

NOVEMBER 2014
STONE HARBOR

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DREDGED MATERIAL MANAGEMENT PLAN

PLANNING REPORT

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1 Objective

The network of waterways surrounding Stone Harbor is an essential component of the local economy, commercial and recreational lifestyle, and environment. Dredging and dredged material management often uses an ad-hoc planning process, resulting in a piecemeal, immediate solution rather than an integrated long-term planning approach. A Dredged Material Disposal Plan (DMMP) can address a communities long-term dredged material management needs by identifying the following elements: dredging demand; quantity and quality of dredged material; environmental considerations; and the disposal strategy for dredged material management including beneficial uses. The objective of this report is to develop a DMMP for the Borough of Stone Harbor to enable the Borough to plan and manage dredged material. This DMMP considers a 10-year planning horizon.

2 Project Area

The Borough of Stone Harbor is located on Seven Mile Island in Cape May County, New Jersey. The figure below identifies the municipal limits of Stone Harbor. The project area focuses on the man-made lagoons, marina, and residential slips located within the limits of Stone Harbor. Consideration of the Federal New Jersey Intracoastal Waterway (NJIWW) and State channels identified by the federal and state agencies that occur near Seven Mile Island are also included. OCC identified these waterways with input from the agencies that have historically dredged those areas.



Figure 1 - Stone Harbor DMMP Project Area

The nine (9) distinct man-made lagoons were created between the 1940's and 1970's. The figure below provides the location and name of each lagoon. In addition to the lagoons, there are two auxiliary waterways that are important to the Borough, Stone Harbor Hole and the Access Channel. Dredge Harbor Hole is located south of Sedge Island near Paradise Bay. The Access Channel starts at Paradise Bay and extends northward along Sanctuary Bay, and then passes in front of Carnival Bay and Pleasure Bay before intersecting with the NJIWW. These waterways are the focus of this DMMP.

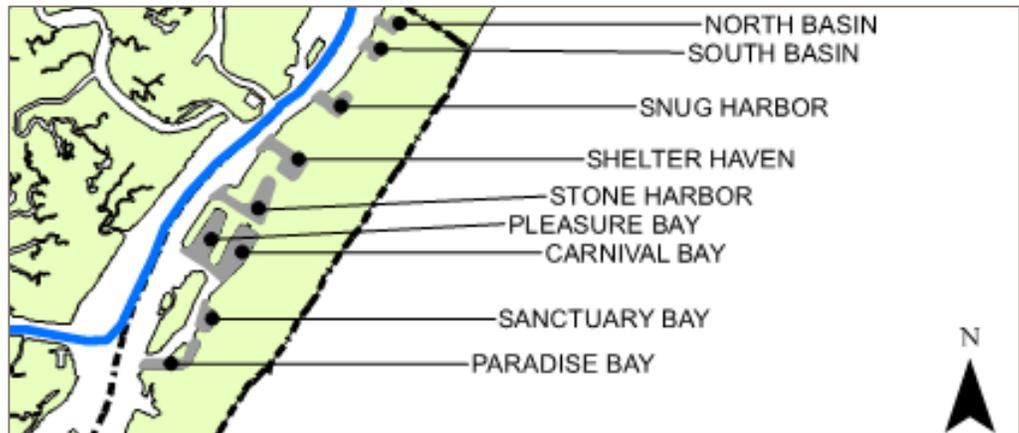


Figure 2 - Stone Harbor Lagoon Legend

The table below provides a brief physical summary of each of the study areas. The waterfront length is the approximate length of bulkhead that is in place within an individual lagoon. For the access channel, the waterfront length combines the waterfront length of Paradise Bay, Sanctuary Bay, Carnival Bay, and Pleasure Bay because each of these lagoons can utilize the access channel to navigate to the NJIWW. The area under consideration is the approximate open water footprint (limits) within the bulkheaded lagoons areas.

Table 1 - Stone Harbor Lagoon Physical Summary

DREDGE AREA	WATERFRONT LENGTH [FT]	AREA [AC]
North Basin	1,500	2
South Basin	1,300	2
Snug Harbor	2,200	5
Shelter Haven	3,100	8
Stone Harbor	4,200	9
Pleasure Bay	2,500	9
Carnival Bay	3,100	11
Sanctuary Bay	1,100	4
Paradise Bay	1,800	4
Access Channel	10,200	9
Stone Harbor Hole	1,200	3

These nine man-made lagoons, the access channel, and Stone Harbor Hole are the focus of this DMMP. Stone Harbor has maintained these waterways in the past through dredging. They are critical to safe navigation for local and transient boaters. There are additional waterways that boaters may utilize for navigation near the project area. However, these waterways have not been maintained, are not marked, and therefore, were not included in the study area. Specifically, the waterway south of the Free Bridge was not included in this analysis for this reason.

3 Dredging Demand

The 10-year dredging demand assessment quantifies the cumulative dredging volume that Stone Harbor should plan to manage. The schedule and number of discrete dredging events during this period is dependent on financial, regulatory, and logistical constraints. The prediction of discrete dredging events is beyond the scope of this document.

OCC divided the dredging demand into four (4) categories: federal, state, municipal, and private and based on the entity that has historically conducted the dredging and not necessarily the owner of said waterways¹. For example, the NJIWW is located in State waters however, it is a federally authorized navigation project; the USACE has historically dredged this waterway as part of their navigation responsibilities and therefore OCC categorized it as a federal waterway for this analysis

OCC coordinated with state and federal agencies to obtain their maintenance dredging demand in channels and anchorages surrounding the project area. To assess the municipal and private dredging demand, OCC utilized historical Stone Harbor Lagoon dredging data provided by Stone Harbor representatives along with recent hydrographic surveys of the subject area. The Richard Stockton College of New Jersey Coastal Research Center (CRC) surveyed the Stone Harbor Lagoons on 8 May 2014. The USACE surveyed the NJIWW near Seven Mile Island on 15-16 August 2013. The figure below provides the interpolated surface results of the hydrographic surveys. The design dredge depth for this analysis is six (6) feet below Mean Low Lower Water (MLLW). Areas in red have a depth less than six (6) feet at MLLW. Areas in blue have a depth greater than 6 feet at MLLW.

¹ The State of New Jersey claims ownership to the tidelands (riparian lands) that New Jersey defines as all lands that are currently and formerly flowed by the mean high tide of a natural waterway. The NJDEP Tidelands Resource Council manages the tidelands and may issue grants, licenses, or leases to utilize these waterways.

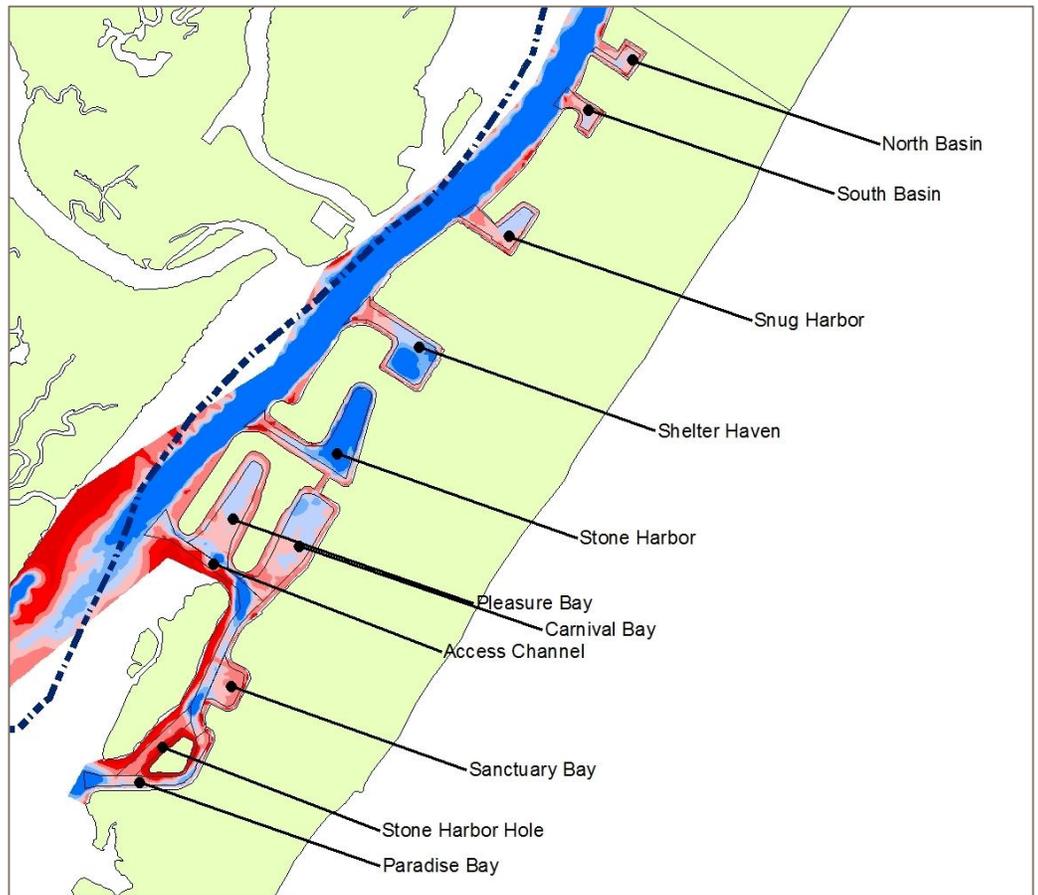


Figure 3 - Stone Harbor hydrographic survey data (CRC2014, USACE 2013)

3.1 Federal Waterways

In 1939, the federal government authorized the United States Army Corps of Engineers (USACE) to create and maintain the NJIWW. The USACE is authorized to maintain this waterway to a depth of 6 feet below MLLW. The NJIWW includes the following channels between Hereford Inlet and Townsends Inlet (south to north) within the Bay waters of southern New Jersey: Great Flat Thoroughfare, Great Channel, Gull Island Thoroughfare, Great Sound, Paddy Thoroughfare, and Ingram Thoroughfare. The NOAA map below highlights these channels.

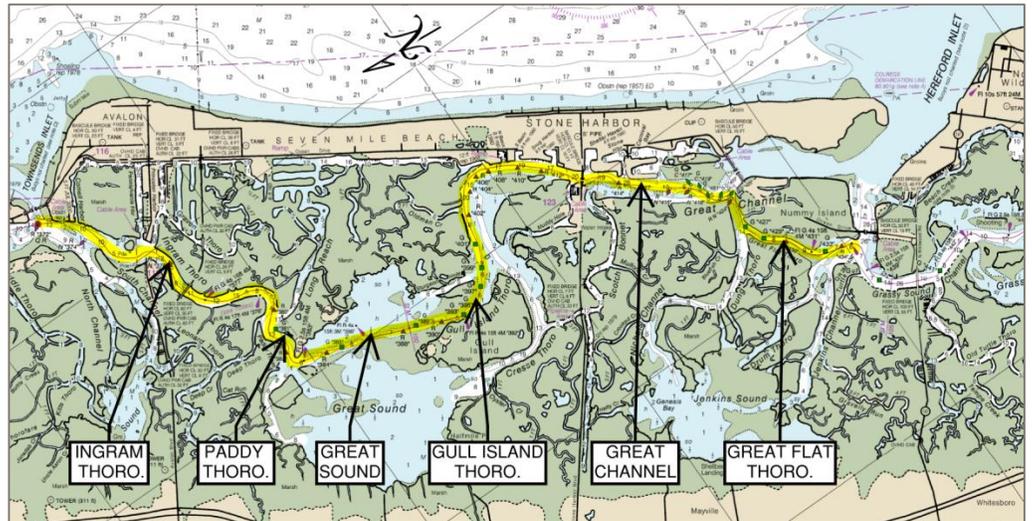


Figure 4 - USACE NJIWW highlighted near Seven Mile Island

Monica Chasten, USACE Philadelphia District, provided the current dredging demand of federal waterways near Seven Mile Island on 7 April 2014. The NJIWW Final Site Selection Report (IT 2001) provided the USACE with historical dredging records from 1973 to 2000.

The Grassy Sound Channel (“Football Field”) is located north of Stone Harbor. Stone Harbor residents traverse this channel when traveling north along the NJIWW to Townsends Inlet. This channel has a current dredging need of approximately 80,000 cubic yards of fine-grained material (silt and clay). Historically, the USACE dredged between 30,000 and 120,000 cubic yards from this channel every two (2) to four (4) years. OCC estimates the 10-year dredging demand for the Grassy Sound Channel to be approximately 150,000 cubic yards.

The Great Flat Thoroughfare is located south of Stone Harbor. Stone Harbor residents traverse this channel when traveling south along the NJIWW to the Wildwoods and Cape May Harbor. This channel has a current dredging demand of approximately 7,000 cubic yards of coarse-grained material (sand). Historically, the USACE dredges between 6,000 and 15,000 cubic yards from this channel every three (3) to seven (7) years. OCC estimates the 10-year dredging demand for the Great Flat Thoroughfare to be approximately 25,000 cubic yards.

OCC estimates the 10-year dredging demand for federal waterways to be approximately 175,000 cubic yards.

3.2 State Waterways

The state of New Jersey has charged the New Jersey Department of Transportation Office of Maritime Resources (NJDOT OMR) with the management of the marine transportation network including state navigation channels. On 7 April 2014, Genevieve Clifton of NJDOT OMR informed OCC that there are no “State channels”

that are actively maintained near the project area. Because of this, NJDOT OMR does not anticipate State dredging in the next 10 years near the project area. Therefore, the State does not have a current or 10-year dredging need demand near the project area.

3.3 Municipal Waterways

The network of waterways surrounding Stone Harbor is an essential component of the local economy, boating activity, and environment. Stone Harbor has taken on the responsibility of managing the waterways used by its residents to access the NJIWW. These waterways primarily exist within nine (9) lagoons that are a combination of natural, man-made, and filled waterways². The figure below identifies each of the lagoons. In addition to the lagoons, Stone Harbor Hole and the Access Channel are included in the group of municipal waterways.

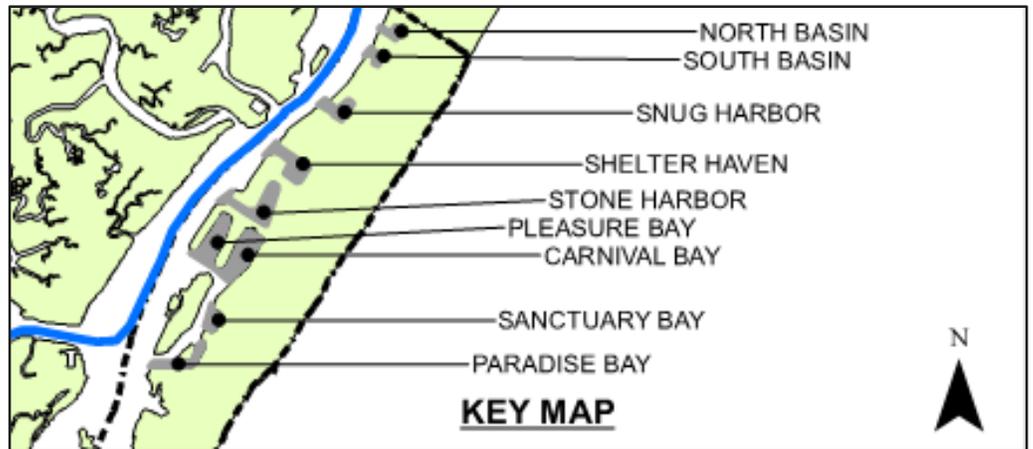


Figure 5 - Stone Harbor Lagoons

OCC reviewed the CRC hydrographic survey data of the Lagoons to evaluate the depth range at the entrance to the lagoon and the location and minimum depth within the lagoon. The depth range at the entrance of the lagoons is a qualitative measurements and it not meant for navigation. Additionally, this data only reflects the conditions at the time of the survey. The objective of the qualitative depth range is to evaluate the water depth navigational hazards present at the entrance that affects all boaters passing through the entrance of the lagoon. The minimum depth measurement and location identify the minimum water depth that the CRC collected during the hydrographic survey. The location of the minimum depth is a local feature and may not affect the entire lagoon. OCC will utilize these site characteristics when assessing the overall demand of the lagoons.

² Based on the Tidelands Conveyance Maps for the Borough of Stone Harbor, New Jersey has issued grants for the following Stone Harbor Lagoons: Stone Harbor, Pleasure Bay, Carnival Bay, Sanctuary Bay, and Paradise Bay. The State owns the areas of the remaining lagoons that do not have a valid tidelands instrument and those were once or are presently flowed by the tide.

Table 2 - Stone Harbor lagoons summary

DREDGE AREA	WATERFRONT LENGTH [FT]	DEPTH RANGE AT ENTRANCE [FT MLLW]	MIN DEPTH [FT MLLW]	LOCATION OF MIN DEPTH
North Basin	1,500	4 - 8	1.8	NW Corner of Lagoon
South Basin	1,300	2 - 3	1.5	South Side of Entrance
Snug Harbor	2,200	2 - 4	1.9	North Side of Entrance
Shelter Haven	3,100	1 - 4	1.0	South Side of Entrance
Stone Harbor	4,200	1 - 3	0.7	South Side of Entrance
Pleasure Bay	2,500	6 - 10	2.3	East Side of Lagoon
Carnival Bay	3,100	1 - 4	1.1	West Side of Entrance
Sanctuary Bay	1,100	4 - 7	2.0	East Side of Lagoon
Paradise Bay	1,800	1 - 5	0.1	NE Side of Lagoon
Access Channel	10,200	2 - 6	0.1	Opposite Pleasure Bay
Stone Harbor Hole	1,200	0-4	0	Adjacent to Shoreline

OCC calculated the May 2014 dredging demand for the municipal waterways identified above. The table below summarizes the available volume of dredged material between the May 2014 hydrographic survey data and a design dredge depth of six (6) feet below MLLW plus two (2) feet of allowable overdepth. This estimated the total volume of dredged material within the design dredge template. Typically, the actual volume of material dredged is less than this volume. OCC estimated a total planning volume that accounts for variations in actual material removed during dredging and potential for additional siltation. The total planning volume is the recommended volume for permitting and OCC based this volume on dredging experience and judgment. Figures showing the dredging limits, existing depths, and areas in need of dredging are also included in the Appendix.

Stone Harbor should use the planning volumes for permitting purposes. Stone Harbor will need to conduct additional hydrographic surveys of the dredge areas, inclusive of

the slip areas, for procurement and construction payment purposes. A conditional hydrographic survey prior the solicitation is needed for the bid process. Additionally, no more than 30 days prior to mobilization, a pre-dredge survey will be needed to establish water depths for payment purposes.

Table 3 – Stone Harbor Dredging Demand, May 2014

DREDGE AREA	VOLUME TO 6 FT MLLW [CY]	VOLUME OF 2 FT OD [CY]	TOTAL DREDGE VOLUME [CY]	TOTAL PLANNING VOLUME [CY]
North Basin	17,500	5,400	22,900	24,000
South Basin	7,800	6,200	14,000	14,500
Snug Harbor	9,100	11,400	20,500	18,000
Shelter Haven	10,800	9,000	19,800	20,000
Stone Harbor	4,200	4,300	8,500	9,000
Pleasure Bay	3,000	22,800	25,800	12,500
Carnival Bay	5,500	30,700	36,200	16,000
Sanctuary Bay	7,100	10,500	17,600	15,000
Paradise Bay	4,200	9,200	13,400	10,000
Access Channel	1,400	19,500	20,900	11,000
Stone Harbor Hole	7,500	9,400	16,900	15,000
TOTAL	78,100	138,400	216,500	165,000

OCC estimates the 10-year dredging demand for the Stone Harbor Lagoons to be approximately 165,000 cubic yards. Our assumption is that the Stone Harbor Lagoons will be dredging within the NJDEP 5-year permit duration and that Stone Harbor may not need subsequent dredging for an additional 5 years following the initial dredging event. This assumption is because Stone Harbor last performed maintenance dredging in 2003. The actual duration between dredging events is unknown and is dependent on environmental, construction, and planning conditions. OCC recommends that Stone Harbor monitor and track these variables to effectively plan for

future dredging events. The following sections provide additional information for planning subsequent dredging events.

Note that the 10-year dredging demand is less than the May 2014 total volume of dredged material available to be dredged to a depth of six (6) feet MLLW plus two (2) feet of overdepth. This is because contractors do not typically remove all of the overdepth material while dredging. Therefore, the planning volume is a more accurate representation of the predicted volume to be removed and will serve as the recommended permit volume.

For reference, in 2003 Stone Harbor Lagoon dredged these nine lagoons to a depth of 6 feet below MLLW plus 2 feet of allowable overdepth. During this event, Stone Harbor dredged a total of approximately 104,800 cubic yards. A table in the appendix provides a summary of the volume removed from each lagoon. Please note that the Access Channel and Stone Harbor Hole volumes are included in the Paradise Bay volume.

3.4 Private Waterways

The private waterways are located between the municipal dredge area and the bulkhead line. This area contains residential slips and marinas. Dredging records for this area are limited. To estimate the current dredging demand, OCC extrapolated the August 2014 survey data to the bulkhead line with an assumption that the average water depth at the bulkhead is three (3) feet MLLW. OCC reduced the design dredge template to four (4) feet MLLW plus two (2) feet of overdepth because this is a typical draft for recreational vessels. Additionally, OCC assumed that only 20% of the dredge area is less than the design dredge depth and would be dredged because the slips occupy only a fraction of the total area. Additionally, OCC assumed that some residents would not elect to perform dredging, as was the case in the 2003 dredge event. Based on these assumptions, OCC calculated the August 2014 private waterway dredging demand to be approximately 18,614 cubic yards.

OCC estimates a 10-year dredging demand for the private waterways to be approximately 20,000 cubic yards.

3.5 Dredging Demand Summary

OCC estimates that over the next 10-years, federal, state, and local stakeholders will need to work together to manage approximately 360,000 cubic yards of dredged material in the project area. OCC estimates that Stone Harbor and its residents will generate approximately 185,000 cubic yards of dredged material over the next 10 years. The table below summarizes dredging quantities for each source.

Table 4 - Dredging Demand Summary

WATERWAYS	10 YEAR DREDGING DEMAND [CY]
Federal	175,000
State	0
Municipal	165,000
Private	20,000
TOTAL	360,000

The management of this material through placement and beneficial reuse is critical to maintaining these waterways with dredging activities. Stone Harbor may not be able to conduct maintenance dredging at all the lagoons during any one dredging season due to but not limited to budget, schedule, and available placement capacity.

To assist in the planning process, OCC characterized each waterway with a relative overall dredging demand. OCC notes that all lagoons are in need of dredging and present a navigational risk due to reduced water depths. The overall demand considers the planning volume, relative navigation risk from water depth, and relative number of users of the waterway. The relative navigation risk considers the information provided in Table 2 (water depth at the entrance, minimum water depth) and engineering judgment. The relative number of users was determined using the overall area of the waterbody, its location, and engineering judgment. The actual number of users, slips, and parcels within each waterway was not collected and is beyond the scope of this report.

The overall dredging demand are based on currently known conditions and are subject to change based on additional information gathered during the planning, permitting and engineering process. For example, construction logistics, such as dewatering and available placement capacity during the time of dredging, may require modification to the phased dredging plan. Additionally, the physical and chemical characteristics the dredged material can influence disposal alternatives and thus selected phase for waterways.

Table 5 – Stone Harbor Lagoon dredging demand evaluation

DREDGE AREA	PLANNING VOLUME [CY]	RELATIVE NAVIGATION RISK	RELATIVE NUMBER OF USERS	RELATIVE OVERALL DEMAND
North Basin	24,000	Low	Low	Medium
South Basin	14,500	Medium	Low	Low
Snug Harbor	18,000	Medium	Medium	Medium
Shelter Haven	20,000	High	Medium	High
Stone Harbor	9,000	High	Medium	High
Pleasure Bay	12,500	Low	Medium	Low
Carnival Bay	16,000	High	Medium	High
Sanctuary Bay	15,000	Medium	Low	Medium
Paradise Bay	10,000	High	Low	High
Access Channel	11,000	High	High	High
Stone Harbor Hole	15,000	Medium	Medium	Medium

4 Alternatives Analysis

The objective of the alternatives analysis is to identify, evaluate, and compare dredged material placement alternatives to manage dredged material disposal from the Borough of Stone Harbor and its local residents. OCC developed alternative placement options in a systematic manner to ensure that reasonable and practical alternatives are evaluated. The alternative options are unique; not restricted to current limitations (regulations, laws, or statutes); they consider relevant measures; include mitigation of significant adverse effects; consider plans/desires of others; consider various implementation schedules; and estimate cost/benefit.

OCC identified and categorized the alternative options. The primary category is either disposal or beneficial use. Disposal options are those, which are only concerned with the disposal of dredged material. Alternatively, beneficial uses of dredged material options are those in which the dredged material serves as a recycled resource and provides a beneficial function to society. This section provides a description, evaluation, and recommendation for each alternative.

4.1 Disposal

Disposal of dredged material consist of the placement of dredged material with the sole purpose of removal from the waterway. The placement of the dredged material provides not immediate benefit or use to society. Disposal options are divided into open water disposal and upland disposal.

4.1.1 Open Water Disposal

Open water disposal consists of placement of dredged material in open water areas. Dredged material may be placed either hydraulically or mechanically. Examples of open water disposal include, but are not limited to, open water ocean disposal, confined aquatic disposal (CAD), side casting, and topography modification through reprofiling. Historically, these methods have proven to be a cost effective methods for placement of dredged material, however they do affect water quality during placement.

Regulatory permits are required for open water disposal. Current regulations discourage open water disposal due to the water quality concerns.

4.1.2 Upland Disposal

Upland disposal consists of placement of dredged material on exposed land surfaces. Contractor can perform upland disposal via hydraulic discharge to local upland sites or by mechanical transportation via truck, rail, or barge to regional upland facilities. Examples of upland disposal facilities include, but are not limited to, confined disposal facilities (CDF), landfill, and dredged material processing facilities. A dredged material processing facility is a site that NJDEP permits to receive and stockpile dredged material for future processing and uses.

4.2 Beneficial Reuse of Dredged Material

The beneficial use of dredged material consists of the placement of dredged material to serve a function other than disposal. The beneficial use of dredged material follows a model of recycling and regional sediment management protocol. Beneficial uses of dredged material are divided into the following categories: environmental restoration, environmental remediation, flood protection, and general aggregate fill.

4.2.1 Environmental Restoration

Environmental restoration consists of improving and restoring environmental resources. Examples include wetland restoration, quarry restoration, and edge restoration. For this beneficial use, dredged material can be used as a material source for restoration where fill material is needed. Typically, the material would need to be of equal or better quality than that which it is being placed in addition other site-specific requirements.

4.2.2 Environmental Remediation

Environmental remediation consists of lessening the environmental concerns a site poses to the environment. Environmental remediation may occur both upland and in open water. For this beneficial use, dredged material can be used as fill or an isolation barrier (capping). Typically, the material requirements are site specific.

4.2.3 Flood Protection

Flood protection consists of increasing elevations to remove upland areas from the flood zone. Along coastal communities, this type of project is typically conducted through beach and dune restorations and enhancements. For this beneficial use, dredged material can be used as fill. Typically, the material would need to be greater than 90% sand to receive authorization to be placed on the beach however fine

grained material may be contained within a geotextile tube and used to reinforce a dune core or as back beach fill.

4.2.4 General Fill

General fill consists of common construction aggregate fill. For this use, the material would need to meet the material requirements for the specific use. Typically, materials will need to be greater than 65% sand.

4.3 Alternatives Analysis Matrix

OCC developed an alternatives analysis matrix to evaluate the dredged material management options listed above for dredged material generated from Stone Harbor. The matrix consists of general information for each option as well as an evaluation of the option for Stone Harbor. The result of this evaluation matrix is provided in the appendix.

4.3.1 General Information

OCC provided general information for each of the alternatives. Specific details of each alternative are site specific and are not included in this analysis.

The capacity column provides an order of magnitude volume for dredged material placement for a single project site example. Multiple placement events may be required to reach this capacity depending on site specifics.

The typical dredging and placement cost column provides an estimated cost to dredge and place the dredged material. The purpose of this column is to provide relative costs. The actual project costs for each example may be +/- 50% based on site specifics.

The sediment testing for placement column provides the expected testing requirements for approved placement of dredged material. At a minimum, physical testing consists of grain size, percent moisture, and total organic content (TOC). Additional site specific physical testing may include permeability, compaction, and shear strength tests. Chemical testing consists of sediment chemistry analysis. The evaluation criteria for chemical analysis may be for general or site-specific human and ecological exposure. Biological testing consists of exposing organisms to the sediments to evaluate mortality and bioaccumulation. The NJDEP Office of Dredging and Sediment Technology must approve a Sampling and Analysis Plan (SAP) for most dredging projects in New Jersey. The SAP will identify the project specific sampling and analysis requirements for dredging and placement of dredged material.

The Min % Sand column provides the minimum percent sand that the dredged material must contain for the alternative. These numbers are not absolute and the regulatory

agencies and uses of the dredged material may modify these requirements on a case-by-case basis.

The contaminated sediments accepted column identifies if contaminated sediments are acceptable. Alternatives that have a site-specific requirement may be able to accept contaminated sediments pending review and approval by regulatory agencies and uses of the dredged material.

The estimated project soft costs column provides an order of magnitude of the costs needed to identify and develop the alternative. These costs include, but are not limited to, sediment sampling, permitting, design, and monitoring.

4.3.2 Evaluation Criteria

OCC evaluated each criteria based on the current available capacity and general information of each alternative. This information is based on professional experience and was undertaken in consultation with local resource agencies and contractors. The current available capacity may change in the future due to regional dredging project and facility operations that are out of the control of Stone Harbor. To aid in the planning effort, Stone Harbor should monitor placement capacity and evaluate entering into agreements with facility operators to provide future capacity. Details of the evaluation including estimated costs and capacity are provided in the Alternatives Analysis Matrix enclosed in the Appendix.

4.4 Alternatives Analysis Summary

OCC evaluated the options to manage the dredged material. Based on this analysis, OCC identified the alternative placement options for immediate implementation, future implementation, and those that are not recommended. OCC's recommendations to implement these alternatives are provided in the next section.

An approximate and relative cost for each alternative per cubic yard is provided for reference. The actual cost depends on additional unknown variables related to the dredged material characteristics, construction logistics, regional dredging demand, and available capacity. Additionally, these costs do not include soft costs such as engineering, permitting, sampling, and coordination.

Based on our analysis, OCC recommends the following dredged material management alternatives for immediate consideration and implementation. These alternatives are identified as currently viable from an economic, regulatory, and logistic standpoint.

- › Confined Disposal Facility (\$30/cy)
- › Landfill (\$55/cy)
- › Dredged Material Processing Facility (\$45/cy)

Based on our analysis, OCC recommends the following dredged material management alternatives for future consideration and implementation. These alternatives are identified as not currently viable but have the potential to be viable in the future with assistance from federal, state, and local stakeholders.

- › Reprofiling (\$10/cy)
- › Wetland Restoration (\$20/cy)
- › Quarry Restoration (\$40/cy)
- › Intertidal Habitat Enhancement (\$20/cy)
- › Edge Restoration (\$25/cy)
- › Upland Remediation (\$50/cy)
- › Open Water Remediation (\$20/cy)
- › Beach and Dune Nourishment (\$30/cy)
- › Landfill Cover and Closure (\$40/cy)
- › Miscellaneous Construction Aggregate+ (\$35/cy)

Based on our analysis, OCC recommends the following dredged material management alternatives not be considered or implemented. These alternatives are identified as not viable and do not have the potential to be viable without a major shift in regulatory sediment management criteria.

- › Ocean Disposal (\$20/cy)
- › Confined Aquatic Disposal Site (\$25/cy)
- › Side Casting (\$15/cy)

5 Implementation Plan

This implementation plan provides guidance and recommendations for Stone Harbor to manage the 10-year dredged material disposal demand. The implementation plan is divided into a short-term plan and a long-term plan. The short-term plan provides guidance to proceed with maintenance dredging in the immediate future. The long-term plan provides guidance for managing dredged material during future dredging events. Additionally, the long-term plan recommends Stone Harbor monitor the water depths with an annual hydrographic survey (similar to the beach profile survey plan).

5.1 Short-Term Plan

The objective of the short-term plan is to perform maintenance dredging of the Stone Harbor Lagoons starting in the Fall 2015. The goal of the short-term plan is to conduct Stone Harbor Lagoon maintenance dredging over a period of two years. There is a possibility that dredging may take between 1 and 4 years. Dredging over multiple years can increase the total project costs due to repeat mobilization costs; however, this may be needed based on environmental, construction, and planning constraints.

Additional information during the implementation of the short-term plan such as material characteristics and contractor's quotes will define the required dredging duration. It is premature to select specific lagoons for each potential phase. OCC estimated the overall demand of the lagoons to assist in the planning effort; however, Stone Harbor needs additional information to finalize the selection of specific lagoons for discrete dredging events. Stone Harbor should evaluate this following the dredged material characterization and during the procurement process.

To prepare, permit, design, and contract maintenance dredging by the Fall 2015, OCC recommends that Stone Harbor utilize the dredged material management alternatives that were recommended for immediate consideration because they are as currently viable from an economic, regulatory, and logistic standpoint. Stone Harbor must conduct the following engineering steps to implement this short-term plan. Additionally, Stone Harbor must conduct political steps such as allocate funding and

obtain local approval for this process, to implement this short-term plan. The details of the political steps are beyond the scope of this plan.

5.1.1 Permitting

Stone Harbor must obtain regulatory authorization prior to perform maintenance dredging. This process can take between six (6) to twelve (12) months to complete and it is imperative that it begins as soon as possible. Stone Harbor must obtain permits from the New Jersey Department of Environmental Protection and the United States Army Corps of Engineers. These permits are valid for a period of 5 years and 10 years, respectively. OCC recommends that the permit area encompass all open waters within the lagoons and access channel to be dredged to a depth of 6 feet below MLLW plus 2 feet of allowable overdepth. This will allow Stone Harbor to include the local residents and business owners during the development of the dredging project.

To obtain permits, the project must comply with necessary regulations, have a valid NJDEP Tidelands Instrument, and obtain letters of material acceptance from an approved upland facility based on sediment sampling and analysis results that were obtained according to an NJDEP approved Sampling and Analysis Plan (SAP).

5.1.2 Engineering

Engineering is needed to evaluate the construction logistics that includes estimated dredging production rates, dewatering rates, placement rates, and capacity at the various upland disposal facilities. These factors are combined with regulatory restrictions and economical restrictions to plan and schedule the maintenance dredging projects that may need to be phased over multiple years to complete Stone Harbor Lagoon maintenance dredging. Based on an approved construction schedule, final designs must be developed that will be utilized to solicit bid and perform the work.

5.1.3 Contracting and Project Execution

With permits in hand and final engineering complete, the maintenance dredging projects can be offered for public bidding. There are a limited number of local dredging contractors and the demand for dredging has increased following Hurricane Sandy. Contractor availability and construction costs will be dependent on this demand as well as the project specifics.

5.2 Long-Term Plan

The long-term plan addresses subsequent maintenance dredging events. Stone Harbor should initially plan to conduct maintenance dredging of the Stone Harbor Lagoons approximately every 10 years. This is the approximate interval from the last dredging project. The recurrence interval is approximate for planning purposes and is

subject to change based on monitoring and additional information gained during the short-term plan.

The focus of the long-term plan is to identify alternative placement options for dredged material. While we believe that the currently viable dredged material management alternatives will remain viable in the future, Stone Harbor should continue to work with local partners to identify beneficial use projects that can provide a costs savings to the community when benefits are considered. Providing dredged material for a beneficial use project prepared by others is preferred. However, Stone Harbor may also elect to lead a local beneficial use project, such as thin layer and edge restoration of local wetlands.

- › Wetlands Institute
- › NJDEP F&W
- › US F&W
- › NOAA – NMF
- › USACE-Philly District
- › The Nature Conservancy of NJ
- › New Jersey Future

For the long-term plan, OCC recommends that Stone Harbor continue to pursue the excavation and restoration of capacity at Nummy Island the Site 103 CDF. The currently viable dredged material management alternatives are managed by others who may elect not to allow placement of dredged material at their facility at their own discretion. The ability to dredge and manage the placement in house is a valuable resource. To proceed with the Nummy Island CDF alternative, Stone Harbor needs to submit permit applications to access, excavate, and restore capacity to the CDF. Increasing or relocating the CDF within Nummy Island will require additional regulatory coordination, investigations, and engineering.

5.3 Monitoring Plan

Stone Harbor should conduct annual hydrographic surveys to monitor the water depths with the Stone Harbor Lagoons. This type of plan is similar to the beach profile surveys that are conducted to assess the condition of the beaches. Yearly monitoring will allow Stone Harbor to identify areas in need of dredging and estimated shoaling rates. This data is needed to predict the timing and quantity for the next dredging event.

6 Summary

OCC developed a 10-year DMMP for the Borough of Stone Harbor to manage dredged material generated from maintenance dredging of the Stone Harbor Lagoons. The DMMP identifies the dredging demand, evaluates management alternatives, and proposes a short-term and long-term implementation plan. Inclusive of the municipal and private waterway in these waterways, OCC identified a 10-year dredging demand of 185,000 cubic yards. OCC identified dredged material management alternative to manage this material. The alternatives analysis matrix identified alternatives that are currently viable, could be viable, and are not viable,

To perform maintenance dredging in the immediate future, OCC recommended a short-term implementation plan. This plan consists of permitting all the lagoon waterways to be dredged to a depth of 6 feet below MLLW with upland disposal. Permit applications should be submitted by the end of the year to allow dredging in the Fall 2015. Pending further engineering analysis, Stone Harbor may need to phase construction over multiple years to dredge all the waterways. Stone Harbor should select lagoons for each phase based on a relative overall demand based on the relative dredging volume, navigational hazard, and number of users. Additional consideration for phasing should include dredged material characteristics, regional dredging demand, and regional placement capacity.

For future dredging events, OCC recommends a long-term implementation plan. The plan consists of working with local stakeholders to identify beneficial use projects that have a net benefit to the community. Additionally, Stone Harbor should continue to pursue the excavation and restoration of capacity to the Site 103 CDF for future management of dredged material.

OCC also recommends that Stone Harbor establish a Stone Harbor Lagoon monitoring plan. The plan consists of annual hydrographic surveys to assess the current water depths. Yearly monitoring will allow Stone Harbor to identify areas in need of dredging and estimated shoaling rates. This data is needed to predict the timing and quantity for the next dredging event.

7 References

IT Corporation. New Jersey Intracoastal Waterway Final Site Selection Report. Prepared for the USACE Philadelphia District December 2001.

USACE. Engineering Manual 1110-2-1003 Hydrographic Surveying. November 2013.

APPENDIX

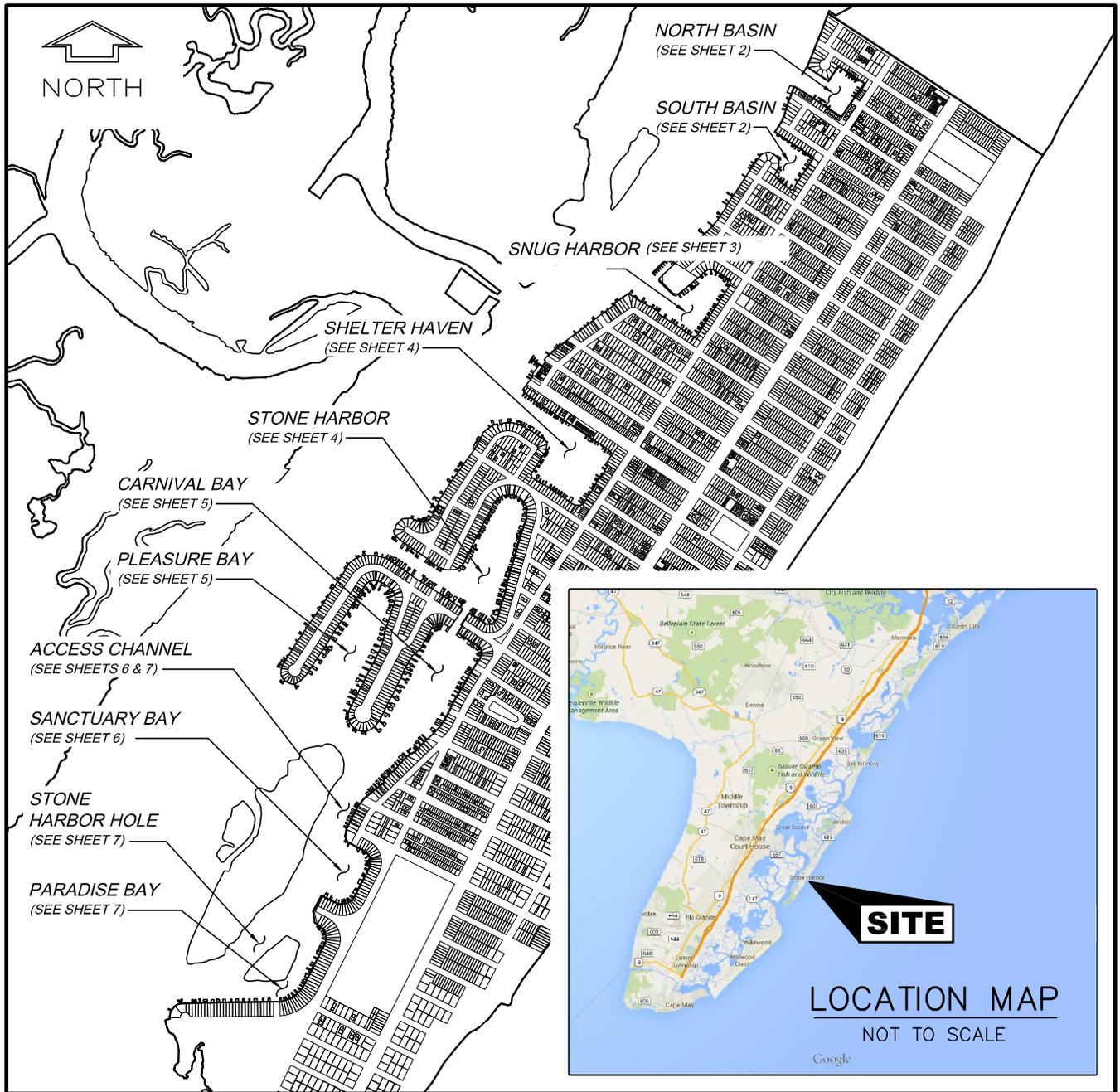
Appendix A 2003 Dredging Summary Table

Table 6 - Stone Harbor 2003 Dredging Summary Table

DREDGE AREA	TOTAL VOLUME DREDGED TO 6 FT MLLW PLUS 2 FT OD [CY]
North Basin	5,700
South Basin	6,800
Snug Harbor	9,300
Shelter Haven	8,800
Stone Harbor	2,200
Pleasure Bay	23,500
Carnival Bay	19,900
Sanctuary Bay	19,100
Paradise Bay	9,500
TOTAL	104,800

*Sanctuary Bay volumes includes material from Access Channel and Stone Harbor Hole

Appendix B Dredging Demand Figures



VICINITY MAP

0 2000 4000 FT.



SCALE 1"=2000'-0"

FOR REFERENCE ONLY
NOT FOR CONSTRUCTION

STONE HARBOR
DREDGED MATERIAL MANAGEMENT PLAN
DATUM: FT M.L.L.W.

OCEAN AND COASTAL CONSULTANTS, INC.

PROPOSED MAINTENANCE DREDGING
AT STONE HARBOR LAGOONS
ALONG THE GREAT CHANNEL WATERWAY
COUNTY OF CAPE MAY
STATE OF NEW JERSEY

DATE: 10/30/14

SHEET 1 OF 7



LEGEND:

- STONE HARBOR DREDGE AREA (DREDGE TO 6 FT MLLW PLUS 2 FT OD)
- SLIP DREDGE AREA (DREDGE TO 6 FT MLLW PLUS 2 FT OD)

GENERAL NOTE:

HYDROGRAPHIC SURVEY OF STONE HARBOR LAGOONS COLLECTED BY RICHARD STOCKTON COLLEGE OF NEW JERSEY COASTAL RESEARCH ON 8 MAY 2014 AND CAN ONLY REPRESENT THE CONDITIONS AT THE TIME OF THE HYDROGRAPHIC SURVEY.

NORTH BASIN & SOUTH BASIN

0 300 600 FT.



SCALE 1"=300'-0"

FOR REFERENCE ONLY
NOT FOR CONSTRUCTION

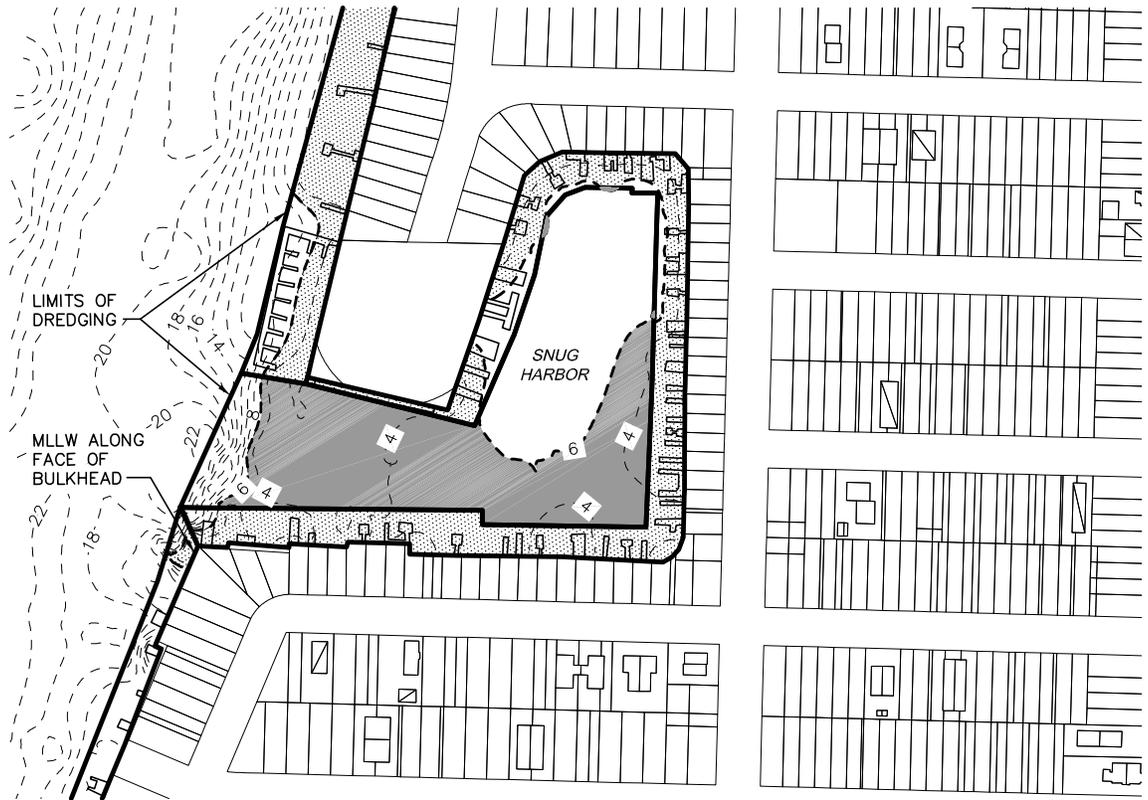
STONE HARBOR
DREDGED MATERIAL MANAGEMENT PLAN
DATUM: FT M.L.L.W.

OCEAN AND COASTAL CONSULTANTS, INC.

PROPOSED MAINTENANCE DREDGING
AT STONE HARBOR LAGOONS
ALONG THE GREAT CHANNEL WATERWAY
COUNTY OF CAPE MAY
STATE OF NEW JERSEY

DATE: 10/30/14

SHEET 2 OF 7



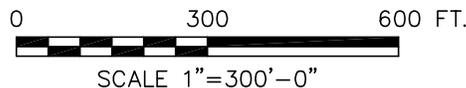
LEGEND:

- STONE HARBOR DREDGE AREA (DREDGE TO 6 FT MLLW PLUS 2 FT OD)
- SLIP DREDGE AREA (DREDGE TO 6 FT MLLW PLUS 2 FT OD)

GENERAL NOTE:

HYDROGRAPHIC SURVEY OF STONE HARBOR LAGOONS COLLECTED BY RICHARD STOCKTON COLLEGE OF NEW JERSEY COASTAL RESEARCH ON 8 MAY 2014 AND CAN ONLY REPRESENT THE CONDITIONS AT THE TIME OF THE HYDROGRAPHIC SURVEY.

SNUG HARBOR



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NOT FOR CONSTRUCTION

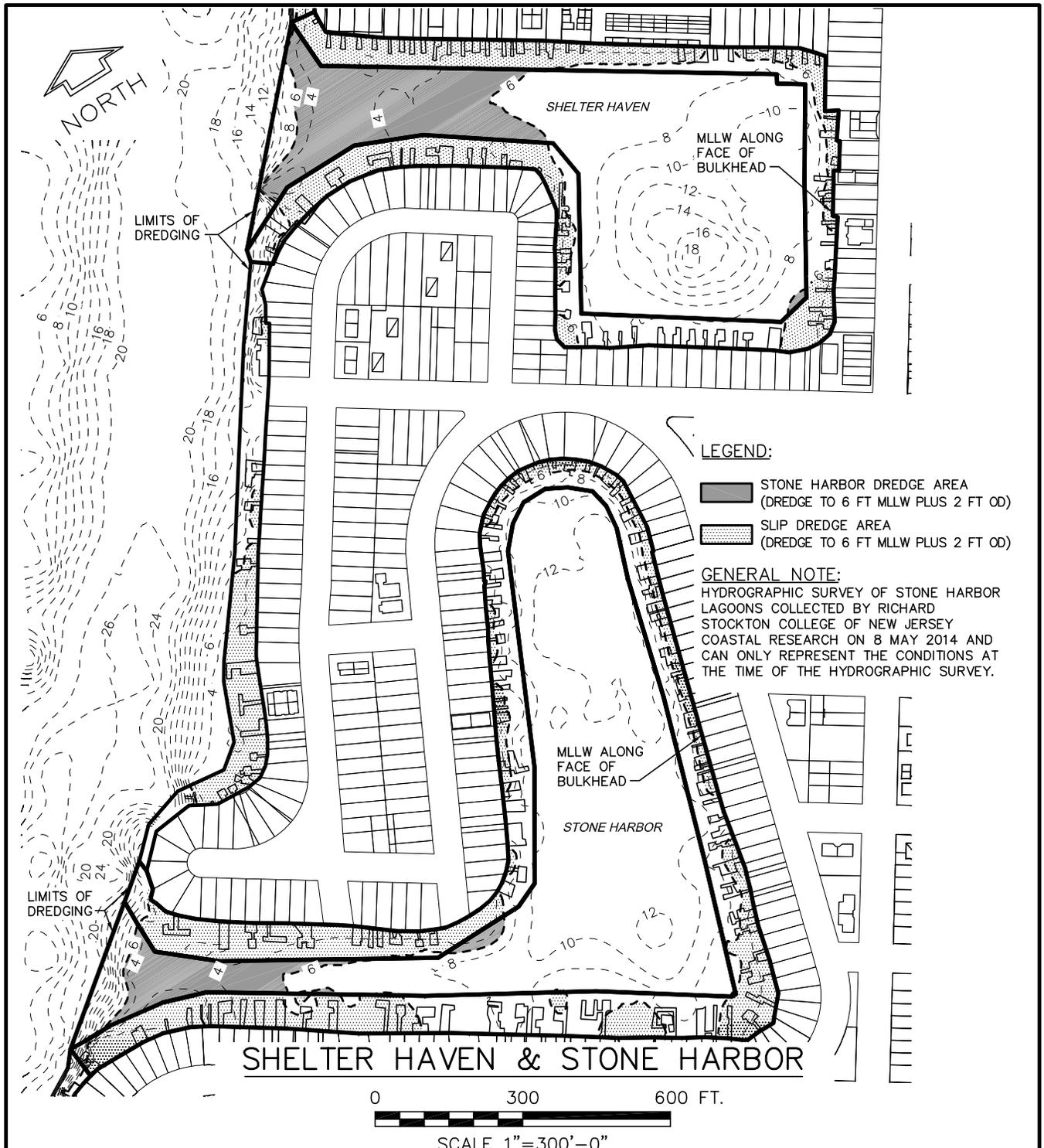
STONE HARBOR
DREDGED MATERIAL MANAGEMENT PLAN
DATUM: FT M.L.L.W.

OCEAN AND COASTAL CONSULTANTS, INC.

PROPOSED MAINTENANCE DREDGING
AT STONE HARBOR LAGOONS
ALONG THE GREAT CHANNEL WATERWAY
COUNTY OF CAPE MAY
STATE OF NEW JERSEY

DATE: 10/30/14

SHEET 3 OF 7



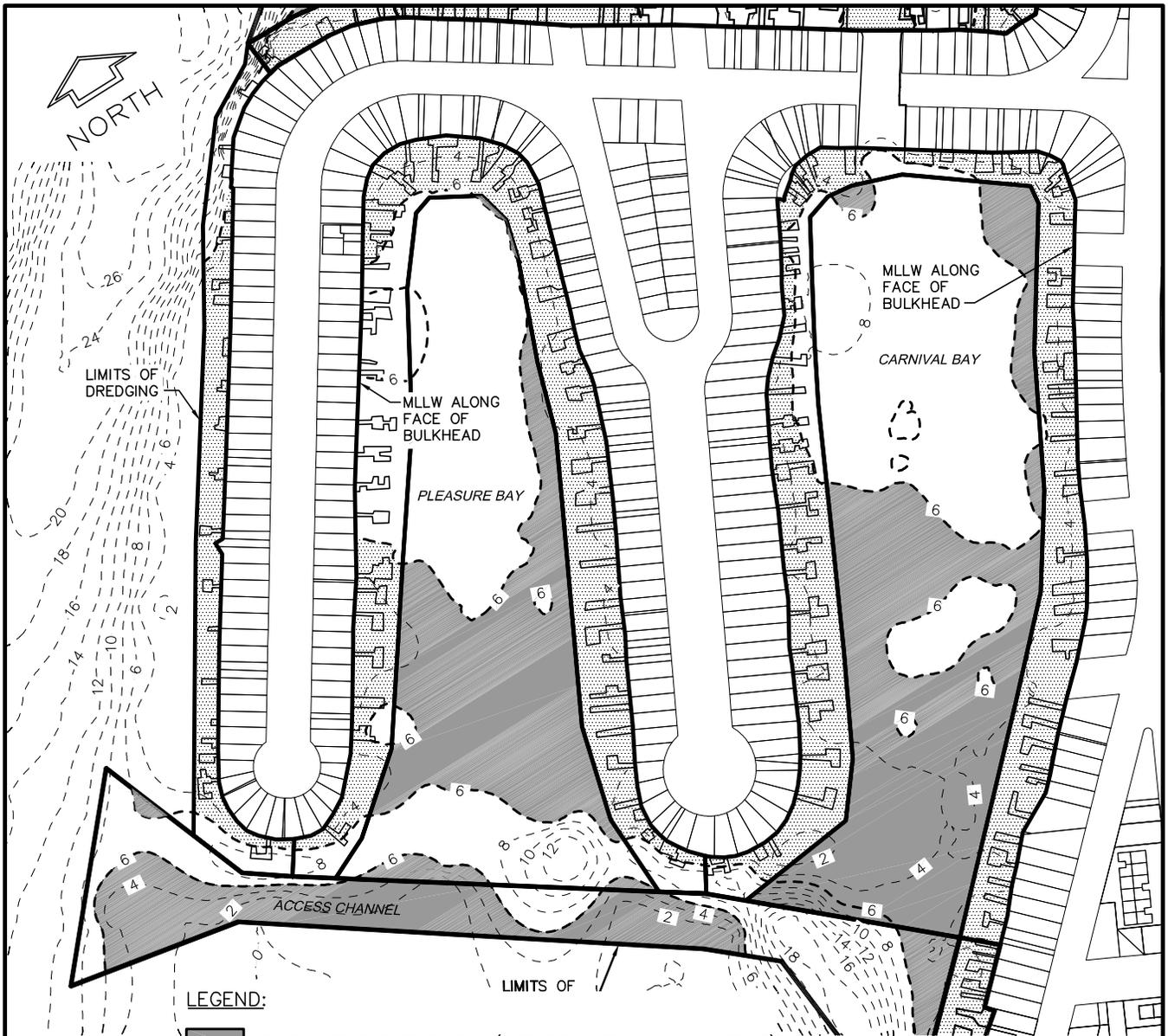
FOR REFERENCE ONLY
NOT FOR CONSTRUCTION

STONE HARBOR
DREDGED MATERIAL MANAGEMENT PLAN
DATUM: FT M.L.L.W.

OCEAN AND COASTAL CONSULTANTS, INC.

PROPOSED MAINTENANCE DREDGING
AT STONE HARBOR LAGOONS
ALONG THE GREAT CHANNEL WATERWAY
COUNTY OF CAPE MAY
STATE OF NEW JERSEY

DATE: 10/30/14
SHEET 4 OF 7



PLEASURE BAY, CARNIVAL BAY, & ACCESS CHANNEL

0 300 600 FT.



SCALE 1"=300'-0"

FOR REFERENCE ONLY
 NOT FOR CONSTRUCTION

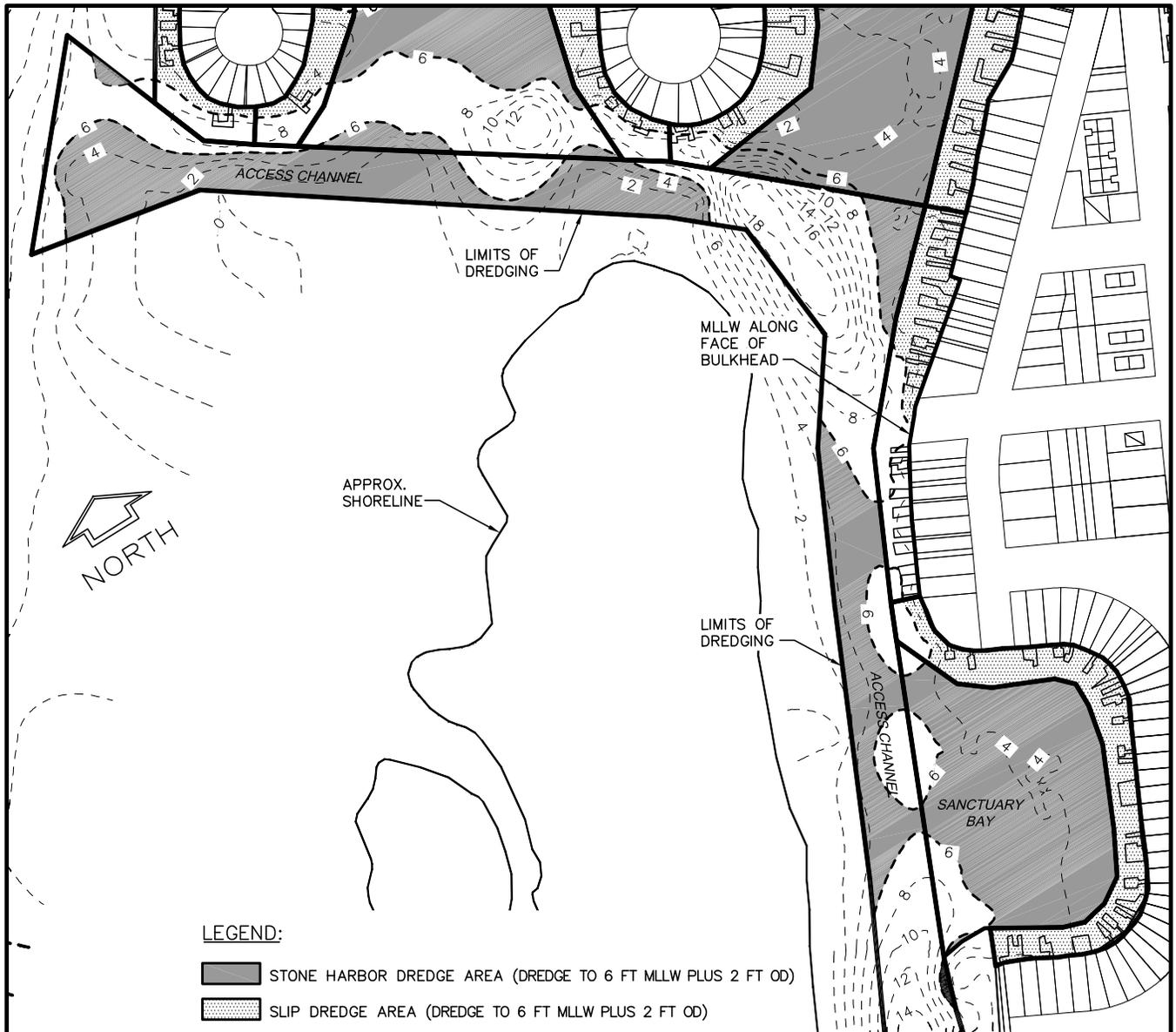
STONE HARBOR
 DREDGED MATERIAL MANAGEMENT PLAN
 DATUM: FT M.L.L.W.

OCEAN AND COASTAL CONSULTANTS, INC.

PROPOSED MAINTENANCE DREDGING
 AT STONE HARBOR LAGOONS
 ALONG THE GREAT CHANNEL WATERWAY
 COUNTY OF CAPE MAY
 STATE OF NEW JERSEY

DATE: 10/30/14

SHEET 5 OF 7



SANCTUARY BAY & ACCESS CHANNEL

0 300 600 FT.



SCALE 1"=300'-0"

FOR REFERENCE ONLY
NOT FOR CONSTRUCTION

STONE HARBOR
DREDGED MATERIAL MANAGEMENT PLAN
DATUM: FT M.L.L.W.

OCEAN AND COASTAL CONSULTANTS, INC.

PROPOSED MAINTENANCE DREDGING
AT STONE HARBOR LAGOONS
ALONG THE GREAT CHANNEL WATERWAY
COUNTY OF CAPE MAY
STATE OF NEW JERSEY

DATE: 10/30/14

SHEET 6 OF 7



APPROX. SHORELINE

LEGEND:

 STONE HARBOR DREDGE AREA
(DREDGE TO 6 FT MLLW PLUS 2 FT OD)

 SLIP DREDGE AREA
(DREDGE TO 6 FT MLLW PLUS 2 FT OD)

GENERAL NOTE:

HYDROGRAPHIC SURVEY OF STONE HARBOR LAGOONS COLLECTED BY RICHARD STOCKTON COLLEGE OF NEW JERSEY COASTAL RESEARCH ON 8 MAY 2014 AND CAN ONLY REPRESENT THE CONDITIONS AT THE TIME OF THE HYDROGRAPHIC SURVEY.

PARADISE BAY, STONE HARBOR HOLE, & ACCESS CHANNEL

0 300 600 FT.



SCALE 1"=300'-0"

FOR REFERENCE ONLY
NOT FOR CONSTRUCTION

STONE HARBOR
DREDGED MATERIAL MANAGEMENT PLAN
DATUM: FT M.L.L.W.

OCEAN AND COASTAL CONSULTANTS, INC.

PROPOSED MAINTENANCE DREDGING
AT STONE HARBOR LAGOONS
ALONG THE GREAT CHANNEL WATERWAY
COUNTY OF CAPE MAY
STATE OF NEW JERSEY

DATE: 10/30/14

SHEET 7 OF 7

Appendix C Alternatives Analysis Matrix

ALTERNATIVES					GENERAL INFORMATION					
Objective	Type	Category	Description	Examples	Capacity (Order of Magnitude)	Estimated Typical Dredging and Placement Cost \$/CY	Sediment Testing for Placement	Min % Sand	Contaminated Sediments Accepted	Estimated Project Soft Costs (Order of Magnitude)
Disposal of Dredged Material	Open Water Disposal	Ocean Disposal	Federally designated offshore ocean disposal.	Cold Spring/Cape May Inlet	10,000,000	\$20	Physical Chemical Biological	0	No	\$1,000,000
		Confined Aquatic Disposal Site (CAD)	Subaqueous disposal site within a confined facility to prevent offsite transportation of dredged material.	Newark Bay CAD	100,000	\$25	Physical Chemical Biological	0	Site Specific	\$100,000
		Sidecasting	Unconfined open water disposal beyond the dredging area.	N/A	100,000	\$15	Physical Chemical Biological	0	No	\$100,000
		Reprofiling	Unconfined open water disposal within the dredging area.	N/A	1,000	\$10	Physical Chemical	0	Site Specific	\$10,000
	Upland Disposal	Confined Disposal Facility (CDF)	Disposal in an upland, nearshore, or island facility that is contained with a dike.	Nummy Island CDF Sedge Island CDF Gravens Island CDF	100,000	\$30	Physical Chemical	0	Site Specific	\$100,000
		Landfill	Disposal at an active sanitary landfill.	Cape May County MUA Landfill	10,000	\$55	Physical Chemical	0	Yes	\$1,000,000
Dredged Material Processing Facility (DMPF)		Disposal at a facility that is permitted to receive, process, and reuse dredged material.	Cape Atlantic Recycling Dredged Material Processing Facility	100,000	\$45	Physical Chemical	0	Site Specific	\$100,000	
Beneficial Use of Dredged Material	Environmental Restoration	Wetland Restoration	Intertidal placement to increase elevations that are suitable for wetland growth.	Gull Island	1,000	\$30	Physical Chemical Biological	0	No	\$100,000
		Quarry Restoration	Upland placement to restore a quarry to its preexisting conditions.	N/A	100,000	\$40	Physical Chemical Biological	0	No	\$10,000
		Intertidal Habitat Enhancement	Intertidal placement to increase elevation to enhance intertidal habitat.	Stone Harbor Point	10,000	\$20	Physical Chemical Biological	0	No	\$100,000
		Dredge Hole Restoration	Open water placement to restore an open water quarry site to depths that promote habitat growth.	Dredge Hole #35	10,000	\$15	Physical Chemical	0	No	\$10,000
		Edge Restoration	Intertidal placement along the edge of wetlands to restore areas of erosion.	N/A	10,000	\$25	Physical Chemical Biological	0	No	\$100,000
	Environmental Remediation	Upland Remediation	Upland placement as fill to cover and cap a remediation project site.	Harbison-Walker Remediation Site	1,000,000	\$50	Physical Chemical	0	Site Specific	\$1,000,000
		Open Water Remediation	Open water placement as fill to cover and cap a remediation project site.	Historic Area Remediation Site (HARS)	10,000,000	\$20	Physical Chemical Biological	0	Site Specific	\$1,000,000
	Flood Protection	Beach and Dune Nourishment	Upland placement to restore and enhance the beach and dunes system.	Stone Harbor Beach Fill	1,000,000	\$30	Physical Chemical	90	No	\$10,000
	General Fill	Landfill Cover	Upland placement for daily and intermediate cover material.	Cape May County Landfill	10,000	\$40	Physical Chemical Geotechnical	65	Site Specific	\$1,000,000
		Pre-1982 Landfill Closure	Upland placement to provide required cover material to close pre-1982 landfill.	Wildwood Landfill	10,000	\$40	Physical Chemical Geotechnical	65	Site Specific	\$100,000
		Misc Construction	Upland placement for use as roadway subbase, embankment fill, or other construction fill.	GSP Interchange	10,000	\$35	Physical Chemical Geotechnical	65	No	\$1,000,000

Estimated dredging costs is only for dredging and placement. Does not include Mob/De-Mob
Capacity is provided as an order of magnitude

ALTERNATIVES			STONE HARBOR EVALUATION		
Objective	Type	Category	Option Currently Available to Stone Harbor (Order of magnitude capacity)	Evaluation for Stone Harbor Dredged Material Management	Recommended for Stone Harbor Dredged Material Management
Disposal of Dredged Material	Open Water Disposal	Ocean Disposal	No	Requires extensive permitting to open an active site that is typically done at the federal or state level. Once a site is active, costly biological testing is needed for approval.	No - The approved site offshore of Cape May Inlet is designated for inlet material only and is not active.
		Confined Aquatic Disposal Site (CAD)	No	A site would need to be developed and permitted for dredged material disposal. If a site were developed it would be a cost effective option for placement.	No - A CAD site does not exist and the development of a site is cost-prohibitive.
		Sidecasting	No	This disposal method would require changes in regulatory policies.	No - Regulatory approval for this process is almost impossible.
		Reprofiling	No	This is feasible within the Stone Harbor man-made lagoons. The Shelter Haven lagoon has depths to accept reprofiling.	Yes - Evaluate cut/fill volumes and discuss with regulatory agencies.
	Upland Disposal	Confined Disposal Facility (CDF)	Yes 1,000 CY Capacity	Nummy Island CDF does not have capacity. Excavation and restoration of the CDF is needed to create capacity for placement. Stone Harbor is currently pursuing creating CDF capacity. Sedge Island CDF has minimal capacity. There is local opposition to actively using this site. Gravens Island CDF is owned and managed by Avalon. They have created capacity at the CDF.	Yes - Nummy Island CDF - Obtain permits to excavate and restore the site to increase local capacity. Yes - Gravens Island CDF - Discuss use with Avalon. No - Sedge Island CDF - Limited capacity and local opposition to use
		Landfill	Yes 10,000 CY Capacity	Dredged material must pass the paint filter test for truck transport and disposal. Clean dredged material may be used for cover material. The current landfill fee for disposal of contaminated soil is \$20/cy (CMCMUA 2014) that does not include dredging or transportation costs.	Yes - Only for contaminated material or if processing facility is at capacity.
Dredged Material Processing Facility (DMPF)		Yes 100,000 CY Capacity	The Cape Atlantic Recycling facility is the only NJDEP approved dredged material processing facility in South Jersey. They only accept clean dredged material. Material is typically trucked to the facility.	Yes - Although more expensive than CDF disposal, placement at the DMPF simplifies contracting and Stone Harbor does not need to develop a beneficial use project.	
Beneficial Use of Dredged Material	Environmental Restoration	Wetland Restoration	No	A site would need to be permitted to accept dredged material for restoration. The USACE recently completed an Environmental Assessment of utilizing dredged material from the New Jersey Intracoastal Waterway for wetland restoration.	Pending approved project - There is limited capacity for wetland restoration and the permit and design process can be cost prohibitive. Should a project be developed by others, Stone Harbor should consider placement at an approved project site.
		Quarry Restoration	No	A site would need to be permitted to accept dredged material for restoration. To our knowledge this is not being pursued by any local quarries.	Pending approved project - Should a project be developed by others, Stone Harbor should consider placement at an approved project site.
		Intertidal Habitat Enhancement	No	A site would need to be permitted to accept dredged material for restoration. Stone Harbor has identified that the Stone Harbor Point is a potential option for habitat enhancement however the dredged material must meet project specific requirements.	Pending approved project - There is limited capacity for intertidal habitat enhancement and the permit and design process can be cost prohibitive. Should a project be developed by others, Stone Harbor should consider placement at an approved project site.
		Dredge Hole Restoration	No	A site would need to be permitted to accept dredged material for restoration. NJDOT OMR is identifying and evaluating dredge holes but they have not identified any site in Stone Harbor.	Pending approved project - The NJDOT OMR has not identified any local dredge holes in need of restoration. Should a project be developed by others, Stone Harbor should consider placement at an approved project site.
		Edge Restoration	No	A site would need to be permitted to accept dredged material for restoration. Areas in need of edge restoration can be identified from comparing shoreline locations along the intertidal waterways to identify areas of erosion that are in need of restoration.	Pending approved project - There is limited capacity for edge restoration and the permit and design process can be cost prohibitive.
	Environmental Remediation	Upland Remediation	No	An environmental remediation project that needs upland fill would need to be approved to accept dredged material.	Pending approved project - We are not aware of any local upland remediation projects in that area that will accept dredged material. Should a project be developed by others, Stone Harbor should consider placement at an approved project site.
		Open Water Remediation	No	An environmental remediation project that needs open water fill would need to be approved to accept dredged material.	Pending approved project - We are not aware of any local open water remediation projects in that area that will accept dredged material. Should a project be developed by others, Stone Harbor should consider placement at an approved project site.
	Flood Protection	Beach and Dune Nourishment	Yes	The USACE has a federally authorized shore protection project in Stone Harbor. It is possible to utilize dredged material for beach fill that has >90% sand. It may be possible to utilize fine grained sediments contained within geotextile tubes to reinforce dunes.	Yes - Evaluate the grain size of the dredged material. If the material is >90% sand discuss placement of dredged material on the beach with USACE.
	General Fill	Landfill Cover	Yes 10,000 CY Capacity	Dredged material must pass the paint filter test for truck transport and use as landfill cover.	Yes - Discuss daily and intermediate cover requirements with CMCMUA.
		Pre-1982 Landfill Closure	No	A site would need to be permitted to accept dredged material for closure. The NJDOT OMR is currently identifying and evaluating potential pre-1982 landfill sites that could utilize dredged material for final cover material.	Yes - Discuss Wildwood Landfill Closure project with Wildwood to evaluate current need for the closure project.
		Misc Construction	Yes 10,000 CY Capacity	If the dredged material meets the construction specifications it can be used in a project. Due to the availability of fill material in South Jersey there is limited incentive for the use of dredged material and Stone Harbor would likely need to pay for its use.	Yes - Evaluate local projects that need general fill and evaluate dredged material to see if it meets the material specifications. Should a project be developed by others, Stone Harbor should consider placement at an approved project site.

Estimated dredging costs is only for dredging and placement. Does not include Mob/De-Mob
Capacity is provided as an order of magnitude