FACILITATED WORKSHOP ON BENEFICIAL USE OF DREDGED MATERIAL AT MACDILL AIR FORCE BASE

Synthesis of Outcomes

P. SOUPY DALYANDER, JESSICA HENKEL, ABBY LITTMAN

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LIST OF ACRONYMS

Acronym	Term
AFB	Air Force Base
BASH	Bird/Wildlife Aircraft Strike Hazard
BUDM	Beneficial Use of Dredged Material
E&D	Engineering and Design
E	East
NBS	Nature-Based Solution
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
O&M	Operations and Maintenance
PrOACT	Problem, Objectives, Alternatives, Consequences, Tradeoffs
SAV	Submerged Aquatic Vegetation
SDM	Structured Decision-Making
SE	Southeast
SW	Southwest
TBEP	Tampa Bay Estuary Program
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
WAD	Wave Attenuating Device

INTRODUCTION

MacDill Air Force Base (AFB), situated on an exposed peninsula at the north end of Tampa Bay (Figure 1), faces significant challenges of shoreline erosion and flooding that will be exacerbated in future years by climate-related effects such as sea-level rise and predicted increases in the frequency and intensity of storm events (Tampa Bay Partnership, 2022; Tampa Bay Regional Planning Council, 2024). The natural configuration of the AFB provides significant opportunities to employ nature-based solutions (NBS), actions inspired by nature that rely on incorporation of natural features and processes. NBS—several of which have been used on site in the past—can provide multiple advantages when used alone or in combination with "gray infrastructure" solutions (levees, seawalls, etc.). These benefits include reducing flood risk, protecting facilities and infrastructure, and supporting ecosystem service co-benefits and habitat creation (U.S. Army Corps of Engineers [USACE], 2023). In addition, use of NBS at MacDill AFB can provide a demonstration of the utility and opportunities of NBS to other stakeholders in the region. Potential high-value opportunities for NBS at the site include restoring the historical longshore bar system, expanding existing submerged shallow shelf habitat, and creating barrier islands. All NBS under consideration require sediment of varying characteristics for implementation.

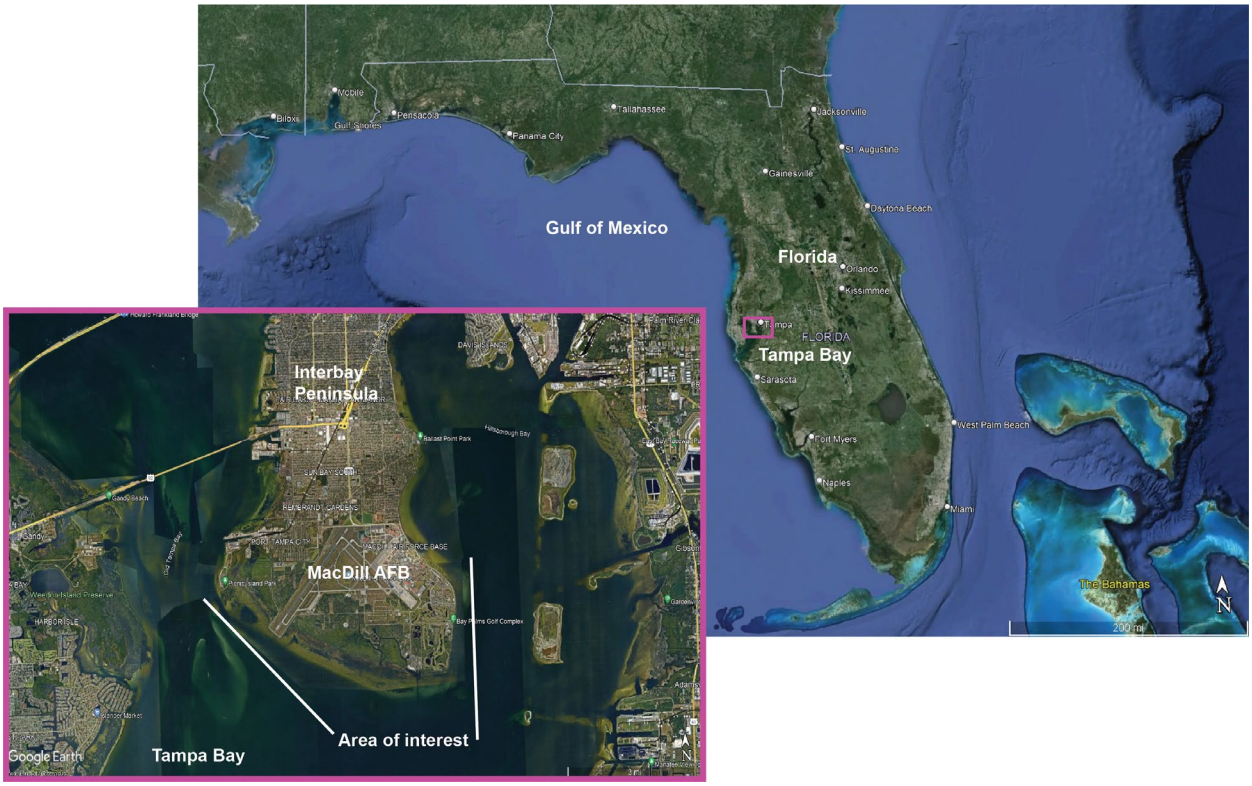

Figure 1. Location of MacDill Air Force Base (AFB) and the Interbay Peninsula in Tampa Bay, Florida.

The USACE Jacksonville District, in partnership with Port Tampa Bay, is currently conducting the Tampa Harbor Navigation Improvements Study.[1] This study is focused on evaluating alternatives for deepening the Tampa Harbor authorized navigation channel. These alternatives focus on using or disposing of the sediment and bedrock material that will result from the project, including the potential for beneficial use of dredged material (BUDM). The Chief's Report for this project was signed by USACE on August 14, 2024 and contains a recommendation to Congress for the Tampa Harbor Navigation Improvement Study to be included in the next Water Resources Development Act. The final General Reevaluation Report and Environmental Impact Statement was released for public review on August 23, 2024 and the public review period ended on September 23, 2024 (USACE, 2024).

The Tampa Harbor deepening project will provide a significant volume of sediment and limestone (USACE, 2024) that could potentially be used for the creation of NBS at MacDill AFB. In addition, the long-term operations and maintenance dredging of the expanded channel will provide materials that could be used to augment any newly created NBS or implement additional NBS projects to improve installation resilience. Other potential sources of material include material previously dredged from the navigation channel and placed in disposal areas.

Making significant changes to a nearshore environment through the placement of large quantities of sediment and limestone will require substantial planning, cooperation, and coordination across decision-makers, stakeholders, and regulatory agencies, including MacDill AFB personnel; the USACE Tampa Harbor Navigation Improvements project team; USACE regulatory and permitting; the U.S. Fish and Wildlife Service (USFWS); the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service; and local community collaborators. Receiving decision-maker input and feedback from these agencies and organizations will be critical to charting the path for successful project implementation, particularly with respect to completing National Environmental Policy Act (NEPA) documentation and all required environmental permitting.

To support and advance the creation of coastal habitat and NBS at MacDill AFB, The Water Institute (the Institute) facilitated engagement with regulatory and resource management agency representatives to identify potential impediments to implementation. In addition, the Institute worked with these representatives to identify strategies for mitigating those impediments, as well as to draft a preliminary, prioritized list of NBS alternatives based on (1) accruing coastal protection benefits to MacDill AFB and nearby communities; and (2) creating nearshore habitat.

[1] https://www.saj.usace.army.mil/Tampa-Harbor/.

METHODS AND ACTIVITIES

The Institute engaged representatives from MacDill AFB and resource management agencies involved with environmental permitting processes through a facilitated virtual working session (Appendix B) and an in-person workshop (Appendix C). The Institute also held calls with MacDill AFB personnel as part of eliciting input on NBS implementation. The Institute used principles of Structured Decision Making (SDM), a transparent and objective-orientated approach that can support identifying actionable alternatives for complex problems where there are multiple stakeholders and interests (Figure 2). SDM is implemented through the "PrOACT" process that includes: (1) clarification of the **Pr**oblems impeding the decisions; (2) articulating the **O**bjectives of the decision makers and stakeholders; (3) identifying **A**lternatives that can advance those objectives; (4) evaluating the **C**onsequences of potential alternatives on the desired objectives; and (5) considering **T**radeoffs as part of optimizing selection of an alternative to ultimately support deciding and acting. The Institute implemented SDM in this case through rapid prototyping, where the PrOACT cycle relies on eliciting attendee input and/or interpretation of existing and available information, as opposed to development or application of quantitative models or tools.

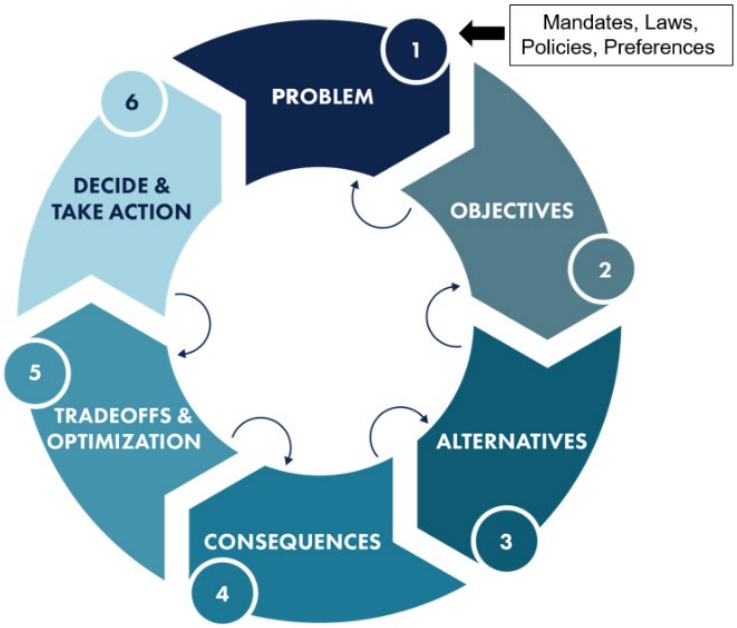

Figure 2. The PrOACT cycle underlying structured decision making (SDM).

The Institute started the SDM process with the **Pr**oblem articulation component of the PrOACT cycle, which includes elicitation and clarification of the following:

- Decision makers: the specific entities with decision-making authority relevant to BUDM at MacDill AFB, including permitting, NEPA, Section 7 consultation, and other relevant regulatory processes;
- Constraints: real or perceived factors limiting potential implementation, including mandates, laws, and policies that impact the decision;

- Timing and frequency: timeline of the decision for, and potential implementation of, BUDM project(s) at MacDill AFB; and
- Scope and action: potential range of alternatives under consideration in the decision, in this case the potential NBS that could be constructed with BUDM at MacDill AFB.

The Institute elicited implementation and regulatory constraints and concerns from representatives of MacDill AFB and resource management agencies during the virtual working session, then refined this input during the in-person workshop. Other aspects of the decision context, and the NBS project **O**bjectives, were elicited from MacDill AFB personnel through a series of facilitated calls. These were held ahead of the in-person workshop and the draft materials were reviewed and refined with input from workshop participants.

The remainder of the PrOACT cycle was completed during an in-person workshop held in August 2024. The **A**lternatives were derived from three conceptual BUDM elements developed for MacDill AFB: creation or expansion of submerged shallow shelf habitat, including filling of historical dredge holes; re-establishment of historical longshore sand bar systems; and creation of barrier islands. These **A**lternatives were considered independently to facilitate eliciting concerns, impacts, and potential benefits from workshop participants. Workshop attendees were prepped for in-person discussion of **A**lternatives through presentations of the MacDill AFB conceptual designs and similar NBS applications at other locations during the virtual working session.

The Institute facilitated the last two phases of the SDM process, comprised of **C**onsequence and **T**radeoff Analysis, during the in-person workshop. Facilitators asked participants to use their best professional judgement to score each of the three alternatives against each objective using a simple scale: ++, very positive impact; +, positive impact; o, neutral impact; -, negative impact; and --, very negative impact. Participants rated each of the three alternatives independently for three nearshore zones (southwest, southeast, and east) to capture spatially specific concerns (Figure 3) and were advised they could abstain from providing a ranking for any objective or alternative for which they did not have relevant subject matter expertise. Participants also provided comments explaining their perspective, and were given the opportunity to provide additional, spatially specific feedback by annotating maps included with the score sheets. These scores were converted to a scale of -2 (negative) to 2 (positive) and summed across participants and objectives as part of a qualitative tradeoff analysis of the alternatives.

Figure 3. Spatial zones used to delineate the MacDill AFB coastal restricted area (i.e., portion of the nearshore region in which access is limited for security purposes): southwest (SW); southeast (SE); east (E).

OUTCOMES

As outlined above, MacDill AFB personnel along with representatives of regulatory and resource agencies were engaged in the SDM process through three mechanisms: (1) a virtual working session in which regulatory and resource agency representatives articulated priorities and concerns related to implementation of NBS; (2) calls with a selection of USAF and USFWS stationed at MacDill AFB to identify a draft set of objectives for NBS at MacDill AFB; and (3) an in-person workshop in which the objectives were refined, NBS alternatives were discussed, the consequences and tradeoffs of different NBS alternatives were evaluated, and next steps were outlined. The outcomes are described below.

REGULATORY AND RESOURCE AGENCY CONCERNS

The primary concerns raised by resource management agencies during the virtual working session (Appendix B) related to BUDM from the Tampa Harbor Navigation Improvements Study. Participants noted that the Environmental Impact Statement and environmental consultations for that project had been completed, and although MacDill AFB was mentioned in the draft Chief's Report, it was not evaluated as part of a programmatic or project-specific environmental consultation. Given the complexity of the NBS under consideration, the addition of MacDill AFB as a placement area would require additional environmental consultation. However, there was uncertainty in when and how that consultation would need to be conducted and thus what the potential implications could be for the Tampa Harbor Navigation Improvements Study. Another potential concern that was raised was whether BUDM placement within MacDill AFB coastal restricted area was still a potential alternative given that USACE had completed its economic analysis for the feasibility study. However, USACE representatives indicated that new BUDM placement alternatives could be implemented if they were lower cost than those identified in the Chief's Report or if cost sharing mechanisms were identified.

Resource management agency representatives were supportive of increasing seagrass habitat through wave energy reduction but highlighted the importance of engaging USFWS and NOAA early and throughout the design and permitting process. Resource managers encouraged consideration of project evolution over time during the engineering and design process, and recommended consideration of "proof of concept" or scaled NBS implementation to potentially streamline permitting processes. The only specific concern identified during the call for the NBS concepts presented was the potential for increased bird strikes by aircraft if barrier islands were constructed, given the potential for heavy use of the islands by nesting birds.

Representatives from NOAA also recommended using the Section 7 mapper tool[2] for the project area to support resource management agencies in identifying potential issues. The Institute used this tool to identify listed species or critical habitat presence in the vicinity of MacDill AFB: loggerhead, green, and Kemp's Ridley sea turtles; giant manta ray and smalltooth sawfish; and Gulf sturgeon.

[2] https://www.fisheries.noaa.gov/resource/map/southeast-region-esa-section-7-mapper

OBJECTIVES

A draft set of objectives were elicited from MacDill AFB during a pre-workshop call, which were grouped into three categories. These objectives were then revised and finalized during the in-person workshop (Table 1).

Table 1. Objectives for construction of NBS at MacDill AFB, along with potential metrics for characterizing success. Objectives and metrics that were revised or added based on feedback from workshop participants are denoted with a (*).

Category	Objective	Metric
Coastal Protection and Air Force Operations	Maximize wave attenuation	*Percent reduction in waves for varying offshore conditions (storm and non-storm)
Coastal Protection and Air Force Operations	*Minimize inland storm surge[1]	*Acreage and time (acre-hours) of flooding during storms
Coastal Protection and Air Force Operations	Minimize probability of bird/wildlife aircraft strike hazard (BASH)	Probability of bird/aircraft interaction
Coastal Protection and Air Force Operations	*Minimize installation perimeter security concerns	*Marine Patrol response time, nearshore access, and line-of-sight to perimeter areas
Habitat	Maximize extent of submerged aquatic vegetation (SAV)	Acreage of existing and potential new SAV
Habitat	Maximize benefits to other habitats and species of concern	*Acreage of net habitat gain / loss of different types on different time scales
Regional Benefits and Impacts	Minimize downstream erosion	Net sediment flux to neighboring shorelines

[1]The objective to "Maximize wave attenuation" was originally combined with the objective to reduce storm surge to streamline the number of objectives that workshop participants provided feedback on. The two objectives were separated after the workshop because (1) attendees noted that some features will have minimal impact on surge while providing a wave attenuation benefit; and (2) the relationship between storm surge and wave attenuation, as well as the impacts of NBS on each, can be resolved in the future with numerical modeling of potential alternatives.

Workshop participants were asked to provide input on each category of objective and the potential metrics. In addition, participants were encouraged to provide information on known datasets that could be used to evaluate those metrics.

Coastal Protection and Air Force

Participants agreed on the value of the two draft objectives identified in the Coastal Protection and Air Force Operations category. The objective and metrics were revised from an original draft version, "Maximize storm surge and wave attenuation," to focus solely on wave energy reduction given that some NBS alternatives (e.g., expansion of the shallow shelf) will not impact storm surge. A second metric, acreage and time (i.e., acre-hours) of flooding, was added to capture feedback received that the recovery time and water drainage a factor to consider alongside the effect NBS might have on surge during the storm itself. Participants provided input on security as an additional Air Force operation concern, specifically that habitat such as mangroves could provide hiding areas for intruders and that shallowing of

the shelf could impede access of Marine Patrol boats to nearshore regions and/or increase response time if smaller watercraft were required. These concerns were captured in a new objective, "Minimize installation perimeter security concerns," with a metric of Marine Patrol response time, nearshore access, and line-of-site to perimeter areas. Participants did note that mangrove pruning, cameras, markers and lights, and other measures could potentially be used to mitigate concerns. A final area of feedback focused on shoreline erosion at MacDill AFB. This input was captured by modifying the metric for storm surge and wave attenuation to include evaluation across a range of conditions, to serve as a proxy for impacts on shoreline erosion.

Habitat

Participants agreed on the value of the two draft objectives identified for the Habitat category. For "Maximize SAV habitat" it was suggested that an additional metric that captures the acreage of existing SAV protected by the NBS alternative be considered, in addition to the total existing and potential new SAV habitat metric. It was also suggested that metrics selected to assess SAV habitat align with the metrics outlined in the Tampa Bay Estuary Program (TBEP) Conservation and Management Plan (TBEP, 2017; see Appendix A).

Participants provided input on the types of habitats and species that could be monitored to evaluate the "Maximize benefits to other habitats and species of concern" objective. They suggested, depending on the type and location of the NBS, the following habitats could be monitored: mangrove islands, tidal wetlands, oyster, sandy bottom and hard bottom habitat. Participants agreed that the metric of "acreage of net habitat change" for different habitat types would be appropriate to monitor, but suggested that the outcomes of an NBS be evaluated on different time horizons (e.g., short-term of less than five years, medium-term of less than 10 years, and long-term). For species of concern, participants suggested monitoring critical habitat for manatees and turtles, and recommended considering whether the target would be no net loss or an increase in those habitats. Participants noted that the TBEP collects and houses data on fisheries, waves, and habitat types that could be incorporated into future modeling and evaluations.

An area of concern raised by workshop participants was the potential for increased operations and maintenance (O&M) needs and cost resulting from any newly created habitat. This O&M could include increased BASH needs (e.g., increased bird numbers on newly built barrier islands), as well as the general maintenance of the habitats (e.g., invasive species management). The level of maintenance required would vary by the type to of NBS, but it was suggested that an additional objective of "Minimize the need for operations and maintenance" be considered. The ability to capture future O&M needs through cost evaluations was also noted, and it was recommended that additional BASH staff be budgeted for.

Regional Benefits and Impacts

Workshop participants agreed with the draft objective proposed for regional benefits and impacts—minimize downstream erosion and were in favor of using net sediment flux to neighboring shorelines as a potential metric. Participants identified additional benefits as well. They agreed that there is an opportunity to reduce placement where it is unwanted (i.e., offsetting non-benefits). Participants also noted that an increase in seagrass acreage would have regional benefits—increasing water quality and the number of aquatic species, as well as water temperature, water clarity, and light attenuation. This group

raised the point that just a few hundred acres of seagrass could mean bay-wide benefits (this would be especially beneficial to the east side of the base in Hillsborough Bay).

Another benefit identified by participants was the fact that successful implementation could be "proof of concept" for NBS permitting, and lead to replication throughout the bay. The groups discussed the "longevity of MacDill Air Force Base" as a potential benefit—as the proposed concepts would provide protection and therefore allow missions to remain at MacDill, maintain the base economy, and maintain the habitats and species associated with the base that are stewarded by various natural resource agencies. Other potential benefits included having a place to put material (which is a cost benefit for USACE), and the benefits to underserved communities in the area (and what this could mean for future funding). One participant also noted the potential value of testing some of these concepts on a smaller scale from a communications standpoint (e.g., the Picnic Island Interventions).

Participants also discussed other concerns with regards to regional benefits. There were questions about point surface discharge of water off base, boat wake action, bird nesting, and flushing channels, and how these factors might be considered when planning project implementation. Participants also raised concerns about keeping important navigation channels open during construction (the marina and other major access points), as well as maintaining traffic corridors around the AFB during construction.

Participants recommended looking to some local projects for more clarity on potential impacts and benefits. They mentioned an AECOM study at the Port Tampa Bay, the TBEP Dredge Hole Study, NOAA Historic Placement Charts, shoreline erosion tracking in Alafia Bank (Bird Island and Sunken Island) where wave attenuation devices (WADs) have been implemented, the Port's public island and the oyster habitat that was created on the southern and eastern side, and a University of South Florida (USF) pilot study that is using wave monitoring devices.

QUALITATIVE EVALUATION OF NATURE-BASED SOLUTIONS

Included below is a summary of the NBS alternative and objective rankings from workshop participants, along with highlights of comments received and a synthesis of the results. The Institute elicited feedback on the impact of the alternatives on the draft objectives developed prior to the workshop only (i.e., objectives that were added during the workshop itself were not evaluated).

Expansion of Shallow Shelf Habitat

Workshop participants generally agreed that expansion of shallow shelf habitat would have a positive impact on the coastal protection objective (Table 2). Multiple respondents noted that this effect would be confined to wave attenuation with limited effect on surge and that numerical modeling would be needed to fully evaluate this impact and/or to determine the added benefit of the NBS in combination with other green or grey coastal protection features.[3] Responses were generally consistent across spatial areas, with

[3] Hydrodynamic, wave, and sediment transport modeling are planned the Engineering and Design phase of selected NBS alternatives.

slightly higher variability between responses for the southwest and east shorelines. Some respondents indicated concerns about the longevity of sediment placement, particularly in the southeast and east due to more ship wake and associated wave energy, which may contribute to the variability in responses.

Responses were more varied, both spatially and across workshop participants, for the impact of expansion of the shallow shelf on BASH (Table 2). Some respondents indicated there would be minimal impact of shallow shelf expansion on bird strikes if built deep enough to be subaqueous even at low tide, while others indicated concerns about potential for subaqueous habitat to attract of wading birds. Based on comments and subsequent discussion, this variability may be attributed to assumptions or concerns on the depth of the constructed features and how they might evolve over time, and if respondents considered the potential for marsh or SAV to colonize the constructed shelf and attract some bird species. The southwest region, near the terminus of the AFB runway, was identified as the region with the most potential for negative BASH effects. However, some respondents indicated concerns that habitat which attracts birds could increase strikes anywhere it was constructed given that flight patterns over the southeast and east shorelines bring aircraft into the altitude range for potential strikes.

Table 2. Summary of input workshop participants provided on the expected impact of expanding shallow shelf habitat along the southwest, southeast, and east shorelines. SAV: Submerged Aquatic Vegetation; BASH: Bird/wildlife Aircraft Strike Hazard.Paricipants were asked to rank the impact of an alternative on an objective on a scale from very positive (++) to very negative (--). These values were then converted to a numerical scale of 2 (very positive) to -2 (very negatve) for aggregation and analysis.

Category	**Coastal Protection & Air Force Operations**		**Habitat**		**Regional Benefits and Impacts**
Southwest Shoreline	Surge, Wave Attenuation	BASH	SAV	Other Habitat	Sediment Retention
Mean (Average)	1.23	-0.43	1.46	1.00	0.60
Standard Deviation	0.58	0.98	1.15	1.15	1.02
Most Common Response	1	0	2	2	0
Number of Responses	13	14	13	6	10
Southeast Shoreline	Surge, Wave Attenuation	BASH	SAV	Other Habitat	Sediment Retention
Mean (Average)	1.00	0.57	1.15	0.43	0.50
Standard Deviation	0.88	0.98	1.10	1.18	0.92
Most Common Response	1	0	2	2	0
Number of Responses	13	14	13	7	10
East Shoreline	Surge, Wave Attenuation	BASH	SAV	Other Habitat	Sediment Retention
Mean (Average)	1.23	0.50	0.85	0.71	0.60
Standard Deviation	0.89	0.98	1.41	1.28	1.02
Most Common Response	2	0	2	2	0
Number of Responses	13	14	13	7	10

There was consensus that expanding the shallow shelf would have a positive impact on SAV (Table 2), assuming the shelf was constructed at an appropriate depth for SAV propagation. Several respondents

indicated that there was less potential for recruitment of SAV in the southwest than in the southeast, with the lowest potential for recruitment in the east due to ship traffic, higher wave energy, and lack of existing beds to support recruitment. However, comments indicated that the design of the feature and its associated longevity (depth; grain size, with coarser material potentially remaining in place longer, etc.) would influence habitat suitability for SAV due to the potential for increased wave attenuation, and that numerical modeling would be needed for robust evaluation. Comments also indicated that other factors that influence SAV habitat suitability, such as water clarity, should be considered in evaluating potential for habitat expansion. Multiple respondents indicated that filling dredge holes near existing seagrass would have a high likelihood of recruiting seagrass if the appropriate material were used.

Fewer respondents provided a categorical ranking (Table 2) on the impacts to other types of habitats, but several provided comments on concerns and/or priorities. Respondents noted that—depending on the construction elevation and its evolution over time—expansion of the shallow shelf could provide additional fish, oyster, and manatee habitat. In addition, it could provide protection to support existing marsh, mangroves, tidal flats, and beach, depending on the location built (e.g., construction in the southeast would protect existing mangroves; in the southwest or east would benefit tidal marsh; in the east would benefit beach). It was noted that there would be tradeoffs between habitats and/or the potential for habitat succession (e.g., between SAV and mangroves), and that building with a diversity of elevations could provide the broadest benefit.

There was variability in the expected impact of expansion of the shallow shelf on sediment flux to downstream areas (Table 2). Comments indicated that numerical modeling and/or consideration of the sediment source was needed to evaluate this effect and to determine if short- and long-term effects would be positive (e.g., through maintaining sediment in Tampa Bay that would otherwise be placed in upland or offshore sites or reducing erosion of the adjacent shoreline) or negative (e.g., through deposition on adjacent SAV beds or shoaling of sediment in navigation channels).

Restoration of Longshore Bars

There was consensus among workshop participants that longshore bars would attenuate wave energy, with a higher average score compared to expansion of the shallow shelf (Table 3). Respondents noted that this effect would vary depending on design, where longshore bars with a shallower depth over the bar will result in greater wave attenuation. Designs that include multiple longshore bars and/or a combination of longshore bars with other wave break structures, such as oyster balls or WADs, were also noted as likely to result in greater wave attenuation. There was greater variability in responses on how longshore bars would affect the risk of BASH (Table 3) with comments that this impact, like input received on shallow shelf habitat, would depend on the design and evolution of the features over time (specifically if they remained subaqueous). For example, one respondent recommended use of a breakwater with no expansion of shallow shelf for the southwest shoreline to discourage bird activity in the area. Respondents noted that preserving access for security patrols is one benefit of longshore bars compared to expansion of the shallow shelf.

Respondents generally concurred the restoration of longshore bars would have a positive impact on SAV (Table 3), but with some variability. Respondents noted that prior studies did not find a statistically significant increase in SAV with placement of longshore bars along the east shoreline, and that bars in

that area might need to be combined with expansion of the shallow shelf and/or with other actions to be effective (note, this region has a smaller extent of existing SAV compared to the southern shorelines). Respondents indicated generally positive impacts to other types of habitats depending on the depth and material of construction, including potentially providing suitable habitat for oysters and fish as well as attenuating wave energy with benefit for sea turtles and manatees. However, respondents did note potential harm to existing habitat depending on where longshore bars are constructed and what they replace, and concerns that, if longshore bars lead to expansion of SAV near navigation channels, it could result in more manatees in those high-traffic areas. These concerns were spatially specific, with a respondent noting that SAV is established in the southwest and southeast and therefore bar placement in those regions could potentially have no benefit impact and could, instead, lead to macroalgae growth and a loss of natural resilience in this area. In contrast, the respondent noted that building longshore bars in the east could attenuate wave energy and support establishment of SAV beds.

Table 3. Summary of input workshop participants provided on the expected impact of restoring longshore bars along the southwest, southeast, and east shorelines. SAV: Submerged Aquatic Vegetation; BASH: Bird/wildlife Aircraft Strike Hazard. Paricipants were asked to rank the impact of an alternative on an objective on a scale from very positive (++) to very negative (--). These values were then converted to a numerical scale of 2 (very positive) to -2 (very negatve) for aggregation and analysis.

Category	**Coastal Protection & Air Force Operations**		**Habitat**		**Regional Benefits and Impacts**
Southwest Shoreline	Surge, Wave Attenuation	BASH	SAV	Other Habitat	Sediment Retention
Mean (Average)	1.36	0.67	1.10	0.86	0.00
Standard Deviation	0.64	0.94	0.70	0.64	1.00
Most Common Response	2	0	1	1	0
Number of Responses	11	12	10	7	6
Southeast Shoreline	Surge, Wave Attenuation	BASH	SAV	Other Habitat	Sediment Retention
Mean (Average)	1.18	0.92	0.70	0.71	-0.33
Standard Deviation	0.72	0.86	0.90	0.45	0.47
Most Common Response	1	0	1	1	0
Number of Responses	11	12	10	7	6
East Shoreline	Surge, Wave Attenuation	BASH	SAV	Other Habitat	Sediment Retention
Mean (Average)	1.30	0.73	1.22	0.86	-0.33
Standard Deviation	1.00	0.96	1.03	0.64	0.47
Most Common Response	2	0	2	1	0
Number of Responses	10	11	9	7	6

Multiple respondents noted that benefits, impacts, and longevity of longshore bars would depend strongly on the material used in construction. Rock or other coarse material would remain in place longer and would evolve less rapidly in response to wave forcing, but conversely would not provide additional sediment for downstream areas and could be subject to local scour. Reduced wave attenuation can also limit longshore transport, which may be the reason respondents indicated, on average, a negative regional

effect of longshore bar placement on sediment retention. Respondents noted that these factors create tradeoffs, where longshore bars constructed of sediment would have greater regional impact while those constructed of coarser material or incorporating structures (oyster balls, WADs) would have greater local benefit in the short- and long-term. Comments recommended use of site conditions and modeling to inform understanding these tradeoffs, as well as the need for a detailed evaluation of cost given that this alternative could be expensive to construct and/or maintain.

Construction of Barrier Islands

Respondents agreed that barrier islands would attenuate wave energy (Table 4), with a higher benefit indicated for the eastern shoreline. Respondents commented that this increased benefit in the east was due to higher wave energy in that area. There was also strong consensus that barrier islands would attract birds, particularly if they included upland habitat, and that would pose an increased risk of bird strikes if constructed along the southwest shoreline. Some respondents indicated that barrier islands could also increase BASH if constructed along the southeast and eastern shorelines, but with a lower risk the farther they were constructed from the runway in the southwest. However, comments were also received suggesting there may be potential for barrier islands constructed to the east to attract birds away from the runway area and thus reduce strike hazard. Respondents indicated that the risk may vary with time as the island vegetates and evolves, with the greatest concern around upland or sandy areas when compared to mangroves.

There was high spatial variability in the expected impact of barrier islands on SAV (Table 4), with the greatest benefit noted for the east shoreline. Comments indicated that this variability could be attributed to the greater wave energy along this shoreline and belief that is a limiting factor for SAV in this area, compared to the southeast and southwest shorelines where SAV is already present at depths it can potentially occur. Respondents expressed some concerns that the construction of barrier islands in these areas could potentially harm SAV depending on erosion and sediment flux from the features, particularly in the southeast where there are extensive existing SAV beds. Respondents rated barrier islands highly in terms of potential benefits to other habitats and species, noting potential benefits for marsh, mangroves, shallow shelf habitat inshore of the islands, birds, fish, and oysters (noting that there could be tradeoffs of loss of SAV habitat depending on sediment flux as noted above).

As with longshore bars, respondents indicated that the benefits and impacts of construction would vary greatly depending on the design, particularly the regional impacts on sediment retention and downstream erosion. Respondents indicated that barriers vegetated with marsh or mangroves, or that are designed with offshore breakwaters or stabilized with rip rap, would be less subject to erosion and more stable in the long term. This type of design would also be more likely to remain subaerial with sea level rise, and would provide a wide range of subaerial habitat benefits (e.g., wetlands), and would reduce potential for shoaling of sediment into navigation channels. Other benefits noted for this design include accommodating a larger volume of sediment than the other NBS under consideration; reduced cost of construction; and less concerns over enforcing restrictions on public access. Conversely, barrier islands with upland habitat and sandy shorelines would potentially increase sediment flux downstream but were noted as requiring more maintenance over time to replace sediment lost to erosion and to remove exotic or nuisance vegetation (including where inhibiting line of sight and creating security concerns). Respondents did note that even a sandy barrier is likely to be more coastal protection over time than a

longshore bar since it will provide wave attenuation even if it becomes subaqueous with sea level rise. As with other NBS, respondents noted the value of modeling and data analysis to provide additional information informing tradeoffs and design.

Table 4. Summary of input workshop participants provided on the expected impact of barrier island construction along the southwest, southeast, and east shorelines. SAV: Submerged Aquatic Vegetation; BASH: Bird/wildlife Aircraft Strike Hazard. Paricipants were asked to rank the impact of an alternative on an objective on a scale from very positive (++) to very negative (--). These values were then converted to a numerical scale of 2 (very positive) to -2 (very negatve) for aggregation and analysis.

Category	**Coastal Protection & Air Force Operations**		**Habitat**		**Regional Benefits and Impacts**
Southwest Shoreline	Surge, Wave Attenuation	BASH	SAV	Other Habitat	Sediment Retention
Mean (Average)	1.17	-1.54	0.08	1.40	1.00
Standard Deviation	1.07	1.08	1.11	0.49	1.20
Most Common Response	2	-2	1	1	2
Number of Responses	12	13	12	5	7
Southeast Shoreline	Surge, Wave Attenuation	BASH	SAV	Other Habitat	Sediment Retention
Mean (Average)	1.17	-0.69	0.33	1.33	0.57
Standard Deviation	0.90	0.82	0.75	0.47	1.05
Most Common Response	2	-1	0	1	0
Number of Responses	12	13	12	6	7
East Shoreline	Surge, Wave Attenuation	BASH	SAV	Other Habitat	Sediment Retention
Mean (Average)	1.54	-0.38	1.17	1.60	0.67
Standard Deviation	0.84	1.21	0.99	0.49	1.37
Most Common Response	2	0	2	2	2
Number of Responses	13	13	12	5	6

Synthesis, Initial Ranking, and Tradeoffs

The mean scores summed across all five objectives for each NBS alternative and each of the three nearshore zones are shown in Table 5. Across all zones and alternatives, the building of barrier islands on the eastern shore ranked highest, followed by shallow shelf solutions in the southwest and southeast of the base.

Table 5. Sum of mean scores across all five objectives provided by workshop participants on the expected impact of the three NBS alternatives along the southwest, southeast, and east shorelines.

	Southwest	**Southeast**	**East**
Shallow Shelf	3.86	3.65	3.89
Longshore Bar	3.81	3.03	3.56
Barrier Islands	2.14	2.73	4.63

In examining the rankings within alternatives for different areas of the base, there was minor variation in ranking across objectives for the shallow shelf alternative. This NBS scored highly across all three nearshore zones and ranked the highest of all alternatives for the southwest and southeast zones. Participants noted that the southeast zone has natural resilience, and therefore an alternative with low alteration (such as building shallow shelf habitat) was preferred. Participants recommended that a shallow shelf NBS could be combined with several breakwaters that get shallower closer to shore where they will not limit marine patrol activities.

Although it scored highly across objectives in the southwest and east, the longshore bar alternative was not the highest ranked alternative for any of the nearshore zones.

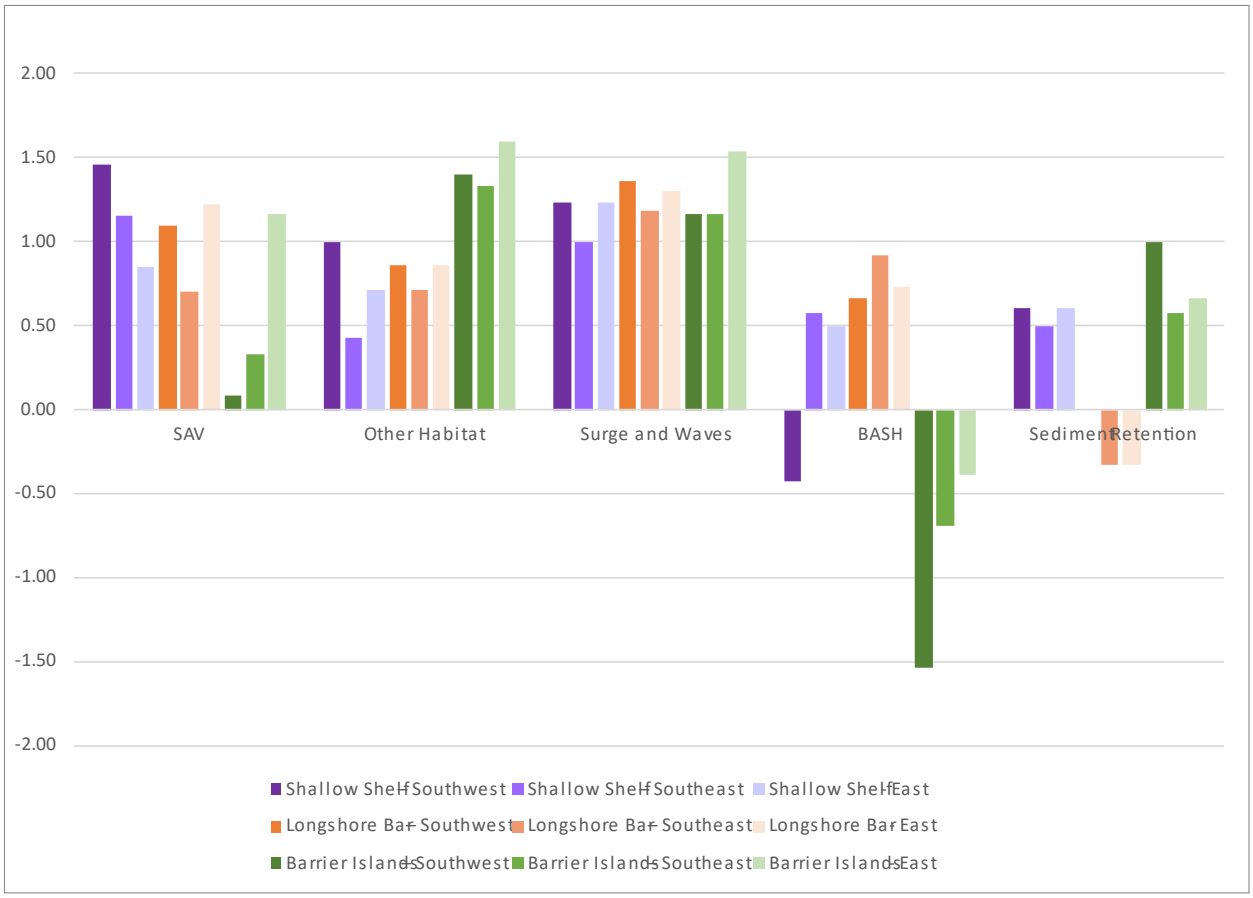

Figure 4. Summary of mean values on the expected impact of each NBS alternative along the southwest, southeast, and east shorelines. SAV: Submerged Aquatic Vegetation; BASH: Bird/wildlife Aircraft Strike Hazard.

The mean scores for each alternative by nearshore zone and objective are shown in Figure 2. This figure highlights some of the tradeoffs that exist for different NBS alternatives. While all three NBS alternatives would positively impact most of the objectives for all nearshore zones, the shallow shelf and barrier island alternatives were evaluated as negatively impacting BASH. Participants noted concerns about BASH with creation of subaerial habitat in the southwest and agreed that—although the impact would still be negative—the area with the lowest concerns for BASH from subaerial features is in the east.

Participants agreed that a barrier island in the east would result in the largest wave attenuation benefit, and therefore result in the largest benefit to coastal protection even considering the tradeoff of elevated BASH concerns. This result highlights an important limitation of the qualitative analysis exercise conducted: while the ranking process was an efficient way to collect and aggregate spatial information quickly, this process did not include objective weighting. For example, as the aim of NBS activities at MacDill AFB are increased coastal resilience, the coastal protection objectives should likely be weighted more heavily than the other objectives for future quantitative analyses. Participants also noted that the qualitative ranking process also did not account for cost, constructability, sediment availability, or other implementation concerns, which will need to be considered as part of the engineering and design (E&D) phase of NBS implementation at the AFB.

CRITICAL PATH AND IMPLEMENTATION

Workshop participants identified several critical path issues associated with NBS construction at MacDill AFB. These issues are summarized in the table below, along with potential strategies for mitigating these issues (Table 6).

Table 6. Critical path issues and associated mitigation strategies for addressing concerns. Columns indicate if there are mitigation strategies relevant to permitting and/or engineering and development (E&D).

Critical Path Issue	Mitigation Strategies
Coastal Protection	
Designing the NBS to have the most benefit in terms of wave attenuation and overall reduction of storm surge	• Preliminary design of NBS alternatives based on input received from workshop participants, including combining elements of expansion of the shallow shelf, restoration of longshore bars, and construction of barrier islands • Numerical modeling of preliminary designs to maximize wave attenuation and minimize inland storm surge, including consideration of the hydrodynamics during storm events • Iteration of designs through E&D based on preliminary results
Air Force Operations	
Bird/Wildlife Aircraft Strike Hazard (BASH) potential, particularly for barrier island or intertidal areas constructed along the southwest shoreline	• Data analysis, numerical modeling, and literature review prior to E&D • Continued engagement of MacDill AFB personnel on BASH concerns • BASH team review of preliminary E&D designs and, as needed, refinement
Maintaining a security perimeter, including maintaining access, line-of-sight, and acceptable response times for 6th Security Forces Squadron Marine Patrol	• Continued engagement of security personnel on security concerns • Marine Patrol team review of preliminary E&D designs and, as needed, refinement • Include option for long-term maintenance or pruning of vegetation such as mangroves in permit applications
National Environmental Policy Act (NEPA) and Regulatory Review	
Mitigating loss of essential fish habitat associated with NBS construction	• Continued engagement of NOAA on mitigation opportunities during E&D • Identify potential mitigation opportunities during E&D, including mangrove or marsh restoration or construction • NOAA review of preliminary E&D designs and, as needed, refinement • Inclusion of mitigation in permit application
Identification and mitigation of potential impacts to federally-listed threatened and endangered (T&E) species and state-listed species of concern	• Continued engagement of USFWS on impact avoidance and mitigation opportunities for federally-listed species during E&D • Engagement of Florida Fish and Wildlife Conservation (FWC) Commission on impact avoidance and mitigation opportunities for state-listed species during E&D

Critical Path Issue	Mitigation Strategies
State permitting requirements impacts to mangrove, wetlands, and other surface waters (OSW)	• Continued engagement of the Hillsborough County Environmental Protection Commission (EPC) throughout E&D • Continued engagement of Tampa Port Authority (TPA), which permits marine construction projects in the waters of Hillsborough County through an Interlocal Agreement between EPC and TPA • Engagement of state permitting offices throughout E&D • Early application for appropriate permits as design is finalized
Other Concerns	
Potential for erosion and deposition from NBS constructed of sediment, along with associated impacts on downstream erosion, smothering of SAV, etc.	• Numerical hydrodynamic and sediment transport modeling of potential NBS designs before and during E&D • Evaluation of potential for sediment deposition in areas with existing SAV and comparison to published thresholds • Numerical modeling to evaluate the potential for longshore bars or shallow shelf to become subaerial over time • Review of existing case studies or similar projects, particularly in Tampa Bay
Potential for BUDM at MacDill AFB from the Tampa Harbor Navigation Improvements Study to impact completed regulatory reviews and permitting for that study	• Coordination between MacDill AFB, USACE, USFWS, and NOAA on pathways for BUDM

In addition, facilitated discussion led to the identification of several project implementation strategies that could enhance the short- and long-term benefits of the NBS under consideration. These included:

- Consider combining alternatives to tailor interventions to specific areas (e.g., longshore bars or breakwaters with barrier islands in the east).
- Maintaining as much flexibility as possible in the NBS design and associated permits. BUDM provides opportunities for relatively economic NBS construction and long-term maintenance of built features. However, workshop attendees noted inherent uncertainty in the type and volume of material that may become available, therefore designing and permitting placement options to cover as many scenarios as possible maximizes the potential for use of BUDM.
- Considering coarser grain material (unconsolidated rock, etc.), geotubes, and/or WADs when constructing longshore bars, either alone or in combination with sediment placement (e.g., bracketing an area of sediment). These options would reduce erosion and the potential for sediment flux from the placed material onto adjacent SAV beds. However, there may be associated tradeoffs in loss of sediment flux to adjacent areas, depending on placement location.
- Considering WADS or rip rap in constructing barrier islands to preserve their longevity, noting that this choice will also have potential tradeoffs in sediment flux to downstream locations.
- Considering barrier islands comprised of mangroves or marsh without upland habitat, particularly for the southwest shoreline. These islands may be less likely to attract birds and create BASH

concerns, would provide significant wave attenuation benefits, and could serve as mitigation of essential fish habitat. However, they may create some line-of-sight concerns, so permit applications should potentially include the option for pruning.

- Identifying additional objectives for evaluation and tradeoff analysis as designs are finalized and E&D moves forward. These include cost, constructability, source material characteristics, and mitigation measures required during construction (e.g., turbidity curtains)
- Evaluation of the short- or long-term potential for green/gray solutions to mitigate the effects of surge and extreme storms in combination with the proposed NBS. Participants noted that NBS solutions provide environmental benefits while supporting wave attenuation, but that fully protecting the installation from storm surge and tropical events will require additional measures used in combination with NBS.

NEXT STEPS

MacDill AFB is pursuing funding to support continued E&D and construction of NBS, as well as to host additional workshops engaging stakeholders and representatives from regulatory and resource management agencies. The SDM PrOACT process would continue to be leveraged throughout E&D, with the findings of this qualitative evaluation used to develop and analyze NBS alternatives comprised of combinations of the NBS considered here. The next steps would include:

- Development of an Engagement Plan and Timeline for decision-makers, stakeholders, and community representatives. In addition to entities represented in the completed virtual working session and the in-person workshop, the engagement plan would include broader representation from the community to (1) refine and extend consideration of regional impacts of NBS; and (2) support NBS development at MacDill AFB as a template for using these types of alternatives throughout Tampa Bay.
- Workshops to refine the objectives and metrics of the NBS project (Table 1) based on input from the expanded set of stakeholders, as well as to develop a draft set of NBS alternatives that combines elements of extending the shallow shelf, constructing longshore bars, and building barrier islands. These preliminary, hybrid alternatives would be informed by input received in the August 2024 workshop, and would include addressing identified critical path issues (Table 6).
- Development of a numerical hydrodynamic and sediment transport model for evaluating draft alternatives, along with targeted data collection to support model development and quality assurance. The design of the model and the simulations that will be conducted are based on the outcomes of the August 2024 workshop. Specifically, the model will be used to:
    - Analyze sediment transport patterns with and without alternatives, including evaluating the potential for sediment flux to downstream shorelines (positive outcome) and/or to be deposited on existing SAV beds (negative outcome);
    - Evaluate the wave attenuation potential of alternatives during quiescent and high-energy (storm) conditions;

    - Evaluate the effects of NBS on storm surge.
- Evaluation of objective metrics (Table 1), refined as needed based on additional engagement of workshops, using outputs of the numerical model as well as targeted data analysis and literature review (for example, assessment of the potential for increased BASH based on review of available data and relevant scientific literature). This step will comprise the new consequence analysis phase of PrOACT.
- Identification of tradeoffs between the refined set of hybrid alternatives based on the data- and model-driven consequence analysis, with results presented to participants during engagement workshops for discussion. These workshops will be used to resolve uncertainties and concerns identified during the August 2024 workshop, and to identify the NBS alternative for E&D.

After the NBS alternative has been identified, the project would move to E&D. This phase would include development of a 30% design. The hydrodynamic and sediment transport model would be applied to assess performance under storm and quiescent conditions, with the results used to refine the plan to a 45% design to improve performance when benchmarked against the project objectives (Table 1). From there, the project E&D would be completed and permitted, with any remaining critical path issues resolved through close coordination with regulatory and resource-management agencies. Stakeholders would continue to be updated throughout this process and through construction and monitoring of the implemented NBS project.

CONCLUSION

SDM was used to identify objectives, evaluate alternatives, and consider tradeoffs for the construction of NBS at MacDill AFB. Objectives identified addressed coastal protection and Air Force operations (maximizing wave attenuation, minimizing inland storm surge, minimizing the risk of BASH, preserving perimeter security); environmental considerations (SAV extent and impacts to other habitat); and regional considerations (e.g., preserving sediment within Tampa Bay). Input was elicited from MacDill AFB personnel, regulatory agencies, and other stakeholders to evaluate the potential impacts of three NBS alternatives—expansion of shallow shelf habitat, restoration of longshore bars, and construction of barrier islands—along the southwest, southeast, and eastern shorelines of MacDill AFB. MacDill AFB is pursuing funding to support continued stakeholder engagement, E&D, and construction of NBS following continued application of an objectives-orientated SDM process, and the findings of the qualitative evaluation conducted during the August 2024 workshop will be used to develop and analyze NBS alternatives comprised of combinations of the NBS considered here.

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USACE. (2024). Tampa Harbor Navigation Improvement Study: Draft Integrated General Reevaluation Report and Environmental Impact Statement (p. 191). U.S. Army Corps of Engineers. https://usace.contentdm.oclc.org/utils/getfile/collection/p16021coll7/id/24350

APPENDICES

APPENDIX A. RESOURCES PROVIDED BY WORKSHOP PARTICIPANTS

Table A-1. Reports and data provided by workshop participants as useful resources for future analyses.

Item	Description	Link
Beaufort South Carolina Living Shoreline Project	Describes the living shoreline project located near Marine Corps Air Station in Beaufort, South Carolina	South Carolina Living Shoreline Project
TBEP Comprehensive Conservation and Management Plan	TBEP Guiding Document	Comprehensive Conservation and Management Plan
TBEP Habitat Master Plan	TBEP Guiding Document	Habitat Master Plan
Habitat Report Card, Oyster Suitability Index, and Seagrass Assessment	Various data resources provided by TBEP	TBEP Data Resources
Data from FWC's Fisheries Independent Monitoring Program	Can be used to document economically important fish that use the MacDill closed area and may be impacted by potential projects	Fisheries Independent Monitoring Program
Information about Red Drum in Interbay peninsula	Spatial differences in hook and line catch per unit effort for red drum indicated that legal sized red drum were frequently collected near the Interbay peninsula	Spatial and Size Distribution of Red Drum Caught and Released in Tampa" by Kerry E. Flaherty, Brent L. Winner et al. (usm.edu)
Habitat information about areas near MacDill	Habitat use of common snook within Florida estuaries and results of sampling within the MacDill closed area to determine if it serves as a de facto MPA	Relative Abundance and Distribution of Common Snook along Shoreline Habitats of Florida Estuaries
Tarpon Cove Estuarine Habitat Restoration Project	Information about a Florida FWC project that is restoring seagrass, tidal flat, mangrove, and oyster and artificial reef habitat to benefit fish and wildlife in the Lake Worth Lagoon	https://www.atlanticfishhabitat.org/project/tarpon-cove-estuarine-habitat-restoration-project/
BASH resources	Resources detailing wildlife strikes, hazardous wildlife attractants near airports, and other relevant information about BASH operations.	Wildlife Strikes to Civil Aircraft in the United States from 1990 to 2023 (faa.gov) Advisory Circular 150/5200-33C, Hazardous Wildlife Attractants on or near Airports, 21 February 2020 (faa.gov) FAA: Frequently Asked Questions on Wildlife Strikes Airforce Policy Direct 91-2

APPENDIX B. VIRTUAL WORKING SESSION

The virtual working session with representatives from MacDill AFB and resource management entities was held on Monday, July 24, from 9:30–11am Eastern Daylight Time. The agenda included:

- Brief project introduction [Jessica Henkel, the Water Institute]
- Examples of USACE BUDM and NBS projects [Laurel Reichold, USACE]
- Presentation of the MacDill NBS Concepts [Andy Rider, MacDill AFB]
- Facilitated discussion of resource management agency concerns [facilitator: Soupy Dalyander, The Water Institute]

Facilitated Prompts used during the facilitated discussion included:

- What is your immediate impression of the MacDill AFB conceptual designs?
- What questions or concerns would you have about these designs?
- What are your regulatory "red flags" or "green flags"?
- What calculations or metrics could be provided to inform or streamline permitting, and are there thresholds or "rules of thumb" used in considering potential impacts?
- Are any question prompts difficult to answer, and if so, why?
- Do you have suggestions for the process of alternative development or evaluation that would streamline permitting?

A meeting recording was sent to invitees who were not able to attend the session, and all invited participants (Table B-1) were given three weeks after the session to provide additional feedback on the prompts.

*Table B-1. Participants invited to a virtual working session on Nature-Based Solutions at MacDill Air Force Base (AFB).**

First Name	Last Name	Organization	Meeting Attendance	
			Virtual	In-Person
Andy	Rider	MacDill AFB	Y	Y
Sophie	Whitworth	MacDill AFB	Y	N
Chris	Sutton	6 CES/CEIE Contractor – MacDill AFB	Y	Y
Todd	Barrett	MacDill AFB	Y	N
Oscar	Gomez	MacDill AFB	Y	Y
James	Layton	MacDill AFB	N	Y
Kristin	Combs	MacDill AFB	N	Y
Jerald	Berry	MacDill AFB	N	Y
Carla	Burch	MacDill AFB	N	Y

First Name	Last Name	Organization	Meeting Attendance	
			Virtual	In-Person
Marek	Abrehamsen	MacDill AFB	N	Y
Kira	Soroka	MacDill AFB	N	Y
Sinead	Borchert	U.S. Fish and Wildlife Service – MacDill	Y	Y
Brendan	Myers	U.S. Fish and Wildlife Service	Y	N
Tiffany	Lane	U.S. Fish and Wildlife Service	N	Y
Mark	Sramek	National Oceanic and Atmospheric	Y	Y
Aubree	Hershorin	U.S. Army Corps of Engineers	Y	Y
Laurel	Reichold	U.S. Army Corps of Engineers	Y	N
Stephen	Conger	U.S. Army Corps of Engineers	N	Y
Mike	Neves	U.S. Army Corps of Engineers	N	Y
Manny	Vianzon	U.S. Army Corps of Engineers	N	Y
Ryan	McNaughton	U.S. Coast Guard	Y	Y
Vanlier	Zachary	U.S. Coast Guard	Y	Y
Micheal	Heldreth	U.S. Department of Agriculture	Y	Y
Anna	Laws	Florida Fish and Wildlife Conservation Commission	Y	N
Chris	Anastasiou	Southwest Florida Water Management	Y	Y
Chris	Pratt	Environmental Protection Commission of Hillsborough County	Y	Y
Whit	Remer	City of Tampa	Y	Y
Jackie	Julien	Port Tampa Bay	N	Y
Kerry	Flaherty Walia	Tampa Bay Estuary Program	N	Y
Meghan	Blancher	Tampa Bay Regional Planning Council	N	Y

*In addition, Karla Reece with the National Oceanic and Atmospheric Administration, who was unable to attend either meeting, provided input regarding Section 7 mapping outside of the meetings.

Included below are slides that were presented to participants as part of familiarizing them with the MacDill AFB NBS effort, similar projects completed elsewhere, and the specific concepts under consideration at MacDill AFB.

U.S. AIR FORCE

THE WATER INSTITUTE

U.S. FISH & WILDLIFE SERVICE

BENEFICIAL USE OF DREDGED MATERIALS AT MACDILL AIR FORCE BASE

Regulatory Context Discussion

June 24, 2024

1

AGENDA

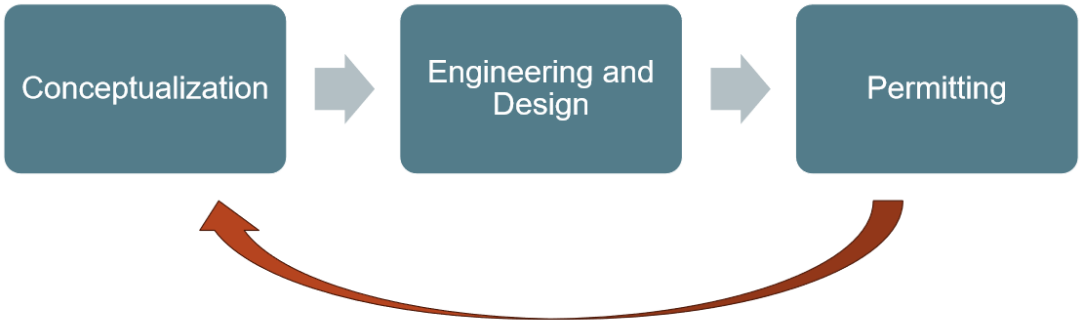
Time	Activity
9:30 – 9:45	Intro to the team, brief overview of Structured Decision Making process
9:45 – 10:00	Examples of BUDM projects
10:00 – 10:15	Presentation about MacDill-specific efforts
10:15 – 10:55	Facilitated discussion about the regulatory context
10:55 – 11:00	Next Steps

STRUCTURED DECISION MAKING (SDM)

INTRODUCTION

- MacDill Air Force Base interested in constructing **nearshore Nature-Based Solutions**
- Opportunity: **Beneficial use of dredged material** (BUDM) from planned deepening of the Tampa Harbor Nav Channel
- Will produce 21.3 MCY of silt, sand, and limestone, with 9.4 MCY slated for disposal areas (not BUDM)

INTRODUCTION



Challenge: issues identified during permitting could result in going "back to the drawing board"

Structured decision making (SDM):

"A formalization of common sense for decision problems which are too complex for informal use of common sense." (Keeney 1982)

ABOUT SDM

A set of tools to aid decision makers

Draws from the fields of:

- Decision Analysis
- Operations Research
  Economics
- Human Dimensions
- Management Science
- Behavioral Psychology

7

KEY BENEFIT

Structuring conversations about complex decisions

Methods:

- Problem decomposition
- Values- and objectives-focused thinking
- Systematic and transparent consideration of decision outcomes

8

WHY SDM

Even the best decision makers encounter pitfalls

- Assume consensus on problems or scope
- Perceive constraints
- Avoid necessary conflict
- Fall into psychological traps (sunk costs, favorite alternatives, preconceived notions, biases, etc.)

9

WHY SDM

Proven applications

- Financial investing
- Project management
- Species and natural resource management (USFWS, USGS)
- Policy and planning (LA Climate Action Plan)
- Life decisions (buying a car, taking a new job, etc.)

10

WHY SDM

It provides a framework

For best possible decision using available information, timing and cost considerations

SDM

Data, Models, Research Process Understanding

11

PROACT FRAMEWORK

1. Define the **Problem** (Decision Context)
2. Determine the **Objectives**
3. Identify **Alternatives** (Solutions)
4. Evaluate alternatives and forecast the **Consequences**
5. Evaluate the **Trade-offs**
6. Make the **decision and take action**
7. Apply **Adaptive Management** as needed

from Runge MC, Grand JB, Mitchell MS. 2013. Structured decision making. Chapter 5 *in* Krausman PR, Cain JW III, eds. Wildlife Management: Contemporary Principles and Practices. Johns Hopkins University Press, Baltimore, Maryland.

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WORKFLOW

Today's call
Regulatory Context (Mandates, Laws, etc.)

In Person Workshop
- Refine objectives, metrics for success that are initially drafted with MacDill AFB
- Develop potential alternatives from NBS concepts for MacDill AFB
- Qualitative consequence analysis and tradeoff evaluation of NBS alternatives

Looking Forward
- Applying for external support for:
  - Quantitative consequence and tradeoff analysis
  - Development of scalable, phased NBS roadmap
  - 30% and 45% design
- Pursue support for design finalization, permitting, and construction

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CONTEXT FOR FEEDBACK REQUESTED TODAY

- This call is for information gathering
- We are not asking for evaluation of specific conceptual designs
- Asking for generic input and feedback that is relevant to the type of work being proposed for MacDill AFB
- Support for MacDill AFB to be able to develop realistic objectives

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EXAMPLES OF USACE BUDM PROJECTS

15

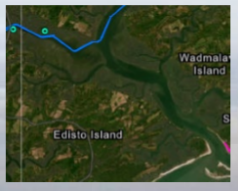
BENEFICIAL USE OF DREDGE MATERIAL

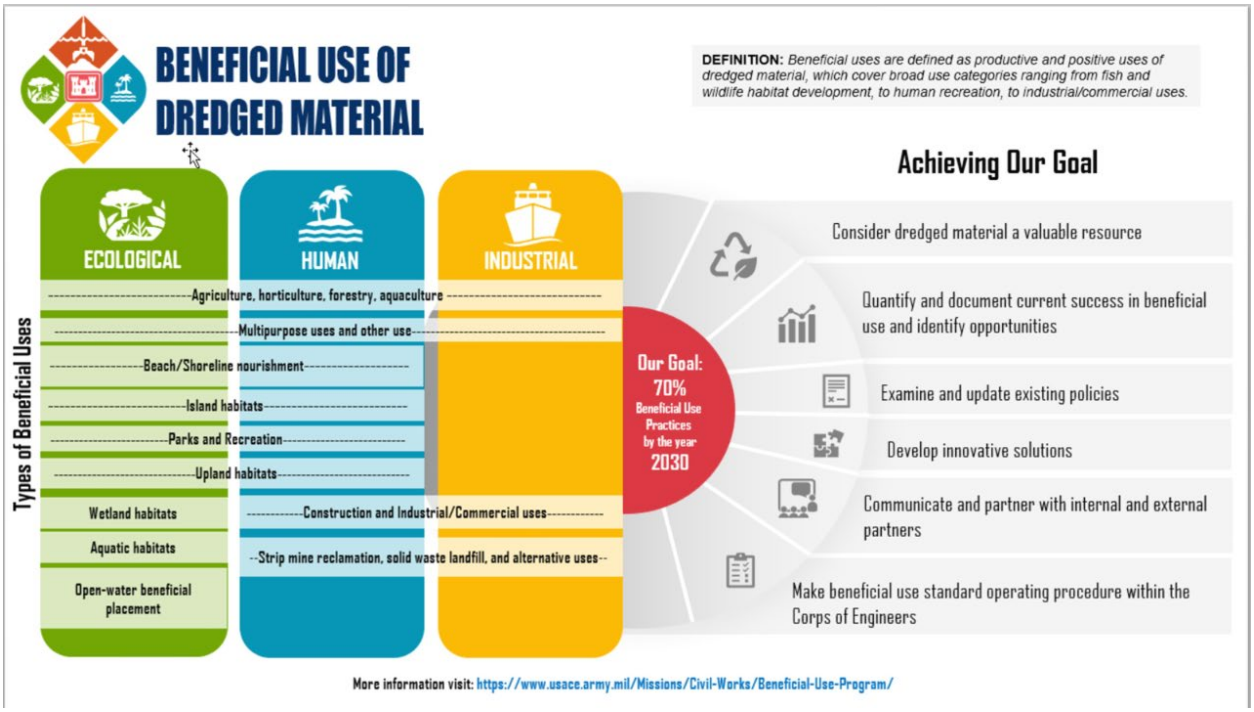
Disposal is defined as the placement of material in an area where the material is anticipated to remain in place and have no measurable benefit.

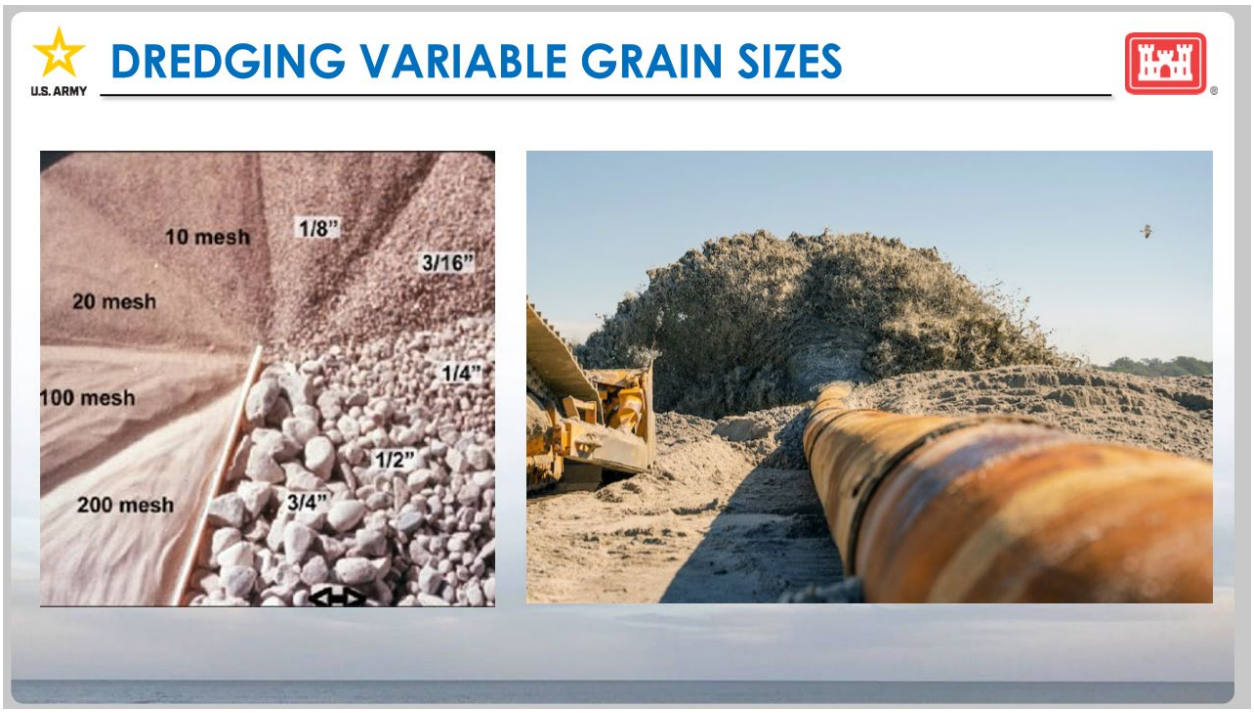
Beneficial use is defined as the productive and positive use of dredged material, which cover broad use categories ranging from fish and wildlife habitat development to human recreation to industrial/commercial uses. Beneficial use placement is intentional and directly creates habitat or benefits.

Transitional placement is keeping sediment in the riverine or coastal system as a part of a management process or in a period of transition.

JEKYLL CREEK THIN LAYER PLACEMENT ON SALT MARSH




BENEFICIAL USE OF DREDGED MATERIAL
DEFINITION: Beneficial uses are defined as productive and positive uses of dredged material, which cover broad use categories ranging from fish and wildlife habitat development, to human recreation, to industrial/commercial uses.
ECOLOGICAL
HUMAN
INDUSTRIAL
Types of Beneficial Uses
Agriculture, horticulture, forestry, aquaculture
Multipurpose uses and other use
Beach/Shoreline nourishment
Island habitats
Parks and Recreation
Upland habitats
Wetland habitats
Aquatic habitats
Open-water beneficial placement
Construction and Industrial/Commercial uses
Strip mine reclamation, solid waste landfill, and alternative uses
Our Goal: 70% Beneficial Use Practices by the year 2030
Achieving Our Goal
Consider dredged material a valuable resource
Quantify and document current success in beneficial use and identify opportunities
Examine and update existing policies
Develop innovative solutions
Communicate and partner with internal and external partners
Make beneficial use standard operating procedure within the Corps of Engineers
More information visit: https://www.usace.army.mil/Missions/Civil-Works/Beneficial-Use-Program/


U.S. ARMY
DREDGING VARIABLE GRAIN SIZES
10 mesh
1/8"
3/16"
20 mesh
1/4"
100 mesh
1/2"
200 mesh
3/4"

ISLAND RESTORATION, CHARLESTON, SC

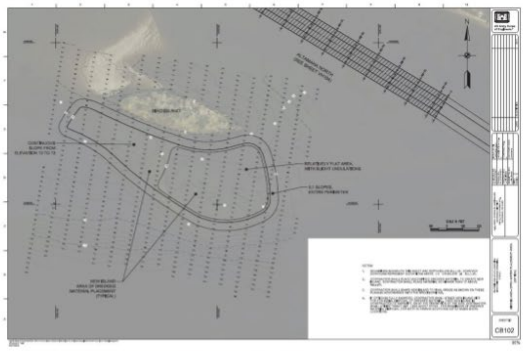
U.S. ARMY

https://youtu.be/huiN4hFOn24

6/21/2024

ISLAND RESTORATION, ALTAMAHA, GA

U.S. ARMY

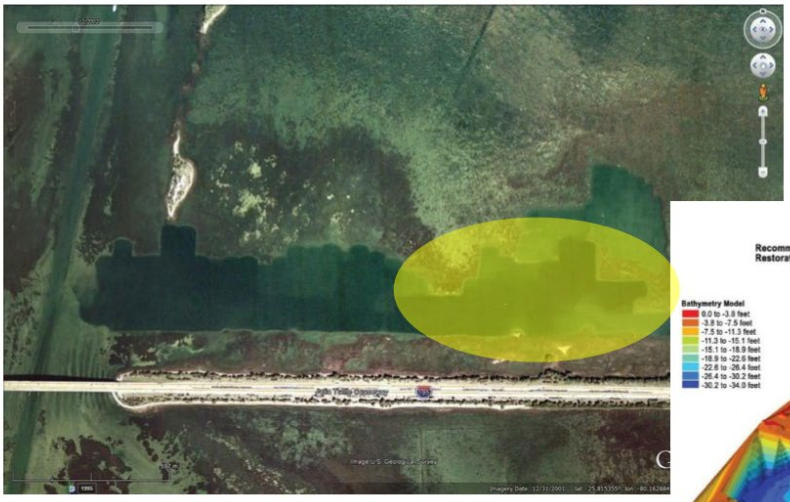


ISLAND RESTORATION – CUMBERLAND, GA

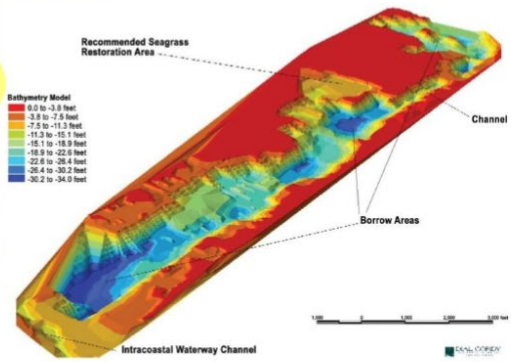
Approximately 316,000 cubic yards (cy) of sediment (78 to 100% sand) to restore island adjacent to AIWW in Cumberland, GA providing nesting and roosting habitats for shorebirds (such as American Oystercatchers and Wilson's Plovers) and seabirds (including Least Terns, Gull-billed Terns, and Black Skimmers).

top of berm was designed to be ~+10ft MLLW with a 1 on 15 slope

JULIA TUTTLE SEAGRASS – BISCAYNE BAY

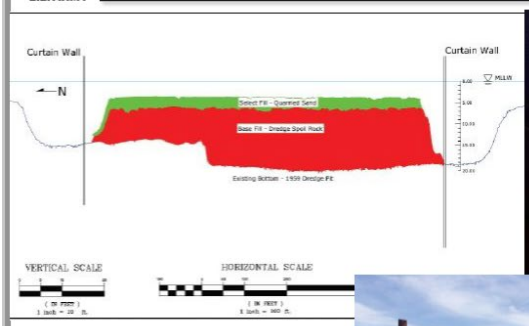


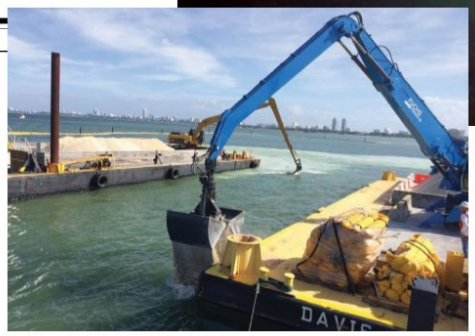
560,000 cubic yards (CY)



6/21/2024

JULIA TUTTLE SEAGRASS – BISCAYNE BAY





6/21/2024

JULIA TUTTLE SEAGRASS – BISCAYNE BAY

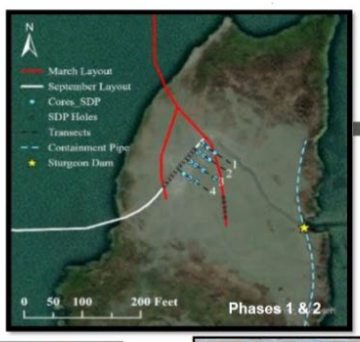
6/21/2024

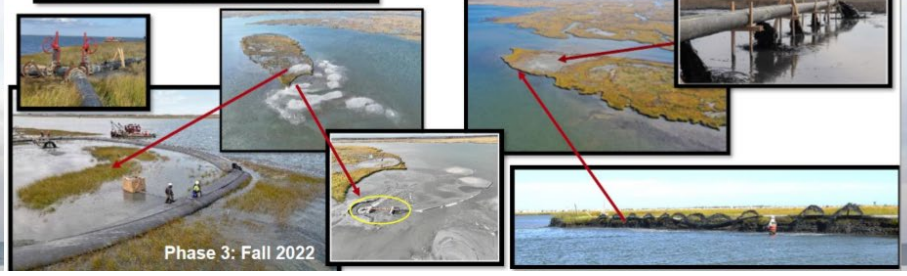
JEKYLL ISLAND TLP, GA

Jekyll Island Thin Layer Placement (TLP)

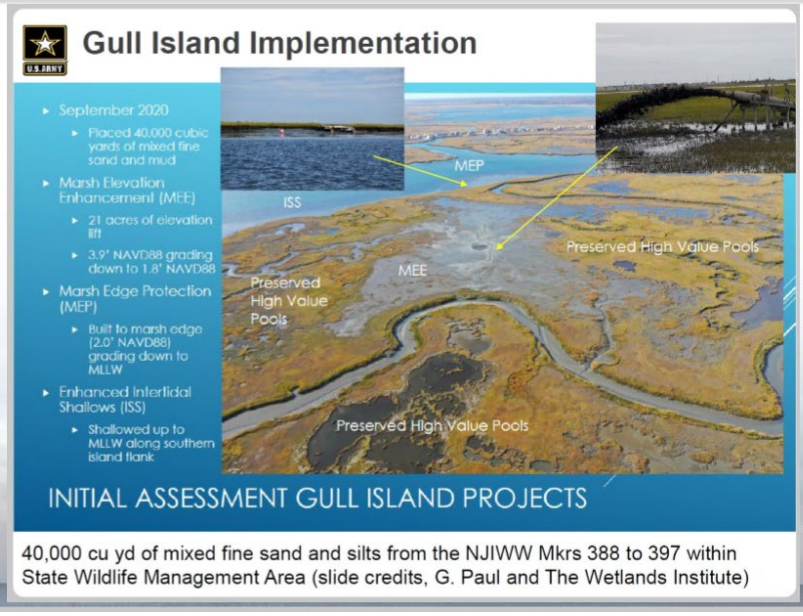
- Proactive approach to support coastal resilience by increasing marsh surface elevations in small lifts.
- Navigation O&M RSM/Beneficial Use placement strategy, not USACE ecosystem restoration project
- 1st TLP project in Georgia

STURGEON ISLAND, NJ



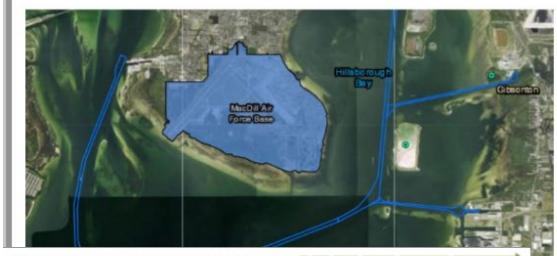


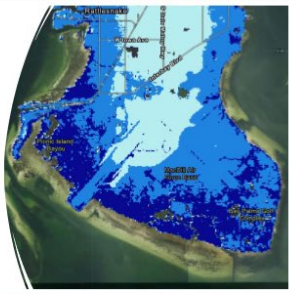
GULL ISLAND, NJ

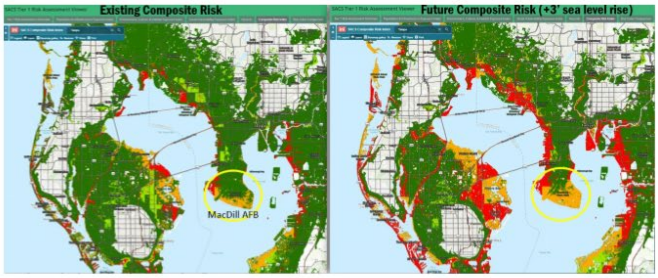


40,000 cu yd of mixed fine sand and silts from the NJIWW Mkrs 388 to 397 within State Wildlife Management Area (slide credits, G. Paul and The Wetlands Institute)

LARGER SCALE RESILIENCY APPLICATIONS







6/21/2024

EFFORTS AT MACDILL AIR FORCE BASE

MacDill AFB
Beneficial Uses of Dredged Material
Conceptual Projects

6 CES/CEIE
24 Jun 2024

CHARGE THE STORM…LET'S GO!

UNCLASS

Grants

- National Fish and Wildlife Foundation (NFWF) National Coastal Resilience Fund (NCRF)
  - Partnering with The Water Institute, a non-profit
  - The Water Institute invited to submit full NCRF proposal – Due 2 July
- Readiness and Environmental Protection Integration Program (REPI)
  - MacDill AFB is preparing grant proposal – Due 30 Sep

UNCLASS

CHARGE THE STORM…LET'S GO!

UNCLASS

Installation resilience is our focus ….using nature-based solutions

To the south:
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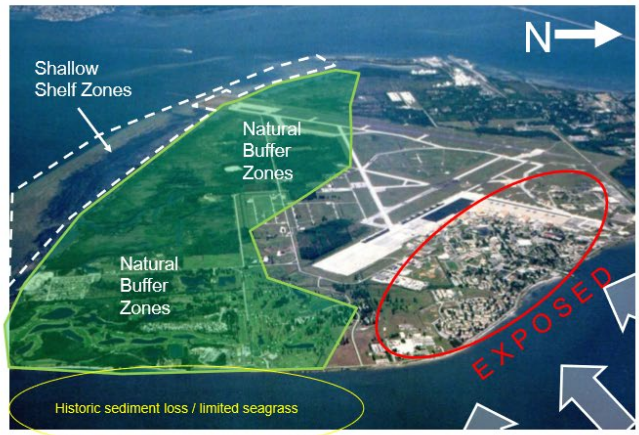

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Resiliency Project Goals

- Fund landscape-scale nature-based resilience work enhancing coastal ecosystems to increase installation resilience
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- Mangrove and maritime forest on islands can reduce wind fetch

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EFFORTS AT MACDILL AIR FORCE BASE

29

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MacDill AFB
Beneficial Uses of Dredged Material
Conceptual Projects

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- Coastal Inundation is MacDill's biggest risk to mission and assets
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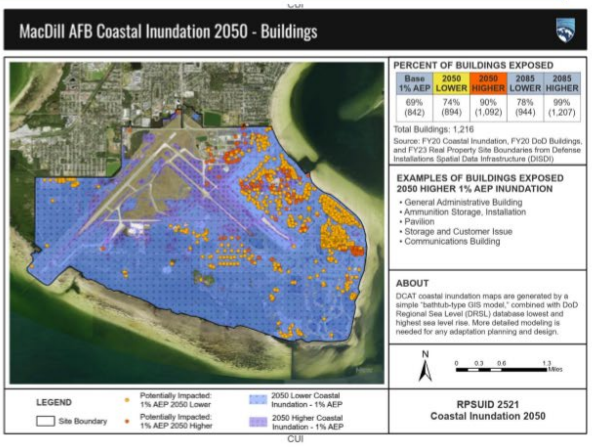

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3

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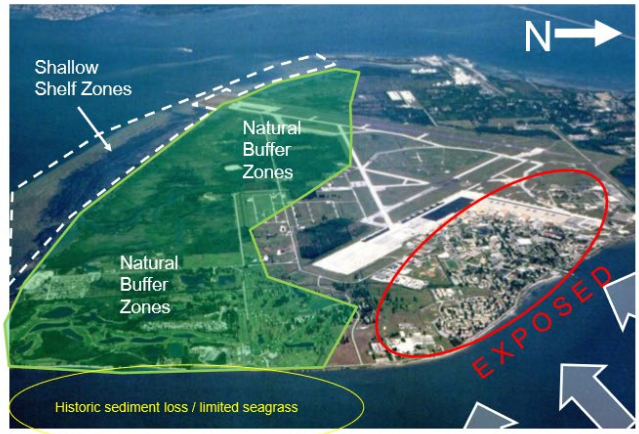

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APPENDIX C. IN-PERSON WORKSHOP

The in-person workshop with MacDill AFB and stakeholders was held on Thursday, August 1, from 8:00am–3:30pm Eastern Daylight Time. The agenda included:

Time	Activity
8:30-8:45	Welcome, Introductions
8:45-9:15	Overview of MacDill AFB, NBS Concepts and Sediment Sources
9:15-10:15	NBS Objectives and Success Metrics
10:15-10:30	Break
10:30-11:30	Alternatives Refinement and Evaluation: Restore eroded shallow shelf habitat
11:30-12:45	Lunch
12:45-1:25	Alternatives Refinement and Evaluation: Construct a longshore bar system
1:25-2:05	Alternatives Refinement and Evaluation: Creation of barrier island(s)
2:05-2:15	Break
2:15-2:30	Initial Ranking of NBS Alternative Types
2:30-3:15	Qualitative Evaluation Results and Implementation Strategies
3:15-3:30	Wrap up and Next Steps

Participants (Table C-1) were given three weeks after the session to provide additional feedback on the after the workshop.

Table C-1. Participants at the in-person workshop on Nature-Based Solutions at MacDill Air Force Base (AFB).

	First Name	Last Name	Affiliation
1	Kristin	Combs	AFB
2	Jerald	Berry	AFB
3	Carla	Burch	AFB
4	Marek	Abreham	AFB
5	Kira	Soroka	AFB
6	Tiffany	Lane	USFWS
7	Chris	Anastasiou	SWFWMD
8	Mike	Neves	USACE
9	Manny	Vianzon	USACE
10	Aubree	Hershorin	USACE
11	Stephen	Conger	USACE
13	Link	Collier	AFB
14	Oscar	Gomez	AFB
16	James	Rodriguez	AFB
17	Micheal	Heldreth	USDA
18	Jackie	Julien	Port Tampa Bay
19	Kerry	Flaherty Walia	Tampa Bay Estuary Program
20	Meghan	Blancher	Tampa Bay RPC
21	Whit	Remer	City of Tampa
22	Chris	Pratt	Hillsborough County EPC
23	Kimberly	Tapley	EPC Wetlands Division
24	Mark	Sramek	NOAA
25	Sinead	Borchert	USFWS
26	Andrew	Rider	AFB
27	Christopher	Sutton	AFB

Included below are slides that were presented to participants as part of workshop facilitation

U.S. AIR FORCE

THE WATER INSTITUTE

BENEFICIAL USE OF DREDGED MATERIALS AT MACDILL AIR FORCE BASE

Working Session

August 1, 2024

1

WELCOME & INTRODUCTIONS

2

REMINDER: WORKFLOW

June 24, 2024
Regulatory Context (Mandates, Laws, etc.)

In Person Workshop

- Refine objectives, metrics for success that are initially drafted with MacDill AFB
- Discuss concerns, critical path issues NBS
- Qualitative consequence analysis and tradeoff evaluation of NBS alternatives

Looking Forward

- Applying for external support for:
  - Quantitative consequence and tradeoff analysis
  - Development of scalable, phased NBS roadmap
  - 30% and 45% design
- Pursue support for design finalization, permitting, and construction

3

OVERVIEW OF MACDILL AFB, PROPOSED NBS CONCEPTS, AND SEDIMENT SOURCES

4

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MacDill AFB
Beneficial Uses of Dredged Material
Conceptual Projects

Andy Rider & Chris Sutton
6 CES/CEIE
1 Aug 2024

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MacDill AFB Missions

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MacDill AFB Flood Maps

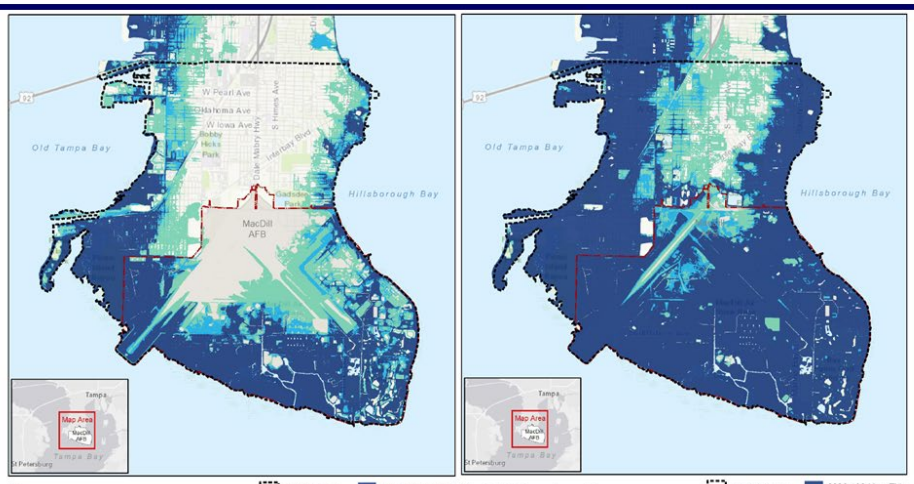

Figure 4.9 10-Year Storm Tide NOAA Intermediate High Flood Map

Figure 4.10 100-Year Storm Tide NOAA Intermediate High Flood Map

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MacDill AFB Flooding after Hurricane Idalia, Aug 2023

Flooding and flood damage caused by Hurricane Idalia, August 2023

Source: MacDill AFB

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9

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MacDill AFB Climate Risks

- Coastal Inundation is MacDill's biggest risk to mission and assets
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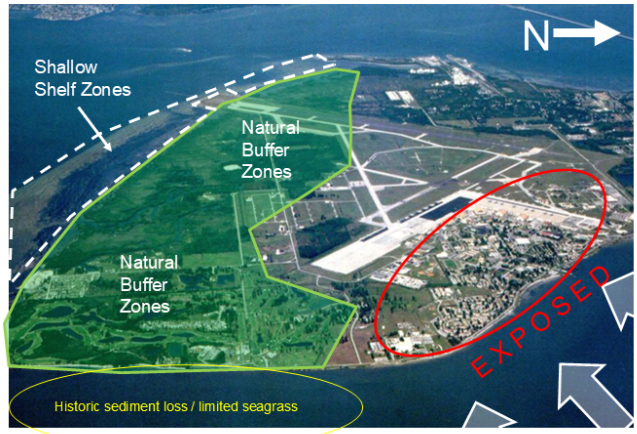

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Resiliency Project Goals

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MacDill Conceptual Projects

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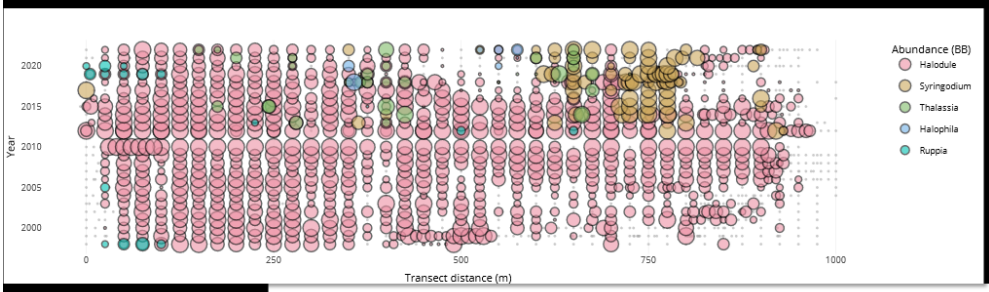
.


Natural Resources on MacDill AFB
Selected mapped resources and existing data
Sinéad Borchert
1 August 2024

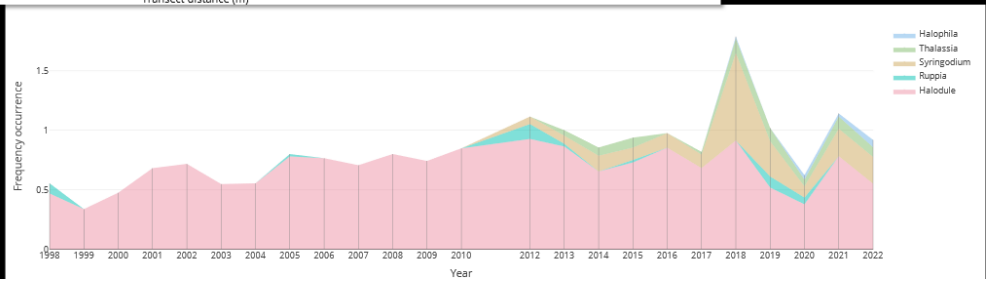

MAFB Boundary
Coastal Restricted Area
USACE Exclusion Markers
N
0
0.5
1
2
Miles

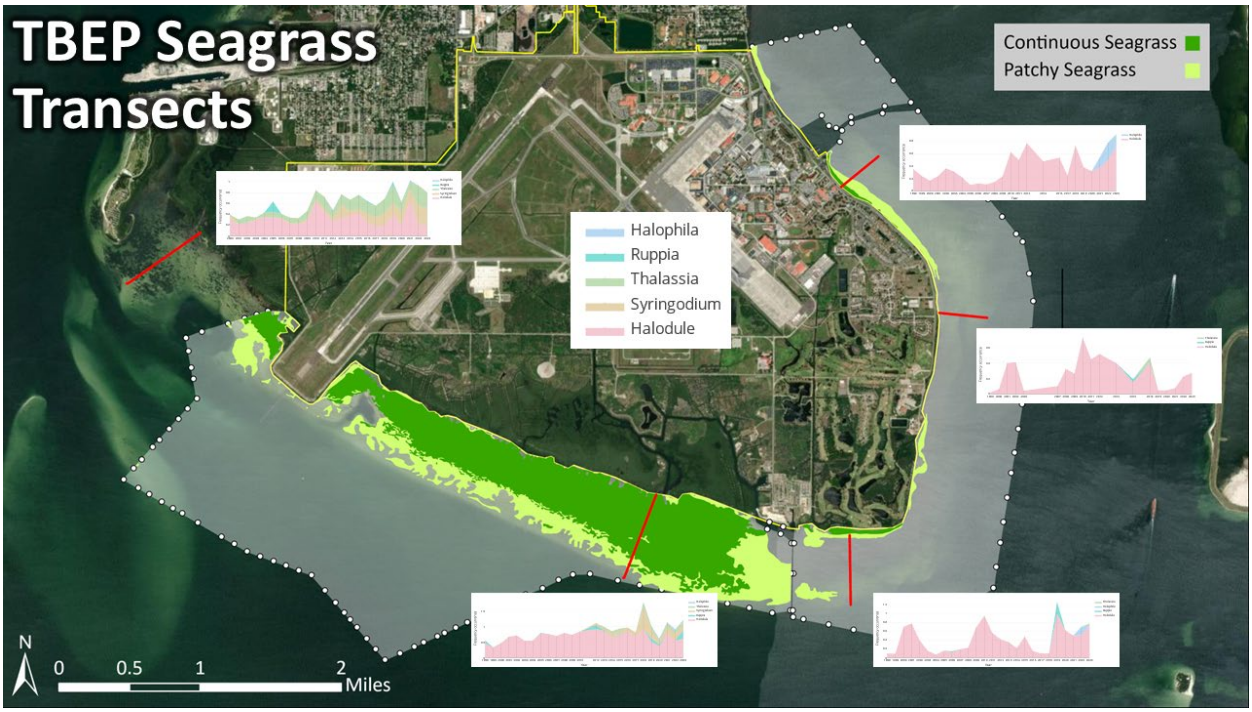
TBEP Transect Data

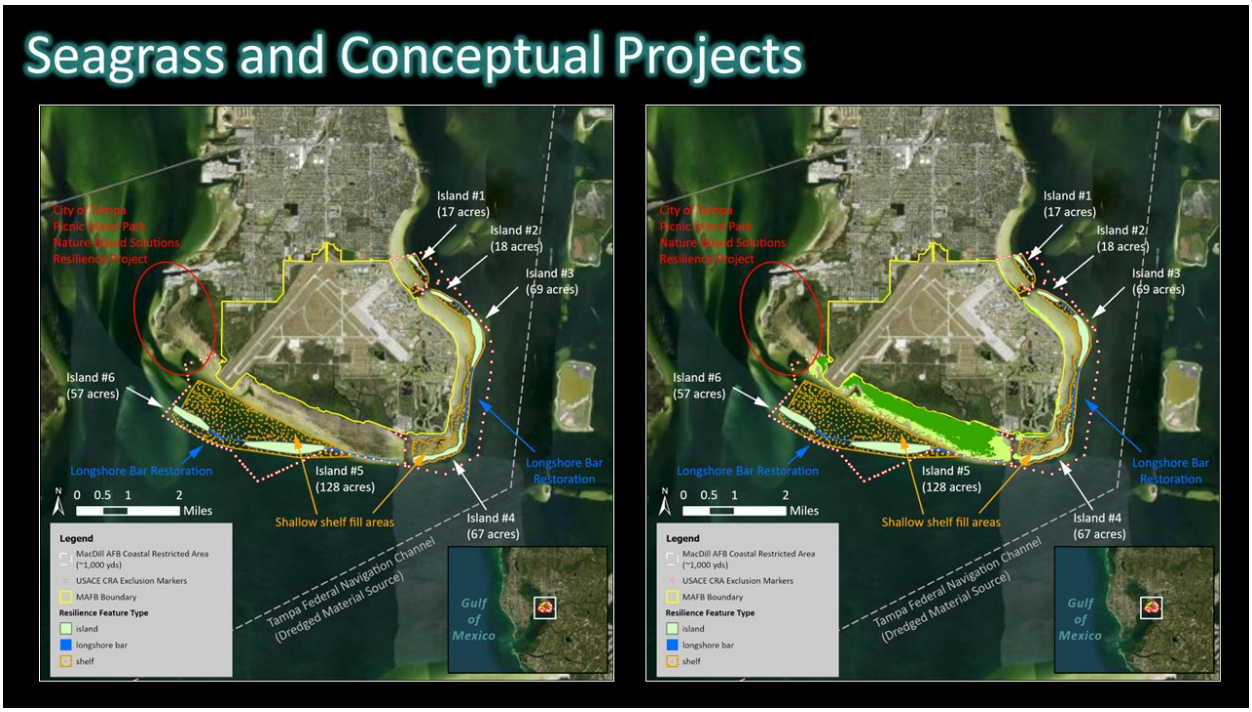


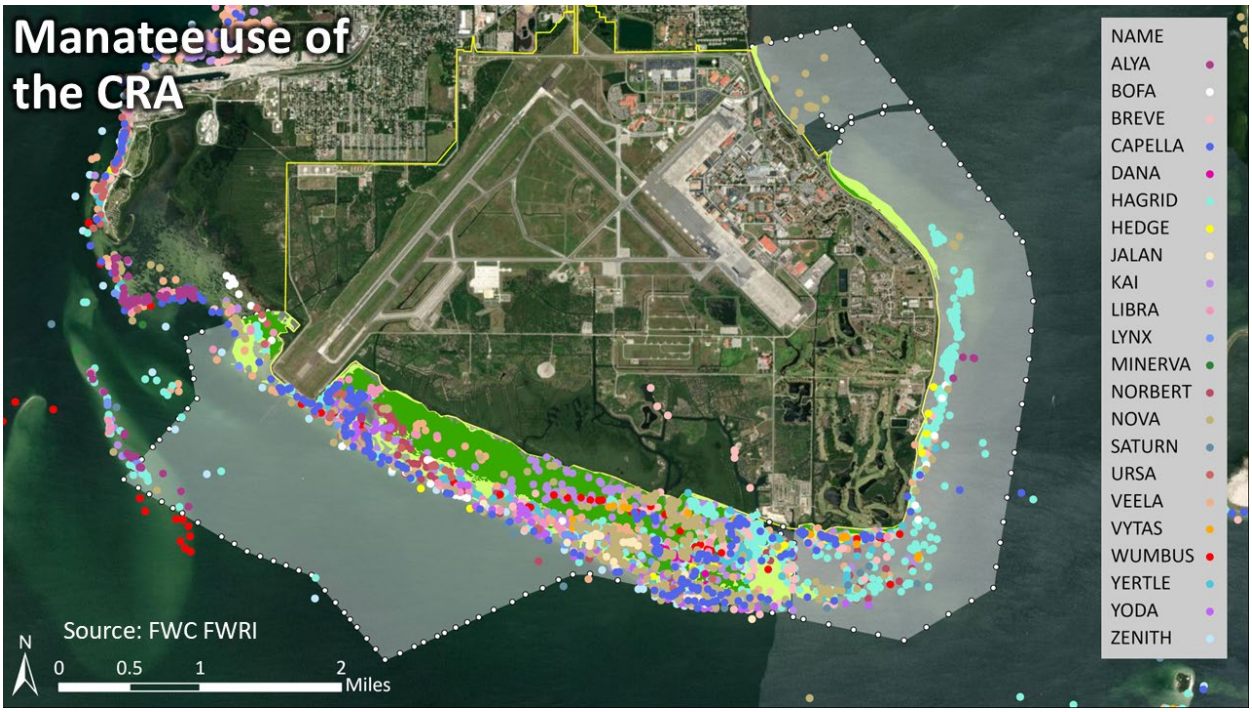
Source: Tampa Bay Seagrass Transect Dashboard

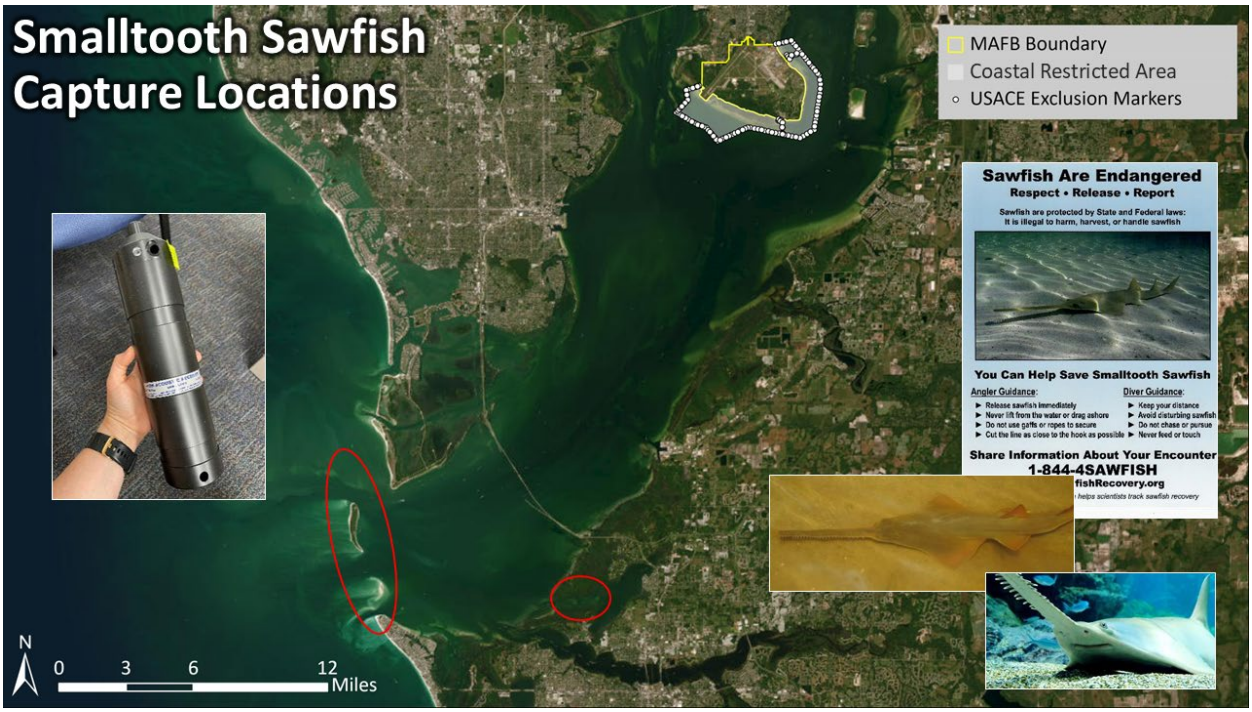
shiny.tbep.org

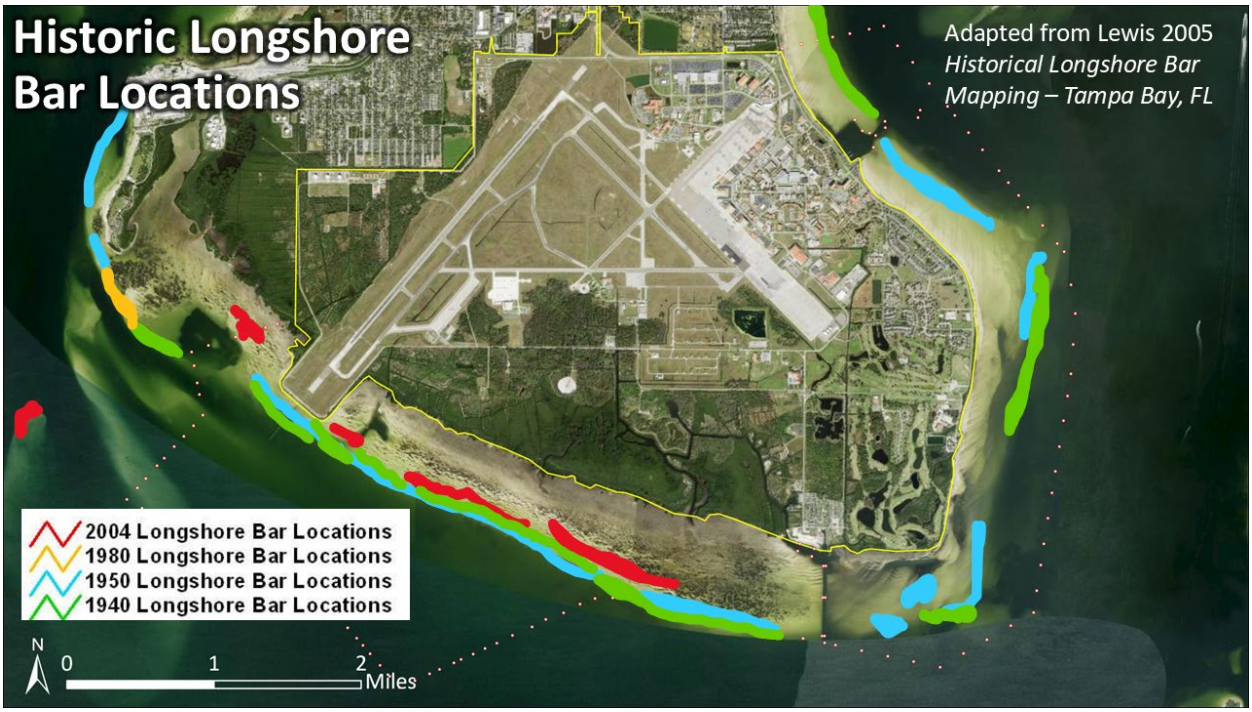



TBEP Seagrass Transects
Continuous Seagrass
Patchy Seagrass
Halophila
Ruppia
Thalassia
Syringodium
Halodule
N
0
0.5
1
2
Miles


Seagrass and Conceptual Projects
City of Tampa Picnic Island Park Nature-Based Solutions Resilience Project
Island #1 (17 acres)
Island #2 (18 acres)
Island #3 (69 acres)
Island #4 (67 acres)
Island #5 (128 acres)
Island #6 (57 acres)
Longshore Bar Restoration
Shallow shelf fill areas
Tampa Federal Navigation Channel (Dredged Material Source)
Gulf of Mexico
Legend
MacDill AFB Coastal Restricted Area (~1,000 yds)
USACE CRA Exclusion Markers
MAFB Boundary
Resilience Feature Type
island
longshore bar
shelf
N
0 0.5 1 2
Miles


Manatee use of the CRA
NAME
ALYA
BOFA
BREVE
CAPELLA
DANA
HAGRID
HEDGE
JALAN
KAI
LIBRA
LYNX
MINERVA
NORBERT
NOVA
SATURN
URSA
VEELA
VYTAS
WUMBUS
YERTLE
YODA
ZENITH
Source: FWC FWRI
N
0 0.5 1 2
Miles


Smalltooth Sawfish Capture Locations
MAFB Boundary
Coastal Restricted Area
USACE Exclusion Markers
Sawfish Are Endangered
Respect • Release • Report
Sawfish are protected by State and Federal laws:
It is illegal to harm, harvest, or handle sawfish
You Can Help Save Smalltooth Sawfish
Angler Guidance:
Release sawfish immediately
Never lift from the water or drag ashore
Do not use gaffs or ropes to secure
Cut the line as close to the hook as possible
Diver Guidance:
Keep your distance
Avoid disturbing sawfish
Do not chase or pursue
Never feed or touch
Share Information About Your Encounter
1-844-4SAWFISH
fishRecovery.org
N
0 3 6 12
Miles

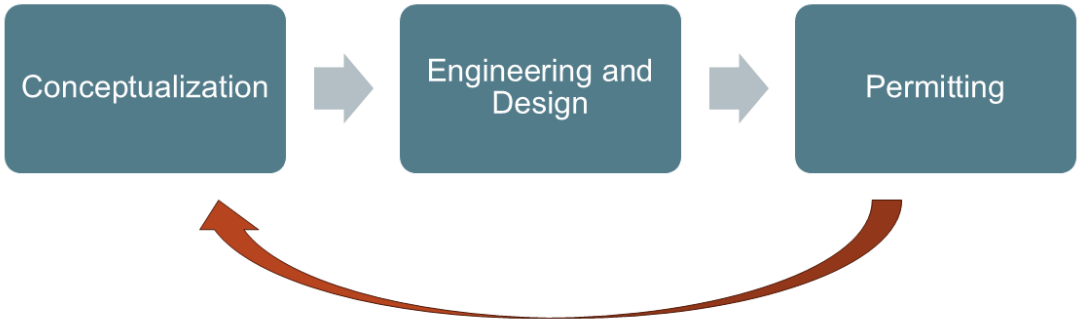

Historic Longshore Bar Locations
Adapted from Lewis 2005
Historical Longshore Bar Mapping – Tampa Bay, FL
2004 Longshore Bar Locations
1980 Longshore Bar Locations
1950 Longshore Bar Locations
1940 Longshore Bar Locations
N
0
1
2
Miles


Dredged Hole Recommendations
Raulerson et al. 2019
Greening 2005
Dredged Hole
Maximum Depth (feet)
Maximum Fill Volume (cubic yards)
Feasibility for Material Delivery (low, medium, high)
Overall USACE Ranking (low, medium, high)
MacDill Docks
-11.7
127,196
high
medium-high
N
0
1
2
Miles

NBS CONCEPTS

- MacDill Air Force Base interested in constructing **nearshore Nature-Based Solutions**
- Discussion today focused on **three alternatives**:
  - Restore eroded shallow shelf habitat
  - Construct longshore bars
  - Build barrier islands

WHY HERE, WHY NOW?



Goal: engage regulatory agencies, stakeholders, and partners early and throughout the process to avoid late-stage issues

SYNTHESIS OF PREVIOUS INPUT RECEIVED

- Concerns about **how BUDM from the Tampa Bay Navigation Channel deepening** would impact the associated EIS
- **Importance of site-specific data and model evaluation** and, where needed, new data collection
- Consideration and avoidance of **negative impacts to existing seagrass beds (southern end), hard bottom, other habitats**
- Potential for increased issues with **bird strikes**
- **Need to evaluate** sites, specific designs (particularly barrier islands), erosion potential, construction techniques, and potential for increased issues with environmental regulation enforcement

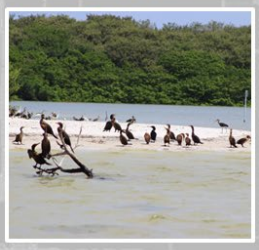
Note, additional location and NBS-specific feedback was received and catalogued

CONTEXT FOR DISCUSSION TODAY

- Information gathering only: we are **not asking for evaluation of specific designs**
- Focus today is on three identified **NBS alternatives** and concerns, objectives on the **sediment placement side**
- Previous call focused on BUDM from Tampa Harbor deepening, but this is **not the only potential source of material for NBS at MacDill AFB**

SEDIMENT SOURCE OPPORTUNITIES FROM THE TAMPA HARBOR NAVIGATION PROJECT

Presented by:
Manny Vianzon
Project Manager
U.S. Army Corps of Engineers, Jacksonville District

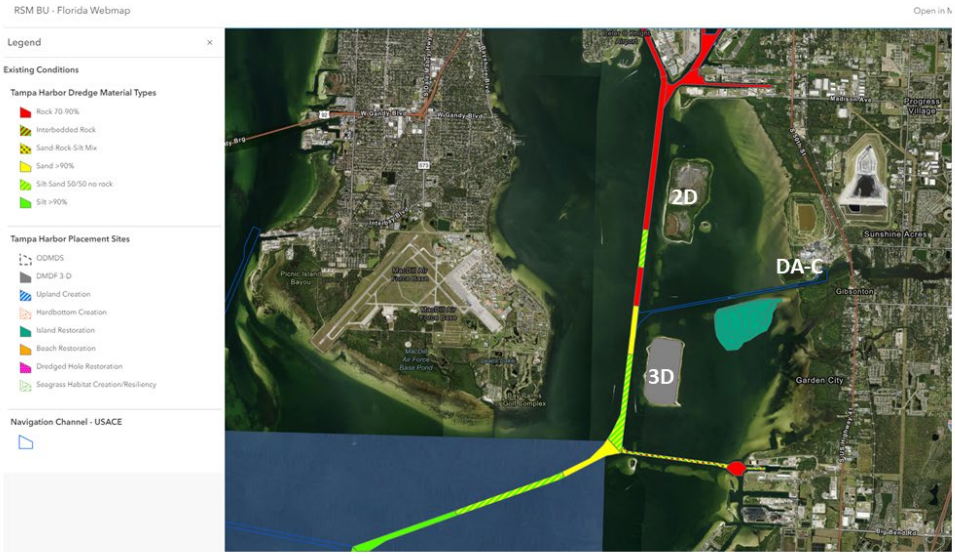


U.S. ARMY US Army Corps of Engineers

PORT TAMPA BAY

Potential Harbor Maintenance (~500kcy/yr different locations)

Potential Offloading of DMMAs (Millions of CY available)

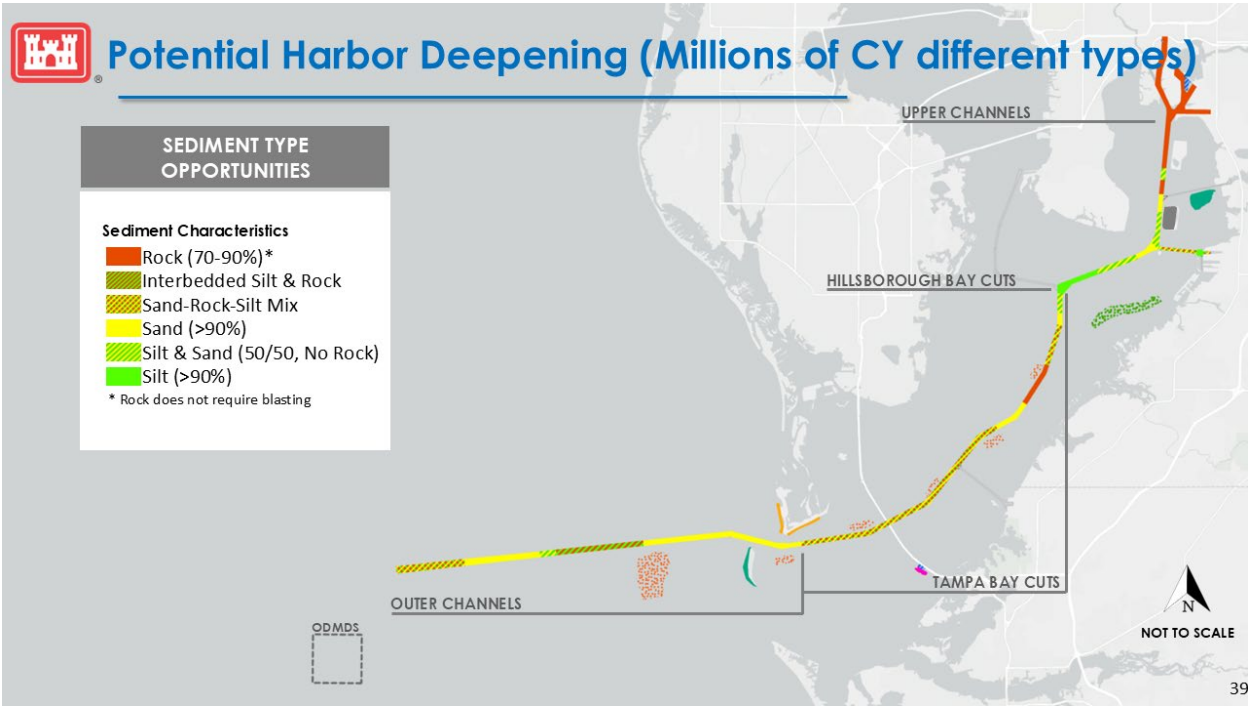


2D is used for berthing areas (non-federal material).

DA-C previously used DMMA.

3D is used for federal channels.

Potential Harbor Deepening (Millions of CY different types)



CONTACTS AND LINKS OF INTEREST

Manny Vianzon
Project Manager, USACE
emmanuel.a.vianzon@usace.army.mil
C: 904-203-6083

Aubree Hershorin, Ph.D.
Planning Technical Lead, USACE
Aubree.G.Hershorin@usace.army.mil
O: 904- 232-2136

ARCGIS WEBVIEWER:
Visit the ArcGIS WebViewer link for interactive project viewing: https://usace-saw.maps.arcgis.com/apps/mapviewer/index.html?webmap=61e9701d559641c295ffcbe5ccfeaeea

PROJECT WEBSITE:
USACE project website: https://www.saj.usace.army.mil/Tampa-Harbor/

OBJECTIVES AND SUCCESS METRICS

DRAFT OBJECTIVES FOR INPUT

Categories

Habitat	Coastal Protection and Air Force Operations	Regional Benefits and Impacts
• Maximize extent of SAV • Maximize benefits to other habitats and species of concern	• Maximize storm surge and wave attenuation • Minimize probability of bird/wildlife aircraft strike hazard (BASH)	• Minimize downstream erosion

POTENTIAL METRICS FOR EVALUATION

Categories

Habitat	Coastal Protection and Air Force Operations	Regional Benefits and Impacts
• Acreage of existing, potential new SAV • Acreage of net habitat gain / lost of different types	• Percent reduction in storm surge, waves for varying storm conditions • Probability of bird/aircraft interaction	• Net sediment flux to neighboring shorelines

ACTIVITY INSTRUCTIONS

- Everyone will have time to provide input on each objective category (1. Habitat, 2. Coastal Protection and Air Force operations, 3. Regional Benefits and Impacts)
- For the first round, please join the station for the objective category that you are **most familiar with**.
- The facilitator will guide you through providing input on that objective category.
- When the timer goes off, please rotate clockwise to the next objective category station.

OBJECTIVE PROMPTS

- Do you have suggestions for refining the wording of the objectives?
- Are there other objectives you'd suggest be considered in designing NBS for MacDill AFB?
- Are there objectives or metrics used by your agency or group?
  - For example, for regulatory evaluation or to pass/fail alternatives?
  - Are there specific thresholds (e.g., 'no net loss of XXX habitat')?

ALTERNATIVES REFINEMENT AND EVALUATION

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ACTIVITY INSTRUCTIONS

- We have divided the MacDill AFB nearshore into **three regions**: southwest, southeast, and east.
  - These regions are delineated on the large map as well as on maps on the back of the score sheets you will receive.
- You will be asked to evaluate the **likely impact of each NBS alternative** on each objective, were it to be built in each of these three spatial regions.
- This qualitative evaluation is being used to **identify high value opportunities as well of areas of concern**.
- Data collection, numerical modeling, costing, and quantitative evaluation **will be conducted in future E&D phases**. Combinations of these NBS will also be considered at that time.

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ACTIVITY INSTRUCTIONS, CONTINUED

- We will be providing **one score sheet per agency**. Please work with other attendees from your agency in filling it out (move to a table to sit together as needed).
- Please provide your responses on the following scale:

++	Very Positive
+	Somewhat Positive
o	Neutral
-	Somewhat Negative
--	Very Negative

- If you do not feel like you have the expertise to provide a response for a specific objective, **please leave it blank.**

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ACTIVITY INSTRUCTIONS, CONTINUED

- Please **provide notes on the reason behind your rankings** and any other concerns you have in the space provided.
- You may also provide additional feedback by **drawing and annotating the map** provided on the back of the score sheet.
- This additional feedback is **extremely important**!
  - Rankings give us a way to quickly gauge perspectives on relative benefits of alternative outcomes
  - Comments and map annotations allow us to understand your specific concerns and where you see NBS providing the highest value

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Alternative: Constructing Marsh Habitat (**note, this is not one of the alternatives being evaluated today**)

Objective Category	Habitat		Coastal Protection and Air Force Operations		Regional Benefits and Impacts
Sub-category	Maximize SAV habitat (++ denotes increase in SAV habitat)	Maximize other wildlife benefits (please indicate which habitats will result in benefits or harm)	Maximize Storm Surge and Wave Attenuation (++ denotes better protection)	Minimize Bird Strike Risk (++ denotes less risk)	Maximize sediment flux to neighboring shorelines (++ denotes increase sediment downstream)
Southwest		Habitat(s): + + Marsh	+	− −	+
Southeast		Habitat(s): + + Marsh	+	0	0
East		Habitat(s): + + Marsh − Beach	+	0	+

Rationale for input provided:

I don't know enough about SAV to respond to that. Direct benefit to marsh since its being created, but negative effect on beach/dune if it replaces those habitats on the eastern shoreline. Studies suggest marsh can somewhat attenuate waves/surge. There might be increased bird strikes if constructed to the southwest since it is near the runway and birds would likely utilize the habitat, but unlikely it would lead to more birds on runway or in takeoff/landing area if constructed elsewhere. Impacts to nearshore communities largest if built proximal because dominant currents are to the north

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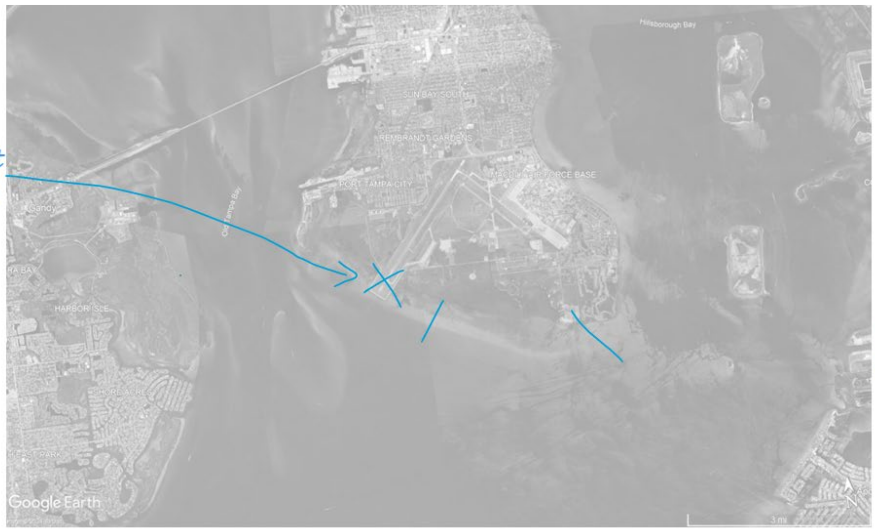
ACTIVITY INSTRUCTIONS, CONTINUED

NOT here - Bird/aircraft interactions



Other locations OK

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PROMPTS AND QUESTIONS

- What would potential **short-** (during construction) and **long-term** effects be? What would potential **direct and indirect effects** be?
- **Which specific habitats and species** do you expect to be impacted by expansion of the shallow shelf?
- What **type of flooding and wave attenuation effects** do you expect (e.g., reduced flooding during storms, protection of specific infrastructure, reduced post-storm recovery time)?
- Are there additional impacts on **Air Force operations**?
- Would this alternative lead to greater longshore transport of sediment to the **adjacent areas**?

ALTERNATIVE REFINEMENT AND EVALUATION: RESTORE ERODED SHALLOW SHELF HABITAT

UNCLASS

Sediment placement to create & expand shallow shelf habitat

UNCLASS

CHARGE THE STORM…LET'S GO!

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ALTERNATIVE REFINEMENT AND EVALUATION: RESTORE LONGSHORE BAR(S)

UNCLASS

Reestablish historic longshore bars – wave reduction

UNCLASS

CHARGE THE STORM…LET'S GO!

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PROMPTS AND QUESTIONS

- What would potential **short-** (during construction) and **long-term** effects be? What would potential **direct and indirect effects** be?
- **Which specific habitats and species** do you expect to be impacted by expansion of the shallow shelf?
- What **type of flooding and wave attenuation effects** do you expect (e.g., reduced flooding during storms, protection of specific infrastructure, reduced post-storm recovery time)?
- Are there additional impacts on **Air Force operations**?
- Would this alternative lead to greater longshore transport of sediment to the **adjacent areas**?

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ALTERNATIVE REFINEMENT AND EVALUATION: CREATION OF BARRIER ISLAND(S)

UNCLASS

Construction of barrier islands to buffer wind and wave energy

PROMPTS AND QUESTIONS

- What would potential **short-** (during construction) and **long-term** effects be? What would potential **direct and indirect effects** be?
- **Which specific habitats and species** do you expect to be impacted by expansion of the shallow shelf?
- What **type of flooding and wave attenuation effects** do you expect (e.g., reduced flooding during storms, protection of specific infrastructure, reduced post-storm recovery time)?
- Are there additional impacts on **Air Force operations**?
- Would this alternative lead to greater longshore transport of sediment to the **adjacent areas**?

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INITIAL RANKING OF NBS ALTERNATIVES

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FACILITATION QUESTIONS

- Are there any NBS alternatives ranked #1 that you would consider completely inappropriate for that region, and why?
- Are there any NBS alternatives ranked #3 that you think are a very good match for the spatial region?
- What specific implementation or regulatory concerns would need to be addressed for each of the #1 ranked alternatives for each spatial area?

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QUALITATIVE EVALUATION RESULTS AND IMPLEMENTATION STRATEGIES

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IMPLEMENTATION STRATEGIES

- For each of the #1 ranked alternatives for each region, elicit input on:
  - Potential “deal breaker” issues and how to resolve
  - What specific evaluation processes would be required for each agency if they have flags of concerns
- Go to the 2nd and 3rd choice alternatives, if time

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1110 RIVER ROAD S., SUITE 200
BATON ROUGE, LA 70802

(225) 448-2813
WWW.THEWATERINSTITUTE.ORG