MANATEE HARBOR

REGIONAL SEDIMENT MANAGEMENT (RSM)

IMPLEMENTATION REPORT

BLUF (Bottom Line Up Front)
Capacity for placement of Operations and Maintenance (O&M) dredged material within the Manatee Harbor Dredged Material Management Area (DMMA) is nearly exhausted. Assuming that capacity for one O&M event needs to be maintained for emergency dredging situations, the DMMA will only accommodate one additional event, anticipated in 2019. Alternatives to create additional capacity and/or place material in alternate locations are evaluated in this report.

Based on existing information and planning level rough order of magnitude (ROM) costs, the most feasible alternatives at this time include:

1. Maximize current active management of material within the DMMA. While not meeting all capacity needs, this has the potential to substantially reduce material volume within the DMMA and facilitate offloading for beneficial uses.
2. Complete NEPA including, at a minimum: placement of dredged material in previously dredged holes, nearshore placement, and offloading existing DMMA material to Washington Park.
3. Pending NEPA, begin offloading DMMA material to Washington Park within 6 years, prior to the second future O&M event. Offloading approximately 400,000 cubic yards (cy) per O&M event (for an approximate total of 1,200,000 cy over time) represents a feasible option that the non-federal sponsor supports.
4. Pending NEPA, include RSM alternatives such as placement of dredged material in previously dredged holes and nearshore placement in O&M permits in order to take advantage of opportunities to beneficially use suitable dredged material.

Concurrent implementation of these recommendations is important to ensure maintenance of the harbor while taking advantage of RSM opportunities to realize incidental benefits and reduce lifecycle costs. It should be noted that a study has been authorized to evaluate the feasibility of deepening Manatee Harbor. Such new work, if realized, would create significant additional demand for capacity in the DMMA and/or other placement alternatives, thus increasing the need to implement the recommendations of this report. Recommendations of this report are based on a planning level analysis using existing information and ROM costs to guide further action. Additional analysis and review may be needed to ensure suitability and practicability of each recommendation.

1 PROJECT INFORMATION

Approximately 330,000 cy of mixed sand, silt, clay, limestone, and mud are dredged from Manatee Harbor every four to five years during O&M events. The average annual shoaling rate is currently estimated at 75,000 cy per year. All dredged material has been placed in the authorized DMMA with limited offloading accomplished by the non-federal sponsor, the Manatee County Port Authority. The DMMA's remaining capacity is approximately 1,200,600 cy which includes capacity reduction from emergency dredging in 2018. A minimum of one full O&M event of capacity should be maintained in the DMMA to ensure a placement location for future and emergency events. While an Ocean Dredged Material Disposal Site (ODMDS) exists, there could be events which prohibit its use such as the need to dispose of unsuitable material. Therefore, a DMMA threshold capacity of 495,000 cy will be used, which includes a bulking factor of 1.5 added to the O&M dredging volume of 330,000 cy. Using the 495,000 cy threshold, the DMMA can only accommodate one future O&M event, anticipated in 2019, and will not be able to accommodate future events or significant emergency dredging needed as a result of storm impacts.

1.1 Current Placement Action

As noted above, dredged material is currently placed within a DMMA. In order to reduce volume within the DMMA, active management has been employed over the past several years and is an emerging practice within Jacksonville District. In general, active management includes actions to dewater material and subsequently reduce volume including periodic lowering of weir crests, improving surface drainage through trenching of material, etc. Offloading can also be associated with active management but is evaluated as a separate action in this report. The hatched area in Figure 1 shows the range of capacity reduction that can be expected with current practices, ranging from no active management to active management that reduces bulked material to 1.2 times its *in situ* volume (volume when dredged, before bulking). The figure assumes O&M dredging events in 2019 and every 4.5 years for the next 20 years and demonstrates that existing capacity will drop below the 495,000 cy threshold in approximately 6 years. The current placement action is not feasible beyond this time. Furthermore, all existing capacity will be used in approximately 10 years.

Modifying the DMMA or constructing a new DMMA to create capacity is not currently feasible or cost effective. Therefore, 189,000 - 284,000 cy of material must be offloaded or placed in another location within 6 years. The lesser volume of this range assumes that current active management practices achieve the maximum volume reducing effect. Offloading this range of material would allow the second O&M event to be placed in the DMMA, using all remaining capacity and requiring other non-DMMA placement or offloading for future events. Overall, 1,395,000 - 1,770,000 cy would need to be offloaded or placed in alternative locations over 20 years in order to maintain 495,000 cy capacity in the DMMA (Figure 1).

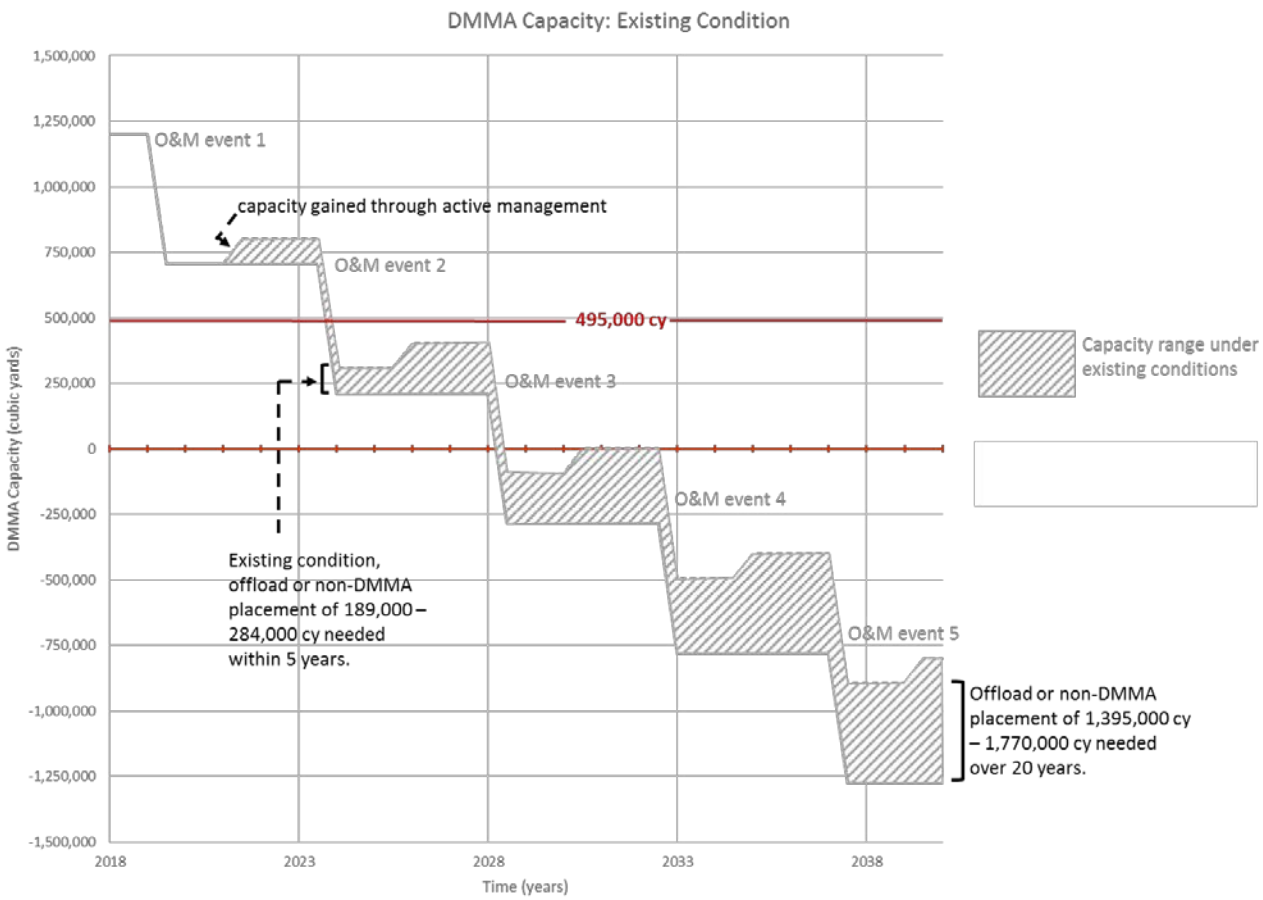

Figure 1: DMMA capacity over the next 20 years under existing conditions which assume O&M events occur every 4.5 years dredging 330,000 cy with a bulking factor of 1.5. Active management can result in a reduction of volume to 1.2 x the in-situ volume, or 400,000 cy (1.2 x 330,000 cy). The first event occurs in 2019.

2 ALTERNATIVES CONSIDERED

A number of alternatives to increase capacity in the DMMA or place dredged material in alternate locations were compiled and evaluated in Table 1 which shows the viability of options. Viability was determined considering the need to implement within 5-10 years and qualitatively considers costs, benefits, capacity creation potential, sediment suitability, constructability, contract-ability, permit-ability, and sponsor/stakeholder support. Existing information and coordination with subject matter experts, the non-federal sponsor, and stakeholders were used to inform these criteria. Alternatives were grouped into tiers with Tier 1 representing the most viable options at this time. This report only evaluates Tier 1 alternatives with the addition of the ODMDS.

Table 1: Alternatives to increase capacity in the DMMA or place dredged material in alternate locations.

Alternative	Location of Beneficial Use (BU)	Viability	Description
Offloading	Washington Park	Tier 1	Washington Park represents the most viable offloading alternative at this time. With significant sponsor/stakeholder support this represents a feasible option for creating 1-1.5 mcy of capacity in the existing DMMA.
Fill dredge holes	multiple locations		Significant progress in plans to fill previously dredged holes has been accomplished by the Tampa Bay Estuary Program in coordination with Jacksonville District. Cost estimates developed for the document *Tampa Bay RSM - Implementation Strategies and Recommendations for Ecosystem Restoration in Tampa Bay, Florida* (USACE, in publication) indicate that this could be a cost effective measure, particularly if benefits justify any cost increment over the federal standard. Further coordination is needed with agencies on acceptable material and placement methodology.
Nearshore placement	Egmont Key		Nearshore placement events have taken place in recent years beneficially using dredged material from federal projects in the area. Placement allowed for a higher percentage of fines than is typically permitted. Further coordination is needed with agencies on acceptable material and placement methodology.
ODMDS		Tier 2	This alternative has significant capacity availability and O&M material has been deemed suitable for placement in past coordination. However, it is costly and placement results in no benficial use or maintenance of sediment within the coastal system.
Beach placement	Egmont Key		Beach placement and nearshore placement generally require a low percentage of fines (10% - 20% for beneficial use). Most of these options are limited by the typical material dredged. These may be practical if a significant volume of suitable material is dredged. Manbirtee Key, in particular, could be an ideal beneficial use site due to its proximity to the port. Emergent island creation could require similar material or some form of sediment retention structure. Island creation has some additional agency coordination considerations since it would typically involve changing submerged habitat to emergent.
	Manbirtee Key		
	Mullet Key		
Nearshore placement	Manbirtee Key		
	Mullet Key		
Emergent island creation	NA		
Expansion of DMMA	NA		Options for expansion of the existing DMMA on port owned property north of the existing DMMA were explored in a 2016 draft DMMP. As of 2016, the port recently renewed a lease with the Florida Fish and Wildlife Conservation Commission (FWC) which has buildings and a fish hatchery on the land, eliminating this option at this time.
Stockpile on port property	NA		Stockpiling would occur on the same land described under the "Expansion of DMMA" alternative. Since this land is currently leased to the FWC, this alternative is not viable at this time.
Use of Tampa Harbor DMMAs	NA		Use would reduce the capacity available to the Tampa Harbor federal project which is preparing for a deepening event. Neither Jacksonville District nor the Tampa Harbor sponsor are in support of this alternative at this time. The draft Mantee Harbor DMMP also cites restrictions per signed agreements for the Tampa Harbor project.
Hardbottom habitat	unknown		This alternative could have future potential depending on the suitability of dredged material. It may be more applicable to material gained from deepening/widening.
Thin Layer Placement	multiple locations	Tier 3	These alterative are discussed in the document *Tampa Bay RSM - Implementation Strategies and Recommendations for Ecosystem Restoration in Tampa Bay, Florida* (USACE, in publication). Experiments with longshore bar creation have been completed in the area, but typically require more coarse grained material. Thin layer placement can have limited capacity creation potential but is suitable for fine material. Additional coordination with agencies and stakeholders is needed within the Tampa Bay area.
Longshore bar creation	multiple locations		
Offloading	Landfill cover		As of 2018, the sponsor has coordinated on this alternative with Manatee County, but it was determined that the material was not suitable for this use.
	Vecenergy Pits (property south of port)		As of 2018, the sponsor confirmed that this location is no longer available.
	Buckeye Pitts		This offloading option has significant environmental concerns due to its proximity to Piney Point. The sponsor also reports that it has limited capacity.
	Bridal Path pits		As of 2018, the sponsor has not been able to obtain permits and approvals for this alternative.
	Leisey Shell Pit		As of 2018, the sponsor has found that the site contains limited capacity and is not pursuing the option further.
	Piney Point		This alternative is not an option due to significant environmental concerns.
DMMA dike raising			Raising of the existing dikes would need to incorporate significant design measures and would require expansion of the entire footprint. This alternative is not practical given potentially viable offloading options such as Washington Park.

2.1 Alternative Costs

Planning level costs were developed for several Tier 1 alternatives in addition to ODMDS placement and the existing DMMA placement. Rough order of magnitude (ROM) costs were based on the technical note, *True cost of dredged material management: Jacksonville Harbor Case Study* (ERDC/TN RSM-17-xx, in publication) which evaluates the "true cost" of dredging and placement alternatives as follows:

True Cost = Direct Costs + Incidental Costs

where

1. Direct Costs are the one-time project costs for the navigation maintenance dredging event, which likely includes dredging contractor costs (dredging, conveyance of dredged material, and dredged material management), as well as USACE in-house engineering, planning, contract management, and contract oversight costs.
2. Incidental Costs are long-term, life-cycle costs associated with site selection, permitting and compliance efforts, construction, maintenance, and monitoring of the dredged material placement site, whether the placement site is for disposal or beneficial use.

Costs in Table 2 are per event (FY18 price levels) and do not fully reflect the life-cycle costs over time. Table 3, shown later in this report, applies costs over a 20 year period and more accurately reflects the application of incidental life-cycle costs.

A project's dredging and placement alternative(s) must comply with the Federal standard which states that the alternative must, "…*represent the least costly alternatives consistent with sound engineering practices and meeting the environmental standards established by the 404(b)(1) evaluation process or ocean dumping criteria."* (CFR, Part 335, Section 335.7). If not the Federal standard, a non-federal sponsor can pay for the additional cost increment of another alternative or cost-share in the increment with the Federal government, if authorized. Table 2 shows that per event, the current placement within the DMMA is the least cost option. However, as discussed in Section 1.1 this alternative is not sustainable beyond the next O&M event. The following paragraphs provide additional information on Tier 1 alternatives regarding their potential to address Manatee Harbor's capacity shortfall.

2.2 Ocean Dredged Material Disposal Site (ODMDS)

The cost of ODMDS placement is relatively high, partly due to its significant distance offshore (approximately 34 miles from the harbor). However, it contains significant capacity (approximately 45 million cubic yards) and is a potential location for future placement if the DMMA runs out of capacity. Incidental costs in Table 2 include continued active management and general maintenance of the DMMA even if the ODMDS is used as a placement option. This is due to the fact that efforts would

continue to reduce material volume so that less costly DMMA placement could occur in the future.

The ODMDS was designated as a U.S. Environmental Protection Agency (EPA)-approved ocean placement site in 1995 and remains jointly administered by the EPA and the USACE. The suitability of dredged material for ocean disposal must be evaluated by the USACE and agreed to by EPA prior to each disposal event. The material from general maintenance dredging operations is expected to be environmentally suitable for placement. Updated EPA concurrence would be needed for use of this site and would be valid for 9-10 years assuming two extensions of concurrence via Tier I evaluations. Initial concurrence and two extensions would cover approximately two O&M events.

Stakeholder input at a January 2016 NEPA scoping meeting for a feasibility study (currently on hold) evaluating deepening of the project indicated that use of the ODMDS was unpopular with stakeholders. The public expressed environmental concerns including potential impact to corals and tropical fish, referencing a 2009 EPA study on the site.

2.2.1 Current Feasibility

While this alternative would maintain the authorized project, it removes sediment from the coastal/bay system and provides no beneficial use. Given that its ROM cost is greater than other alternatives which could provide benefits, this alternative should be used as a last resort option.

Table 2: Dredging event analysis using planning level costs (FY18 price levels).

Dredging Event Analysis						
Placement Option			**Cost**	**Unit**	**Assumptions**	**Feasibility for Future Events**
1	**Current Placement (Existing Condion) - DMMA with Active Management**					Not sustainable as a stand-alone option beyond the next O&M event, anticipated in 2019.
	Direct Costs	Excavation (unit cost only)	$14	cy	Assumes pipeline dredge.	
		Excavation (including mobilization)	$22	cy	Includes other associated costs and S&A.	
		Excavation per event (including mobilizaton)	$7,260,000	event		
		PED	$620,000	event		
		Total Direct Cost	$7,880,000	event		
	Incidental Costs	Current active management	$37,000	month	Current Active Management includes ditching, dewatering etc. with two large pieces of equipment. Operation includes two weeks per month. Assume $450,000 annual cost.	
		General maintenance	$6,000	month	General Maintenance. Operation includes two weeks per month.	
		Total Incidental Cost	$2,322,000	event		
		True Cost	**$10,202,000**	**event**	Includes 4.5 years of Current Act. Mgt and General Maintenance two weeks per month year round.	
2	**ODMDS Placement**					Significant capacity, and a viable option. However, there could be events which prohibit its use. Significant cost and no additional benefits created.
	Direct Costs	Excavation (unit cost only)	$26	cy	Assumes mechanical dredge.	
		Excavation (including mobilization)	$35	cy	Includes other associated costs and S&A.	
		Excavation per event (including mobilizaton)	$11,710,000	event		
		PED	$620,000	event		
		Total Direct Cost	$12,330,000	event		
	Incidental Costs	Current active management	$37,000	month	Current Active Management includes ditching, dewatering etc. with two large pieces of equipment. Operation includes two weeks per month. Assume $450,000 annual cost.	
		General maintenance	$6,000	month	General Maintenance. Operation includes two weeks per month.	
		Evironmental coordination	$2.20	cy	Unit cost for one 9.5 year EPA 103 concurrence cycle divided by two events (660,000 cy).	
		Evironmental coordination	$726,000	event	Includes items associated with EPA 103 concurrence (applicable for 9.5 years).	
		Total Incidental Cost	$3,048,000	event		
		True Cost	**$15,378,000**	**event**	Includes incidental costs for the volume of disposal for a single event.	
3	**DMMA Placement with Filling Dredged Holes**					Not immediately viable. Coordination needed on sediment suitability/constructability. Current limited capacity in dredged holes. Lower cost indicates that any open water placement could be economical. However costs could increase as a result of regulatory/permitting needs. Significant benefits could result.
	Direct Costs	Excavation and fill dredged hole	$30	cy	Assumes 197,000 cy of 330,000 cy (60%) goes to dredged hole up to 10 miles away (20 mile round trip).	
		Interim mobilization	$750,000	event	Additional mobilization for dredged hole placement.	
		Excavation with DMMA disposal (includes mobilization)	$22	cy	Unit cost for remaining 40% of material from O&M event to DMMA. Includes other associated costs and S&A.	
		Excavation per event (including mobilization)				
		PED	$620,000	event		
		Total Direct Cost	$10,214,000	event	Assumes 60% of QTY at dredged hole unit price and 40% at DMMA unit price.	
	Incidental Costs	Current active management	$37,000	month	Current Active Management includes ditching, dewatering etc. with two large pieces of equipment. Operation includes two weeks per month. Assume $450,000 annual cost.	
		General maintenance	$6,000	month	General Maintenance. Operation includes two weeks per month.	
		Total incidental cost	$2,322,000	event		
		True Cost	**$12,536,000**	**event**	Includes 4.5 years of Current Act. Mgt and General Maintenance two weeks per month year round.	
4	**DMMA Disposal with Offload to Washington Park**					Pending further analysis (NEPA, etc) could be viable in near-term. Has stakeholder support. Costs could increase as a result of regulatory/permitting needs. Pending stakeholders' use of material to create park, significant benefits could result.
	Direct Costs	Offloading and placement at Washington Park	$9	cy	Offload of 400,000 cy from DMMA. No site work at Washington Park is included.	
		Excavation with DMMA disposal (includes mobilization)	$22	cy	Placement of 330,00 cy in DMMA. Includes other associated costs and S&A.	
		Excavation and offload per event (includes mobilization)	$10,860,000	event	Includes an offload quantity of 400kcy assuming after active management the net bulking factor is 20%.	
		PED	$620,000	event		
		Total Direct Cost	$11,480,000	event		
	Incidental Costs	Current active management	$37,000	month	Current Active Management includes ditching, dewatering etc. with two large pieces of equipment. Operation includes two weeks per month. Assume $450,000 annual cost.	
		General maintenance	$6,000	month	Includes General Maintenance only for DMMA. No permitting or environmental coordination costs are included for Washington Park.	
		Total incidental cost	$2,322,000	event		
		True Cost	**$13,802,000**	**event**	Includes 4.5 years of Current Act. Mgt and General Maintenance two weeks per month year round.	

Notes: *Costs rounded to nearest $1,000. Event frequency is every 4.5 years with an assumed O&M volume of 330,000 cy. All costs include profit and contingency. Associated cost includes turbidity monitoring.*

2.3 Offloading to Washington Park

Offloading is a guaranteed alternative for creating capacity. As shown in Table 1, Washington Park is the only offloading option ranked as a Tier 1 alternative. Stakeholder interest, capacity, proximity, and current understanding of sediment suitability make this a potentially viable offloading opportunity at this time.

Washington Park is located approximately 8 miles from the existing DMMA. The site has several pits containing low-grade wetlands. Stakeholders would like to fill the pits and complete additional earth work to create a public park using roughly 1,000,000 cy of material. Costs for this alternative shown in Table 2 assume that 400,000 cy of dewatered material would be offloaded from the DMMA prior to an O&M event and trucked to Washington Park. Material from the O&M event (330,000 cy) would then be placed into the DMMA. Material placed in the DMMA bulks, and then is reduced to approximately 400,000 cy through active management resulting in a net zero DMMA capacity change. The first offloading event would need to occur within 6 years.

Stakeholders' plans for park creation require roughly 1,000,000 cy which would accommodate approximately three offloading events. This would meet a significant portion of the 1,395,000 cy capacity shortfall over 20 years shown in Figure 1, assuming that current active management practices are maximized.

This analysis only assumes offloading, transport of material, and placement in Washington Park in order to not impact wetlands. Costs do not include any earthwork, planting, etc. needed to fulfill stakeholders' park plans. Evaluation of placement options, such as placing material in the existing pits, will require further coordination and NEPA analysis. Costs could increase from the planning level costs shown here as a result of needed regulatory or compliance items.

Pending stakeholders' use of offloaded material to create the planned park, a number of benefits could be realized including a positive community and social impact in addition to maintaining the authorized project. Improved park lands can increase real estate value and other social benefits. Additionally, environmental benefits could result by potentially improving habitat within the park.

2.3.1 Recommendation

While Table 2 shows that offloading is one of the more costly alternatives, it has the potential to assist in creating social and environmental benefits, pending stakeholders' use of offloaded material to carry out plans for park construction. This alternative will be carried forward for recommendation.

2.4 Filling Previously Dredged Holes for Restoration

During the development of Tampa Bay, upland development was often created from wetlands or open water. This process created a number of dredged holes throughout the Bay that are of various sizes and depths. Resource agencies in Tampa Bay value some dredged holes for the habitat they provide to fisheries; however, dredged holes

that are anoxic or otherwise limited in their habitat value are considered to be higher priority for restoration. Restoration typically involves filling the hole to the surrounding water depths and planting seagrass at the newly restored site. Through ongoing efforts, the Tampa Bay Estuary Program (TBEP) and other stakeholders identify holes and coordinate their restoration. Figure 2 shows dredged hole management recommendations in blue from TBEP Tech Pub. #04-05 (2006), as well as dredged holes currently under evaluation, shown in orange, in a follow-up 2016-2017 TBEP study. Recommendations for the dredged holes shown in orange are anticipated in a report to be published in 2018.

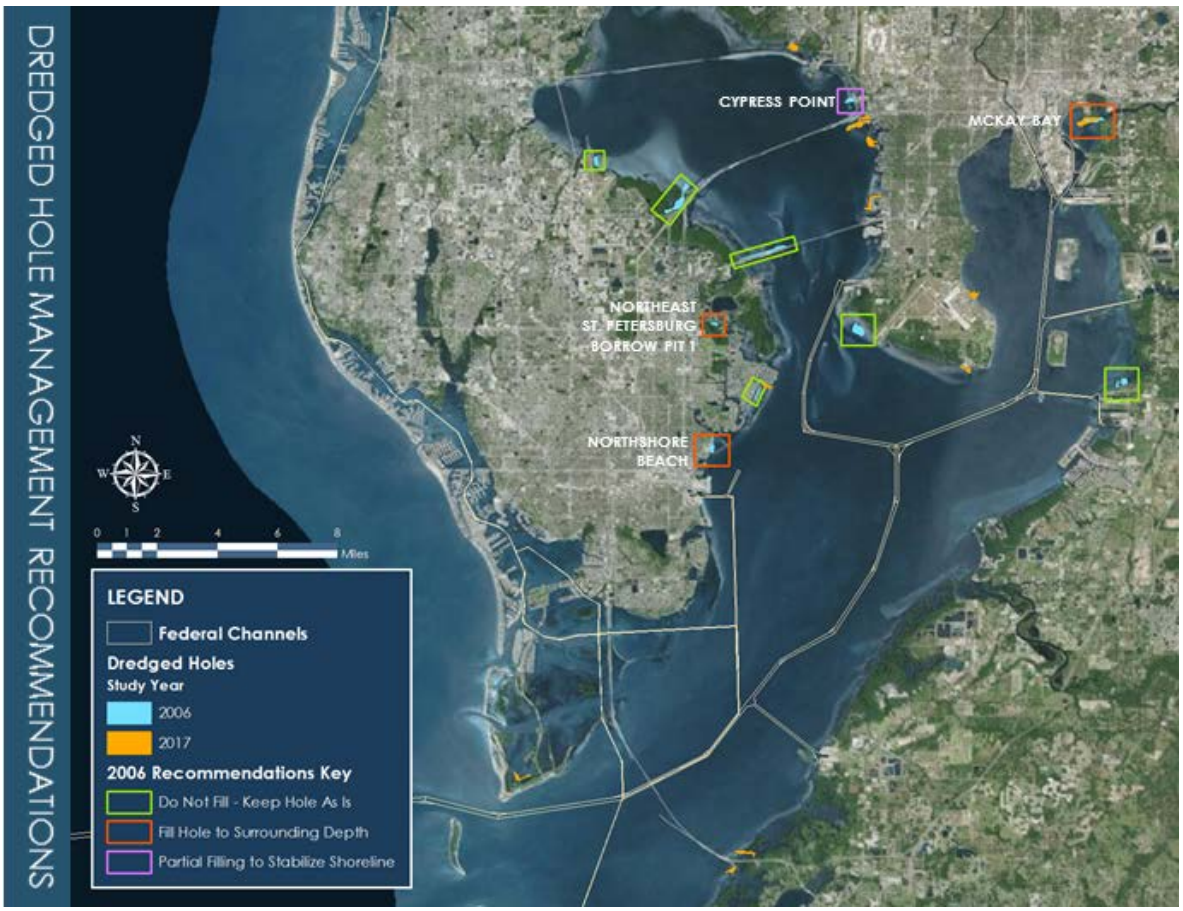

Figure 2: Dredged hole management recommendations from TBEP Tech Pub. #04-05 (2006; shown in blue). Recommendations for the dredged holes shown in orange are anticipated in a report to be published in 2018.

Provided the appropriate benthic surveys are conducted to identify whether a hole is suitable for restoration, dredged hole restoration has significant stakeholder support. However, coordination on sediment suitability and construction techniques, as well as NEPA and permitting, are necessary to move this alternative toward implementation. The draft technical note, *Tampa Bay RSM - Implementation Strategies and Recommendations for Ecosystem Restoration in Tampa Bay, Florida* (USACE, in publication) notes, “Ideally, dredged holes would be filled with rock or coarse sand and

capped with material that is similar to the surrounding substrate. Silty material can billow out of a dredged hole if covered with heavier material, causing localized turbidity if not contained." Coordination on the feasibility of using some, or all, of the material from a Manatee Harbor O&M event is needed.

Pending this type of coordination and evaluation under NEPA, it would be important to include potential dredge holes in the Manatee Harbor O&M permit. The dredged holes identified in the 2006 study (shown in blue in Figure 2) are included in the Tampa Harbor O&M permit, but are not included in the Manatee Harbor O&M permit. Including these dredged holes and the holes identified by the 2017/2018 study in the next permit would enable them to be utilized when appropriate.

Given the potential for only a portion of material from an O&M event to be suitable for dredge hole filling, costs in Table 2 assume that 60% of the dredged material (197,000 cy) would be used to fill a dredged hole up to 10 miles away, and the remaining 40% would go to the DMMA and be actively managed.

In addition to maintaining the authorized project, benefits of restoring dredged holes include enhanced habitat value and potential mitigation credit for seagrass impacts. TBEP Tech Pub. #04-05 found that restoration of four out of eleven studied holes, through complete or partial filling, would enhance the holes' habitat values (TBEP, 2005). The availability of seagrass mitigation in this watershed is limited, and recent cost estimates for one acre of seagrass mitigation are approximately $330,000. Seagrass habitat created through the restoration of a dredged hole could be accounted for in the Manatee Harbor Florida Department of Environmental Protection (FDEP) permit and used to offset future seagrass impacts in the project area. Restoring seagrass habitat also improves water quality, supports fisheries, and provides other incidental environmental benefits.

2.4.1 Recommendation

Recent coordination with the TBEP stakeholder group in February 2018 indicates that several of the holes identified in the 2006 study are slated for filling with Tampa Harbor O&M material and several holes from the 2017/2018 study may not be recommended for filling. While this reduces the potential capacity available for this alternative, sediment from one or multiple future events may be suitable for this alternative, alleviating capacity needs of the DMMA. Table 2 also indicates that the costs could be less expensive than other options. This alternative should be evaluated under NEPA, coordinated further with stakeholders, and included in future permitting in order to take advantage of opportunities to fill dredged holes when they arise.

2.5 Nearshore Placement at Egmont Key

O&M material from the Gulf Intracoastal Waterway Federal Navigation Project was placed in the nearshore region of Egmont Key in 2012. Because Egmont Key experiences significant erosion, USACE coordinated with agencies to allow for the placement of sediments that exceeded the criteria outlined in state regulations. It is

reasonable to assume that FDEP may make similar allowances for material from Manatee Harbor. Coordination on sediment suitability, NEPA evaluation, and permitting would be needed.

A separate cost for nearshore placement was not developed for this effort. However, the draft technical note, *Tampa Bay RSM - Implementation Strategies and Recommendations for Ecosystem Restoration in Tampa Bay, Florida* (USACE, in publication) indicates that nearshore placement costs could be similar, or slightly less, than those for restoring dredged holes.

In addition to maintenance of the authorized project, benefits of nearshore placement at Egmont Key include restoring sediment to the coastal/bay system and potentially reducing erosion impacts to structures on the island. If placed close enough to the beach, material placed in the nearshore can move onshore through wave action and widen the emergent shoreline. However, equipment used and other factors can limit a placement's proximity to shore.

2.5.1 Recommendation

Similar volume limitations to those described for filling dredged holes may apply to nearshore placement, pending coordination on sediment suitability. While neither of these alternatives may fully address capacity needs, they may be cost effective, and a combination of these alternatives could be used to address future capacity shortfalls.

3 PLACEMENT SCENARIOS

Currently, there is no single alternative for material placement over the long-term. While the ODMDS has significant capacity, it is a costly option and DMMA capacity must still be maintained for emergency dredging or situations where the ODMDS would not be available. Constructing a new DMMA or significantly modifying the existing DMMA would incur significant cost and is not considered feasible at this time. In reality, a combination of placement options would be used over time to meet the project's capacity needs. Many scenarios are possible, but four simplified scenarios were evaluated in Table 3 to provide perspective on present value costs over 20 years. Scenarios combine placement options shown in Table 2.

Table 3: 20 year life-cycle analysis of different placement scenarios (FY18 price levels, FY18 Water Resources discount rate of 2.75%).

20 Year Life-cycle Analysis of Placement Scenarios				
20 year Scenario	**Placement Options Used (from Table 2)**	**Description**	**Present Value of costs over 20 years (FY18 dollars)**	**Increase in Present Value costs over least cost alternative**
A	1, 2, 3	**Event 1**: DMMA with active management and general maintenance. **Event 2 - 3**: dredge hole restoration and DMMA with active management and general maintenance. **Event 4 - 5**: ODMDS placement and continue DMMA active management and general maintenance.	$ 48,600,000	$ -
B	1, 2, 4	**Event 1**: DMMA with active management and general maintenance. **Event 2 - 4**: offload 400,000 cy to Washington Park and DMMA placement with active management and general maintenance. **Event 5**: ODMDS placement and continue DMMA active management and general maintenance.	$ 50,000,000	$ 1,400,000
C	1, 2	**Event 1**: DMMA with active management and general maintenance. **Event 2 - 5**: ODMDS placement and continue DMMA active management and general maintenance.	$ 53,300,000	$ 4,700,000
D	2	**Event 1 - 5**: ODMDS placement and continue DMMA active management and general maintenance.	$ 58,800,000	$ 10,200,000
*Costs are rough order of magnitude (ROM) and rounded to the nearest $100,000.				

All scenarios include ODMDS placement at some point due to eventual filling of the DMMA to its 495,000 cy threshold. Scenario D displays the rough order of magnitude cost of using the ODMDS for all events over a 20 year period and demonstrates that it is the most costly option. This emphasizes the need to develop RSM alternatives to minimize costs and realize benefits of maintaining sediment within the coastal system.

While Scenario A represents the least costly option, additional coordination on filling dredged holes is needed before it is considered feasible as described elsewhere in this report. Scenario B, offloading to Washington Park, is the next least cost option and has better potential for near-term viability. It is important to note that additional analysis and coordination is needed to implement this option.

4 SUMMARY AND PATH FORWARD

In order to maintain 495,000 cy of capacity in the DMMA, the current placement action is not viable beyond the next O&M event, anticipated in 2019. Modifying the existing DMMA or constructing a new DMMA to create capacity is not currently feasible or cost effective. While rough order of magnitude (ROM) costs in Table 2 indicate that open water placement alternatives such as filling dredged holes may be less costly than other alternatives, further coordination is needed on placement locations, sediment suitability, and construction methods. Planning level analysis indicates that offloading to Washington Park is the most viable option for creating capacity at this time.

Based on existing information and planning level ROM costs, the most feasible alternatives include:

1. Maximize current active management practices of material within the DMMA. While not meeting all capacity needs, this has the potential to substantially reduce material volume within the DMMA and facilitate offloading for beneficial uses.
2. Complete NEPA including, at a minimum: placement of dredged material in previously dredged holes, nearshore placement, and offloading existing DMMA material to Washington Park. Coordination with agencies and stakeholders on issues such as sediment suitability and construction methods is essential for evaluation of alternatives such as filling dredged holes.
3. Pending NEPA, begin offloading DMMA material to Washington Park within 6 years, prior to the second future O&M event. Offloading approximately 400,000 cy per O&M event (for an approximate total of 1,200,000 cy over time) represents a feasible option which the non-federal sponsor supports.
4. Pending NEPA, include RSM alternatives such as placement of dredged material in previously dredged holes and nearshore placement in O&M permits in order to take advantage of opportunities to beneficially use suitable dredged material.

Concurrent implementation of these recommendations is important to ensure maintenance of the harbor while taking advantage of RSM opportunities to realize incidental benefits and reduce lifecycle costs. Recommendations of this report are based on a planning level analysis using existing information and rough order of magnitude (ROM) costs to guide further action. Additional analysis and review may be needed to ensure suitability and practicability of each recommendation.

5 REFERENCES

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