

November 26, 2019

David Ryan, Town Engineer
Town of Nags Head Town Hall
5401 S. Croatan Hwy.
Nags Head, North Carolina 27959

Reference: Coastal Engineering and Design Services

Dear Mr. Ryan:

Moffatt & Nichol (M&N) is a full-service consulting firm with unique experience and expertise to complete the environmental planning and engineering services required for future beach nourishment and related shoreline management efforts.

To date we have completed:

- More than 500 million cubic yards of dredging
- More than 200 waterfront environmental study projects
- More than 100 numerical and/or physical model studies

M&N will warrant that at all times during the term of the Agreement we shall maintain in good standing all required licenses, certifications, and permits required under federal, state, and local laws necessary to perform the services requested. We acknowledge addendum one. Mr. Johnny Martin will lead our team. With over 25 years of coastal engineering and project management experience with M&N, Mr. Martin brings a wealth of North Carolina-focused beach management experience to help address the Town's needs for years to come. He has worked with many of our key personnel to provide similar services throughout North Carolina and Virginia throughout the years. To supplement our efforts, we invited Geodynamics (surveying services – Woman-Owned, HUBZone), Athena Technologies (geotechnical services – HUBZone-certified, small business), and CATLIN (geotechnical services – small business) to complete our professional team.

Pioneering Level of Expertise. M&N designed, planned, and permitted the first NC multi-decadal beach and inlet management master plan that has actual permits to actually construct multiple events over multiple decades.

Proven Track Record. The M&N team has worked together to complete numerous beach nourishment and coastal management projects throughout the region. We understand all aspects of beach management including engineering, design, planning, permitting, construction, bidding, community engagement, and economic sustainability.

Flexibility and Availability. Although we have assigned a highly specialized, local team with unique technical expertise from our more than 100 professional and technical staff located within our Raleigh, Norfolk, Morehead City, and Wilmington offices we have access to more than 800 employees, including more than 700 marine and civil engineers and scientists to meet your needs. Our staff has completed or assisted in shoreline evaluation and mapping, coastal planning, design, and inlet management studies for cities and counties throughout the region including the U.S. Navy, multiple U.S. Army Corps of Engineers (USACE) Districts, and state Departments of Transportation. Through these projects, we have effectively monitored and assisted communities to manage their coastal systems.

As Vice President, I am the firm's authorized representative for this project. You can reach me at treid@moffattnichol.com or 919.781.4626. We look forward to continuing our work with you on this important project.

Very truly yours,

MOFFATT & NICHOL



Timothy R. Reid, PE
Vice President



Johnny Martin, PE
Project Manager



**RECOGNIZED
COMMITMENT TO AND
LEADERSHIP IN COASTAL
ENGINEERING**

Since 1977, the American Society of Civil Engineers (ASCE) has awarded the John G. Moffatt and Frank E. Nichol Harbor and Coastal Engineering Award to recognize new ideas and concepts that can be efficiently implemented to expand engineering or construction techniques for harbor and coastal projects.

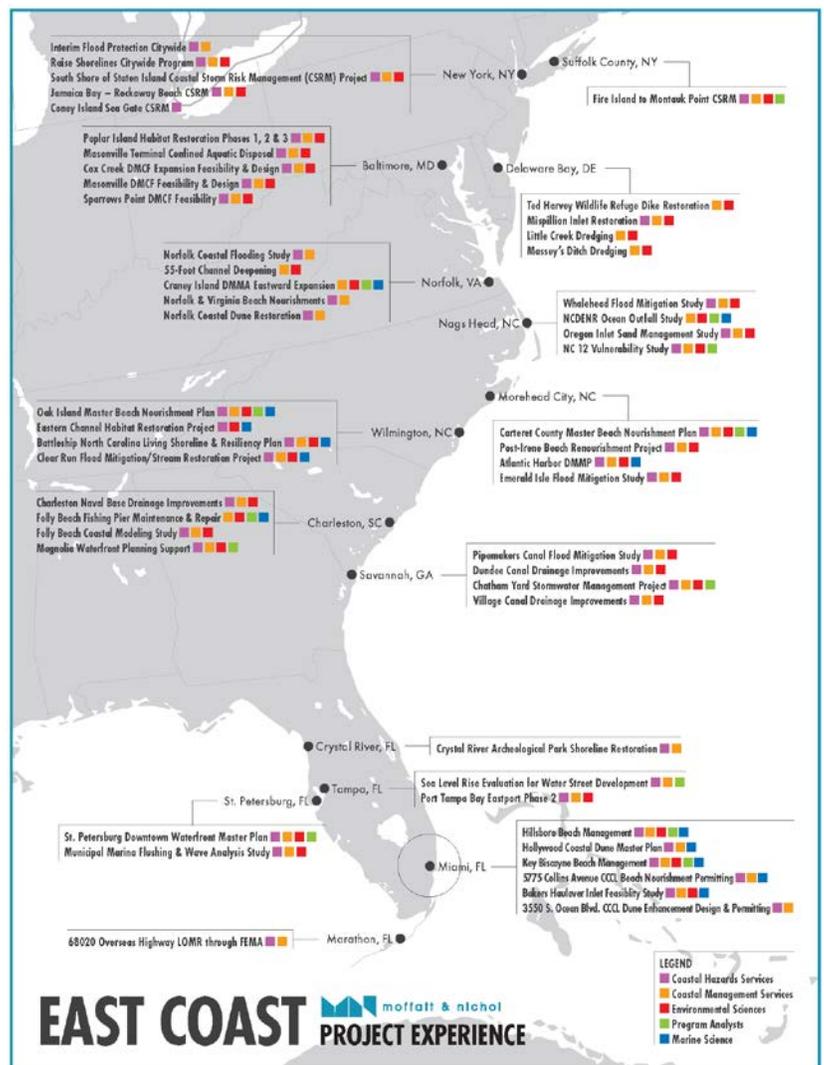
A. Corporate Information

Moffatt & Nichol (M&N) has served the East Coast coastal engineering and environmental permitting needs of clients since 1981. For the last 25 years, *proposed Project Manager, Johnny Martin, PE* has been an integral part of building the firm's coastal engineering reputation with municipal governments in North Carolina and Virginia and with state and federal agencies.

Under Johnny's leadership, M&N developed the first North Carolina multi-decadal beach and inlet management master plan, including securing the first 50-year federal and state authorizations to allow dredging and sand placement across 24 continuous miles of oceanfront shoreline in Bogue Banks. In just the past 6 years, M&N has completed planning and design for placement of 6 separate beach nourishment projects in North Carolina with a construction value of over \$60 million. We have been actively monitoring over 70 miles of North Carolina oceanfront and inlet shoreline. We developed a comprehensive Beach and Inlet Management Plan (BIMP) for the State of North Carolina that is being used to develop a statewide fund for coastal storm damage reduction projects. We evaluated the economic importance of the Oregon inlet and prepared alternatives for its long-term management. Our experience in coastal engineering and environmental permitting along the North Carolina and Virginia coasts stems from our passion and dedication to serving our coastal neighbors.

Our expertise in both the technical and client service aspects of coastal engineering has been gained through successful, long-term service to many clients at the municipal and state level. The map at right illustrates our experience providing coastal engineering services to similar clients throughout the eastern United States. These services are similar to the types that will be needed on this contract for the Town and are evidence of our ability to complete this type of work.

M&N's Raleigh and Norfolk offices are two of our firm's 36 North American locations. We also have offices in Morehead City and Wilmington, North Carolina. *Our team of 100 professional and technical staff located within our Raleigh, Norfolk, Morehead City, and Wilmington offices* can provide quality service for the Town's coastal engineering needs for the in less than a few hours' drive. *Our team has completed coastal engineering and planning investigations for over 20 municipalities and counties within the States of North Carolina and Virginia.* Through these projects, M&N has used analytical methods and simple models as well as multi-dimensional morphological models to replicate inlet and beach behaviors and evaluate comprehensive management strategies. Many of our beach and inlet management projects have involved high-end numerical hydrodynamic and sediment fate modeling and included permitting and endangered species coordination, long term management strategies, Dredged Material Management Plans, and construction plans, technical specification documents, and construction management oversight. *Our recent staff additions of Sam Morrison (Great Lakes Dredge & Dock) and Doug Huggett (NC Division of Coastal Management) also provides our coastal clients with recent, direct knowledge from the dredging industry and the regulatory community.*



M&N is very familiar with FEMA funding procedures for an engineered beach. We have assisted the Towns of Emerald Isle, Pine Knoll Shores, and Indian Beach in establishing design and planning documents, including maintenance nourishment triggers, to be

eligible for FEMA Public Assistance Category G renourishment funds. We have been successful in helping these communities acquire and administer FEMA federal funds including the most recently constructed Bogue Banks Post-Florence Phase 1 Renourishment Project., which successfully placed over 975,000 cubic yards of beach quality sand along 9 miles of beach in winter 2019. Overall, after all phases are completed, 4 million cubic yards of material will be placed along Emerald Isle, Indian Beach and Pine Knoll Shores.

Subconsultants

M&N has invited Geodynamics (surveying services – Woman-Owned, HUBZone), Athena Technologies (geotechnical services – HUBZone-certified, small business), and CATLIN (geotechnical services – small business) to complete our professional team.

Geodynamics (Surveying Services – Woman-Owned, HUBZone)

Principals at Geodynamics have been involved in high-resolution coastal shoreline mapping and analysis for over 20 years. As a firm, Geodynamics has an 15 year track record of successfully performing high-accuracy beach and nearshore surveys and has supported the transition of several long-term beach monitoring programs to a modern seamless topo/bathy approach, including New Hanover County, NC (5 years); Ocean View, VA (11 years) and Bogue Banks, NC (12 years).

Geodynamics' staff reflects the company's priorities of excellence in data quality, safety in all environments, and timely project completion. They bring a wealth of specialized marine mapping and coastal environment experience, including North Carolina Professional Land Surveyors, NSPS-THSOA Certified Hydrographers, certified GIS Professionals, USCG licensed vessel captains, and academically-trained project managers.

Geodynamics is a *woman-owned Historically Underutilized Businesses certified through the State of North Carolina* Statewide Uniform Certification (SWUC) program.

Athena Technologies (Geotechnical services – HUBZone-certified, Small Business)

Athena Technologies, Inc. is a *HUBZone-certified small business* incorporated in 1987. Athena is comprised of a tenured staff with each performing multiple functions. Athena has a well-rounded crew of geologists, captains, and technicians with extensive experience collecting environmental and geotechnical vibracore samples in support of navigation, research, remediation, and beach nourishment projects. All personnel are technically oriented and capable of operating, troubleshooting, and repairing equipment in the field. Additionally, Athena has a wide variety of research vessels that can operate in most aquatic environments. Athena's largest vessel, RV Artemis, has a single day operational range of 90 miles, which allows for rapid access to remote locations.

Athena has been providing vibracore and geotechnical reporting services in support of beach nourishment projects throughout the Atlantic and Gulf Coasts for over 30 years. *Athena's North Carolina project portfolio includes* geotechnical projects completed in the following areas: *Carteret County, Bogue Banks, Kure Beach, North Topsail Beach, Oak Island, and Holden Beach*. Athena has also provided geotechnical vibracore services at various inlets along the North Carolina coastline to support dredging for navigation projects and determine beneficial use for beach placement.

CATLIN (Geotechnical Services – Small Business)

CATLIN Engineers and Scientists (CATLIN) has provided Geotechnical, Environmental and Civil engineering and consulting services for 34 years. Since 1985, CATLIN has delivered professional engineering, planning and management services to a broad ranging clientele, including Federal, State and Local governments, industrial clients and private companies. They are a *locally owned and operated Small Business*, committed to providing our clients with the highest level of total client satisfaction. CATLIN currently has offices in Wilmington, NC (Corporate Headquarters); Raleigh, NC; Washington, NC; and Atlanta, GA.

CATLIN currently has 45 employees. The CATLIN team is comprised of experienced and registered professionals with disciplines in geotechnical, environmental, and civil engineering; hydrogeology; geology; and environmental science. The stability of our team is a benefit to our longstanding clients. CATLIN has many employees that have been with us 15 to more than 20 years.

B. Team/Org Chart

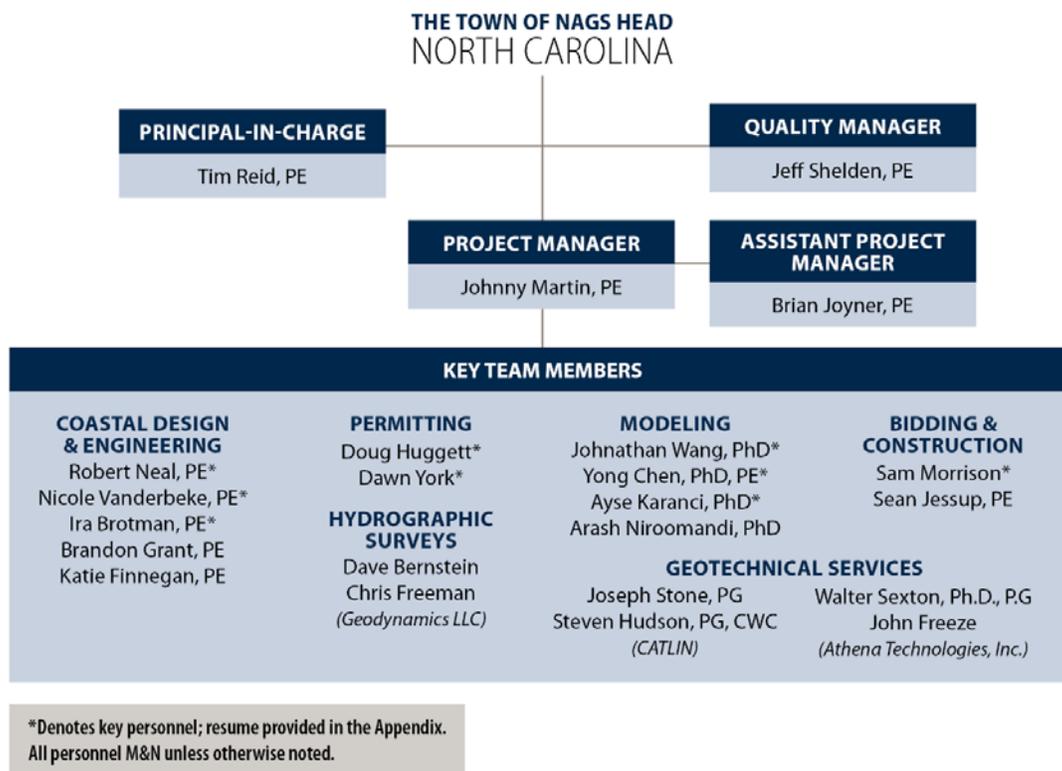
Introduction to Proposed Project Management Team

Johnny Martin, PE, is a Coastal/Hydraulic Engineer in Raleigh and has been intimately involved with coastal projects in North Carolina and Virginia, including leading Master Planning efforts for Bogue Banks, in Carteret County. Mr. Martin, who will serve as project manager for this contract, provides over 25 years of experience – all with M&N - in coastal engineering and water resources planning, analysis, and design including detailed experience with numerical modeling for a variety of coastal and hydraulic engineering projects.

Brian Joyner, PE, is a Coastal/Hydraulic engineer in Norfolk, VA. His 21-year career includes extensive experience in providing shoreline protection assessments and beach nourishment projects in Norfolk, Virginia Beach, and North Carolina. Brian and Johnny have been working together on projects since 2011, and as a team they will provide experienced and consistent project management and technical leadership for the Town’s coastal and shoreline protection program. As the project management team, both Johnny and Brian will be intimately involved in providing responsive and consistent service to the Town while providing oversight through M&N’s internal Quality Management System (QMS).

Proposed Organizational Chart

A chart of key team members is included below. *Detailed resumes are in the Appendix of this submittal.*



C. Representative Projects

The following are brief descriptions of M&N’s experience providing similar services to those requested by the Town of Nags Head. More detailed descriptions can be found in the appendix.

Bogue Banks Master Beach Nourishment Plan

M&N successfully developed and obtained regulatory approval of the multi-decadal programmatic Environmental Impact Statement (EIS) for Carteret County, including beach design template and nourishment triggers, that incorporate all of Bogue Banks’ beach nourishment and inlet management needs for the next 50 years. This allows the communities in Carteret County to consistently implement beach renourishment events without extensive re-permitting and re-study. The first project under these permits was completed in 2019 and the second will be constructed in early 2020.

Oak Island Master Beach Nourishment Plan

The Oak Island Master Plan, currently in development, will create a multi-decadal shoreline protection plan encompassing the 9.25 mile ocean shoreline of the Town of Oak Island in Brunswick County, NC. The master plan creates a roadmap for the Town's beach nourishment program. In addition, a maintenance plan for Lockwoods Folly Inlet will be established.

City of Norfolk Coastal Engineering and Management

Under on-call contracts held since 2003, Moffatt & Nichol has completed a wide range of coastal engineering and management tasks along Norfolk's 7 mile Ocean View shoreline. Tasks have included design of four large-scale beach renourishments and three series of detached breakwaters (all constructed); annual monitoring of dune, beach and nearshore profiles and wave climates; dune restoration, vegetation and management; support for the City's involvement with the US Army Corps of Engineers on shore protection and resilience projects; and calculations and consulting related to FEMA coastal floodplain requirements. Services for these projects included planning, permitting, preliminary / final design and construction documents; comprehensive study of historical and present conditions and complex numerical modeling.

City of Virginia Beach Coastal Engineering

Under and on-call contract held for the past 11 years, M&N has provided coastal engineering studies, planning and design services to the City of Virginia Beach to help manage the City's Chesapeake Bay and Atlantic Ocean beaches and inlets. Within the past four years, M&N completed evaluations of beach and dune storm protection capacity, held public information and planning meetings, and prepared construction plans and specifications for nourishment of three City beaches including Chesapeake Beach, Ocean Park Beach and Croatan Beach. Two of the projects are designed for nourishment by hydraulic dredging, while the third, at Croatan Beach, was designed for nourishment by truck haul. All three projects utilized coastal numerical models to evaluate storm protection capacity and post-nourishment shoreline change. These models were critical to the project design as well as evidence to state and federal regulators leading to permit approval. M&N also provided coastal engineering expert witness services on behalf of the City in defense of lawsuits brought by owners of beachfront property claiming riparian rights were severed by a beach nourishment project fronting their properties. M&N's expert testimony primarily dealt with the historical erosion patterns and justification for nourishment at Cape Henry Beach. The case was decided in the City's favor.

North Carolina Beach and Inlet Management Plan & Update, Statewide

For the State of North Carolina, M&N developed a comprehensive beach and inlet management plan identifying potential strategies to maintain beach and inlet characteristics.

NC 12–Ocracoke Island Erosion Hotspots & Hot Spot Update

M&N provided coastal engineering services for a vulnerability analysis of a 5.5-mile-long stretch of NC 12, the principal roadway along North Carolina's Outer Banks. Modeling included predictions for future shoreline positions in 10, 25, and 50 years.

Beach Nourishment, Breakwaters, and Dune Restoration Along Ocean View Beach

M&N assisted the City of Norfolk to stabilize and manage the seven miles of historically eroding shoreline comprising Ocean View Beach. Projects included beach nourishment, dune restoration, constructing nearshore breakwaters, coastal modeling, and periodic surveying and beach change monitoring.

New Hanover County Monitoring

M&N developed the New Hanover County Shoreline Mapping Program, a yearly study which monitors the beach conditions in New Hanover County, evaluating shoreline and volume change trends and optimizing future shoreline maintenance strategies. M&N is responsible for overall project management, survey data analysis, and compilation of the final report and presentation of findings. M&N is supported by Geodynamics, who performs the annual beach profile surveys.

D. Proposed Project Approach

Beach nourishment efforts within the Town of Nags Head began in 1990 with the Dare County Hurricane Protection and Beach Erosion Control Project. Due to significant property damage from Hurricane Isabel (2003), forced abandonment of property, and lack of federal funding, the Town decided to create its own locally funded nourishment project. Beginning in the early 2000's, the Town committed to maintaining 10 miles of their beach via locally funded sand nourishment projects. The two most recent nourishment events in 2011 and 2019 have placed a total of 8.6 million cubic yards (MCY) of material on this highly popular stretch of beach. This significant local investment demonstrates the Town's willingness to commit to long-term protection of the beach as a driver of local tourism and economic productivity, while also providing quality of life benefits and protection from significant storm events. M&N is committed to helping the Town of Nags Head maintain this important

economic driver.

Beyond the normal background erosion rates that occur in the high-energy wave environment of the Outer Banks, large tropical events such as Hurricane Isabel (2003) and Hurricane Matthew (2016) caused significant erosive damage in Nags Head. Hurricane Matthew alone caused over 1.4 MCY of sediment loss along 10 miles of Nags Head’s oceanfront shoreline. Additionally, unnamed extratropical cyclones (i.e. nor’easters) have also caused severe erosion and shoreline recession, as seen most recently with the nor’easter in November 2019. Erosion rates along the Town’s beach vary from about 2 feet per year of shoreline recession in the northern portions of the beach to about 8 feet per year at the southern end of the beach near the Cape Hatteras National Seashore. The nourishment trigger currently utilized by the Town is set at every 6 years unless less than 50% of the initial nourishment sand remains on the beach as a whole. Based on these erosion rates and the existing nourishment trigger, the next beach-wide renourishment event will likely need to occur within the next 5 or 6 years (2025 – 2026).

The Town is in a unique position to evaluate the course and direction of their ongoing beach nourishment program and to prepare, not just for the next nourishment event, but for a sustainable program for the next 30 to 50 years.

Our experience at successfully developing a 50-year beach nourishment programs at Bogue Banks in Carteret County will help the Town in developing a long-range Master Shoreline Management Plan and Beach Preservation Program. These efforts were completed by the team proposed for this project including Johnny Martin, Brian Joyner, Doug Huggett, Dawn York, Nicole VanderBeke, Brandon Grant, and our surveying partner, Geodynamics.

Other coastal communities in Dare County and Currituck County are also conducting periodic nourishment of their beaches. Given the limited number of dredging contractors that can accomplish the needed dredging work, and the high demand for dredging contractors all along the East and Gulf Coasts, it is possible that Nags Head and its neighboring communities could end up competing for dredging contractors. Based on our experience, we believe that coordinating efforts regionally among other beach communities may prove beneficial to the Town as well as the region.

M&N stands as a willing partner to assist the Town in these efforts, including providing guidance on how to navigate regional partnerships, establish funding mechanisms, develop interlocal agreements and coordinate shoreline protection activities among partners. We have assembled a team of coastal professionals that together provide the full perspective needed on the economic, regulatory, permitting, engineering, and construction feasibility aspects of creating a robust, long-term coordination of activities to the best benefit of the Town of Nags Head.

A regionalized approach may prove successful in streamlining permits across multiple communities, sharing costs of sand source identification, spreading mobilization costs across larger nourishment projects, reducing competition among dredging contractors, and coordinating nourishment efforts to target highest priority areas (i.e. hot spots), without requiring nourishing stable reaches.

While these benefits may flow out of potential regional partnerships, we will work with the Town of Nags Head to help determine if a regionalized approach makes sense. Whether an independent or coordinated approach ultimately proves the most beneficial course for the Town, we will prepare a Master Shoreline Management Plan and Beach Preservation Program (also called Master Beach Maintenance and Monitoring Plan or BMMP) that will reduce uncertainty for the future of the Town’s beach management and guide the next 30 to 50 years of nourishment activities.

The M&N team’s approach to creating the Town’s BMMP is based on proven success creating the engineering and monitoring aspects and obtaining regulatory approval for similar plans in NC. Our recommended approach consists of the tasks and workflow illustrated in Figure 1 and described below:

Planning and Design



Figure 1. Outline of Tasks to Creating and Implementing the Beach Maintenance and Monitoring Program (BMMP)

Task 1: Data collection and review

M&N will review all available engineering and planning data from the Town's initial 2011 shoreline restoration and subsequent 2019 renourishment event, along with annual beach monitoring data. This data includes borrow area assessments, design and monitoring beach surveys, available wave and current data, and design reports. M&N will provide a written assessment of the available data and work conducted to date. M&N will identify any data gaps necessary to complete the Town's 30 to 50-year BMMP. Potential data gaps may include survey coverage of submerged areas, i.e. for numerical modeling and borrow area evaluation; geotechnical and sediment data related to potential borrow areas; and defining and obtaining the necessary easements to nourish the beach over a 30 to 50-year period. While we understand that a separate RFQ has been released for beach monitoring surveying services, the M&N Team includes Geodynamics as our long-term field investigations partner to provide supplemental nearshore and offshore data collection support if the need arises. Our partners, CATLIN Engineers and Scientists and Athena Technologies, Inc. provide geotechnical services and quality data to permit future borrow areas and ensure compatibility of dredged material with State sediment criteria. Easements and other real estate data will be catalogued in a GIS based on existing data sets provided by the Town, supplemented with additional property surveys that may be conducted during this task.

Task 2: Vulnerability Analysis and Design Options Development

M&N will perform a vulnerability analysis to categorize the current level of risk to property and life within the project area from storm surge, waves, and erosion, and will provide design alternatives, including a beach and dune enhancement plan, to reduce the damage potential to upland infrastructure. The Town will benefit from our experience in dune restoration and planting efforts for the City of Norfolk. Our lessons learned in the management of wind-blown sediment transport will be key to keeping the dunes robust and not migrating and encroaching on private property.

The vulnerability analysis will directly inform the formulation of design options for the Town's 30-Year BMMP. M&N will present design options based on modeled storms for a minimum of the 2-, 5-, 10-, 25-, and 50-year return period events along with the background erosion anticipated over the 30 to 50-year project life. M&N will employ standard numerical models such as XBeach and GenCade for the vulnerability analysis. M&N's team of expert modelers has identical and recent project experience with a suite of numerical modeling tools for this type of analysis, including SBeach, XBeach, CSHORE, GenCade, and Delft3D, to provide a sound basis for management decisions.

As the next step in the modeling analysis, M&N will analyze the beach to refine existing reaches or design areas. The design areas will encompass shoreline regions similar in shape and natural characteristics. M&N will use existing data to determine the background erosion rate (erosion anticipated under normal weather conditions with no project in place), the average existing dune elevation / width, and setback distance to categorize the design areas into representative segments for further analysis. This process addresses the need to provide the same relative level of benefit/protection to every parcel along the shoreline. In addition, this process structures the design, so sand is placed efficiently across the entire project area. It is likely that the beach fill template will vary along Town's shoreline so that enough material placement occurs in critical areas while less material could be placed in more stable areas. Efficient material placement will allow longer nourishment intervals by optimizing the manner in which 'hot spots' are addressed.

Using GenCade and XBeach numeric models, M&N will develop an 'engineered beach' template and advance nourishment section that provides relatively equal protection to the project area. M&N will calibrate the model(s) based on offshore wave data collected through NOAA/USACE programs and existing survey data. Calibration of the GenCade model will compare measured shoreline evolution with modeled results for applicable periods. The XBeach calibration will compare measured profile change with simulated results occurring during previous storm events. The calibration of both numeric models will utilize several combinations of long-term and storm conditions to assure the necessary robustness of the model's applicability for a wide range of conditions.

To determine the overall level of protection afforded the project area, M&N will use the GenCade and XBeach models to simulate the potential effects on the first row of structures. The calibrated and verified models will be run for various storm events (2-year, 5-year, 10-year, etc.) and the shoreline/volume losses calculated by the models will be recorded. M&N will then compare these loss calculations and the long-term erosion rates to the stable vegetation line and the first line of infrastructure to estimate which storm events will likely "reach" the lines and in what future year. The M&N Team will compile and summarize these types of results for design areas or reaches. This type of summary allows the development of meaningful nourishment triggers that can vary by reach, and taking this approach facilitates project monitoring and planning for future nourishment events. The nourishment trigger would most likely be a combination of shoreline position and beach profile volume between two known elevations, as determined from the vulnerability analysis calculations for various levels of protection (i.e., 10-year, 25-year, and 50-year storm events).

M&N expects that the nourishment triggers will vary along the project reach, to provide a consistent level of protection. These types of results allow the project team to develop volume needs and associated cost estimates [e.g., 3 million CY of sand needed every 6 years to provide protection from a 10-yr. event at a cost of \$40 million]. M&N will then compare the sediment needs and nourishment intervals to the known sediment sources and their capacities to estimate what sources to utilize under specific scenarios. *Nourishment events would occur based on the reach-based nourishment triggers (not individual transects) and would focus on addressing hotspots more than stable portions of the beach.* The modeling will also be instructive on where sand should be placed so that natural processes can be used to help stabilize the hotspots as well so that more frequent nourishment intervals are not needed for these smaller hotspot areas. The frequency of these events would likely be driven by the occurrence of large tropical or extratropical events.



Figure 2. Potential sand sources.

M&N will review available sediment data utilized by the USACE to designate borrow area S-1 previously and will recommend areas for further study. The team will collect and analyze sediment samples in accordance with state guidelines to develop a sediment source viable for the comprehensive 30 to 50-year BMMP.

Task 4: Alternative Recommendations

M&N will summarize the results of the engineering analysis and provide recommendations for moving forward with the environmental documentation for the preferred alternative in the Town's 30 to 50-year BMMP. M&N would work with the Town to host public information meetings and provide an opportunity for residents to inform the recommendations. Results of discussions with the Town and input received from the residents, stakeholders and environmental agencies will form the basis of M&N's recommendations.

The recommendations will include the design level of protection and applicable sediment sources for the 30 to 50-year BMMP. M&N will also develop a feasibility level cost estimate for each alternative discussed in the report. The Town will then decide what level of protection to propose for all of Nags Head and which alternatives to pursue within the environmental documents.

Because the southern portion of the Nags Head beach has significantly higher erosion rates than the northern portion, the Town has indicated interest in exploring alternatives beyond nourishment, including structural approaches. *M&N's unique combination of coastal structures engineering and regulatory experience can identify the most feasible options and establish realistic expectations of performance, cost, and impact of any soft or structural alternative. Alternatives will be evaluated with a goal of achieving long-term sustainability, including project life-cycle costs, funding.* Leveraging local, state, and federal funding sources is key to a sustainable beach management plan for the Town of Nags Head. Through our efforts in Carteret County and Oak Island, we prepared the necessary design, planning, and documentation to allow the communities to receive not only FEMA Category G funds, but also State and other available funds.

When nourishment event is necessary based on the nourishment triggers, M&N will prepare bid documents for a specific project

including plans, specifications, quantity summary, and Engineer's opinion of probable cost. In just the past 4 years, M&N has produced 4 different sets of plans, specifications and estimates for large beach nourishment projects in North Carolina.

Task 5: Permitting

M&N's environmental permitting team is led by Dawn York, who was the lead technical author of the State's first 50-year Environmental Impact Statement (EIS) for the Carteret County's Bogue Banks Master Plan. Dawn has extensive experience in preparing the necessary state and federal documentation and permit applications to authorize projects on-time and with minimal agency concerns. M&N's team includes Doug Huggett, who recently retired from the N.C. Division of Coastal Management (NCDCM). As Manager of NCDCM's Major Permit Section, Doug was heavily involved with and authorized every CAMA permit in the Outer Banks for the last 20 years. He similarly authorized all nourishment projects located within the rest of North Carolina over that time period. His experience and insight will prove invaluable to Nags Head.

The Town of Nags Head currently has active state and federal permits for the nourishment of the Town's beach. As an initial step in the environmental permit acquisition process, M&N will coordinate with relevant state and federal permit agencies to determine whether new or modified permits will be required. M&N will then complete permit application packages for all required State and Federal permits, leases and authorizations, including a Coastal Area Management Act (CAMA) from the N.C. Division of Coastal Management (NCDCM), a Section 401 Water Quality Certification from the N.C. Division of Water Resources (NCDWR), Section 404 and Section 10 authorizations from the U.S. Army Corps of Engineers, and leases and authorizations from the Bureau of Ocean Energy Management (BOEM) for activities, including geological and geophysical survey work, that involve the use of any potential borrow area(s) within federal waters. The preparation of these various application packages will build upon lessons learned and commitments made during the development of NEPA/SEPA documents, which will include substantial agency and stakeholder involvement.

M&N would also coordinate directly with the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) to determine whether existing Biological Opinions would be adequate to satisfy Endangered Species Act (ESA) requirements. Based upon recent experiences with similar projects, M&N would at the least expect that dune planting efforts using mechanical equipment would necessitate at least an update of the existing Biological Opinion. Regardless of whether a new or modified Biological Opinion is required, M&N would use our significant experience in this area to work directly with the necessary federal agencies to ensure any such process is completed in a timely fashion.

M&N would hold pre-application conferences with all relevant permit agencies, prepare and submit all required application packages, and coordinate and resolve any issues that arise during the application review processes. As an additional part of this permit acquisition process, M&N would also obtain authorizations for any required modifications to existing stormwater outfalls within the project limits, and authorizations for managing sand that might migrate from the beaches onto individual properties, similar to approaches the Town has used following its past nourishment events. Given the M&N team's vast experience with permit application processing and in-process problem resolution, the Town can have confidence in the Team's ability to ensure that all approvals are received within a timeframe that meets with bidding and construction timelines.

Task 6: Physical Monitoring Plan

M&N will provide the Town with a project monitoring plan recommending schedules and activities for documenting project performance and FEMA compliance for storm recovery assistance. We believe it is important to perform a yearly beach survey to monitor the state of the beach and evaluate the volume and location reaches relative to the nourishment triggers. The monitoring plan will include measures and procedures for the Town to receive FEMA reimbursement for post-storm event monitoring.

Task 7: Economic Analysis and Long-Term Funding

One of the primary challenges with decadal beach nourishment programs is identifying, securing, and maintaining dedicated funding sources to meet the required cost of funding beach nourishment activities. One important aspect is leveraging local, state, and federal funding sources through establishing and maintaining a FEMA engineered and maintained beach. We keep a pulse on local, State, and Federal grants to identify alternate funding streams that can help defray some of the costs to the Town beyond FEMA post-storm damage recovery dollars. This approach helped us secure \$18 million in State funding for two of our coastal clients in North Carolina, the only two communities in the state to receive funding from this source.

One cost-savings approach is to set nourishment triggers by reach to allow placement of sand where and when its needed. Thus, sand could be placed every second or third nourishment event in areas of low erosion, while areas of higher erosion are nourished during every event. While specific reaches may not receive sand during every nourishment event, all areas of the community benefit by having a healthy and sustainable beach that is inviting to tourists. Again, the goal of our plan will be “equal protection” not “equal sand.”

During her PhD studies, M&N team member Dr. Ayse Karanci developed a coupled human-nature model in Nags Head that tied the economic viability of the community to the beach width and dune height. Her research suggests certain beach widths and dune heights led to the highest economic development potential and long-term sustainability of the community. According to this modeling experiment, the growth of the coastal community requires a balance between optimal recreational economic benefits gained from wide beaches and adequate protection against storm-driven erosion. The Town may use this research to inform funding and investment decisions.

Bidding, Negotiating and Construction Phase Services

Task 8: Bidding, Negotiating and Construction Phase Services

M&N has successfully bid over \$60 million of beach nourishment projects in North Carolina alone in the last 6 years. We maintain close ties with the dredging industry to understand bid timing and strategy. Sam Morrison, M&N’s lead on bidding, negotiating, and construction services, brings 29 years of experience in the dredging industry. This will allow us to provide economic and constructability review of designs to optimize the Town’s budget for a renourishment project. The experience will also allow M&N to develop specifications that are fair and reasonable for both the Contractor and Town and reduce risk thus ultimately reducing costs. Timing is everything in the procurement of dredging services in the U.S. With Sam on the team we constantly monitor the workloads of all the major U.S. dredging contractors and look for the best opportunities to advertise the projects to provide the best value. We also look at alternate bid strategies to allow the contractors flexibility which also generally results in lower bid prices. From the Construction oversight perspective Sam has managed over US \$1B of dredging work in his career which allows him to work seamlessly with the Contractors and have a clear understanding of issues that may arise during the construction phase.

Why Select Moffatt & Nichol

M&N provides the Town of Nags Head with an experienced and dedicated team to create a sustainable, long-term plan that addresses all of the Town’s beach management needs.

- Accessible project management team with industry leaders Johnny Martin and Brian Joyner who are dedicated to successful project implementation
- Our track record of developing 50-year beach management plans in North Carolina, securing required permits, and placing sand on the beach allows us to provide the Town with a proven workflow for establishing and maintaining a customized BMMP that achieves the Town’s particular goals.
- Our knowledge and project history in completing beach nourishment and coastal engineering projects in North Carolina provides context and vision for the Town’s future efforts
- Expert knowledge and experience with navigating permitting on the State and Federal levels that benefits the
- History of successfully securing of alternative funding sources through grant-funding
- Our approach to early engagement with the dredging industry, through open Industry Days and direct personal contacts, will allow the Town to better evaluate the dredging market climate and plan successful, cost-effective bidding strategies.

THE FOLLOWING APPENDIX SECTION INCLUDES KEY PERSONNEL RESUMES, TEAM CAPACITY AND AVAILABILITY, PROPOSED PROJECT SCHEDULE, MORE DETAILED DESCRIPTIONS OF OUR TEAM’S SIMILAR PROJECT EXPERIENCE, AND THE REQUIRED FORMS AND ATTACHMENTS ASSOCIATED WITH THIS REQUEST FOR QUALIFICATIONS.

JOHNNY MARTIN, PE**PROJECT MANAGER****KEY FEATURES**

- Managed Teams Including Proposed Key Personnel for Many Similar Projects
- Extensive Knowledge of Numerical Modeling
- Funding Methodologies
- Stakeholder Coordination
- Coastal Analysis, Planning & Engineering Design
- Construction Document Preparation
- Post Construction Award Services

EDUCATION

MS, Civil Engineering (Water Resources), North Carolina State University, 1997

BS, Civil Engineering, North Carolina State University, 1992

REGISTRATION**Professional Engineer:**

North Carolina, #23487, 1998

AFFILIATIONS

Board Member, North Carolina Beach & Inlet Waterway Association

American Water Resources Association

National Council of Examiners for Engineering and Surveying, Water Resources Board

North Carolina American Public Works Association, Water Resources Division

Mr. Martin provides project management, planning, analysis, design, construction documents, and post-construction-award services for a variety of coastal and hydraulic engineering projects including several wetland restoration projects. As a part of his coastal engineering experience, Mr. Martin has specialized numerical modeling of the hydrodynamics of flow in coastal, estuarine, and riverine systems. He has extensive knowledge of state-of-the-art numerical models including the MIKE Suite (MIKE 11, 21, 3, and MIKE SHE), as well as specialized models developed by the USACE such as RMA-2 and -4 and the current set of Hydrologic Engineering Center models. In addition, Mr. Martin has completed all stream restoration courses with the North Carolina Stream Restoration Institute. Notable projects include the Flood Mitigation Study for Emerald Isle, North Carolina, which is an innovative wetlands restoration and treatment project.

REPRESENTATIVE PROJECT EXPERIENCE

Master Beach Nourishment Plan for the Town of Oak Island, NC. Project Manager responsible for leading multidiscipline team for project to Determine the Sediment Needs and Locations of Available Sand for the Next 30 to 50 Years. M&N will complete all engineering/environmental studies required to acquire the permits for the Master Plan and will also provide engineering design services for the initial project as well as FEMA documentation for an engineered beach.

Bogue Banks Master Beach Nourishment Plan, Carteret County, NC. Project manager (PM) responsible for the development of a multi-decadal programmatic EIS for shoreline management and infrastructure protection for Carteret County along Bogue Banks. The project will incorporate all of Bogue Banks' beach nourishment and inlet management needs and acquire permits that will cover these needs and the use of required sand sources for the next 50 years. The project will also be used to update and maintain static-line exceptions as well as FEMA engineered beach designation.

Bogue Banks Beach and Nearshore Mapping Program, Carteret County, NC. Project manager who oversees surveys performed each spring along all three stretches of shoreline to document changes in the beach morphology and serve as a baseline before each storm season. After large storm events, surveying is also performed along Bogue Banks to assess damages and to serve as documentation for FEMA reimbursement for sand lost. The survey data is used to compute shoreline change at Mean High Water (MHW) and volume change above MHW, 25 feet NAVD 88 (wading depth), 12 feet NAVD 88 (outer bar), and 20 feet NAVD 88 (closure).

North Carolina Beach and Inlet Management Plan, NC. Project manager for this statewide study developing a beach and inlet management plan for North Carolina's ocean coastline of over 320 miles and 19 active inlets. Gathered, compiled, and analyzed relevant coastal datasets, including beach nourishment, dredging, and shoreline erosion. Developed management regions and strategies and conducted stakeholder process, including facilitating 10 public meetings. The final comprehensive plan covered beach and inlet management strategies, regional approaches, economic valuation, vulnerability assessment, and funding methodologies.

Hyde County Shoreline Protection and Intertidal Marsh Creation, Ocracoke Island, NC. Assistant project manager and lead coastal and stormwater engineer for stabilization of an eroding shoreline on Ocracoke Island by creating intertidal/upland marsh protected by segmented offshore breakwaters. Led the coastal engineering aspects of planning, permitting, preliminary/final design, and construction documents involving two rows of segmented offshore breakwaters, marsh/upland vegetation plantings, and shoreline reclamation. Also provided permitting and stormwater system design for the proposed parking area and upland development inland of the 30-ft-wide Zone 1 Tar-Pamlico Buffer. Stormwater system included site grading to direct drainage and stormwater management controls including energy dissipation, stormwater treatment, and runoff diffusion.

Shoreline Protection and Engineering Services Contract, Norfolk, VA. Project manager, coastal engineer and modeler for numerous task orders under three consecutive annual services contracts. Provided design of repairs, rehabilitation, upgrades and replacement of existing shoreline protection structures; and engineering and consulting services related to design documents requesting federal or state participation.

IQC: Shoreline Protection Projects, Norfolk, VA. Assistant project manager and lead coastal engineer under this five-year on-call contract for 13 of 21 shoreline protection tasks completed for the City of Norfolk.

- **East Ocean View Beach Nourishment Construction Services, Norfolk, VA.** Assistant project manager and lead coastal engineer who provided review for as-built surveys and authorized pay requests.
- **Ocean View 800 Block Beach Restoration Study, Norfolk, VA.** Assistant project manager and lead coastal engineer for a study to restore an erosion "hot spot." Managed data collection, including new surveys and sediment sampling. Directed sand compatibility analysis and numerical modeling using GENESIS to determine a long-term shoreline change rate and estimate future shoreline changes. Oversaw DELFT3D modeling to analyze sediment transport patterns/morphological changes. Developed beach restoration alternatives. Provided report presenting preferred alternative with opinions of probable costs.
- **West Ocean View Dune Restoration and Central Ocean View Beach Restoration, Norfolk, VA.** Lead coastal engineer for a dune and beach restoration project to repair storm-induced erosion involving planning, permitting, analysis, design, construction documents, and PCAS to restore the beach using approximately 428,000 cy of material obtained two offshore borrow sites and placed along 18,300 lf of beach. Directed sand compatibility analysis and prepared beach profile template, preliminary design, permit application, response to regulatory agency inquiries, final design, and construction documents.
- **Ocean View Permit and Design Sand Borrow Investigation, Norfolk, VA.** Using the results of the earlier survey task, he oversaw the design effort to develop potential borrow sites (develop quantities and sizes) for use in beach nourishment. Directed permit application preparation. During agency review, he directed responses to address agency questions and requests for information and attended meetings with various regulatory agencies to acquire permits.
- **Sand Source Investigation Phase 1, Norfolk, VA.** Assistant project manager and lead coastal engineer who developed and directed vibracoring plan and associated laboratory analysis.
- **Ocean View 800 Block Breakwater Design, Norfolk, VA.** Assistant project manager and lead coastal engineer who completed final design and construction documents for 800 Block breakwater. Provided bid assistance and construction observation as well as review of contractor submittals. Reviewed as-built plans.
- **East Ocean View Breakwater, Norfolk, VA.** Lead coastal engineer for repair of storm-induced erosion involving planning, permitting, analysis, design, and construction documents for full-scale beach restoration. Utilized 359,000 cubic yards of beach fill placed along 5,300 linear feet of shoreline. Oversaw MIKE 21 wave modeling to generate wave climate for Ocean View Beach based on offshore wave data for use in SBEACH and GENESIS. Utilized SBEACH to analyze profile response to numerous storm scenarios and based on those results, completed preliminary design of a beach profile restoration template.

BRIAN JOYNER, PE

ASSISTANT PROJECT MANAGER

KEY FEATURES

- Field Data Collection and Monitoring;
- Detailed Numerical Modeling
- Sediment Transport
- Beach and Dune Design
- Coastal Flooding/Sea Level Rise

EDUCATION

MS, Civil Engineering with Coastal Concentration, North Carolina State University, 1997

BS, Environmental Engineering, North Carolina State University, 1995

REGISTRATION**Professional Engineer:**

North Carolina, #039594, 2012

CERTIFICATIONS

FEMA Enter on Deployment (EOD) Status

AFFILIATIONS

American Society of Civil Engineers (ASCE)

Coasts, Oceans, Ports & Rivers Institute (COPRI)

Mr. Joyner is M&N's lead coastal and storm water engineer in Virginia. His 20-year career has focused on determining coastal and stormwater flood hazards at both local and regional scales and designing systems to mitigate or withstand those hazards. His experience includes field data collection and monitoring; detailed numerical modeling of storm surge, waves, and sediment transport; and design of beaches, dunes and coastal structures such as breakwaters to manage shoreline stability. He is responsible for the delivery and quality of the firm's shoreline protection, dune management, coastal flooding/sea level rise, and stormwater projects for Virginia's coastal communities. He regularly participates in community meetings regarding sensitive issues such as balancing coastal flood risk with property owner concerns. Isle, North Carolina, which is an innovative wetlands restoration and treatment project.

REPRESENTATIVE PROJECT EXPERIENCE

Bogue Banks Master Beach and Inlet Management Nourishment Planning and Programmatic EIS, Carteret County, NC. Lead coastal engineer and modeler for analysis of Bogue Inlet morphology and separate beach erosion hot spot analysis on Carteret County's Bogue Banks shoreline, as part of developing a multi-decadal plan and programmatic EIS for long-term beach nourishment and inlet maintenance needs. The inlet and beach management studies use high-resolution, local numerical models of the inlet and barrier island shorefront, driven from a single regional model of historical waves and tidal hydrodynamics. The local models consist of integrated wave, flow, and sediment transport computations. The inlet model also includes continuous computation of bed change (morphodynamics), to develop a more realistic understanding of the inlet channel and shoal behavior. The beach erosion model uses high-resolution sediment transport calculations for a typical year to understand the reasons this particular hot spot exists, for developing mitigation alternatives.

Preliminary FEMA Flood Insurance Rate Map (FIRM) Review and Appeal Support, Carteret County and Incorporated Communities, NC. Coastal engineer and FEMA coastal hazard subject matter expert for review of the preliminary FIRM panels prepared by NC Floodplain Mapping Program (NCFMP) for the County and its various waterfront Towns. Reviewed the underlying numerical modeling data and its input/output analyses and compared the model results and preliminary flood zones to detailed LiDAR topography. Recommended multiple localized revisions to the preliminary VE zones and Limit of Moderate Wave Action (LimWA), and prepared formal appeals for the communities to submit to NCFMP. Led discussions with NCFMP and obtained their concurrence on technical basis for appeals and presented findings and conclusions to community staff and elected officials.

Ocean View Shoreline Periodic Survey and Analysis, Norfolk, VA. Project manager and lead coastal engineer for ongoing spring and fall surveys and monitoring reports along Norfolk's seven-mile long Ocean View and Willoughby Spit shoreline. Coordinated subconsultants' field data collection. Provided engineering technical review of volume change and shoreline change calculations and documentation. Established reporting methods for monitoring the performance of the USACE's Coastal Storm Damage Reduction Federal beach nourishment project.

Sand, Beach and Dune Management Committee and Technical Investigations, Norfolk, VA. Coastal engineer. Provided data products and technical documents on an on-call basis in relation to Cottage Line dune management and participated actively as a member of the City's Sand, Beach and Dune Management Plan Steering Committee in a process intended to address residents' concerns about sand encroachment on their properties while maintaining storm damage protection afforded by the dunes.

Ocean View Sand Management Pilot Project, Norfolk, VA. Project manager and lead coastal engineer working with City of Norfolk staff, other consultants, and the Cottage Line Civic League to design and coordinate permits for a project to excavate sand encroaching against private structures and place the excavated sand into gaps and narrow reaches in adjacent dunes. The present effort covers a limited extent of shoreline—between Grove Avenue and Cape View Avenue—as a pilot project to work through the technical, financial and regulatory requirements, with a view to applying the process elsewhere in Ocean View.

USACE Project Review, Norfolk, VA. Project manager and lead coastal engineer. Reviewed and commented on preliminary and pre-final Federal beach nourishment project design documents, attended multiple design review meetings with USACE,

their consultants, and City staff, and provided recommendations for refining beach nourishment template design in relation to existing breakwater and stormwater outfalls.

Toler Place Breakwater Modifications, Norfolk, VA. Project manager and lead coastal engineer for design and construction phase support to modify an existing detached breakwater and add a new breakwater to stabilize an erosional hot spot within a Federal beach nourishment project extent. Supervised three-dimensional sediment transport and morphological modeling of the existing and proposed breakwater system, reviewed and approved designs for the modified and new breakwater. Conducted bidding and construction phase support to the City's construction group including responding to contractor RFIs and reviewing contractor submittals.

Chesapeake Beach Nourishment Design and Permitting, Virginia Beach, VA. Lead coastal engineer and project manager for design of a hydraulic dredging and beach nourishment and dune restoration project at Chesapeake Beach between the CBBT and JEB—Little Creek. The nourishment sand is obtained by hydraulic dredging of a nearshore shoal with pipeline to the beach. Designed the nourishment template and prepared basis of design and the Joint Permit Application and supporting documents. Coordinated with federal and state agencies to assist with permit processing and federal Section 408 review.

Croatan Beach Shoreline Protection Assessment, Beach Nourishment Design and Section 408 Review Support, Virginia Beach, VA. Lead coastal engineer and project manager for a study of long-term behavior of the Croatan Beach shoreline and dunes. Determined shoreline, beach and dune change patterns over several decades; estimated the level of protection currently provided by the beach and dune system; and made recommendations on the necessity for and purpose of changes in beach or inlet management. Evaluated annual and seasonal sediment budgets for the inlet and documented impacts of beach management actions on the Federal navigation channel and resort beach nourishment projects. Prepared bidding and construction documents for beach nourishment to create the recommended beach and dune template.

Cape Henry Beach Coastal Engineering Expert Witness, Virginia Beach, VA. Coastal engineer supporting expert witness services on behalf of the City in defense of lawsuits

TIMOTHY REID, PE**PRINCIPAL IN CHARGE****KEY FEATURES**

- Decades of Experience Overseeing and Effectively Allocating Personnel and Other Resources
- Practical Design Experience from Ideation through Construction
- Vested Interest in Building Strong Client Relationships through Excellent Service
- Worked with Project Manager, Johnny Martin for More Than 20 Years

EDUCATION

BS, Civil Engineering,
North Carolina State
University, 1984

REGISTRATION

Professional Engineer:
North Carolina, #15869,
1989

Mr. Reid is currently the M&N's branch manager of our Raleigh, North Carolina office overseeing its day-to-day operations and having responsibility for assigning office resources to furnish timely and accurate project completion. In addition, he routinely provides quality control/assurance, team coordination, and project oversight. In addition to being a vice president, Mr. Reid is a senior civil engineer with 34 years of project management, planning, evaluation, design, construction document preparation, and post-construction award services experience acquired on a wide variety of civil engineering assignments. His project management experience includes team assembly, direction of personnel and subcontractors, client relations, proposal preparation, manpower estimates, project oversight and other administrative duties. In addition, his civil engineering experience also includes planning, design, and construction document preparation for a variety of projects such as stormwater management facilities, drainage systems, military and industrial pavements, traffic staging/control, highways, utilities (water, sewer and fuel), and erosion control plans.

REPRESENTATIVE PROJECT EXPERIENCE

Terminal Groin Study, NC. Principal-in-charge for this study to evaluate the applicability and feasibility of terminal groins as an erosion control device in the State of North Carolina. This study led to aiding the North Carolina General Assembly to develop terminal groin guidelines.

Canal Del Dique Phase I Conceptual Design Review, Bolivar Department, Colombia.

Civil engineer for review, modeling, and validation of the conceptual design of a series of three constriction structures intended to improve environmental and navigational conditions in Canal del Dique.

Fire Island to Montauk Point Breach Contingency Plan, Long Island, NY. Civil engineer for evaluation of barrier island breach potential and development of alternative corrective actions should a breach occur. Provided reach delineation for a 50-mile-long segment of shoreline. Developed borrow area locations from which to obtain emergency fill material including evaluation of different breach closure methods, including dredging, trucking from upland, and stockpiling material near "hot" spots. Determined detailed quantities as input to cost estimate.

Westhampton Beach Storm Damage Protection Interim Plan, Long Island, NY. Civil engineer for detailed planning study for interim shore protection, which examined improving the shoreline using a combination of existing groin modification, beach fill placement, and new groin construction. Provided planning and design for groin modification, new groin construction, and beach fill including groin details and beach fill layout. Developed groin field-beach fill transition schemes and provided quantity determinations as input to detailed cost estimate.

JEFFERY SHELDEN, PE**QUALITY MANAGER****KEY FEATURES**

- Analysis of Shoreline Evolution
- Analysis of Inlet and Channel Morphology
- Preparation of Construction Documents for Beach Restoration Projects
- Numerical Models Such As GENESIS, LITPACK, MIKE 21, and DELFT3D

EDUCATION

MS, Civil Engineering,
North Carolina State
University, 1985

BS, Civil Engineering with
Highest Distinction,
University of Virginia, 1984

REGISTRATION**Professional Engineer:**

North Carolina, #15470,
1989

Virginia, #0402 044560,
2009

AFFILIATIONS

American Shore and Beach
Preservation Association

American Society of Civil
Engineers

Chi Epsilon, the National
Civil Engineering Honor
Society

Tau Beta Pi, the National
Engineering Honor Society

Mr. Shelden has served as a coastal engineer with M&N for 33 years and is experienced in the analysis of coastal processes and hydraulics, including shoreline evolution and inlet and channel morphology modeling. These models include GENESIS, LITPACK, SBEACH, MIKE 11, MIKE 21, MIKE 3, RMA-2, RMA-4, and DELFT3D. He has also analyzed and designed several beach restoration projects, prepared construction documents and provided construction services.

REPRESENTATIVE PROJECT EXPERIENCE

North Carolina Beach and Inlet Management Plan, NC. Senior coastal engineer who developed a comprehensive beach and inlet management plan (BIMP) identifying potential strategies to maintain beach and inlet characteristics at levels determined from analysis of historic, current, and forecasted future positions and composition. Provided oversight and QA/QC for the studies five main tasks: formation of a centralized database of available beach and inlet data, definition of management regions, development of draft management strategies, prioritization for state funding of beach and inlet management projects, and the project final report.

North Carolina Terminal Groin Study, NC. Senior coastal engineer who participated in the terminal groin study to evaluate their applicability and feasibility as an erosion control device in the state. This study led to aiding the North Carolina General Assembly to develop terminal groin guidelines.

NC 12 - Ocracoke Island Hotspots Update, Ocracoke, NC. Senior coastal engineer who provided updates to existing coastal erosion analysis for a vulnerability analysis of a 5.5-mile-long section of NC 12 located within Cape Hatteras National Seashore Recreation Area. Effort included the review of potential project alternatives to prevent the highway from damage during the near future.

IQC: Shoreline Analysis and Protection Services, Norfolk, VA. Senior coastal engineer who provided oversight and QA/QC for several tasks under this open-end contract, including the following:

- **East Ocean View Beach Nourishment Phase II, Norfolk, VA.** Senior coastal engineer who provided QA/QC for planning and design of beach nourishment for a mile-long section of beach. Provided input to and review of a detailed sand compatibility analysis of potential material borrow sources, along with detailed analysis of project wave climate, historical shoreline change, and subsequent SBEACH and GENESIS modeling to determine project design life. Reviewed permit drawings and documentation along with final construction documents for beach fill placement.

Figure Eight Island Dredging and Beach Nourishment, Figure Eight Island, NC. Coastal engineer who prepared plans and monitored construction of a dredging and beach nourishment project, providing on-site consultation during the fill placement.

B-2500 Herbert C. Bonner Bridge Replacement Coastal Processes Modeling, Oregon Inlet, NC. Assistant project manager who provided evaluation of coastal processes at Oregon Inlet, including inlet migration, shoreline changes, and the effects of dredging and construction of a terminal groin as part of determining the alignment of a new bridge. Used GENESIS, a shoreline evolution model, to project future shoreline conditions in response to a new terminal groin and future conditions considering the possibility of major jetty construction at the inlet. Conducted investigations to describe historic and existing coastal conditions and forecasted future shoreline positions as well as future location and orientation of inlet's principal and main subsidiary channels for a 50-year project life. Evaluated various bridge replacement alternatives with consideration given to secure approach and abutment locations, navigational channel requirements, and anticipated scour impacts.

ROBERT NEAL, PE**COASTAL ENGINEER****KEY FEATURES**

- Dynamic modeling studies,
- Environmental Restorations
- Inlet Relocations
- Storm Protection Analysis
- Budget Management
- 10 Years of Public Sector Experience

EDUCATION

MS, Civil Engineering, Old Dominion University, VA, 2011

BS, Civil Engineering (Water Resource Planning & Coastal Engineering), North Carolina State University, Raleigh, NC 1997

Coastal Engineering Certificate, Old Dominion University, Virginia, VA, 2006

REGISTRATION**Professional Engineer:**

North Carolina, #39470, 2012

AFFILIATIONS

Board of Directors, North Carolina Beach, Inlet & Waterway Association

American Society of Civil Engineers

Society of American Military Engineers

2019 NCBIWA Member of the Year

Mr. Neal joined M&N in August 2015 as a coastal engineer. With over 18 years of experience specializing in coastal and water resource initiatives, Mr. Neal has provided long-term management solutions to complex beach and shoreline projects, including inlet relocations and environmental restorations. Mr. Neal has conducted storm protection analyses, borrow source determinations, and hydro-dynamic modeling studies, and is familiar with North Carolina permitting requirements for coastal projects, including the National Environmental Policy Act (NEPA) process. Mr. Neal has provided cost effective engineered alternatives for private and governmental entities. to achieve project goals while consistently remaining within budgetary constraints. Mr. Neal's decade of experience as a county government leader, prior to joining M&N enables him to blend his private and public-sector experience to offer a unique dual perspective of coastal engineering and shoreline management that will aid in development of a unified plan.

REPRESENTATIVE PROJECT EXPERIENCE

North Carolina Beach and Inlet Management Plan, NC. Mr. Neal assisted with the stakeholder involvement and community meetings for this statewide study developing a beach and inlet management plan for North Carolina's ocean coastline of over 320 miles and 19 active inlets. Mr. Neal worked with the M&N Team to collect and analyze dredging and beach renourishment records to develop historical use trends. Mr. Neal also evaluated the historical results to estimate future needs for dredging along the North Carolina coast. The final comprehensive plan covered beach and inlet management strategies, regional approaches, economic valuation, vulnerability assessment, and funding methodologies.

Oak Island Master Beach Nourishment Plan Feasibility Study, Oak Island, NC. Project manager for a consulting team to provide a 30-year plan for managing the Oak Island shoreline. Mr. Neal assisted junior staff to interpret numerical modeling results and provide estimates of annual volumetric quantities necessary to maintain a stable shoreline and acceptable storm protection buffers. Mr. Neal also conducted a sediment compatibility analysis to determine the most economical borrow site(s) for the 30-year project.

Bogue Banks Master Beach Nourishment, Carteret County, NC. Project engineer for this team that was selected by Carteret County to complete a three-year project to develop a multi-decadal programmatic Environmental Impact Statement (EIS) that will incorporate all of Bogue Banks beach nourishment and inlet management needs and acquire permits that will cover these needs and the use of required sand sources for the next 30 to 50 years. Provided a forecast of future financial requirements expected for the continued management of the Bogue Banks and Carteret County shoreline.

New River Inlet Channel Realignment and Beach Restoration, North Topsail Beach, NC. Project manager who developed a monitoring plan to demonstrate compliance with Federal Emergency Management Agency requirements for public assistance to restore the engineered beach in the event of a major storm event. Conducted sampling and testing procedures to verify the project was compliant with the US Army Corps of Engineers and North Carolina Division of Coastal Management sediment compatibility standards. Provided oversight and coordination with the contractor, client, and interested parties to accomplish the design intent and inform all parties of the construction status. Responsible for the design of a dune and beach system that mitigated the effects of Hurricane Sandy, which impacted the project during the early phase of construction.

IRA BROTMAN, PE**COASTAL/GEOTECHNICAL ENGINEER****KEY FEATURES**

- Beach Restoration Design
- Sediment Sourcing /Investigations
- Design Permit Acquisition
- Dredging Design

EDUCATION

MS, Civil Engineering,
Virginia Polytechnic
Institute and State
University, 1991

BS, Civil Engineering,
Virginia Polytechnic
Institute and State
University, 1990

REGISTRATION

Professional Engineer:
Virginia, #0402028530,
1998

AFFILIATIONS

American Society of Civil
Engineers (ASCE)
Geo-Institute

Mr. Brotman joined M&N in 2003 and has more than 25 years of experience in the design, construction, and rehabilitation of waterfront civil engineering projects. This experience includes analysis, design, permit acquisition, and preparation of final design documents for municipal waterfront projects. He has served as both project manager and project engineer on a wide range of projects involving waterfront structures, marinas, bridges, and stormwater outfalls.

REPRESENTATIVE PROJECT EXPERIENCE

On-Call Coastal Engineering Contract, Virginia Beach, VA. Project manager for task orders including scoping, planning, preparation and management of profile monitoring along Sandbridge and Big Beach. These large scale periodic topographic and bathymetric surveys included the collection and evaluation of over 48 linear track miles of survey data used to evaluate the condition of the beach dune and near shore and need for nourishment. Using GIS analysis methods, comparisons to prior surveys were made to evaluate erosion bathymetric changes along the ocean floor. Other task orders included evaluation and recommend repairs to waterfront structures including Rudee Inlet jetty system, and repairs to Owl Creek boat ramp and First Landing Park piers.

Ocean View Beach 800 Block Beach Restoration Study, Norfolk, VA. Project manager for a detailed study of the shoreline erosional hotspot at the 800 Block of Ocean View Beach and the development of a recommended alternative for beach restoration at this location. Incorporated survey data and sediment information collected during the Central Ocean View project, transformed offshore wave data to the site, modeled the existing system at the 800 Block hotspot area to determine the cause of erosion, and developed a list of alternatives for beach restoration. The selected alternatives for beach restoration were also modeled to determine the impact and effectiveness of each alternative. Construction documents were prepared for the recommended alternative.

East Ocean View Dune Restoration and Beach Nourishment, Norfolk, VA. Project manager for the design, planning, permitting, and engineering services related to the restoration of approximately 1 mile of previously eroded shoreline adjacent to the East Beach community, and 3.5 miles of dune restoration along Central Ocean View. This beach nourishment project provided protection for property, creation of recreational beach area, and increased coastal dune habitat as part of the city's larger neighborhood revitalization plan for Ocean View. Services included coastal modeling and analyses, as well as sediment compatibility analysis in order to determine the suitability of proposed borrow areas.

Study of Sediment Sources for Future Beach Nourishment Projects, Norfolk, VA. Project manager for collecting and reviewing sediment data within the lower Chesapeake Bay to determine the availability of beach-quality sand for future beach nourishment projects along Ocean View beach. The first phase involved a literature search, mapping of previous investigations, and development of a GIS database to summarize the information, as well as an initial coordination with regulatory agencies. The second phase included investigation, sampling of forty vibracores, and analysis of sediment compatibility based on existing sand along Ocean View and that within the borrow areas of two potential sources of sand, Willoughby Bank and Thimble Shoal Channel. Prepared permits for the dredging of areas determined from the investigations to be good borrow sources and placing a beach berm and dune along the entire Ocean View shoreline.

Chesterfield Heights Shoreline Protection, Norfolk, VA. Project engineer for the inspection of existing conditions and visible structures and preparation of a concept design report to mitigate the eroding shoreline at Chesterfield Heights. Concept alternatives included revetments, bulkheads, and a riprap sill with re-vegetated shoreline. Each concept design included development of sufficient design details to prepare estimated quantities and concept-level opinions of probable cost.

NICOLE VANDERBEKE, PE**COASTAL ENGINEER****KEY FEATURES**

Beach Nourishment
 Master Plan Development
 Coastal Modeling
 Shoreline Monitoring
 GIS Database
 Development and
 Management

EDUCATION

BS, Civil Engineering,
 North Carolina State
 University, Raleigh, 2003

REGISTRATION

North Carolina, #37991,
 2011

AFFILIATIONS

American Shore and Beach
 Preservation Association
 North Carolina Beach, Inlet
 and Waterway Association.

Ms. VanderBeke provides engineering support for water resources and coastal engineering projects including numerical modeling and GIS analysis. Ms. VanderBeke has been involved in shoreline and beach volume change analysis, development of shoreline stabilization and beach nourishment projects, analysis of borrow area and native beach sediment data, wave environment analysis, coastal flooding studies, and coastal floodplain mapping. Her coastal modeling experience has involved the use of SBEACH and GENESIS.

REPRESENTATIVE PROJECT EXPERIENCE

Bogue Banks Master Beach Nourishment Plan, Carteret County, NC. Coastal engineer responsible for long-term shoreline change modeling using GENESIS. Developed a calibrated and verified GENESIS model using historical data from which future project scenarios were modeled based on project template results from cross-shore SBEACH model simulations. Developed a GIS database of existing data for the study area including shorelines, beach profile surveys, inlet/offshore multi-beam surveys, and vibracores. Assisted in developing the plan for offshore borrow area geotechnical data collection required for the project. Compiled historical volume change data from previous monitoring efforts dating back to 1999 and calculated volume changes, where absent, using BMAP for analytical analysis to determine future beach volume needs based on prior history.

North Carolina Beach and Inlet Management Plan, Statewide, NC. As coastal EIT, she assisted the development of a comprehensive beach and inlet management plan (BIMP) identifying potential strategies to maintain beach and inlet characteristics at levels determined from analysis of historic, current, and forecasted future positions and composition. Gathered data (beach profile & bathymetric surveys, wave, tide, storm, aerial photography, historic shoreline positions, geologic (sediment), sediment budgets) and created and populated a statewide beach nourishment GIS database providing nourishment location, date, extent, quantity, source, total project cost, project sponsor, and method of material delivery to site (pipeline, hopper dredge, etc.). Also created and populated a statewide coastal structures GIS database recording location, orientation, and structure type. Using these data, she analyzed erosion rates, potential offshore sediment sources, shoreline development and beach management practices. For the project's final report, she wrote multiple sections of final report.

Post-Irene Beach Renourishment Project, Carteret County, NC. Coastal engineer responsible for determination of the amount of material lost during Hurricane Irene. Assisted in determination of beach reaches in most need of nourishment material and development of the nourishment template for these reaches based on the amount of material the County and Towns could afford. Participated in and led weekly construction meetings and site visits. Assisted with verification of material placement quantities based on BD and AD surveys using BMAP and adjustments to the design template given changes in the beach since the plans were created and imprecise placement of material common in nourishment projects. Authored final report.

Lockwood Folly Habitat Restoration – Dredging of the Eastern Channel, Oak Island, NC. Coastal engineer tasked with construction administration for the dredging of Eastern Channel, placement of beach compatible material on Oak Island, and disposal of non-compatible material on Horse Island. Helped develop the front end documents, technical specifications, and construction plans for the project. Led weekly progress meetings at the project site with the dredging contractor and Town of Oak Island officials to facilitate discussion on work completed and upcoming work as well as address any questions or issues from the contractor or Town and discuss any changes to the original construction plans (i.e. changes in beach fill or dredging template) that needed to be made based on daily dredging reports and progress surveys from the contractor. Also, in charge of developing the final project report for the Town of Oak Island.

DOUG HUGGETT

PERMITTING

KEY FEATURES

- Environmental Permitting Process
- Agency Coordination
- Problem Resolution
- Project Management
- Beach Master Plan Development
- Permit Compliance
- Rule Analysis and Interpretation

EDUCATION

MA, Biological Oceanography, Virginia Institute of Marine Science (College of William and Mary), 1987

BS, Biology, Florida Institute of Technology, 1983

AFFILIATIONS

American Shore and Beach Preservation Association
North Carolina Beach, Inlet and Waterway Association.

Mr. Huggett, an environmental permit specialist and project manager for M&N, has 30 years of experience in environmental permitting in North Carolina. He served as the manager of the North Carolina Division of Coastal Management's Major Permit Section for more than 20 years. During this time, Doug managed all aspects of permitting all beach nourishment, inlet dredging, beneficial use and terminal groin projects for North Carolina's oceanfront shoreline. He oversaw permitting and problem-resolution for transportation, port expansion, marina and subdivision development, navigational dredging, living shoreline, docks, and shoreline stabilization projects taking place within North Carolina's coastal zone.

REPRESENTATIVE PROJECT EXPERIENCE

- **Nags Head Beach Nourishment Projects, Dare County, NC.** As CAMA Major Permits Coordinator for the N.C. Division of Coastal Management, was responsible for permit processing and coordination for Town of Nags Head's initial 2011 nourishment event, as well as the 2019 follow-up nourishment event. Responsibilities included problem-resolution and coordination between sponsor and state and federal agencies on issues such as borrow area selections, sediment compatibility analysis, and other project design components. Responsibilities also included working with Town of Nags Head to develop acceptable process for removing nourishment sand that migrated onto adjacent properties. Since 2017, was also responsible for supervising permit compliance before, during, and after project construction.
- **Bogue Banks Master Beach Nourishment Plan, Carteret County, NC.** As CAMA Major Permits Coordinator for the N.C. Division of Coastal Management, was responsible for coordination between sponsor and state and federal agencies of issues such as borrow area selections, nourishment triggers, project frequencies and other project design components for Carteret County's 30-year master nourishment plan for the Towns of Atlantic Beach, Pine Knoll Shores, Indian Beach, Salter Path and Emerald Isle. Also responsible for initial CAMA permit issuance and the development of a new CAMA permit authorization process, in lieu of permit modifications for each separate event, for future nourishment actions.
- **Village of Bald Head Island Terminal Groin, Brunswick County, NC.** As CAMA Major Permits Coordinator for the N.C. Division of Coastal Management, was responsible for permit processing and coordination of the permitting of a terminal groin for the Village of Bald Head Island, the first terminal groin permitted and constructed under the North Carolina General Assembly's 2011 terminal groin legislation. Responsibilities included ensuring compliance with all legislatively mandated requirements, coordination and management of the development of the required Environmental Impact Statement, coordination of an inlet management plan including monitoring plan and mitigation triggers to ensure that down-drift properties or communities were not adversely impacted by the groin structure, coordination of permit conditions with applicant's engineer, and issuance of the CAMA permit.
- **Ocean Outfall Repairs, Replacements and Extensions, Dare County, NC.** As CAMA Major Permits Coordinator for the N.C. Division of Coastal Management, was responsible for permit processing and coordination of ocean outfall repairs, replacements and extensions that were necessitated by beach nourishment events. Responsibilities involved coordinating design and timing requirements with the N.C. Department of Transportation (owner/manager of the outfalls), permit issuance, and when required, coordinating variance requests with the N.C. Department of Justice and the N.C. Coastal Resources Commission.

DAWN YORK**PERMITTING****KEY FEATURES**

- 17 years of coastal NC experience
- Led the NEPA process for 12 large-scale beach and inlet management projects
- Knowledgeable of State and Federal permit process

EDUCATION

MS, Marine Science,
University of North
Carolina at Wilmington,
2003

BSc, Biology and
Environmental Studies,
Minor in Chemistry, 1999

Visiting Scholar, 2001

CERTIFICATIONS AND TRAINING

TogetherGreen, 2008,
Conservation Fellow
(National Audubon Society)

Intermittent and Perennial
Stream Identification for
Riparian Buffer Rules,
2006, (Department of
Forestry and
Environmental Resources,
North Carolina State
University)

Wetland Determination and
Delineation, 2004,
(Department of Forestry,
North Carolina State
University)

Rare Plant Identifications,
2003 (USFWS and
NCNHP)

Trained in Wetlands Rapid
Assessment Procedure
(WRAP)

Professional Training and
Experience in Shorebird
Surveys and Wetland
Delineations

CPR/First Aid, 2008

Certified Boat Operator (<
20 feet), UNC-Wilmington

Ms. York, a senior coastal scientist and project manager for M&N, has been involved in the design, preparation, coordination, and adaptive management of large-scale, multi-disciplinary coastal monitoring, environmental assessment, and comprehensive natural resource management programs for over 16 years. Her experience is associated with environmental permitting requirements for large-scale beach nourishment programs including the management and direction of environmental documentation and permit authorizations in accordance with the State Environmental Policy Act (SEPA) and the National Environmental Policy Act (NEPA). Ms. York received her Bachelor of Science and Master of Science degrees from the University of North Carolina at Wilmington where she conducted three years of extensive sea level rise research on the Cape Fear and Northeast Cape Fear Rivers under the direction of Dr. Courtney Hackney for the US Army Corps of Engineers (USACE) Wilmington Harbor Deepening Project.

In addition to her position as a Coastal Scientist, Ms. York currently serves as the Coordinator for the Cape Fear River Partnership, a coalition of federal, state, industry, private, non-profit organizations working towards the restoration of anadromous fish species in the Cape Fear River watershed. She works closely with fisheries scientists from National Oceanic and Atmospheric Administration (NOAA), US Fish and Wildlife Service (FWS), NC Division of Marine Fisheries and NC Wildlife Resources Commission to implement the goals and targets for restoring fisheries populations in the Cape Fear River. Ms. York has currently raised \$3.4 million for the construction of a rock arch ramp at Lock and Dam 2 and 3 in the Cape Fear River to allow fish passage of endangered and federally managed anadromous fish species.

REPRESENTATIVE PROJECT EXPERIENCE

Oak Island Master Beach Nourishment Plan - Environmental Impact Statement (EIS), Brunswick County, NC. Environmental technical lead for the preparation of an EIS for the development and design of the Master Beach Nourishment Plan, a 50-year study to manage and protect the shorelines and inlets of Oak Island. Directly coordinates with the USACE and BOEM as federal lead agencies. Serves as the lead coordinator for the Project Review Team and public involvement during the scoping process.

Environmental Impact Statement (EIS) for the North Topsail Beach Shoreline Protection Project, North Topsail Beach, NC. Environmental project manager and environmental technical lead for the preparation of an EIS for the construction of a five-phased beach nourishment and inlet realignment project. Conducted biological assessments of coastal shorebird and colonial water bird as baseline analysis for permit compliance.

Oak Island Pre-Feasibility Study in Support of a Comprehensive Beach Management Plan, Brunswick County, NC. Project manager and environmental technical lead for the evaluation and documentation of federal and state permitting requirements for a long-term beach renourishment and dune restoration program.

Bogue Banks Master Beach Nourishment Plan - Environmental Impact Statement (EIS), Carteret County, NC. Project manager and environmental technical lead for the preparation of an EIS for the development and design of the Master Beach Nourishment Plan, a 50-year study to manage and protect the shorelines and inlets of Bogue Banks. Directly coordinates with both the USACE and Bureau of Ocean and Energy Management as federal lead agencies. Served as the lead coordinator for the Project Review Team and public involvement during the scoping process. In addition to the preparation of an EIS, Ms. York has assisted in the assessment of direct and indirect cumulative impacts as it relates specifically to the project and within the State of NC.

ZHANXIAN “JONATHAN” WANG, PHD**MODELING****KEY FEATURES**

- Data analysis
- Shoreline change modeling
- Cross-shore profile change modeling
- Wave modeling
- Storm surge modeling
- Surface water/groundwater modeling
- Tidal hydraulics:
- Numerical modeling
- Coastal flooding risk analysis

EDUCATION

PhD, Coastal Engineering,
University of Florida, 2004

MS, Offshore Engineering,
Tianjin University, China,
1997

BS, Ocean Engineering,
Tianjin University, China,
1995

AFFILIATIONS

American Society of Civil
Engineers

American Shore and Beach
Preservation Association

Dr. Wang provides a strong academic background and work experience in coastal hydrodynamics, sediment transport, shoreline change, beach nourishment, coastal structures, and numerical modeling techniques. This experience includes both surface water and groundwater hydraulics. Since joining M&N, he has acquired extensive experience in riverine, estuarine and coastal hydraulics and regularly uses state-of-practice numerical models to analyze those. These models include Delft3D, MIKE Suite, and USACE models (e.g., ADCIRC, RMA-2, RMA-4) to analyze water movement processes.

REPRESENTATIVE PROJECT EXPERIENCE

New Hanover County (NHC) Shoreline Risk Reduction Plan, NC. Lead coastal modeler for the refined modeling of the risk reduction analysis and complete assessments of existing and proposed NHC Coastal Storm Damage Reduction (CSDR) templates. Developed DELFT3D models to provide long-term hydrodynamics, wave, sediment transport and morphological change modeling of each CSDR alternative over five years to support developing optimal beach nourishment templates for NHC beach communities.

Oregon Inlet Sand and Navigation Management Feasibility Study, NC. Lead coastal modeler for the hydrodynamics, wave, sediment transport, morphological change as well as larval transport modeling of Oregon Inlet sand and navigation management plans. Delft3D modeling suite was utilized to provide numerical modeling analysis of proposed Oregon Inlet sand and management alternatives (including but not limited to jetties, groins, optimal dredging, sand bypassing system, and a combination of above) to develop recommendations for feasible options that warrant further study.

Port of Wilmington, Section 203 Navigation Channel Improvement Integrated Feasibility Study and Environmental Impact Statement, Wilmington, NC. Lead coastal modeler for the hydrodynamics, wave, sediment transport, channel and shoreline morphological change as well as water quality modeling of navigation channel deepening impacts on estuarine and coastal environments within Cape Fear River estuary and surrounding area. DELFT3D modeling suite and GENCADE were among the engineering tools utilized to support the formulation and evaluation of channel deepening alternative plans at the site.

NC 12 Interim Highway Improvements, Ocracoke Island, NC. Coastal hydraulic scientist for vulnerability analysis of a 5.5-mile-long section of NC 12 within the Cape Hatteras National Seashore Recreation Area. Performed beach profile changes under storm waves using SBEACH. Forecasted probabilistic future shoreline positions using the U.S. Army Corps of Engineers' Empirical Simulation Technique (EST) model with a risk and frequency-based approach.

Master Beach Nourishment Plan, Town of Oak Island, NC. Lead coastal modeler for numerical modeling of Lockwoods Folly Inlet and adjacent Holden Beach and Oak Island shorelines. Developed DELFT3D models to provide long-term hydrodynamics, wave, sediment transport and morphological change modeling for inlet and shoreline management. The objectives of the project include determining the sediment needs and locations of available sand for the next 30 – 50 years, completion of all engineering and environmental studies required to acquire the permits for the Master Plan, and providing engineering design services for the initial project as well as FEMA documentation for an engineered beach.

YONG CHEN, PhD, PE**MODELING****KEY FEATURES**

- 30+ years of coastal engineering project experience
- Coastal numerical and physical modeling for preliminary navigational channel design, harbor layout design, marina and beach protection design in China, U.S. and international
- Beach nourishment design for more than 10 beach nourishment projects in U.S. and international
- Preliminary marina design for more than 10 marina projects in U.S. and international
- Jetty/groin and breakwater design for 8 coastal engineering projects in China, U.S. and international
- Coastal project management in China and U.S.

EDUCATION

PhD, Civil and Structural Engineering, Hong Kong Polytechnic University, 2001

MS, River and Coastal Engineering, Nanjing Hydraulic Research Institute, 1990

BS, Harbor and Waterway Engineering, Hohai University, 1984

REGISTRATION

Professional Engineer:
Florida, #82318, 2017

Dr. Chen's consulting experience in all phases of coastal engineering projects involving planning of field investigations and processing of field data from hydrographic surveys, geotechnical and wave/current gauges; navigation channel planning; port and harbor planning and sediment dredging analysis; FEMA coastal floodplain mapping; wave statistical analysis, wave transformation, storm surge analysis and sediment transport analysis; structural design projects involving riprap shore protection, breakwaters, jetties, single point mooring systems, marina basins, dredging, and beach nourishment and management.

Dr. Chen has extensive experience in developing and applying software packages for numerical model simulations of coastal processes. He has applied the DHI MIKE21 modules, Delft3D modules and other two-dimensional and three-dimensional coastal numerical models for wave transformation, hydrodynamics, sediment transports, flushing analysis, dredging plume, coastal processes and morphology, and shoreline change evaluation. The 3-dimensional coastal sediment transport model (3DCSTM) developed by Dr. Chen has been successfully applied for challenging coastal engineering projects in China and USA.

REPRESENTATIVE PROJECT EXPERIENCE

Town of Sunset Beach, 2016 Shoreline Management & Pre-Dredged Analysis, 2D Hydraulic Modeling, Town of Sunset Beach, NC. Lead coastal modeler. Coastal engineering responsible for hydraulic estimation to show that the proposed dredging work in Jinks Creek will not create additional shoaling in the Atlantic Intracoastal Waterway crossing, and not create additional scour to alter the creek's historical alignment after project construction.

Chesapeake Beach Nourishment Template Design, Virginia Beach, VA. Lead coastal modeler. Coastal engineering responsible for 300,000 cubic yard beach nourishment project. Conducted beach nourishment template conceptual design. Analyzed sediment transport, shoreline performance and beach renourishment intervals.

Ocean Park Beach and Cape Henry Beach Nourishment Template Design – Conceptual Engineering Designs, Virginia Beach, VA. Coastal engineer responsible for beach nourishment template conceptual design, longshore sediment transport and shoreline evolution.

Munden Point Shoreline Stabilization, Virginia Beach, VA. Coastal engineer responsible for design and construction documents for shoreline stabilization along select reaches of the Munden Point Park. Alternatives developed include a living shoreline with rock sill and a riprap revetment, with consideration to permitting, constructability, schedule, availability of materials, subsurface conditions and cost.

Ocean View Shoreline Periodic Survey and Analysis, Norfolk, VA. Coastal engineer for twice-yearly spring and fall surveys and monitoring reports along Norfolk's seven-mile-long Chesapeake Bay shoreline. Conducted volume change and shoreline change calculations on survey profile data and provided technical reports summarizing the beach condition for each monitoring period, including post-construction monitoring of Norfolk's Coastal Storm Damage Reduction federal beach nourishment project.

Croatian Beach Sediment Budget Analysis, Virginia Beach, VA. Coastal engineer responsible for providing a study of the sediment budget at Croatian Beach, and assessment of impacts on current inlet practices and beaches north of the Inlet.

Toler Place Breakwater Modifications, Norfolk, VA. Lead coastal engineer. Performed conceptual alternative development, wave transformation modeling, shoreline/morphological modeling using Delft3D model and 3DCSTM model. JPA permit application.

AYSE KARANCI, PhD**ECONOMIC ANALYST****KEY FEATURES**

- Coupled human-nature systems
- Climate change
- Resiliency
- Soft-engineered coastal protection

EDUCATION

PhD, Civil Engineering,
North Carolina State
University, 2017

MSc, Coastal Engineering,
Middle East Technical
University, Turkey, 2011

BS, Civil Engineering,
Middle East Technical
University, Turkey, 2008

Dr. Karanci provides engineering and GIS support for morphological storm impact analysis, shoreline and beach volume change analysis, development of shoreline stabilization and beach nourishment projects, analysis of borrow area and native beach sediment data. Her coastal modeling experience has involved the use of XBeach, SBEACH, BMAP, and ADCIRC.

Before joining Moffatt & Nichol, Dr. Karanci earned her PhD from North Carolina State University. During her PhD studies, she developed an agent-based coastal town model that can simulate coupled evolution of coastal landforms and housing dynamics. She implemented this model to evaluate the impacts of sea level rise, nourishment design options and possible shoreline management policies using the Town of Nags Head as study area.

REPRESENTATIVE PROJECT EXPERIENCE

Oak Island Master Beach Nourishment Master Plan - Year 1: Initial Project and FEMA Engineered Beach, Town of Oak Island, NC. Coastal scientist responsible for compatible sand search and storm impact analyses. Analyzed data from a combination of sediment sources (including offshore sites, AIWW sites, and upland sites) that would meet the nourishment needs for the design alternatives. Carried out SBEACH and XBeach calibrations for storm impact estimations. ¹

New Hanover County - FY 18 Wrightsville Beach Coastal Storm Damage Reduction Project, Wrightsville Beach, NC. Coastal scientist assisting the storm impact analysis. Examined profile response to various storm scenarios using SBEACH.

Post-Matthew FEMA Emergency Dune Restoration Project, Town of Oak Island, NC. Coastal scientist assisting the field investigations to nourish beaches impacted by Hurricane Matthew. Aided with material placement verification using AD and BD surveys. Carried out temperature and sand color monitoring studies.

Bogue Banks Beach Nourishment Master Plan - Optional Tasks, Carteret County, NC. Coastal scientist responsible for preparation of beneficial dredge material placement proposal submitted to USACE.

Research Assistant, Teaching Assistant at North Carolina State University, Raleigh, NC. (August 2012 - December 2017). Projects:

- Developed agent-based model for coastal resort town and provided its integration with geospatial data.
- Conducted storm impact simulations to evaluate alternative dune designs for development of dune design criteria.
- Explored the influence of land cover on storm impact vulnerability of the dunes to enhance resilience of the coasts.

Decision Making Coaching Team Member, Southeast Climate Center, US Geological Survey (May 2013 - Feb. 2014). Aided the decision-making coaching team during the decision framework development and elicitation process.

SAM MORRISON**BIDDING & CONSTRUCTION****KEY FEATURES**

- Contract Creation & Negotiation
- Strategic Planning & Implementation
- Project Management
- P&L Management
- Cultural Awareness
- Team Building

EDUCATION

BS, Construction Management, Purdue University, Indiana, 1989

CERTIFICATIONS

OSHA 40-Hour
HAZWOPER

AFFILIATIONS

American Shore and Beach Preservation Association (ASBPA)

Western Dredging Association (WEDA)

Mr. Morrison is a dynamic construction project manager with history of leading multi-million-dollar projects to timely and effective completion. Mr. Morrison's 29-year career has involved expertly managing profit & loss (P&L), project resources, and engineering staff in US-based and overseas operations. Excellent track record of managing multiple operations, including project planning, estimating, bidding, and administration. Cultivate and maintain effective business relationships with key executive stakeholders across enterprise accounts. Enforce quality control and adherence for private and municipal clients.

REPRESENTATIVE PROJECT EXPERIENCE**Hillsboro/Deerfield Beach Renourishment Project, Hillsboro/Deerfield Beach, FL.**

Area Manager responsible for overall construction and compliance for the renourishment of Deerfield Beach and Hillsboro Beach in the early spring of 2011. The project involved the renourishment of approximately 1.2 miles of shoreline with some 340,000 CY of sand borrowed from a nearshore borrow area. The project was complete utilizing a Cutter Suction Dredge (hydraulic dredge) that pumped the material directly to the beach. Responsible for overall estimating, procurement, contract management, contract and environmental compliance, and overall P&L of the project. Project value \$5.5M

Beach Erosion Control and Hurricane Protection Project, Dade County Florida, Beach Renourishment 2011, Miami Beach – Contract E, Miami Beach, FL.

Area Manager and Project Sponsor for the renourishment of approximately 1 mile of beach comprising of three segments. The primary segment involved the placement of approximately 250,000 CY of material from an offshore borrow site 11.2 miles from the placement site. This portion of the project was executed utilizing a hopper dredge. The other two smaller segments, 1,000 feet and 55,000 CY each, were done with what was identified as back-passing. Material was taken from an accreted area of South Beach and removed from the beach by mechanically excavating the material then slurring it to pump it hydraulically to the renourishment site. Responsible for the proposal process, the back-passing plan and methodology, contract and environmental compliance. Also led all effort with regard to the tender and procurement process up to where the project was awarded based on "best value" to our team. Project Value \$16M

South County Beach and Dune Restoration Project, St. Lucie County Hutchinson Island South, FL.

Area Manger & Project Sponsor for the beach Nourishment project that involved the placement of approximately 500,000 CY of material from an offshore borrow areas with placement along over 3 miles of beach. The material was obtained from an offshore borrow source and transported to the placement site utilizing a hopper dredge. There were strict environmental constraints on the project especially with endangered species and hard bottom protection. Responsible for overall project compliance and adherence to the contract and environmental requirements. Project Value \$6.5M

Miami Harbor Deepening Phase III, Port Miami, Miami, FL.

Area Manager and Project Sponsor for the development of the dredging plan and RFP tender for the \$205M Phase III deepening project. This project involved the deepening of the Entrance Channel and South Harbor to -50' to accommodate post panama class vessels. This project had very strict environmental controls which called for ingenuitive measures on maintaining those controls and liaising with the Agencies. Led effort to develop a project specific Environmental Management team to oversee and QC the environmental controls that were put in place for the project. Also led all effort with regard to the tender and procurement process up to where the project was awarded based on "best value" to our team. The project ultimately was successfully completed on time and within budget.

DAVE BERNSTEIN, CH, PLS, GISP**SURVEYOR****KEY FEATURES**

- Hydrographic & Shoreline Surveys
- Acting Lead Hydrographer on Over 100 Independent Task Orders For USACE, US Navy, NOAA and the USGS
- Instrument Expertise Includes Multibeam, Singlebeam, Sidescan Sonar, Sub-Bottom and Magnetometer, RTK-GNSS Survey Positioning and Topographic Survey

EDUCATION

MS, Marine Geology, NC State University, 2002

BA, Environmental Geo-Science, West Virginia University, 1999

REGISTRATION**Professional Land Surveyor:**

North Carolina
Professional Land Surveyor
(#L-5151)

GIS Professional (GISP)

Mr. Bernstein is a geospatial mapping specialist, NSPS-THSOA Certified Hydrographer, Professional Land Surveyor, and GIS Professional. He excels in the field of coastal geographic information science including the collection, processing, and analysis of high-density spatial data derived from sophisticated marine, airborne, and land-based instrumentation systems. Dave is actively involved in all stages of hydrographic and topographic survey: design, implementation, processing, and reporting. His specialized background in coastal geology and beach morphology ensures that surveys are planned and executed with the highest data quality standards in place.

REPRESENTATIVE PROJECT EXPERIENCE

Hydrographic Surveying IDIQ for USACE Wilmington District, NC. Geodynamics is contracted by the USACE Wilmington District for hydrographic survey services including topo/bathy beach profiles at Rodanthe, Fort Fisher, Carolina Beach, and Ocean Isle. Surveys have also included multibeam, singlebeam, and topographic data acquisition for inlets including Oregon Inlet, Carolina Beach Inlet, and Cape Fear River with creation of seamless topo/bathy elevation models of these complex nearshore shoaling environments Mr. Bernstein was responsible for hydrographic survey design & acquisition, advanced hydrographic data processing in CARIS HIPS/SIPS, QA/QC of instrument calibration and patch test. Lead GIS analyst, metadata author and QA/QC of all data processing routines. Geodynamics has served the District under this contract since 2006.

Multibeam Hydrographic & Geophysical Surveys: Oak Island Master Beach Nourishment Plan (2019), Oak Island, NC. Geodynamics performed three phases of high-resolution surveys of the seafloor surface and sub-bottom for several areas in Long Bay, North Carolina as part of a large-scale effort to locate potential sand resources for future beach nourishment projects. Surveys included multibeam with acoustic backscatter, sidescan, sub-bottom sonar and magnetometer; data were analyzed for object detection and archaeological analysis, and sub-bottom profiles were assessed to determine sediment distribution and volume available. Mr. Bernstein was responsible for survey planning, oversight of GIS deliverables.

Topo-Bathy Beach Profiles of Carteret County, NC. Geodynamics has completed comprehensive annual shoreline surveys of Bogue Banks, Bear Island, and Shackleford Banks since 2008 with Moffatt & Nichol to support regional sediment management, beach nourishment, and coastal engineering needs. Post-storm surveys are initiated following a natural disaster declaration to measure volumetric change for FEMA reimbursement. Data is acquired on stationed profiles and extend to approximately -30' MLLW. Accurate change data is captured across the entire profile; especially offshore where large volumes of sand movement are observed in this beach environment. Mr. Bernstein was responsible for survey design, data QA/QC, data processing, report and GIS deliverables.

Shoreline Mapping and Monitoring of New Hanover County Beaches, NC. Geodynamics has completed annual beach profile surveys for New Hanover County as part of a five-year annual erosion monitoring program that includes Wrightsville Beach, Kure Beach, Masonboro Island, Ft. Fisher and Carolina Beach. Surveys measure volumetric rates of change, track movement of sand in the longshore and cross-shore direction and compare beach conditions for purposes of evaluating beach nourishment efforts. He was responsible for survey design, data QA/QC, data processing, report and GIS deliverables.

CHRIS FREEMAN, PLS**SURVEYOR****KEY FEATURES**

- 21 Years of Experience in Coastal Geology in Data Acquisition and Analysis
- Hydrographic & Coastal Surveys Offshore & Dynamic Tidal Inlet Environments
- Has Completed Over 100 Independent Task Orders For USACE, U.S. Navy, NOAA, and the USGS
- Managed 10 Hydrographic Survey Projects for State Government Agencies

EDUCATION

BS, Environmental & Earth Science, UNC-Wilmington, 1995

MS, Marine Geology, UNC-Wilmington, 2001

REGISTRATION**Professional Land Surveyor:**

NC Professional Land Surveyor

(#L-5119)

TRAINING

USGS Advanced ADCP Applications Training

AAUS & NOAA Research Diver

Mr. Freeman has managed coastal and nearshore studies throughout the Atlantic and Gulf of Mexico, including high-resolution hydrographic mapping for sediment transport modeling, coastal change analyses and habitat classification, inlet and headland-related tidal hydrodynamics, and the quantification of shoreline processes through 4D shoreline change analyses. As President and co-founder of Geodynamics, he has provided technical oversight and project management for all hydrographic and topographic survey projects, using interferometric, mulbeam, singlebeam, and sidescan sonar and 3D beach/nearshore mapping techniques using RTK-GPS and topographic survey.

REPRESENTATIVE PROJECT EXPERIENCE

NC 12 - Ocracoke Island Hotspots Update, Ocracoke, NC. Senior coastal engineer who provided updates to existing coastal erosion analysis for a vulnerability analysis of a 5.5-mile-long section of NC 12 located within Cape Hatteras National Seashore Recreation Area. Effort included the review of potential project alternatives to prevent the highway from damage during the near future.

Hydrographic Surveying IDIQ for USACE Wilmington District, NC. Geodynamics is contracted by the USACE Wilmington District for hydrographic survey services including sand resource surveys at Rodanthe and Topsail Island, and channel deepening survey of Charleston Harbor, SC. Surveys have also included multibeam, sidescan, singlebeam, and topographic data acquisition. Deployed sound velocity probe, tide gauges, and geophysical equipment. He provided project management, survey design, technical oversight.

Engineering & Hydrographic Survey IDC for USACE Norfolk District, VA. Geodynamics provides hydrographic and geodetic surveying under an ongoing long-term contract for the Norfolk District. Task orders included hydrographic surveys and tidal studies of federal navigation channels, multibeam surveys, and shoreline monitoring surveys for NASA Wallops Island facility. He provided project management, survey design, and technical oversight.

Shoreline Mapping and Monitoring of New Hanover County Beaches, NC. Geodynamics has completed annual beach profile surveys for New Hanover County as part of a five-year annual erosion monitoring program for Wrightsville Beach, Kure Beach, Masonboro Island, Ft. Fisher and Carolina Beach. Surveys measure volumetric rates of change, track movement of sand in the longshore and cross-shore direction and compare beach conditions for purposes of evaluating beach nourishment efforts. He provided project estimation and management, survey design and oversight.

Multibeam Hydrographic & Geophysical Surveys: Oak Island Master Beach Nourishment Plan, Oak Island, NC. Geodynamics performed three phases of high-resolution surveys of the seafloor surface and sub-bottom for several areas in Long Bay, North Carolina as part of a large-scale effort to locate potential sand resources for future beach nourishment projects. Surveys included multibeam with acoustic backscatter, sidescan, sub-bottom sonar and magnetometer; data were analyzed for object detection and archaeological analysis, and sub-bottom profiles were assessed to determine sediment distribution and volume available. Mr. Freeman was responsible for project estimation and management, BOEM reporting and permit management.

Hydrographic Surveys for Dredge Clearance Planning & Verification, Atlantic Beach, NC. Geodynamics completed multibeam and singlebeam surveys in a network of navigable access channels to establish accurate pre- and post-dredge clearance depth maps and calculate dredge volumes to verify contractor payment amount. He was responsible for project estimation and management, topo/hydro data collection, survey design, GIS and technical oversight.

WALTER SEXTON, PhD, PG**SENIOR GEOLOGIST/SEDIMENTOLOGIST****KEY FEATURES**

- Shoreline Erosion
- Coastal Mapping
- Marine Sedimentation
- Pre-Dredge Environmental and Geotechnical Studies
- Modern Stratigraphic Studies
- Groundwater Contamination Assessment
- Coastal Geomorphology
- Mineral Exploration

EDUCATION

PhD, Sedimentology,
University of S. Carolina
1987

MS, Coastal Geology, USC
(1981), B.S., Marine
Science, USC 1977

REGISTRATION

Professional Geologist:
North Carolina, #678
South Carolina, #569
Florida, #PG2594

AFFILIATIONS

American Association of
Petroleum Geologists
Society for Sedimentary
Geology
National Ground Water
Association

Dr. Sexton has over 30 years of experience in providing geological expertise and vibrocore expertise in support of similar projects throughout the Atlantic and Gulf Coasts. His areas of expertise include marine sedimentation, pre-dredge environmental and geotechnical studies, modern stratigraphic studies, groundwater contamination assessment, coastal geomorphology, mineral exploration, shoreline erosion, oil spill response and contingency planning, and coastal mapping. Dr. Sexton has extensive experience studying marine sedimentation and performing pre-dredge environmental studies. He has conducted groundwater investigations evaluating contaminant concentrations for metals, PCBs, creosote, hydrocarbons and radionuclides. He has conducted research and managed projects associated with oil spill mapping and assessment, three-dimensional geologic modeling of modern sediments, and sand source evaluations for beach nourishment. He has also conducted numerous mineral surveys to evaluate the economic value of sand and gravel, coquina, heavy minerals, limestone, and peat resources.

Since 1987, Dr. Sexton has led, or co-led, over 250 field courses for geoscientists from both industry and academia. Dr. Sexton's most renowned field course is the week-long Modern Clastic Depositional Environments course, which focuses on the depositional processes associated with fluvial, deltaic, shoreface, and estuarine settings along the South Carolina and North Carolina coastlines.

REPRESENTATIVE PROJECT EXPERIENCE

Subsurface Investigation and Geotechnical Laboratory Testing, Bogue Banks Coastal Storm Risk Management Project Borrow Areas Q2, U, and Y Investigation, Carteret County, NC. Athena collected 190 vibrocore samples for a geotechnical evaluation of sediments in 3 offshore borrow areas in Carteret County; Athena provided all vessel support using the company-owned research vessel Artemis, which was outfitted with all vibrocore equipment, navigation systems, and RTK instrumentation. Athena was then responsible for geotechnical reporting, including core logging, photography, laboratory oversight for grain size and carbonate, and final reporting of results. Dr. Sexton provided QA/QC guidance and oversaw final report production.

Geotechnical Vibrocore Sampling, Folly Beach, Folly Beach, SC. Athena collected 170 vibrocore samples for a geotechnical evaluation of sediments offshore of Folly Beach, SC. Athena provided all vessel support using the company-owned research vessel Artemis, which is outfitted with all vibrocore equipment, navigation systems, and RTK instrumentation. Athena was then responsible for geotechnical reporting, including core logging, photography, laboratory oversight for grain size and carbonate, and final reporting of results. Dr. Sexton provided project management and oversight and oversaw all aspects of vibrocore processing and geological reporting.

Carteret County Navigation Project Sediment Collection & Testing, Carteret County, NC. Athena collected a total of 60 vibrocore samples for a geotechnical and environmental evaluation of sediment from 5 separate project areas in Carteret County, Athena provided all vessel support using the company-owned research vessel Artemis. Athena was also responsible for subsequent reporting of environmental results and for preparing a geotechnical report, which included: core logs, core photographs, and laboratory analytical results. Dr. Sexton provided QA/QC guidance and oversaw final report production.

Geotechnical Vibrocore Sampling, Nassau Sound, Florida, Amelia Island, FL. Athena collected 53 vibrocore samples for a geotechnical evaluation of sediments at Nassau Sound. Athena provided all vessel support using the company-owned research vessel Artemis, which is outfitted with all vibrocore equipment, navigation systems, and RTK instrumentation. Athena was also responsible for subsequent geotechnical core processing and reporting; Dr. Sexton provided project management and oversight and oversaw all aspects of vibrocore processing and geological reporting.

John Adam Freeze**GEOLOGIST****KEY FEATURES**

- Sediment Sampling Project Management
- Geological Data Evaluation and Reporting
- Field Equipment Operation
- In-depth understanding of coastal and fluvial processes

EDUCATION

B.A., Geology and Environmental Geosciences, College of Charleston, 2005

CERTIFICATION

OSHA 40-Hour HAZWOPER Training/ w 8 Hour Refresher
OSHA 30-Hour Construction Safety Training
First Aid/CPR/AED
PADI Open Water Certification

Mr. Freeze joined Athena Technologies, Inc. (Athena) as a geologist in 2009. Prior to joining Athena, Mr. Freeze worked for 3 years as a staff geologist for Golder Associates, Inc. and Handex Consulting & Remediation – SE, LLC. Since 2009, Mr. Freeze’s role at Athena has evolved from a purely scientific role to a broader role which now includes directing and coordinating field crews ensuring compliance with health and safety requirements, managing sediment sampling projects with contract values up to \$400,000, conducting quality assurance reviews of project deliverables, and geological data evaluation and reporting. Mr. Freeze’s project management experience includes projects located throughout the Atlantic and Gulf Coasts, as well as Puerto Rico.

Mr. Freeze has provided project management roles for recent projects in North Carolina at Bogue Banks, Carteret County, Oak Island, and Holden Beach. He has also provided project geologist services for projects at: Kure Beach, Bald Head Island, and North Topsail Beach.

REPRESENTATIVE PROJECT EXPERIENCE

Oak Island Multi-Decadal Master Plan, Sediment Collection and Testing, Brunswick County, NC. Athena collected 27 vibrocore samples and 143 surface grab samples for a geotechnical evaluation of sediments in the waters adjacent to Oak Island. Athena provided all vessel support using the company-owned research vessel *Artemis*, which was outfitted with all vibrocore equipment, navigation systems, and RTK instrumentation. Athena was then responsible for geotechnical reporting, including core logging, photography, laboratory oversight for grain size and carbonate, and final reporting of results. Mr. Freeze was responsible for project management, pre-project planning, laboratory coordination, core logging, and geotechnical report preparation.

Subsurface Investigation and Geotechnical Laboratory Testing, Bogue Banks Coastal Storm Risk Management Project, Borrow Areas Q2, U, and Y Investigation, Carteret County, NC. Athena collected 190 vibrocore samples for a geotechnical evaluation of sediments in 3 offshore borrow areas in Carteret County. Athena provided all vessel support using the company-owned research vessel *Artemis*, which was outfitted with all vibrocore equipment, navigation systems, and RTK instrumentation. Athena was then responsible for geotechnical reporting, including core logging, photography, laboratory oversight for grain size and carbonate, and final reporting of results. Mr. Freeze was responsible for project management, pre-project planning, laboratory coordination, core logging, and geotechnical report preparation.

Folly Beach and Sullivans Island, Subsurface Investigation and Geotechnical Laboratory Testing, Folly Beach, Charleston County, SC. Athena collected 140 vibrocore samples for a geotechnical evaluation of sediments in 2 offshore borrow areas in Charleston County at Folly Beach and Sullivans Island. Athena provided all vessel support using the company-owned research vessel *Artemis*. Athena was then responsible for geotechnical reporting, including core logging, photography, laboratory oversight for grain size and carbonate, and final reporting of results. Mr. Freeze was responsible for project management, pre-project planning, laboratory coordination, core logging, and geotechnical report preparation.

Carteret County Navigation Project Sediment Collection & Testing, Carteret County, NC. Athena collected a total of 60 vibrocore samples for a geotechnical and environmental evaluation of sediment from 5 separate project areas in Carteret County. Athena provided all vessel support using the company-owned research vessel *Artemis*, which is outfitted with all vibrocore equipment, navigation systems, and RTK instrumentation. Athena was also responsible for subsequent reporting of environmental results and for preparing a geotechnical report, which included: core logs, core photographs, and laboratory analytical results. Mr. Freeze was responsible for pre-project planning, laboratory coordination, core logging, and geotechnical and analytical report preparation.

STEVE HUDSON, PG, CWC**SENIOR GEOLOGIST****KEY FEATURES**

- Drilling
- Geotechnical Testing and Soil Classifications
- NC Certified Well Contractor – Level A
- CPT, DPT, SPT, Vibracore
- Coastal NC Expertise

EDUCATION

BS, Geology UNC
Wilmington, 1993

REGISTRATION**Professional Geologist:**

North Carolina #1583,
1997

NC Certified Well
Contractor - Cert. No.
2161-A

AFFILIATIONS

Association of
Environmental &
Engineering Geologists
(AEG)

Mr. Hudson is well versed in conducting geotechnical investigation operations at NCDOT facilities. Project responsibilities have included performing drilling, geotechnical testing and soil classifications, soil and groundwater sampling techniques, and construction of groundwater monitoring well networks. Mr. Hudson is extremely knowledgeable of drilling operations including hollow-stem auger methods, Direct Push Technology (DPT), CPT, vibracoring, mud and air rotary methods, rock coring, and Shelby Tube sampling, to name a few. He is manager of all CATLIN North Carolina drilling operations. Mr. Hudson prepared subsurface and surface field mapping, technical reports, geotechnical sampling and testing, and other field activities necessary for the completion of these projects. He is proficient in Microstation and gINT for the preparation of accurate project drawings. Steve has completed hundreds of projects in the NC Coastal Plain physiographic province and has served as project manager/field supervisor for NCDOT Geotechnical projects since 1997.

REPRESENTATIVE PROJECT EXPERIENCE

Sunset Beach Pre-Dredge Analysis, Sunset Beach, NC. Project Manager/Senior Geologist, Steve oversaw the project from start to finish including soil laboratory analysis. CATLIN crews conducted pre-dredge sediment sampling and analysis for the proposed dredging project near Sunset Beach, NC. Steve coordinated field crews and equipment to advance 22 vibracore borings (cores) and collect 15 benthic samples along six (6) proposed dredge areas near Sunset Beach including Mary's Creek, Turtle Creek, Jinks Creek, North Shore Drive Feeder Canal, Canal Street Feeder Canal, and Finger Canals A, B, C, and D. Steve prepared the report including boring logs in gINT, site plans and subsurface inventory.

Sloops Channel Sediment Sampling and Analysis, Dare County, NC. Project Manager/Senior Geologist, As Project Manager, Steve prepared the cost estimate, oversaw all project activities and prepared the report documenting our subsurface investigation. CATLIN assisted NCDOT by providing sedimental sampling and characterization in the Pamlico Sound near the town of Hatteras. CATLIN provided Vibracore sediment sampling, laboratory analysis and reporting. Project activities included, boring layout, property owner contacts, advancement of Vibracore Soundings at five locations, geotechnical laboratory testing and reporting.

B-2500B - Bridge on NC 12 (-2014B-) over the Pamlico Sound, Dare County, NC. Project Manager/Senior Geologist, Steve oversaw all activities and prepared the investigation report. Design Build Investigation Report conducted by CATLIN consisted of the installation of the advancement of over 3,000 feet of SPT borings and 2,700 feet of Cone Penetration Testing (CPT) borings along the proposed bridge over the Pamlico Sound. Borings depths averaged approximately 150 feet deep and were advanced from jack-up and spud barges.

Ocean Isle Beach Terminal Groin, Ocean Isle Beach, NC. Lead Geologist, Steve led the subsurface exploration performed for the proposed new sheet pile wall tie in portion of the terminal groin on the east end of Ocean Isle Beach. CATLIN collected and evaluated subsurface geotechnical information from the project site in order to determine the soil parameters and recommendations to be used in design of the proposed terminal groin sheet pile wall.

NCDOT Hatteras and Ocracoke Floating Docks, Dare and Hyde County, NC. Project Manager/Senior Geologist, Steve oversaw all project activities from cost estimate preparation to final report delivery. CATLIN conducted a Subsurface Geotechnical Investigation and Inventory Report for a proposed floating dock at two ferry terminals. Activities included boring layout, advancement of SPTs, geotechnical laboratory analysis and reporting.

Joseph Lee Stone, PG**SENIOR GEOLOGIST****KEY FEATURES**

- Significant Coastal NC Experience
- Knowledgeable in all aspects of Coastal Drilling

EDUCATION

MS, Geology, University of North Dakota, 2002

BS, Geology, UNC Wilmington, 1999

BS, UNC Wilmington, Environmental Science, 1999

REGISTRATION**Professional Geologist:**

North Carolina #2007, 2005

AFFILIATIONS

Association of Environmental & Engineering Geologists (AEG), Carolina Geological Society (CGS)

Mr. Stone has over 15 years of experience in planning, coordinating and overseeing simple to very complex geotechnical investigations. Lee has completed numerous subsurface investigation projects for roadway and structure foundations and retaining walls. He is an experienced senior geologist and project manager. He worked for the NC Department of Transportation, Geotechnical Engineering Unit for 13 years as a Transportation Engineering Geologist and Project Geological Engineer. He supervised a team of Geologists and Engineering Technicians in the collection of geotechnical data along project corridors, developed investigation guidelines in order to insure the appropriate collection of data and applied sound geological and engineering principles in order to develop subsurface inventory and design recommendation reports. He is proficient in preparing project cost estimates and meeting project schedules and budgetary requirements. He has a broad range of experience conducting subsurface investigations for projects.

REPRESENTATIVE PROJECT EXPERIENCE

R-5014 - SR 1217 from End to US 158, Kill Devil Hills, NC. Senior Engineering Geologist, Lee provided the subsurface inventory and analysis for this NCDOT project, Roadway Inventory and Foundation Design Recommendations investigation and reporting for the proposed widening and realignment of a roadway located in the Outer Banks of North Carolina near Kitty Hawk. Field investigation included the advancement of approximately 100 SPT and Hand Auger borings along the proposed alignment resulting in over 1,000 linear feet of borings. A Retaining Wall Inventory and Foundation Design Recommendations investigation and reporting were also conducted during the completion of this project.

NCDOT Hatteras and Ocracoke Floating Docks, Dare and Hyde County, NC. Senior Engineering Geologist, Lee assisted with preparation of the subsurface investigation report. CATLIN conducted a Subsurface Geotechnical Investigation and Inventory Report for a proposed floating dock at two ferry terminals. Activities included boring layout, advancement of SPTs, geotechnical laboratory analysis and reporting.

P 1387F – Onslow Beach Bridge Replacement, Onslow County, NC. Project Manager/Senior Engineering Geologist, Lee oversaw all project activities from scope development, preparation of a cost estimate to scheduling and project reporting. CATLIN prepared a Geotechnical Site Characterization Report that summarized the findings of the subsurface investigation, particularly those that may influence the design and construction of the planned bridge replacement and approaches at Onslow Beach aboard Marine Corps Base (MCB), Camp Lejeune.

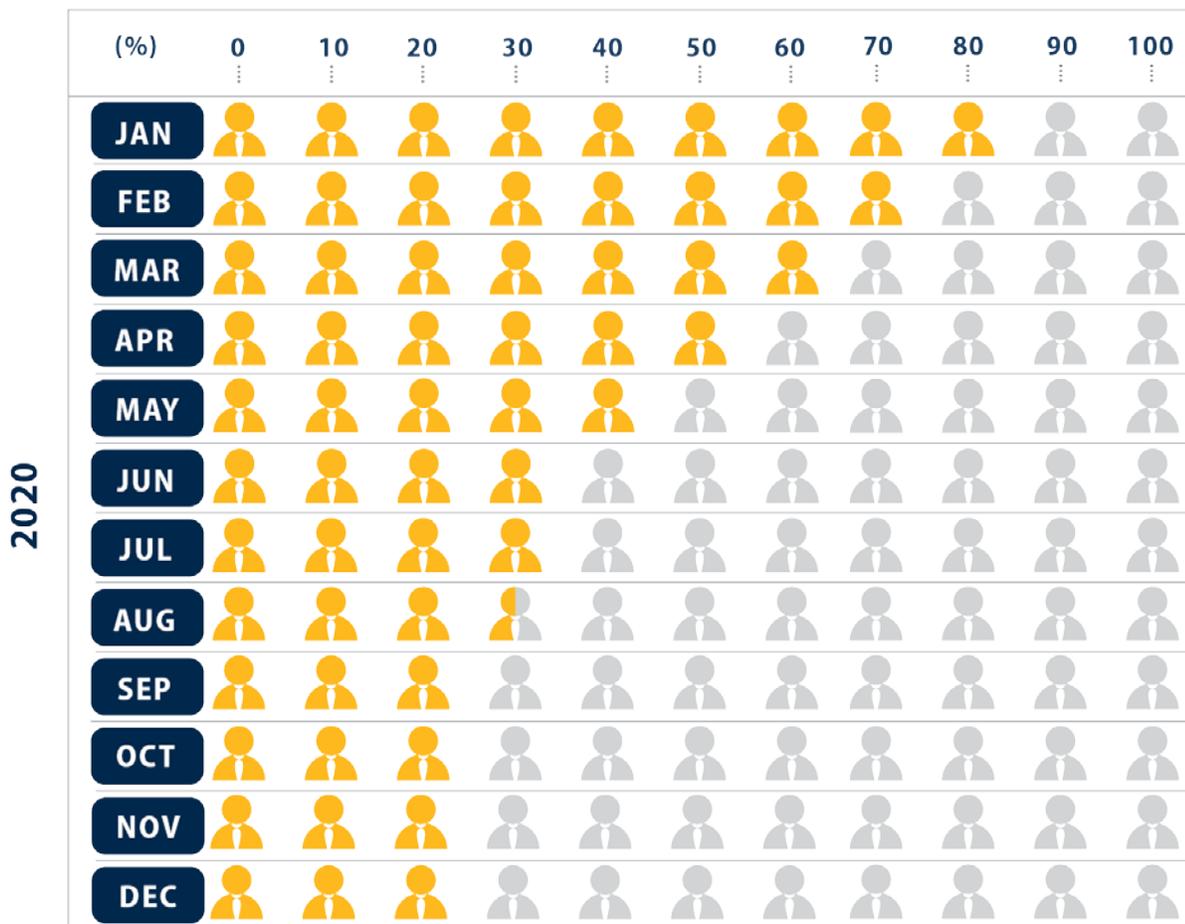
P 1505F – Railroad Trestle Replacement, Onslow County, NC. Project Manager/Senior Engineering Geologist, egin the resume entry for this project by describing your role, for example Civil engineer, Project manager followed by what you did (your primary responsibilities) on this project. Include additional responsibilities as appropriate. Conclude with a brief project scope. Ideally try and connect your role and primary work to the overall project's scope. (Body Copy).

B-2500B - Bridge on NC 12 (-2014B-) over the Pamlico Sound, Rodanthe, NC. Senior Engineering Geologist, Lee assisted with the structure subsurface field investigation and reporting. The project included Design Build Geotechnical Subsurface Investigation for approximately 0.4 miles of roadway and 2.5 miles of bridge across the Pamlico Sound extending from the Pea Island National Wildlife Refuge to the town of Rodanthe. The structure subsurface field investigation included the advancement of 20 SPT and 18 CPT borings within the Pamlico Sound to depths ranging from approximately 80 to 150 feet below the sound bottom. All structure borings were advanced from floating platforms including sectional and jack-up barges. The roadway subsurface investigation included the advancement of seven (7) SPT borings to depths ranging from 50 to 150 feet below land surface. Reports included the submittal of SPT and CPT borings logs and boring plans along the proposed project.

TEAM CAPACITY & AVAILABILITY

Although we have assigned a highly specialized, local team with unique technical expertise from our more than 100 professional and technical staff located within our Raleigh, Norfolk, Morehead City, and Wilmington offices we have access to more than 800 employees, including more than 700 marine and civil engineers and scientists to meet your needs. Our staff has completed or assisted in shoreline evaluation and mapping, coastal planning, design, and inlet management studies for cities and counties throughout the region including the U.S. Navy, multiple U.S. Army Corps of Engineers (USACE) Districts, and state Departments of Transportation. Through these projects, we have effectively monitored and assisted communities to manage their coastal systems. Our subconsultants also provide additional support with more than 50 additional personnel. The chart below reflects our team’s availability to provide the Town of Nags Head with coastal engineering and design services under this contract

M&N TEAM AVAILABILITY
PERCENT OF WORKDAYS AVAILABLE PER MONTH



} % COMMITTED DAYS } % OF WORK DAYS AVAILABLE

Note: Beyond December 2020 M&N maintains a 20% commitment level to existing projects.

PROPOSED PROJECT SCHEDULE

M&N has developed a proposed project schedule for the Town of Nags Head Coastal Engineering and Design Services contract. Our proposed schedule was developed as a result of the requested scope and our experience providing similar services. The proposed schedule is as follows:

Town of Nags Head Master Beach Maintenance and Monitoring Plan Project Schedule																												
Task	Months From Notice To Proceed																											
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27+
Project Coordination																												
1-Data Collection and Review																												
Data Review																												
Reach Development																												
2-Vulnerability Analysis and Design Options Development																												
Calibrate GenCade/XBeach																												
Anlaysis of Loss Calculations																												
Develop Level of Protection Alternatives																												
Develop Nourishment Needs & Thresholds																												
3-Geotechnical Analysis																												
Borrow Area Evaluation																												
Recipient Beach Evaluation																												
4-Alternative Recommendations																												
Draft Report																												
Final Report																												
5-Permitting																												
Scoping and Coordination																												
Prepare Preliminary & Draft Programmatic EIS																												
Essential Fish Habitat (EFH) Analysis																												
Biological Assessment (BA) - Endangered Species Act																												
Prepare Final Programmatic EIS																												
6-Physical Monitoring Plan																												
7-Economic Analysis and Long-Term Funding																												
8-Bidding, Negotiating, and Construction Phase Services (As-needed)																												

SIMILAR PROJECT EXPERIENCE

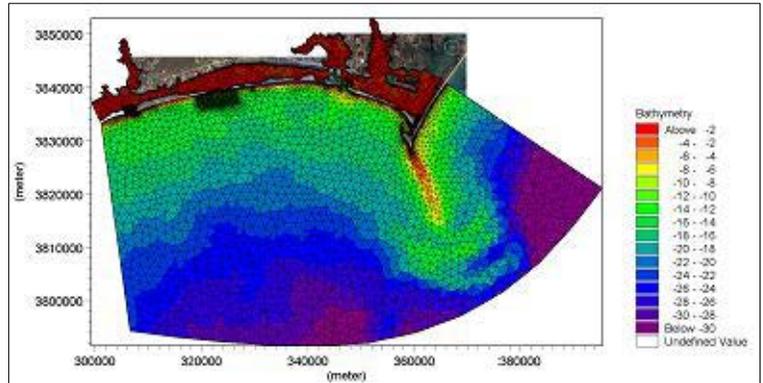
The following project descriptions offer additional information regarding M&N’s project experience mentioned in the project approach section.

BOGUE BANKS BEACH NOURISHMENT MASTER PLAN

Client: County of Carteret, NC

M&N developed a multi-decadal programmatic Environmental Impact Statement (EIS) that incorporated all of Bogue Banks’ beach nourishment and inlet management needs for the next 50 years. In addition to the EIS, the necessary permits were secured to address Bogue Banks’ needs and to use specific sand sources for the beach nourishment.

M&N also completed an engineering report to outline the historical regional sediment budget, including the response of shorelines and inlets to natural long-term erosion, storm-induced erosion, and man-made dredging and beach nourishment. The report also determined the desired overall level of protection to be provided across the island and the appropriate nourishment volumes, benchmarks, and reach-based triggers that should be used for the various regions of Bogue Banks to achieve that outcome. To create the protection itself, M&N considered potential U.S. Army Corps of Engineers’ short- and long-term local navigation dredged material management plan strategies, as well as work efforts completed by the Corps as part of its long-term project study.



The Bogue Banks Beach Nourishment Master Plan was formulated to meet FEMA requirements for post-storm reimbursement, which required M&N to coordinate with FEMA. The master plan was also designed to comply with NCDQM static line exception requirements.

The first nourishment project under the 50-year permits was implemented in 2019, immediately following Hurricane Florence. The second nourishment event will take place in early 2020.

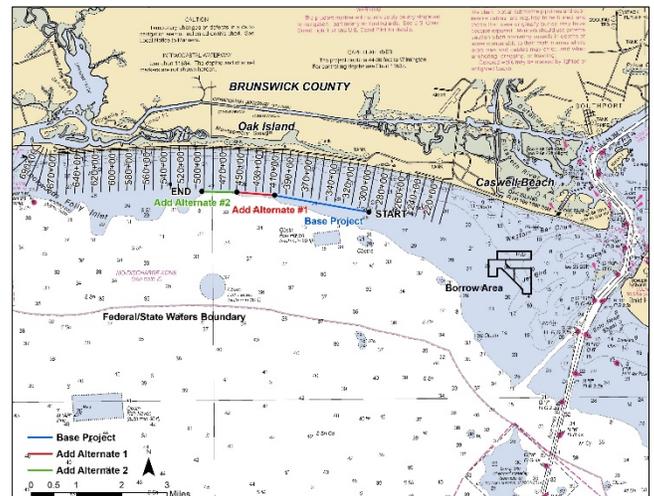
OAK ISLAND MASTER PLAN

Client: Town of Oak Island, NC

The Oak Island Master Plan (Master Plan), in development, will create a multi-decadal shoreline protection plan encompassing the 9.25 mile ocean shoreline of Oak Island in Brunswick County, NC. In addition, a maintenance plan for Lockwoods Folly Inlet will be established.

The Master Plan will include a comprehensive review of current beach conditions, a review of past County and USACE beach nourishment and beneficial use projects, and the development of a multi-decadal plan based on volumetric need and minimum thresholds for protection along various reaches of shoreline.

The Master Plan will: (a) establish the volume requirement for the initial project based on a selected level of protection, (b) establish minimum beach volumetric triggers for nourishment events to maintain the selected level of protection, (c) provide a basis for future FEMA reimbursement qualifications, (d) conform to the North Carolina DCM rules for static vegetation line and DCM sediment criteria exceptions, and (e) establish a programmatic approach facilitating the authorization and scheduling of Oak Island nourishment/maintenance events.



OCEAN PARK BEACH NOURISHMENT PERMITTING AND DESIGN

Client: City of Virginia Beach

The City of Virginia Beach sought to construct a beach nourishment project along Ocean Park Beach to enhance coastal storm protection and the recreational beach. M&N provided preliminary and final design, permitting support and prepared bid documents for beach nourishment along Ocean Park Beach, approximately between Rookery Way and the western abutment of the Lesner Bridge. The City's intent was to design the project to be constructed through hydraulic dredging of an area of the Chesapeake Beach Shoal with pipeline placement of dredged sediment on the beach.

NORTH CAROLINA BEACH AND INLET MANAGEMENT PLAN & UPDATE, STATEWIDE

Client: North Carolina Department of Environment and Natural Resources (NCDENR)

For the State of North Carolina, M&N developed a comprehensive beach and inlet management plan identifying potential strategies to maintain beach and inlet characteristics at levels determined from analysis of historic, current, and forecasted future positions and composition. Developed for coastal regions defined by physiography, vulnerability, and natural processes, management strategies were focused on the allocation and stewardship of available sediment resources in an attempt to maintain and prolong the character of North Carolina’s shorelines. Specific aspects of the project included:



- Data identification & acquisition
- Beach & inlet management region definition
- Draft management strategy development
- Public review and input
- Final report development

At the conclusion of the project, M&N produced a report presenting study elements and process, proposed management strategies by region, identified potential funding sources, and provided background data supporting the study.

NC 12–Ocracoke Island Erosion Hotspots & Hot Spot Update

Client: North Carolina Department of Transportation

As a subconsultant to the team preparing an Environmental Impact Statement for short-term alternatives for protecting a transportation corridor on Ocracoke Island, M&N provided coastal engineering services for a vulnerability analysis of a 5.5-mile-long stretch of NC 12, the principal roadway along North Carolina’s Outer Banks. This erosional “hot spot” is subject to frequent overwashing and damage to the roadway due to high surges and waves experienced during hurricanes and northeasters. The protective dune system has been rendered ineffective by significant losses over time.



M&N completed a complex, risk- and frequency-based numerical modeling approach to predict future shoreline positions in 10, 25, and 50 years using the U.S. Army Corps of Engineers’ Empirical Simulation Technique model. This model incorporated both long-term average annual shoreline erosion rates, which were estimated using digitized shoreline positions from aerial photography, and short-term storm-induced shoreline erosion rates, which were estimated using the Corps’ SBEACH model. M&N ran the SBEACH model for approximately 35 hurricane and 21 northeaster events to account for the range of storms that Ocracoke Island has experienced. The inputs required by the SBEACH model included surge, wave, and wind hydrographs, which were gleaned from various data sources and previous studies. The results of the modeling were used to develop viable alternatives for near-term sustainability of NC 12, including highway realignments, small-scale beach nourishment, large-scale beach nourishment, and combinations of these.

For the beach nourishment alternatives, M&N completed a thorough review of area sediment sources to identify borrow sources for both small- and large-quantity projects by reviewing U.S. Army Corps of Engineers dredging records and ongoing research. M&N identified two main sediment sources: Hatteras Inlet Channel dredging and offshore sediment near either

Ocracoke Island or Cape Hatteras. M&N also developed opinions of probable costs for both the small- and large-scale nourishment alternatives based on the beach fill volume, borrow site, and necessary dredging equipment.

Following the initial report, Hurricane Isabel crossed the North Carolina coastline immediately southwest of Ocracoke Island. Extensive beach and dune erosion occurred, and significant sections of NC 12 were damaged, covered with sand, or completely destroyed. M&N was asked to evaluate the effects of the hurricane on the island and NC 12 and to update the vulnerability analysis and report accordingly.

City of Norfolk (VA) Indefinite Quantity Contract for Shoreline Protection and Coastal Engineering

Client: City of Norfolk

Under an on-call type contract, M&N has completed shoreline protection tasks including:

East Ocean View Beach Nourishment: Completed planning, preliminary/final design and construction documents for placement of 355,000 cy of sand along 5,300 lf of shoreline. Tasks included optimization of the beachfill template using SBEACH and GENESIS.

Central Ocean View Beach Re-Nourishment: M&N completed planning, permitting, preliminary / final design and construction documents for placement of 428,000 cy of sand along 18,300 lf of shoreline. Tasks included a sand compatibility analysis and SBEACH numerical modeling of several representative beach profiles.

Beach Restoration, 800 Block, Ocean View Beach: For this study, M&N performed a comprehensive study of historical and present conditions at the 800 Block area of Willoughby Spit to determine the cause of erosion and to develop a recommended alternative for future erosion control. The work included complex numeric modeling of the existing system to determine the causes of erosion.

This study involved an intensive review of historical data and engineering activities at the 800 Block area followed by complex numerical modeling of the existing system, all of which aided in the determination of the probable cause of erosion at the study area. The calibrated model was used to evaluate alternatives to mitigate erosion in this area. The recommended alternative included removal of the groin spur and addition of a new breakwater located further offshore. M&N worked with the City during a public outreach effort with the local civic leagues to explain the recommend alternative and the expectations of the project. With the public satisfied, M&N prepared permits and project plans and specifications.

Bay Oaks Hot Spot Beach Restoration Design, Norfolk: Upon completion of a comprehensive study of the Bay Oaks erosional hotspot along the City's Ocean View Shoreline, M&N developed a fully permitted final design for the breakwaters using offshore segmented breakwaters that were 125 feet long and set 140 feet apart to allow sufficient wave energy to penetrate and move sand along the shore. This optimal configuration helped smooth the transition from existing breakwater field while increasing stable beach width along Bay Oaks.

Willoughby Spit Beach Restoration Study

Client: City of Norfolk

M&N performed a detailed study of shoreline erosion at the Willoughby Spit area of Ocean View Beach and developed a recommended alternative for beach restoration and stabilization. The study focused on a terminal groin and the area near 12th View Street, both of which were expected to require solutions. M&N compiled and reviewed existing shoreline, survey, sediment, and shoreline trend data using GIS and analyzed existing wave data. The firm also conducted field reconnaissance of the groins and breakwaters to assess their condition from a structural and coastal performance perspective. The compiled data supported the development of models of the Willoughby Spit system using GENESIS-T, SBEACH, and Delft3D. These models allowed M&N to assess the performance of current shoreline stabilization projects, examine multiple structural and non-structural alternatives for beach restoration, and determine the potential impacts these alternatives would have on the stability of the beach. M&N worked with the city to evaluate the list of alternatives based on a practical application of the alternatives to the site and narrowed the list to a number of selected alternatives for further evaluation. Order-of-magnitude cost estimates were prepared for the selected alternatives. Based on cost estimates for construction and management, potential environmental and shoreline impacts, and potential aesthetic impacts, a recommended alternative was selected. M&N presented its findings and recommendations in a final report.



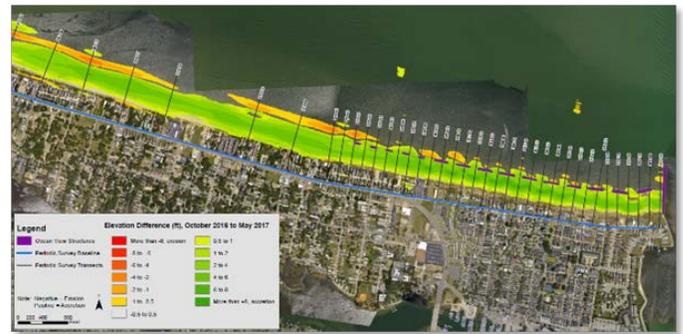
Beach Nourishment, Breakwaters, and Dune Restoration Along Ocean View Beach

Client: City of Norfolk

M&N assisted the City of Norfolk to stabilize and manage the seven miles of historically eroding shoreline comprising Ocean View Beach. Projects included beach nourishment, dune restoration, constructing nearshore breakwaters, coastal modeling, and periodic surveying and beach change monitoring.

Ocean View Beach, Dune and Nearshore Monitoring:

Since 2005, M&N, with Geodynamics as a subconsultant, has provided survey, data analysis, and reporting services to monitor and document the condition the entire shoreline. While working with the USACE Norfolk District, the City succeeded in obtaining Congressional approval, funding, and construction of a Federal Coastal Storm Damage Reduction beach nourishment project. The construction of this project provides very significant storm protection and recreational benefit. The beach and nearshore monitoring data were utilized in designing the Federal project.



Toler Place Emergency Dune Restoration: A section of residential beachfront between 11th View and 12th View Streets was heavily eroded by a series of storms in 2015. The erosion left the homes along Toler Place at a greater than typical risk of damage from storm surge and waves that occur nearly every winter on this shoreline. M&N worked quickly, both before and after the storms to inspect the condition of the beach, to prepare engineering plans and a bid package for an emergency restoration of beach and dune volume.

In collaboration with City staff and Toler Place residents, M&N designed a beach berm and dune restoration project that could be constructed above the Mean High Water (MHW) contour using sand available from a nearby accretional location on the beach. These design features were intentionally included so that no state or federal permits would be required, allowing the emergency project could proceed more quickly.

M&N's coastal engineers supported the City through bidding and construction of the project which was successfully completed in time to mitigate against winter storms that occurred in early 2016.

Ocean View Dune and Sand Management: M&N helped the City evaluate, permit, and communicate with beachfront residents about strategies for managing the dunes in the Cottage Line reach of Central Ocean View, including a short extension into East Ocean View. M&N also participated on the City's Sand, Beach, and Dune Management Plan Steering Committee and prepared additional technical materials as needed to facilitate discussions on managing dunes in Cottage Line. M&N presented the findings of technical studies and provided recommendations to Norfolk City Council, and actively participated in discussions with residents, City staff, and regulatory agencies including VMRC, FEMA, and USACE, in a process intended to address residents' concerns about sand encroachment on their properties while maintaining storm damage protection afforded by the dunes.

Central Ocean View Dune Restoration: M&N provided planning, permitting, and engineering services for beach nourishment, breakwaters, and dune restoration for a 3.5 mile reach of Ocean View Beach which was severely damaged by Hurricane Isabel in 2003. Services included: evaluating sand source alternatives to provide interim property protection, recommending an emergency truck haul using an upland borrow source for interim protection of critical areas, attending Civic League meetings to educate residents about the benefits of the project, planting due grass to stabilize the dune, preparing a dredging alternatives analysis to compare the cost and feasibility of using a hydraulic pipeline and/or mechanical dredge with a hopper dredge within Thimble Shoal Channel, and preparing contract documents.

Borrow material was dredged from Thimble Shoal Channel. Permits for dredging were prepared on an accelerated schedule in order to complete the project prior to the ensuing hurricane season. Extensive coordination with USACE, VMRC, DEQ and the National Marine Fisheries Service was required to deal with sea turtle time-of-year restrictions.

East Beach Restoration: M&N provided planning, permitting, and engineering services to stabilize a one-mile area of the beach which was undergoing redevelopment by the City. Services included: preparing permit applications and drawings on an accelerated schedule, coastal modeling and analyses to determine design life and maintenance cycles, sediment compatibility analysis to determine suitability of proposed borrow areas, attending Civic League meetings to educate residents about the benefits of the project, planting 10 acres of dune grass planting to stabilize the dunes, and preparing contract documents.

Croatan Beach Shoreline Protection Assessment

Client: City of Virginia Beach

After residents expressed concerns that inlet and beach management practices have caused increased beach and dune erosion along the Croatan Beach shoreline resulting in diminished protective and recreational beach width and elevation, M&N studied the long-term behavior of the Croatan Beach shoreline and dunes. M&N determined shoreline, beach, and dune change patterns over time for Croatan Beach, estimated the level of protection currently provided by the beach and dune system to the upland, and made recommendations on the necessity for and purpose of a beach nourishment project. The study also included an evaluation of impacts of Sea Level Rise (SLR) on the dune and the protection it offers. Our team evaluated annual and seasonal sediment budgets for Rudee Inlet and documented impacts of beach management actions on the Federal navigation channel and resort beach nourishment projects. M&N participated in scoping meetings with City and community leaders to develop criteria to guide the analysis and presented study results to neighborhood residents.



Chesapeake Beach Nourishment Template Design

Client: City of Virginia Beach

The City of Virginia Beach retained M&N to provide a study and conceptual engineering designs of alternative beach profile templates for sand nourishment at Chesapeake Beach. Chesapeake Beach is part of the 4.9-mile shoreline segment between Little Creek Inlet and Lynnhaven Inlet, extending from the City’s boundary with Joint Expeditionary Base (JEB) Little Creek/Fort Story, past the southern end of the Chesapeake Bay Bridge-Tunnel to Joyce Avenue. M&N assisted the City to prepare for sand nourishment of Chesapeake Beach by providing a recommended beach profile template for nourishment construction that effectively balances shoreline advancement (with associated recreational beach width) with dune height and dune volume for a realistic total nourishment volume.



The study evaluated historical beach volume change and shoreline position change trends, longshore transport rates and gradients, and published data on potential sediment borrow area properties. A numerical shoreline evolution and storm-induced beach profile erosion model was used to evaluate alternative design beach profiles. The study culminated in the recommendation of a design beach and dune profile to provide a level of protection to existing structures from a coastal storm similar to the November 2009 Nor’easter. That storm had peak water levels equivalent to approximately a 40-year return period (2.5 percent annual chance), with depth-limited waves impacting the project area.

The recommended conceptual design for the proposed beach nourishment includes advance nourishment to allow for the expected typical annual shoreline retreat over an estimated four-year interval between planned renourishment events.

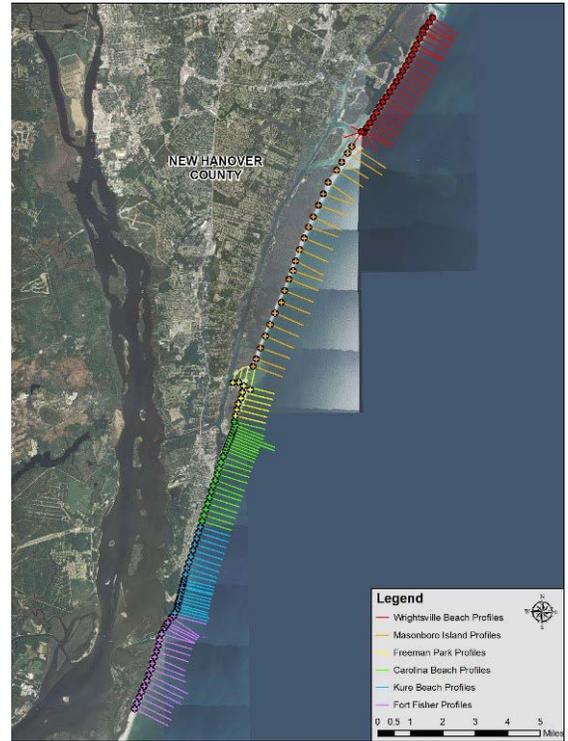
New Hanover County Shoreline Mapping

Client: New Hanover County, NC

M&N developed the New Hanover County Shoreline Mapping Program, a yearly study which monitors the beach conditions in New Hanover County, helping to establish shoreline and volume change trends and optimize future shoreline maintenance strategies. M&N is responsible for overall project management, survey data analysis, and compilation of the final report and presentation of findings. M&N is supported by Geodynamics, who performs the annual beach profile surveys.

This study involved intense analytical analysis of the survey data provided by Geodynamics each survey period. Both shoreline change and volume change are calculated at multiple elevations between subsequent surveys, reflecting the movement of sediment in both the longshore and cross-shore directions. These calculations indicate the erosion and accretion patterns which occur along the New Hanover County shoreline on a yearly basis. Due to multiple CSDR projects performed by the USACE in this region, careful consideration was taken into account for any engineering activities (i.e. sand placement) which take place between surveys and greatly influence results. This consideration allowed for the calculation of background erosion rates along each reach of shoreline, indicating trends which may be expected if shoreline maintenance (i.e. CSDR projects) was not performed.

The following pages include examples of our subconsultants similar project experience, required statements forms and attachments.



The following project examples reflect our subconsultants previous, similar experience.

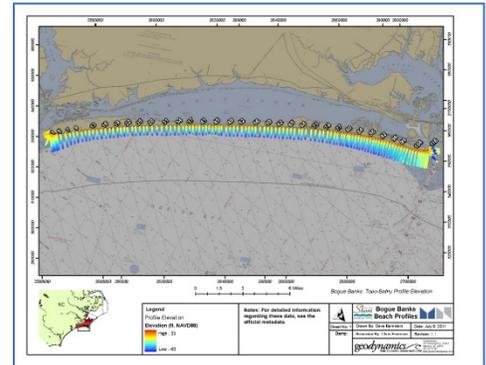
Geodynamics Similar Experience

Bogue Banks Nearshore Monitoring Project Topographic and Hydrographic Profiles

Client: Carteret County, NC

Geodynamics was contracted by **Moffatt & Nichol**, through the Carteret County Shore Protection Office for the collection of topographic and hydrographic profile data for Bear Island (18 profiles), Bogue Banks (122 profiles), and Shackleford Banks (24 profiles). The project is part of a 5-yr ongoing annual and post-storm effort to help monitor baseline and post-storm conditions. Tasks include acquiring profile elevation data in a timely manner, with spatial and data-density constraints, and RTK-GPS accuracy requirements.

Geodynamics’ willingness to develop a successful monitoring program has included post-storm survey work after Hurricanes Irene, Matthew, Florence, and Dorian providing quick and thorough comparison of pre- and post-storm conditions on which the County has based their FEMA claims. Additional products include developing digital elevation models (DEMs), QA/QC assessments, and calculating volumetric changes alongshore. This project has just been renewed for its third 5 year cycle. Geodynamics has provided services under this contract since 2008 to present.



Athena Technologies Similar Project Experience

Folly Beach and Sullivan’s Island Subsurface Investigation and Geotechnical Laboratory Testing

Client U.S. Army Corps of Engineers, Wilmington District

Athena was contracted by the U.S. Army Corps of Engineers, Wilmington District (USACE) to collect 140 vibracores up to 10 feet below sediment surface in borrow areas offshore of Folly Beach and Sullivan’s Island in Charleston County, South Carolina. Athena was tasked with vibracore collection, geological logging, photomosaic compilation, oversight of geotechnical laboratory services, and producing a geotechnical report.

R.V. *Artemis*, Athena’s company-owned research vessel, was utilized as the primary sampling platform. This vessel, which was piloted by a U.S. Coast Guard-certified 100 Ton Master Captain, included all necessary vibracore equipment, DGPS and RTK systems, and U.S. Coast Guard mandated safety gear.



CATLIN Similar Project Experience

Sloops Channel Sediment Sampling and Analysis

Client: North Carolina Department of Transportation; Geotechnical Engineering Unit

CATLIN was retained by the NCDOT to provide sedimental sampling and characterization in the Pamlico Sound near the town of Hatteras. CATLIN provided Vibracore sediment sampling, laboratory analysis and reporting. Project activities included, boring layout, property owner contacts, advancement of Vibracore Soundings at five locations, geotechnical laboratory testing and reporting. Boring locations and depths were provided by the NCDOT.

Laboratory testing was performed at CATLIN’s NCDOT certified laboratory facility in Wilmington, NC to confirm the field geologist's observations and soil classifications. At selected intervals, Atterberg Limits, Grain Size Analysis with NCDOT modified hydrometer, organic content, and moisture content were performed on selected samples. The samples selected were representative of the predominant lithologic units encountered spatially across the site. CATLIN personnel determined the horizontal and vertical location of proposed and -advanced sounding locations and elevations utilizing a Real Time Kinematics (RTK) Global Positioning System (GPS). All units were recorded and submitted in United States (US) feet to a horizontal accuracy of one foot and vertical accuracy of one-tenth of a foot and referenced horizontally to the North Carolina State Plane (NCSP) North American Datum (NAD) 1983 and vertically to Mean Low Low Water (MLLW). Final deliverables included electronic files of all information used to generate the Final Report including Site Plan, gINT logs, Laboratory Summary Tables, and Graphs.

STATEMENTS & FORMS

Moffatt & Nichol's Anti-Discrimination Statement

M&N maintains a policy of non-discrimination with all employees and applicants for employment. The Company attempts at all times to provide a work environment free from discrimination, harassment, and retaliation. M&N is an Equal Opportunity Employer (EOE) and makes employment decisions on the basis of merit, competence, and qualifications, and prohibits unlawful discrimination based on race/color; national origin/ancestry; citizenship; gender; religion; age; mental or physical disability; veteran status; medical condition including genetic characteristics; marital status; sexual orientation; gender perception or identity; political affiliation; pregnancy; family or medical leave status; or any other consideration made unlawful by federal, state, or local laws. Company policy also prohibits unlawful discrimination based on the perception that anyone has any of those characteristics or is associated with a person who has or is perceived as having any of those characteristics. All such discrimination is unlawful. Equal Opportunity Employer.

M&N acknowledges receipt of addendum 1 and attachment 2 as part of the RFP. The required forms with signature sections associated with the RFP have been included in the following pages. Please note Attachment 1 has an additional statement following the signature page.

Attachment 1

RESPONDENT'S CERTIFICATION FORM

THIS PAGE MUST BE COMPLETED AND INCLUDED WITH THE SUBMITTAL CERTIFICATION

The undersigned hereby certifies, on behalf of the Respondent named in this Certification (the "Respondent"), that the information provided in this proposal submittal to Town is accurate and complete, and I am duly authorized to submit same. I hereby certify that the Respondent has reviewed this RFQ in its entirety and accepts its terms and conditions. I certify that all information contained in this proposal is truthful to the best of my knowledge and belief. * Please see following page with proposed modification

I further certify that I did not either directly or indirectly enter into any combination or arrangement with any person, firm or corporation, or enter into any agreement, participate in any collusion, or otherwise take any action in the restraint of free competition in violation of the Sherman Anti-Trust Act, 15 USCS Sections 1 et seq.; the North Carolina General Statutes Sections 133-24 through 133-31.

I further certify, under oath, that this proposal is made without prior understanding, agreement, connection, discussion, or collusion with any other person, firm or corporation submitting a proposal for the same product or service; no officer employee or agent of the Town of Nags Head or any other respondent is interested in said proposal; and that the undersigned executed this Respondent's Certification with full knowledge and understanding of the matters therein contained and was duly authorized to do so. This is an acknowledgement that FEMA financial assistance will be used to fund the contract only. The Respondent will comply with all applicable federal laws regulations, executive orders, FEMA policies, procedures, and directives. It is distinctly understood that the Town of Nags Head reserves the right to reject any or all proposals

Moffatt & Nichol, Inc.

(Name of Respondent)



(Signature of Authorized Representative)

Timothy R. Reid, PE

(Typed Name of Authorized Representative)

Vice President/Business Unit Leader

(Title)

11/25/19

(Date)

*** Town of Nags Head's Contract Terms and Conditions**

Moffatt & Nichol (M&N) has reviewed the Town of Nags Head's contract terms and conditions and generally complies. The indemnification requirements, however, are broad and would most likely not be covered by Moffatt & Nichol's insurance. Moffatt & Nichol proposes the language markups below, and at the Town's convenience and if necessary, we are available to discuss these terms in more depth.

U. INDEMNIFICATION AND INSURANCE REQUIREMENTS

1. The Consultant(s) shall ~~defend,~~ indemnify, and hold harmless the Town, its officers, employees, agents, and representatives from any and all liability or loss of any nature whatsoever arising out of or relating to the Consultant(s) negligent operations under the Scope of Services and any contract entered into including, without limiting the generality of the foregoing coverage, any negligent act or omission of the Consultant(s), its agents, servants, employees, or invitees in the execution of performance of said contract.

Certification for Contracts, Grants, Loans, and Cooperative Agreements

(To be submitted with each bid or offer exceeding \$100,000)

The undersigned Moffatt & Nichol, Inc. [insert name of Contractor] certifies, to the best of his or her knowledge, that:

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form- LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
3. The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

The Contractor, Moffatt & Nichol, Inc. [insert name], certifies or affirms the truthfulness and accuracy of each statement of its certification and disclosure, if any. In addition, the Contractor understands and agrees that the provisions of 31 U.S.C. Chap. 38, Administrative Remedies for False Claims and Statements, apply to this certification and disclosure, if any.

Moffatt & Nichol, Inc. [Insert name of Contractor]

By: 
Name: Timothy R. Reid, PE

Title: Vice President / Business Unite Leader

Date: November 25, 2019