	(1,566,464)	-
2041	1,225,851	(340,613)	-
2042	(20,022,771)	(20,363,383)	-
2043	1,253,279	(19,110,105)	-
2044	1,266,909	(17,843,196)	-
2045	1,280,468	(16,562,728)	-
2046	1,293,946	(15,268,782)	-
2047	1,307,329	(13,961,453)	-
2048	1,320,604	(12,640,849)	-
2049	1,333,760	(11,307,089)	-
2050	(25,587,742)	(36,894,831)	-
2051	1,359,652	(35,535,179)	-
2052	1,372,358	(34,162,821)	-
2053	1,384,885	(32,777,936)	-
2054	1,397,214	(31,380,722)	-
2055	1,409,329	(29,971,393)	-
2056	1,421,211	(28,550,182)	-
2057	1,432,842	(27,117,340)	-
2058	1,444,201	(25,673,139)	-
2059	1,455,269	(24,217,870)	-
2060	1,466,024	(22,751,846)	-

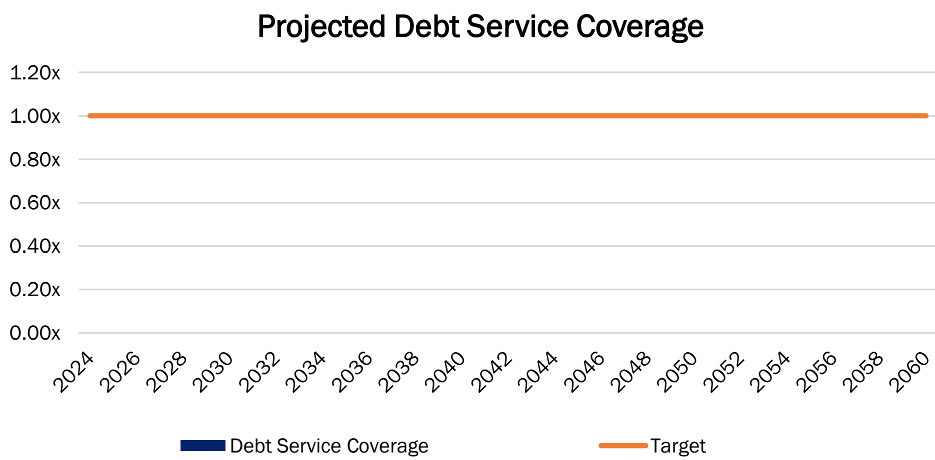
Start Year	2024
End Year	2060



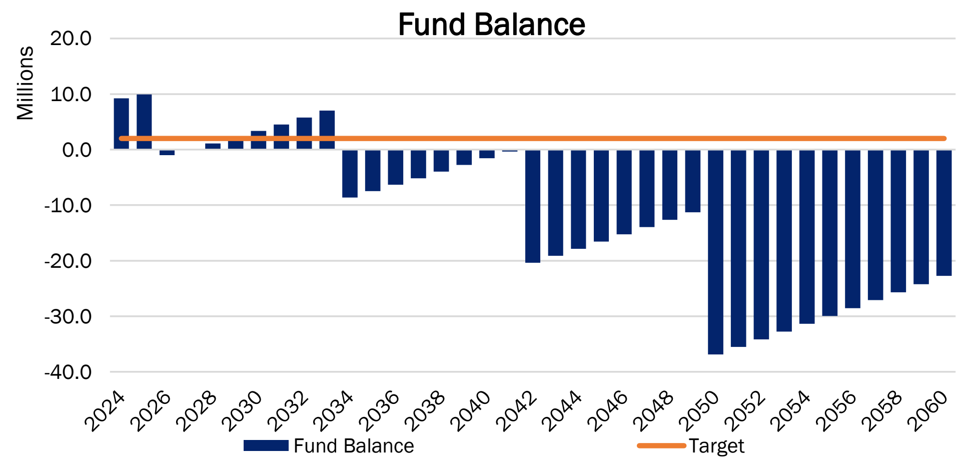
Start Year	2024
End Year	2060



Start Year	2024
End Year	2060



Start Year	2024
End Year	2060



City of Isle of Palms, SC

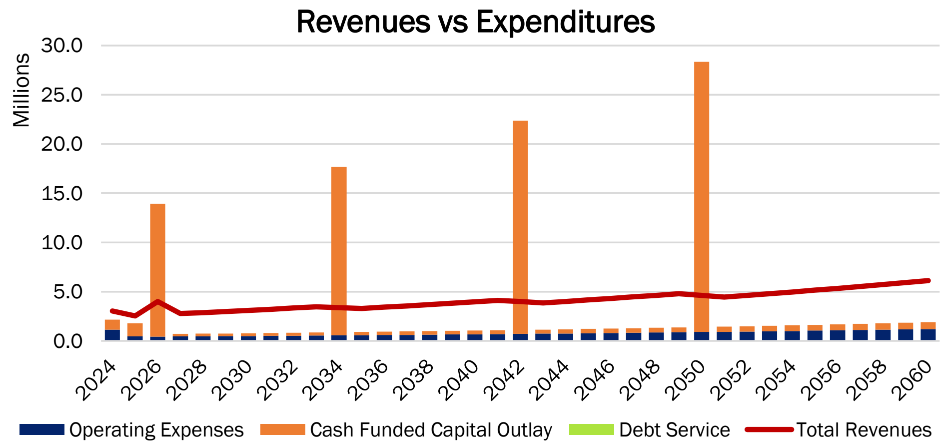
Beach Renourishment Planning Model

Dashboard

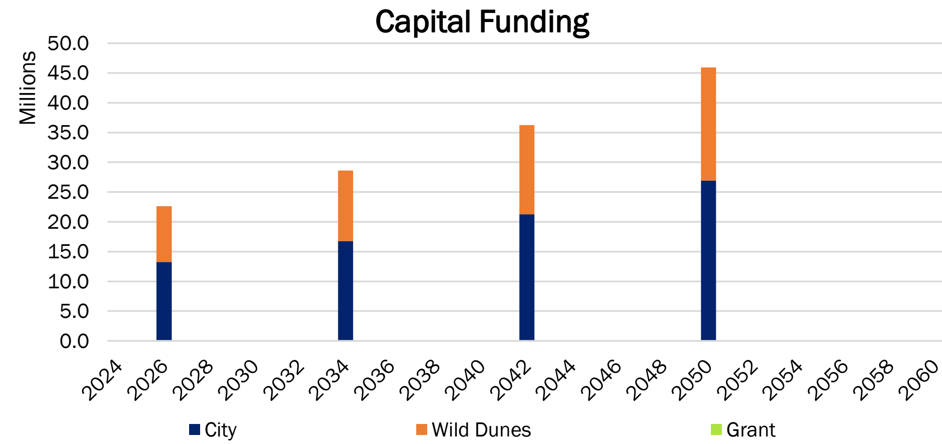
	Fund Balances		Debt Service Coverage
Target		2,000,000	1.00x
16	17	18	19
FY	Annual Surplus (Deficit)	Fund Balance	Debt Service Coverage
Total			
2024	868,787	9,214,510	-
2025	732,596	9,947,106	-
2026	(9,947,055)	52	-
2027	2,058,756	2,058,807	-
2028	2,144,184	4,202,992	-
2029	2,232,211	6,435,203	-
2030	2,322,905	8,758,108	-
2031	2,416,333	11,174,441	-
2032	2,512,569	13,687,010	-
2033	2,611,682	16,298,692	-
2034	(14,280,763)	2,017,929	-
2035	2,393,982	4,411,911	-
2036	2,491,562	6,903,472	-
2037	2,592,062	9,495,534	-
2038	2,695,556	12,191,090	-
2039	2,802,120	14,993,210	-
2040	2,911,833	17,905,043	-
2041	3,024,773	20,929,816	-
2042	(18,387,118)	2,542,698	-
2043	2,722,458	5,265,156	-
2044	2,832,118	8,097,274	-
2045	2,945,005	11,042,279	-
2046	3,061,198	14,103,478	-
2047	3,180,779	17,284,257	-
2048	3,303,831	20,588,087	-
2049	3,430,438	24,018,526	-
2050	(23,710,515)	308,011	-
2051	3,012,890	3,320,901	-
2052	3,133,649	6,454,550	-
2053	3,257,895	9,712,445	-
2054	3,385,713	13,098,158	-
2055	3,517,186	16,615,344	-
2056	3,652,403	20,267,747	-
2057	3,791,450	24,059,197	-
2058	3,934,417	27,993,614	-
2059	4,081,398	32,075,012	-
2060	4,232,484	36,307,496	-

FIRST TRYON ADVISORS

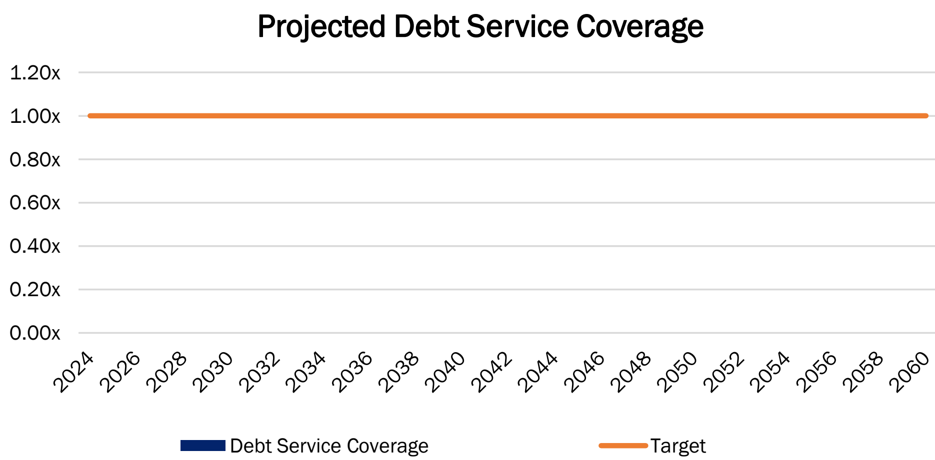
Start Year	2024
End Year	2060



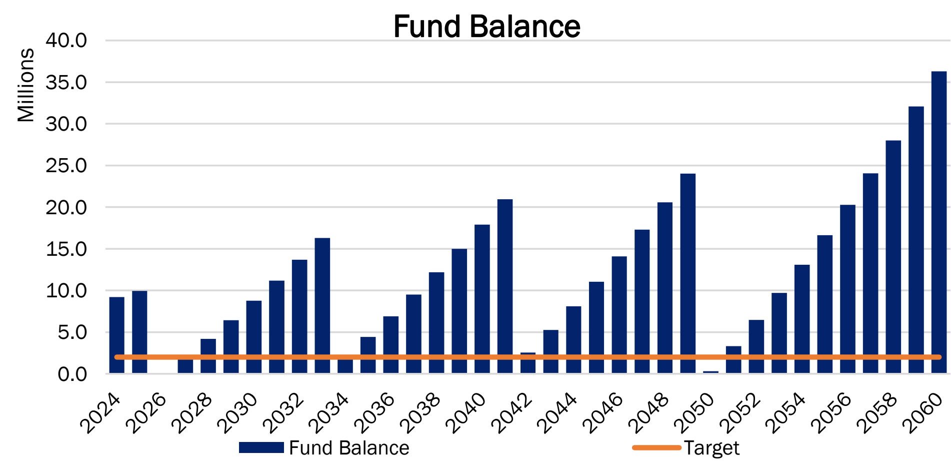
Start Year	2024
End Year	2060



Start Year	2024
End Year	2060



Start Year	2024
End Year	2060



CONSTRUCTION PROVISIONS

§ 151.20 ACCESS TO BEACH DURING CONSTRUCTION; PROTECTION.

(A) Any individual or contractor who desires to use an access to the beach will place in the access portable metal or wood mats for the purpose of moving equipment or material on the beach.

(B) The contractor or individual will remove the mats as soon as he or she no longer needs them to move equipment or material.

(`95 Code, § 5-3-19) (Ord. 78-8, passed 7-18-78)

§ 151.21 BEACH PROTECTION; EROSION CONTROL LINE.

Upon approval of the erosion control line by the State Coastal Council, permits for erosion control structures will be provisioned so that structures will be located at the erosion control line as shown on the maps, hereby incorporated by reference and available at the Coastal Council office and at City Hall.

(`95 Code, § 5-3-20) (Ord. 83-10, passed 8-2-83)

§ 151.22 ALTERATIONS IN LINE.

(A) The erosion control line may be extended or modified as conditions warrant. Any change must be approved by the city and the State Coastal Council after a public notice period of 30 days.

(B) Changes will then be recorded on the base maps.

(`95 Code, § 5-3-21) (Ord. 83-10, passed 8-2-83)

§ 151.23 CONSTRUCTION STANDARDS FOR BERMS, BULKHEADS, RIPRAP, SEAWALLS, REVETMENTS, AND RETAINING WALLS WITHIN 15 FEET OF THE CRITICAL LINE.

(A) For the purposes of this section, the following definitions shall apply:

BERM. A compacted mound of earth, soil, or sand, which may be used independently or to cover riprap, constructed to protect against flooding.

BULKHEAD. A vertical erosion control device installed on high ground which is adjacent to the marsh front critical line as defined by OCRM.

RETAINING WALL. A vertical erosion control or stabilization device installed on high ground within 15 feet of the OCRM critical line.

REVETMENT. Sloping material installed seaward of a seawall facing the oceanfront baseline as defined by OCRM.

RIPRAP. Sloping material installed in front of a bulkhead on the side of the bulkhead facing the marsh front critical line as defined by OCRM or as the foundation of a berm.

SEAWALL. A vertical erosion control device installed on high ground which is adjacent to the oceanfront baseline as defined by OCRM.

(B) The following minimum construction standards are enacted.

(1) All erosion control structures placed wholly or partly within the Dune Management Area or the setback from the critical line must be maintained in an intact usable condition or removal may be sought at the owners expense.

(2) New or substantially improved seawalls and associated revetments on the beach constructed after March 1, 2019 and placed wholly or partly within the Dune Management Area must be constructed so that the top of the vertical seawall is at an elevation of eight feet NAVD 88. Any portion of the Dune Management Area disturbed for the repair of an existing seawall or the construction of a new or substantially improved seawall after March 1, 2019 shall be filled such that the finished grade of the area of disturbance is at an elevation of ten feet NAVD 88 and planted with appropriate vegetation as designated by the Building Official.

(3) New or substantially improved bulkheads, retaining walls, or associated riprap constructed within 15 feet of the critical line after March 1, 2019 and placed wholly or partly within the required setback from the critical line must be constructed so that the top of the vertical structure is no higher than the adjacent grade on the landward face. Any portion of the critical line setback disturbed for the repair of an existing bulkhead or the construction of a new or substantially improved bulkhead after March 1, 2019 shall be filled such that the finished grade of the area of disturbance is at an elevation similar to the grade on the landward side and planted with appropriate vegetation as designated by the Building Official.

(4) New or substantially improved berms constructed within 15 feet of the critical line after March 9, 2021 and placed wholly or partly within the required setback from the critical line must be constructed so that the highest point of the berm is no more than three feet above the highest adjacent grade.

(5) New or substantially improved erosion control methods cannot be combined in a manner that would compound flooding, significantly impair drainage, cause adjacent shoreline impacts, or cause any negative impacts to marsh growth. However, mix use of erosion control methods dictated by site conditions on homeowner property can be permissible in the same contiguous linear plane.

EXHIBIT 5

(6) Construction of bulkheads, seawalls, retaining walls and berms within 15 feet of the critical line, and revetments as well as the placement of riprap shall require a permit from the city and proof of location behind the SCDHEC OCRM critical line or baseline in the form of a pre-construction survey with an OCRM certified critical line or baseline location and an as-built survey showing as-built improvement and the certified baseline or critical line as applicable.

(7) No portion of a bulkhead, riprap, seawall, retaining wall, revetment, or berm shall be placed seaward of the baseline or beyond the critical line without approval of SCDHEC OCRM.

(8) Bulkhead, riprap, seawalls, retaining walls, berms and revetments shall be designed by a certified design professional, registered in the state and shall meet the following minimum standards:

(a) *Bulkhead, retaining walls and seawall requirements.*

1. *Materials.*

i. Reinforced concrete six inches thick designed with adequate reinforcement to achieve a 3,000 psi 28-day strength.

ii. Pressure treated wood three inches by ten inches or three inches by 12 inches tongue and groove, or a double thickness of two inches sheeting with staggered joints is acceptable for walls with a standing height of under four feet.

2. *Depth of embedment.* The depth of embedment of a bulkhead shall be at least equal the height of the wall above the ground. An allowance should be made to account for erosion scour after construction.

3. *Tiebacks.* Tiebacks shall be located at a spacing of eight feet or less and attached to secure anchors capable of withstanding a 2,000- pound pull. Tiebacks may be deleted if a revetment is placed seaward of the bulkhead.

4. *Backfill.* The bulkhead will be backfilled with a compacted clean granular material to provide adequate support. “Clean” shall mean no metal, wood or glass.

5. *Protection from flanking.* Bulkheads will either tie into adjacent bulkheads or will have an adequate return wall meeting the same requirements as the seaward wall.

6. *Seawalls.* No new vertical unfaced seawall shall be allowed on the ocean front. Any new vertical seawall surface must be faced with a sloping revetment.

(b) *Revetments.*

1. *Materials.* Broken pavement, blocks or bricks are not acceptable materials for the outer layer of a revetment. However, they may be used for under layers. The outside of a revetment shall consist of at least two layers of armor stones whose pieces shall range in weight from a minimum of ten pounds to a maximum of 250 pounds; at least 60% shall weigh more than 150 pounds.

2. *Construction.* Revetments shall be underlain with a commercial grade porous filter cloth designed for ocean erosion control and approved by the Building Official (i.e. Phillips 66 stock or equal), and placed on a slope no steeper than one vertical to two horizontal. The toe at the revetment shall extend at least two feet below the existing beach elevation and the ends shall be protected from flanking.

(c) *Riprap.*

1. *Materials.* Broken pavement, blocks or bricks are not acceptable.

2. *Design.* Riprap placement, including when used as the foundation of a berm, must be designed by a licensed marine contractor or a certified designed professional registered in the State of South Carolina so as to prevent movement into the critical area.

(d) Berms within 15 feet of the critical line shall be designed by a certified design professional registered in the State of South Carolina and shall meet the following minimum standards:

1. Berms shall be designed to prevent shedding of storm, flood and tide waters onto adjacent properties and a no adverse impact statement in congruence with other city ordinances including floodplain shall be included on designs provided during permitting.

2. Berms shall be tied into existing grades along the entire length of their perimeter to ensure that berms are naturally appearing, and floodwaters are not impacting surrounding properties.

3. Berms shall be compacted prior to planting, landscaping, or revegetation.

4. Berms shall be landscaped along the landward side with appropriate native vegetation such that at least 50% of the surface of the berm is covered by plant material when calculated using the average mature size of the proposed plantings. In the case of damage or erosion resulting in the loss of required vegetation, berms must be repaired and replanted to meet the requirements of this section.

5. Naturally occurring, protected trees shall not be "buried" or incorporated within the berm so as to cause the trees to die unnaturally from piling up and stacking of soils above and around the natural ground level surrounding the tree trunks. Boxing of protected trees is acceptable.

6. Any riprap used as the foundation of a berm must be completely covered by compacted earth so that no riprap is visible. In the case of damage or erosion resulting in the exposure or disturbance of riprap, berms must be repaired to meet the requirements of this section.

(C) Adherence to these minimum standards will not guarantee that the bulkhead, riprap, seawall or revetment will withstand wave or tide forces or that it will protect against erosion. These standards are to prevent unsightly and inferior structures that would have little or no chance of success, and could possibly become a hazard or nuisance.

(D) Seawall construction activity from May 1 through October 31 is subject to the following requirements.

(1) The permit holder must contact the Folly Beach Turtle Watch Permit Holder each day prior to the commencement of work. The Folly Beach Turtle Watch Permit Holder will provide verification that there are no active turtle nests in the work area. Verification will be provided prior to 8:00 a.m.

(2) If an active nest is located in the work area, work must stop until the nest is relocated. If a turtle nest located in the work area is established before permitted work begins and can't be relocated, construction cannot begin until the nest hatches.

(3) The ***WORK AREA*** shall be defined as the area within 25 feet of the location of the seawall or the path used to access the site.

(`95 Code, § 5-3-22) (Ord. 83-10, passed 8-2-83; Am. Ord. 83-18, passed 1-3-84; Am. Ord. 84-29, passed 12-18-84; Am. Ord. 02-05, passed 1-25-05; Am. Ord. 10-15, passed 8-11-15; Am. Ord. 09-19, passed 2-11-19; Am. Ord. 26-19, passed 8-13-19; Am. Ord. 04-20, passed 6-9-20; Am. Ord. 03-21, passed 3-10-2021)

§ 151.24 SPECIAL REQUIREMENTS FOR CONSTRUCTION SEAWARD OF THE BASELINE.

If an applicant requests to build or rebuild a structure, including an erosion control structure or device, seaward of the proposed baseline that is not allowed otherwise, the city may issue a special permit to the applicant authorizing the construction or reconstruction upon verification from SCDHEC OCRM that the structure has received approval from the state. The structure shall not be constructed or reconstructed on a primary oceanfront sand dune or on the active beach. If the beach erodes to the extent the permitted structure becomes situated on the active beach, the permittee agrees to remove the structure from the active beach. However, the use of the property authorized under this provision, in the determination of the city, must not be detrimental to the public health, safety, or welfare.

(Ord. 28-98, passed - - 98; Am. Ord. 09-19, passed 2-11-19)

§ 151.25 DUNE WALKOVERS.

To protect the integrity of the front dune and to mitigate intrusion into ocean views from adjacent beachfront property, the following standards shall apply to the construction of new and replacement dune walkovers. These standards shall apply in addition to any and all regulations promulgated by the State Office of Ocean and Coastal Resources Management for dune walkovers incidental to residential uses on Folly Beach.

(A) Dune walkovers shall not be wider than six feet.

(B) Dune crossovers shall not be built more than three feet higher than required by beachfront management regulations, floodplain management standards, or other applicable requirements, or, in the absence of such requirements, no more than three feet above grade, excepting stairs and handicap access ramps leading to the first heated floor of the primary structure on the lot.

(C) Dune walkovers shall be constructed to extend beyond the toe of the seaward most dune.

(D) Observation decks shall be limited to 35 square feet in area. These may include benches, light storage, and other appurtenant features in accordance with OCRM and/or city floodplain management standards.

(E) Observation decks shall not be covered, roofed, or provided with any overhead structure.

(Ord. 05-06, passed 1-24-06; Am. Ord. 07-19, passed 2-11-19)

BEACH PRESERVATION

§ 151.35 AREAS OF PRESERVATION.

All portions of the city extending from the mean high water line to the primary dune through or to the first manmade object, whichever comes first, on property now platted on Folly Island and controlled by the city or the state shall be retained and preserved by the city in trust as an area of conservation for the purpose of protecting the ecology of the property, the adjoining property, and of the beaches of Folly Island, for enhancing the environment, and for the health, safety and welfare of the residents of the state.

(`95 Code, § 5-10-1)

§ 151.36 MAINTENANCE AND PRESERVATION.

(A) Any sand mined from the beach proper and placed on properties above defined shall henceforth and hereinafter be subject to the administration and police power of the City Council and shall not be subdivided into building lots.

(B) They shall be maintained and preserved for the benefit of all people in their natural state for the purpose of protecting the environment, ecology and health, safety and welfare of the city, property owners and residents of the state.

(`95 Code, § 5-10-2)

§ 151.37 CONSTRUCTION PROHIBITED IN CERTAIN AREAS.

No structure of any kind shall be constructed in the above defined area which is hereby established for conservation and preservation without the expressed written permission of the city and, where applicable, from Coastal Council.

(`95 Code, § 5-10-3) Penalty, see § 151.99

§ 151.38 DEFINITIONS.

For the purpose of this chapter, the following definitions shall apply unless the context clearly indicates or requires a different meaning.

AREA OF CONSERVATION. Any sand placed on the above defined properties will remain in its natural state with no manmade, artificial changes other than additional sand dunes or approved dune walkover structures. City Council will promulgate regulations defining approved dune walkovers.

MAINTAINED AND PRESERVED. The city will utilize its administrative powers to prevent altering of this area in any way.

MEAN HIGH WATER. The line established by survey on a series of plats titled *Plat Showing Perpetual Easement for Beach Renourishment*, dated June 1, 1992, and as recorded in the RMC Office.

RETAINED AND PRESERVED. Property subject of this chapter shall not be subdivided in any manner into lots and that the city will utilize all legal means to guarantee that this natural habitat will be undisturbed.

TRUST. The city shall act as custodian of the natural habitat in an effort to maintain it as protection against erosion caused by the sea, and for the health, safety and welfare of the public.

(`95 Code, § 5-10-4)

§ 151.39 BEACH PRESERVATION FEE.

(A) The Beach Preservation Act of 2014 authorizes qualifying coastal municipalities to impose a beach preservation fee not to exceed 1% of the gross proceeds derived from the rental or charges for accommodations furnished to transients.

(B) The City of Folly Beach is a qualifying coastal municipality with shoreline on the Atlantic Ocean, a public beach, and a local accommodations tax not exceeding 1½%.

(C) An additional 1% beach preservation fee is hereby added to the accommodations tax for the purpose of nourishment, renourishment, maintenance, erosion mitigation, monitoring of beaches, dune restoration and maintenance, including planting of sea grass, sea oats or other vegetation useful in preserving the dune system, and maintenance of public beach accesses within the corporate limits of the City of Folly Beach.

(Ord. 12-14, passed 7-8-14)

Cross-reference:

Funding of Beach Preservation Fund, see §§ 38.03, 113.04 and 113.05

Municipal accommodations fee, see § 113.03

PROTECTION OF LOGGERHEAD SEA TURTLES

§ 151.45 DEFINITIONS.

For the purpose of this subchapter, the following definitions shall apply unless the context clearly indicates or requires a different meaning.

ARTIFICIAL LIGHT. Any source of light emanating from a manmade device, including but not limited to, incandescent mercury vapor, metal halide, or sodium lamps, flashlights, spotlights, street lights, vehicular lights, construction or security lights.

BEACH. The area of unconsolidated material that extends landward from the mean low water line to the place where there is a marked change in material or physiographic form, or to the line of permanent vegetation (usually the effective limit of storm waves).

FLOODLIGHTS. Reflector type light fixture, attached directly to a building and is unshielded.

LOW PROFILE LUMINARIES. Light fixtures set on a base which raises the source of the light no higher than 48 inches off the ground, and designed in such a way that light is directed downward from a hooded light source.

NEW DEVELOPMENT. New construction and remodeling of existing structures when the remodeling includes alteration of exterior lighting.

PERSON. Any individual, firm, association, joint venture, partnership, estate, trust, syndicate, fiduciary, corporation, group or unit or federal, state, county or municipal government.

POLE LIGHTING. Light fixture set on a base or pole which raises the source of the light higher than 48 inches off the ground.

SOLAR SCREEN. Screens which are fixed installations and permanently project shade over the entire glass area of the window. The screens must be installed outside of the glass and must have:

(1) Visible light transmittance value of 45% or less (inside to outside;

(2) A minimum five-year warranty; and

(3) Performance claims supported by approved testing procedures and documentation.

TINTED OR FILMED GLASS. Window glass which has been covered with window tint or film such that the material has:

(1) Visible light transmittance value of 45% or less (inside to outside);

(2) A minimum five-year warranty;

(3) Adhesive as an integral part; and

(4) Performance claims which are sup- ported by approved testing procedures and documen- tation.

VISIBLE LIGHT TRANSMITTANCE. A measurement of the amount of light in the visible portion of the spectrum that passes through a glazing material.

(Ord. 8-92, passed 4-21-92; Am. Ord. 11-97, passed 7-1-97; Am. Ord. 18-99, passed 7-13-99; Am. Ord. 007-23, passed 4-11-23)

§ 151.46 PURPOSE.

The purpose of this subchapter is to protect the threatened loggerhead sea turtles which nest along the beaches of the city, by safeguarding the hatchlings from sources of artificial light.

(Ord. 8-92, passed 4-21-92; Am. Ord. 11-97, passed 7-1-97; Am. Ord. 18-99, passed 7-13-99; Am. Ord. 31-08, passed 12-30-08)

§ 151.47 NEW DEVELOPMENT.

(A) It is the policy of the city that no artificial light illuminate any area of the beaches of the city.

(B) To meet this intent, if lighting associated with construction or development can be seen from the beach, all building and electrical plans for construction of single family or multi-family dwellings, commercial or other structures, including electrical plans for parking lots, dune walkovers or other outdoor lighting for real property shall be in compliance with the following:

(1) Floodlights shall be prohibited. Wall mounted light fixtures shall be fitted with hoods so that no light illuminates the beach.

(2) Pole lighting shall be shielded in a way that light will be contained within arc of three to 73 degrees on the seaward side of the pole. Outdoor lighting shall be held to the minimum necessary for security and convenience.

(3) Low profile luminaries shall be used in parking lots and the lighting shall be positioned so that no light illuminates the beach.

(4) Dune crosswalks shall utilize low profile shielded luminaries. Only mushroom-type light fixtures, which direct light downward, shall be permitted. Such lighting shall also meet the following requirements:

(a) Fixtures shall be installed at least 25 feet apart and not more than one foot above the surface of the walkovers.

(b) Illumination shall be limited to 25 watts through the use of "bug" type bulbs.

(5) Lights on balconies shall be fitted with hoods so that lights will not illuminate the beach.

(6) Tinted or filmed glass shall be used in windows facing the ocean beginning at the first floor level of multi-story structures. Shade screens can be substituted for this requirement.

(7) (a) Temporary security lights at construction sites shall not be mounted more than 15 feet above the ground.

(b) Illumination from the lights shall not spread beyond the boundary of the property being developed, and in no case shall those lights illuminate the beach.

(C) The provisions of this section shall not apply to any structure for which a building permit has been issued by the Building Official, prior to the effective date of this subchapter.

(Ord. 8-92, passed 4-21-92; Am. Ord. 11-97, passed 7-1-97; Am. Ord. 18-99, passed 7-13-99; Am. Ord. 31-08, passed 12-30-08) Penalty, see § 151.99

§ 151.48 EXISTING DEVELOPMENT.

(A) It is the policy of the city that no artificial light illuminate any area of the beaches of the city.

(B) To meet this intent, lighting of existing structures which can be seen from the beach shall be in compliance with the following.

(1) Lights illuminating buildings or associated grounds for decorative, security, or recreational purposes shall be shielded or screened such that they are not visible from the beach and will be turned off after 10:00 p.m. until dawn during the period of May 1 to October 31 of each year.

(2) Lights illuminating dune crosswalks of any areas oceanward of the dune line shall be turned off from dusk to dawn during the period of May 1 to October 31 of each year.

(3) Motion detecting security lighting shall be permitted throughout the night so long as low profile luminaries are used and screened in a way that those lights do not illuminate the beach.

(4) Window treatments in windows facing the ocean at the first floor of single-story or multi-story structures are required so that interior lights do not illuminate the beach. The use of blackout draperies or shade screens are preferred. The addition of tint or film to windows or awnings is also encouraged, as is turning off unnecessary lights if the lights illuminate the beach.

(Ord. 8-92, passed 4-21-92; Am. Ord. 11-97, passed 7-1-97; Am. Ord. 18-99, passed 7-13-99; Am. Ord. 31-08, passed 12-30-08) Penalty, see § 151.99

§ 151.49 PUBLICLY OWNED LIGHTING.

Street lights and lighting at parks and other publicly owned beach access areas shall be subject to the following:

(A) Whenever possible, street lights shall be located so that the bulk of their illumination will travel away from the beach. These lights shall be equipped with shades or shields that will prevent backlighting and render them not visible from the beach.

(B) Lights at parks or other public beach access points shall be shielded or shaded or shall not be utilized during the period May to October 31 of each year.

(Ord. 8-92, passed 4-21-92; Am. Ord. 11-97, passed 7-1-97; Am. Ord. 18-99, passed 7-13-99) Penalty, see § 151.99

§ 151.50 PENALTIES AND ENFORCEMENT.

Any person violating any provision of this subchapter shall be deemed guilty of a civil offense and shall be subject to a fine of up to $500 upon conviction. Each day of violation shall be considered a separate offense.

(Ord. 029-22, passed 9-13-22)

PROPERTY OWNER ELEVATION MAINTENANCE

§ 151.60 PURPOSE.

Public beach renourishment projects, including maintenance of adjacent private property, benefit and constitute an improvement for the entire city and also provide a significant and direct benefit to owners of the adjacent, private beachfront property. The purpose of this subchapter is:

(A) To safeguard the city's critical and significant commitment to and investment in beach renourishment and preservation;

(B) To abate any nuisance that might be created on private property by beach renourishment including ponding, or areas significantly lower than the elevation of the renourishment that could threaten the integrity of the renourished beach;

(C) To ameliorate and prevent public hazards, detrimental environmental impacts, adverse effects on the quality of a coastal resource, and disruption of access to a public coastal resource that might be created when private property adjacent to a renourishment is not also renourished or is otherwise maintained in a manner that is not compatible with the renourishment or compromises the integrity of the renourishment;

(D) To protect, preserve, restore, and enhance the beach/dune system that protects life and property; and

(E) To comply with requirements imposed by the U.S. Army Corps of Engineers or any other entity conducting beach renourishment.

(Ord. 31-17, passed 12-12-17)

§ 151.61 DUTY OF BEACHFRONT PROPERTY OWNERS.

It shall be the duty of every beachfront property owner to ensure that:

(A) The property is maintained in a manner that does not compromise the integrity of the public beach renourishment; and

(B) Any eroded areas of the beach that are on private property and landward of the perpetual easement line are brought into compliance with local, state, and Federal requirements if directed by the city. A property is considered to be compliant when the seaward most elevation of the property matches the elevation of the renourishment. Any action by the owner that compromises the integrity of the renourishment or failure of the property owner to maintain adequate elevation landward of the renourished beach is hereby deemed a nuisance. It is within the discretion of the Code Enforcement Officer, in consultation with the U.S. Army Corps of Engineers or any other entity conducting beach renourishment, to determine affected properties, the permissible options for eliminating the nuisance (which may include sand fill, dune restoration, or structural solutions), the necessary elevation, or any other necessary actions the owner must take to preserve the integrity of the public beach seaward of their property. Once the Code Enforcement Officer has made a determination that a property is in violation, the property owner has the burden of showing that the property has been brought into compliance through an elevation survey or through other action required by the Code Enforcement Officer.

(Ord. 31-17, passed 12-12-17)

§ 151.62 NOTICE TO PROPERTY OWNERS.

The Code Enforcement Officer will provide notice to property owners by certified mail or personal delivery of any upcoming renourishment for which they are expected to comply with this subchapter. The notice will provide the following information:

(A) That the property is subject to this subchapter;

(B) The anticipated date or date range of the renourishment of the beach adjacent to the property;

(C) A deadline, not less than 60 days from the date of the notice, for when the property must be brought into compliance;

(D) The minimum action that must be taken by the property owner to bring the property into compliance with the renourishment, such as the anticipated height to which the property must be elevated;

(E) The anticipated cost of filling the owner's property or otherwise bringing it into compliance with the renourishment if performed by the city and billed to the owner;

(F) That the property owner must inform the city within 20 days of the date of the notice whether the owner will address the identified nuisance by filling the property or by otherwise bringing the property into compliance with the renourishment, or, alternatively, will allow the city to bring the property into compliance and agree to pay associated costs; and

(G) If the property owner does not make an election within 20 days of the notice or does not bring the property into compliance with the renourishment by the deadline provided and to the satisfaction of the code enforcement officer, the city will fill the property or otherwise bring it into compliance, and bill the property owner for the associated costs of same.

(Ord. 31-17, passed 12-12-17)

§ 151.63 RIGHT OF ENTRY.

When it is necessary to make an inspection to enforce the provisions of this subchapter, or if the property owner has not addressed the identified issues in a timely fashion, the code enforcement officer, the city, or its designee, has the right to enter the property:

(A) To inspect it;

(B) To determine what actions must be taken to bring the property into compliance with the renourishment; or

(C) To bring the property into compliance by filling the property in or otherwise addressing any other noticed issues. The city will provide at least 48 hours of notice of such entry to the occupants of the property or, at the option of the owner, directly to any owner that provides a method of immediate contact.

(Ord. 31-17, passed 12-12-17)

§ 151.64 PRESENTATION AND PAYMENT OF BILL; LIEN.

(A) If the property is filled or brought into compliance by the city, the code enforcement officer will present a bill to the property owner by certified mail or hand delivery. The bill will be based on the cost of filling the owner's property, including the cost of transporting and placing the sand, or otherwise bringing the property into compliance with the renourishment. The bill will set forth the amount owed by the property owner along with an explanation for how the amount was calculated. The property owner will have 60 days to pay the bill.

(B) If the property owner has not fully paid the bill within 60 days or made other arrangements with the code enforcement officer, the bill plus any costs of collection will constitute a lien against the property in the manner provided by law, and the city or code enforcement officer may undertake collection of the bill plus the costs of collection by any legal means, including filing a recorded lien against the property in the amount of the bill plus the costs of collection, initiating an action to collect on the bill plus the costs of collection or to foreclose on the lien in the Charleston County Court of Common Pleas, or assessing a fee or tax against the property in the amount of the bill plus the costs of collection.

(Ord. 31-17, passed 12-12-17)

§ 151.65 REQUEST FOR HEARING.

If a property owner objects to any aspect of the notice or the requirements set forth therein, including any bill presented to the property owner for payment, the owner may request a hearing before the City Administrator within 20 days of the date of the notice. The City Administrator will then set a hearing to address any such objections within ten days of the request and will issue a ruling on any such objections. The City Administrator's ruling will be the final determination of the city.

(Ord. 31-17, passed 12-12-17)

§ 151.99 PENALTY.

(A) Any person violating any provision of this code for which no specific penalty is prescribed shall be subject to §10.99.

(B) Any person altering the area that is the subject of §§151.35 through 151.38 by littering, destruction of vegetation or the artificial movement of the existing sand dunes shall subject to a $500 fine, and each day such exists shall constitute a separate offense. Violators will be required to replace altered sand dunes and replant the natural vegetation of the area.

(`95 Code, § 5-10-5) (Ord. 15-93, passed 9-7-93)

CHAPTER 154: (RESERVED)

CHAPTER 155: EMINENT DOMAIN

Section

155.001 General provisions

§ 155.001 GENERAL PROVISIONS.

At no time shall the city use eminent domain to buy or condemn real property and transfer or sell same to any individual or entity for profit.

(Ord. 53-05, passed 8-23-05)

2618 Herschel Street
Jacksonville, FL 32204
(904) 387-6114
foth.com

September 29, 2025

Douglas Kerr, Deputy City Administrator
City of Isle of Palms
P.O. Drawer 508
Isle of Palms, SC 29451

RE: Island of Palms, SC Beach Management Program – Review and Second Opinion

Foth Infrastructure & Environment, LLC (Foth | Olsen) is pleased to provide this summary of our review of the City of Isle of Palms (IOP) beach management program. For our review, we deferred exclusively to existing information made available to Foth | Olsen by the City. The work did not seek to conduct independent research or engineering analyses but rather relied upon existing information and reports by others to assess past, current, and expected future shoreline conditions. Furthermore, it aims to develop opinions about expected future conditions and possible beach management initiatives that may be considered to improve future conditions and potentially reduce the long-term cost of beach management for the City and community.

We focused our efforts on information and technical reports that have been prepared by the City of IOP and the city's coastal engineering consultant, Coastal Science and Engineering (CSE), including the summary report prepared by the Ad Hoc Beach Committee and CSE. Since initial planning of the 2008 restoration project, CSE has prepared dozens of reports that document shoreline conditions, shoreline change, project development details, project implementation, project performance, and other related beach management activities and results. From the work of CSE, the City and community have pursued a range of beach management initiatives ranging from large-scale comprehensive beach restoration to smaller, localized emergency sand scraping and redistribution projects, dune restoration, emergency sandbag projects, and experimental structural shore-stabilization projects.

For our review, we have specifically reviewed the following…

1. Beach Ad Hoc Committee Report and recommendations,
2. Prior beach management project planning reports and presentations,
3. Prior project scope summaries and presentations,
4. Prior post-construction summary reports,
5. Prior planning, engineering and design reports,

6. Permit applications for currently planned future projects,
7. Select beach monitoring reports,
8. Available aerial imagery with focus on inlet shoal bypass events, and
9. City regulations that prohibit erosion control structures within 250 feet of the MHWL.

The purpose of our efforts is to provide the City with a second opinion regarding the scope and appropriateness of past and planned future beach management activities. We also offer suggestions and recommendations about other beach management initiatives that the City may want to consider for future beach management. From this, we address the following,

a. The impact of each item listed above on IOP beach management,

b. Possible solutions and alternatives to reduce erosion and enhance the effectiveness of future renourishment projects,

c. Causes of recent shoreline erosion acceleration along the southern end of the island, and

d. A potential relationship between beach management activities on IOP and observed changes that occur to Breach Inlet.

Our comments and recommendations are presented to address general island-wide conditions and the City's beach management approach along the north and south ends of the island where conditions require active beach management. For this summary, we describe the north end of the island (Reaches 5 and 6) as being adjacent to Dewees Inlet and the south end of the island (Reaches 1 and 2) being adjacent to Breach Inlet. We focus our review and comments on these areas separately. **Figure 1** presents the location and limits of the IOP Atlantic Ocean shoreline, and the noted beach management reaches. The defined reaches are used through our comments for reference.

Given the long-term and expected future stability of the central area of the island (Reaches 3 and 4), we did not focus our review on that area of the island. The central island area has historically been stable due to the benefits derived from the management practices implemented along the areas to the north and south. This condition is expected to continue for the foreseeable future assuming that proactive sand management will continue along the adjacent areas. Moreover, development along the central area of the island is more set back from the active beach and primary dune than development along the northern and southern areas of the island. This also benefits beach and dune conditions along the central area of the island and limits the need for proactive beach and dune management activities along that area.

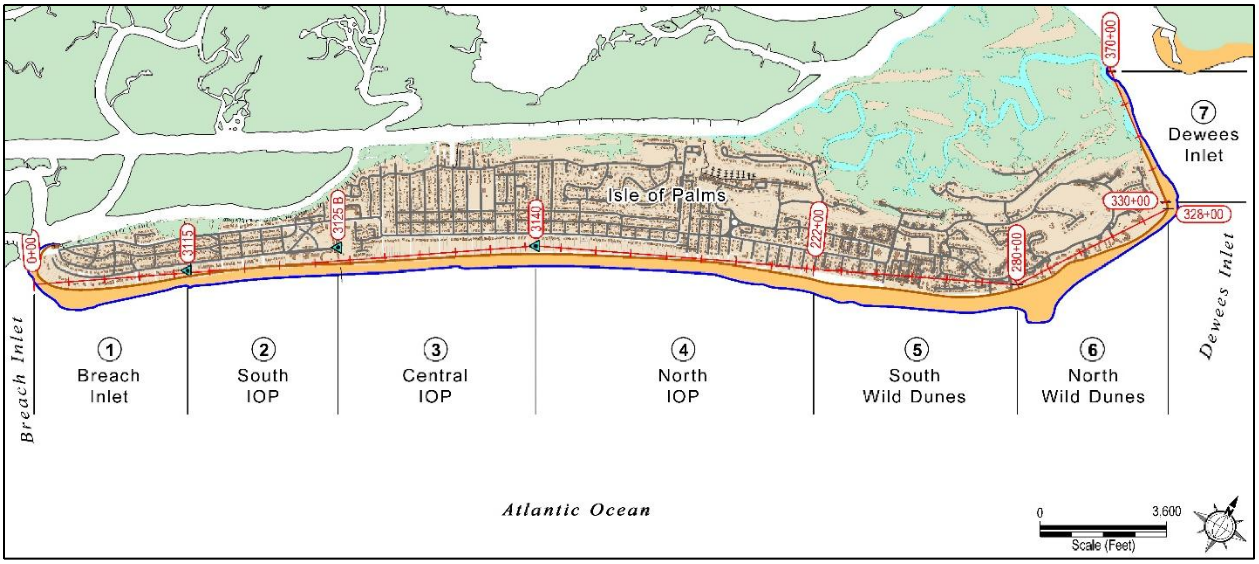


Figure 1: Location of beach management reaches along Isle of Palms, SC (CSE, 2024a).

Summary of Beach Conditions and Past Management Efforts

Overall, there appears to be a good understanding by CSE and the City of the sediment transport regime and past shoreline change conditions along the IOP Atlantic Ocean, Dewees Inlet, and Breach Inlet shorelines as it relates to the City's beach management program. The available surveys, analyses, and reports clearly capture shoreline conditions, shoreline change, and the performance of past beach management efforts.

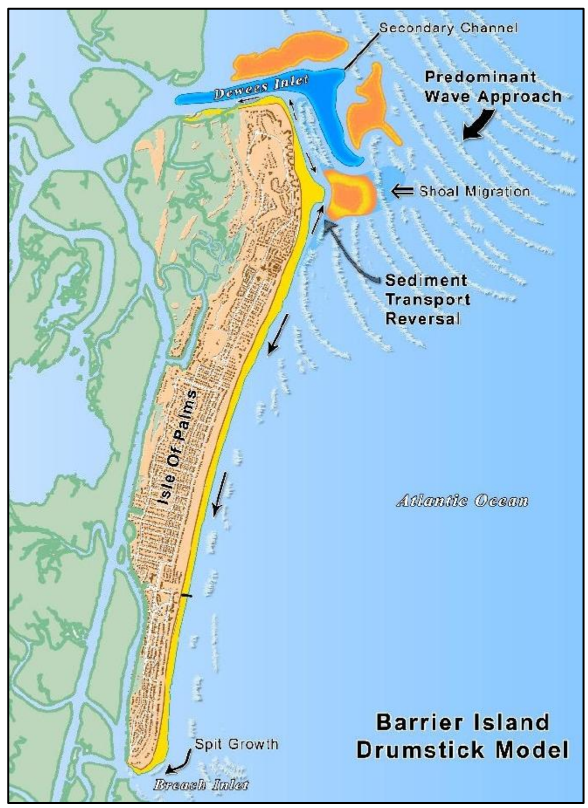


Figure 2: Concept of sediment transport regimen along the drumstick shaped IOP barrier island (Hayes, 1979 and CSE, 2024a).

As presented by CSE, the island's morphology and large-scale sediment transport conditions along IOP are well explained by the barrier island drumstick model of Hayes, 1979 and CSE, 2008. (**Figure 2**). That is, the island is wider on the north end and narrower on the south end. From north to south, the island's shape and shoreline behavior is strongly related to the Dewees Inlet ebb shoal, the periodic north to south sand bypass events that occur across the ebb shoal, and the periodic attachment of large bypass shoals to the IOP shoreline (**Figure 3**).

When the bypass shoals attach to the island, shoal sand is spread both north and south by the incident wave climate (**Figure 3**). This sand is available to accumulate along the Dewees Inlet shoreline and the central and southern area of the island. This contributes to the stability of the shoreline enjoyed along the central area of the island and the presence of a large historically accretional spit shaped feature at the southern terminus of the island (**Figure 4**). The southern end of the island's shoreline terminates at Breach Inlet where sand movement transitions to the inlet's ebb tidal shoal.

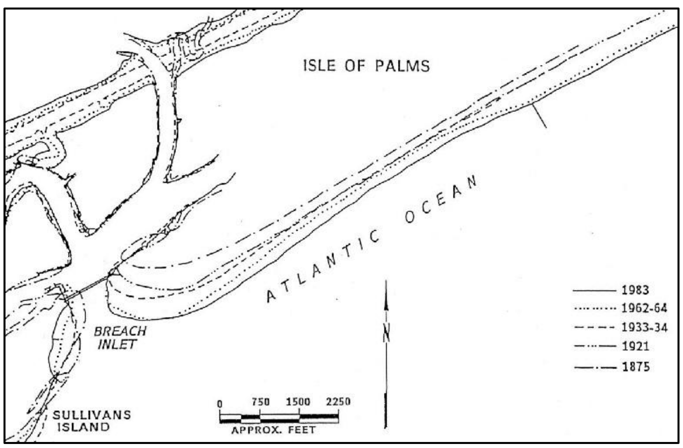


Figure 4: Historical growth of "spit" at southern terminus of Isle of Palm at Breach Inlet (IOP, 2007).

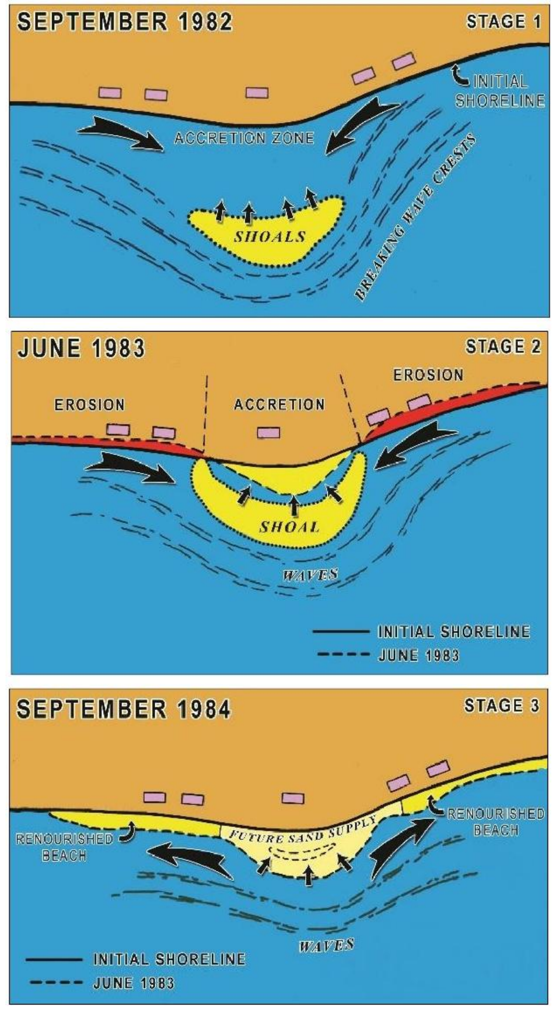


Figure 3: Phases of shoal attachments along northern end of the island and concept of shoal spreading following full shoal attachment (CSE, 2024a).

The delivery of large volumes of sand to the island from Dewees Inlet bypass events would be expected to provide a net benefit to at least a portion of the island's shoreline and total sand volume. Unfortunately, history has shown that shoal migration toward the island and the influence of a shoal's shape as it approaches the island alters the incident wave climate in such a manner that causes highly localized erosional stress and sand loss immediately north and south of the shoal that has proved difficult to manage. An example of the eroded shoreline condition that occurs with shoal migration is shown in **Figure 5** (CSE, 2022). The shoal induced localized erosion can be so extreme that past interventions such as large-scale renourishment and sand scraping have not been able to effectively offset this effect and protect upland infrastructure throughout the entire cycle of shoal approach and attachment. The impact of these localized erosion events is exacerbated by the erosional stress associated with inlet dynamics, sea level rise, and the presence of upland development within the range of natural beach movements.

The areas of the managed beach referred to as Reaches 5 and 6 are affected most by these extreme erosion events. The wide range of available sand volume in the beach profile through time for Reaches 5 and 6 compared to other areas of the island is represented in **Figure 6**. It is also along these areas where the measured beach volume more commonly decreases below the identified "healthy" conditions.

As identified by CSE, in addition to the localized effects, the sand shoals have not been able to completely offset the long-term background loss rates for Reaches 5 and 6. As a result, the entire northern end of the island suffers from long-term net sand volume loss in the absence of large-scale periodic renourishment projects. The net sand loss and the localized impacts from shoal migration will continue to be a beach management challenge for the northern end of the island.

Figure 5: Example of shoal attachment event along northern end of Isle of Palms and the associated severe erosion along the shoreline leeward of the shoal edges (CSE, 2024b).

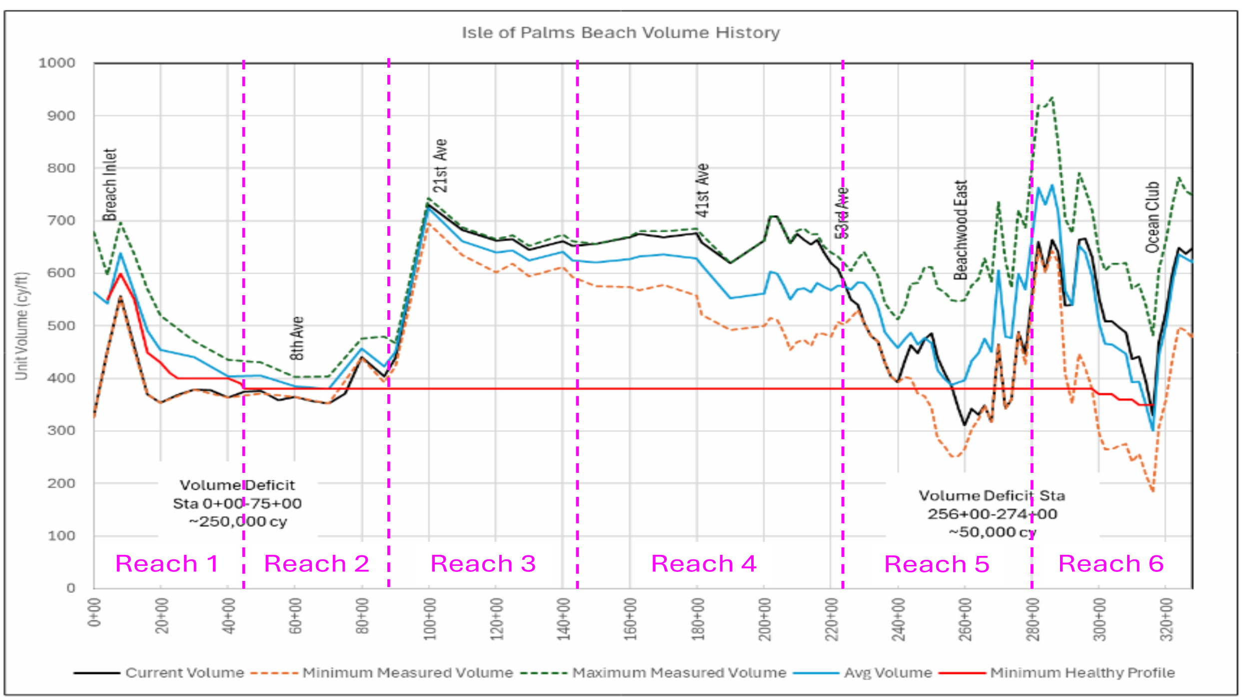


Figure 6: The range of documented shoreline locations and extent of beach management reaches along Isle of Palms, SC (CSE, 2024c).

North End (Reaches 5 and 6) Management

To date, the northern end of the island (Reaches 5 and 6) has required the most active management compared to all other areas of the island. Efforts have been required to address the significant localized erosion events associated with shoal attachments and an overall persistent net loss of sand volume from the beach. The management initiatives have included two large-scale beach restoration projects, several smaller emergency sand-scraping projects, and temporary shore-hardening applications (i.e., sandbags) when shoal attachment events induced severe localized erosion during the pre-attachment phase of the shoal event.

The past management efforts for the northern end of the island have been reasonable given what was known about general shoreline behavior and the effects of shoal migration and attachments. These projects, based upon well-established beach management techniques, however, have not been sufficient to completely offset and/or control (1) the impacts associated with the localized erosional effects caused by the sand shoal attachment events and (2) the overall net sand loss rate from the northern end of the island.

Erosion associated with shoal attachment events continues to severely impact the Reaches 5 and 6 shorelines and beach management projects. Localized volume loss rates associated with these events far exceed the average rates along each reach, reducing the extent of protection provided by management events, such as beach fill or sand scraping projects. For example, the average sand loss rate along Reach 5 since completion of the 2018 project has been about -25 cy/ft/yr, which unto itself is extremely high compared to typical barrier islands. During this same period, however, a localized area of Reach 5 experienced sand loss rates over a one-year period that approached -150 cy/ft/yr, or 6 times the average rate. Even if a renourishment project design is based upon an expected sand loss rate of -25 cy/ft/yr, on average, a localized erosion rate of more than 6 times the average along any section of the project will have a significant impact on the overall project's performance and significantly reduce the effectiveness of that project.

The recent overall net loss of sand from Reaches 5 and 6 is also problematic for beach nourishment performance and feasibility. **Figures 7** and **8** present a timeline of volume change for Reaches 5 and 6 for the period late 2007 to late 2024. Notable conditions from these figures show that Reach 5 experienced more erosion over the period than Reach 6. As of September 2024, Reach 5 contains less than 5% of the 2018 project volume.

Volume loss rates along both reaches have increased significantly since completion of the 2018 project. Along Reach 5, the average volume loss rate is about 1.7 times higher than that which occurred following the 2008 project. For Reach 6, the sand loss rate after the 2018 project is more than 15 times higher than following the 2008 project. These changes are likely related to shoal attachment events, continued sea level rise, and storm activity. It is noted, however, that

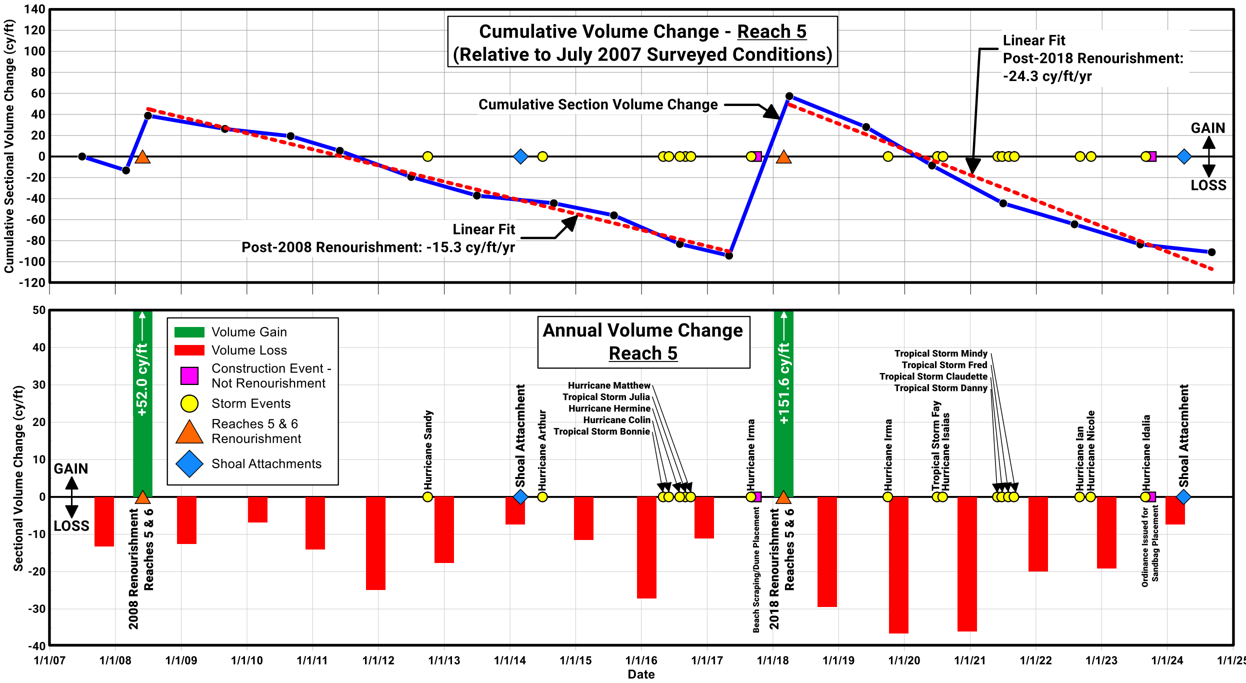


Figure 7: Timeline of IOP Reach 5 beach volume change between 2007 and late 2024. (Data Source: CSE, 2024a)

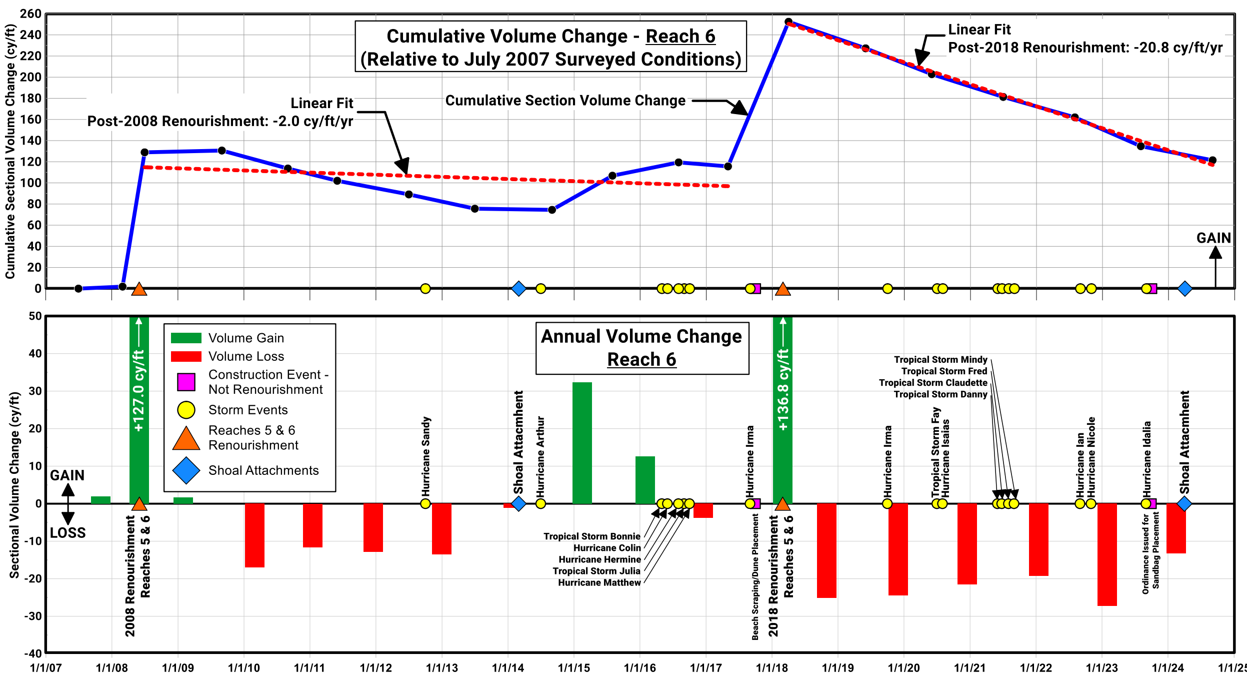


Figure 8: Timeline of IOP Reach 6 beach volume change between 2007 and late 2024. (Data Source: CSE, 2024a)

the rates through time following the 2018 project are consistent, suggesting that they may not be strongly related to episodic events but rather reflective of a possible change in background conditions. The reasons for this change are not clear. We note that we have not reviewed borrow source geotechnical information for the 2018 project in detail. As such, we cannot determine to what extent borrow area sediment compatibility with the native beach sediments may have contributed to the increase in sand loss rates, but differences in sediment conditions can lead to changes in beach behavior. Sediment quality for future nourishment activities should remain an important consideration for future project planning.

CSE (2007) reports average long-term historical net sand loss rates along this area of the island to be between 5 and 10 cy/ft/yr. Average net loss rates of this magnitude may be manageable with beach nourishment, but the recent trend of volume loss rates along both the northern and southern ends of the island suggest that future conditions may not be represented by those experienced historically.

Given the apparent increase in the background net sand loss rate and the magnitude of localized erosion caused by shoal migration, it is our opinion that beach nourishment alone will not be a feasible nor sustainable long-term solution to address beach and dune erosion conditions along Reaches 5 and 6 and provide reliable shore protection. Accordingly, we believe that future planning and management at IOP should consider the following,

1) The localized erosion rates that occur during shoal attachments cycles are too large to address with sand placement alone. The timing and occurrence of these large erosion events cannot be managed with an offshore dredge project because of the time required to identify and permit an offshore source and the cost to mobilize a large offshore dredge,

2) Localized erosion cannot be effectively managed with emergency sand scraping events. The magnitude of erosional stress far exceeds the amount of sand that can be effectively moved to address the rate of sand loss,

Ideally, the City should seek to implement beach management measures to reduce the rate of localized erosion caused by sand shoal attachment events and protect the most vulnerable areas of Reaches 5 and 6 from the impacts of the extreme erosion that occurs during a shoal attachment event. The goal will be to provide more consistent beach conditions and shore protection between large-scale nourishment events and increase the time between required large-scale renourishment. The latter will potentially reduce the long-term demand on available offshore sand resources as well as reduce the impacts of dredge mobilization costs to long-term beach management.

Based upon documented performance of past beach management activities as well as expected future increases in sand loss rates from the island's beach, it is recommended that the City and community explore more proactive beach management measures beyond nourishment alone.

These will likely be needed to manage the impacts from future shoal migration events and an increase in the overall background sand loss rate from the island. The goal will be to identify an approach or approaches that control and/or prevent future excessive sand loss from the island and decrease the long-term cost of beach management for the City and community. To accomplish this, the City and community may consider the following,

- more proactive management of the sand shoal migrations (**Figure 9**).

- the strategic use of shore-stabilizing structures along those areas of Reaches 5 and 6 that are most susceptible to large sand loss rates between shoal attachment events (**Figure 10**).

Proactive shoal management may consist of the use of dredge equipment, rather than mechanical scrapers, to excavate and reshape large areas of the approaching shoals to reduce the wave focusing effect that causes the highly localized erosion. The excavated material would be placed along the leeward shoreline (i.e., the eventual natural destination of the shoals) along areas most susceptible to the wave-focusing effects of the remaining shoal. This approach offers the opportunity to manipulate the shape of the approaching shoal to reduce the wave focusing effects that cause the localized erosional stress along Reaches 5 and 6. This would also accelerate and better control the delivery of shoal sand to the IOP beach.

The shoal management approach could also include the creation of an offshore sand trap that is the designated sand collection area as shoal events form and migration toward the island. The trap would be strategically sited far enough away from the island's shoreline to reduce the adverse effects caused by a shoal event.

The specifics of how a more proactive shoal management strategy will be implemented will require significant investigation. Geotechnical studies to determine if the shoal can be dredged in a manner that will only produce beach compatible sand during excavation will be necessary. A detailed numerical wave, hydrodynamic, and sediment transport study will also be useful to better understand how shoal shape affects the wave climate and shoreline erosion. This model can also be used to evaluate feasible dredging approaches and shoal reshaping shape that will reduce the most problematic wave refraction/diffraction and wave focusing.

Shore-stabilizing structures would limit the landward extent that the beach could migrate during the most severe eroded condition and maintain more consistent conditions until a shoal migration event can fully attach to the shoreline, and/or a large-scale beach nourishment project can be constructed.

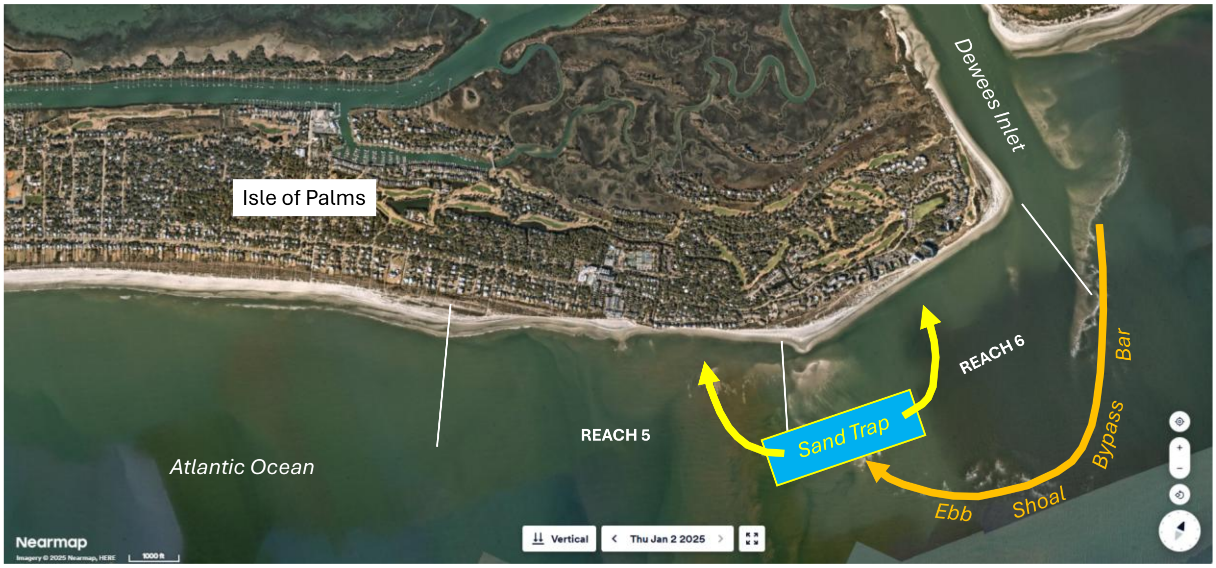


Figure 9: CONCEPT of shoal borrow area/sand trap. This would be intended to control the shoal shape and the unpredictable onshore migration of sand shoals along the northern end of IOP. Sand from the trap would be periodically dredged and placed along the northern IOP shoreline. The trap would then capture additional sand bypassing Dewees Inlet ebb shoal to be used for future dredging.

Figure 10: CONCEPT of a series of detached breakwaters along areas most impacted by variable shoal shoreline attachment. The purpose of the breakwaters will be to maintain a minimum beach condition along the most vulnerable areas of Reaches 5 and 6 during all phases of sand shoal migration and attachment.

The two proposed proactive approaches for future management of Reaches 5 and 6 are very different in concept. The application of shore-stabilizing structures will simply stabilize the areas of shoreline that are most vulnerable to localized erosional stress during shoal migration events. This would not address the periodic occurrence and magnitude of shoal induced erosion along areas of Reaches 5 and 6. Proactive shoal management will seek to reduce the magnitude of localized erosional stress that occurs during shoal advancement. It may be prudent to consider both approaches to address future management of Reaches 5 and 6.

Proactive shoal management will require project permits that allow the City and/or community the opportunity to work in advance of a specific erosion problem. There should be sufficient historical data to demonstrate the cause and effect of shoal migration to shoreline impacts. Ideally, project permits would allow multiple shoal management events to reduce the administrative effort and time to acquire permits. This will be very important given the uncertainty about the future timing and occurrence of shoal attachment events. Maintenance style permits that allow multiple actions under one regulatory authorization are unusual in South Carolina both at the State and Federal level. So, some advance work with the agencies may be required to ultimately be successful in acquiring such permits.

Under existing conditions and typical permits, timing and executing a response to shoal induced erosion is difficult due to the variability of the timing of the occurrence and the magnitude of the erosion that occurs during the shoal event. The uncertainty about the timing of occurrence for shoal response makes timing a response when other areas of the island need sand more difficult. Again, the goal of more proactive management of the northern end of the island’s shoreline will be to control the effects of shoal migration events and reduce the extent of localized erosion between large-scale restoration events along all managed areas of the island. This may likely contribute to extending the time between large-scale renourishment events which can reduce program costs over time.

Even with more proactive management actions, it should be expected that future beach nourishment projects will continue to be required to address the continued net sand loss from the northern end of the island. A future beach management goal should be to reduce the frequency and magnitude of these projects as their cost is higher than shoal management.

South End (Reaches 1 and 2) Management

The southern area of the island has historically been naturally accretional over the past 150+ years (**Figure 4**) due to the north to south transport of sand along the central and southern areas of the island. This accretion has created the morphological, spit-shaped feature that forms the southern end of the island.

However, beginning as early as 2011 the southern end of the island has experienced a general trend of retreat. Based upon available data, it appears that the change in the trend of accretion to erosion occurred around the 2010-2012 timeframe. CSE has suggested that the onset of this change may have been exacerbated by the effects of Hurricane Sandy in 2012. However, the occurrence of that one event could not be entirely responsible for the ongoing erosional stress and sand loss that continues to occur along the southern end of the island.

Figures 11 and **12** present a timeline of volume change for beach management areas Reach 1 and 2, respectively. Recent elevated erosion along Reaches 1 and 2 has reduced overall beach volume and eliminated the primary dune along the combined large reach of shoreline, about 8,600 feet in length. It is estimated that the total sand loss since 2011 is about -558,800 cy with about -456,600 cy occurring along Reach 1 and -102,200 cy occurring along Reach 2. This sand loss has exposed shorefront development to the effects of the active beach dynamics and frequent impacts associated with elevated wind and wave conditions. The most severe volume losses have occurred over the past 18 to 24 months, but a review of historical conditions dating back to at least 2011 suggests that the south end of the island has experienced net volumetric sand loss since that time. Although this area may have historically been accretional, as identified by CSE, available data suggests that the beach along Reaches 1 and 2 is now net erosional. Erosion appears to gradually increase from north to south starting at the northern limit of Reach 2 with the high sand loss rates occurring in Reach 1. Although there are periods of both accretion and erosion along Reaches 1 and 2 during this period, there has been a net loss of sand from each reach over the past 14 years.

The net erosion rate along Reach 1 is higher than along Reach 2 suggesting that the sand loss rate is highest near Breach Inlet and increases from north to south from the central area of the island to the inlet. This pattern of erosion along the terminal end of a drumstick barrier island is not uncommon.

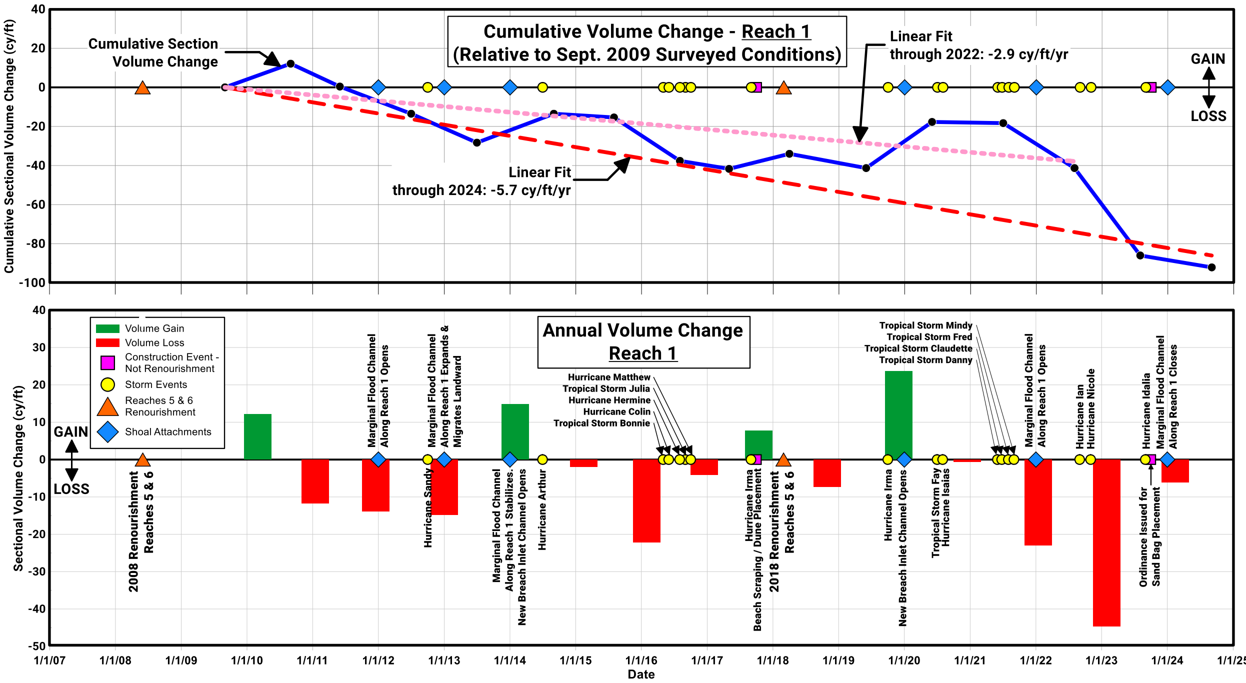


Figure 11: Timeline of IOP Reach 1 beach volume change between 2009 and late 2024. (Data Source: CSE, 2024a)

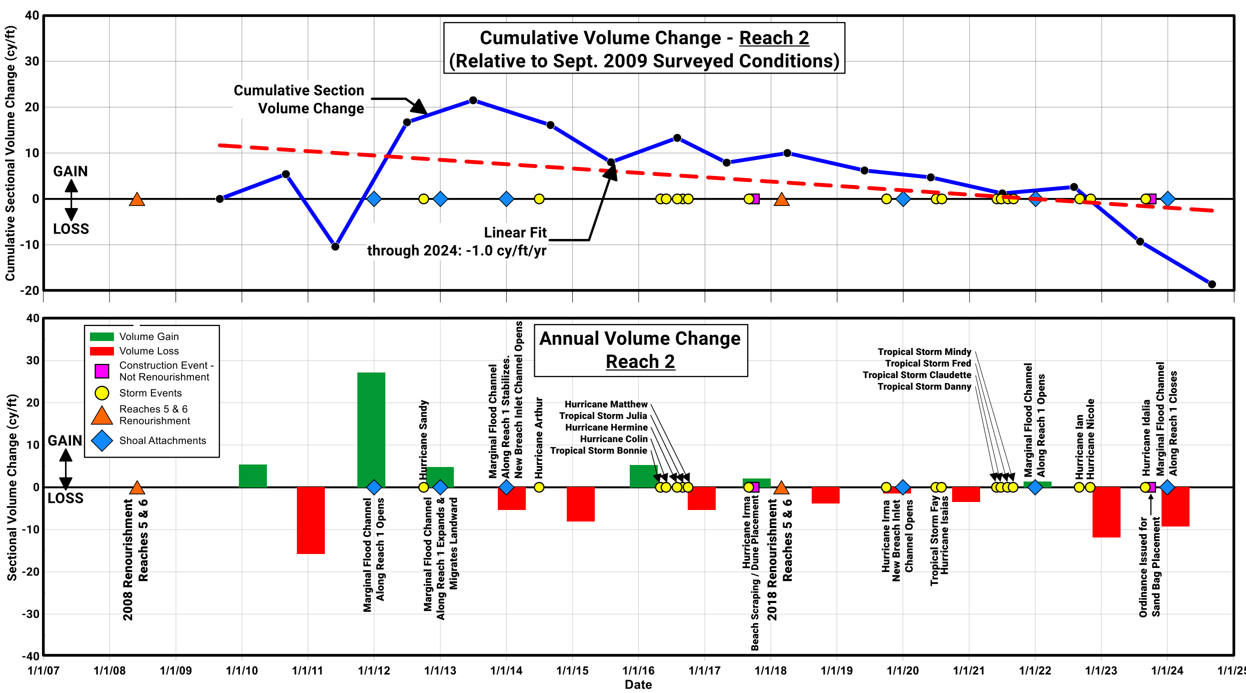


Figure 12: Timeline of IOP Reach 2 beach volume change between 2009 and late 2024. (Data Source: CSE, 2024a)

Although the exact reason(s) for the significant shift in shoreline change trends are not clearly understood, we explore some possible reasons in the following section. Regardless of the reason, it appears that some form of proactive intervention will be required to address the recent beach volume loss and expected continued future trend of sand loss from the southern end of the island. We believe that the options to address the problem are limited to several commonly used shore restoration and stabilization approaches. These are,

1) Large scale sand restoration with periodic renourishment. This approach would consist of replacing the recently lost sand volume and providing a sufficient volume of additional material (i.e., advance nourishment) to offset anticipated future sand losses over a planned project performance period (i.e. renourishment interval). Consideration will also need to be given to compatibility between the native beach sediments and borrow area sediments available for the project. Emphasis should be placed on incorporating overfill ratios in future beach fill designs to improve the success and longevity of projects.

   It is possible that restoration and periodic renourishment alone may not be an effective or cost-effective beach management approach along Reach 1 where sand loss rates are highest, especially near Breach Inlet. Moreover, implantation of a renourishment-only approach under existing sand loss rates may limit the long-term success of this approach due to the need for high frequency renourishment and demands on limited offshore sand sources. Thus, a more proactive approach may be necessary to successfully manage and maintain future conditions.

2) Renourishment with Shoreline Stabilization. This approach would consist of replacing the recently lost sand volume and constructing a strategically designed shore-stabilizing structure, or structures, to reduce future sand loss rates and provide more consistent beach conditions between required renourishment events. The improved shoreline stability would also serve to maintain a minimum beach condition between renourishment events. This would be particularly beneficial should the timing of the required renourishment be delayed and/or dependent upon the required timing of renourishment along other areas of the island.

   In our opinion a terminal groin-type structure would be the most effective at meeting the intended shoreline stability requirements at the southern end of the island. This structure could be implemented as a single terminal groin or a terminal with a complementary breakwater or breakwaters to its immediate north. The combined approach can be beneficial to address shorelines with significant curvature. In such instances, a standalone terminal groin may need to be very long to provide the required shoreline stability and protection along a long, curved shoreline. Such a structure may have undesired effects on an adjacent inlet or other areas.

Figure 13 presents an example concept of a standalone terminal groin. This example is depicted as a single, relatively long structure that would reposition the southern end of the island such that the most erosional areas of the southern shoreline will benefit from the effect of the structure. This would reconfigure the southern end's plan form shape to a more linear alignment. The beach would be wider at the southernmost area of the island, near the structure and gradually narrow in the northward direction.

Figure 14 presents an example concept of a shorter terminal groin with a complementary breakwater to the immediate north. This approach is intended to stabilize all of the southern end of the island requiring stabilization while maintaining a more curved planform shoreline shape than that associated with the single terminal groin approach. The length of the terminal groin and the position and size of the breakwater would need to be determined to maximize shoreline stability while minimizing the size and scope of the structures. Structure design would need to consider potential impacts and impact minimization to interior sand shoreline downdrift of the structure.

The terminal groin approach can also incorporate multiple complementary structures, such as breakwaters and groins. Ultimately, the structure application will depend upon the specific situation and identified best solution for the specific problem. Selection of an appropriate plan and structure configuration will require a significant amount of detailed investigation.

Figure 13: CONCEPT of a long terminal groin and the intended residual beach position response at the southern end of IOP adjacent to Breach Inlet.

Figure 14: CONCEPT of a short terminal groin and updrift detached breakwater to address the natural curvature of the island's southern shoreline. The CONCEPT of residual beach position response to both the short terminal groin and updrift breakwater at the southern end of IOP adjacent to Breach Inlet is also depicted in the figure.

Figures 15 and **16** depict two examples where "leaky" terminal groins have been implemented with complementary updrift structures. Foth | Olsen was the Engineer of Record for both terminal groin projects. These structures are configured to maintain minimum beach conditions on their updrift side while allowing some sand transport to occur over and through the structure(s) to minimize impacts to the adjacent downdrift shoreline and inlet.

The first example, shown in **Figure 15**, is located at the southern end of Amelia Island, Florida adjacent to Nassau Sound, a large natural tidal inlet. There the southern end of the island was experiencing significant erosion and shoreline recession that could not be managed with beach nourishment alone. Following the onset of elevated erosion and shoreline loss, a large-scale beach restoration project with no structural stabilization was constructed. Although that project restored a significant portion of previously lost sand volume, the post-project shoreline, particularly closest to the inlet, continued to experience ever increasing and unmanageable sand loss rates. Through project monitoring and consideration of available limited offshore sand resources as well as the need to increase protection to a maritime forest, the decision was made to add a low-crested leaky terminal groin along with an updrift detached breakwater to reduce sand loss rates along the southern end of the island. The structures were constructed in 2004 and have successfully reduced the long-term sand loss rates from the island, allowing for more consistent minimum beach position conditions and time between required renourishment events. Shoreline conditions updrift of the terminal groin also benefit from the placement of sand dredged from a nearby shoal in the Atlantic Intracoastal waterway (AICWW) every 2 to 3 years. This

Figure 15: Example at the southern end of Amelia Island, Florida of a low-crested terminal groin and updrift detached breakwater to address chronic shoreline erosion that could not be addressed with beach nourishment alone due to excessively high erosion rates. This project has reduced sand loss rates along the southernmost end of Amelia Island to a level that allows typical beach restoration along the southern end of the island to be a successful beach management application.

material is much finer than the native beach material along the southern end of the island and erodes away much quicker than sand place from offshore borrow areas. Accordingly, it has been found that the AICWW sand cannot be a replacement for the periodic placement of higher quality sand from offshore borrow areas.

The other example, shown in **Figure 16**, is located at Bald Head Island, NC along the western end of South Beach adjacent to the Cape Fear River entrance, a coastal inlet with a federal navigation channel. Like the structure implemented at Amelia Island, the Bald Head Island terminal groin is a low-crested, leaky structure that allows sand transport to occur through the structure while maintaining intended minimum beach conditions on its updrift side. Two lengths of the terminal groin were considered. Ultimately, the shorter option was selected, and emphasis was placed on continued maintenance of an existing updrift radial sand tube groin field that had been constructed a decade earlier. The combined effects of this structure configuration, regular sand renourishment from channel maintenance dredging, and occasional beach renourishment using offshore sand resources has been successful in maintaining required beach conditions. Future uncertainties about the continued availability and accessibility of offshore sand resources may warrant consideration of additional structural applications. Both structure projects described herein are relevant examples of the type of structure application that should be considered for the southern end of IOP.

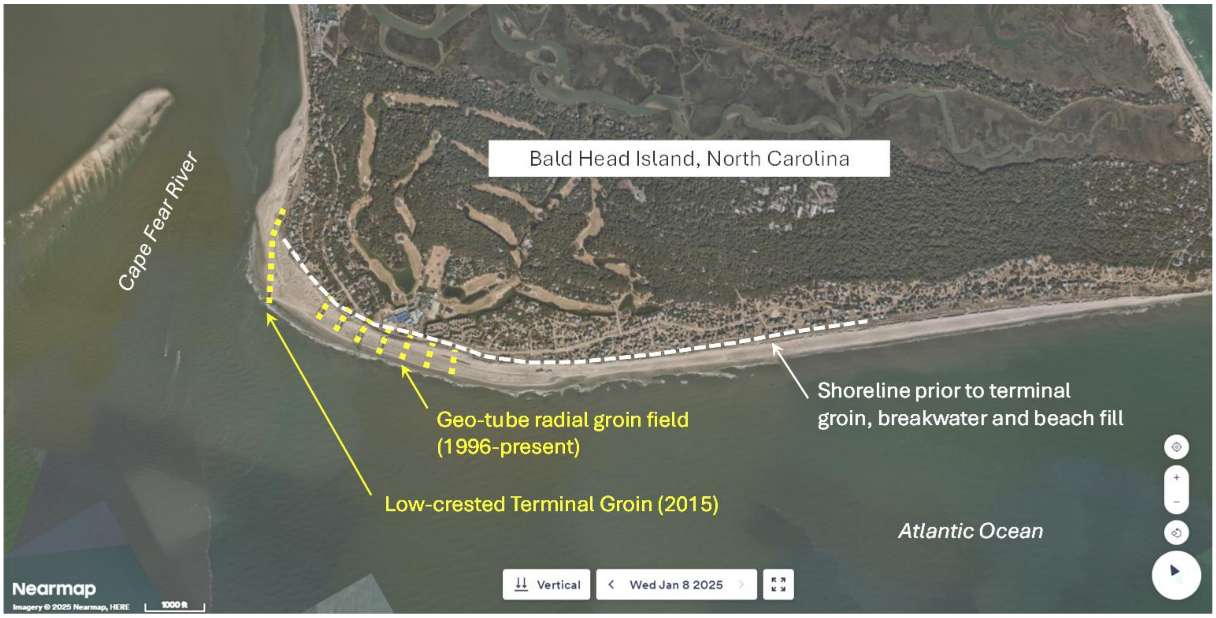


Figure 16: Example at the western end of Bald Head Island, North Carolina of a low-crested terminal groin and series of geo-tube groins to address chronic shoreline erosion that cannot be addressed with beach nourishment alone due to excessively high erosion rates.

For any beach management strategy that incorporates shore-stabilizing structures, a detailed engineering investigation is recommended. Moreover, such an investigation may be required to justify the project and support statements regarding expected performance to regulatory agencies. A shore-stabilizing structure investigation may include, but not be limited to, a comprehensive numerical model investigation that considers inlet hydrodynamics, the near-shore wave climate, and the effect of both upon the local sediment transport and shoreline and inlet shoal change. The model would be used to study existing conditions as well as the various project alternatives and their respective performance and effects. Although a numerical model would not be expected to provide a definitive answer to the question regarding need and scope of a structural stabilization approach, it would provide insight into the expected benefit of the use of structures as well as the expected relative performance of various structural alternatives to one another and to the no-action and nourishment only alternatives.

The cost of a shore-stabilizing structure project can be offset over a long-term planning period by the reduction in the amount and frequency of future sand renourishment events. There is also the benefit of more consistent beach conditions and relatively stable minimum beach conditions if the structures are configured in such a manner to provide that condition. Efforts to reduce future sand loss will benefit managed beaches as the availability of beach compatible sand resources suitable for beach project use become more limited and as sea levels increase. Further, the distance between managed beach and suitable sand resources will also increase in the future, increasing the cost to transport the materials to the beach. Exacerbating the situation are the ever-escalating costs from the U.S. dredge industry.

Causes of Recent Changes to South End Shoreline

The recent changes to the southern end of the island consist of a net loss of beach and dune sand volume and a persistent trend of sand volume loss. Historically, over the past 150+ years, this area of the island was generally stable to accretional. The specific reason or reasons for the change is unclear. There are, however, several recent and notable morphological changes around the southern end of the island and Breach Inlet that may have contributed in part to the recent observed changes. Given the lack of specific investigations of the probable causes, at this time, we can only hypothesize about the possible causes.

As correctly identified by CSE, there appears to be a strong relationship between the condition and behavior of the southern IOP shoreline (Reaches 1 and 2) and Breach Inlet and its associated shoals and channels. So, it may be reasonable to assume large changes to Breach Inlet and the shoals and channels, such as realignment, shift or other large change, can impact the IOP southern shoreline. Based upon our very cursory review of available inlet history information and knowledge of recent regional changes due to storms and global water level change, we believe that observed shoreline changes may be due, in part, to the following or a combination of the following,

- Changes to Breach Inlet tidal prism and inlet shoals,
- Recent hurricanes and other coastal storms, and
- Sea Level Rise (SLR).

<u>Changes to the Breach Inlet Tidal Prism.</u> CSE (2022) notes significant changes to the Breach Inlet ebb shoal and the potential relationship between these changes and the recent sand loss experienced along the southern end of the island. We agree that the historical stability of the southern end of the island is related to the location and condition of the northern lobe of the Breach Inlet ebb shoal and recent changes to this shoal are likely responsible, at least in part, to the recent sand losses along the southern end of the island. Of interest to future planning are the reasons for the large changes to the Breach Inlet ebb shoal.

Review of historical aerial photography of the Breach Inlet area shows that the interior area of the Breach Inlet channel at the Atlantic ICWW has experienced significant changes over the past several decades. Specifically, it appears that the interior area of the inlet channel is expanding. **Figure 17** depicts aerial photographs from 1994 and 2024. The respective apparent interior marsh edges near Breach Inlet are also shown. The specific area of interest is located within the purple circle included in the figure. Comparison of the photographs and delineated marsh edges show that the planform size of the direct opening between the Atlantic ICWW and the Breach Inlet channel has increased over this noted period. This change has also caused the channel between the ICWW and the ocean to become straighter.

An expanded and straighter inlet channel can increase the hydraulic efficiency of the channel which can increase the amount of water that is transported into and out of the inlet over a tidal cycle, a fixed amount of time. The total flow of water into and out of an inlet over a tidal cycle is termed the "tidal prism." An increase in the tidal prism will increase water velocities and the amount of sediment transport that occurs over the same period. Such permanent change to the tidal prism can have significant impacts on the overall inlet structure as well as the size, shape, location and function of the inlet's ebb and flood shoals as well as shorelines adjacent to the inlet. With an increase of the tidal prism at Breach Inlet, there could be significant changes to the adjacent shorelines including increase sand volume loss like that observed along the IOP southern shoreline.

The effects of a gradual increase in the inlet tidal prism would likely have a similar gradual influence on the condition and behavior of the adjacent shorelines. However, the occurrence of a large coastal storm while the inlet is experiencing changes to the general morphology and tidal prism can exacerbate and accelerate change to the entire inlet system. Further, it could be that such storm impacts are so significant that there can be permanent change to the inlet structure that the structure will not return to pre-storm conditions. As noted below, the IOP shoreline has experienced significant impacts from numerous hurricanes over the past 15 years, which is within the time frame of the noted inlet planform changes. So, it may be reasonable to conclude that the observed changes are related to the combined effects of overall inlet morphology change due to an increase in the tidal prism and large coastal storms that have a direct impact on the inlet and beach system.

It is noted that these observations are based upon limited aerial photography and there are no direct measurements of the inlet's width and cross-section. However, anecdotal observations from locals who use the inlet have indicated that conditions within the inlet, including the magnitude of water velocities, have increased over the years.

It is possible that maintenance of the ICWW at Breach Inlet has contributed to the observed changes in the interior channel and marsh edge conditions. Dredge records suggest that the area of the ICWW at Breach Inlet regularly requires dredging to maintain ICWW navigable conditions. The presence of the large dredge material disposal areas immediately adjacent to this area support the ICWW channel maintenance need. Long-term and frequent dredging of the ICWW immediately inside Breach Inlet may have contributed to the observed interior marsh edge change and channel expansion. Should this be the case, one could likewise conclude that ICWW maintenance dredging could be responsible, in part, to the long-term effects to shoreline conditions along the southern end of IOP. Given the noted change to the inlet marsh edges and channel, a more detailed investigation of a possible increase to the Breach Inlet tidal prism and possible associated effects to the inlet and adjacent shoreline may be a beneficial endeavor to support long-term beach management at IOP.

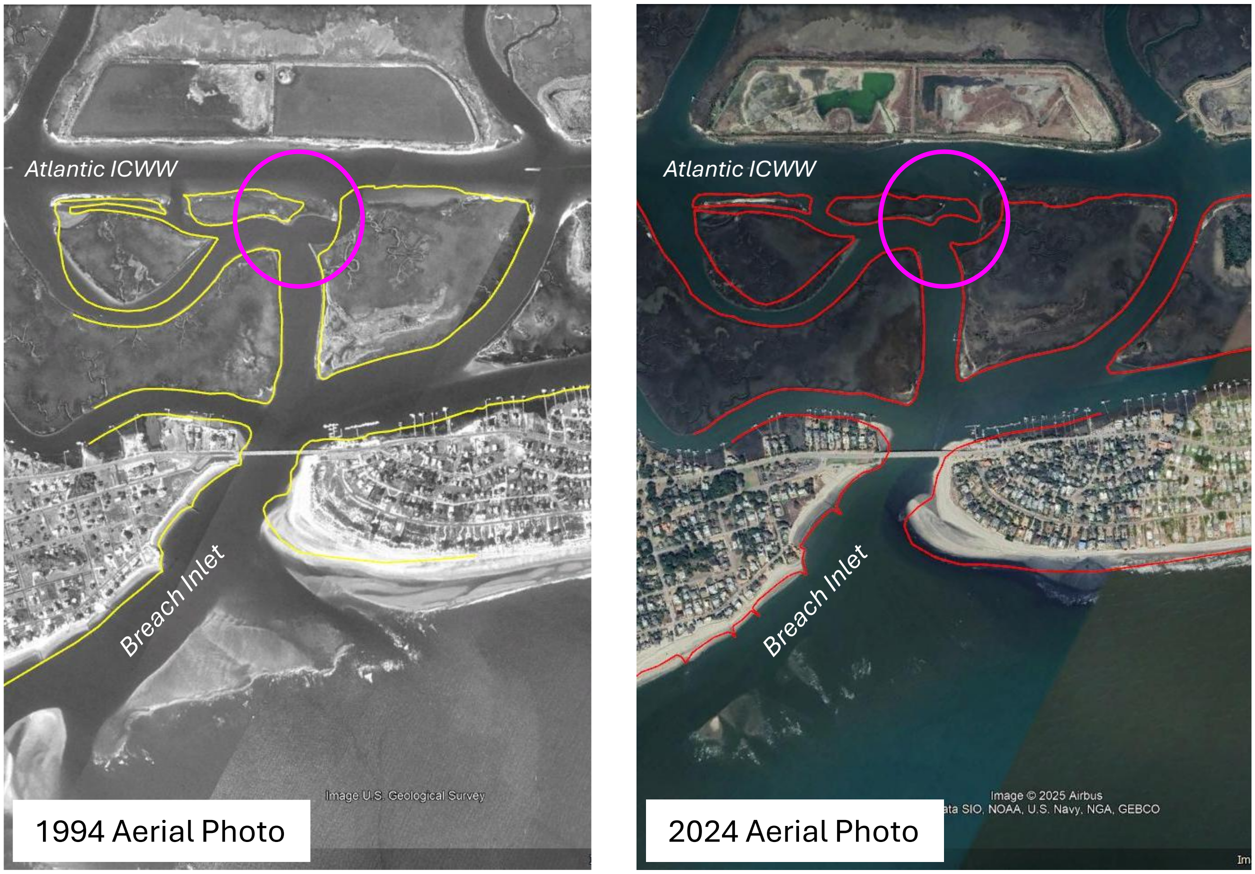


Figure 17: Aerial photographs of Breach Inlet from 1994 (left panel) and 2024 (right panel) with the respective apparent interior marsh edges near Breach Inlet also shown. The purple circle indicates the specific area of interest.

Storms. Recent net beach volume loss along the southern end of the island and changes to the Breach Inlet ebb shoal, also may be related to recent hurricane activity. Large sand volume losses occurred along Reaches 1 and 2 during Hurricanes Sandy (2012), Hurricane Matthew (2016), and Hurricane Irma (2017), among others. Although there was some volumetric recovery in the beach system following these events, there has been a trend of net sand loss from both Reach 1 and 2 since about 2011. Large storms can cause significant sand loss from across the entire beach profile from the upper dune to beyond the typical depth of closure. When this occurs, the sand is lost to the adjacent inlets as well as to the offshore, beyond the typical depth of closure. Once sand is transported beyond the local littoral system, it is not available to support post-storm recovery. From review of the recent sand loss trends at IOP, it appears that storm activity has contributed to the net loss of sand from the island's beach system.

Sea Level Rise (SLR). CSE (2022) summarizes the general trend of increasing average water levels in the vicinity of IOP and Charleston (**Figure 18**). Inspection of this figure reveals the gradual increase in measured water levels between 2000 and 2023. The most obvious change in this record appears to occur between about 2010 and 2023.

An increase in average water levels contributes to numerous changes in beach and inlet behavior. For sand beaches, higher water levels allow larger waves to reach the shoreline, allowing waves to increase sand transport, and allowing waves to remove sand from higher aeras of the beach and dune profiles. Higher water levels can also increase the amount of water that is transported through tidal inlets, increasing the tidal prism, water velocities through the inlet, and sediment transport rates. Large water volumes and velocities through an inlet will alter the shape and behavior of the inlet's channel, shoals, and adjacent shoreline. In instances where shoreline stability is maintained through inlet ebb shoal configuration and stability, changes to an inlet and inlet stability can adversely impact adjacent beaches.

Sea level rise is expected to continue at an ever-increasing rate. Additional increases in average water levels will further exacerbate the erosional effects to the island's sand beach and increase the amount of sand that will be required to maintain desired beach and dune conditions. The higher water levels will likewise increase potential instabilities around the adjacent inlets and associated shorelines.

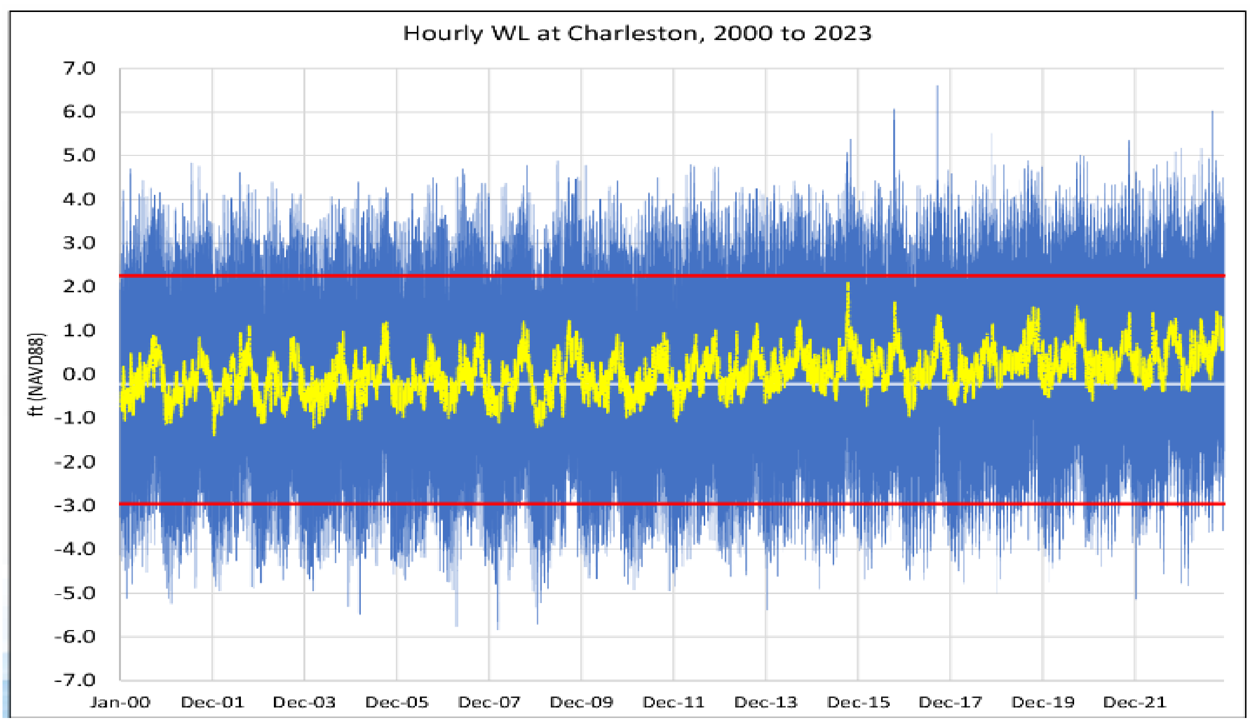


Figure 18: Sea level measures in the vicinity of Charleston, SC between 2000 and 2023 (CSE, 2022). Note the position and range of the yellow line relative to the white horizontal line.

Future beach management planning at IOP should consider the known effects that higher water levels can have upon beach and dune behavior. Specifically, plans should consider structural changes to beach fill design including changes to berm crest elevations and increases in sand volumes to offset future increases in sand loss rates due to higher water levels.

Comments on the USACE Beneficial Use Project. The USACE beneficial sand use project is a unique opportunity for the city to replace a portion of the recent sand loss along the southern end of the island. We are concerned, however, about the quality of the material compared to the sand that occurs naturally on the island's beach and dune and its ability to provide meaningful benefit. The material in the disposal area originated from maintenance dredging of the ICWW channel. It is common for sand excavated from interior waterways such as the ICWW to have a smaller average grain size and higher fines (silts and clays) content than that which typically found along Atlantic Ocean sand shorelines.

When materials with a smaller grain size than those which occur naturally are placed on the beach, they are susceptible to rapid transport away from the placement area contributing to higher-than-normal sand loss rates. The fines fraction of the material will be lost almost immediately, reducing the net volume of material that remains on the beach immediately after placement. Should the material be placed in the intertidal or nearshore region, the sediments will tend to sort by grain size from large to small with larger grain sized material tending to migrate shoreward and finer grain sediments migrating offshore (Dean (1973), Kraus et. al. (1991), and Dalrymple (1992)). Preliminary observations of the material placed by the USACE in 2025 indicate that the material is not being retained along the southern end of the island as hoped (Douglas Kerr, personal communication). This is likely due in part to the fine grain characteristics of the material and high silt content. Much of the placed material has likely migrated offshore and/or to the Breach Inlet shoals.

Given the nature of the material from the ICWW, it should not be considered a reliable future sand source for the island. Although placement along areas of the beach can have some benefit, any meaningful improvement will likely be short in duration and will not be expected to maintain desired beach volume and width conditions for an entire nourishment cycle. Should the recent sand loss rates along the southern end of the island continue, additional sand placement from offshore or other sources will be required.

Potential relationship between IOP beach management activities IOP and Breach Inlet

In short, we have found no evidence that would suggest that beach management activities on IOP have influenced the recent changes that have occurred at Breach Inlet. Further, there is no evidence that past beach management practices along the northern end of the island are related to the recent changes along the southern end of the island. As discussed above, we believe that the recent changes along the southern end of the island are related to morphological changes at Breach Inlet, recent storms, sea level rise, and/or a combination of these.

It may be possible that the release of the large volume of sand from the southern end of IOP (i.e., the recent net loss of sand) may have contributed, in part, to growth of the inlet's ebb and flood shoals, as well as increasing sand transport toward Sullivan's Island. An increase in the amount of sand transported to the Breach Inlet ebb shoal, especially the northern ebb shoal lobe just off IOP, may increase the potential for the Breach Inlet channel to migrate southward toward Sullivan's Island. Such channel migration could increase erosional stress along areas of the Sullivan's Island shoreline, especially that area of shoreline immediately adjacent to Breach Inlet. Again, we do not believe that the large loss of sand along the southern end of IOP and changes to the Breach Inlet ebb shoal and channel, and the Sullivan's Island shoreline are related to past beach management activities at IOP.

Future Sand Sources and Sand Source Sustainability

Current and expected future sand loss rates along the IOP shoreline, with or without shore-stabilizing structures will require regular sand replacement events to maintain desired beach and dune conditions. This need places significant demand on beach compatible sand resources that may be available to the island.

Regionally, sand resources suitable for placement on the beach are limited. The City should prioritize the identification of the future sand volume need and the sand resources that are available for currently planned and future projects. Planning should extend beyond just the next project and consider the sand resource needs over the coming decades. It is noted that USACE project planning typically involves identification of sand resources that will meet at least a 50-year project need.

Knowledge of the location and extent of available sand sources also allows for meaningful evaluation of the long-term probable sand replacement costs. The distance between the sand source and placement site has a significant impact on sand cost. As sand near the island is depleted, the City will be required to use more distant sand resources for future projects. This will have a direct impact on the cost of future projects. Between the ongoing cost increases in the US dredge market and expectation that future sand resources will be farther away from the island, the City should expect that the cost of future sand placement projects will continue to increase at an ever-increasing rate. The impacts of such cost increases to the overall beach management program should be considered in continued program planning.

Beyond identification of the available suitable sand resources, the City should prioritize sand resource preservation. This will include strategic borrow area design and controls over how dredge contractors are allowed to use borrow areas. We often develop dredge plans as part of borrow area design that are intended to control how a dredge contractor will work within a borrow area and this information is provided to bidding contractors prior to bidding. The purpose of this is to control where and how the contractor removes material from a borrow area so as not to unnecessarily disturb large areas of a sand resource. We often subdivide the sand borrow areas into zones and prescribe a specific order of dredging and the amount of sand that must be removed from each zone before the contractor can move to a subsequent zone. This information is provided in the project design, bid and contract documents. Without such constraints, a dredging contractor will operate in a borrow area in a manner that is most advantageous to their production and profitability. This may or may not be beneficial to sand source preservation and sustainability. It is possible for dredging equipment to dredge borrow areas in such a way that all usable sand is not removed and other areas are disturbed in such a way that future access to that material with a dredge is not possible. Beach compatible sand resources are a valuable and limited resource. Their prudent use and preservation are important for all beach management practices.

Summary and Recommendation

In summary, we believe that the beach management practices and projects implemented to date have been reasonable and prudent. But localized erosion rates caused by sand shoal migration along the northern end of the island and a persistent increase in the sand loss rate from the island's beach has limited the benefit of the sand placement only approach. There is no evidence that the occurrence of localized erosion due to shoal migration and attachments on the northern end of the island and recent increased sand loss rates along the southern end of the island will change. In fact, it should be expected that sand loss rates along the island may only continue to increase into the future. Accordingly, it is clear to us that sand placement alone as a beach management strategy will not be the most effective approach moving forward. More proactive approaches, such as intervention in shoal migration events and the use of strategic shore-stabilizing structures, along with sand placement, should be considered.

Below is a summary of future management practices that can be considered by the City,

- Future Restoration and Renourishment Schedules. The City should anticipate that the foundation of continued beach management at IOP will be beach restoration and periodic renourishment. A future challenge will be addressing this need in the most cost-effective way possible. To accomplish this, the City should explore measures to,

1) reduce the amount of sand needed to maintain suitable beach conditions,
2) address the cause of localized problematic erosion that triggers the need for emergency dredge mobilization and/or sand scraping events (i.e., proactive shoal management),
3) implement improvements to address areas with above average erosion rates and seek to create conditions that allow regular renourishments to occur for all areas of the island on the same schedule (i.e., use of strategic shore-stabilizing structures),
4) identify sand source(s) to address immediate need and long-term numerous future needs, and
5) implement measures to preserve available sand sources.

- Proactive Management of Shoal Attachments (Reaches 5 and 6). The City should consider implementing a shoal management plan that will reduce or eliminate the impacts that accompany shoal migration toward the island (i.e., localized hot-spot erosion on the shoulders of the shoal) and provide more consistent beach conditions between shoal attachment events. In concept, this would involve programmatic manipulation of approaching shoals with dredging equipment to alter the shape of the approaching shoal and transfer sand to the leeward beach. This work should be accomplished before the shoal shape and location becomes problematic to the leeward shoreline. It is possible that this could be a highly efficient and cost-effective long-term approach to managing the consistent beach conditions along the northern end of the island.

  The City should coordinate with representatives from the dredging industry regarding the feasibility of using dredge equipment (small or large) to excavate areas of the shoal to meet the goal of reducing shoal impact. Likewise, the City should also consult with state and federal regulatory and resource agencies about if such an activity is permittable. Additionally, the City should explore with the agencies the concept of a maintenance style authorization that would allow the city to respond in a timely manner to shoal events as they occur. This will eliminate permit processing time and allow for immediate responses before a shoal can adversely impact the shoreline.

  The specifics of how a more proactive shoal management strategy may be implemented will require significant investigation including geotechnical and numerical wave, hydrodynamic and sediment transport studies. These studies would help evaluate the feasibility and scope of a project approach.

- Strategic Shore-Stabilization Structures in Reaches 5 and 6. With or without the implementation of a proactive shoal management project, there are areas along Reach 5 and 6 where the use of shore-stabilization structures should be considered. Past beach restoration projects have not successfully provided consistent protection to all areas of the Reaches 5 and 6 shorelines. The structures would provide a last line of defense and establish a minimum shoreline position between the edge of upland development and the waterline. This would be particularly beneficial along those areas of Reaches 5 and 6 that have been most susceptible to highly localized erosion and infrastructure impacts during shoal migration events. The City should consider both a more aggressive shoal management program and the implementation of the shoreline stabilizing structures. The cost of the structures should be compared to the potential benefit of reduced sand placement needs in the future.

- <u>Terminal Groin at Beach Inlet (Reach 1).</u> Review of beach condition and shoreline change data available along the southern end of IOP as well as recent changes to the Breach Inlet morphology suggest that the current pattern of erosion will continue into the foreseeable future. Should existing sand loss rates along the southern end of the island continue, sand replacement alone is not expected to provide reasonable protection, likely requiring frequent maintenance to maintain conditions. Frequent dredge mobilization for beach maintenance is typically not the most cost-effective long-term beach management strategy.

  To reduce sand loss rates along the southern end of the island and provide more consistent beach and dune conditions, the City should consider the implementation of a terminal groin at the southern end is the island at Breach Inlet. The terminal groin should be scoped to maintain the desired shoreline position along the southern end of Isle of Palms while minimizing impacts to Breach Inlet and Sullivan's Island. Similar terminal groins have been constructed at the ends of Amelia Island, FL and Bald Head Island, NC. Both example groins have been constructed adjacent to tidal inlets and have been very successful in stabilizing the island shoreline while minimizing effects to the adjacent inlet and inlet shorelines.

- <u>Sand Source Identification and Preservation.</u> IOP beach management will continue to require compatible sand resources to maintain beach and dune conditions along the island. To support long-term planning and program sustainability, the City should seek to identify all potentially available sources that may be available for immediate needs as well as the need over the coming decades. Knowledge of the location and availability of future sand sources benefits and better understanding of the potential cost of future sand sources and projects. It is expected that future sand sources will be farther from this island than those that have been used historically and those that may be identified for the next renourishment. The cost of sand is directly related to the distance between the sand source and the beach placement site. The price of sand increases with distance between borrow source and beach.

Beach compatible offshore sand sources are not unlimited. Therefore, prudent beach and beach program management will require careful planning for sand source design and use to maximize the available sand source opportunities. The City should prioritize sand source identification and preservation as part of continued beach management program planning and implementation.

To round out our review of the IOP beach management program, we have identified select topics identified by the city's Ad Hoc Beach Management Committee for which we will provide some thoughts and comments for committee consideration. The selected topics and our comments are provided below.

Establish a minimum healthy beach volume profile. We agree with this goal. Note, more proactive management of Reaches 1, 2, 5, and 6 will be necessary to achieve this goal. The minimum beach volumes currently used by the city seem reasonable and measures should be implemented to address areas where current beach management practices have not been successful at maintaining consistent minimum conditions. We do not recommend increasing regional minimum beach volume requirements, island-wide, as an approach to address localized problem areas. The proactive measures explored throughout this report, including better shoal management and strategic shore-stabilizing structures, are recommended as priorities in future beach management on IOP.

Establish triggers for when Council should consider authorizing construction of mid-scale and large-scale project. Project triggers should be part of a proactive beach management strategy. Efforts should be made to establish triggers that represent large regions of the island's managed beach rather than highly localized areas. It is not cost-effective in the long term to have beach management decision making for the entire island based upon highly localized problems. Efforts to reduce the occurrence and extent of localized erosion problems should be pursued as part of the island's overall beach management strategy.

Consider becoming a USACE managed beach. There are pros and cons associated with a USACE managed beach. The most obvious benefit of a USACE managed beach is the cost-sharing that can be available from the USACE to restore and maintain the beach and dune. Also, the USACE managed beach can be eligible for 100% federal cost for repairs following impacts due to an eligible coastal storm event. The journey to successfully becoming a USACE managed beach, however, can be long and difficult and there is no guarantee about the ultimate financial benefit that can be secured.

Eligibility for a USACE beach is based upon but not limited to (1) the amount of storm damage protection that a project will provide, (2) the amount of public access that is available along a project area, and (3) the availability of perpetual easements from private owners along the area that allow USACE and public access to their beach front.

Below are some discussion points for the City to consider regarding a potential study by the USACE aimed at creating a federal beach project at Isle of Palms. In considering the desirability of a federal project, we believe the following questions or topics should be considered by the City and subsequently addressed by the USACE. It is noted that answers to many of these points would likely require some level of research by the USACE.

Necessary studies. It is assumed that the city would be seeking a project that encompassed most, if not all of, the entire shoreline of the IOP shoreline.

- What series of studies and/or steps would be required to ultimately achieve an authorized project, assuming the initial studies return favorable findings?
  - How much time would be required to reach authorized project status?
    - Recent examples of USACE projects that we have been involved with have required 10 to 15 years from initiation of study to project authorization, followed by additional years to fund and initiate construction.
  - Would the studies include investigations of other possible federal project authorizations, such as limited renourishment from adjacent navigation projects? What are the steps, costs, and requirements associated with these potential projects?
  - Could a federal project include proactive shoal management and shore-stabilizing structures as project features?

Up-front study costs.

- Except for a limited initial reconnaissance-level review, the City would be expected to share in the costs of all upfront feasibility studies, engineering analyses, design, and permitting. What will the cost-sharing percentage be between the city and the USACE? We expect that it will be an even 50%-50% cost-share. Currently, a feasibility study by the USACE typically costs on the order of $3M or more.
- Can the USACE estimate for the City what the total costs of all the studies and preparation will be to get to the point of an authorized project, assuming the studies result in a favorable finding?
- Is it correct that the City would be required to provide their portion of the funding for each step in the process up front, prior to any work being performed?
- What happens to the City's contributed funds if the project is determined to be ineligible for Federal funding? At what point (and cost) might this be known?

Potential Benefits and Eligibility.

- It is our understanding that a new USACE feasibility study will base the comparative "pre-project" conditions on the current beach conditions. The City has already made a very significant investment in its beaches. Accordingly, that investment has substantially improved the level of storm protection offered by the beach.

- To compute the benefits of a federal beach project, this existing level of storm protection would be compared to various project scenarios to determine the added levels of storm protection from each option (the "benefit"). Unlike a calculation based on a non-restored and severely eroded beach, the difference between the existing condition and any new project condition (i.e., the BENEFIT) will be significantly less than conditions that existed prior to the City's past beach management projects. Hence, the benefit-to-cost ratio could be much less. Many projects are facing a similar circumstance since many beaches have been substantially restored and are now essentially in maintenance mode. This is a significant issue for consideration here.
- As mentioned above, it is also our understanding that the current federal guidelines for Public Use Determination limit the potential level of federal participation. Can the USACE estimate how this might impact IOP prior to the city agreeing to participate in and fund a study?

Easements.

What are the public-use easement requirements from each property owner for the USACE to construct and maintain a federal project?

Project Control.

- What control will the City as local sponsor have over engineering, permitting, costs, and timing decisions for a federal project on IOP?
- Can the USACE contribute funds to a project constructed by the City, or must the USACE wholly control and manage the project? It is our experience that the USACE must control and manage a project to which it provides funds. Hence, costs typically increase due to USACE supervision and conformance with federal contract regulations.
- Can the City provide in-kind participation to provide survey, engineering, and environmental services for such a study (and perhaps a project, if authorized)? The City should consider that option as one way to exert increased control in the process should a decision be made to pursue a federal project. Such participation would have to be clearly described in the agreement documents between the City and the USACE.
- Assuming a federal project is initiated, could the City amend the USACE's construction drawings and contract to add beach nourishment at locations outside of a federally authorized project (at local cost)?

Foth | Olsen is the coastal engineering consultant for the non-Federal (local) sponsor of numerous federal shore protection and navigation projects throughout the southeast U.S., many of which we have worked with for over 30 years. As such we are very familiar and experienced with the complex requirements, costs, advantages, and disadvantages of federal projects, particularly from the perspective of the local sponsor. There are significant differences between older comprehensive shore protection projects and new projects with limited federal interest. Toward providing the City with a clear explanation of the complex realities of the federal program, these issues and questions should be addressed by the USACE.

Repeal/modify ordinance prohibiting hard erosion construction structure 250’ of mean high-water line. Consideration should be given to modifying the prohibition of hard structures along the shoreline to allow for the use of temporary structures should beach management practices not provide adequate protection to all shorefront infrastructure. Ideally, problematic areas will be addressed through programmatic change to the beach management approach that would render the need for hard structures useless. Once those goals are achieved, the temporary structures can be removed.

Determine City Responsibility for Emergency Work. The most effective community beach management programs approach management on a comprehensive manner with a single entity, such as the City, being responsible for all activities. Otherwise, it is difficult to implement projects that are most effective and cost-effective in addressing the beach system needs and consistent with the City’s beach management program. This does not mean that the City would need to fund all the activities. Rather, the City could establish funding responsibilities with all stakeholders, public and private, and use the available funds in areas if needed and in the most effective manner that benefits the overall managed beach and dune.

Establish property owner responsibility for dune maintenance on private property. Following the comprehensive model with a single entity heading responsibility described above, it may be best for the City to assume this responsibility.

Prohibit construction of new pools seaward of the maximum building line. Although likely politically unpopular, it is our opinion that new pools should not be constructed seaward of a maximum building line. The price to construct and continued value of pools to a property make them an indispensable asset to the owner. Should beach and dune conditions degrade to a point where a pool is exposed to the active beach, private owners will want to protect a pool in the same manner that they would want to protect the habitable structure. Such need will place additional strain on the beach system and beach management resources. The City’s focus should be on maintaining a reasonable development line for ALL infrastructure and implementing a reasonable and feasible beach management program to protect that infrastructure.

Accelerate and increase frequency of large-scale dredging projects from 10 years to 8 years. We recommend seeking a management strategy that will decrease, rather than increase the frequency of large-scale projects. The long-term cost of beach management using beach nourishment is directly related to the fixed cost of dredge equipment mobilization. The more frequently dredging equipment is mobilized, the more expensive the program cost is over time. The City should seek to implement management strategies that increase the time between required dredge mobilizations. More frequent large-scale projects will increase the overall program cost through time.

Initiate permitting for large-scale projects two years after completion of a large-scale project. Given typical permit acquisition timelines in the State of South Carolina, this may not be unreasonable. Consider seeking project permits that allow for multiple events under one authorization.

Coordinate the construction of large-scale nourishment project on both un-stabilized inlet zones to occur at the same time. We agree with and encourage this approach. There are significant long-term cost savings to the beach management program through minimization of dredge mobilization events and maximization of sand placement volume when a dredge is mobilized to the island. This effort, however, will not just simply occur through planning but rather through proactive management of areas of the island's beach that experience above average erosion rates compared to the island-wide average. The goal should be to manage sand loss rates to be more uniform along large areas of the island's shorefront. Trigger areas should not be localized hot spots but rather larger areas of the managed beach that require nourishment at the same time.

Hire full-time employee tasked with overseeing resilience efforts, including beach management. Many communities throughout the southeastern US with established and active beach management program typical have at least one dedicated staff member responsible for the community beach program. With the increase in awareness and activity related to community resiliency in addition to beach management, more communities are finding a dedicated staff person is essential to management all aspects of the program. The responsibilities of such a dedicated staff person may also include overseeing grant and resiliency programs related to the beach. A City led program for all beach management activities should justify such a position.

Increase the frequency of beach monitoring surveys from annual to semi-annual. We agree with this proposed change to annual monitoring. Semi-annual surveys are useful for several reasons. One reason is the ability to capture seasonal behavior of the beach, dune and inlets along the island's shoreline. The other is focused on the effects of potential annual storm impact on the island's shoreline and potential eligibility for FEMA Public Assistance funding should the island be impacted by an eligible storm. In many instances, we encourage the communities with which we work to conduct one survey in late spring, prior to hurricane season, and the other in late-fall after hurricane season. We also use the second annual survey as the immediate post-storm event should a damage assessment survey be required in the summer or fall. We recommend an annual comprehensive summary report that details the conditions represented by both surveys.

We thank you for the opportunity to review the City's beach management program and provide our thoughts and comments about potential future strategies that the City can consider for continued program sustainability. We look forward to your review and discussing any questions and comments that you may have.

Sincerely yours,

Christopher G. Creed, P.E.
Senior Coastal Engineer & Client Team Leader

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