Guinea Resilience & Innovation for Tidal Wetlands (GRIT) – Phase I Project

RFP # FY26-GRIT1
Middle Peninsula Planning District Commission
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Vegetated islands for roosting habitat in decline. Credit VA SeaGrant

Section 1. Introduction

Marstel-Day is pleased to submit this proposal in response to RFP #FY26-GRIT1 for professional services supporting the Guinea Resilience and Innovation for Tidal Wetlands (GRIT) Phase I project. Marstel-Day has assembled a multidisciplinary team with decades of experience integrating science, engineering, conservation, long-term adaptation, and stakeholder engagement, all of which are critical to achieving the goals and objectives of this effort. The Marstel-Day Team was formed with the understanding that the Guinea Marsh system is a dynamic, living landscape shaped by sediment transport, hydrology, ecology, and human decisions. As such, the Team will implement a holistic and cohesive planning approach that considers how these processes interact across space and time, rather than addressing shoaling, erosion, subsidence, or marsh degradation as isolated issues.

The Marstel-Day Team includes Marstel-Day, LLC as prime consultant with Resource Environmental Solutions (RES), the Virginia Institute of Marine Science (VIMS), Taylor Engineering (Taylor), and KCI Technologies, Inc. (KCI) providing specialized expertise in ecological restoration, coastal and marsh science, sediment dynamics, engineering feasibility, and field data collection. Detailed descriptions of team roles, experience, relationships, and value to the Middle Peninsula Planning District Commission (MPPDC) are provided in Section 5, Qualifications and Experience of the Firm and Project Team. Members of the Marstel-Day Team are highlighted below.

The Marstel-Day Team

Marstel-Day, LLC

***Overview*:** Marstel-Day is an environmental consulting firm providing planning, assessment, compliance, design, facilitation, and outreach services with a strong commitment to landscape-scale conservation. We have managed over 20 ecosystem restoration projects across the Chesapeake Bay region and have extensive experience designing, permitting, constructing, and monitoring shoreline stabilization projects in Virginia, using living shorelines and other nature-based techniques to reduce erosion, protect infrastructure, and enhance habitat.

Role: Marstel-Day will serve as the prime consultant and integrator for the GRIT Phase I effort, leading project management, coordination, QA/QC, and the integration of engineering, ecological, and planning inputs. We will develop the adaptive resilience framework, Comprehensive Existing Conditions Report, and Land Conservation Suitability Assessment, ensuring all deliverables support permitting, funding, and phased implementation.

Value: Given our highly relevant experience on projects addressing resilience challenges and developing mitigation solutions through research, assessment, planning, design, construction, stakeholder engagement, and partnership development, Marstel-Day offers MPPDC a combination of knowledge and experience, making the company an unparalleled, low-risk choice to successfully execute this project.

Resource Environmental Solutions, LLC (RES)

Overview: Resource Environmental Solutions, LLC (RES) is a national leader in marsh and shoreline restoration, ecological assessment, and nature-based and hybrid resilience strategies. As the country's largest nature-based solutions company, RES delivers science-led design, full project implementation, long-term stewardship, and guaranteed performance to restore wetlands, streams, floodplains, and coastal systems that improve water quality, protect communities, support wildlife, buffer storms, and sequester carbon.

***Role*:** RES will lead the Basis of Design Report and co-lead conceptual design, feasibility assessment, and environmental and regulatory documentation. RES will also direct ecological field assessments under the optional field services task, translating ecological insights into implementable restoration and stabilization strategies. *RES's role is central to translating ecological understanding into implementable restoration and stabilization strategies.*

***Value*:** RES brings nearly 10 years of local and regional experience successfully executing projects involving assessment, siting, design, permitting, construction, and monitoring of wetland restoration, living shoreline, and beneficial use of dredged material projects. *RES brings direct experience working with MPPDC on conducting an analysis of 21 sites the Commission planned for dredging to evaluate potential for beneficial reuse of dredged material and worked with MPPDC and The Nature Conservancy (TNC) to facilitate a beneficial reuse project*.

Viginia Institute of Marine Sciences (VIMS)

Overview: VIMS is a leading science and advisory institution for coastal Virginia, and it plays a hands-on role in Lower Chesapeake Bay and tidal-marsh restoration by combining field research, mapping, and practical design guidance for shoreline and wetland projects. VIMS supports restoration by producing decision-support tools and datasets (e.g., marsh migration and sea-level-rise planning products) that help agencies and local partners identify where marshes are most vulnerable and where restoration or protection will be most effective.

In the Lower Bay region—*especially across places like the Middle Peninsula—VIMS research also underpins "living shoreline" approaches that stabilize eroding coasts while maintaining habitat, and it helps quantify the ecological and community benefits of marsh and shoreline restoration to guide investment and prioritization*.

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Role: Co-lead for conceptual design development, feasibility assessment, and environmental and regulatory documentation, and support for the Basis of Design. VIMS ensures that resilience strategies are grounded in current science, system dynamics, and long-term marsh response under changing coastal conditions.

Value: VIMS brings a deep bench of scientific expertise and direct experience working with the MPPDC through the development of critical planning tools, including AdaptVA, the Virginia Coastal Resources Tool, and the VIMS Shoreline Change Maps.

Taylor Engineering, Inc. (Taylor)

***Overview*:** Taylor is a leader in coastal and water resources engineering, delivering innovative, science-based solutions for shoreline management, inlet systems, sediment transport, and resiliency planning. Taylor combines decades of experience with advanced, state-of-the-art numerical modeling and high-performance computing to address complex coastal challenges. Taylor brings extensive expertise in all aspects of coastal process analysis, including shoreline and beach volume changes, empirical orthogonal analyses, sediment budgets, littoral transport (waves, tides, and winds), wave and tidal hydrodynamics, beach morphology modeling, storm impact assessments, inlet management, sand bypassing, and shoreline stabilization.

Role: Support conceptual design development and the resilience feasibility assessment and provide targeted technical input to the Basis of Design. *Taylor's role ensures that proposed strategies are technically defensible and feasible under future conditions.*

Value: Taylor's hydrodynamic, wave, sediment transport, and morphology modeling capabilities support short- and long-term as well as storm-driven erosion and shoreline change analyses. Using advanced tools such as MIKE3/21, DELFT3D, XBeach, GENESIS, and other specialized and proprietary models, Taylor helps quantify restoration benefits, design shore protection projects, assess storm risk, and develop sea-level rise resilience strategies across shorelines, inlets, estuaries, and marsh systems**.**

KCI Technologies, Inc. (KCI)

Overview: KCI provides integrated land and marine surveying services using high-resolution LiDAR and multibeam hydrographic technologies to support coastal engineering, shoreline assessment, and resilience planning. Their georeferenced point cloud models capture detailed above-water and submerged environments, including marsh elevations, bathymetry, and shoreline geomorphic features.

Role: Under Optional Task 8, KCI will conduct targeted LiDAR and multibeam bathymetric surveys to fill critical data gaps identified in the Existing Conditions Report. These site-specific surveys will support hydrodynamic modeling, sediment transport analysis, marsh vulnerability assessment, and feasibility testing while minimizing unnecessary field effort.

Value: With extensive experience in challenging coastal environments, KCI's advanced point cloud surveying improves data quality, reduces field risk, and enables efficient, targeted investigations. These capabilities strengthen modeling and design inputs, support constructability evaluation, and enhance cost-effective decision-making for marsh resilience and shoreline restoration planning.

Critical habitat for migrating seabirds. Credit VA SeaGrant

Section 2. Project Understanding, Approach, and Methodology

Guinea Marsh's challenges reflect the behavior of an interconnected system in which altered sediment pathways, hydrodynamic constraints, and ecological responses collectively influence both marsh resilience and adjacent navigation conditions. Persistent subsidence and marsh edge erosion are symptoms of broader system dynamics that must be understood at a landscape scale to develop effective, durable solutions. Rather than pursuing static end-state designs, the Marstel-Day Team will advance an adaptive pathways framework that supports near-term implementation while preserving flexibility under future uncertainty. This approach recognizes that long-term resilience depends on aligning physical processes, ecological function, and management decisions under changing environmental conditions.

This Phase I effort is essential to move from problem identification to informed, coordinated action. The purpose of the GRIT Phase I study is not to produce abstract analyses or prescriptive designs, but to generate implementation-ready decision support that can guide concept development, feasibility evaluation, permitting strategy, funding alignment, and phased implementation. By grounding conceptual solutions in a defensible understanding of system behavior and explicitly linking technical analysis to downstream decisions, this effort will position Middle Peninsula Planning District Commission and its partners to advance resilient, nature-based solutions that are feasible under current and future conditions.

Key Outcomes of this Phase I Effort

- *A clear, evidence-based understanding of the physical and ecological drivers influencing subsidence, shoaling, erosion, and marsh resilience within the Guinea Marsh system.*
- *A system-scale conceptual framework describing sediment pathways, hydrodynamic controls, and marsh response under present-day and future conditions.*
- *Development of three coordinated, feasible concept alternatives that collectively support marsh resilience, navigation function, and long-term adaptability.*
- *Identification of implementation pathways that consider constructability, permitting requirements, beneficial use of dredged material, and opportunities for phased investment.*
- *Decision-support tools and documentation that enable Middle Peninsula stakeholders to prioritize actions and advance toward design and implementation.*

Marstel-Day will lead a team of specialized firms with expertise in coastal engineering, marsh and shoreline restoration, hydrodynamic and sediment transport modeling, permitting, and community engagement. The team is structured to support integrated planning that aligns engineering, ecological, and stakeholder priorities through ongoing coordination with the client and project partners. This team understands that the Guinea Resilience and Innovation for Tidal Wetlands Phase I Project is intended to establish a clear and actionable pathway from assessment to implementation within a complex tidal marsh and

shoreline system. This proposal advances a planning-led resilience approach that integrates engineering analysis, coastal and marsh science, land use, and stakeholder decision-making, into a cohesive decision framework designed to support implementation. This integrated approach ensures the Phase I effort produces decision-ready outputs that can directly support future design refinement, permitting strategy, funding alignment, and phased implementation. The effort is not intended to produce a single fixed solution. Instead, it establishes a decision framework that identifies where actions are appropriate, how they can be implemented, and under what conditions they should advance over time. The project integrates coastal engineering analysis, landscape-scale planning, and field-based understanding to evaluate vulnerability, identify feasible interventions, and support informed decisions under current and future climate conditions, including shoreline protection, marsh restoration, and beneficial use of dredged material strategies.

The Guinea Marsh system functions as a coastal landscape shaped by processes of hydrodynamics, sediment transport, shoreline change, and ecological response. Effective resilience planning in this setting requires understanding how these processes interact over time, where system thresholds may be reached, and how management actions influence long-term outcomes. Marstel-Day applies an adaptive planning framework that uses system thresholds and performance limits to guide decisions under uncertainty. This approach avoids reliance on static design assumptions. Guinea Marsh's persistent subsidence, marsh edge erosion, and long-term resilience are best understood as interconnected system behaviors rather than separate problems. Accordingly, the Team will evaluate marsh platform elevation dynamics, sediment pathways, hydrodynamic controls, and management constraints together to identify coordinated strategies that are feasible, durable, and adaptable.

The technical approach is structured as an iterative workflow in which data collection, field investigations, modeling, and design development inform one another through defined feedback points. Field observations, light detecting and ranging (LiDAR) topographic and bathymetric data, biological assessments, and stakeholder input inform hydrodynamic and coastal process analyses, which guide conceptual design. Clear decision logic is applied to test assumptions, refine priorities, and determine when strategies such as shoreline stabilization, marsh elevation enhancement, or beneficial use of dredged material are appropriate. Findings from each task are used to refine assumptions and test feasibility, allowing conceptual strategies to evolve in response to observed conditions and analytical results.

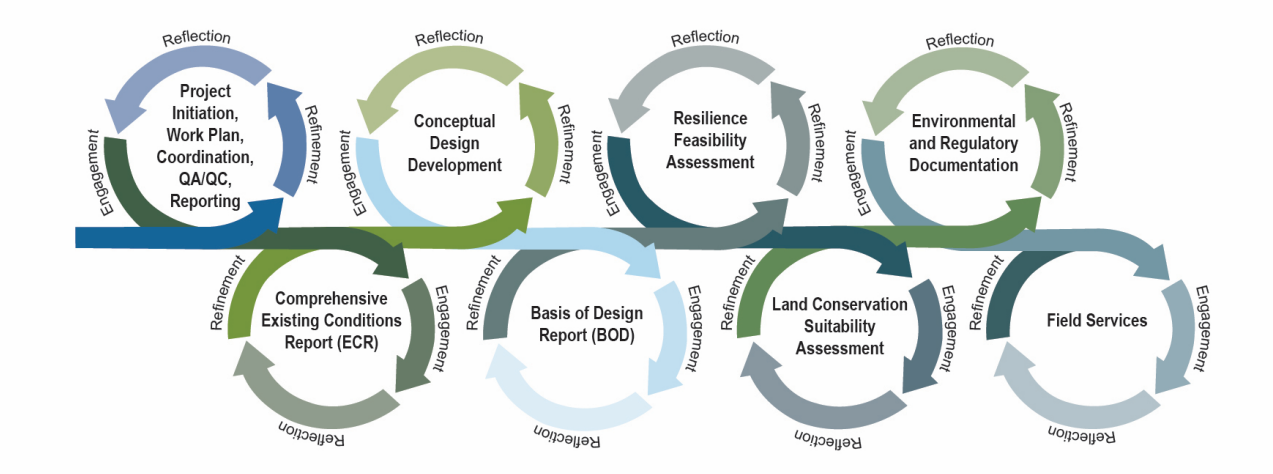


Figure 1: The planning framework illustrates how project tasks are intentionally sequenced and iteratively linked, with reflection, engagement, and refinement occurring throughout. This adaptive approach ensures decisions are revisited and strengthened as new information is incorporated, rather than progressing through a linear workflow.

Engineering analyses are applied to evaluate shoreline and marsh processes, erosion and shoaling dynamics, sediment availability, and system response under sea-level rise scenarios. Hydrodynamic, wave, sediment transport, and morphology modeling and scenario analysis are used to assess the performance of nature-based and hybrid interventions. Engineering is used to test constraints and performance limits, not to pre-select fixed designs, supporting development of multiple conceptual strategies tailored to specific locations and conditions. These concepts provide the technical foundation for refinement through feasibility testing and incorporation into a final Basis of Design.

Stakeholder and community engagement is integrated throughout the process to ensure technical recommendations reflect local knowledge, management priorities, and regulatory considerations. Engagement outcomes are used to inform assumptions, refine concepts, and support transparent decision-making. Conceptual design graphics and narratives communicate how resilience strategies function within the marsh system, and address erosion, subsidence, and sediment management at a system scale.

The central objective of this effort is to advance phased and adaptable solutions that enhance long-term ecosystem function and resilience while remaining constructible, cost-efficient to maintain, and effective over a fifty-year planning horizon. Marstel-Day emphasizes technical rigor, transparency of assumptions, and consistent quality control to ensure that deliverables are defensible, permitting-ready, and positioned to support future funding, regulatory review, and phased implementation.

The Marstel-Day team is uniquely positioned to achieve the project's goals by delivering an integrated planning framework that aligns engineering analysis, sediment management, land conservation, and stakeholder decision-making to support durable, flexible, and fundable resilience outcomes for Guinea Marsh.

Section 2.1 Task 1: Project Initiation, Work Plan, Coordination, QA/QC, and Reporting

Task 1 establishes the foundation for effective project delivery, consistent with Marstel-Day's approach to planning-led resilience initiatives. This task ensures that work begins with shared expectations and remains aligned as information and priorities evolve.

The project will begin with a kickoff meeting, intended to be in-person, involving MPPDC, the Virginia Department of Wildlife Resources (DWR), key project partners, and identified stakeholders to confirm project goals, scope, schedule, communication protocols, roles and responsibilities, and expectations for coordination and review. The kickoff meeting will also establish the approach to stakeholder and agency engagement for Phase I, including coordination points, information sharing, and opportunities for input as technical work progresses. This early coordination helps ensure that initial analyses support later feasibility, permitting, and implementation decisions.

Following project kickoff, the Marstel-Day Team will prepare a detailed Project Work Plan that clearly defines task sequencing, milestones, deliverables, and review and decision checkpoints tied to each major task. These checkpoints will include scheduled coordination meetings with MPPDC and the project team to review findings, confirm assumptions, and guide next steps before advancing subsequent tasks. This approach maintains schedule and budget control while allowing informed decisions as the project progresses. Each checkpoint will include (1) a short summary of findings, (2) assumptions to validate, (3) decisions needed from MPPDC/partners, and (4) confirmation of readiness to proceed to the next task. This structure supports schedule control while ensuring the technical work remains decision-driven.

Quality assurance and quality control (QA/QC) procedures focusing on accuracy, consistency, and clear documentation will be applied consistently across all tasks, including field data integration, engineering analyses, modeling, mapping, and report development. Documentation will follow best practices and National Fish and Wildlife Foundation's (NFWF's) National Coastal Resilience Fund requirements to support future use in permitting, funding

applications, and phased implementation. Stakeholder meetings will be held and coordinated with Consociate Media, University of Virginia's Institute for Engagement and Negotiation (IEN), and the project team. These meetings will be used to listen to representatives, receive local knowledge and advice, set goals, review project work, and provide a space for comments and feedback that will be integrated as part of the adaptive approach.

Given our highly relevant experience on projects addressing resilience challenges and developing mitigation solutions through research, assessment, planning, design, construction, stakeholder engagement, and partnership development, Marstel-Day offers MPPDC a combination of knowledge and experience, making the company an unparalleled, low-risk choice to successfully execute this project.

Monthly progress reports will document completed activities, upcoming work, schedule status, and any issues requiring coordination or resolution or decision by MPPDC and the project team. These reports will serve as a recurring coordination and decision checkpoint, allowing risks, schedule adjustments, and alignment with project objectives to be addressed proactively. At project completion, all deliverables will be compiled into a final, quality-controlled technical data package suitable for continued implementation planning, regulatory review, and long-term resilience management.

Deliverables for Task 1

- **Kickoff meeting minutes** documenting project team, MPPDC, DWR, and key stakeholder discussions, project scope, roles and responsibilities, communication protocols, and other project initiation items**.** Meeting minutes of key discussion points will be distributed to the team.
- **Monthly progress reports** documenting upcoming and completed work, project status, issues, and resolutions.
- **Project Work Plan** documenting the project tasks, sequencing, supporting actions and decision checkpoints for each major task.
- **Stakeholder meeting notes** will document key outcomes of at least two meetings to support communication efforts and provide technical expertise.
- **Final Report and Data Package**

Section 2.2 Task 2: Comprehensive Existing Conditions Report

Task 2, the Comprehensive Existing Conditions Report (ECR) establishes the technical and analytical foundation for the entire GRIT Phase I effort. The ECR develops a clear and integrated understanding of existing physical, ecological, and regulatory conditions to support decision-making, identify vulnerabilities, and guide evaluation of feasible strategies under future conditions. The ECR is structured as a starting baseline that informs subsequent vulnerability and risk assessments. Findings from later analyses build upon this foundation to establish a more complete living baseline used for comparison, adaptive management, and tracking future outcomes as conditions and priorities evolve.

Desktop Assessment

The desktop assessment compiles and synthesizes existing information necessary to characterize physical, ecological, and regulatory conditions across the project area. The objective is to develop a decision-grade understanding of how the marsh system functions today and how it may respond under future conditions. Core inputs include prior shoreline and marsh studies, bathymetric and elevation data, submerged aquatic vegetation (SAV) mapping, aerial imagery, hydrologic and coastal models, and climate and sea-level rise projections.

In addition, the Team will incorporate VIMS-provided remote sensing datasets specific to the Guinea Marsh system, including high-resolution land use mapping (1 m) distinguishing water, marsh, forest, and developed land uses;

marsh–forest boundary slope and elevation data; marsh migration projections under multiple sea-level rise scenarios; vegetation health and productivity indices (NDVI); marsh condition metrics such as the Unvegetated–Vegetated Ratio (UVVR); and updated mapping of historic berms and their relationship to marsh migration corridors.

VIMS brings a deep bench of scientific expertise and direct experience working with the MPPDC through the development of critical planning tools, including AdaptVA, the Virginia Coastal Resources Tool, and the VIMS Shoreline Change Maps.

Additional datasets, such as parcel ownership, land use information, conservation prioritization frameworks, and recreation and fisheries datasets, shoreline management guidance will be incorporated to evaluate how management objectives, conservation status, access considerations, and external stressors influence marsh condition, vulnerability, and adaptation potential. These datasets support a clear understanding of how management and policy decisions interact with physical and ecological processes to shape long-term outcomes.

Rather than evaluating datasets in isolation, the assessment integrates information across interacting physical, ecological, and human systems. Hydrodynamic and sediment processes are evaluated alongside habitat conditions, land use patterns, and management constraints to understand cumulative effects on marsh stability, water quality, sediment delivery, and marsh migration potential. Remote sensing products describing marsh condition, productivity trends, and migration pathways are explicitly evaluated alongside physical drivers to identify areas where geomorphic constraints, vegetation stress, or legacy features such as berms influence system response. Evaluation focuses on spatial coverage, resolution, recency, and relevance to project objectives, with emphasis on identifying datasets that most directly influence system response and decision uncertainty.

Based on Marstel-Day's experience assessing complex wetland and shoreline systems, organizing information within these interacting systems provides the most effective framework for identifying constraints, distinguishing primary drivers of change, and clarifying where targeted interventions can meaningfully improve resilience.

This synthesis establishes a clear picture of how the landscape is functioning today and where stresses, sensitivities, trade-offs, and opportunities for intervention are most pronounced, including locations where conservation value, ecosystem services, shoreline management constraints, and future adaptation needs converge.

This synthesis evaluates whether existing elevation and tidal datasets provide sufficient confidence to support concept development, feasibility analysis, and future permitting decisions. It distinguishes where available information is adequate to move forward and where uncertainty remains high enough to warrant targeted, site-specific field data collection to reduce risk and improve the reliability of subsequent modeling and design evaluations.

Field Data Assessment

The field data assessment builds directly on the desktop synthesis and focuses on confirming whether existing information is sufficient to support vulnerability assessment, conceptual design development, modeling, feasibility evaluation, and regulatory pathways, or whether targeted field data collection is warranted to reduce uncertainty in key design and permitting decisions. This task is intentionally decision-driven and avoids assuming a predefined level of field effort. Instead, field services are scoped based on how the data will be used to inform modeling confidence, feasibility conclusions, marsh elevations and implementation pathways.

Field data types considered under this task may include LiDAR, bathymetric data, marsh edge and erosion assessments, biological surveys, or other targeted measurements relevant to marsh and shoreline conditions. High-precision elevation surveys (e.g., RTK GPS) will be used where necessary to verify marsh–upland boundaries,

marsh–developed edges, and the elevation and integrity of historic berms, including surveys that can be used to ground-truth or correct drone-based LiDAR datasets if collected. Data needs are evaluated in consultation with the project team and client, with attention to the scale, resolution, and accuracy required to support coastal process analysis, sediment dynamics evaluation, and resilience strategy development. This ensures that any recommended field effort is proportional, cost-effective, and clearly linked to specific analytical or decision needs.

A core component of this effort is field verification of critical tidal and design elevations in priority areas identified through desktop assessment. This verification focuses on site-specific confirmation of Mean Low Water, Mean High Water, and 1.5 times the mean tide range sufficient to inform realistic and permittable conceptual designs. Rather than relying solely on regional tide station data, the team applies best practices for tidal wetland and shoreline restoration by incorporating localized water level observations, geomorphic context, and biological benchmark indicators, such as vegetation zonation, marsh-forest transitions, and marsh platform characteristics, to derive accurate, site-specific tidal datums where permanent instrumentation is not feasible.

Figure 2: Map of historical berms in the Guinea marshes study area from Hall et al., 2022. Mapped levees are indicated with orange lines, and each field site is indicated with a white box, b-e. In this proposal, we would survey the elevation of the berms with RTK GPS, identify natural breaches, and determine the efficacy of berm breaches on marsh health as a design alternative for creating and restoring tidal wetlands.

This approach ensures that any recommended data collection is directly focused on reducing uncertainty that affects feasibility, design confidence, and implementation decision-making, rather than increasing scope without a clear analytical or management purpose.

Where historic berms are identified as influencing marsh hydrology or migration potential, the Marstel-Day Team will synthesize existing field measurements of vegetation composition, soil carbon content, soil moisture, bulk density, and marsh soil depth on both the landward and seaward sides of berms. Targeted new measurements may be collected at natural berm breaches to evaluate ideal breach spacing, quantify restored or created wetland area, and inform feasibility of berm modification as a resilience strategy (Figure 2).

If desired and funded, sensor-based measurements of water level, soil moisture, groundwater, and soil salinity may be deployed in targeted areas, including berm-affected marshes, using short-interval (e.g., 15-minute) data collection over the growing season. Optional field efforts may also include high-resolution mapping of invasive *Phragmites australis* using aerial imagery and field verification to inform future management considerations.

This integrated approach reflects established regulatory and scientific practice in tidal systems, recognizing that localized tidal behavior and marsh response often diverge from regional averages and that biological benchmarks provide a reliable means of reducing uncertainty where instrumental records are limited. Field services recommended, whether for Task 2 or Optional Task 8, are intended to strengthen confidence in modeling results, design baselines, and feasibility findings, rather than expand scope unnecessarily. This ensures that Phase I field efforts remain focused on advancing implementable, well-supported resilience strategies for the Guinea Marsh system.

By explicitly tying field data collection to identified uncertainties and downstream use, this approach supports informed decision-making while maintaining flexibility as project understanding evolves.

Data Processing and Mapping

All desktop and field datasets will be processed, quality-checked, and integrated within a geographic information system (GIS) to support consistent analysis, visualization, and interpretation. Processed deliverables will include elevation models, bathymetric surfaces, habitat and land cover maps, and related spatial products prepared with complete metadata. Remote sensing datasets provided by VIMS and field-verified elevation data will be incorporated as core GIS layers supporting analysis of marsh condition, migration potential, and legacy feature influence.

GIS products will be organized as layered representations of existing conditions that allow relationships among physical processes, ecological resources, and management constraints to be evaluated together. These products support interpretation of geomorphic context, habitat distribution, and areas of vulnerability and are used to inform conceptual design development, feasibility evaluation, and future monitoring.

To support downstream analyses, the Marstel-Day Team will establish baseline inputs for landscape-scale evaluation of future marsh conditions under varying sea-level rise scenarios using an appropriate planning-level tool and combining that information with measured shoreline erosion loss using aerial imagery comparison and physical observations of marsh subsidence. Outputs will inform identification of priority areas for resilience interventions and evaluation of sediment needs for adaptation strategies such as elevation enhancement and thin-layer placement.

Identification of Data Gaps and Uncertainty

An essential function of the ECR is to clearly identify data gaps and uncertainties that influence confidence in vulnerability assessments and resilience strategies. The ECR will document where information is robust and where limitations remain. This transparency provides a sound basis for determining whether additional data collection may be warranted in later phases and supports adaptive refinement of the project approach.

To further support this effort, an initial modeling iteration will be used to conduct a focused uncertainty analysis. The analysis will evaluate sensitivity to key inputs such as elevation accuracy, land cover classifications, tidal datums, and assumptions related to tidal range and inundation dynamics. Based on these outputs, the team will identify specific locations or data types where better information would most improve future model performance.

Report Development and Review

Findings from the desktop assessment, field data assessment, data processing, and uncertainty analyses will be synthesized into a Comprehensive ECR that serves as the primary technical reference for Phase I. The ECR documents site characteristics, geomorphic setting, habitat types, vulnerabilities, data quality, and potential restoration opportunities, and provides the technical basis for subsequent vulnerability assessments, modeling, and conceptual design decisions.

The ECR will be developed through a series of structured ECR Review Checkpoints that align with key stages of analysis and interpretation. These checkpoints occur after completion of major analytical steps, including desktop synthesis where we (1) outline prospective available data and confirm its relevancy. Collect field data following an uncertainty assessment, (2) adding additional resolution to mapping and modeling. Analyze the collected data as we move into subsequent phases of the project with (3) a draft and (4) final ECR Report. Each checkpoint provides an opportunity to review assumptions, validate interpretations, and confirm that findings are suitable to carry forward into subsequent tasks. Feedback from the project team, agency partners, and community representatives is incorporated at these points to ensure shared understanding and alignment before advancing to feasibility testing and conceptual design development. Adjudication will be determined by the POC and MPPDC if any conflicts persist.

Completion of Task 2 results in a defensible starting baseline that supports informed decision-making across all remaining Phase I tasks. This foundation ensures that vulnerability assessment, feasibility analysis, and conceptual design development are grounded in observed system behavior, clearly documented assumptions, and identified areas of uncertainty, rather than generalized or static existing-conditions snapshots.

Deliverables for Task 2

- **GIS-based existing conditions dataset**, developed as a structured, layered representation of current conditions and baseline inputs for subsequent modeling, analysis, and visualization.
- **Data gaps and uncertainty assessment**, including identification of limitations in existing information and documentation of how those uncertainties influence confidence in vulnerability assessment, design development, modeling, and decision-making, including results from an initial modeling-based uncertainty analysis to test sensitivity to key inputs.
- **Draft and Final Comprehensive ECR** that documents physical, ecological, and regulatory conditions across the project area; explains how core datasets and supplemental information were evaluated, integrated, and interpreted; describes relationships among datasets; identifies dominant drivers of change affecting the marsh system; and summarizes implications for vulnerability, feasibility, and future resilience actions.

Section 2.3 Task 3: Conceptual Design Development

Task 3 advances the project toward implementation by developing conceptual design strategies that are informed by a comprehensive understanding of site conditions, feasibility, and land use context. Conceptual design development is not treated as a single step that follows the ECR, but as an iterative process that integrates findings from the resilience feasibility assessment and the land conservation suitability assessment. This approach ensures that conceptual strategies are grounded in both physical system behavior, implementation constraints, and long-term management considerations, rather than isolated engineering feasibility alone.

While the ECR provides insight into system dynamics and vulnerability to identify the types of interventions that may warrant consideration, refinement of conceptual strategies relies on additional evaluation of feasibility, resilience performance under future conditions, and land ownership and conservation opportunities. A site selection framework is used to establish clear benchmarks that guide design evaluation and ensure consistency as subsequent tasks are undertaken. This framework is then applied through the Land Conservation Suitability Assessment to identify priority locations for implementation and to inform future project phases. Together, these analyses clarify both which solution types are appropriate and where they can be implemented in a manner that is feasible, effective, and sustainable over time.

Priority Based Concept Development

Conceptual design development will focus on candidate locations identified through synthesis of vulnerability, feasibility, and land conservation assessments. Priority locations will be refined and confirmed through coordination with the client and informed by stakeholder input, ensuring that design effort is focused where resilience investments align with management priorities, land availability, and implementation readiness.

For these locations, the project team will develop three conceptual design alternatives that are feasible from cost, constructability, performance and ecological enhancement perspectives. The suite of design projects will be developed as a complete and technically defensible strategy, capable of supporting permitting and future design advancement following feasibility and land conservation evaluation. While tailored to site specific conditions, the concepts will be developed within a consistent coastal engineering and ecological performance framework, so they function together within a marsh wide resilience strategy, collectively addressing the most critical challenges facing the Guinea Marsh system.

Comprehensive Concept Types and Design Considerations

A core component of this effort is field verification of critical tidal and design elevations in priority areas identified through desktop assessment. This verification focuses on site-specific confirmation of Mean Low Water, Mean High Water, and 1.5 times the mean tide range sufficient to inform realistic and permittable conceptual designs. Rather than relying solely on regional tide station data, the project team will apply best practices for tidal wetland and shoreline restoration by incorporating localized water level observations, geomorphic context, and biological benchmark indicators, such as vegetation zonation and marsh platform characteristics, to derive accurate, site-specific tidal datums where permanent instrumentation is not feasible. This integrated approach reflects established regulatory and scientific practice in tidal systems, recognizing that localized tidal behavior and marsh response often diverge from regional averages and that site-specific biological benchmarks provide a reliable means of reducing uncertainty where instrumental records are limited.

Facilitating marsh migration is a distinct conceptual design focus within this task. Based on data compiled through Task 2 and marsh migration projections evaluated in Task 5, the team will identify locations where active management can optimize the extent, quality, and sustainability of marsh migration. While marsh migration is projected to occur across large areas of the Chesapeake Bay region even without intervention, local outcomes may be constrained by topographic barriers, historic berms, altered drainage patterns, residential land use, and invasive species dynamics.

Conceptual designs may include marsh edge stabilization and bank protection measures, nature-based shoreline treatments such as living shorelines and oyster-based structures, and hybrid measures including sills, breakwaters, and headland features that reduce wave energy and promote sediment retention.

The conceptual design will identify areas where marsh migration corridors are constrained by anthropogenic or geomorphic barriers and where migration is likely to be dominated by invasive species such as *Phragmites australis*. These findings will be used to distinguish between locations where marsh migration is likely to succeed without intervention and those that would benefit from active management measures, such as targeted invasive species management, berm removal or breaching, channel extension to restore tidal exchange, or conservation-based land management actions.

Where berms influence marsh migration pathways, conceptual designs will evaluate ideal spacing for berm breaches, the need for associated tidal channel extensions, and the approximate area of marsh created or restored through each intervention. These concepts build on established research demonstrating the importance of tidal connectivity in supporting marsh migration and long-term wetland function.

Beneficial use of dredged material is a central consideration within this task. Concepts may include marsh platform enhancement and expansion strategies that rely on beneficial use of dredged material, including thin-layer placement to build elevation capital, improve vegetative resilience, and support long term marsh sustainability under sea-level rise.

Where appropriate, designs may incorporate sediment nourishment, targeted sediment placement for marsh edge toe support, and strategic sediment management approaches that improve system function while remaining feasible to permit, construct, and maintain.

Additional considerations may include dune and beach restoration, upland transition zone improvements that support marsh migration, tidal creek interface treatments, and habitat focused measures such as planting strategies and invasive species management where they influence long term performance.

Iterative Evaluation and Refinement

Conceptual designs will be evaluated qualitatively for constructability, anticipated cost, resilience performance under future conditions, and ecological enhancement. Evaluation is an iterative process, with findings from feasibility analysis and land conservation assessment feeding back into design refinement. Design elements may be adjusted, scaled, or reconfigured to improve performance, reduce risk, or enhance long term sustainability. This feedback-driven approach reflects the dynamic nature of the tidal marsh system and ensures that conceptual designs remain adaptable as conditions change and new information is incorporated.

Design Review Workshop

An in-person design review workshop will be conducted with the project team and client representatives to support structured technical review and iterative refinement of the conceptual design alternatives. The workshop will be timed to occur after completion of the feasibility assessment and land conservation suitability assessment so that discussions are informed by a full understanding of physical constraints, resilience performance, and land use considerations.

During the workshop, each conceptual design will be reviewed with respect to underlying assumptions, anticipated performance under future conditions, cost and constructability considerations, and alignment with long term resilience objectives. The workshop will provide a forum to evaluate how individual design elements function within the broader marsh system and how the concepts collectively contribute to a coordinated marsh wide strategy.

The workshop will focus on identifying opportunities for refinement, adjustment, or phasing of design elements rather than selecting a single preferred alternative. Feedback generated through the workshop will be documented and used to strengthen each concept (suite of design projects) and to clarify how the concepts can be advanced toward permitting and implementation. The primary outputs of the workshop will include refined conceptual design narratives, updated conceptual graphics as appropriate, and workshop notes that will include a clear summary of recommended refinements to be carried forward into subsequent tasks.

Holistic Vision for Guinea Marsh

While Task 3 produces three location specific conceptual designs, these designs also inform development of a holistic vision for the conservation and restoration of Guinea Marsh. Together, the concepts illustrate how coordinated interventions across the landscape can improve marsh resilience, support ecological function, and respond to evolving conditions over time.

By the conclusion of Task 3, the Marstel-Day Team will have a set of refined, implementable conceptual designs that address priority needs while contributing to an integrated and adaptive marsh scale resilience strategy. These designs provide a strong foundation for development of the Basis of Design and subsequent permitting and implementation planning.

Deliverables for Task 3
• **Concept development goals and performance objectives** defining what the conceptual designs are intended to achieve in terms of resilience, sediment management, ecological function, and long-term adaptability. • **Priority locations and site selection framework** including a prioritization matrix informed by vulnerability, feasibility, land conservation suitability, and stakeholder input, identifying where conceptual strategies are most appropriate for evaluation. • **Alternatives Summary** evaluating how feasibility findings, land use and conservation considerations, and resilience performance under future conditions informed the development and refinement of conceptual strategies. • **Three location-specific design concepts,** developed as coordinated interventions that collectively contribute to a marsh-wide resilience vision, rather than as competing alternatives for a single site. • **Design Review Workshop materials** including synthesized maps, evaluation summaries, and conceptual graphics that present existing conditions, drivers of change, feasibility constraints, land use considerations, and conceptual strategies together to support informed discussion and decision-making. • **Design Review Workshop** with project team and client representatives to refine the three concepts and strengthen the design solutions. • **Design Review Workshop Notes/Summary** documenting feedback, evaluation outcomes, and recommended refinements to concept location, scale, phasing, and performance expectation.

Section 2.4 Task 4: Basis of Design Report (BOD)

Figure 3: Example of a system-based coastal resilience strategy integrating shoreline stabilization, sediment placement, and habitat restoration. The Queen Bess Island project illustrates how adaptable design concepts can rebuild landform integrity and ecological function under dynamic coastal conditions.

Task 4 advances the project from conceptual strategy development to a clearly documented Basis of Design (BOD) that establishes how priority resilience interventions are intended to function, perform, and be implemented over time. The BOD process provides a structured technical framework that supports feasibility evaluation, design strategies, permitting, and design typologies by documenting the evolution of the conceptual design. Performance objectives, engineering considerations, and implementation considerations will strengthen our decisions for the Guinea Marsh system as the project progresses.

The BOD is developed as an iterative product, beginning with a BOD Framework that documents design considerations, concept types, and preliminary strategies informed by existing conditions and system behavior. At this stage, the BOD does not select a preferred design, but instead establishes the range of viable strategies, key design drivers, assumptions, and performance considerations that will be tested through subsequent feasibility and land conservation suitability assessments.

RES brings nearly 10 years of local and regional experience successfully executing projects involving assessment, siting, design, permitting, construction, and monitoring of wetland restoration, living shoreline, and beneficial use of dredged material projects.

RES's direct experience working with MPPDC includes analyses of 21 planned dredging sites to evaluate potential for beneficial reuse of dredged material and facilitation of a beneficial reuse project with MPPDC and The Nature Conservancy.

Findings from the Resilience Feasibility Assessment (Task 5) and the Land Conservation Suitability Assessment (Task 6) are then used to test these strategies, identify tradeoffs, and evaluate where different concept types are most appropriate based on land availability, permitting considerations, ecological constraints, and implementation feasibility. This feedback-driven process allows design considerations to be refined, combined, or deferred, ensuring that the BOD reflects both system performance and real-world constraints.

The process culminates in a BOD report that reflects selection of conceptual design approaches and implementation pathways informed by feasibility findings, land conservation suitability, and stakeholder coordination. The BOD provides a clear, defensible foundation for future permitting, funding, and phased implementation, while maintaining flexibility to adapt as conditions, data, and priorities evolve.

Design Framework and Design Criteria

The BOD Framework documents the design considerations and concept type applicable to priority resilience interventions across the Guinea Marsh system. These may include marsh edge stabilization, nature-based shoreline treatments, hybrid structural features, marsh platform enhancement, and beneficial use of dredged material. Strategies are framed as adaptable concept types rather than fixed designs. Design considerations are tied directly to site-specific conditions identified through the ECR and refined through iterative concept development.

Where appropriate, the BOD identifies performance thresholds, tolerances, and adaptive triggers that allow design elements to be adjusted over time in response to observed conditions.

Design criteria address coastal engineering, ecological, and implementation considerations, including:

- *Hydrodynamic conditions, wave climate, and shoreline exposure.*
- *Sediment characteristics, transport processes, and sediment availability.*
- *Existing and target marsh elevations and elevation capital.*
- *Sea-level rise scenarios and anticipated future system response.*
- *Ecological performance objectives and habitat enhancement goals.*
- *Constructability, access, maintenance, and regulatory constraints.*

Supporting Analyses and Model Results

The BOD synthesizes technical analyses that support evaluation of the conceptual strategies. These include results from hydrodynamic and sediment transport/morphology evaluations, landscape-scale resilience modeling, and scenario-based assessments developed earlier in the project. Model outputs such as projected marsh response under sea-level rise scenarios, sediment requirements, and system performance indicators are documented and explicitly linked to design assumptions and considerations. This synthesis establishes a transparent analytical basis for comparing strategies and supports the quantitative and comparative evaluations conducted in Task 5.

Cost Estimates and Phased Implementation Strategy

The BOD includes planning-level cost estimates for each conceptual design strategy to support feasibility screening and funding planning. Cost estimates will consider construction methods, material quantities, access limitations, and opportunities for beneficial use of dredged material.

Phased implementation recommendations will be a central component of the BOD. Building on the priority-based framework, the BOD will outline logical phasing sequences that reflect:

- Relative vulnerability and urgency across priority locations
- Constructability and permitting considerations
- Land ownership and conservation status
- Opportunities to align with sediment availability, funding cycles, or regulatory windows
- Adaptive triggers tied to observed system response or environmental change

This phased approach provides a clear roadmap for incremental implementation while preserving flexibility as conditions and priorities evolve.

Linkage to the Resilience Feasibility Assessment

The BOD serves as the technical baseline for the Resilience Feasibility Assessment in Task 5. By clearly documenting design assumptions, performance objectives, cost considerations, and phasing logic, the BOD establishes a consistent framework for evaluating technical, environmental, and economic feasibility under multiple future scenarios.

Task 5 will build upon the BOD Framework by testing how the documented design approaches perform under varying sea-level rise conditions, assessing relative benefits and tradeoffs, and refining cost and implementation considerations. This progression ensures that feasibility findings are grounded in clearly defined design intent and support informed decision-making prior to implementation.

Review, Coordination, and Refinement

A draft BOD will be prepared and submitted for review by MPPDC, DWR, and the project team, followed by a structured review meeting to discuss key assumptions, analytical findings, and design considerations. Feedback from this review will be used to identify refinements and determine which strategies are carried forward into subsequent assessments. Ongoing coordination and stakeholder discussions will continue to inform the design approach, ensuring alignment with project objectives, regulatory considerations, and long-term resilience goals as the Final BOD is developed.

Deliverables for Task 4

- **BOD Framework** documenting design criteria documenting design intent, conceptual strategy types, drivers, assumptions, preliminary performance objectives, supporting analyses, cost considerations, and initial phasing concepts informed by the ECR and strategy development. The draft BOD establishes the range of viable design approaches and evaluation criteria.
- **BOD Review Meeting** with the full project team to review the BOD Framework, confirm design assumptions, discuss linkages to modeling, feasibility, and land conservation considerations, and identify refinements to be carried forward into Tasks 5 (Resilience Feasibility Assessment), 6 (Land Conservation Suitability Assessment), and 7 (Environmental and Regulatory Documentation).
- **Draft BOD Report** includes findings from the Resilience Feasibility Assessment, Land Conservation Suitability Assessment, and stakeholder coordination to document how the three conceptual design approaches were evaluated, refined, and selected. The suite of design projects will be described, validated with modeling results, and analyzed to provide cost estimates within this stage of the report.
- **Final BOD Report** synthesizes review comments from the project team following the Concept Design Workshop in Task 3. This report captures the full design rationale, finalized design criteria, performance expectations, planning-level cost estimates, and phased implementation pathways, providing a clear and defensible foundation for permitting, funding, and implementation.

Section 2.5 Task 5: Resilience Feasibility Assessment

Task 5 evaluates the technical and economic feasibility of priority resilience interventions using the integrated baseline established in the Comprehensive ECR. This task tests what strategies work, where they are viable, and when they should be advanced under future sea-level rise conditions. Feasibility is evaluated to support decision-making across the suite of projects rather than to select a single preferred solution.

Interventions evaluated under this task include thin-layer placement, beneficial use of dredged material, marsh elevation enhancement, marsh migration accommodation, shoreline stabilization, and hybrid measures. Feasibility is assessed through both technical and temporal lenses, recognizing that strategy performance depends on location, timing, and evolving system conditions. Findings from Task 5 inform refinement of conceptual design strategies in Task 3, provide technical inputs to the BOD in Task 4, and directly support the Land Conservation Suitability Assessment in Task 6. Task 5 also synthesizes feasibility findings across engineering, ecological, and land-based considerations so that resilience benefits, constructability constraints, and management pathways are evaluated together rather than in isolation.

Feasibility Framing and Scenario Definition

The feasibility assessment begins with coordination with MPPDC, DWR, and the project team to confirm the questions that feasibility analysis must answer. This discussion establishes how feasibility findings will be used to inform restoration, sediment management, shoreline protection, and conservation decisions across Guinea Marsh.

Scenario framing focuses on how marsh and shoreline systems respond over time to increasing water levels, changing sediment dynamics, and cumulative stress. This framing ensures that feasibility analysis supports the holistic vision developed in Task 3 and avoids treating feasibility as a static screening exercise.

Sea-level rise and Marsh Migration Scenario Evaluation

Feasibility analysis for marsh migration and long-term resilience relies on application of a landscape-scale modeling tool to evaluate system response under a range of future sea-level rise scenarios. The purpose of this modeling is to test sensitivity and identify thresholds rather than to predict a single outcome.

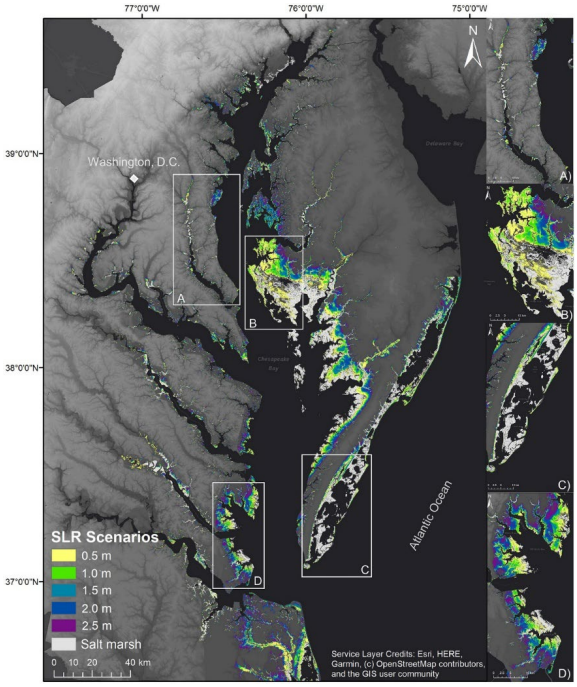


Figure 4: Marsh migration projections from Molino et al. 2022, with an inset showing projected marsh migration for Mobjack Bay in panel D. In this proposal, we would create a similar map for just the Guinea

The project team will evaluate whether datasets compiled through the ECR are sufficient to support scenario-based modeling. Key inputs include elevation surfaces, land cover and habitat classifications, shoreline position, tidal datums, sea-level change projections over time and connectivity between marsh platforms, tidal creeks, and adjacent uplands. These inputs are assessed for resolution, vertical accuracy, and consistency. Using these inputs, the modeling effort will simulate multiple future scenarios to evaluate where marshes are likely to persist, where transition may occur, and where accommodation space is limited. Results are interpreted in relation to feasibility questions, including where marsh migration corridors remain viable, elevation enhancement may be required, and long-term marsh loss may constrain restoration or conservation strategies.

VIMS will provide marsh migration projections specific to the Guinea Marsh WMA and will quantify the amount of marsh created and restored under a range of sea-level rise and management scenarios. These projections will be updated to incorporate mapped historic berms and verified berm conditions, as well as mapped invasive Phragmites distribution, so that migration pathways and management constraints are evaluated using the best available site-specific information. In addition to marsh migration, scenario evaluation will assess saltwater intrusion-driven transitions in adjacent upland habitats within the study area and how those transitions influence long-term marsh opportunity space and management needs.

Building on Task 2 biological benchmark interpretation and berm condition synthesis, marsh migration outcomes will be categorized to clarify where migration is self-sustaining versus management-dependent. Categories will include: (1) locations where interventions such as berm removal are expected to enhance existing marsh health and function; (2) locations where migration creates new marsh without active intervention; (3) locations where migration produces healthy marsh only with targeted management such as berm removal and/or Phragmites control; (4) locations where migration is expected to produce persistently low-quality marsh regardless of management; and (5) locations where migration is unlikely to occur and alternate resilience strategies are required to sustain marsh area and function.

Where results are highly sensitive to specific assumptions, the team will identify targeted data refinements that would most improve confidence. Any recommended refinements are reviewed with the client before implementation. If desired and funded, marsh migration projections will be re-run using newly collected LiDAR and RTK elevation data to improve vertical confidence in migration thresholds and marsh-upland transition elevations.

Hydrodynamic, Wave, and Sediment Transport Modeling

Hydrodynamic, wave, sediment (fines and/or sand) transport, and morphology modeling is used to evaluate shoreline erosion, shoaling patterns, sediment pathways, and system response under representative normal tide and wave and extreme storm conditions. These analyses support feasibility evaluation of shoreline stabilization, hybrid structures, sediment placement, and beneficial use of dredged material strategies.

Taylor's hydrodynamic, wave, sediment transport, and morphology modeling capabilities support short- and long-term as well as storm-driven erosion and shoreline change analyses. Using advanced tools such as MIKE3/21, DELFT3D, XBeach, GENESIS, and other specialized and proprietary models, Taylor helps quantify restoration benefits, design shore protection projects, assess storm risk, and develop sea-level rise resilience strategies across shorelines, inlets, estuaries, and marsh systems.

Integrated two-dimensional modeling is applied, as appropriate to available data and decision needs, to simulate tides (wave levels), storm surge, waves, and currents. Model outputs are used to evaluate relative sediment transport pathways, erosion and deposition, and system response relevant to conceptual performance strategy. Where sufficient data are available, models are calibrated and verified. Where data are limited, parameters are derived from published literature and professional experience, and sensitivity analyses are used to evaluate uncertainty.

Modeling is used to test performance limits, durability, and feasibility rather than to pre-select fixed designs. Preliminary results are reviewed with the client and project team to confirm interpretation, identify key sensitivities, and determine where refinement or additional information would most improve feasibility and implementation decisions.

Technical Feasibility and Implementation Constraints

Technical feasibility is evaluated by examining how each intervention performs within its geomorphic, hydrodynamic, and ecological context. Considerations include shoreline exposure, sediment compatibility, elevation requirements, access constraints, constructability, and regulatory limitations.

Feasibility screening also considers constraints that influence implementation, including land ownership, utility corridors, navigation and access limitations, shellfish leases, SAV, and other sensitive resources. This screening identifies where strategies are viable, conditionally viable, or constrained, and where hybrid approaches may offer improved performance.

Economic Feasibility and Adaptive Pathways

Economic feasibility is evaluated at a planning level to support comparison across strategies. Order-of-magnitude cost considerations, material needs, access limitations, and lifecycle implications are evaluated to understand how interventions align with anticipated funding pathways and maintenance expectations.

Technical and economic findings are considered together to define adaptive pathways. These pathways identify trigger points such as elevation thresholds, rates of marsh loss, or sediment availability windows that indicate when strategies should be implemented, scaled, or deferred. This approach supports phased implementation and avoids premature commitment to strategies that may be more effective at a later stage.

Decision Support, Prioritization, and Integration

Findings from the feasibility assessment are synthesized into a structured decision-support framework that allows strategies to be compared across locations and future conditions. Results are evaluated in relation to resilience benefit over time, sensitivity to sea-level rise scenarios, implementation feasibility, cost considerations, and ecological and regulatory constraints.

This synthesis supports prioritization by distinguishing between strategies that provide near-term stabilization, those that sustain function over longer planning horizons, and those that are constrained under projected conditions. Results are interpreted spatially to identify where specific intervention types are viable, conditionally viable, or not recommended, and where adaptive pathways may be appropriate.

Feasibility findings are used to refine conceptual design strategies in Task 3, inform selection of design pathways in the BOD, and provide direct technical input to the Land Conservation Suitability Assessment. This integration ensures that design development, land conservation decisions, and phased implementation are grounded in a consistent understanding of system performance and feasibility under future conditions.

Review, Coordination, and Deliverables

Findings from the feasibility assessment will be reviewed with MPPDC, DWR, Carlexson, and the project team to confirm assumptions, interpretation of results, and implications for subsequent tasks. Feedback from this review will be incorporated prior to finalization.

Deliverables for Task 5
• **Sea-level rise and marsh migration modeling outputs** used to evaluate intervention performance across future conditions. • **Hydrodynamic, wave, sediment transport, and morphology modeling outputs** supporting evaluation of shoreline stabilization, marsh enhancement, beneficial use of dredged material strategies. • **Planning-level cost estimates** for evaluated intervention types, including order-of-magnitude construction and lifecycle considerations. • **Feasibility and prioritization matrix** comparing intervention types and locations based on technical performance, cost, resilience benefit, and timing. • **Draft Resilience Feasibility Assessment Report** summarizing modeling assumptions, scenario framing, and evaluation methods. • **Feasibility Review Meeting** with MPPDC and Carlexson to discuss feasibility results, tradeoffs, and implications for conceptual design refinement. • **Final Resilience Feasibility Assessment Report** documenting modeling results, cost screening, prioritization outcomes, and recommended pathways forward.

Section 2.6 Task 6: Land Conservation Suitability Assessment

Task 6 develops a marsh-wide, spatial decision-support framework to identify priority areas for land conservation and restoration that support long-term resilience of the Guinea Marsh system. This task frames land conservation as an interconnected strategy with restoration, focused on protecting space for marsh migration, maintaining elevation gradients, sustaining ecological connectivity, and reducing future risk to natural and built systems under sea-level rise. Suitability findings explicitly build upon feasibility-tested system responses and management pathways identified in Task 5, ensuring that conservation priorities reflect both ecological opportunity and practical implementation constraints.

The Land Conservation Suitability Assessment applies a raster-based spatial modeling framework to evaluate where conservation and restoration actions are most effective, feasible, and durable over time. This framework integrates authoritative statewide datasets, project-specific analyses developed through earlier tasks, and targeted custom modeling to identify priority conservation systems and restoration opportunity areas. Results are translated into parcel-level and management-unit guidance to support actionable implementation decisions.

Analytical Framework and Scale

The suitability analysis is conducted using a GIS raster-based modeling approach that allows multiple physical, ecological, and land use factors to be evaluated together across the full marsh and watershed context. Analyses will overlay and summarize priorities from a combination of authoritative state or regional datasets along with specific data developed for this project to support marsh-scale decision-making. Where finer resolution data are available from the ECR or feasibility analyses, those datasets will be incorporated to refine results in priority areas. This includes higher-resolution elevation, berm condition, and migration threshold data where those factors influence management feasibility. This approach supports evaluation across multiple spatial scales, from landscape-level conservation systems to parcel-level implementation decisions, while maintaining analytical consistency. Marstel-Day is an award-winning, proven expert that has integrated the best data and science into 50+ land conservation planning or assessment efforts.

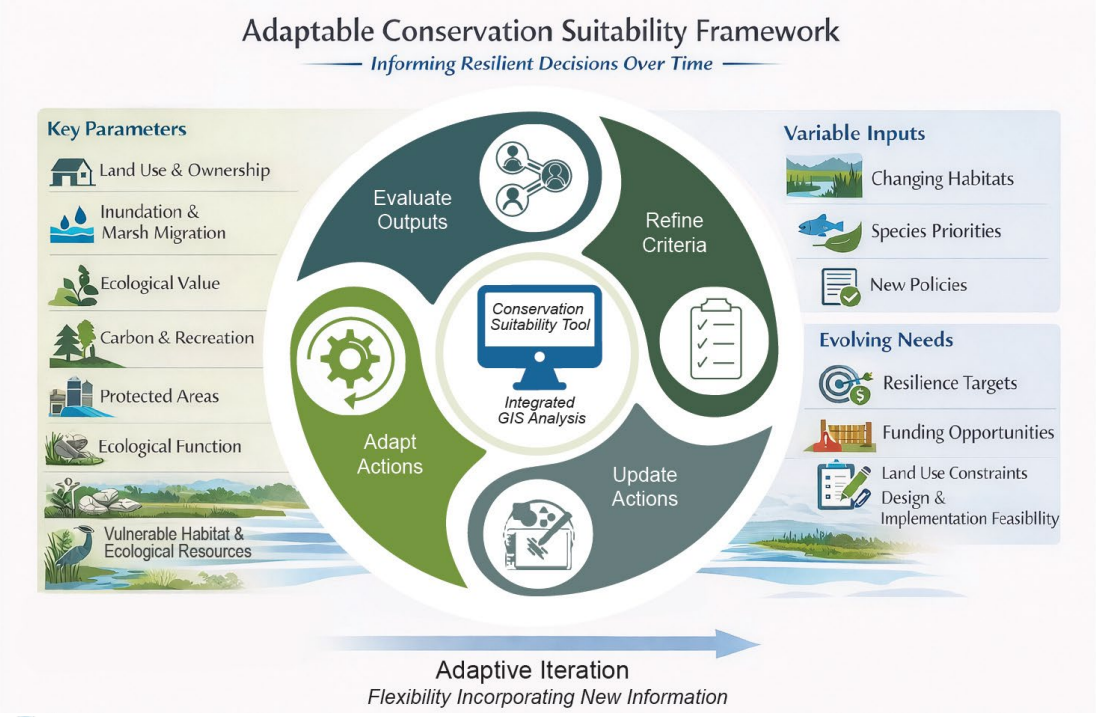


Figure 5: Marstel-Day's marsh scale, adaptable spatial decision-support framework identifies priority areas for land conservation and restoration that support long-term system resilience.

Conservation and Restoration Objectives

The assessment distinguishes between conservation goals and restoration goals, recognizing that each is informed by different data inputs and decision criteria. Conservation suitability focuses on identifying areas where protecting land or water space preserves future options for marsh migration, supports ecological connectivity, safeguards biodiversity, and reduces long-term exposure of critical infrastructure. Restoration suitability focuses on identifying locations where active interventions such as thin-layer placement, beneficial use of dredged material, shoreline stabilization, or hybrid measures are both technically feasible and likely to deliver sustained benefits.

Marsh migration suitability is further differentiated based on Task 5 findings, distinguishing locations where migration is expected to occur without intervention, locations where active management is required to produce healthy marsh, and locations where migration is unlikely or constrained regardless of management.

Both conservation and restoration priorities are evaluated within the same spatial framework to ensure that strategies are complementary and coordinated across the marsh system.

Data Integration and Modeling

The suitability framework integrates multiple categories of data, including:

- Physical and process-based data developed through the ECR and Resilience Feasibility Assessment, such as elevation, inundation exposure, shoreline change, sediment dynamics, and marsh migration potential.
- Ecological and habitat data from authoritative Virginia sources, including Virginia Natural Heritage Program data, state species habitat models, and other agency datasets relevant to marsh condition, biodiversity, and water quality.
- Land use, ownership, and infrastructure data needed to assess implementation feasibility, conservation mechanisms, and risk reduction opportunities.
- Targeted custom modeling outputs developed through this project, including marsh migration and sea-level rise response surfaces, saltwater intrusion transition zones, sediment suitability indicators, and connectivity analyses.

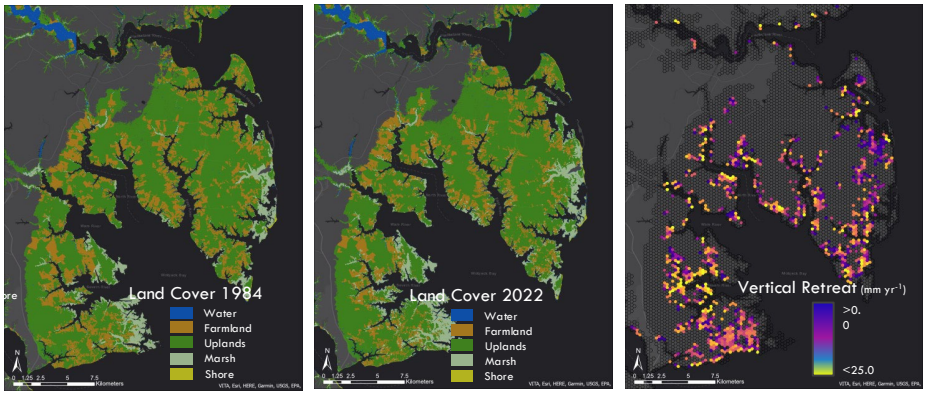


Figure 6: Land cover change map of the Mobjack Bay region, including the Guinea marshes WMA, with emphasis on marsh migration into retreating uplands. We will create a similar map specific to the Guinea marshes WMA., to support evaluation of migration opportunity, management constraints, and conservation prioritization under future conditions.

Where appropriate, ecosystem service indicators such as water quality protection, habitat value, and risk reduction benefits may be evaluated using established modeling approaches. The scope of ecosystem services modeling will be scaled to support planning-level decision-making without overcommitting beyond project needs. All datasets are organized within a consistent GIS framework, allowing relationships among physical processes, ecological function, and human influence to be evaluated directly, rather than as isolated layers.

Integrated Suitability and Feasibility Evaluation

Suitability results are informed by feasibility findings from Task 5, ensuring that conservation and restoration priorities reflect both system need and implementation practicality. Technical constraints, permitting considerations, sediment availability, land ownership, and access are incorporated alongside ecological and physical performance factors.

This integration ensures that areas prioritized for conservation align with feasible resilience pathways, including protection of migration corridors that reduce long-term intervention needs and identification of areas where conservation alone is insufficient without complementary restoration or management actions.

Application to Implementation Decisions

Suitability results are applied to three complementary unit types:

- Raster-based conservation and restoration suitability surfaces that identify priority systems across the marsh.
- Aquatic management units and shoreline segments derived from marsh processes and feasibility constraints.
- Parcels and infrastructure zones that translate spatial priorities into actionable conservation and implementation opportunities.

Each unit type is evaluated using ranking logic appropriate to its decision context. Results directly inform refinement of conceptual design siting, adjustment of design criteria within the BOD, and development of phased implementation strategies that align with feasibility-tested outcomes.

Decision Support for Adaptive Implementation

The Land Conservation Suitability Assessment produces decision-ready outputs, including suitability maps, prioritization tables, and GIS datasets with complete metadata. Documentation clearly explains how data were organized, how conservation and restoration priorities were identified and differentiated, how tradeoffs were evaluated through coordination with the project team and stakeholder input. Mapped results and ranking outputs support adaptive implementation as structured tools to support stakeholder engagement, enabling transparent discussion, refinement, and validation of prioritization decisions prior to finalization.

This task provides a clear, defensible framework for aligning land conservation and restoration actions within a marsh-wide resilience strategy, informed through coordination with the project team to confirm assumptions, priorities, and acceptable tradeoffs, ensuring that future investments are coordinated, flexible, and responsive to changing conditions over time.

Deliverables for Task 6
• **Land Conservation Suitability Assessment outputs** including maps, prioritization tables, and GIS data derived from raster-based analysis of physical, ecological, land use/ownership, and custom datasets to identify the most suitable conservation locations now and in the future. • **Land Conservation Suitability Assessment Documentation** capturing data organization, prioritization, and application of results for decision making purposes.

Section 2.7 Task 7: Environmental and Regulatory Documentation

Task 7 establishes a planning-level environmental and regulatory framework to support implementation of the finalized conceptual design strategies developed through Task 3, following integration of findings from the ECR, Resilience Feasibility Assessment, Land Conservation Suitability Assessment, and the design review workshop. This task identifies anticipated environmental effects, regulatory considerations, and feasible compliance pathways early enough to inform decision-making, while remaining appropriately scaled to a Phase I effort.

Rather than treating permitting as a downstream constraint, regulatory considerations are integrated into the planning process to reduce uncertainty, avoid infeasible pathways, and support efficient transition to future design and permitting phases. Environmental and regulatory documentation is informed by refined conceptual designs and supporting analyses, ensuring that regulatory risk is evaluated alongside technical feasibility, ecological performance, and land availability.

Regulatory Context and Constraints

Resilience actions within the Guinea Marsh system must navigate Virginia's coastal permitting framework, including regulation of tidal wetlands and subaqueous bottomlands by the Virginia Marine Resources Commission. Attention is required in areas where SAV is present and where proposed actions could alter existing habitat conditions.

Regulatory framing is based on the three refined conceptual designs advanced through Task 3. Historical shoreline imagery, geomorphic context, and system evolution are used to distinguish areas that historically supported upland or marsh habitat from areas that function as subaqueous habitat. Conceptual strategies are framed to prioritize restoration or stabilization within historically marsh or upland footprints where feasible, while preserving flexibility where SAV avoidance, preservation, or future recolonization is a priority. In some locations, this may include maintaining shallow open-water conditions behind shoreline features to support long-term habitat function.

Environmental Effects and Mitigation Considerations

An environmental evaluation summary will be prepared to describe anticipated effects of the refined conceptual designs at a planning level. This summary will characterize expected temporary and permanent effects associated with nature-based and hybrid interventions such as living shorelines, marsh enhancement, thin-layer placement, beneficial use of dredged material, and shoreline stabilization features.

Effects will be evaluated using outputs from the ECR, conceptual design development, and feasibility analyses, with focus on tidal wetlands, SAV, benthic habitat, water quality, and related ecological functions. The evaluation will distinguish short-term construction effects from long-term system response and emphasize net ecological benefit, resilience gains, and consistency with marsh-wide restoration objectives.

Where potential impacts are identified, the summary will outline anticipated avoidance, minimization, and mitigation considerations appropriate to each concept type. These considerations are intended to inform future permitting and design rather than prescribe project-specific mitigation at this stage.

Regulatory Pathways and Coordination

Task 7 will identify applicable county/local, state, and federal regulatory requirements and outline anticipated compliance pathways associated with the refined conceptual designs. This includes identifying likely permits, agency coordination needs, and key information requirements for subsequent phases. Regulatory permits that are anticipated to be required for these projects include VMRC subaqueous bottomlands and tidal wetlands permits, USACE Section 10 permit for work or structures placed in navigable waters, and USACE Section 404 permit for wetland restoration.

Documentation will be structured to support development of a draft Joint Permit Application by clearly describing project purpose, design intent, anticipated effects, and mitigation considerations. Findings will be coordinated with the project team and client representatives to confirm assumptions, identify regulatory sensitivities, and inform refinement of implementation pathways. A draft JPA package will be prepared that has been sufficiently field verified to address regulatory concerns and will have undergone sufficient pre-application coordination with the regulatory agencies to increase the likelihood of permit issuance when the time comes to advance the project to final design.

By completing Task 7, the project team establishes a clear, planning-level understanding of environmental effects, mitigation needs, and regulatory pathways tied directly to the refined conceptual designs. This supports informed decision-making during Phase I and positions priority strategies for efficient permitting and implementation in future phases.

Deliverables for Task 7
• **Draft Environmental Evaluation Summary** documenting anticipated environmental effects, potential mitigation needs, and applicable regulatory requirements and compliance pathways associated with the refined conceptual design strategies. • **Final Environmental Evaluation Summary** incorporating feedback from the project team and client to support future permitting, feasibility refinement, and implementation planning. • **Draft JPA package** that has been field verified sufficiently to increase likelihood of permit issuance.

Section 2.8 Task 8: Field Services (Optional Task)

Field services under Task 8 consist of targeted, site-specific data collection to support accurate characterization of physical, ecological, and geomorphic conditions within the Guinea Marsh system. These services are intended to supplement existing datasets where additional resolution or verification is necessary to support hydrodynamic analysis, sediment transport evaluation, marsh vulnerability assessment, and development of feasible, implementation-ready resilience strategies.

The extent, location, and resolution of field services will be determined collaboratively by the project team and client, informed by the ECR and integrated uncertainty evaluation. This approach ensures that field data collection is appropriately scaled to project needs and focused on information that materially improves analytical confidence and decision making.

LiDAR and Elevation Data Collection

High-resolution elevation data are essential for understanding marsh platform elevations, shoreline gradients, and upland transition zones that control marsh vulnerability, migration potential, and response to sea-level rise. Field services may include acquisition of LiDAR elevation data or refinement of existing elevation datasets in areas where current information does not adequately represent microtopography, marsh edges, or transitional landscapes. LiDAR data will be used to improve representation of elevation inputs for marsh response modeling, shoreline stability evaluation, and assessment of adaptation strategies such as thin-layer placement, berm construction, and hybrid shoreline features.

With extensive experience in challenging coastal environments, KCI's advanced point cloud surveying improves data quality, reduces field risk, and enables efficient, targeted investigations. These capabilities strengthen modeling and design inputs, support constructability evaluation, and enhance cost-effective decision-making for marsh resilience and shoreline restoration planning.

Bathymetric Surveying

Bathymetric data collection may be conducted to characterize nearshore and shallow subtidal areas that influence tidal exchange, wave transformation, sediment transport, and marsh edge processes. Accurate bathymetry is critical for representing hydrodynamic conditions and sediment pathways that affect erosion, and shoreline stability. Survey methods may include vessel-based or shallow-water bathymetric techniques, selected based on site access, water depth, and required resolution. Bathymetric data collected under this task will support development and refinement of hydrodynamic and sediment transport analyses and improve confidence in evaluation of shoreline and marsh resilience strategies.

Hydrodynamic and Sediment Transport Data Support

Field services under this task will be designed to support hydrodynamic, wave, sediment transport, and morphology analyses used to evaluate tidal circulation, wave climate, sediment erosion and deposition, shoreline response, and performance of nature-based and hybrid stabilization measures. Relevant data needs may include water levels, waves, meteorology data (e.g., rainfall, winds, storms) water depth, bed elevation, channel geometry, shoreline configuration, land cover, sediment characteristics, and indicators of active sediment transport. Data collected may be used to inform model inputs, boundary conditions, and model calibration parameters where existing information is insufficient to represent site-specific conditions.

Marsh Edge and Shoreline Condition Assessments

Field observations may be conducted to document marsh edge conditions, erosion patterns, shoreline retreat, sediment redistribution, and structural features influencing shoreline behavior. These assessments provide context for interpreting shoreline change analyses and support evaluation of stabilization, restoration, and sediment management strategies at priority locations.

Biological and Habitat Verification

Targeted biological and habitat verification may be conducted to confirm mapped conditions for marsh vegetation, SAV, and other sensitive ecological resources that influence design feasibility and regulatory considerations. Ground-truthing will be used to validate and refine existing datasets and decision-support tools, including the Shoreline Management Model and the VIMS Interactive Submerged Aquatic Vegetation Map.

Data Processing and Integration

All field data collected under Task 8 will be processed, quality-checked, and integrated into the project GIS framework consistent with the approach described in Task 2. Updated datasets will be used to refine analyses supporting vulnerability assessment, feasibility evaluation, conceptual design development, and BOD refinement.

Through targeted application of field services, Task 8 strengthens the technical foundation of the project by ensuring that critical physical processes are accurately represented and that resilience strategies are evaluated using defensible, site-specific information. This approach supports informed decision making and positions Phase I outcomes to advance toward implementation with confidence.

Deliverables for Task 8

- **Field survey datasets and associated metadata**, including LiDAR, bathymetric, shoreline condition, and biological or habitat verification data.
- **GIS-ready spatial datasets** integrating field-collected data with existing project datasets to support modeling, feasibility evaluation, conceptual design refinement, and BOD development.
- **Field Data Technical Summary** documenting field methods, data limitations, and how collected information improves analytical confidence and decision-making.

Section 2.9 Long-Term Solutions and Conceptual Sketches

The entire Guinea Marsh system has experienced significant land subsidence over the past 30 years that could benefit from thin layer placement of dredged material, but the largest land loss during that time has occurred on the northeastern, eastern, and southeastern facing shorelines. The preliminary concept design that has already been developed for those shorelines would require placement of hardened structures along those eroded shorelines to halt that erosion. We also recognize that this site's marshes have experienced significant fiddler crab bioturbation. Fiddler Crab Bioturbation is a leading cause of marsh collapse and subsidence in the Chesapeake Bay and throughout the east coast, which Marstel-Day and RES are experienced with identifying and mitigating. Marshes that are most resistant to wave erosion are the ones that are rooted in marine silts and clays. However, those are where fiddler crabs burrow, because the material supports the walls of the burrows. Eventually, too many burrows can result in marsh surface collapse, as can readily be observed at Guinea Marsh Wildlife Management Area (WMA).

Based on our knowledge of these existing conditions in the waters around the Guinea Marsh WMA, we have developed preliminary concepts for three different areas to facilitate a variety of project phasing and ecological restoration options. Our concepts would place the hardened structures further offshore in the vicinity of the historic limits of the Guinea Marsh shoreline. This would require greater initial quantities of rock than a simple shoreline placement but would serve the same immediate coastal resilience function as the direct shoreline placement while allowing many options for ecologically beneficial marsh, oyster, and SAV restoration in the shallow waters behind the offshore breakwaters including incorporating the beneficial reuse of dredged material, and all of those options can be phased based on availability of different sources and quantities of dredged material. When we replace the eroded clay marsh with an offshore rock breakwater and restore marsh elevations behind them using sandier dredged material, the restored marsh is less attractive for fiddler crab re-colonization because the sandy substrate will not support their burrows, thus minimizing the potential for future marsh subsidence due to fiddler crab bioturbation.

Our team is familiar with the project area and understands that project site access can only be achieved by water. Since all materials, equipment, and crews must be transported to the project areas by barge and boat, water depths both nearshore and offshore will dictate the means and methods to accomplish the work. We also understand the complex regulatory permitting challenges associated with projects like this, beginning with acquisition of Section 10 permits for temporary mooring of barges and equipment and the permanent installation of the breakwaters in navigable waters, while simultaneously obtaining US Army Corps of Engineers (USACE) Section 404 permits, Virginia Department of Environmental Quality (VDEQ) Section 401 permits, and the Virginia Marine Resources Commission (VMRC) and Local Wetlands Board permits for the restoration activities, and are experienced in navigating those complex permitting challenges.

Figure 7: Exemplary conceptual design approaches for the Guinea Marsh system illustrating offshore sill placement along historically eroded shorelines, integration of dredged material for marsh elevation recovery, and phased habitat restoration strategies that respond to subsidence, wave exposure, access-by-water constraints, and long-term marsh stability. – 34.55 acres (north), 28.25 acres (central), and 12.55 acres (south).

Marsh edge erosion and subsidence causing significant concern to marsh loss. Credit VA SeaGrant

Section 3. Innovation and Resilience Integration

Innovation in the Guinea Marsh GRIT Phase I effort lies in structuring resilience planning to integrate marsh science, targeted field observations, modeling, and implementation experience into an adaptive decision-support framework that functions under uncertainty and changing coastal conditions. This approach treats resilience as infrastructure—embedding land conservation, marsh migration space, adaptive design logic, and decision workflows as essential systems that enable nature-based and hybrid solutions to perform and evolve over time rather than degrade.

A central element of this resilience infrastructure is the establishment of a living baseline. Initial conditions documented in the ECR are treated as a starting point rather than a fixed reference. As additional analyses, modeling, engagement, and feasibility testing are completed under subsequent tasks, the baseline is intentionally revisited, refined, and updated to reflect improved understanding of vulnerability, risk, and system behavior. This approach creates a durable foundation for future decision-making that can be revisited as interventions occur or as new stressors emerge. This living system reduces vulnerability and optimizes performance.

Stakeholder and partner engagement is integral to this process. Engagement is used not only to inform priorities, but to fill data gaps, test assumptions, and validate how scientific and technical findings translate into real-world decision-making. In this way, engagement functions as a core input to the resilience framework rather than a parallel or downstream activity.

Rather than treating resilience as resistance to erosion or inundation at a fixed point in time, this effort evaluates resilience as the capacity of the Guinea Marsh system to persist, adapt, and reorganize over multiple planning horizons. Nature-based and hybrid strategies are assessed for near-term effectiveness, as well as durability, flexibility, and compatibility with projected sea-level rise, sediment dynamics, regulatory constraints, and land-use context. This framing reflects the team's experience delivering long-lived shoreline and marsh interventions designed under future sea-level rise scenarios, including adaptive berm and shoreline stabilization projects at Naval Support Activity (NSA) Annapolis and iterative restoration efforts at Marine Corps Base (MCB) Quantico, where long-term performance, adaptability, and post-construction management were fundamental design drivers.

For example, at MCB Quantico, the grading of the living shoreline was designed and revised to maximize marsh migration over time, and innovative technologies such as floating islands and breakwater units that promote oyster growth were incorporated into the design. While the initial design achieved the baseline resilience goals at the MCB Quantico site, the design details were curated through an iterative process to strengthen habitat benefits and resilience over time. This approach treats resilience not as a fixed design outcome, but as a managed system of interconnected actions, supported by decision frameworks that evolve with conditions, priorities, and constraints.

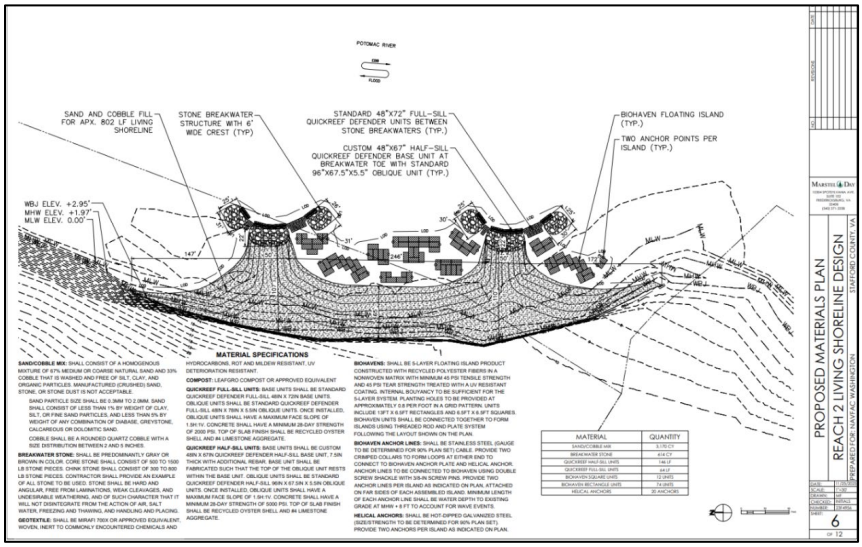


Figure 8: Example of innovative design using hybrid strategies, tombolo breakwater design, floating islands, Quickreef oyster structures, and adaptive marsh creation.

Section 3.1 Adaptive Design as an Organizing Principle

Adaptive management is embedded as an organizing principle across all Phase I tasks through a multi-loop, feedback-driven process, similar to mature technical and organizational innovation frameworks. Rather than following a single linear progression from data collection to recommendations, the approach intentionally allows insights generated at each phase to inform, refine, and recalibrate all other phases multiple times as understanding evolves outlined in Section 2 (Figure 1).

Initial synthesis of existing conditions and targeted field data informs the vulnerability assessment and modeling. Vulnerability findings shape the development of conceptual resilience strategies and identify where additional data resolution or focused analysis is warranted. Feasibility testing, including technical, ecological, regulatory, and implementation considerations, then feeds back into earlier assumptions. This feedback prompts refinement of concepts, adjustment of performance expectations, or reconsideration of strategy viability. This cycle may occur repeatedly throughout Phase I, ensuring that new information is incorporated as it becomes available rather than deferred to later phases. Figure 8 provides a visual representation of this stepwise, feedback-driven structure as it has been applied to this planning process.

Adaptive management is operationalized through the identification of vulnerability thresholds and performance limits rather than fixed design endpoints. Metrics are selected to reflect system behavior, such as elevation capital, exposure, sediment balance, and ecological response, and are intentionally structured to evolve as conditions and priorities change. Trigger points are established to indicate when adaptation, scaling, or reprioritization is warranted, allowing resilience goals and strategies to shift as the system responds to new inputs. Importantly, metrics and trigger points are not treated as fixed decision points; they are weighted and interpreted in relation to project goals and stakeholder priorities that may evolve over time.

Vulnerability thresholds and performance limits are used to define trigger points for adaptation. When thresholds are approached or exceeded, the framework supports reassessment of strategy selection, scaling, sequencing, or the need for additional intervention. This ensures that resilience actions remain responsive to changing conditions rather than locked to assumptions established early in the planning process.

This structure reflects practical experience delivering shoreline and marsh projects where survey results, modeling outputs, regulatory feedback, and constructability considerations must be reconciled iteratively. One example is the phased, survey-driven shoreline restoration design process implemented at MCB Quantico. By enabling information from any task to influence all others, the multi-loop process operationalizes adaptive design. It ensures that uncertainty is addressed proactively, thresholds and constraints are identified early, and conceptual strategies remain responsive to both scientific findings and real-world implementation considerations.

Section 3.2 Integration of Nature-Based and Climate-Resilient Strategies

Nature-based solutions, including marsh restoration, living shorelines, and hybrid shoreline features, are evaluated as components of an integrated marsh–shoreline–upland system, rather than as isolated design treatments. Beneficial use of dredged material and thin-layer placement are considered in relation to marsh elevation capital, geomorphic setting, sediment supply, and ecological response, recognizing that their effectiveness depends on system-scale conditions rather than construction feasibility alone.

This perspective reflects direct experience evaluating sediment-based marsh resilience strategies through historical analysis, targeted field investigations, and future condition modeling, such as the beneficial use site scoping conducted for Naval Submarine Base (NSB) Kings Bay. In that context, restoration viability depended not only on sediment availability, but also on timing, elevation targets, land ownership, and long-term marsh response under sea-level rise. These same considerations directly inform how beneficial use and thin-layer placement are evaluated for Guinea Marsh.

Marstel-Day received the 2025 Climate Change Business Journal, Business Achievement Award in Project Merit: Climate Change Adaptation and Resilience for Beneficial Uses of Dredged Material.

The Beneficial Use Site Scoping for NSB Kings Bay was awarded this honor for the innovative analytical and collaborative methods used to evaluate large-scale marsh loss.

The approach explicitly distinguishes between strategies that primarily buy time and those that meaningfully increase long-term adaptive capacity, allowing MPPDC to understand where short-term stabilization is appropriate and where investment in adaptability and migration potential is required. Land conservation and marsh migration suitability are treated as resilience infrastructure, essential to sustaining ecological function and protecting the longevity of restoration or stabilization investments over time and under changing conditions. Conservation, restoration, and engineered elements are therefore evaluated together as complementary components of a resilient system.

Section 3.3 Innovation as Decision Support for Implementation

The primary innovation of this approach lies in how resilience analysis is translated into actionable, defensible guidance. This approach builds directly on Marstel-Day's experience designing adaptive, resilience-driven decision-support systems for large, complex landscapes. Notably, Marstel-Day led development of an innovative, GIS-based, parcel-level conservation planning framework for the New River and Eastern Divide Conservation Plan, spanning 11 counties in Southwest Virginia. The framework integrated authoritative state and federal datasets, academic research, and local expertise across multiple interrelated systems, including habitat, water resources, climate resilience, wildlife connectivity, and land-use pressure. In 2025, this work was recognized with a Virginia Governor's Environmental Excellence Award.

Rather than producing a static prioritization, the framework was intentionally designed as a living decision-support system, with metrics weighted to reflect evolving priorities and system conditions. Parcel-level rankings automatically recalibrate as new data, updated climate projections, or shifting conservation goals are introduced, allowing users to test scenarios, explore alternative futures, and support adaptive management over time. This same philosophy, treating nature-based solutions, green infrastructure, and conservation as adaptable resilience infrastructure rather than fixed design outcomes, directly informs the innovation and decision-support approach applied to the Guinea Marsh GRIT Phase I effort. Rather than producing abstract vulnerability metrics or prescriptive designs, the Phase I effort delivers implementation-ready concepts supported by transparent assumptions, feasibility stress-testing, and explicit consideration of future adaptation needs.

The decision-support framework is intentionally action-oriented, structured to inform conceptual design, the permitting strategy, implementation sequencing, long-term maintenance, and future reinvestment across multiple planning horizons. Outputs are designed to support prioritization, scaling, and scheduling decisions, enabling alignment with funding availability, dredging cycles, regulatory milestones, governance constraints, and operational capacity. Stakeholder engagement is embedded within this framework as a data-generating and validation tool, rather than as stand-alone outreach. Engagement inputs are used to help fill data gaps, test assumptions, clarify priorities, and inform tradeoff decisions where scientific or technical uncertainty exists. In combination with marsh science, field observations, and modeling, this approach supports the development of a baseline vulnerability assessment that reflects current conditions while explicitly recognizing uncertainty.

Critically, this baseline is not treated as static. The framework establishes a process to revisit and update baseline vulnerability and performance assumptions as additional analyses are completed, as interventions are implemented, or as new stressors emerge. This creates a living decision-support system that can be revisited over time to reassess risk, refine priorities, and guide future investment.

Engineering analyses are applied to evaluate performance limits, wave attenuation potential, sediment behavior, and constructability. Marsh science and field observations guide decisions about where interventions are fundamentally viable and where alternative strategies are warranted. This reflects experience delivering adaptive shoreline stabilization and marsh restoration projects, such as the Greenbury Point Berm at NSA Annapolis, where long-term sea-level rise projections, regulatory constraints, and post-construction monitoring requirements were integral to feasibility and design decisions from the outset.

The resulting products enable MPPDC to make informed decisions about where to invest, how to sequence actions, and when adaptation or refinement will be required, rather than locking in static solutions that may underperform over time.

By integrating technical analysis, stakeholder input, and feasibility testing within a single planning-led framework, the decision-support system enables transparent tradeoff evaluation and defensible decision-making in the presence of uncertainty. This approach is fully consistent with best practices outlined in the U.S. Climate Resilience Toolkit, supporting iterative risk assessment, adaptive management, and long-term resilience planning.

Section 3.4 Operationalizing Resilience for Phase 1

This integrated approach ensures that Phase I deliverables function as decision-support tools rather than static reports. Nature-based and hybrid strategies are evaluated for durability and adaptability. Beneficial use of dredged material is assessed in relation to sediment supply, timing, and ownership constraints. Conservation is treated as a foundational resilience investment. Engineering analysis is used to test limits and performance rather than to pre-select solutions.

This approach reflects direct experience developing adaptive decision-support systems in which metrics are weighted based on priorities that can change over time. In these efforts, baseline conditions and performance indicators are intentionally revisited as new information became available, allowing resilience strategies to be optimized as a managed system rather than evaluated against a static reference condition.

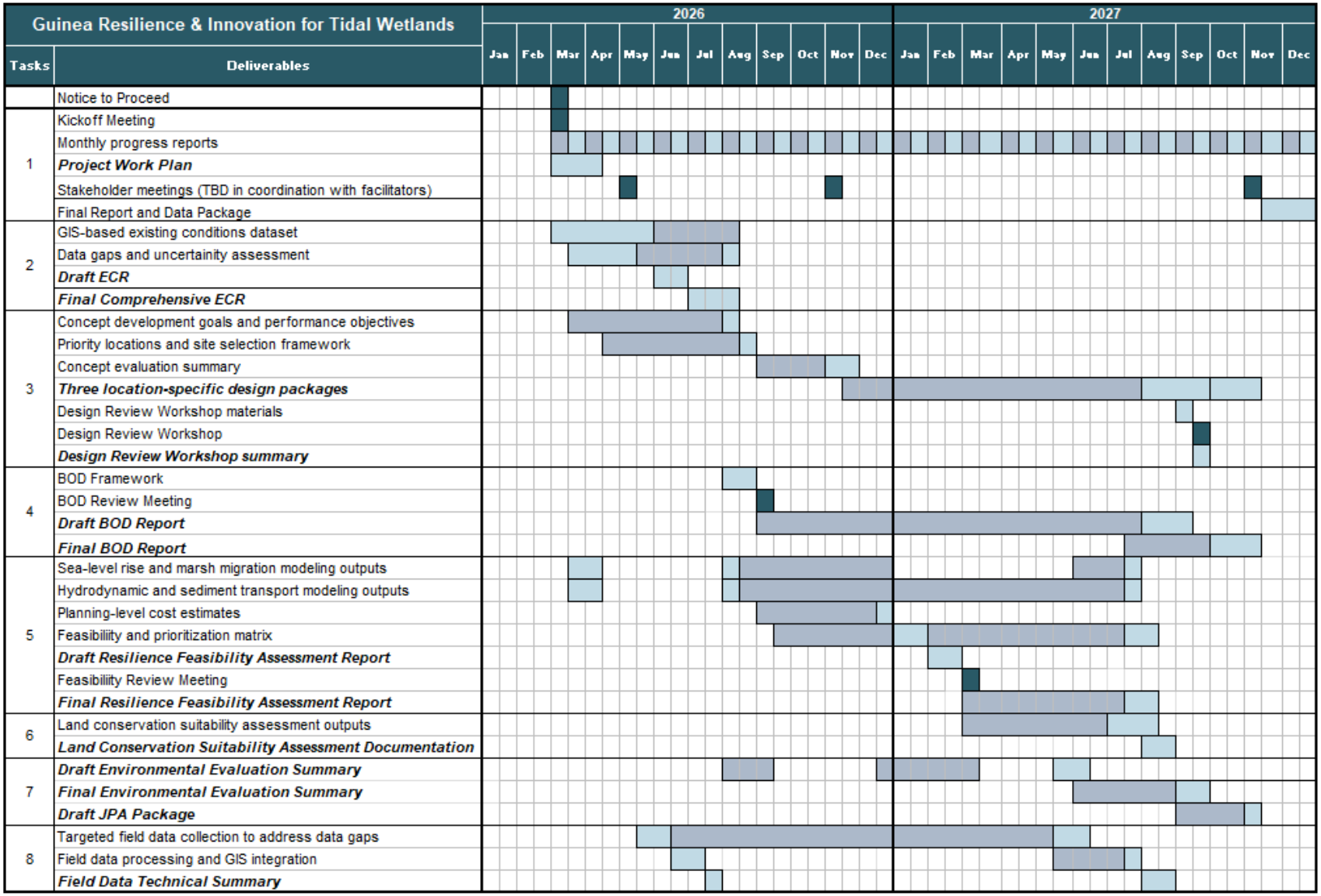
By structuring the effort around adaptive, multi-loop learning and implementation-ready feasibility, grounded in experience from adaptive berm stabilization, beneficial use planning, and iterative shoreline restoration, the project delivers innovative yet practical guidance that positions MPPDC to pursue durable, fundable, and adaptive resilience investments in a dynamic marsh system.

Figure 9 - Phase I deliverables function as decision-support tools that incorporate a resilience management framework.

Inundation and Sea-level Rise contributing to island loss. Credit VA SeaGrant

Section 4. Schedule and Deliverables

The schedule presented below illustrates a preliminary, milestone-based framework for completing Phase I activities within the overall project timeframe, with final completion anticipated by December 31, 2027. It illustrates task sequencing, interdependencies, review periods, and key milestones, and reflects a planning-led approach in which early baseline characterization, data synthesis, and uncertainty evaluation are intentionally sequenced to inform subsequent conceptual development, feasibility analysis, and regulatory documentation. This schedule is intended to demonstrate the realism and completeness of the proposed workflow, identify key review checkpoints, and show how parallel coordination among tasks supports continuity and efficiency. The schedule will be refined and finalized through the Project Work Plan developed at project initiation, allowing adjustments to sequencing, review windows, and task overlap as coordination with MPPDC and project partners progresses.


Guinea Resilience & Innovation for Tidal Wetlands
2026
2027
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Tasks
Deliverables
Notice to Proceed
1
Kickoff Meeting
Monthly progress reports
Project Work Plan
Stakeholder meetings (TBD in coordination with facilitators)
Final Report and Data Package
2
GIS-based existing conditions dataset
Data gaps and uncertainity assessment
Draft ECR
Final Comprehensive ECR
3
Concept development goals and performance objectives
Priority locations and site selection framework
Concept evaluation summary
Three location-specific design packages
Design Review Workshop materials
Design Review Workshop
Design Review Workshop summary
4
BOD Framework
BOD Review Meeting
Draft BOD Report
Final BOD Report
5
Sea-level rise and marsh migration modeling outputs
Hydrodynamic and sediment transport modeling outputs
Planning-level cost estimates
Feasibility and prioritization matrix
Draft Resilience Feasibility Assessment Report
Feasibility Review Meeting
Final Resilience Feasibility Assessment Report
6
Land conservation suitability assessment outputs
Land Conservation Suitability Assessment Documentation
7
Draft Environmental Evaluation Summary
Final Environmental Evaluation Summary
Draft JPA Package
8
Targeted field data collection to address data gaps
Field data processing and GIS integration
Field Data Technical Summary
Meeting
Passive monitoring/evaluation
Deliverable / supporting task

4.1 Project Schedule and Review Checkpoints

Marstel-Day proposes a realistic, task-driven schedule that aligns with the Project Timeline, based on a predicted Notice to Proceed in early March 2026, and is structured around clear technical benchmarks, iterative review points, and decision checkpoints. The schedule reflects a planning-led, adaptive workflow in which early baseline characterization and data synthesis directly inform conceptual development, modeling, feasibility evaluation, and subsequent design refinement.

Work proceeds from early project initiation and baseline data development through conceptual design, feasibility testing, and regulatory documentation, with targeted overlap among tasks where appropriate to support efficiency and continuity. Deliverables are shown as physical deliverable checkpoints, while passive monitoring/evaluation shows continuous work in progress, Monthly Progress Reports (MPR) exemplifies this method with reoccurring blocks for each report and with passive evaluation in between to show continued preparation. Early emphasis is placed on completion of the Comprehensive ECR and identification of data gaps, allowing targeted field services and modeling preparation to occur at the point of greatest value. Early modeling will be conducted alongside the uncertainty assessment as part of the data gaps analysis. Data collected will be summarized to inform the pre-existing ECR and subsequent assessments. Modeling is performed as iterative runs, rather than as a single-pass analysis, that becomes more refined as new data is collected. Concept development is coordinated closely with existing conditions synthesis and stakeholder input, ensuring that conceptual strategies are grounded in system understanding from the outset.

Formal review checkpoints are embedded at the completion of major draft deliverables, including the Existing Conditions Report, Concept Development and Framework, Basis of Design Reports, Resilience Feasibility Assessment, Environmental Evaluation Summary, and draft JPA package. Draft outputs are intentionally used as interim review checkpoints, allowing assumptions, methods, and preliminary findings to be evaluated and confirmed before refinement and finalization. These checkpoints provide structured opportunities for MPPDC and project partners to review findings, confirm assumptions, and guide progression to subsequent tasks. Draft and final deliverables are sequenced to allow sufficient review time while avoiding conflicts with seasonal availability constraints.

4.2 Schedule Management and Optimization

Marstel-Day actively manages project schedules through a structured project management framework that emphasizes coordination, accountability, and transparency across the full project team. The Project Manager serves as the single point of contact for MPPDC and is responsible for tracking progress across all tasks, coordinating inputs from teaming partners, and maintaining alignment with the approved work plan and schedule.

Schedule optimization strategies include early confirmation of data availability and modeling needs to minimize rework, deliberate sequencing of draft deliverables to support informed review, and parallel coordination between planning, modeling, and design teams where tasks are interrelated but not dependent. Standing coordination meetings with task leads are used to manage task interfaces, address dependencies, and resolve issues efficiently.

Draft review cycles are intentionally incorporated to surface technical or stakeholder concerns early, reducing the likelihood of late-stage revisions. Monthly progress reports provide routine documentation of completed work, upcoming activities, schedule status, and emerging issues, allowing for proactive schedule adjustments as needed to continually optimize the schedule, while maintaining momentum toward key milestones.

4.3 Schedule Risks and Mitigation Strategies

The team recognizes that coastal resilience planning efforts may encounter schedule risks related to data availability, modeling uncertainty, stakeholder coordination, or regulatory complexity. Marstel-Day incorporates risk-aware planning throughout the project to preserve schedule integrity while maintaining technical rigor.

Potential schedule challenges and corresponding mitigation measures include early identification of data gaps and uncertainty through the Existing Conditions Report, followed by targeted field services to address critical information needs. Modeling complexity is managed through phased and scenario-based approaches, allowing preliminary results to inform design and feasibility decisions before final refinement. Conceptual Design Development is an integral part of the shared project framework, where all review checkpoints are used for design considerations, and where stakeholder meetings also account for additional QA/QC. Stakeholder availability constraints are addressed through advance scheduling of workshops and review meetings, with flexibility built into review windows to accommodate agency and partner coordination needs.

Regulatory considerations are addressed through early planning-level evaluation and documentation that frames anticipated impacts, mitigation needs, and compliance pathways, supporting efficient future permitting without introducing delays late in the project. Together, these strategies ensure the project remains on schedule while supporting informed, defensible decision-making throughout the planning and design process.

High energy areas vulnerable to continued subsidence and collapse. Credit VA SeaGrant

Section 5. Qualifications and Experience

Marstel-Day is a natural resources and environmental consulting firm that provides management, planning, assessment, compliance, design, facilitation, and outreach and engagement services. Together with its teaming partners, RES, VIMS, Taylor, and KCI (formerly McLaren), Marstel-Day offers a well-rounded team of engineers, scientists, analysts, designers, project managers, and planners to deliver a robust and technically sound coastal resilience solution for the Guinea Marsh.

Marstel-Day is a small-business environmental consulting firm with more than 20 years of experience delivering planning-led, data-informed solutions to complex natural resource and coastal resilience challenges. Our interdisciplinary team includes resilience planners, landscape architects, ecologists, and geospatial analysts who specialize in integrating science, engineering, land use, and stakeholder priorities into clear, defensible decision frameworks. Marstel-Day approaches projects as adaptive planning efforts rather than linear design exercises, ensuring that technical analyses directly support implementation decisions under uncertainty. For the Guinea Marsh project, Marstel-Day serves as Prime and integrator, leading project management, stakeholder coordination, GIS-based decision support, and quality control while ensuring that all technical work remains aligned with marsh-wide resilience objectives and long-term implementation pathways.

Marstel-Day brings extensive experience throughout coastal Virginia and the Chesapeake Bay region, including shoreline stabilization, living shoreline planning, marsh restoration support, beneficial use of dredged material studies, land conservation planning, and climate resilience assessments. Our work consistently emphasizes adaptive pathways, phased implementation, and avoidance of maladaptation by testing where, when, and under what conditions strategies are appropriate. This planning-led approach positions Marstel-Day to coordinate complex, multi-partner efforts and translate scientific and engineering analyses into actionable outcomes that support funding, permitting, and future construction.

Resource Environmental Solutions (RES) contributes deep, full-lifecycle expertise in nature-based and hybrid restoration, ecological feasibility, and regulatory strategy. RES has extensive experience designing, permitting, constructing, and stewarding tidal marsh, living shoreline, and sediment-based restoration projects throughout Virginia and the Mid-Atlantic. For this project, RES supports evaluation of ecological feasibility, constructability, and biological performance for strategies such as thin-layer placement, beneficial use of dredged material, marsh enhancement, and hybrid shoreline stabilization. RES also provides critical regulatory insight related to tidal wetlands, subaqueous bottomlands, SAV, and Joint Permit Application requirements, ensuring that conceptual strategies and feasibility findings are positioned for efficient future permitting.

Virginia Institute of Marine Science (VIMS) provides Virginia-based scientific leadership in coastal processes, shoreline change, sediment transport, and living shoreline performance. VIMS researchers bring decades of applied experience studying tidal marsh dynamics, wave mechanics, sediment behavior, and shoreline evolution across the

Chesapeake Bay and Virginia's coastal systems. Their role strengthens interpretation of existing conditions, supports defensible assumptions about marsh and shoreline response under sea-level rise, and informs both feasibility evaluation and regulatory framing. VIMS' applied research perspective ensures that resilience strategies are grounded in observed system behavior and aligned with current scientific understanding of marsh sustainability and coastal change.

Taylor Engineering, Inc. (Taylor) provides advanced coastal engineering and state-of-the-art numerical modeling expertise to evaluate hydrodynamics, waves, sediment transport, and shoreline response under representative and extreme storm conditions. Taylor's experience spans shoreline stabilization, sediment management, inlet and bay systems, and resilience planning, with strength in testing how alternative strategies perform over time rather than assuming static design conditions. For Guinea Marsh, Taylor leads modeling and sensitivity analyses that inform feasibility evaluation, performance thresholds, and adaptive triggers, including analyses relevant to sediment placement and beneficial use of dredged material. Taylor's prior collaboration with Marstel-Day on the Kings Bay Marsh Analysis strengthens coordination between planning-led decision frameworks and engineering performance evaluation.

KCI Technologies, Inc. (KCI) provides specialized hydrographic surveying expertise, including multibeam bathymetric data collection and processing to support model-ready datasets. KCI's experience conducting high-resolution bathymetric surveys across coastal and estuarine systems ensures accurate representation of nearshore and shallow subtidal conditions where additional data are needed to reduce uncertainty. Their work supports hydrodynamic and sediment transport analyses and strengthens confidence in feasibility testing and conceptual design assumptions. KCI and RES have a long history of working together on regional projects, supporting efficient coordination between field data collection and restoration planning.

Together, this team functions as an integrated, planning-led partnership with demonstrated experience working collaboratively across disciplines. Each task is led by the firm best suited to provide technical leadership, supported by complementary expertise from the broader team. Marstel-Day maintains overall integration and decision management so that existing conditions, modeling, feasibility testing, land conservation suitability, and regulatory documentation inform one another through structured feedback loops. This coordinated approach ensures that the Guinea Marsh project delivers technically rigorous, locally informed, and implementation-ready outcomes that support a resilient marsh system over time.

The table below highlights the key team members that would support this project. The team members bring valuable experience encompassing the entire project process, from on-the-ground surveys to desktop analyses, modeling, design and engineering, permitting and grant writing, and stakeholder engagement and facilitation. While each team member brings a unique skillset to this project, they are unified by expertise in, and passion for, resilient and sustainable coastlines.

Organization	Team Member	Role	Value
Marstel-Day	Garrett Wolf, PhD, AICP	Project Manager, Resilience Planner	16 years of diverse experience in coastal resilience planning and design, integration of scientific modeling, stakeholder engagement, and project management
	Meredith Miller	Environmental Planner	25 years of experience in sustainable land use and resilience planning, coastal zone management, risk analyses, funding, and grant writing
	Jason Winner, AICP, PLA, GISP, LEED AP	Conservation Planner; Technical Advisor	27 years of experience with a strong focus on resilience and adaptation planning and expertise in facilitation and stakeholder engagement
	Patrick Boyle, ASLA	Landscape Designer	5 years of experience with a background in marine science and landscape architecture applied to coastal resilience design, natural resource management, and permitting
	Kole Dufore	GIS and Remote Sensing Specialist; Conservation Planner	15 years of GIS and remote sensing experience supporting conservation and sustainability planning, including landscape-scale spatial analysis, shoreline and resilience assessments
RES	Robin Bedenbaugh	Wetland Restoration Specialist/ Regulatory Framework Strategist/Biological Surveyor	43 years of wetland restoration experience spanning site analyses, design, and construction for federal, state, local, and private clients
	Joe Caterino, PE	Water Resource Engineer	29 years of experience with water resource projects defining restraints related to flood resiliency and stream & shoreline restoration
	Benjamin Guempel	GIS Analyst	20 years of experience in GIS analysis, field data integration and management, modeling, and web application development
	Kelsey Gray, PWS	Restoration Specialist	14 years of experience with proficiency in wetland delineations, stream assessments, wetland mitigation, living shorelines, and restoration design
	Bailey Wilfong, PE, LEED AP BD+C	Technical Specialist	17 years of experience with over a decade of specialized work with ecosystem restoration, including all phases of the project from analysis through permitting and design
VIMS	Scott Hardaway, Jr.	Living Shoreline Scientist/Environmental Compliance Specialist	50 years of experience in coastal systems processes and analyses including shoreline change, sediment transport, wave mechanics, and research experience in living shorelines and shoreline management planning
	Donna Milligan	Regulatory Research Scientist/Data Auditor	34 years of experience with a strong research background in coastal geomorphology, shoreline change, and living shoreline performance

Organization	Team Member	Role	Value
Taylor	Christopher Bender, PhD, PE, BCCE	Lead Coastal Engineer	22 years of coastal engineering experience specializing in simulation and analysis of coastal processes including wave mechanics, sediment transport, and shoreline protection
	Michael Kabiling, PhD, PE, CFM	Hydraulic Engineer/ Hydrodynamics Analyst	33 years of experience in coastal engineering and water resources with a strong focus on numerical modeling for hydraulic analyses
	Duncan Greer, PE	Environmental Engineer/Coastal Analyst	13 years of coastal engineering experience leading projects from modeling and analysis through design, permitting, and construction
	Wendy Laurent, PE, WEDG	Ocean Engineer/Coastal Strategist	9 years of experience with an emphasis on resilient coastlines, nature-based solutions, and system-based problem solving
KCI	J.J. Woolley, PE	Marine Surveyor	15 years specializing in marine / waterfront construction, analysis, and design of maritime structures, vessel operations, underwater construction inspections, and resident engineering.
	Michael Valente, EIT	Land Surveyor	4 years of marine engineering, structural inspection, surveying, data analysis, and drafting experience.
	Samuel Zook	Land Surveyor	19 years of experience with topographic + boundary surveys, hydrographic + bathymetric surveys, aerial (drone) surveys, vault surveys, and highway, sewer, and water main projects.

The following sections include the resumes (Section 5.1) and past performance examples (Section 5.2) for Marstel-Day and its project partners.

Section 5.1 Resumes

The proposed project team brings exceptional depth, credentials, and regional experience to support delivery of the Guinea Marsh resilience planning effort. Collectively, the team includes more than 25 professionals, the majority of whom hold graduate degrees in planning, engineering, marine science, ecology, landscape architecture, or related disciplines. The team includes multiple licensed professionals, including Professional Engineers (PE), Professional Geologists (PG), Certified Planners (AICP), Professional Landscape Architects (PLA), Professional Wetland Scientists (PWS), and GIS Professionals (GISP), as well as staff with specialized certifications in living shoreline design, coastal resilience, facilitation, and nature-based solutions. Team members bring extensive experience working throughout Virginia's coastal and tidal systems, including direct experience within the MPPDC region and comparable Chesapeake Bay environments.

Marstel-Day provides a robust professional staffing structure capable of supporting planning, analysis, stakeholder engagement, technical coordination, and long-term implementation support. In addition to core planning and design staff, Marstel-Day maintains in-house expertise in GIS and remote sensing, resilience modeling, facilitation, and regulatory coordination, allowing the firm to manage complex, multidisciplinary efforts while maintaining continuity from assessment through implementation planning. This depth enables Marstel-Day to scale staff resources as needed to support project development, training, implementation sequencing, and adaptive management.

The team reflects both corporate and individual experience working together. Marstel-Day and Taylor previously collaborated on the Kings Bay Marsh Analysis for Beneficial Use of Dredged Material, integrating planning-led decision frameworks with advanced sediment transport and hydrodynamic modeling. RES and KCI have worked extensively together across Virginia and the Mid-Atlantic on biological surveys, hydrographic data collection, and restoration-support field investigations. In addition, individual team members bring prior collaborative experience with VIMS through Department of Defense Chesapeake Bay initiatives, shoreline management planning, living shoreline research, SAV assessment, and oyster and marsh restoration projects. This shared experience reduces coordination risk and supports efficient, seamless collaboration.

The project team is organized to ensure clear lines of communication, defined roles and responsibilities, and strong technical leadership for each task. Marstel-Day's Project Manager will serve as the single point of contact with MPPDC, providing overall coordination, schedule and quality control, and integration across tasks. Each major task is led by the firm best suited to provide subject-matter leadership, supported by designated staff from partner organizations to ensure depth, continuity, and cross-disciplinary integration. Although the team includes multiple firms, it operates as a fully integrated unit, structured to function seamlessly through shared workflows, regular coordination, and unified project management.

The organization chart that follows illustrates this structure and demonstrates how Marstel-Day leads an integrated, planning-driven team that combines local knowledge, scientific rigor, engineering analysis, and regulatory expertise to deliver actionable, implementation-ready outcomes for the Guinea Marsh system.

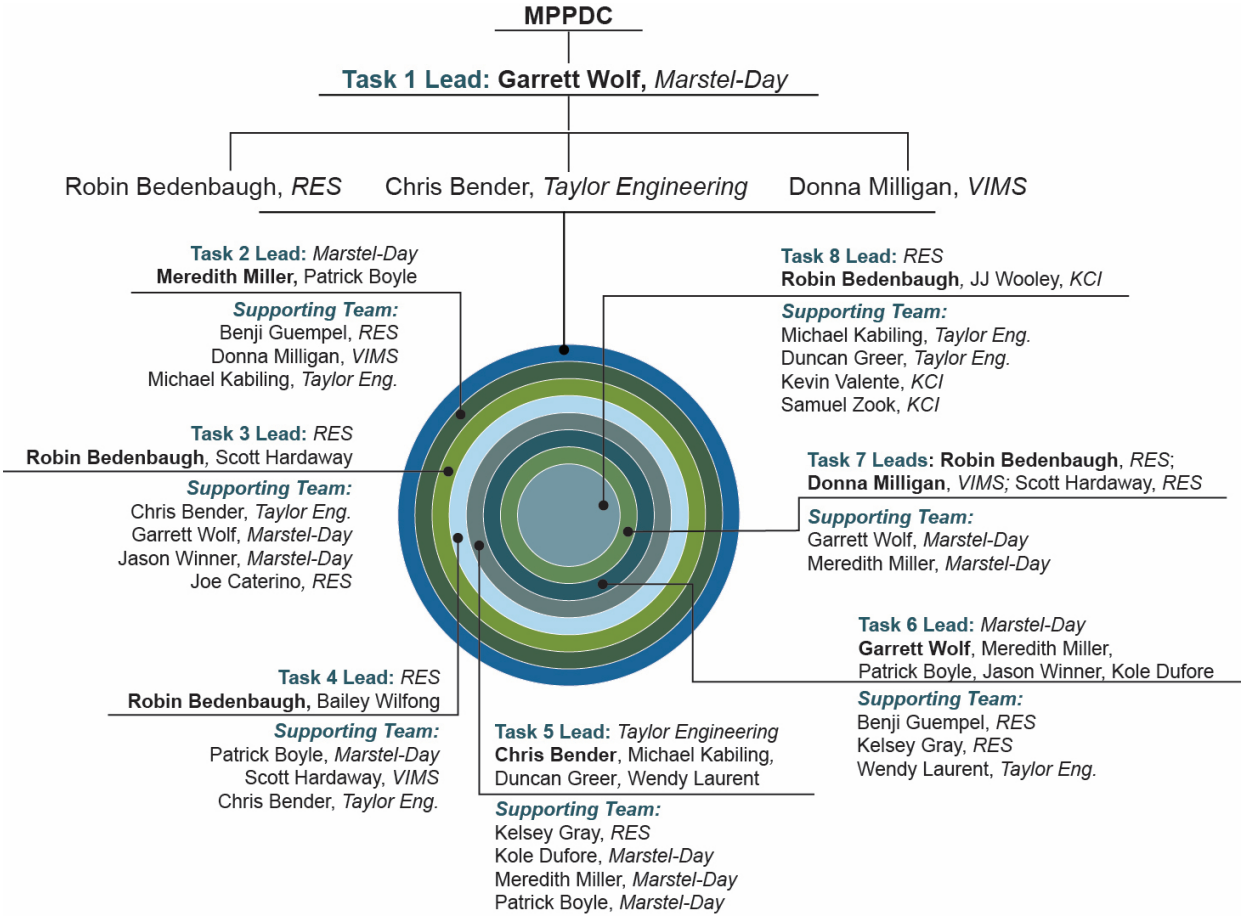


Figure 10: Team Leads by Project Task illustrating how specialized expertise is integrated across the project.

Garrett Wolf, PhD, AICP, *POC/Project Manager/Resilience Planner*

MARSTEL DAY

Years Experience
16

Years Employed at M-D
4

Education
Ph.D., Architecture, Univ. of Manchester, 2020
M.A., Geography, Louisiana State Univ. 2012
B.A., Geography, Louisiana State Univ, 2010
B.LA., Landscape Architecture, Louisiana State University, 2010

Highlights of Qualifications
Workshop Facilitator for Climate Vulnerability, Risk, and Resilience
TTX Design

Certifications
AICP
National Charrette Institute, Certified Facilitator
Nature-Based Solutions for Coastal Hazards Training
Advancing Coastal Resilience through Nature-Based Solutions Training
Coastal Resiliency Assessment Training
Coastal Hazard Risk Management and Adaptation Planning Training

Professional Background

Dr. Garrett Wolf is a certified planner and charrette facilitator with over 15 years of expertise in addressing the multifaceted challenges posed by sea-level rise (SLR) and coastal resiliency. His work focuses on designing and implementing adaptive strategies that mitigate the impacts of SLR on infrastructure, ecosystems, and communities. Dr. Wolf has extensive experience leading projects that integrate scientific modeling, stakeholder engagement, and policy development to create actionable solutions for vulnerable coastal areas.

Dr. Wolf has developed and applied predictive models to assess future SLR impacts on coastal marshes, urban areas, and military installations. His leadership integrates data-driven insights into planning and design to protect infrastructure, expand habitats, and strengthen community resilience.

In addition to technical expertise, Dr. Wolf excels at facilitating collaborative charrettes and workshops that bring together scientists, planners, community members, and policymakers to co-create adaptive strategies. He emphasizes nature-based solutions, such as living shorelines and marsh restoration, to enhance ecological and infrastructural resilience to long-term SLR.

Selected Project Experience

Living Shoreline and Coastal Stabilization, NSA Annapolis. *Project Manager.* Dr. Wolf led research and authorship of a design report that informed a living shoreline resilience strategy, coordinating with the installation, Naval Facilities Engineering Systems Command (NAVFAC) Washington, and subcontractors to assess site conditions, conduct SLR modeling, and develop designs that protect a nearshore lagoon, expand marsh habitat, and stabilize the shoreline for at least the next 50 years.

Marsh and Habitat Evaluation and Recommendations for Naval Submarine Base (NSB) Kings Bay. *Project Manager.* Dr. Wolf led the evaluation of historical marsh loss, current marsh and habitat conditions, and recommendations for the conservation and restoration of marsh and associated habitat. He led the SLR and marsh modeling, analysis, field work, and report writing. Dr. Wolf also led charrettes on prioritizing future marsh restoration projects.

Louisiana Coastal Masterplan, Coastal Protection and Restoration Authority/Water Institute of the Gulf, Gulf Coast of Louisiana. *Project Manager/Lead Author.* Dr. Wolf led research and planning to develop best practices for climate change adaptation, disaster preparedness, infrastructure protection, and natural resource conservation along the Louisiana Coast. He was the lead author of a toolkit for planners in coastal communities. Dr. Wolf worked with community planners to develop community plans that utilized best practices for protecting utility and transportation infrastructure.

Project Experience cont.

Navy Region Northwest Installation Resilience Strategic Planning. *Project Manager*. Dr. Wolf led the natural resource and resilience planning for Navy Region Northwest. He developed resilience guidance for community planners and environmental personnel. He led research, data gathering, analysis, coordination, and engagement to support the resilience and conservation planning efforts.

Avon Park Military Installation Resilience Review (MIRR). *Resilience Lead.* Dr. Wolf served as resilience lead for this MIRR, engaging four counties, three cities, and 100+ stakeholders in Central Florida. He supported partnership development, risk and hazard assessments, solution prioritization, and Department of Defense (DoD) Community Partnership integration, led an innovative tabletop exercise for vulnerability assessment, and helped develop 30+ solutions to strengthen regional resilience.

Living Shoreline and Coastal Stabilization, Naval Support Facility (NSF) Dahlgren. *Project Manager.* Dr. Wolf led the redesign of a failing shoreline stabilization project, replacing a seawall with a living shoreline that expanded marsh and restored native upland grasses. He coordinated with the installation, NAVFAC, and subcontractors to assess site conditions and develop recommended designs, while avoiding onsite excavation due to unexploded ordnance risks.

Navy Indo-Pacific Region Natural Resource and Resiliency Strategic Planning. *Lead Analyst.* Dr. Wolf supported the natural resource and resilience planning for Navy Indo-Pacific Region. He supported the development of resilience guidance for community planners and environmental personnel. He led research, data gathering, analysis, coordination, and engagement to support the resilience and conservation planning efforts.

Federal Triangle Flood Risk Assessment and Action Plan. *Project Manager.* Dr. Wolf led a multi-agency team from federal and local (Washington, DC) agencies in conducting a study of flood risk in the Federal Triangle, including an assessment of damage caused by major Federal Triangle floods in 2006 and 2019. An action plan was developed to develop a comprehensive onsite stormwater management system, which included innovative green infrastructure solutions combined with enhanced grey infrastructure, and the construction of a pumping station for extreme storm events. Mitigation sites created through the green infrastructure plan are sold to other federal entities as part of a stormwater retention credit program to supplement maintenance costs.

Tyndall Air Force Base Installation Complex Encroachment Management Action Plan, U.S. Air Force. *Engagement Team Leader.* As part of a broad installation encroachment management action plan Dr. Wolf helped develop action items to identify corridors for terrestrial, aquatic, and aerial wildlife. The plan included partnering with the Florida Fish and Wildlife Conservation Commission.

Stormwater Management and Green Infrastructure Plan for the Monumental Core. *Project Manager.* Dr. Wolf led a multi-agency team to develop a plan for the integration of federal property into the local mitigation and stormwater retention credit trading programs. This project included developing guidelines to ensure that federal properties and facilities integrate more effectively in the Washington, DC MS4. The Guidelines developed for this project also guide review of federal projects that come before the Commission.

Air Force Community Partnership Program, U.S. Airforce. *Workshop Facilitator.* Dr. Wolf lead group facilitation amongst installation personnel, local government officials, and community members at Scott Air Force Base (AFB) in St. Clair County, IL and Davis-Monthan AFB in Tucson, AZ. He helped broker partnerships on stormwater management, wastewater management, public works purchasing, and land acquisition.

Urban Forest Master Plan, City of Fairfax, VA. *Project Manager.* Dr. Wolf is leading the public engagement consulting services. This includes developing an engagement plan, facilitating four large public meetings, conducting stakeholder interviews, facilitating steering committee meetings, and leading a public survey. These engagement efforts support the development of the masterplan, its recommendations, and additional communication efforts and one-pagers to improve the communities relationship with the urban forest.

Meredith Miller, *Environmental Resilience Planner*

MARSTEL DAY

Years Experience

25

Years Employed at M-D

2

Education

MS, Biology; Aquatic Resources Management, Texas State University

BSA, Agricultural & Applied Economics; Natural Resources Management, University of Georgia

Highlights of Qualifications

Sustainability, Natural Resource, and Climate Adaptation Planning

Engagement and Facilitation – Climate and Natural Resource Vulnerability, Risk, and Resilience

Coastal community resilience

Coastal zone, estuary, fisheries management

Stakeholder-based, adaptive watershed planning

Certifications

Facilitation Certification, ICAI, APMG

Stakeholder-based Watershed Planning, Management Training, USEPA

Habitat Assessment, Restoration, & Management, NRCS

Professional Background

Mrs. Miller supports Sustainable Planning and Design Services and Environmental Resilience and Ecosystem Restoration efforts. Her work centers on facilitating and developing collaborations to promote healthy, sustainable ecosystems and communities. She works with clients and partners to promote resilience, protect critical resources, and realize sustainable planning and management goals. Mrs. Miller has expertise in resource conservation; watershed protection; environmental and community resilience; grant-writing; sustainable development and land use, including low impact/green infrastructure design and installation; educational programming; public engagement; and outreach. She has contributed to several Office of Local Defense Community Cooperation (OLDCC) funded efforts, including MIRRs.

Selected Project Experience

Ellsworth AFB/City of Box Elder MIRR. *Deputy Project Manager.* Mrs. Miller supports project leadership, technical analysis, and multi-jurisdictional coordination, leading engagement, risk assessment, and prioritization of readiness strategies. She facilitated a tabletop exercise with 35+ stakeholders to assess energy, cybersecurity, flooding and severe weather risks and is integrating results into the MIRR implementation framework to advance resilient planning, emergency coordination, and mission sustainment, drawing on over a decade of experience in climate adaptation and mitigation.

Marine Corps Installations Command (MCICOM) Encroachment Management Support. *Senior Planner & Project Lead.* Mrs. Miller leads Marine Corps installation sustainability and resilience initiatives, including climate resilience partnership strategies to ensure mission sustainment for the lifespan of infrastructure and assets. Mrs. Miller offers customized adaptation management, restoration, and protection strategies to support Resilience and Environmental Protection and Integration (REPI) plans and funding proposals, aligning them with climate resilience, coastal habitat protection, and natural resource management plans. Deliverables include shoreline restoration and marsh protection measures.

Avon Park Air Force Range (APAFR) MIRR. *Senior Planner and Analyst.* Mrs. Miller supported the community-led effort to improve long-term resilience and sustainability of the APAFR and surrounding communities. She facilitated coordination, communication, and collaboration between local governments, military, community stakeholders, educational institutions, and state agencies to leverage funds for climate adaptation planning, restoration and management of coastal habitats, infrastructure, and resilience-building strategies.

Fort Leonard Wood MIRR. *Senior Planner & Analyst.* Mrs. Miller served as a subject matter expert for hazard and risk analysis and resilience planning, identifying climate risks, evaluating adaptation strategies, and leading development of funding approaches to implement resilience measures.

Virginia Department of Transportation (VDOT) Land Stewardship Program Support. *Project Manager.* Mrs. Miller supported development of a comprehensive land management program, creating methodologies, frameworks, policies and decision-support tools to sustainably manage resources, strengthen resilience, ensure stewardship and compliance, and balance diverse stakeholder needs, including climate resilience planning.

Project Experience cont.

City of San Antonio Climate Action and Adaptation Plan, San Antonio, TX. *Project Coordinator.* Mrs. Miller contributed to grant-funded initiatives to support the 6th largest U.S. city's effort to develop a stakeholder-based climate mitigation and adaptation plan. She provided technical support for multiple research projects and working groups, including flood mitigation infrastructure resilience and land conservation prioritization. Additionally, she led collaborative efforts to provide community outreach, develop a funding strategy, and secure funding for plan implementation.

Developing a Fully Approved Coastal Nonpoint Source Pollution Control Program, TX. *Sr. Program Coordinator/Project Manager.* The Texas General Land Office established the Texas Coastal Nonpoint Source Pollution Program to protect and enhance critical coastal natural resources under National Oceanic and Atmospheric Administration (NOAA) and Environmental Protection Agency (EPA) approval. Mrs. Miller led an initiative to significantly update and secure federal approval for the program, including developing urban and coastal management measures—such as watershed protection, site and development standards, and roadway practices—and creating a Coastal Stormwater Management Manual and community engagement plans.

Blanco & Upper San Marcos Watershed Strategic Conservation Prioritization, Central TX. *Sr. Program Coordinator.* Mrs. Miller led a grant-funded initiative to prioritize conservation and restoration efforts in a region increasingly impacted by climate change, flooding, and population growth. Her research included characterizing land use and natural resources to highlight vulnerabilities and inform local conservation and climate adaptation efforts. The deliverables included GIS-based tools to identify and prioritize areas of the highest conservation value, metrics for tracking climate resilience and materials to support action by stakeholders, decision-makers, conservation practitioners, and grantors.

Stakeholder-driven Watershed Protection Planning (USEPA). *Program Director.* Mrs. Miller provided leadership for a grant-funded program that supported community-led efforts to strengthen watershed resilience in rapidly growing Texas regions. She secured several million dollars in funding for local governments and stakeholders to develop protection and implementation plans focused on equitable resource use, supply conservation, instream flow protection, estuary and marsh protection and restoration and infrastructure resilience. These plans included stakeholder engagement, community involvement, governance alignment, goal and plan development, modeling current and desired future conditions, technical management, ordinance and policy development, and implementation plans and funding strategies.

Regional Framework for Sustainable Use of the Rio Bravo, U.S. and Mexico. *Technical Advisor and Program Coordinator.* Mrs. Miller coordinated project development for a large international, study and comprehensive, binational, ecosystem-based action program based on the principles of integrated water resources management, for the sustainable management and use of the Rio Bravo throughout its basin, and to create the enabling social-economic and policy mechanisms for implementing the agreed action program. Specific efforts included hydraulic/hydrologic modeling and climate risk mitigation planning. Developed programs included water quality and quantity improvement projects, water quantity use decision support systems, water rights allocation planning tools, estuary minimum flow requirement modeling, diversity equity and inclusion strategies, educational programs and draft policies and ordinances.

UN Environment Program's Small Island Developing States (SIDS). *Technical Advisor*. Mrs. Miller supported community-based water resource protection, nonpoint source pollution prevention, climate adaptation, sea level rise mitigation planning and water conservation initiatives across the Caribbean, and contributed to climate resilience, Integrated Water Resource Management publications, and information-sharing working groups to strengthen marine and coastal governance capacity in small island nations.

Jason Winner, *Conservation Planner/Technical Advisor*

MARSTEL DAY

Years Experience
27

Years Employed at M-D
11

Education
MBA, Wilmington University, 2015

BS, Landscape Architecture, University of Kentucky, 2000

Highlights of Qualifications
Recognized adaptation and planning expert for community responses to sea-level rise and coastal risks

Facilitated 100+ workshops in areas of resilience, conservation, or land use

Licenses/Registrations
Certified Planner (AICP)

Professional Landscape Architect (PLA)

Certified GIS Professional (GISP)

Leadership in Energy and Environmental Design (LEED) Accredited Professional (AP)

Professional Background

Mr. Winner shepherds many efforts for planning, resilience, and partnership development. He specializes in coastal vulnerability assessments and climate adaptation plans for federal and community clients. He has led assessments and resilience planning efforts for 20+ regions, which often include multidisciplinary planning and engagement teams that analyze challenges and find adaptation solutions that protect or restore critical resources, support adaptive management, and improve sustainable outcomes. Mr. Winner worked extensively for over four years on different vulnerability assessments and adaptation plans for 78 communities along the Hudson River Estuary. He has experience working with coastal experts from NOAA and Federal Emergency Management Agency (FEMA) and is a recognized expert in the use of best practices to identify vulnerable assets and resources under different climate scenarios. Mr. Winner is a seasoned facilitator at technical or public workshops, leading climate adaptation planning processes to desired outcomes. He understands the need for balanced local approaches that respond to the unique challenges of different systems. Mr. Winner has worked with communities to prioritize vulnerabilities, develop recommendations, identify strategies, and create roadmaps for resilience.

Selected Project Experience

Avon Park MIRR. *Project Manager.* Managed resilience review that engaged four counties, three cities, and 100+ stakeholders in Central Florida. He led engagement and partnership efforts to identify stakeholder priorities, assess risks, develop solutions, and align the project with DoD Community Partnership initiatives Mr. Winner was the lead facilitator for engagement, including innovative Tabletop Exercises, and helped stakeholders prioritize 30+ partnership solutions to reduce risks and improve regional resilience for built infrastructure and natural resources.

Eastern Divide Partnership Strategic Conservation Plan. Blacksburg, VA. *Project Manager*. Mr. Winner developed an expert input model that leveraged rich engagement with conservation stakeholders to identify collaborative conservation goals and build those into a prioritized decision support system. GIS was used to analyze critical factors including biodiversity, water quality, forest resilience, scenic viewsheds, and agricultural value. Outcomes included parcel scoring based on geostatistical analyses and identification of conservation priority areas to enhance ecological resilience, climate adaptation, recreation, cultural resources, and landscape connectivity. Results demonstrated the value of multi-factor conservation planning to ensure long-term sustainability in conserving and managing resources with limited funding.

Sonoran Institute. Resilient Communities Starter Kit. *Project Manager*. Mr. Winner was the lead author for a Resilience Communities Starter Kit to improve resilience planning processes for communities throughout the western U.S. This tool provided a communications framework for integration of cohesive planning for built and natural systems that is critical for sustainability in rural communities. His team identified connections to many existing community stakeholders and planning efforts including smart growth, hazard mitigation planning, and water and wastewater infrastructure planning; and designed a customized system for strategic communication to overcome the barriers for risk mitigation.

Project Experience cont.

MCAS Beaufort Compatible Land Use and Resilience Strategy. *Project Manager.* Mr. Winner led the development of a Compatible Land Use Strategy for MCAS Beaufort and surrounding locations to respond to increasing coastal and land use challenges. He led modeling for compatible land uses and for sea-level rise/coastal risks, which identified regional locations most at risk for permanent inundation and increased coastal flooding. He led the identification of partnership conservation and restoration solutions to reduce risks and improve the resilience of coastlines to withstand storm and flooding impacts.

Climate, Environment, & Readiness Plan for Virginia's George Washington Region. *Subject Matter Expert.* Mr. Winner was a subject matter expert for regional climate, environmental, and urban growth modeling. This project utilizes a systems-based approach to prioritize critical resources and vulnerable lands within climate resilient locations, focusing on those areas most immediately at risk. Scenario planning synthesizes priorities and identifies regional conservation opportunities for high-priority, climate resilient landscapes that are most at risk.

U.S. Air Force, Installation Complex Encroachment Management Action Plans. *Coastal Risk Subject Matter Expert.* Mr. Winner was a subject matter expert for sea-level rise and coastal risk assessments for three encroachment studies for Air Force installations and surrounding communities. He developed guidelines and led team assessments of sea-level rise, increased coastal flooding, and major storm risks. Efforts included GIS and technical modeling, collaborative engagement with military and community stakeholders, and the development of conservation and restoration efforts including living shorelines, sedimentation solutions, beach nourishment, conservation efforts, and more.

Resilience Roadmap, Planning for Piermont's Future. *Subject Matter Expert/Technical Advisor.* Mr. Winner developed a vulnerability assessment for the Village of Piermont, NY that identified significant assets, infrastructure, and natural resources at risk under different sea level rise scenarios. Recommendations and implementation strategies were identified to create a more resilient village.

Hudson River Estuary Vulnerability Assessment and Regional Adaptation Strategies. Mr. Winner spent over four years leading regional coastal vulnerability assessment and adaptation planning in the Hudson River Estuary. He developed analytical models based on the best available science for inundation, increased coastal flooding, shoreline erosion, and potential loss of estuarine habitat caused by climate change. Mr. Winner identified adaptation strategies for protection of critical infrastructure, responses to wetland migration and potential loss of natural resources, and strategic accommodation to allow flooding for compatible land uses or by utilizing innovative design strategies.

Hudson River Estuary Sea-level Rise Mapper. Mr. Winner developed an interactive web mapping application and adaptation toolbox that visualized thirteen different scenarios for sea-level rise and increased coastal flooding in 78 coastal communities. The application allowed users to zoom to various locations and identify at-risk infrastructure, natural/cultural resources, and population at risk under each climate scenario. Communities continue to use this application to plan for future coastal risks.

City of Kingston Adaptation Planning. Mr. Winner worked with the City of Kingston, NY to evaluate current and future vulnerability to flooding, storm surges, and rising sea levels. He helped lead public workshops and stakeholder-driven strategies for adaptation planning to create a resilient waterfront. Collaborative recommendations directly contributed to climate-smart strategies for the City's Emergency Management Plan and Comprehensive Master Plan.

Patrick Boyle, *Ecological Planner/ Data Analyst*

MARSTEL DAY

Years Experience
5

Years Employed at M-D
1

Education
M. LA., Landscape Architecture, University of Maryland, 2024

BS, Marine Science, University of South Carolina, 2013

Highlights of Qualifications
Sustainability, Natural Resource, and Climate Adaptation Planning

Engagement and Facilitation – Climate and Natural Resource Vulnerability, Risk, and Resilience

Affiliations & Certifications
American Society of Landscape Architects

Chesapeake Bay Landscape Professional Certification – Living Shoreline Training for Coastal Professionals

Professional Background

Mr. Boyle is a landscape designer with increasingly diverse project experience on the East Coast and in the Southeastern United States. His current efforts include design and implementation of ecological restoration projects, resilience design, and analyses and community engagement for conservation and restoration efforts. His past work includes parks and recreation design, coastal resilience analysis and planning, public engagement facilitation, and cultural preservation advocacy. He has also supported client coordination and project management.

Selected Project Experience

Carr Creek Integrated Shoreline Restoration and Conservation Management, NSA Annapolis, Anne Arundel County, MD. *Landscape Designer / Project Manager.* Mr. Boyle manages a multi-year, systems-based restoration and conservation effort along Carr Creek at NSA Annapolis, integrating living shoreline design, regulatory coordination, construction oversight, and long-term stewardship. Shoreline restoration efforts address severe erosional pressures driven by long fetch conditions exceeding 70 miles, which have contributed to chronic bluff and bank failure, undermining upland stabilization and threatening adjacent infrastructure. His work includes assessment, design, and implementation of climate-adaptive living shoreline systems incorporating marsh creation, native planting, and erosion control measures. Mr. Boyle also oversees a three-year invasive species management program utilizing a two-phase chemical and mechanical treatment approach to control phragmites, paired with post-construction monitoring and adaptive maintenance. This coordinated framework links monitoring, maintenance, and new shoreline interventions to support long-term ecological resilience and installation sustainability.

Marsh Loss Assessment and Beneficial Use of Dredged Material Feasibility Study, NSB Kings Bay, St. Mary's County, GA. *Resilience Planner.* Mr. Boyle supported a large-scale marsh loss assessment and beneficial use of dredged material feasibility study conducted for USACE within a 14,000-acre estuarine system adjacent to NSB Kings Bay. He contributed to GIS-based analyses evaluating historical marsh loss, existing marsh conditions, and projected future marsh loss under sea-level rise scenarios. Mr. Boyle assisted in the development and evaluation of feasibility criteria for beneficial use placement, including marsh vulnerability, elevation targets, sediment needs, restoration potential, and long-term resilience considerations. He developed a prioritization matrix to support comparative decision-making across multiple candidate marsh areas and contributed to the interpretation of modeling outputs and restoration strategies. Mr. Boyle also created an interactive ArcGIS Experience Builder engagement tool to support stakeholder review of spatial data, field assessments, and modeling results, strengthening interdisciplinary coordination during agency workshops and an onsite stakeholder charrette.

Kole Dufore, *GIS & Remote Sensing Specialist/Conservation Planner*

MARSTEL DAY

Years Experience
15

Years Employed at M-D
2.5

Education
Masters, Natural Resource Stewardship, Colorado State University

BGS, Geography, Business Administration, and GIS Georgia Southern University

Highlights of Qualifications
Sustainability, Natural Resource, and Climate Adaptation Planning

Preplanning and Feasibility Support for Coastal and Waterborne Infrastructure

Sea-level rise, Marsh Migration, and Beneficial Use Planning

Interagency Coordination and Regulatory Consultation Support

Certifications
FAA Licensed Remote Pilot

Professional Background

As a Conservation Planner with Marstel-Day, Mr. Dufore brings over a decade of experience in GIS, remote sensing, and spatial modeling to support sustainability, ecological planning, and climate adaptation. He specializes in translating complex environmental and infrastructure data into GIS-based decision support tools that inform planning, resilience, and restoration outcomes. His work includes landscape-scale spatial analyses, habitat and watershed modeling, advanced terrain and elevation analysis, and unmanned aerial vehicle (UAV)-based photogrammetry to support infrastructure risk assessment, marsh and wetland modeling, and shoreline resilience evaluations. Mr. Dufore also applies sea-level rise modeling and marsh migration analysis, including the Sea Level Affecting Marshes Model (SLAMM), to evaluate future coastal conditions, assess habitat response to rising seas, and inform long-term resilience and adaptation planning.

Selected Project Experience

Kings Bay Submarine Base Marsh Migration Modeling. *GIS & Remote Sensing Specialist.* Developed a SLAMM analysis to evaluate long-term marsh migration, conversion, and potential habitat loss under multiple sea-level rise scenarios. This predictive modeling was used to assess future marsh conditions and identify areas where intervention could sustain coastal wetland systems. In support of beneficial use planning, Mr. Dufore performed volumetric calculations to estimate sediment quantities required to maintain marsh elevations over time and align placement needs with projected dredged material availability. These analyses informed strategic siting and scaling of beneficial use placement to support marsh resilience while reducing long-term sediment management challenges and supporting installation-level climate adaptation and resilience planning.

NSA South Potomac Vulnerability Assessments. *Conservation Planner.* Mr. Dufore has supported climate change adaptation planning for NSA South Potomac installations by evaluating climate-related threats and vulnerabilities affecting mission readiness, infrastructure, and natural resources. His work has focused on identifying assets and locations most at risk from sea-level rise, coastal flooding, erosion, and other climate stressors to inform resilience planning efforts. Through these assessments, Mr. Dufore has helped define priority targets for resilience actions by evaluating exposure, sensitivity, and potential consequences under current and future climate conditions. He has contributed to the development of practical recommendations to reduce vulnerability, support long-term adaptation planning, and improve installation awareness of climate risks. His efforts also include identifying indicators, and monitoring needs to track changing conditions over time and support adaptive management as climate impacts evolve.

Project Experience cont.

Camp Lejeune Waterborne Training Infrastructure Preplanning. *Conservation Planner.* Supported preplanning efforts for expanded waterborne training infrastructure at Camp Lejeune in coordination with Marine Corps stakeholders. Mr. Dufore provided early-stage planning support related to dredging and dredged material management to inform the feasibility and long-term viability of proposed training enhancements. His work focused on identifying key planning considerations, including dredging feasibility, regulatory and permitting requirements, interagency coordination and consultation needs, and anticipated environmental review pathways. These efforts helped clarify potential constraints, data needs, and sequencing considerations to support future Environmental Assessment development and informed decision-making related to waterborne training infrastructure expansion.

Integrated Natural Resources Management Planning. *Conservation Planner.* Supported the development and update of Integrated Natural Resources Management Plans (INRMPs) for multiple DoD installations by integrating natural resource priorities with installation mission requirements and long-term planning objectives. Mr. Dufore worked closely with installation stakeholders to translate operational needs, training requirements, and land use constraints into actionable natural resource management strategies that support both mission sustainment and regulatory compliance. His responsibilities included synthesizing ecological conditions, identifying resource management challenges and opportunities, and contributing to planning-level analyses that informed conservation priorities, adaptive management strategies, and future project development. This work supported compliance with applicable environmental requirements while ensuring natural resource management frameworks remain aligned with installation missions, infrastructure planning, and evolving operational demands.

Naval Facilities Washington (NAFAC Washington) NEPA Support. *Conservation Planner.* Provided National Environmental Policy Act (NEPA) support for projects under Naval Facilities Washington (NAFAC Washington) within the Chesapeake Bay and Potomac River coastal regions. Mr. Dufore supported assessments of potential effects to coastal and hydrologic resources, including shorelines, tidal waters, and floodplains, associated with proposed actions and installation activities. His work included facilitating coastal consistency reviews and supporting coordination with regulatory agencies to ensure compliance with applicable coastal management requirements in tidal and estuarine environments. Mr. Dufore also contributed to evaluations of vegetation and biological resources, including potential direct, indirect, and cumulative effects within coastal and riparian systems. These efforts supported comprehensive NEPA analyses that considered past, present, and reasonably foreseeable actions to inform defensible decision-making and long-term coastal planning.

National Wetlands Inventory (NWI) Data Enhancement. *Remote Sensing Analyst.* Supported the development and updating of National Wetlands Inventory (NWI) datasets through advanced GIS data management, image interpretation, and remote sensing analysis. Mr. Dufore worked with multi-source imagery and geospatial datasets to identify, classify, and map wetland features in accordance with established NWI classification standards, supporting consistent and defensible wetland inventories.

His work included interpreting high-resolution aerial imagery, satellite data, and ancillary environmental datasets to improve wetland delineation accuracy across diverse landscapes. Mr. Dufore also assisted with the development and refinement of workflows to support automation and efficiency, including early-stage applications of machine learning to streamline wetland classification and quality control processes. These efforts supported scalable, repeatable approaches to wetland mapping while maintaining data quality and consistency across datasets.

Robin Bedenbaugh, *Wetland Restorations Specialist/ Regulatory Framework Strategist/Biological Surveyor*

Years Experience

43

Education

MS. Biological Sciences, Old Dominion University

BS. Biological Sciences, Old Dominion University

Highlights of Qualifications

Biological Surveys in Intertidal and Subtidal Systems

Sediment Sampling and Analysis for Dredged Material Disposal or Re-Use

Cost-Benefit Analyses of Alternative Wetland Restoration Options

Environmental Permitting for Tidal Wetland Restoration

Tidal Wetland Design and Construction

Post-Construction Monitoring of Restored Wetlands

Certifications

Virginia Professional Wetland Delineator Certification No.3402000076

Virginia Surface Waters Delineator Certification No. VSWD 0029

Professional Background

Robin has more than 43 years of experience in applied environmental sciences research and environmental consulting. During this time, he has worked for a highly diverse client base, including the DoD, state Departments of Transportation, Federal Highway Administration, National Park Service, National Aeronautics and Space Administration, Port Authorities, United States Environmental Protection Agency, Railroads, Utilities (water, wastewater, electric, and gas), state agencies, localities, and confidential private clients. He has extensive experience in applied wetlands science in marine, estuarine, and palustrine systems, including sediment and water sampling; wetland assessments; wetland mitigation feasibility studies; wetland mitigation design and construction; and permitting. He has served as a senior scientist/technical lead on numerous wetland mitigation site feasibility, site design, site construction, and site monitoring projects, including tidal wetland and submerged aquatic vegetation restoration projects.

In addition to his scientific technical expertise, Robin has an excellent knowledge and understanding of engineering design and constructability issues associated with large mitigation projects; and is especially knowledgeable about environmental constraints to construction, and how those environmental constraints affect the permitting, cost, and the schedule of a project.

Selected Project Experience

TNC Baltimore Patapsco Sediment Bank Project, Baltimore County, MD. 2022-2023. *Tidal wetland design lead* for a project focused on the beneficial reuse of dredged material from private facility dredging in Baltimore Harbor to enhance coastal resilience for underserved communities. Participated in site assessment and ranking for restoration opportunities, collaborative workshops, and stakeholder engagement to identify challenges and develop a high-level framework to advance a selected project within the current regulatory environment while addressing long-term regional needs. Provided design expertise for wetland restoration using dredged material and developed preliminary designs and cost estimates to support final site selection.

Virginia Railway Express – SAV Mitigation, Quantico, VA. 2006-2008. *Senior Environmental Scientist.* Assisted with baseline site data collection, including mapping of SAV beds that would be impacted. Prepared the permit application for the new bridge over tidal Quantico Creek. Coordinated with the regulatory agencies to establish appropriate mitigation requirements for impacts to SAV. Developed and coordinated an approved SAV mitigation plan with the VDEQ and VMRC. Oversaw implementation of the SAV restoration work and the 2-year compliance monitoring work. Prepared compliance reports for submission to the agencies.

TNC Eastern Shore Tidal Wetland VARTF ILF Mitigation Project – Accomack County, VA. 2023-2026. *Senior Wetland Designer.* Responsible for site selection, feasibility studies, design, permitting, construction, and post-construction monitoring for this 8.2-acre Virginia Aquatic Resource Trust Fund tidal mitigation site.

Project Experience cont.

Belle Isle State Park Shoreline Stabilization Design, Lancaster County, VA. 2019-2021. *Senior Technical Reviewer.* Provided technical oversight for this shoreline stabilization project using offshore breakwaters and living shorelines to stabilize and aggrade the shoreline along the Rappahannock River.

Jones Point Shoreline Stabilization Design, Alexandria, VA. 2001-2002. *Senior Environmental Scientist.* Responsible for the design of this tidal wetland restoration, shoreline bioengineering, and other shoreline stabilization measures project at Jones Point Park. Responsible for site feasibility studies, tidal wetland restoration site design, and development of shoreline bioengineering, streambank stabilization, and invasive species management special provisions. Responsible for site feasibility studies, mitigation site design, and development of wetland construction, wetland planting, and invasive species management special provisions for each site.

Route 33 West Point Bridge Replacement Project, West Point, VA. 2003-2004. *Senior Environmental Scientist/Project Technical Manager.* Responsible for wetland delineations, site selection and design of tidal marsh mitigation site, development of construction cost estimates, development of construction special provisions, and acquisition of environmental permits.

Woodrow Wilson Bridge Project Tidal Mitigation Projects. 2000-2001. *Senior Environmental Scientist/Project Technical Manager.* Responsible for the design of 7 tidal wetland mitigation sites to provide compensation for tidal wetland impacts from the construction of the Woodrow Wilson Bridge.

Felgates Creek Tidal Wetland Mitigation, Naval Weapons Station, Yorktown, VA. 2004-2005. *Senior Technical Advisor.* Contracted to review mitigation design plans for a tidal wetland mitigation site, revise plans as necessary to ensure successful restoration, provide site construction monitoring, planting inspection, and post-planting monitoring of the mitigation site. Prepared monitoring reports for submission to the regulatory agencies.

United States Navy, Little Creek Channel Sediment Sampling and Whole Sediment Bioassay, Norfolk, VA. 1998. *Project Technical Manager.* Supervised the field collection of marine sediment samples for chemical analyses and sediment bioassays to determine options for dredged material disposal.

United States Navy, Sediment Sampling and Whole Sediment Bioassay, Cheatham Annex, Williamsburg, VA. 1999. *Project Technical Manager.* Supervised the field collection of marine sediment samples for chemical analyses and sediment bioassays to determine options for dredged material disposal.

Hampton Roads Sanitation District, York River Outfall, York County, VA. 2011-2012. *Senior Environmental Scientist.* Supervised underwater archaeological surveys and SAV presence/absence surveys, and wetland delineations. Responsible for preparation of the Joint Permit Application and assisted with coordination with VMRC to provide compensation for impacts to state owned and privately-owned shellfish grounds.

I-664 Bridge-Tunnel Construction Environmental Compliance Monitoring, Newport News and Suffolk, VA. 1983-1985. *Senior Scientist/Vessel Operator.* Conducted environmental permit compliance monitoring of the 3-year bridge-tunnel construction project, including water quality monitoring and sediment sampling. Performed turbidity monitoring of the dredge plume every 2 hours and collected major water samples every 2 weeks.

Tidal Wetland Mitigation Options Study, Portsmouth Marine Terminals Improvements, Portsmouth, VA. 1995. *Principal Investigator.* Assessed 16 potential sites for tidal wetland restoration potential, with rankings assigned based on potential for success, location within the watershed, and estimated cost of acquisition and construction.

Joe Caterino, PE, *Water Resource Engineer*

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Years Experience

29

Education

BS, Civil Engineering, Penn State University

Highlights of Qualifications

Professional Engineer in Virgina and Maryland

VA #035242

MD #28756

Certifications

Rosgen Level I-III

Advanced Stream Restoration Design Principals – North Carolina Stream Restoration Institute

NSCD Stream Restoration Construction Management Workshop – Canaan Valley Institute

Rivermorph Stream Restoration Software Training – Pilot View Resource and Conservation Development, Inc.

Professional Background

As Senior Project Manager with RES, Joe Caterino manages water resource engineering projects for residential, commercial, industrial, and recreational developments. His involvement begins at site selection, where Joe works with a team of environmental specialists to define environmental constraints of the property. Joe prepares water quality plans to reduce non-point source pollutants by implementing conventional or low-impact integrated management strategies. He has experience drafting floodplain studies to obtain local and federal permits for work within a regulated floodplain or floodway.

Joe utilizes various methods for estimating volumetric benefits for projects in North Carolina, Virginia, Maryland, and Ohio. These include guides for accounting for the benefit of nature-based solutions which have been authored by members of UN Global Compact CEO Water Mandate, TNC, Danone S.A. and World Resources Institute, Quantis, Valuing Nature, and LimnoTech. Joe is also an expert in water balance calculations and Chesapeake Bay expert panel water quality benefit quantification tools.

Joe has been an integral part of the design and construction management team for several wetland creation and stream restoration projects that provide mitigation to development projects with environmental impacts. Other management responsibilities include managing watershed management and planning studies, dam rehabilitation, erosion and sediment control design, floodplain studies including FEMA no-rise, Conditional Letter of Map Revision (CLOMR), and Letter of Map Revision (LOMR) certifications, project bidding, on-site construction administration, and post-construction monitoring.

Selected Project Experience

Tazewell County Resiliency Project, Tazewell County, VA, (2022-Present). Currently serving as the project manager to deliver resiliency solutions for Tazewell County to mitigate flooding issues that have historically impacted the County. From the resiliency study that was prepared in 2022, six projects representing $2.21 million from Community Flood Preparedness Fund (CFPF) funding have been or are currently being developed to provide flood reduction solutions. All six project will incorporated nature-based solutions to provide flood attenuation.

Statewide MS4 / TMDL Implementation & Related Activities On-Call Contract. VDOT Statewide, VA, (2017-Present). Serves as Project Engineer for five-year, open-end contract with VDOT to provide technical services for the development and implementation of projects to meet applicable TMDL Action Plans in support of VDOT's MS4 Program. Anticipated projects include stream restoration, land cover conversion, shoreline stabilization, and other structural and non-structural Stormwater Management (SWM) Best Management Practices under this contract include ecological assessment, regulatory permitting, design, construction, construction oversight, and maintenance and monitoring services.

Benjamin "Benji" Guempel, *GIS Analyst*

Years Experience
20

Education
MS, Natural Sciences, Geography, Louisiana State University

Highlights of Qualifications
Experience supporting federal client in mapping water features across 150 National Parks.

Professional Background

Benji joined RES in 2015 and has over 20 years of extensive GIS experience in the environmental consulting field providing GIS analysis, database development, spatial analysis, imagery analysis, cartographic design, litigation support, 3d modeling, data management, field data collection/integration, map automation, internet mapping applications, and report production for research, planning, impact assessment, and land acquisition projects. Benjamin currently manages the enterprise geographic information systems, RES Geospatial Solutions Group, and drone operations.

Benji has created, developed, and implemented multiple custom web applications, web solutions, system enhancements, workflows, and methodologies to improve accuracy, efficiency, and communication for internal and client-related projects. He has extensive knowledge in model development, data integration, imagery analysis, and system architecture.

Selected Project Experience

Shakopee Mdewakanton Sioux Community (SMSC) Wetland Program Expansion & Refinement, Scott County, MN, 2022-2023. *Geospatial Team Lead.* Led this GIS-based project to provide SMSC with a much-improved, more robust wetland program that will facilitate efficient and effective inventory, assessment, monitoring, restoration, and protection for their wetland resources. This project created a dynamic and scalable wetland identification tool designed to use their UAV LiDAR data to model potential wetlands. In addition, a repeatable methodology for identifying threats and stressors using artificial intelligence/machine learning (AI/ML) technology was developed to create a high resolution, high accuracy land cover dataset. Finally, a web portal was designed to host, communicate, and disseminate SMSC wetland information/data to all stakeholders.

Wetland, Stream, and Species Mitigation Sites, Various Sites – CA, LA, MD, NC, OR, PA, SC, TN, TX, VA, IN, IL, WV. *Geospatial Team Lead.* Prepares graphic and mapping documentation for Interagency Review Team (IRT) submittal for the development of mitigation banks. Prepares existing constraints mapping including bank site vicinity maps, national wetland inventory maps, threatened and endangered species inventory maps, and cultural resource inventory maps. Prepares all needed graphics plans.

National Park Service Program Support, 2024–2027 and proposed conditions mapping, including proposed mitigation. *Geospatial Team Lead.* Led the design and implementation of an end-to-end geospatial methodology to map and compile degraded aquatic resource features into a centralized, standardized database across 150 National Parks. Developed the system architecture and custom web applications to support large, multidisciplinary teams, enable stakeholder participation, conduct structured park staff interviews, manage data across a national geographic extent, and ensure a robust QA/QC process.

Scott Hardaway, Jr., *Living Shoreline Scientist/Environmental Compliance Specialist*

VIMS | William & Mary
Virginia Institute of Marine Science

Years Experience
50

Years Employed at VIMS
46

Education
Master of Geology, East Carolina University, 1980
Bachelor's in Geology, East Carolina University, 1973

Skills
Shoreline Management Design
Scientific & Technical Writing
Coastal Field Research
Design Permitting
Licensed Geologist
Sediment Analysis & Classification
Small Vessel Operations
Microsoft Office
ArcGIS

Certifications
Virginia Professional Geologist License
North Carolina Professional Geologist License

Professional Background

Senior Research Scientist experienced in processes and responses of shoreline systems, which includes geomorphology of coastal change, wave mechanics and sediment transport, numerical modelling of hydrodynamic processes and shoreline change, as well as breakwater and beach fill performance. Currently, the Director of the Shoreline Studies Program, Dept. of Coastal and Ocean Processes. Applied research efforts focus on shoreline management planning and living shoreline applications. This often involves shore surveys, conceptual designs, and acquiring state and federal permits from VMRC and the USACE, Norfolk District.

Core Competencies

Living Shoreline Design | Shoreline Management & Project Design

Coastal Surveying | Design Permitting | Shoreline Management Instruction

Professional Experience

Virginia Institute of Marine Science, Gloucester Point, VA. 2013-Present *Professional Faculty, Senior Research Scientist.*

- Director of the Shoreline Studies Program
- Lead project design for shoreline management plans
- Create and submit permit drawings for approval
- Analyze and classify coastal and marine sediments
- Assist with grant and permit applications
- Oversee surveying projects for shoreline management plans
- Lecture and instruction in shoreline management and living shoreline design
- Communicate with project clients and partners

Virginia Institute of Marine Science, Gloucester Point, VA. 1986-2013. *Associate Research Scientist.*

Virginia Institute of Marine Science, Gloucester Point, VA. 1979-1986. *Associate Marine Scientist.*

National Academies' Committee on Mitigating Shore Erosion on Sheltered Coasts. 2005-2007. *Committee Member*

American Society of Civil Engineers, Shoreline Protection Standards Committee. 1995-2005. *Vice Chairman*

Relevant Publications

Milligan, D.A., **C.S. Hardaway**, C.A. Wilcox, and C.W. Green, 2023. Naval Weapons Station Yorktown and Cheatham Annex Shoreline Management and Coastal Resiliency Plan. VIMS, W&M, Gloucester Point, VA.

Milligan, D.A., **C.S. Hardaway**, C.A. Wilcox, and N.J. DiNapoli, 2021. Living Shoreline Sea-Level Resiliency: Performance and Adaptive Management of Existing Sites, Year 3 Summary Report. VIMS, W&M, Gloucester Point, VA.

Hardaway, C.S., D.A. Milligan, and K. Duhring, 2021. Living Shoreline Design Guidelines for Shore Protection in Virginia's Estuarine Environment. Special Report in Applied Marine Science and Ocean Engineering #473. VIMS, W&M, Gloucester Point, VA.

Hardaway, C.S., D.A. Milligan, C.A. Wilcox and R. Herzick, PE, 2020. Penniman Spit, Living Shoreline and Oyster Restoration Project. Design and permitting. Shoreline Studies Program, VIMS, W&M, Gloucester Point, VA. For Naval Weapons Station Yorktown, York County, VA. **Installed 2024.**

Hardaway, C.S., D.A. Milligan, and C.A. Wilcox, 2016. Blossom Point Research Facility, Shoreline Management Plan for Potomac River and Nanjemoy Creek. Shoreline Studies Program, VIMS, W&M, Gloucester Point, VA.

Hardaway, C.S., D.A. Milligan and R. Herzick, PE, 2016, Werowocomoco Living Shoreline Project, Gloucester County, Va.: Design, permitting and construction management Performed under grant contract to National Fish and Wildlife Foundation, Washington D.C. **Installed 2019.**

Hardaway, C.S and D.A. Milligan: 2013. Design, permitting and construction management, Camp Occohannock Living Shoreline Project, Accomack County, Va. Performed under contract to The Nature Conservancy. Virginia Operating Unit, Charlottesville, VA. **Installed 2013.**

Hardaway, Jr., C.S., D. A. Milligan, and C.A. Wilcox, 2011. Marine Corps Base, Quantico, Shoreline Protection Plan. Contract Report to the US Navy, NAVFAC, Washington Naval Yard, Washington, DC. 63 pp.

Francese, R.S., **C.S. Hardawa**y, D.A. Milligan 2011. Hampton Beachfront and Storm Protection Management Plan. Contract Report prepared for the City of Hampton, Va. 118 pp. Breakwater installation.

Hardaway, Jr., C.S. and J.R. Gunn, 2010. Design and Performance of Headland Breakwaters in Chesapeake Bay, USA. Coastal Engineering 57 (2010) 203-212. Elsevier B.V 2009.

Hardaway, Jr. C.S and J.R. Gunn 2010. A Brief History of Headland Breakwaters for Shore Protection in Chesapeake Bay, USA. American Shore and Beach Preservation Association, Vol. 78 No.4/Vol. 79 No.1, Fall 2010/Winter/2011.

Hardaway, Jr., C.S., D.A. Milligan, C.H. Hobbs, C.A. Wilcox, K.P. Obrien and L. Varnell, 2010. Mathews County Shoreline Management Plan Special Report in Applied Marine Science and Ocean Engineering #417. Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, VA.

Hardaway, Jr. C.S., D.A. Milligan, J. Shen, C.H. Hobbs, 2009. Encroachment of Sills onto State-Owned Bottom: Design Guidelines for Chesapeake Bay. Contract report for the Virginia Department of Environmental Quality's Coastal Resource Program. Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, Va

Hardaway, Jr., C.S. W.G. Reay, J. Shen, S. Lerberg, D.A. Milligan, C.A. Wilcox, K.P. Obrien, 2007. Performance of Sills: St. Mary's City, St. Mary's River, Maryland. Contract report for the Virginia Department of Environmental Quality's Coastal Resource Program. Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, Va

Donna Milligan, *Regulatory Research Scientist/Data Auditor*

VIMS | William & Mary
Virginia Institute of Marine Science

Years Experience
34

Years Employed at VIMS
34

Education

PhD Candidate, Educational Policy, William & Mary

Master of Marine Science, William & Mary, VIMS, 1994

Bachelor's in Marine Science, Coastal Carolina College, University of South Carolina, 1991

Skills

Shoreline Management Design & Project Design

Coastal Field Research

Program Management

Scientific & Technical Writing; Grant Writing

Shoreline Project Permitting

Scientific Data Analysis

Trimble R12i GNSS Real-Time Kinematic GPRS, Trimble Robotic Total Station & Business Center

Esri ArcGIS

Professional Background

Marine scientist and program administrator for the Shoreline Studies Program, Coastal and Ocean Processes Section, with extensive experience in research-based analyses of coastal geomorphology and physical forces to create effective shoreline management. Transdisciplinary research topics include wave mechanics and sediment transport, beach surveying and analysis, numerical modelling of hydrodynamic processes, shoreline change and its impact on infrastructure and marine resources, and living shoreline design/performance.

Core Competencies

Communicate Well | Leadership | Organization | Detail Oriented | Analytical | Flexible and Adaptable | Technical Expertise | Strategic Planning Professional Experience

Virginia Institute of Marine Science, Gloucester Point, VA. 2022-Present *Associate Research Scientist.*

- Shoreline Studies Program Administrator responsible for performance management, grant oversight, field research planning and supervision, data analysis, report writing, and program budgeting
- Since 2018, I have written, been awarded, and managed 45 grants totaling over $5 million
- Collaborate with other researchers, grantors, and stakeholders through meetings and workshops
- Hire and train new employees
- Identifying and implementing new technology and techniques for coastal research

Virginia Institute of Marine Science, Gloucester Point, VA. 1997-2018. *Senior Marine Scientist.*

Virginia Institute of Marine Science, Gloucester Point, VA. 1994-1997. *Marine Scientist.*

Virginia Institute of Marine Science, Gloucester Point, VA. 1991-1994. *Graduate Assistant*

Christopher J. Bender, Ph.D, P.E., BC.CE, *Lead Coastal Engineer*

TAYLOR ENGINEERING, INC.

Years Experience

22

Years Employed at Taylor Engineering

22

Education

Ph.D./Coastal Engineering, University of Florida

M.S./ Coastal Engineering, University of Florida

B.S./Ocean Engineering, University of Rhode Island

Licenses/Certifications

Professional Engineer – FL (#64736), MS (#19134)

Memberships

American Society of Civil Engineers (ASCE) Coastal Engineering Research Council (CERC)

ASCE Academy of Coastal, Ocean, Port & Navigation Engineers (ACOPNE)

ASCE Coasts, Oceans, Ports, Rivers Institute (COPRI) — Coastal Engineering Sciences Committee Chair

Florida Engineering Society

Part-time Faculty Member — University of North Florida, School of Engineering

Professional Background

Dr. Bender directs the Coastal Engineering Group at Taylor Engineering. Over his career, he has taken a leading role in the simulation and evaluation of hurricane surge, wave mechanics and loading, littoral processes, shoreline protection, and sediment transport. Dr. Bender's coastal engineering experience includes use of the following assessment tools: STWAVE, SWAN, SWAN+ADCIRC, REF/DIF-1, MIKE21, SMS, ACES, Beach-fx, GENESIS, and SBEACH as well as numerous desktop assessment techniques. He has successfully applied these models to many Atlantic and Gulf Coast locations from New England to Texas and the Great Lakes. Dr. Bender serves on the American Society of Civil Engineers (ASCE) Coastal Engineering Research Council (CERC) and has taught coastal engineering courses at the University of North Florida as a part-time faculty member.

Selected Project Experience

C2023-088 USACE Philadelphia District Kings Bay Modeling, Camden County, GA (Ongoing) *Principal in Charge.* Dr. Bender provides oversight and quality control for the Kings Bay Modeling Project. For the project, Taylor Engineering is performing a sediment transport and shoaling analysis using a coupled MIKE model for a site near NSB Kings Bay in coastal Georgia. Taylor Engineering also developed a benefit/cost and trade-off analysis related to the beneficial use sites and options for both future dredging and dredged material management area (DMMA) offloading. Dr. Bender also led the coordination and update meetings with the USACE and U.S. Navy staff to ensure efficient execution of the project tasks and coordination across project tasks.

Volusia County Feasibility Assessment, Volusia County, FL (Ongoing). *Senior Technical Reviewer.* The project assesses the risk to Volusia County coastal communities, evaluates the feasibility of different solutions, and provides recommendations for best management practices. The study includes the collection and review of existing data, analysis of historic shoreline performance, characterization of the shoreline on a parcel-by-parcel basis, incorporation of vulnerability parameters to determine risk, and recommendations for beach management measures for each reach within the county. The project includes multiple public outreach meetings and the analysis of public opinion survey responses. The final report will document the recommended feasible shoreline strategies to revitalize and better manage their 37 miles of beach. It will be provided to the County Council for adoption, paving the future of beach management for their coastal communities.

C2022-089 USACE Regional Sediment Management Decision Support Tool, Nationwide, U.S. (Ongoing). *Principal in Charge* for project to develop a decision support tool for USACE ERDC to inform district leaders and other stakeholders about the relative costs and benefits of Regional Sediment Management (RSM) dredging and placement.

Project Experience cont.

C2023-008 Florida Department of Environmental Protection (FDEP) Anastasia State Park Beach Project, St. Johns County, FL (Ongoing). *Principal in Charge* of project to analyze existing conditions, prior work completed, and potential beach/dune restoration alternatives at Anastasia State Park for the Florida Department of Environmental Protection. The project also developed plans and specifications for a beach and dune nourishment project to meet the project goals.

Western Destin Beach Restoration Project, FEMA Category G, Okaloosa County, FL (Ongoing). *Coastal Engineering Expert*. Provides QA/QC for the design and construction of the FEMA-authorized repairs to the Western Destin Beach Restoration project following damages from Hurricane Sally in 2020. Assists in analyses and discussions related to FEMA Category G funding aspects.

St. Lucie County Fort Pierce Shore Protection Project (SPP) Coastal Engineering Services, St. Lucie County, FL (Ongoing). *Coastal Engineering Expert.* Supports St. Lucie County with obtaining state and federal permits for the federal SPP south of Fort Pierce Inlet. Also supports with construction administration for nourishments of the Fort Pierce SPP. Senior review and quality control for annual physical monitoring reports, which included beach profile surveys, aerial photography, marine turtle nest monitoring, beach fill performance evaluation, and annual physical monitoring report preparation.

C2017-073 FEMA Coastal Flood Risk Analysis, NY and NJ (Ongoing). *Technical Manager.* To support FEMA Region II with the resolution of an appeal of New York City FIRMS, prepared coastal flood risk analysis for several counties in New York and New Jersey. Coordinated, designed, and executed tasks necessary to complete a storm surge study along the entire New Jersey coast and shorelines around New York City. Developed a computational mesh necessary to evaluate storm surge and offshore and nearshore waves in the project area. Validated storm surge and wave model system with available data for historical storm events. Developed a framework to execute a modeling system for a complete storm suite developed to produce return period water levels required by the study.

C2022-077 FEMA Standard Ops 2, Nationwide (Ongoing)

C2022-038 Martin County Shore Protection Project Phase 2, Martin County, FL (Ongoing).

C2021-067-01 Marsh Landing Stormwater Analysis, Jacksonville, FL (Ongoing).

C2022-056 St. Lucie County Fort Pierce Shore Protection Plan 2023 Construction Administration St. Lucie County, FL (2023).

Michael B. Kabiling, Ph.D., P.E., CFM, *Hydraulic Engineer/ Hydrodynamics Analyst*

TAYLOR ENGINEERING, INC.

Years Experience
33

Years Employed at Taylor Engineering
24

Education
- Ph.D./Hydraulic & Coastal Engineering, Yokohama National University
- M.E./Water Resources Engineering, Asian Institute of Technology
- B.S./Civil Engineering, University of the Philippines

Licenses/Certifications
- Professional Engineer—FL (#69054), SC (#29908), GA (#35002), WA (#52514)
- Certified Floodplain Manager —U.S. (#09-04385)

Memberships
- American Society of Civil Engineers (ASCE)
- Association of State Floodplain Managers (ASFPM)
- International Association for Hydro-Environment Engineering and Research (IAHR)

Professional Background

Dr. Kabiling has over 30 years of experience, with advanced expertise in water resources, hydraulic and coastal engineering, numerical modeling, and climate change resiliency. His responsibilities at Taylor Engineering include providing project management, leading business development, overseeing engineering studies, and heading the numerical modeling practice area of the company. His project experience includes the application of one-, two-, and three-dimensional hydrodynamic, advection-dispersion, wave, sediment transport, and morphology models such as the MIKE11/MIKE21/MIKE3 model suites, Delft3D model suites, ADCIRC, EFDC, CMS-Flow, HEC-RAS, HEC-HMS, RMA2, RMA4, MIKE21 Spectral Wave, Boussinesq Wave, Nearshore Wave, Delft3D-Wave / SWAN, ACES, STWAVE, REFDIF1, CGWAVE, and CMS-Wave models. He has applied these models to more than 40 hydraulics and scour studies in Florida, South Carolina, Louisiana, and Texas, and more than 85 numerical modeling projects in hydrology, hydrodynamics, waves, riverine and coastal flood, dam break, water quality, contaminant transport, sediment transport, morphology, and sea-level rise.

Selected Project Experience

USACE Kings Bay Sedimentation and Beneficial Use of Dredged Material Strategic Implementation Plan, Camden, Georgia (2025). *Coastal Engineer and Lead Modeler*. Analyzed the hydrodynamic forcings and sediment transport pathways contributing to the shoaling within the NSB Kings Bay channel to provide information for the NSB Kings Bay Beneficial Use of Dredged Material Strategic Implementation Plan. Developed and validated a new 3-dimensional (3D) mixed sand and mud transport and morphology model that integrates with 3D hydrodynamic and wave models. Performed 3D sediment transport and morphology modeling of the NSB Kings Bay channel, Cumberland Sound, Crooked River, Amelia River, St. Marys River, and portion of the Atlantic Ocean to understand the sources, dominant forcings, and conditions of the shoaled sediments settling within the NSB Kings Bay channel; developed and recommended alternatives to reduce shoaling (or frequency of dredging events) within the NSB Kings Bay channel; and evaluated engineering with nature solutions that leverage tidal currents and other natural forces to decrease or minimize dredging requirements. Evaluated the effects of sea-level rise, marsh degradation, and marsh restoration on NSB Kings Bay channel shoaling and resiliency.

USACE Numerical Modeling in Support of the Green Harbor Navigation Improvement Project (GHNIP), Plymouth County, Massachusetts (2025). *Project Manager, Coastal Engineer, and Lead Modeler*. Developed and validated an integrated two-dimensional hydrodynamic, wave, and sediment transport model to support coastal engineering efforts for the GHNIP. Evaluated the performances of (a) the No-Action Plan, (b) construction of a settling basin within the harbor, (c) extension of the east jetty, (d) raising a portion of the east jetty, (e) advance navigation channel pre-dredging, and (f) combination of navigation pre-dredging to reduce the volume of sediment deposition in the navigation channel, extend the dredging interval, and thereby reduce the cost of maintenance dredging.

Wendy Laurent, P.E., WEDG, *Ocean Engineer/Coastal Strategist*

TAYLOR ENGINEERING, INC.

Years Experience

9

Years Employed at Taylor Engineering

8

Education

M.S./Civil & Environmental Engineering, University of Rhode Island

B.S./Ocean Engineering, University of Rhode Island

Licenses/Certifications

Professional Engineer – FL (#90472), MD (#58561), NJ (#24GE05781200), NY (#105762), PA (#PE092962), VA (#0402065750)

WEDG Associate

Memberships

American Shore and Beach Preservation Association (ASBPA): Board of Directors (2024-present)

Northeast Chapter—Board Member (2022-present)

Coasts, Oceans, Ports, and Rivers Institute (COPRI ASCE)

Florida Shore and Beach Preservation Association (FSBPA)

Society of American Military Engineers (SAME)

Professional Background

Ms. Laurent manages and provides support on a wide variety of coastal engineering projects, including beach nourishment, inlet management, sand source investigations, coastal condition characterization, beneficial use of dredged material, structure-induced sediment scour, wave mechanics and loading, FEMA flood insurance studies, natural resource economic benefit studies, in addition to public outreach and permitting. She specializes in applying sustainable coastal strategies and is dedicated to enhancing resilience in coastal communities by implementing data-driven strategies that take a regional, holistic systems approach and apply natural and nature-based features.

Selected Project Experience

MacArthur Beach and Dune Construction, Martin County, FL (Ongoing). *Project manager and Engineer.* Provides the County with the final plans and specifications for this beach restoration project. To supplement the design, the team conducted an unmanned aircraft system (UAS, drone) survey to document the beach's current conditions and map the complex system of onshore rock outcrops and nearshore hardbottom resources. The team created an online easement dashboard/map to assist with the acquisition of easements and ensure a contiguous project without gaps.

Indian River County Beach Preservation Plan Update, Indian River County, FL (Ongoing). *Project Manager and Technical Lead.* Ms. Laurent is coordinating an update to the County's Beach Preservation Plan in partnership with Jones Edmunds. The update's primary goals are to update the history of beach management throughout the County and document the available management strategies in each planning sector. To accomplish this the team is collecting previous studies and data; assessing the performance of the beach; investigating beach management alternatives for each sector and addressing the permitting requirements, environmental implications, and possible funding mechanisms to implement the strategies; and participating in one public meeting to present the results. This study will provide one comprehensive, robust planning document to help guide beach management activities.

Volusia County Feasibility Assessment, Volusia County, FL (Ongoing). *Project Manager and Technical Lead.* The project serves to assess the risk of the Volusia County coastal communities, evaluate the feasibility of different solutions, and provide recommendations for best management practices. The study includes the collection and review of existing data, analysis of historic shoreline performance, characterization of the shoreline on a parcel-by-parcel basis, incorporation of vulnerability parameters to determine risk, and recommending beach management measures for each reach within the county.

Project Experience cont.

FDEP North Peninsula State Park Dune Resilience Engineering Design, Volusia County, FL (Ongoing). *Project Manager*. Ms. Laurent is leading her team through permitting and design of a dune in North Peninsula State Park. The dune restoration will serve to increase resilience and maintain the natural dune habitat in this undeveloped area. This project's main goal is to restore the dunes to their historic position and promote dune growth through native plantings and strategic placement of sand fencing.

Martin County Shore Protection Program Permitting Assistance, Martin County, FL (Ongoing). Taylor Engineering is working alongside the USACE and Martin County in advance of the next nourishment of the Shore Protection Project (SPP) in 2025/2026 and is permitting the placement of additional sand to account for sea-level rise observed since project authorization. As the project manager, Ms. Laurent is coordinating all project modifications, which include borrow area optimization, inclusion of a local option dune project, and simultaneous nourishment with the adjacent South St. Lucie Coastal Storm Risk Management (CSRM) project.

USACE RSM Decision Support Tool, Nationwide, U.S. (Ongoing). *Project Manager and Technical Expert.* Ms. Laurent leads the Taylor team's development of a regional sediment management decision support tool. This tool, created for the Engineering Research and Design Center, will inform district leaders and other stakeholders about the relative costs and benefits of dredging operations. Both quantitative and qualitative benefits associated with beneficial use placements are included in the tool.

Martin County MacArthur Dune Permitting, Martin County, FL (Ongoing). Following the significant erosion caused by Hurricanes Ian and Nicole in 2022, Ms. Laurent and her team worked alongside Martin County to develop plans and a permit application package for the reconstruction of the dune along MacArthur Boulevard. At the guidance of the Florida Department of Environmental Protection (FDEP) the team completed a JCP modification, tying this project into the larger adjacent federal project as a local option.

Narragansett Beach Carrying Capacity Study, Narragansett, RI (2024). With beach safety and the quality of user experience in mind, Taylor Engineering is performed a multi-parameter carrying capacity study that provided recommendations for beach operations, management, and sustainability. Ms. Laurent acted as the project manager, leading the team in their scope, which included a beach user and worker survey, analysis of historic data, and the creation of a physical carrying capacity analysis based on aerial photographs and data collected in the summer of 2023. The beach user survey generated over 1,000 responses related to each user's experience and concerns and compiled trends into one comprehensive report that included 39 recommendations specific to the site.

Martin County Shoreline Protection Plan Resilience Phase 2, Martin County, FL (2024). *Project Manager.* Evaluated the performance of the federal Martin County Shore Protection Project against storm forcing and SLR conditions. The team is investigating alternative beach templates that will decrease berm overtopping and erosion and thus increase project performance and storm protection.

Martin County Indian Riverside Park Living Shoreline, Martin County, FL (2022). To assist Martin County in its efforts to stabilize the park's severely eroded shoreline, enhance nearshore habitats, maintain recreational access, and increase public awareness of nature-based solutions, Ms. Laurent led data collection efforts, participated in grant writing, conducted coastal conditions analyses, and assisted in the project design.

Martin County Shoreline Protection Plan Resilience Phase 1, Martin County, FL (2021). Phase I of a multi-phase analysis to increase resilience along the Martin County Shore Protection Project. Acting as the technical lead, Ms. Laurent led the team in background data collection and analyses that tracked historic beach trends and analyzed project performance. The team met with state and federal agencies to ensure project objectives and permit requirements were still met when redesigning the project in phase 2.

John (JJ) Woolley, Jr, PE, *Marine Surveyor*

KCI

Education

BS, Industrial Engineering, Lehigh University (2010)

Licenses

Professional Engineer:

NY #101591

NJ #24GE05287700

CT #33792

TX #136074

Certifications

ADCI Commercial Diver

Certification - Surface-Supplied Air Diving Supervisor, Cert #57424

#FHWA-NHI-130053 - Bridge Inspection Refresher

#FHWA-NHI-130055 - Safety Inspection of In-Service Bridges

#FHWA-NHI-130091 - Underwater Bridge Inspection

OSHA Confined Space Entry Training (29 CFR 1910.146)

OSHA 30-Hour Construction Safety Training

Transportation Worker Identification Credentials

CPR, First Aid, Oxygen Administration, and Bloodborne Pathogens

Professional Background

John (JJ) Woolley, Jr. is a PE licensed in multiple states, ADCI-certified diver, and project manager with 15 years of diving inspection and marine engineering experience in New York City. As the Regional Director of diving + inspections, JJ oversees, manages, and participates in diving and marine field activities for New York City and State agencies. His project experience consists of a wide array of assignments that include bathymetric + hydrographic surveys, dredge plan development, underwater inspections, bulkhead rehabilitation, grading and site projects, marine fender construction, and structural and protective pile encasements. JJ's specialties include marine / waterfront construction, analysis, and design of maritime structures, vessel operations, routine inspections, underwater construction inspections, and resident engineering.

Selected Project Experience

Yonkers Waterfront Park Bathymetric Survey | Yonkers, NY *Marine Engineer / Surveyor* for the construction of a new waterfront park along the Hudson River in Yonkers, NY. To facilitate the design and permitting of the pier structures, JJ completed a bathymetric survey of the project site. He coordinated the survey and oversaw the field work. Upon completion, the survey information was tied into the existing topographic survey and utilized for the cut/fill permit calculations along with pile lengths and depth requirements for mooring the service boats.

Liberty Landing Marina Multibeam Survey | Jersey City, NJ

As *Marine Engineer / Surveyor*, JJ completed a multibeam survey of 25 acres of waterway at an existing marina on the Hudson River in Jersey City, NJ. The survey was completed by KCI's team as a subconsultant to the prime consultant to provide baseline conditions of the site's waterfront. JJ coordinated the survey and completed a portion of the field work. Upon completion, the survey data was tied into the existing topographic survey and utilized for baseline condition assessment prior to the implementation of structural and resiliency upgrades.

NYC Parks FEMA Funded Shoreline Stabilization | New York, NY As *PE Diver*, JJ completed underwater inspections at Pelham Bay Landfill, Socrates Sculpture Park, Joe Michaels Mile, and Lemon Creek to assist with the design of shoreline protection and dredging. JJ led a three-person team during the design level inspection of the shoreline structures comprised of rip raps and bulkheads. He evaluated the data and prepared an inspection letter report that informed the design development at each of the sites.

NYCDOT Bridge Diving Inspection and Fathometer Survey | New York, NY

As a Team Leader, JJ provided Bridge Diving Inspection and Fathometer Survey services for thirteen New York City Department of Transportation (NYCDOT) bridges located throughout the five boroughs of New York City. The project consisted of 13 diving inspections and four general bridge inspections. JJ also reviewed field data and bridge inspection reports to ensure compliance with the New York State Department of Transportation (NYSDOT) Bridge Inspection Manual (BIM) and NYCDOT specifications.

Section 5.2 Relevant Past Performance

Project Descriptions

The projects presented in this section demonstrate the team's ability to deliver planning-led, technically rigorous coastal resilience efforts that closely align with the scope and intent of the Guinea Marsh Resilience Initiative. Collectively, these projects reflect experience working across tidal marsh and shoreline systems where sea-level rise, sediment dynamics, ecological performance, and regulatory considerations must be evaluated together to support defensible decision-making and long-term resilience outcomes.

These examples highlight the team's strength in moving from existing conditions assessment through conceptual planning, feasibility evaluation, and regulatory documentation while maintaining a clear focus on marsh-scale system behavior rather than isolated site solutions. Several projects illustrate direct experience with beneficial use of dredged material, marsh elevation enhancement, hybrid living shoreline design, and sediment management strategies that parallel the challenges and opportunities present at Guinea Marsh. Others demonstrate the application of landscape-scale GIS analysis, marsh migration assessment, land conservation prioritization, and adaptive planning frameworks that inform where and when interventions are most effective.

The selected projects also show the team's familiarity with working in complex regulatory environments, particularly within tidal wetland systems governed by state and federal permitting frameworks. This includes experience developing design assumptions, biological benchmarks, and planning-level documentation that support efficient permitting pathways without predetermining final engineered solutions. Importantly, the examples reflect coordination among planners, coastal engineers, restoration ecologists, and survey specialists, reinforcing the integrated, adaptive management approach proposed for this effort.

Together, these projects demonstrate a consistent capability to translate data-driven analysis into clear, actionable strategies that balance ecological performance, feasibility, cost, and long-term resilience. This experience provides a strong foundation for advancing resilience planning, feasibility assessment, and conservation analysis for the Guinea Marsh Wildlife Management Area and adjacent marsh systems.

NSA Annapolis Greenbury Point Berm Stabilization

NAVFAC Washington, Anne Arundel County, MD

Relevancy to RFP

- Integration of site-specific coastal process analysis into shoreline and marsh resilience planning.
- Application of living shoreline and berm stabilization strategies within a complex tidal marsh system.
- Design development informed by long-term sea-level rise projections and future hydrologic conditions.
- Consideration of marsh migration, elevation gradients, and adaptive landscape response in design.
- Coordination of ecological assessments, regulatory requirements, and environmental protection objectives.
- End-to-end project experience connecting assessment, design, permitting, construction, and monitoring.

Budgeted Cost

$2,585,653.39

Cost of Comparable Scope

$268,434.35

Completed Cost

$2,585,653.39

Scheduled Completion Date

29 June 2024

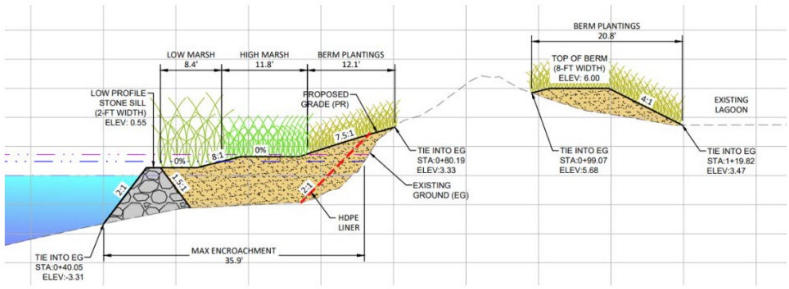
Actual Completion Date

28 November 2024

MARSTEL DAY

Project Summary

Marstel-Day supported NAVFAC Washington with site assessments, surveys, design, permitting, construction, and monitoring of a stabilization project for a 750-foot berm at Greenbury Point at NSA Annapolis. Construction was completed in November 2024 and the project is now in the monitoring phase. The berm, which was experiencing erosion, separates the Severn River system from a lagoon that contains contaminated sediment from historical dredge projects conducted nearby. The stabilization project incorporates a living shoreline approach and will protect the Severn River system by preventing failure of the berm, which, if left unprotected, could result in contamination entering the river system. The stabilization design was developed based upon a sediment data analysis, wave energy assessment and tide characterization data, hydrologic and hydraulic studies, geotechnical and structural analyses, bathymetric and topographic surveys, wetland delineation and biobenchmark studies, and an essential fish habitat assessment. In preparation for the field work and construction components of this project, Marstel-Day developed an accident prevention plan (APP) that follows the format and covers all topics as delineated in Appendix A of the USACE engineering manual EM-385-1-1, including the Activity Hazard Analysis and Situation Specific Safety Plans for the contaminants present in the site's soils.



The berm stabilization approach is designed to last at least 50 years and considers sea-level rise and high-water events recommended for the U.S. Naval Academy for 2075 by the Sea-level Rise Advisory Committee, which is formed by scientific experts from the installation and surrounding community of Annapolis, MD. The berm stabilization design will continue to attenuate wave action sufficiently as water levels rise and will capture sediment in future higher water level scenarios by implementing native shoreline plantings. The design allows for the upslope migration of the marsh plant community as sea levels rise, which contributes to ensuring long-term stability.

Beneficial Use Site Scoping Support Services

USACE, NSB Kings Bay, Camden County, GA

Relevancy to RFP

- Recipient of the **2025 CCBJ Business Achievement Award** for Climate Change Adaptation and Resilience
- Demonstrated capability to assess marsh change across historical, existing, and future conditions at landscape scale.
- Direct experience evaluating beneficial use of dredged material as a marsh resilience strategy.
- Application of field-based marsh assessments to inform model inputs and restoration feasibility.
- Use of SLAMM to evaluate marsh response under no-action and restoration scenarios.
- Integration of land ownership, implementation constraints, and phasing into resilience recommendations.
- Structured coordination and stakeholder engagement to support actionable outcomes.

Budgeted Cost

$399,045.69

Completed Cost

$399,045.69

Scheduled Completion Date

18 November 2024

Actual Completion Date

17 January 2025

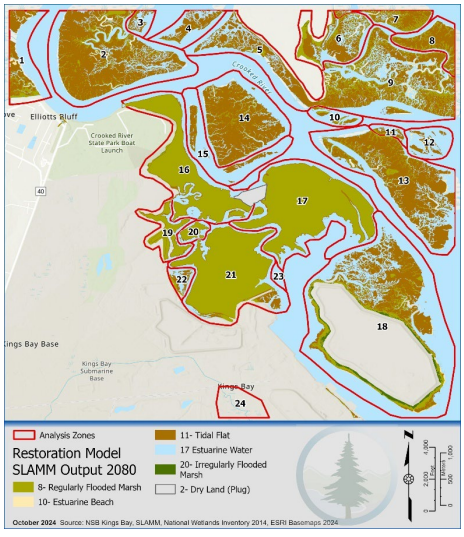
MARSTEL DAY

Project Summary

Under contract with the USACE, Marstel-Day assessed historical marsh loss, existing marsh conditions, and potential future marsh loss in a 14,000-acre study area northwest of NSB Kings Bay in St. Mary's, Georgia. These assessments were performed with the goal of understanding the potential for the beneficial use of dredged material as a strategy to manage dredged sediment from the base. To start, the team performed GIS-based analyses using historical and current data to estimate the acreage and cubic yardage of marsh loss over a 90-year period beginning in 1932. Eight vulnerable marsh areas identified through the historical analysis were then studied through fieldwork and desktop analyses to characterize the existing marsh conditions. These eight areas were assessed for physical and biological parameters, including marsh elevation range, accretion rate, sediment samples, vegetation and invertebrate species identification, and stem density, height, and cover.

Following the historical and existing conditions analyses, the team developed a Sea Level Affecting Marshes Model (SLAMM) to project marsh loss due to sea-level rise through 2080. The SLAMM was used for a no-action scenario, assuming no marsh restoration takes place during that timeframe, as well as a preliminary project scenario, to simulate the benefits of restoring a focus area to a desired target elevation. The team estimated the amount of sediment that could be placed in the marsh areas, as well as the amount of sediment needed to achieve target marsh elevations and prevent marsh loss into the future. These findings were used to develop beneficial use recommendations that considered appropriate timeframes, prioritized locations, property ownership, and other factors.

The historical, current, and future marsh analyses were each summarized in standalone reports, and the team regularly coordinated with USACE, the Army, and other consultant teams working on concurrent projects. The project culminated in an onsite charrette with over 30 attendees from a variety of local, regional, and regulatory stakeholder groups to share the findings and seek feedback. The findings from this project can be used to drive more detailed beneficial use of dredge material feasibility studies for NSB Kings Bay.



Compatible Land Use and Resilience Strategy

MCICOM, Marine Corps Air Station Beaufort, SC

Relevancy to RFP

- Direct experience using land conservation as a resilience strategy to address climate, ecological, and land use pressures.
- GIS-based prioritization of conservation and resilience opportunities at landscape scale.
- Integration of climate hazard assessment and exposure analysis into planning decisions.
- Proven ability to translate planning analysis into funded, implemented conservation outcomes.
- Experience coordinating multi-stakeholder conservation partnerships and governance structures.
- Regional conservation leadership that supports resilience at system scale.

Budgeted Cost

$175,000

Completed Cost

$175,000

Scheduled Completion Date

02 October 2023

Actual Completion Date

30 September 2022

MARSTEL DAY

Project Summary

Marstel-Day recently completed a land use planning and conservation partnering strategy at Marine Corps Air Station (MCAS) Beaufort to identify and prioritize potential conservation partnerships based on local land use and encroachment issues, including climate and resilience threats. The project identified climate hazards, assessed exposure, and used GIS to prioritize potential conservation and resilience projects with mutual benefits. For more than five years, Marstel-Day has supported MCAS Beaufort with conservation projects and funding strategies through the REPI program, which has protected 6,530 acres with a focus on protecting the installation from incompatible development, protecting endangered species, and improving water quality and wildlife habitat. The installation has received more than $15 million for these efforts. In part, due to the success at MCAS Beaufort, Marstel-Day is currently supporting Marine Corps Recruit Depot Parris Island to stand up a resilience-focused REPI program, which included the facilitation of multi-stakeholder conservation partner workshops. We also supported the region's recent success by establishing the South Carolina Lowcountry Sentinel Landscape to protect the area's unique biodiversity and promote climate resilience.

AO8-Willowdale Tidal Wetland Mitigation Site

Accomack County, VA

Relevancy to RFP

- Local tidal wetland restoration experience
- Tidal site existing conditions surveys
- Tidal wetland permit acquisition

Budgeted Cost

$2,530,000

Completed Cost

Currently under construction

Period of Performance

2023-2025 Monitoring Ongoing

Reference

Karen Johnson, Director of Wetland and Stream Mitigation

804.249.3416

530 East Main Street, Suite 800
Richmond, VA 23219

res

Project Summary

The purpose of this project is to provide tidal wetland mitigation to offset unavoidable impacts in the Atlantic Ocean Basin within the Commonwealth of Virginia. The Virginia Aquatic Resources Trust Fund (VARTF) was utilized as compensatory mitigation. RES is providing a full delivery wetland mitigation project at the Willowdale Tidal Wetland Mitigation Site to provide compensatory mitigation, which will yield a minimum of 5.5 tidal wetland credits.

Activities covered under this contract include all necessary land searches and land acquisition services, existing conditions surveys, design services, permit submittals and approvals, site construction, establishment of necessary long-term maintenance and stewardship endowments, and site success monitoring until final credit releases at Year 10.

The general scope of work RES performed and will be performing include:

- Topographic and boundary surveys;
- Existing conditions surveys including tidal and nontidal wetland delineations, soils evaluations, collection of biological benchmark elevation data, non-native and invasive species surveys and mapping to inform vegetation management strategies;
- Development of Preliminary Mitigation Design;
- Development and Approval of the formal Site Development Plan per the current USACE-approved SDP process;
- Establish and fund the Long-term Stewardship Endowment, the Long-term Management Endowment, and the Maintenance and Monitoring Fund;
- Record the Real Estate Protections and Conservation Easement;
- Prepare Final Design Plans for construction;
- Acquisition of all federal, state, and county permits;
- Implementation of Construction and Planting, and preparation of the As-Built survey and Report;
- Perform 10 years of success monitoring

Queen Bess Island

Jefferson Parrish, LA

Relevancy to RFP

- Shoreline restoration and stabilization
- Reconstruction of former island footprint lost to multiple named tropical storms
- Revegetation of reconstructed portions of the island with shrub vegetation to promote re-establishment of pelican nesting habitat

Budgeted Cost

$350,000

Completed Cost

$350,000

Period of Performance

2018-2020

Reference

Shane Faust,
Engineer Technician,
CPRA (Owner)
225.342.4599
Prime: Ponchartrain Partners

Project Summary

Queen Bess Island, pre-restoration

Queen Bess, a historic island off the coast of Grand Isle, Louisiana, is known for its importance as a nesting ground for many coastal bird species. The most significant of these birds, the brown pelican, was reintroduced to the island in 1963 after its disappearance caused by using a pesticide called dichlorodiphenyltrichloroethane (DDT) which was banned by the EPA in 1972. Multiple named storms, continuous erosion, and impacts from the BP oil spill left the island degraded and in poor condition. The state of Louisiana put out a request for proposals to revitalize this landmark in a five-month process between Pontchartrain Partners, LLC and RES. This project finally came to completion on February 15, 2020, just two months before the 10th anniversary of the catastrophic oil spill on April 20, 2010. Restoration was accomplished by restoration and stabilization of the historic shoreline followed by reconstruction of the island footprint through pumping of 150,000 CY of sand dredged from the Mississippi River. The new substrate was then replanted to re-establish the island's vegetation.

To meet the project's need for vegetative cover, 26,313 plants were custom grown from cuttings at RES' Pointe Aux Chenes Nursery. These plant species were made up of Matrimony Vine (*Lycium carolinianum*), Groundsel Bush (*Baccharis halimifolia)*, and Marsh Elder *(Iva frutescens*). Matrimony Vine was found currently growing on the island and was chosen for this project because of the Brown Pelican's favoritism towards use of this species in nest building. Additionally, the vine-like nature of the plant causes it to grow horizontally along the soil surface, putting roots down as it grows, resulting in increased stabilization of the freshly placed sand, and reducing erosion.

This restoration project required transporting all personnel, supplies, materials, and equipment to the work area by way of barges. RES subsoiled lines for five-foot spacing in the fresh aggregate within the planting cells, de-potted the plants on site, and installed the vegetation using augers to dig holes for each plant. Additionally, 1,325 hay bales were employed to help reduce wind erosion on the island. For the welfare of the wildlife on Queen Bess Island, RES only provided hay bales bound with biodegradable twine strings and placed in rows running parallel with the rows of plants. Bermuda Grass seed and Annual Rye Grass seed were broadcast by RES over the sand areas to expedite the root development and further stabilization of the island's surface.

Penniman Spit Hybrid Living Shoreline Project

Naval Weapons Station, York County, VA

Relevancy to RFP

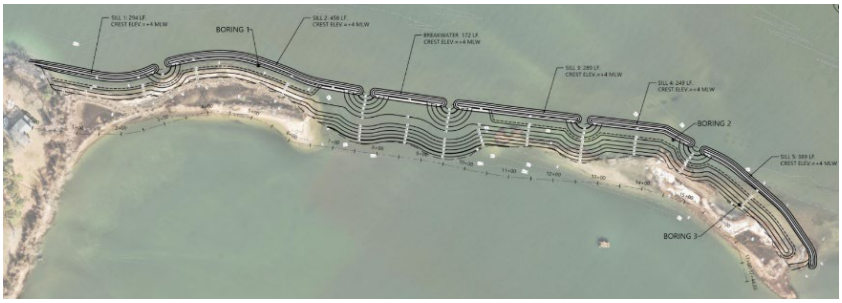
- Hybrid living shoreline design reduces wave energy in a highly eroded tidal system.
- Demonstrates a clear progression from conceptual planning through detailed design and regulatory permitting.
- Addresses marsh fragmentation and loss driven by sea-level rise and increased wave exposure.
- Combines structural elements with sediment placement to rebuild elevation capital and protect existing marsh.
- Reflects deep experience navigating Virginia's tidal wetland and VMRC regulatory framework.
- Integrates coastal engineering, ecological restoration, and habitat performance within a marsh-scale resilience strategy.

Competion Date

2021

VIMS | William & Mary
Virginia Institute of Marine Science

Project Summary



Penniman Spit is located on the southern side of the York River approximately 5 miles north of the Route 17 Coleman Bridge in Yorktown. It is attached to the upland at the Naval Weapons Station Yorktown Cheatham Annex and protects the entrances to both King Creek and Felgates Creek. What was once a continuous 14-acre spit in 1937, split into two sections in 2011, and its remnant now only consists of about 4 acres eroding marsh shoreline and sandy washovers. By 2019, the water was 2 ft deep between the two sections, allowing tide and wave energy to impact previously protected habitat in King Creek.

In 2014, Hardaway et al. developed a concept plan for Penniman Spit as part of the York County Management Plan (doi.org/10.21220/V54C72) which included a semicontinuous sill to rebuild sections of the marsh and protect the remaining sections from continued loss. In 2019, the Shoreline Studies Program (SSP) at VIMS received funding from the Chesapeake Bay Trust to further develop the hybrid living shoreline concept project. For this effort, the physical, hydrodynamic, and biologic elements at Penniman were analyzed. At that time, only 1.7 acres of land occurred above mean high water limiting the amount of high marsh present on the Spit. SSP developed a detailed conceptual plan, typical cross-sections, and draft joint permit application for the hybrid living shoreline project that was designed to provide habitat restoration by rebuilding marsh and sandy beach ecosystems and by the installation of rock structures on which shellfish would grow.

The hybrid living shoreline project consists of 6 rock sills with sand placed between the two spit remnants and behind the sill structures to create a continuous project. The crest elevation of the structures is +4 ft MLW (1983-2001 NTDE), and the rocks provide additional habitat for oysters and other shellfish. Small gaps between sills reduce wave impacts to the marsh while still allowing faunal access. Sand was placed on a 40:1 slope behind the rock sills and on an 8:1 or 10:1 slope further landward to +4 ft MLW. The sand was planted with Spartina alterniflora (0.94 acres) for low marsh and Spartina patens (1.31 acres) for high marsh. The total marsh created is 2.25 acres along 1,950 ft of shoreline and protects nearly 5 acres of existing marsh. The site was accessed by water with materials being delivered by barge.

Fort Pierce Shore Protection Project
General Re-Evaluation Report

St. Lucie County, FL

Relevancy to RFP

- Two-Dimensional (2D) Hydrodynamic, Wave Modeling
- Two-Dimensional (2D) Sediment Transport, Morphology Modeling
- Long-Term Coastal Morphology
- Field Measurements
- Erosion Control
- Beach Nourishment
- Jetties
- Storm Impact Assessment
- Inlet and Coastal Processes
- Coastal Structures

Contract Value

$398,882 (For GRR)

Completion Date

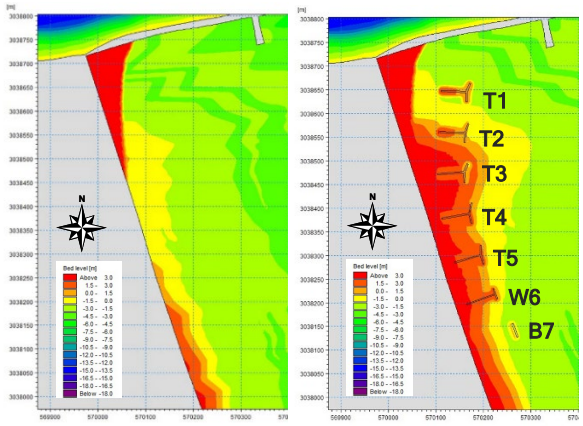
2018

Reference

Joshua Revord, P.E.
Senior Coastal Engineer
St. Lucie County Erosion District
3071 Oleander Ave.
Ft. Pierce, FL 34982
(772) 462-1269

TAYLOR ENGINEERING, INC.

Project Summary



Shoreline morphology after three years without coastal structures and with coastal structures

The Fort Pierce Shore Protection Project nourishes a 1.3-mile Atlantic Ocean shoreline south of Fort Pierce Inlet. The beach erodes nonuniformly with a hotspot along the northernmost 0.4 mi, requiring nourishment after about two years of normal wave regime. In 2016, as part of the Fort Pierce Shore Protection Project General Reevaluation Report (GRR), Taylor Engineering conducted a study using a hybrid coastal morphology model to evaluate the performance of shoreline stabilization alternatives.

A fully integrated 2D hydrodynamic, spectral wave, sediment transport, and morphology model with quasi-stationary time formulations for the hydrodynamics and spectral wave modules allowed faster computation of long-term shoreline evolution. A littoral processes model—calibrated to provide good estimates of the cross-shore variation of the longshore sediment transport—generated equivalent effective waves to represent long-term waves and water levels at the model's offshore boundary.

The model was used to evaluate how beach nourishment alone and beach nourishment with coastal structures (T1 – T5, W6, and B7 in the above figure) reduce shoreline erosion, retain beach nourishment sand, and increase the beach nourishment interval. With the beach nourishment alone alternative, the model provided a shoreline movement pattern similar to the general historical pattern observed in the project area, including accurately indicating the largest erosion rate and shoreline retreat along the first 0.4 mi south of the jetty. Model simulations with beach nourishment combined with coastal structures show longer retention of beach fill, resulting in lower erosion rates from 0.5 to 4.0 miles south of the jetty. A comparison of results for the two evaluated beach stabilization alternatives shows that beach nourishment with coastal structures alternative feasibly extends the normal beach nourishment interval from the current two years to four years and thereby reduces the long-term cost of beach nourishment.

USACE Kings Bay Sedimentation and Beneficial Use of Dredged Material Strategic Implementation Plan

USACE Jacksonville District, Camden County, GA

Relevancy to RFP

- Hydrodynamic, Wave, Particle Tracking, Sediment Transport, Morphology Modeling
- Mixed Sand/Mud Transport
- Shoaling Reduction
- Effects of Sea-level rise
- Effects of Marsh Degradation/Restoration
- Riverine Processes Analysis
- Coastal Processes Analysis
- Dredging and Resiliency
- Economic/Cost Analysis
- Dredged Material Management
- Beneficial Use of Dredged Materials

Contract Value

$610,866

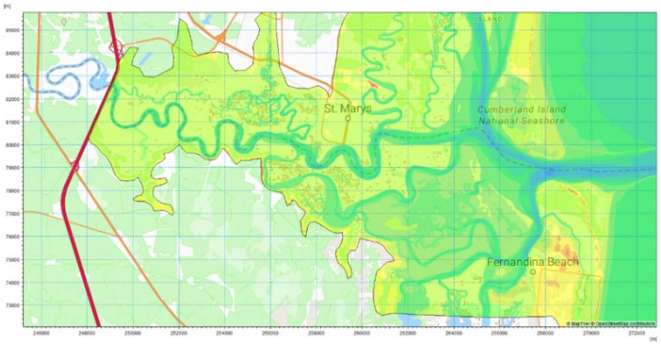
Completion Date

Ongoing

Reference

Laurel Reichold
Director, RSM RCX
SAD Regional Sediment Management Center of Expertise
U.S. Army Corps of Engineers
701 San Marco Blvd.
Jacksonville, FL 32207
904.401.3871
Laurel.P.Reichold@usace.army.mil

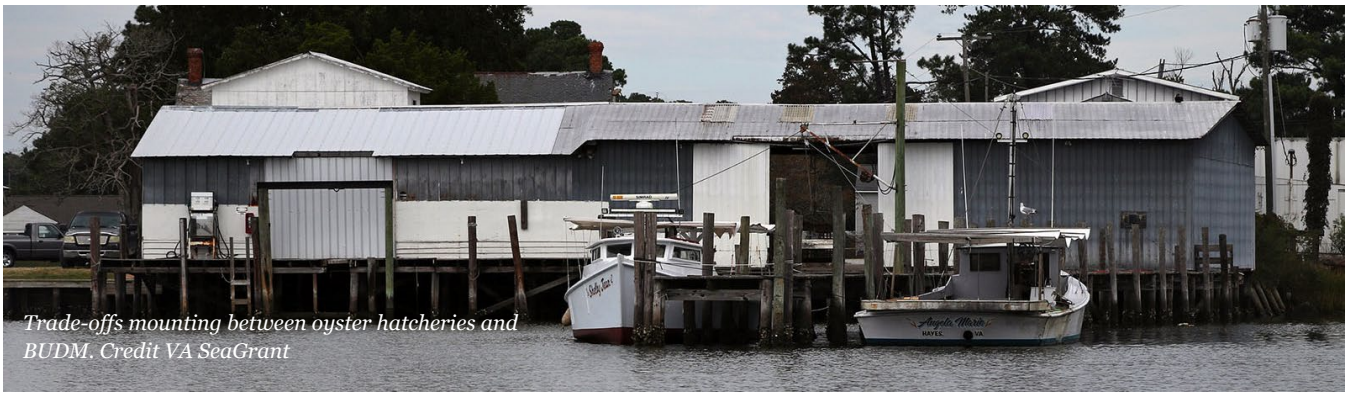
Project Summary



St. Marys River Portion of the Integrated Hydrodynamic, Wave, and Mixed Sand & Mud Sediment Transport Model in NE FL and SE GA.

NSB Kings Bay is in Camden County, Georgia, just north of the St. Marys River and west of Cumberland Sound. The U.S. Navy (USN), with support from the USACE Jacksonville District, manages the federal navigation channels to support the NSB Kings Bay mission. USACE Jacksonville performs the maintenance dredging of the NSB Kings Bay channel and Federal Channel through the Kings Bay Maintenance Project. The dredge material is beneficially used as beach and nearshore placement, placed in nearby upland DMMAs, and some is placed at ocean dredged material disposal sites (ODMDS). As the subbase channel and surrounding NSB Kings Bay uplands are located among extensive salt marsh and sand flats, future sea-level rise and other factors degrade these natural features and adversely affect navigation, increase maintenance dredging, and thereby reducing the resilience of NSB Kings Bay to rising sea levels.

USACE Jacksonville requested that Taylor Engineering provide a comprehensive analysis of the hydrodynamic forcings and sediment transport pathways contributing to the shoaling within the NSB Kings Bay channel and provide information for the NSB Kings Bay Beneficial Use of Dredged Material Strategic Implementation Plan. Among other things, USACE Jacksonville required Taylor Engineering develop and validate a mixed sand and mud transport and morphology model, and perform sediment transport and morphology modeling of the NSB Kings Bay channel, Cumberland Sound, Crooked River, Amelia River, St. Marys River, and portion of the Atlantic Ocean to understand the source(s), dominant forcing(s), and conditions of the shoaled sediments settling within the NSB Kings Bay channel; recommend alternatives to reduce shoaling (or frequency of dredging events) within the NSB Kings Bay channel; evaluate the effect of sea level change and marsh degradation on NSB Kings Bay channel shoaling; and propose engineering with nature solutions that leverage tidal currents and other natural forces to decrease or minimize dredging requirements.



Trade-offs mounting between oyster hatcheries and BUDM. Credit VA SeaGrant

Section 6. Response Capability

This project will be assigned high priority within the Marstel-Day Team's active workload, with dedicated staff identified specifically to support MPPDC and the full project team throughout the duration of the effort. Key staff members across firms have confirmed more than sufficient capacity to perform the services called upon in this contract.

Dr. Wolf, the Project Manager and key technical leads will maintain direct responsibility for day-to-day coordination, schedule management, and quality control, ensuring timely responsiveness to MPPDC requests and decision-making needs. The team has deliberately structured its current workload and staffing plan to maintain available capacity for time-sensitive coordination, iterative review cycles, and adaptive project needs. Core team members will be supported by an established bench of senior technical specialists who can be engaged as needed to address peak workload periods, accelerated review schedules, or unanticipated tasking. Marstel-Day also maintains a large bench of on-call support and specialty professionals, providing surge capacity and specialized expertise as needed.

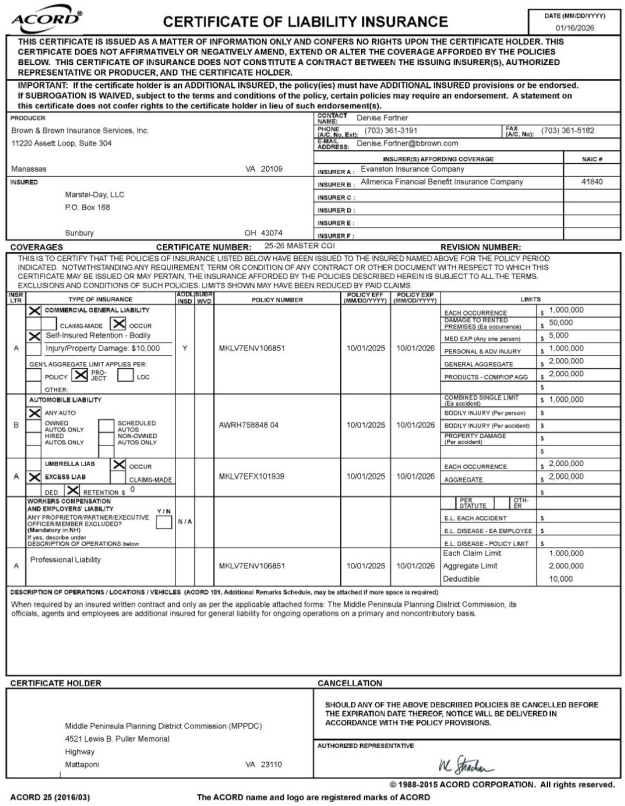
To support responsiveness, the Marstel-Day Team will employ clear internal communication protocols, defined points of contact, and standing coordination procedures that allow MPPDC to rapidly access technical leads and management staff. The Marstel-Day Team's organizational structure enables parallel task execution, allowing multiple work streams to advance concurrently without compromising quality or schedule.

If priorities shift or additional coordination is required, the Marstel-Day Team can readily reassign internal resources or augment the team with qualified personnel familiar with the project objectives, regulatory context, and regional conditions. This approach ensures that MPPDC and project partners receive consistent, timely, and informed support, while maintaining flexibility to adapt to evolving project needs.

Overall, the Marstel-Day Team's staffing plan, workload management practices, and organizational depth provide a high level of confidence in our ability to respond promptly and effectively to MPPDC and the project team while delivering high-quality technical products on schedule.

Section 7. Insurance

Marstel-Day, LLC affirms that it currently maintains and will continue to maintain throughout the duration of any resulting contract, the insurance coverages required by the RFP and Appendix A. Evidence of coverage is provided on the next page. Upon award and prior to contract execution, Marstel-Day will furnish updated Certificate(s) of Insurance naming the Middle Peninsula Planning District Commission (MPPDC) as the Certificate Holder and naming MPPDC, its officials, agents, and employees as additional insureds as required. Further, policies will provide forty-five (45) days advance written notice prior to cancellation/termination, will be primary to other insurance or self-insurance, and will remain applicable to claims made during the contract period or within the applicable statute of limitations.



ACORD

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY) 01/16/2026

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER
Brown & Brown Insurance Services, Inc.
11220 Assett Loop, Suite 304
Manassas VA 20109

CONTACT NAME: Denise Fortner
PHONE (A/C, No, Ext): (703) 361-3191 FAX (A/C, No): (703) 361-5182
E-MAIL ADDRESS: Denise.Fortner@bbrown.com

INSURER(S) AFFORDING COVERAGE	NAIC #
INSURER A: Evanston Insurance Company	
INSURER B: Allmerica Financial Benefit Insurance Company	41840
INSURER C:	
INSURER D:	
INSURER E:	
INSURER F:	

INSURED
Marstel-Day, LLC
P.O. Box 168
Sunbury OH 43074

COVERAGES CERTIFICATE NUMBER: 25-26 MASTER COI REVISION NUMBER:

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS
A	X COMMERCIAL GENERAL LIABILITY CLAIMS-MADE X OCCUR X Self-Insured Retention - Bodily Injury/Property Damage: $10,000 GEN'L AGGREGATE LIMIT APPLIES PER: POLICY X PRO-JECT LOC OTHER:		Y	MKLV7ENV106851	10/01/2025	10/01/2026	EACH OCCURRENCE $ 1,000,000 DAMAGE TO RENTED PREMISES (Ea occurrence) $ 50,000 MED EXP (Any one person) $ 5,000 PERSONAL & ADV INJURY $ 1,000,000 GENERAL AGGREGATE $ 2,000,000 PRODUCTS - COMP/OP AGG $ 2,000,000 $
B	AUTOMOBILE LIABILITY X ANY AUTO OWNED AUTOS ONLY / SCHEDULED AUTOS HIRED AUTOS ONLY / NON-OWNED AUTOS ONLY			AWRH758848 04	10/01/2025	10/01/2026	COMBINED SINGLE LIMIT (Ea accident) $ 1,000,000 BODILY INJURY (Per person) $ BODILY INJURY (Per accident) $ PROPERTY DAMAGE (Per accident) $ $
A	UMBRELLA LIAB X OCCUR X EXCESS LIAB CLAIMS-MADE DED X RETENTION $ 0			MKLV7EFX101939	10/01/2025	10/01/2026	EACH OCCURRENCE $ 2,000,000 AGGREGATE $ 2,000,000 $
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY Y/N ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? N/A (Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below						PER STATUTE / OTH-ER E.L. EACH ACCIDENT $ E.L. DISEASE - EA EMPLOYEE $ E.L. DISEASE - POLICY LIMIT $
A	Professional Liability			MKLV7ENV106851	10/01/2025	10/01/2026	Each Claim Limit 1,000,000 Aggregate Limit 2,000,000 Deductible 10,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)
When required by an insured written contract and only as per the applicable attached forms: The Middle Peninsula Planning District Commission, its officials, agents and employees are additional insured for general liability for ongoing operations on a primary and noncontributory basis.

CERTIFICATE HOLDER
Middle Peninsula Planning District Commission (MPPDC)
4521 Lewis B. Puller Memorial Highway
Mattaponi VA 23110

CANCELLATION
SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.
AUTHORIZED REPRESENTATIVE

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ACORD

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY) 01/16/2026

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER
Marsh Affinity
a division of Marsh USA LLC.
P.O. BOX 14484
Des Moines, IA 50306-9688

CONTACT NAME: Marsh Affinity
PHONE (A/C, No, Ext): 800-743-8130 FAX (A/C, No):
E-MAIL ADDRESS: ADPTotalSource@marsh.com

INSURER(S) AFFORDING COVERAGE	NAIC #
INSURER A: New Hampshire Insurance Co.	23841
INSURER B:	
INSURER C:	
INSURER D:	
INSURER E:	
INSURER F:	

INSURED
ADP TotalSource NH XXVIII, Inc.
5800 Windward Parkway
Alpharetta, GA 30005
Alternate Employer:
Marstel-Day, LLC
10304 SPOTSYLVANIA AVE, SUITE 102
Fredericksburg, VA 22408

COVERAGES CERTIFICATE NUMBER: REVISION NUMBER:

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS
	COMMERCIAL GENERAL LIABILITY CLAIMS-MADE OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: POLICY PRO-JECT LOC OTHER						EACH OCCURRENCE $ DAMAGE TO RENTED PREMISES (Ea occurrence) $ MED EXP (Any one person) $ PERSONAL & ADV INJURY $ GENERAL AGGREGATE $ PRODUCTS - COMP/OP AGG $ $
	AUTOMOBILE LIABILITY ANY AUTO OWNED AUTOS ONLY / SCHEDULED AUTOS HIRED AUTOS ONLY / NON-OWNED AUTOS ONLY						COMBINED SINGLE LIMIT (Ea accident) $ BODILY INJURY (Per person) $ BODILY INJURY (Per accident) $ PROPERTY DAMAGE (Per accident) $ $
	UMBRELLA LIAB OCCUR EXCESS LIAB CLAIMS-MADE DED RETENTION $						EACH OCCURRENCE $ AGGREGATE $ $
A	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY Y/N ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? N N/A (Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below			WC 063528477 VA	07/01/2025	07/01/2026	X PER STATUTE / OTH-ER E.L. EACH ACCIDENT $ 2,000,000 E.L. DISEASE - EA EMPLOYEE $ 2,000,000 E.L. DISEASE - POLICY LIMIT $ 2,000,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)
All worksite employees working for Marstel-Day, LLC paid under ADP TOTALSOURCE, INC.'s payroll, are covered under the above stated policy. Marstel-Day, LLC is an alternate employer under this policy. Proprietor/Partner/Executive Officer/Member are not excluded as long as they are in the ADP'S payroll or have completed the SEI Participation Addendum.

CERTIFICATE HOLDER
Middle Peninsula Planning District Commission (MPPDC)
4521 Lewis B. Puller Memorial Highway
Mattaponi, VA 23110

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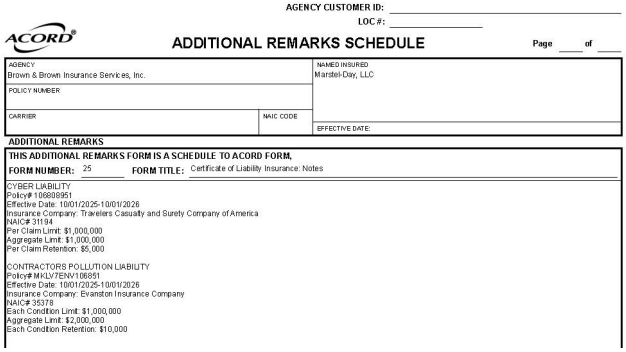


AGENCY CUSTOMER ID:
LOC #:

ACORD

ADDITIONAL REMARKS SCHEDULE

Page of

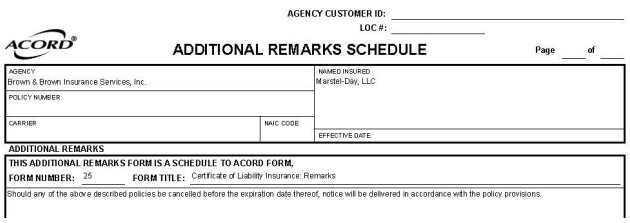
AGENCY: Brown & Brown Insurance Services, Inc.
NAMED INSURED: Marstel-Day, LLC
POLICY NUMBER:
CARRIER: NAIC CODE:
EFFECTIVE DATE:

ADDITIONAL REMARKS

THIS ADDITIONAL REMARKS FORM IS A SCHEDULE TO ACORD FORM,
FORM NUMBER: 25 FORM TITLE: Certificate of Liability Insurance: Notes

CYBER LIABILITY
Policy# 108689951
Effective Date: 10/01/2025-10/01/2026
Insurance Company: Travelers Casualty and Surety Company of America
NAIC# 31194
Per Claim Limit: $1,000,000
Aggregate Limit: $1,000,000
Per Claim Retention: $5,000

CONTRACTORS POLLUTION LIABILITY
Policy# MKLV7ENV106851
Effective Date: 10/01/2025-10/01/2026
Insurance Company: Evanston Insurance Company
NAIC# 35378
Each Condition Limit: $1,000,000
Aggregate Limit: $2,000,000
Each Condition Retention: $10,000



AGENCY CUSTOMER ID:
LOC #:

ACORD

ADDITIONAL REMARKS SCHEDULE

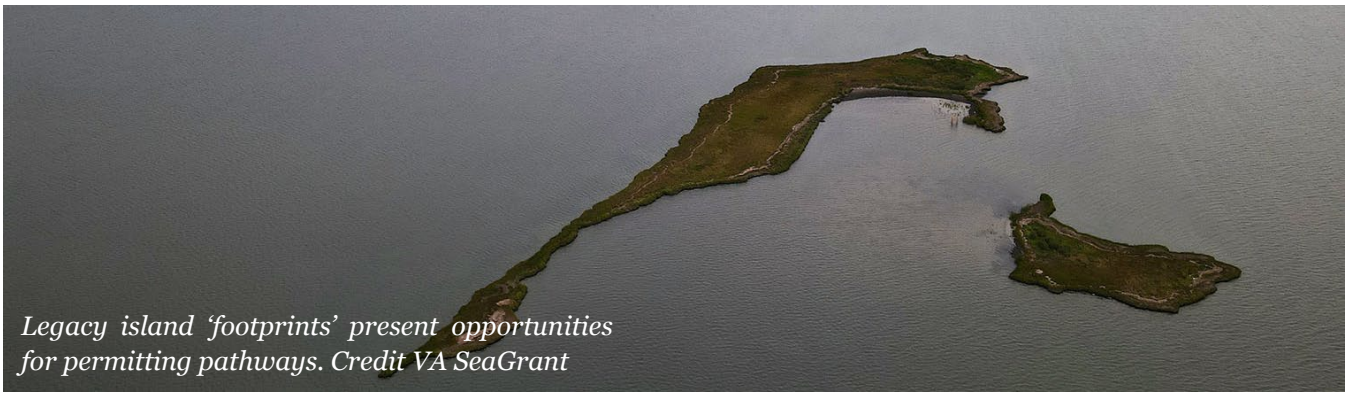
Page of

AGENCY: Brown & Brown Insurance Services, Inc.
NAMED INSURED: Marstel-Day, LLC
POLICY NUMBER:
CARRIER: NAIC CODE:
EFFECTIVE DATE:

ADDITIONAL REMARKS

THIS ADDITIONAL REMARKS FORM IS A SCHEDULE TO ACORD FORM,
FORM NUMBER: 25 FORM TITLE: Certificate of Liability Insurance: Remarks

Should any of the above described policies be cancelled before the expiration date thereof, notice will be delivered in accordance with the policy provisions.



Legacy island 'footprints' present opportunities for permitting pathways. Credit VA SeaGrant

Section 8. References

Additional references can be found in Section 5, Project Descriptions.

NSA Annapolis Greenbury Point Berm Stabilization

Description of Services: Marstel-Day supported NAVFAC Washington with site assessments and surveys, design, and permitting, along with construction and monitoring of a berm stabilization project for a 750-foot berm.

Reference: Lisa Dosmann

Phone Number: (301) 370-5513

Email Address: lisa.a.dosmann.civ@us.navy.mil

Address:

NAVFACSYSCOM
1314 Harwood Street, BLDG 212, FL 2
Washington DC

Beneficial Use Site Scoping Support Services

Description of Services: Marstel-Day assessed historical marsh loss, existing marsh conditions, and potential future marsh loss in a 14,000-acre study area northwest of NSB Kings Bay in St. Mary's, Georgia. These assessments were performed with the goal of understanding the potential for the beneficial use of dredged material as a strategy to manage dredged sediment from the base.

Reference: Laurel Reichold, *Director, Regional Sediment Management Center of Expertise (RSM RCX)*

Phone Number:
Office: (904) 232-1458 | Cell: (904) 401-3871

Email Address: laurel.p.reichold@usace.army.mil

Address:

SAD Regional
Sediment Management Center of Expertise
U.S. Army Corps of Engineers, Jacksonville District
701 San Marco Blvd.
Jacksonville, FL 32207

Compatible Land Use and Resilience Strategy

Description of Services: Marstel-Day completed a land use planning and conservation partnering strategy at MCAS Beaufort to identify and prioritize potential conservation partnerships based on local land use and encroachment issues, including climate and resilience threats.

Reference: Mary Ryan Krieger, formerly *MCAS Beaufort Community Plans and Liaison Officer (CPLO)*

Phone Number: (804) 543-3253

Email Address: mrkrieger@compatiblelands.org

Address:

Remote

Critical to identify marsh migration corridors as shorelines recede. Credit VA SeaGrant

Section 9 Other Supporting Data - Commitment to Innovation, Conservation, Protection and Restoration

The Marstel-Day project team brings together locally and nationally recognized leaders in environmental planning, coastal science, engineering, and ecological restoration who share a long-standing commitment to protecting, conserving, and restoring coastal and tidal ecosystems through innovative, science-based approaches. Collectively and uniquely, these firms have decades of experience advancing natural and nature-based solutions, particularly across Virginia and the Chesapeake Bay region, where coastal resilience, habitat conservation, and community well-being are inextricably linked. Unlike teams that focus primarily on discrete engineering outputs, this team applies a systems-based perspective that integrates science, planning, and implementation, producing living frameworks and adaptive strategies designed to evolve over time. Each team member contributes specialized expertise while working within a collaborative approach that prioritizes ecological function, climate resilience, and decision-ready solutions that remain relevant and actionable well beyond initial delivery.

Innovation in the Guinea Marsh GRIT Phase I effort is grounded in the team's shared belief that natural systems function as essential infrastructure for both environmental and economic resilience. Rather than relying on unnecessary complexity or single-purpose engineering fixes, the project approach emphasizes holistic, adaptive, and nature-based solutions that align ecological function, sediment dynamics, and long-term management needs. This philosophy is reflected in Marstel-Day's extensive experience supporting the U.S. Department of Defense's Engineering With Nature (EWN) initiative, where living shorelines, marsh restoration, sediment management, and hybrid stabilization strategies have been shown to reduce risk while improving ecosystem performance and sustaining critical infrastructure.

Our collaborative, scenario-based frameworks recognize natural systems—wetlands, forests, floodplains, and open space—as essential assets for community resilience and economic stability. Integrating scenario planning, modeling, and stakeholder collaboration provides local governments with tools to anticipate climate impacts and protect coastal and inland ecosystems before losses become irreversible.

The team brings proven experience translating innovative conservation and resilience concepts into actionable planning and implementation pathways. Marstel-Day contributes more than 20 years of planning-led coastal resilience and conservation expertise, with particular strength in adaptive decision frameworks, stakeholder-driven coordination, and implementation-ready GIS-based decision support. This capability ensures that technical analyses are not isolated products, but directly inform permitting strategy, funding alignment, and phased investment decisions.

Scenario-based frameworks, geospatial prioritization, and collaborative decision-support tools—recognized through award-winning conservation planning efforts in Virginia—demonstrate the team's ability to turn complex ecological and coastal data into clear strategies that guide investment, permitting, and phased action. These approaches provide value-added insight by ensuring that resilience solutions are not only technically sound, but also locally feasible, fundable, and durable under future climate conditions.

A key value-added element of this effort is the integration of beneficial use of dredged material as a resilience asset rather than a disposal challenge. RES contributes deep, full-lifecycle restoration expertise—from ecological feasibility and conceptual design through permitting, construction, and long-term stewardship—with a strong track record in marsh creation, thin-layer placement, and hybrid shoreline stabilization projects across Virginia and the Mid-Atlantic. Their experience helps ensure that innovative sediment-based concepts are both biologically effective and practically constructible. Team expertise will bridge the gap between concept development and on-the-ground implementation.

Scientific rigor and forward-looking performance testing further strengthen innovation. The team draws on decades of applied coastal research in Virginia, ensuring that strategies are grounded in observed system behavior. VIMS provides Virginia-based scientific leadership on shoreline change, marsh dynamics, sediment processes, and sea-level rise response. Their applied research and decision-support tools—such as shoreline change maps and marsh migration datasets—ensure that restoration strategies are grounded in observed system behavior and aligned with the best available coastal science.

Advanced engineering evaluation is provided through Taylor Engineering's state-of-the-art hydrodynamic, wave, and sediment transport modeling. Taylor's expertise allows the team to test how alternative strategies will perform under both everyday and extreme storm conditions, quantify resilience thresholds, and define adaptive triggers that support long-term success rather than static end-state assumptions.

Finally, the team enhances project outcomes through KCI's specialized surveying and geospatial data collection capabilities enabling innovation at the earliest stages of project development. High-resolution geospatial and hydrographic surveying methods reduce uncertainty in shallow tidal environments early in the process. Detailed LiDAR and multibeam bathymetric datasets allow restoration concepts to be precisely tailored to site conditions, improve modeling accuracy, and support efficient, targeted field efforts in complex tidal environments. These data-driven methods improve decision-making, minimize disturbance, and support efficient implementation of nature-based solutions in complex tidal systems.

Together, the project team represents a partnership with a proven history of innovation in natural resource conservation and coastal resilience, particularly within Virginia. These capabilities form an integrated, planning-led innovation framework that combines Engineering With Nature principles, sediment-based restoration, cutting-edge science and modeling, and implementation-ready decision support. The result is a Phase I effort that advances resilient, nature-based solutions for Guinea Marsh that are adaptive, defensible, and positioned for successful permitting, funding, and long-term performance - delivering solutions that protect, conserve, and restore coastal ecosystems while supporting communities, infrastructure, and long-term resilience.

Community stakeholders hold the answers to some of the marsh's biggest problems. Credit VA SeaGrant

Section 10 Local Economic Participation

Marstel-Day has assembled a team of subcontractors and academic partners with a presence near or within the MPPDC's planning area, who've made significant contributions to the local resilience and coastal economy either within the neighboring jurisdictions or directly in MPPDC's planning area. Marstel-Day's headquarters are in Fredericksburg, VA and staff are officed near Richmond and throughout Northern Virginia. Marstel-Day supports projects across the Virginia coast and throughout the northern and western regions of the state. RES has offices in Richmond, Annandale and Warrenton and works with public and private clients across coastal Virgina. VIMS is located at William and Mary University in Williamsburg, with a laboratory and offices on the Eastern Shore and offices in Gloucester Point. VIMS supports students, provides funding for local research and offers invaluable technical support to the community. KCI has offices in Norfolk, Richmond and Fredericksburg and supports clients and communities across the state of Virginia. Taylor's projects and economic contributions span the southeastern United States. Samples of the project team's local participation and contributions are noted below.

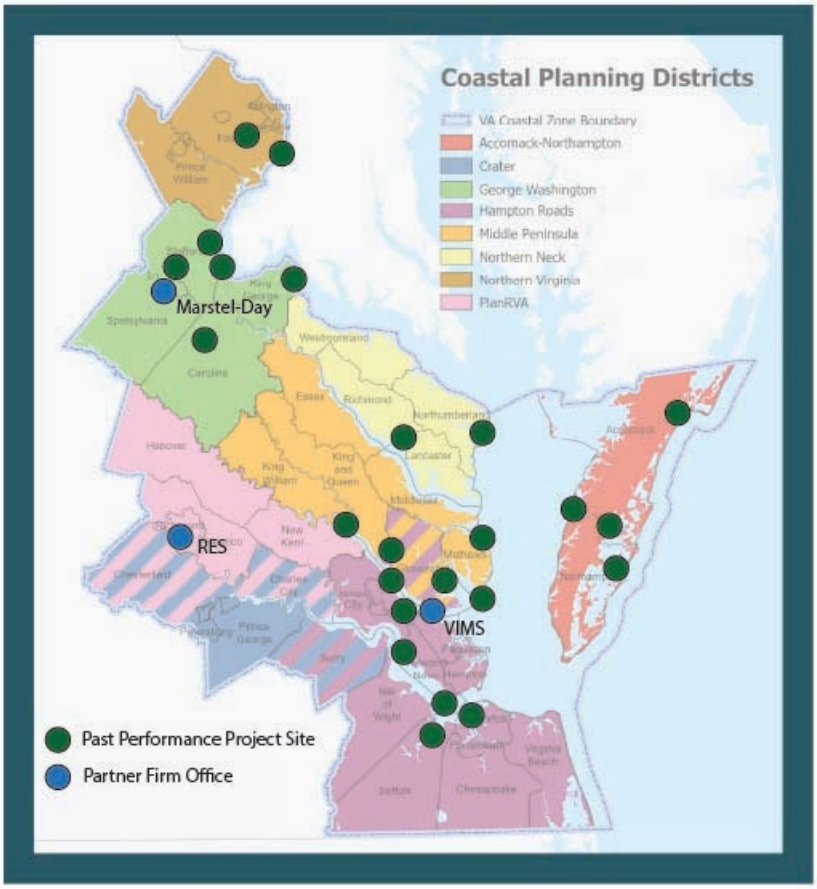


Figure 11: Map of project team offices and select projects.

*Shoreline Stabilization Surveys, Design, Permitting, and Construction at N*aval Support Facility (NSF) Dahlgren, King George County, VA (Marstel-Day)

At NSF Dahlgren, Marstel-Day's team is providing survey, design, and permitting services for eight shoreline reaches of the Potomac River, with upcoming construction for three of the reaches. The three reaches slated for construction have a span of over 2,800 linear feet. The designs for the eight reaches employ a variety of shoreline stabilization methods, including cobble aprons, stone sills, breakwaters, and geogrid stabilization. The stabilization solutions incorporate marsh creation and upland meadow seeing. The designs respond to challenging site conditions by minimizing excavation and soil disturbance and prioritizing the reuse of existing materials wherever possible. In addition to the eight reaches along the Potomac River, Marstel-Day's team is providing survey, wetland delineation, design, permitting, and construction management services for an additional 130 linear feet of shoreline along Gambo Creek at NSF Dahlgren. This is a collaborative effort with multiple local, regional, and national partners, and Marstel-Day supports partner coordination and dissemination of information to stakeholders.

Living Shoreline Surveys and Design at MCB Quantico, Prince William County, VA (Marstel-Day)

Marstel-Day is supporting a living shoreline project at MCB Quantico near Garrisonville, VA. The project involves surveys, wetland delineation, topographic and bathymetric data collection, soil characterization, a wave energy assessment, and shoreline restoration design for over 800 linear feet of shoreline along the Potomac River. The Existing Site Analysis Report captures critical data to support MS4 reporting and summarizes the existing conditions, potential challenges, and recommended stabilization methods for the shoreline using written descriptions and photographs. Following construction, the report will also document the species planted, final planting counts, the total planting area, projections for carbon sequestration, and the sequestration calculation methodology used. The design's solutions are being prepared to provide a minimum 50-year lifespan based on sea-level rise projections and aim to maximize habitat along the reaches. Development of stabilization solutions began with a review of past schematic designs, followed by updates to the designs to improve resilience and maximize habitat along the beach and streambank. The project team is preparing the design and permit packages and, following approval, will support the construction of the living shorelines.

George Washington Regional Commission Climate, Environment, and Readiness Plan (Marstel-Day)

The CLEAR plan is the product of a comprehensive strategy session attended by residents of the City of Fredericksburg and the counties of Spotsylvania, Stafford, King George and Caroline. The goal of the plan is to ensure the region's basic infrastructure – its wetlands and forests, open spaces and agricultural lands, roads, water and electric utilities, communications networks, emergency services, healthcare institutions, government and commerce can regain functionality after a traumatic event, such as a natural disaster, drought, or sustained resource shortage. A fundamental premise of the CLEAR plan is that the region's natural systems are a critical asset to its environmental and economic health and quality of life. The plan offers strategies for protecting these natural systems. Key components of the Marstel-Day approach include the following:

- CLEAR Framework: A strategic environmental planning tool for collaborative assessment and resilience, helping stakeholders visualize and analyze future environmental challenges and solutions.
- Scenario Planning: Developing detailed storylines around potential climate impacts and other disruptions to test strategies.
- Modeling: Use of complex simulations to predict long-term effects of policies, enhancing decision-making for better ecological outcomes.
- Stakeholder Collaboration: Integrates input from various stakeholders to build consensus and effective plans.

Living Shorelines (RES)

When Virginia and Maryland began accepting Living Shoreline projects to provide nutrient credits to meet Chesapeake Bay TMDL requirements in late 2017, RES began performing desktop shoreline erosion analyses and landowner contact and coordination to develop nutrient banks on private properties within the Chesapeake Bay watershed, specifically in Virginia and Maryland. RES has implemented the first two full delivery Living Shoreline nutrient banks in Virginia – Lucas Farms on the Potomac River and Nansemond Shoals on the James River, and has also constructed multiple Living Shoreline projects designed by others in Virginia waters. It is now well recognized that Living Shorelines provide important water quality functions by sediment trapping and removal of nitrogen and Coastal Resiliency benefits through erosion prevention and rebuilding of marsh elevations.

Tidal Wetland Restoration (RES)

Since 2018, RES has been locally and regionally involved in the successful siting, design, permitting, construction, and monitoring of tidal wetland restoration projects on public and private lands in the Chesapeake Bay watershed, and gave a presentation at the first Florida Coastal Resiliency conference in 2021 highlighting Virginia's Living Shoreline history as a case study for the use of Living shorelines to support the future of Florida's water quality and coastal resiliency goals. RES' local staff are experienced in desktop analyses of shorelines for erosion, and in the field collection of biological benchmark data to inform tidal site design. RES also participated as tidal wetland mitigation expert stakeholders during the VMRC workshops to revise Virginia's tidal mitigation guidelines in 2023. In 2022 RES local staff participated in the TNC Baltimore Patapsco Sediment Bank project for the beneficial re-use of dredged material from private facility dredging projects within Baltimore Harbor to provide coastal resilience for underserved communities. RES participated in assessment and ranking of numerous sites for potential restoration through beneficial re-use of dredged material and participated in collaborative workshops and stakeholder engagement meetings to define challenges perceived by the various participants and actively engaged in the development of a high-level framework to advance a selected project through the current regulatory climate while considering the region's long-term needs. RES provided design expertise in working with dredged material for wetland restoration; and developed preliminary design and implementation costs to inform final site selection.

MPPDC Experience

In early 2024, RES began communicating with MPPDC regarding plans for development of a dredged material master plan for their planned creek dredging projects, and began independently performing desktop analyses of 21 sites MPPDC had planned for dredging to evaluate potential for beneficial reuse of the dredged material, and was working with MPPDC and TNC in Late 2024 to facilitate a beneficial reuse project at TNC's New Point Comfort property to potentially accommodate the reuse of dredged material from the Davis Creek dredging project. RES staff were simultaneously participating as part of the Workgroup developing the Beneficial Use of Dredged Material Guidance document for Virginia.

Mummichog Nutrient Bank, Gloucester County, VA

In this ongoing project, RES is supporting the protection of over 400 linear feet of shoreline along the York River through the installation of breakwaters and living shoreline. RES drafted the Nutrient Reduction Implementation Plan, drafted the permit application for the State Programmatic General Permit, and has been a primary contact with state and local governments.

Mattaponi Mitigation Bank and Rapidan River Restoration

Under RES' VDOT Statewide Wetland and Stream Mitigation Maintenance and Monitoring On-Call contract, RES conducted drone and aerial survey operations for the production of orthorectified aerial imagery of the ~27-acre Mattaponi Mitigation Bank near Milford, VA and the ~1,500 linear foot Rapidan River Restoration site near Graves

Mill, VA. Drone operations were conducted in accordance with all FAA regulations and by a licensed FAA Part 107 pilot. RES obtained all waivers for flight operations where applicable. Both flights were scheduled during leaf-on conditions to assist VDOT with calculation of percent tree canopy cover at each site.

Thompson North Wetland Mitigation Bank, TNC

In this project, RES designed, permitted, and constructed a wetland mitigation site for TNC under their Virginia Aquatic Resource Trust Fund program on land in Northumberland County owned by the Northern Neck Land Conservancy. RES developed multiple conceptual plans for review by TNC and developed final mitigation design plans for the selected option to be approved by the IRT. As part of the site's feasibility work to support the design, RES installed monitoring wells and an onsite tidal, gauge, performed a Waters of the US delineation, and conducted topographic mapping. RES performed a water quality impact assessment to support DEQ stormwater permitting and obtained all necessary DEQ and County land disturbance permits. RES then led permitting efforts for the Federal (section 404) and State (Section 401 and VMRC) permits, and once approved, constructed the project.