



TASK 7 INTRODUCTION

Task 7 includes professional services to perform geotechnical field investigations of the Town's previously-permitted offshore sand borrow areas (excluding Borrow Area 4), evaluate the geotechnical borings and sediment sample data, and communicate the results of that survey and data analysis to the Town. The purpose of this effort is to provide information to the North Carolina Division of Coastal Management (NC DCM) that NC DCM has indicated may be required for permitting the borrow areas for an upcoming beach nourishment project.

In this Task, **Athena Technologies, Inc. (Athena)** will conduct the geotechnical field investigations, sampling, laboratory analyses and analysis reporting, as a subconsultant to **Moffatt & Nichol (M&N)**. M&N will be responsible for receiving the data products from Athena, evaluating the geotechnical data, and assessing the sediment compatibility across the horizontal and vertical extents of the investigated area, to establish compliance with state and federal regulations for using the sediments as beach nourishment material.

TASK 7 SCOPE OF WORK

Task 7.1 – Borrow Area Geotechnical Investigations and Analysis

Field Investigations – **Athena** will conduct vibrocore borings, record the boring logs, take sediment samples and perform laboratory grain size and carbonate analyses on the samples as described their attached detailed proposal dated January 26, 2021. The geotechnical investigations will be limited to the previously permitted beach nourishment Borrow Areas 2, 3, and 3A. The investigations do not cover the area known as Borrow Area 4, due to observations of the quality of material found in that borrow area during the Town's 2019 beach nourishment, and the fact that sufficient sand material for the upcoming nourishment project is known or expected to be available within Borrow Areas 2, 3 and 3A. The borrow areas to be investigated are shown in Figure 1.

Geotechnical Data Analysis and Interpretation of Potential Dredging Depths – **M&N** will use the geotechnical data and reporting provided by Athena to generate maps and calculations illustrating the compatibility of the sediments for beach nourishment per the State's beach quality sediment guidelines. The quantitative spatial analysis will allow M&N to recommend reasonable, increased dredging depths in the borrow areas, with the goal to request extending the depth of the borrow areas to a greater depth than is shown in the current permits. If the data supports significantly deeper permitted dredging depths, it is expected that having that flexibility in the borrow area design will facilitate more favorable unit costs for dredging the sediment for beach nourishment.

Rather than providing a separate standalone memo or additional reporting document for this Task 7, **M&N** will incorporate the findings of the geotechnical investigations and analysis in the design and permitting documents that M&N will be preparing under a previously authorized scope of work (contract Task 4) for the post-Dorian beach nourishment project. M&N will discuss the geotechnical investigations findings with the Town and with NC DCM, as part of the post-Dorian project design and document preparation to pursue permits for new dredging in the borrow areas.



TASK 7 PROJECT COST

The total fee for the Borrow Area Geotechnical Investigation and Analysis task is a lump sum of **\$195,855.00**. M&N proposes to invoice the Town monthly on a percent complete basis by Task.

Task 7: Borrow Area Geotechnical Investigations and Analysis	M&N Fee
Task 7.1 – Borrow Area Geotechnical Investigations and Analysis	\$195,855.00

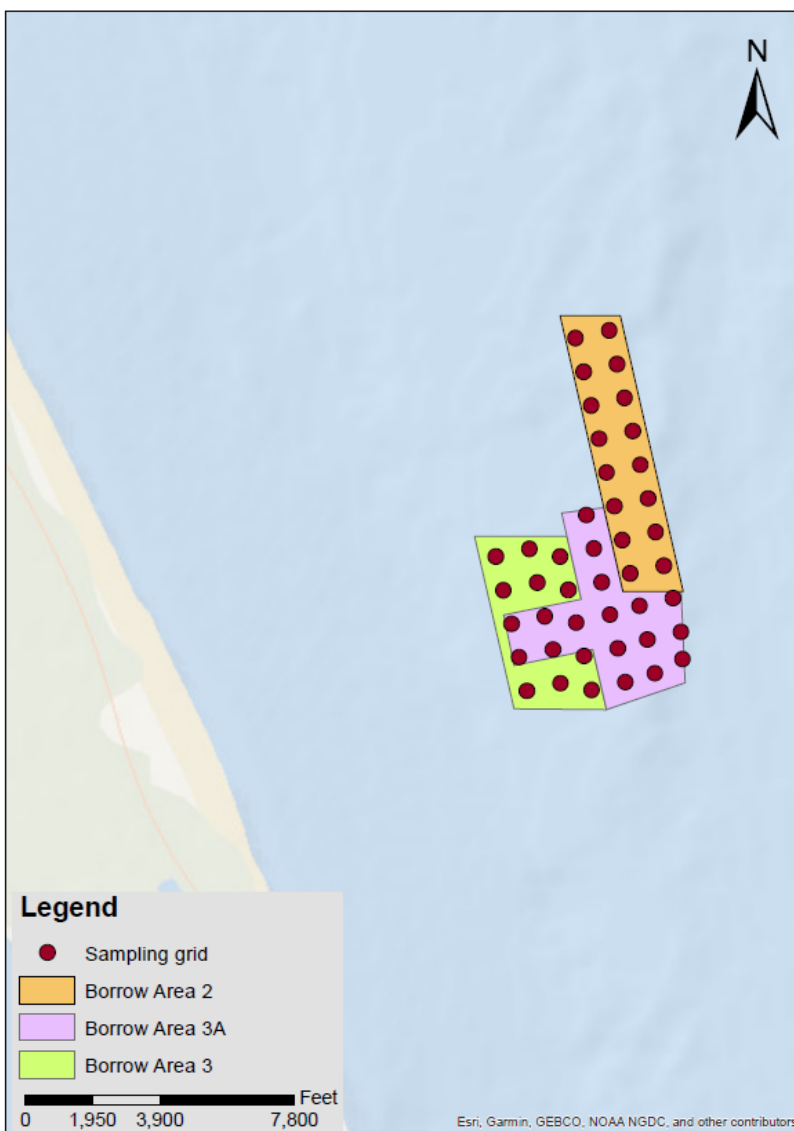


Figure 1. Survey Extent to Cover Borrow Areas 2, 3 and 3A



January 26, 2021

Brian Joyner, PE
Moffatt & Nichol
101 W. Main Street, Suite 3000
Norfolk, VA 23510

**RE: *Cost Proposal for Vibracore Sample Collection and Geotechnical Reporting
Offshore Borrow Area Investigation
Nags Head, Dare County, North Carolina***

Dear Mr. Joyner,

This letter is intended to serve as a technical cost proposal for the abovementioned vibracore sampling effort. This proposal is based on a request for quote sent to Athena Technologies, Inc. (Athena) by Moffatt & Nichol (M&N) in December of 2020, and subsequent discussions between the two firms. This proposal supersedes a previous proposal submitted by Athena on December 9, 2020.

We understand that you will require the collection of 43 vibracore samples to a depth of 15 feet below sediment surface from proposed borrow areas 2, 3, and 3A, which are located between 1 and 3 miles offshore of Dare County, North Carolina. Athena will be responsible for vibracore collection, geological logging, vibracore photomosaic production, oversight of laboratory analyses, and geological reporting.

We are proposing the use of our thirty-five (35) foot research vessel, *Artemis*, to operate as the sampling platform for this effort. This vessel is equipped with all required U.S. Coast Guard (USCG) safety gear and will be operated by a USCG-certified Master Captain. The Captain will be accompanied by 3 additional crewmembers. Athena will utilize a Trimble Differential Global Positioning System (sub-meter accurate) interfaced with HYPACK for horizontal positioning, and a Furuno fathometer and lead line for collecting water depths. A Spectra Precision SP80 Global Navigation Satellite System (GNSS) (accurate to +/- 2 centimeters) interfaced with the North Carolina Continuously Operating Reference Station (CORS) network will be utilized to determine sediment surface elevations and final horizontal coordinates.



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During field activities, Athena will navigate to the sample coordinates and, once on station, the vessel will be immobilized using a triple-point anchor system. When the vessel is immobilized, the coordinates at the vessel location will be compared with coordinates for the desired sample site to ensure accurate vessel positioning. Athena's custom-designed and fabricated vibracore system will then be deployed from the sampling platform. The vibracore system consists of a generator with a mechanical vibrator attached via cable to a 3-inch diameter, aluminized steel sample barrel. The sample barrel is lowered to the sediment surface through a moon pool in the deck of the vessel by attaching lengths of drill stem. The vibracore machine is then turned on and the sample barrel is allowed to penetrate until it reaches target depth, or refusal. The sample barrel is then retrieved using an electric winch. Once the sample is on deck, the core is measured to ensure acceptable recovery. The completed core will then be capped on both ends, labeled and marked with arrows for orientation purposes.

If vibracore recovery is less than 80%, or if refusal is met and the material at the base of the core is not limestone, carbonate-cemented clastic sediments, or indurated silt/clay, then Athena will make one additional vibracore attempt to reach the required penetration depth and/or increase recovery.

The completed cores will be sectioned into 5-foot lengths and opened longitudinally at Athena's facility in McClellanville, South Carolina. Athena will photograph and log the cores (in accordance with ASTM D2488-09A) at this facility. Draft core logs and vibracore photomosaic images will be sent to M&N to allow for sub-sample interval determination. Upon receipt of sample intervals from M&N, Athena will extract and ship the sub-samples to Terracon Consultants, Inc. (Terracon) in Jacksonville, Florida for analysis. Terracon is a USACE- and AASHTO-certified laboratory. Grain size analysis will be conducted in accordance with procedures outlined in ASTM D6913, using the following sieves: 3/4-inch, 5/8-inch, 7/16-inch, 5/16-inch, No. 3.5, No. 4, No. 5, No. 7, No. 10, No. 14, No. 18, No. 25, No. 35, No. 45, No. 60, No. 80, No. 120, No. 170, No. 200, and No. 230. Visual estimation of shell and rock fragment content will be conducted for each sub-sample using the Terry & Chilingar (1955) method, and samples will also be classified in accordance with guidelines outlined in ASTM D2487. Additionally, each sub-sample will be analyzed for carbonate content using the Twenhofel and Tyler (1941) acid digestion method.

Upon receipt of all laboratory sample data, Athena will produce a PDF report that will contain sampling methodology, site maps, core logs, photomosaic images, grain size and carbonate data, and a brief summary of site conditions. Athena will also provide the gINT project file used to produce the logs and grain size statistics.

In consideration of the scope of services, our proposed costs for this effort are as follows:

Item	Description	Quantity	Unit Cost	Total Cost
1	Mobilization/Demobilization, lump sum	1	\$11,865.00	\$11,865.00
2	Vibracore, per core	43	\$2,500.00	\$107,500.00
3	Spectra Precision SP80 GNSS Rental, lump sum	1	\$850.00	\$850.00
4	Vibracore Processing, Logging, Photomosaic Production, and Archiving, per core	43	\$400.00	\$17,200.00
5	Grain Size Analysis w/ Visual Percent Shell, per sample (ASTM D6913 Method, Terry & Chilingar Method))	215	\$75.00	\$16,125.00
6	Carbonate Analysis, per sample (Twenhofel & Tyler Method)	215	\$95.00	\$20,425.00
7	Analytical Sample Shipping, lump sum	1	\$250.00	\$250.00
8	Reporting, lump sum	1	\$2,500.00	\$2,500.00
Total =				\$176,715.00
Notes	[1] = Assumes that up to 5 grain size and 5 carbonate samples will be analyzed from each vibracore.			

The per core rate includes the following: vessel and vibracore equipment rental, labor, per diem, consumables, and all other associated sediment sampling costs. The above prices are valid through July 26th, 2021. These costs are subject to change dependent upon the final scope of work.

We sincerely appreciate the opportunity to provide a cost estimate for this project and please let us know if you have any questions or comments.

Best Regards,



J. Adam Freeze
Vice President / Geologist

Fee Proposal
Town of Nags Head--Task 7 -- Borrow Area Geotechnical Investigations



Town of Nags Head
 Borrow Area Geotechnical Investigation and Analysis
 Nags Head, North Carolina

Proposal No: P10979-07

Date: January 27, 2021

I. MAN-HOUR BUDGET BY LABOR COSTS

Task	Classification	Princ. Rate	Project Manager \$ 220.00	Superv. Engineer \$ 236.00	Senior Engineer \$ 195.00	Eng. III \$ 165.00	Eng. II \$ 140.00	Eng. I \$ 120.00	Staff Engineer \$ 110.00	Senior Tech. \$ 168.00	ACAD Designer \$ 119.00	ACAD CADD II \$ 108.00	ACAD CADD I \$ 93.00	Word Proc. \$ 94.00	General Clerical \$ 60.00	Total Hours	Total Labor Cost
1	Task 7.1 - Borrow Area Geotechnical Investigation and Analysis	8	14	10	-	36	-	48	-	-	-	-	-	-	-	116	\$ 19,140.00
2		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	\$ -
3		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	\$ -
4		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	\$ -
5		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	\$ -
Total Labor Budget		\$ 2,000	\$ 3,080	\$ 2,360	\$ -	\$ 5,940	\$ -	\$ 5,760	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		
Labor Budget Distribution		10%	16%	12%	0%	31%	0%	30%	0%	0%	0%	0%	0%	0%	0%	116	\$ 19,140.00
Total Labor Hours		8	14	10	-	36	-	48	-	-	-	-	-	-	-		
Labor Hours Distribution		7%	12%	9%	0%	31%	0%	41%	0%	0%	0%	0%	0%	0%	0%	100%	
Man-weeks		0.2	0.4	0.3	0.0	0.9	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	

II. SUMMARY

Task	Total Cost Labor	Total Cost Subconsultants	Total Cost Travel	Total Cost Miscellaneous	Total Cost
1	\$ 19,140.00	\$ 176,715.00	\$ -	\$ -	\$ 195,855.00
2	\$ -	\$ -	\$ -	\$ -	\$ -
3	\$ -	\$ -	\$ -	\$ -	\$ -
4	\$ -	\$ -	\$ -	\$ -	\$ -
5	\$ -	\$ -	\$ -	\$ -	\$ -
Total					\$ 195,855.00