TASK 9 INTRODUCTION

Task 9 includes professional services to conduct the Town of Nags Head Beach Monitoring and Analysis program for one year, generally including the summer 2021 annual monitoring survey period and the 2021 hurricane season to early 2021 winter storm season. The Town's Beach Monitoring and Analysis program represents a continued effort of conducting beach monitoring surveys and providing analyses, building upon past efforts by Town of Nags Head from 2012 through 2020 in association with the 2011 and 2019 Nags Head Beach Nourishment post-construction monitoring. The primary purpose of the beach monitoring is to determine the condition of the beaches, measure shoreline change and volumetric rates of erosion and accretion, maintain eligibility for designation as a FEMA engineered beach, estimate when future maintenance activities may be warranted, and evaluate the performance of beach nourishment and other restoration efforts.

In addition to the primary Annual (Summer 2021) monitoring analysis and report, this Scope of Work includes two optional tasks to conduct, if necessary, analysis and reporting on post-storm monitoring surveys, and preparation of documentation to FEMA requesting post-storm beach restoration funds.

It is understood that McKim & Creed will be conducting the monitoring surveys under a separate contract with the Town. M&N has been coordinating with McKim & Creed to ensure that their survey scope and M&N's analysis scope are in alignment. Under this proposed scope of work, M&N will be responsible for receiving the survey data products from McKim & Creed, writing and production of the reports, and the shoreline/volumetric analyses associated with the reports.

TASK 9 SCOPE OF WORK

As stated above, the proposed Scope of Work is for the 2021 Town of Nags Head Beach Monitoring and Analysis. In general, the tasks include preparation of an annual report and presentation to summarize the shoreline and volume change analysis of 174 profiles along the Town of Nags Head shoreline that will be surveyed under a separate contract between the Town and McKim & Creed. Two optional tasks have been developed to supplement the annual beach profile analysis including (1) a post-storm survey and analysis and (2) preparation of documentation in support of application for FEMA post-storm beach restoration funds which would only be completed if authorized in writing by the Town. A more detailed outline of project tasks is as follows.

Task 9.1 – Completion of Annual Surveys and Report

(A) Survey Scheduling and Client Coordination - The monitoring schedule for each year typically includes a comprehensive survey of the transects conducted by late spring/early summer to ensure seasonal differences in the beach profile are consistently measured from year to year, and to document annual pre-hurricane season beach conditions. **M&N** will coordinate with **McKim & Creed** and the Town to verify that the surveys are collected during this time period. The project team will coordinate with the Town concerning the time and approaches to be followed for each survey.

(B) Survey Profiles – The 126 survey transects established in 2012 for the 2011 Nags Head Beach Nourishment post-construction monitoring and additional 48 transects introduced by **M&N** in 2020 to better track sand movement at southern and northern end of the beach nourishment project and hotspots will be used for analysis.

(C) Data Analysis and Reporting - Using data provided by **McKim & Creed**, **M&N** will perform the following annual monitoring analysis:

Annual Shoreline Change
M&N will compute shoreline changes between subsequent surveys for the MHW elevation of +1.18 ft NAVD88. **M&N** will report these results at each transect as well as the average changes for each of the previously established subreaches.

Annual Volume Change
M&N will compute volume changes above several strategically selected elevations to ensure the complete tracking of sand movement along the profile. **M&N** will calculate these volume changes in accordance with the previous 2020 annual monitoring effort from a landward point on the back of the dune out to the seaward edge of the nourishment berm (+6 ft NAVD88), above MHW (+1.18 ft NAVD88), above -6 ft NAVD (wading depth), above -14 ft NAVD88 (capturing the offshore bar), above -19 ft NAVD (depth of closure), and above -30 ft NAVD (approximate seaward extent of surveys). **M&N** will report these results at each transect as well as the overall changes for each of the previously established subreaches.

Beach Nourishment Project Performance
The volumetric change calculations performed during the annual analyses will be used to track the performance of any beach nourishment or other maintenance projects. Annual changes from each placement area will be documented throughout the nourishment cycle to gain an understanding of actual volume lost, providing insight into future volume need. Upon development of nourishment triggers (covered under a separate task order), comparisons will be made between the current condition of the beach and the calculated triggers, allowing for estimates of when the next nourishment will be needed.

Background Erosion Rates
The volumetric change calculations performed during the annual analyses will be used to update estimates of background erosion or accretion rates. These are erosion rates that would be expected if no beach nourishment or maintenance projects were to occur.

Dune Behavior
The volumetric change calculations performed during the annual analyses will be used to update estimates of dune growth/erosion trends, allowing for identification of areas vulnerable to overwash or exhibiting significant dune growth.

Long-term Trends
The volumetric change calculations performed during the annual analyses will be used to update the evaluation of long term trends by incorporating the current datasets with those

acquired during the 2012 through 2020 monitoring efforts. Annual volume changes from each year (excluding nourishment) will be averaged and plotted for each transect, allowing for identification of long-term stable locations and erosional hotspots in each survey reach as compared to annual changes that may vary significantly from year to year.

In addition, nodal zones established during ongoing modeling efforts will be analyzed with respect to volume changes in these areas, providing insight into longshore sediment transport patterns and optimal future nourishment placement locations.

Reporting

Once all of the analyses are completed, the resulting calculations and analysis will be included within the annual report. One (1) copy of the draft report will be submitted to the Town by September 15, 2021 (or six weeks after receiving all survey products from **McKim & Creed**) for Town review and comment. The report will include sections such as introduction, methodology, results/conclusions, and appendices. **M&N** will submit four (4) hard copies of the final report (including profiles print outs) to the Town by October 15, 2021. **M&N** will also develop, attend and provide a presentation to the Town's Board of Commissioners at one of their monthly, regularly scheduled meetings. Eight (8) hard copies of the report (including profiles print outs) and one (1) electronic copy of the report, the annual presentation, and all data collected for each survey event, etc. will also be provided on a USB flash drive.

Task 9.2 – Completion of Post Storm Survey and Report (OPTIONAL TASK)

This task will only be completed if authorized by the Town.

In the event of a significant coastal storm, and if authorized by the Town, **M&N** will complete a post-storm field reconnaissance trip to document storm effects. It is understood that McKim & Creed will provide post-storm surveying under separate contract between the Town and McKim & Creed. **M&N** will assist the Town to coordinate the survey with McKim & Creed. Following receipt of the survey data products from McKim & Creed, M&N will prepare a Post-Storm monitoring report documenting the shoreline and volume change due to the storm and making recommendations on needs for renourishment to address the storm impacts. Shoreline and volume changes will be calculated to assess storm related damages.

Task 9.3 – Preparation of Documentation for FEMA Category G Project Funding (OPTIONAL TASK)

This task will only be completed if authorized by the Town.

In the event of a significant coastal storm and a subsequent Federal disaster declaration that provides for Category G Public Assistance, and if authorized by the Town, **M&N** will prepare the supporting documents to show eligibility of the beach for the FEMA Category G post storm restoration funding, reporting previous beach monitoring and maintenance efforts, storm event volume losses, potential sand sources, restoration project cost estimates and schedule. M&N will utilize the post-storm survey and analysis report resulting from Task 9.3 above to support the preparation of documents for FEMA submittal. In association with this subtask, M&N anticipates attending up to two additional in-person meetings in Nags Head and up to four (4)

virtual meetings or teleconferences with Federal, State and Town representatives to coordinate the agencies' review of the Category G funding request.

TASK 9 PROJECT COST

The total estimated fee for the 2021 Town of Nags Head Beach Monitoring and Analysis is a lump sum of **$57,119,** including expenses for travel for a site visit and reproduction. If a storm event were to occur, post storm monitoring and analysis would total a lump sum of **$57,119,** including expenses for travel for a site visit and reproduction, and support for FEMA post-storm beach restoration funds would total a lump sum **$33,660** in the event that these tasks were authorized by the Town.

M&N proposes to invoice the Town monthly on a percent complete basis by Task. Our invoice format can be tailored to meet the Town's requirements and preferences, and the invoice would generally be accompanied by a cover letter or cover sheet summarizing progress on the Task during the invoice period.

The fees for each of these subtasks are summarized below:

Task 9: **Beach Monitoring Analysis, Reporting and Post-Storm FEMA Support (2021)**	**M&N Fee**
Task 9.1 – Completion of Annual Surveys and Report	$57,119
Task 9.2 – Completion of Post Storm Survey and Report (OPTIONAL TASK)	$57,119
Task 9.3 – Preparation of Documentation for FEMA Category G Project Funding (OPTIONAL TASK)	$33,660