Town of Beaufort, NC
701 Front St. - P.O. Box 390 - Beaufort, N.C. 28516
252-728-2141 - 252-728-3982 fax - www.beaufortnc.org

Town of Beaufort Beaufort Harbor and Waterways Master Plan Advisory Committee
3:00 PM Thursday, July 15, 2021 - Virtual
Monthly Meeting

Call to Order

Roll Call

Agenda Approval

1. Agenda Approval

Items for Discussion and Consideration

1. Committee Information for Meeting

Presentations

Public Comment

Commission / Board Comments

Staff Comments

Adjourn

Town of Beaufort, NC
701 Front St. - P.O. Box 390 - Beaufort, N.C. 28516
252-728-2141 - 252-728-3982 fax - www.beaufortnc.org

Town of Beaufort Harbor & Waterways Master Plan Advisory Committee
3:00 PM Thursday, July 15, 2021 - Meeting will be held Virtually via Zoom
Due to the COVID-19 Pandemic

Call to Order

Introduction by John Day and Kyle Garner

- Discuss What the Committee is Charged to Do
    - The following elements are listed in priority order but others may be identified during the process.
        - Disposition of the Beaufort Docks (the current lease expires in 2024)
        - Reconstruction of the Front Street bulkhead between Turner and Queen Streets
        - Reconstruction of the Front Street boardwalk
        - Consideration of establishing mooring fields in Taylors Creek and Town Creek (harbor of refuge)
        - Disposition of the National Park Service leas for the Town Hall Information Center and ferry concessionaire docks (lease expires in 2024)
        - A dredging plan (which includes plans for the necessary environmental assessments required for dredging of Taylors Creek and Town Creek)
        - Suggested amendments to the Navigable Water Ordinance
        - Opportunities for Public Access
        - Water quality and environmentally sensitive areas (examples follow)
            - Best practices for reduction of black water and grey water
            - Best practices for reduction of marine debris
            - Protection of the Rachel Carson Reserve
- Discuss Contract with Moffatt & Nichol

Town of Beaufort, NC
701 Front St. - P.O. Box 390 - Beaufort, N.C. 28516
252-728-2141 - 252-728-3982 fax - www.beaufortnc.org

Town of Beaufort Harbor & Waterways Master Plan Advisory Committee
3:00 PM Thursday, July 15, 2021 - Meeting will be held Virtually via Zoom
Due to the COVID-19 Pandemic

Mark Pirrello with Moffatt & Nichol

- Committee Expectations
- Committee Homework

Meeting Dates/Time/Location

Adjourn

Town of Beaufort, NC
701 Front St. - P.O. Box 390 - Beaufort, N.C. 28516
252-728-2141 - 252-728-3982 fax - www.beaufortnc.org

Town of Beaufort Harbor Management Committee
3:00 PM Thursday, July 15, 2021 – Virtual Meeting via Zoom

AGENDA CATEGORY: New Business

SUBJECT: Committee Information for Meeting

BRIEF SUMMARY:

In preparation for the meeting on the 15th the Town Staff has assembled the attached information that you might find useful in the discussions regarding the Harbor Management Plan. At time of agenda preparation a copy of the updated Scope of Work from the consultant was not available. However, we will get a copy to you as soon as one becomes available. Included are the following items:

- Chapter 97 – Navigable Waters Ordinance – Beaufort
- Navigable Waters Brochure
- Hydrographic Survey Maps – Prepared by the Army Corps of Engineers
- Bulkhead Channel – Environmental Assessment
- Sample Master Plans from Consultant

SUBMITTED BY:

Kyle Garner, AICP

Planning & Inspections Director

CHAPTER 97. - NAVIGABLE WATER

Sec. 97.01. - Authority; scope.

(A) This article is adopted pursuant to the authority granted to the board of commissioners in Session Law 1981-710 to regulate the navigable waters within the Town, enforceable pursuant to G.S. 160A-175.

(B) This article shall apply to all navigable waters within the jurisdictional boundaries of Town of Beaufort, North Carolina, as they presently exist and as they may be modified in the future.

(C) This article shall not apply to vessels owned or operated in the official performance of duties by any federal, state, or local government authority.

(D) This article shall not apply to any shipwreck, cargoes, tackle, and other underwater archeological remains that have been in place and unclaimed for more than ten years, and shall not be removed without the approval of the North Carolina Department of Cultural Resources, which is the legal custodian of these properties pursuant to G.S. 121-23.

(E) This article shall not be construed to obligate the town to appropriate funds to implement the provisions herein.

(Ord. of 11-21-2019)

Sec. 97.02. - Definitions.

The following words, terms and phrases, when used in this article, shall have the meanings ascribed to them in this section, except where the context clearly indicates a different meaning:

Abandoned vessel means:

(1) An unattended vessel that is moored, anchored, or otherwise located for more than ten consecutive days anywhere in the waters of the Town, or without permission of the dock owner;

(2) A vessel that is in danger of sinking, has sunk, is resting on the bottom, or is located such that it is a hazard to navigation or is an immediate danger to other vessels; or

(3) Shipwrecks, vessels, cargoes, tackle, and other underwater archeological remains that have been in place and unclaimed for more than ten years shall not be considered abandoned vessels unless approved by the North Carolina Department of Cultural Resources, which is the legal custodian of these properties pursuant to G.S. 121-22 and 121-23.

Days means calendar days, where the term is used for computation of time.

Derelict vessel means a vessel that has been left unattended and is in significant disrepair, such that the condition may affect the seaworthiness of the vessel or affect the safety of the public or the environment.

Navigable waters means all waters within the jurisdictional boundaries of the town that are subject to the ebb and flow of the tide, including rivers, waterways, streams (including intermittent streams), mudflats, sandflats, and wetlands.

1.

Owner means a person, other than a lien holder, having the legal or equitable property interest in or title to a vessel, or the person's legal representative. For purposes of this article, where a vessel is determined to have been registered with the North Carolina Wildlife Resources Commission, or an agency of another state responsible for registration, such registration shall create a rebuttable presumption that the owner is the last registered owner of record.

Person means an individual, partnership, firm, corporation, association, or other entity.

Police chief means the Police Chief of Town of Beaufort, or such duly authorized agent of the police chief.

Vessel means every description of watercraft or structure, other than a seaplane on the water, used or capable of being used as a means of transportation or habitation on the water.

(Ord. of 11-21-2019)

Sec. 97.03. - Anchoring; docking; mooring; interference with navigation.

(A) It shall be unlawful for any person, except in the case of emergency or as required for maintenance dredging, to anchor, moor, raft-up or permit to be anchored, moored or rafted-up, or operate, any vessel or carry on any activity including, but not limited to, the placing of crab traps, anchor lines, anchors, mooring buoys, pilings or similar objects in a manner which shall constitute a hazard to navigation, interfere with another vessel, or for which a permit has not been issued by the appropriate government agency. Anchoring under bridges or in or adjacent to heavily traveled channels shall constitute interference if done during periods of heavy vessel traffic.

(B) It shall be unlawful for any person to anchor, dock, moor, or store any vessel in the waters of the Town for more than ten days in a 30-day period in any calendar year, except at a private dock or marina.

(C) For its first ten days in town waters in any 30-day period in any calendar year, any transient vessel legally anchored and attended shall be deemed to have anchorage permission for provisioning, repairs, tourism, and recreational use, unless such permission is revoked in writing by the police chief for any of the reasons given below:

(1) The vessel has dragged anchor, or is moored or anchored in an unauthorized area or in a marked channel;

(2) Unless exempt pursuant to G.S. 75A-7, the vessel displays no evidence of current state, federal, or foreign registration, or, when asked by the police chief, the owner or operator of the vessel fails to present a current registration, cruising permit, or other official documentation of ownership upon which he or she is named as the owner or operator;

(3) The vessel is left unattended for a period exceeding 24 hours. "Unattended" shall mean for the purposes of this section that the owner or operator has not been found on the boat or in its immediate vicinity and has failed to respond to any posting or citation left by the police chief;

(4) The vessel is slept on but is not equipped with a holding tank or the owner or operator fails to provide the police chief with receipts for regular weekly pump outs of the vessel's holding tank;

(5) Law enforcement officers have responded to complaints of excessive noise, thefts, firearms violations, controlled substance violations, other disturbances of possible danger to the

1.

environment or any person, emanating from the vessel or its crew;

(6) The vessel is at any time within 75 feet of any other legally anchored vessel, or any private, properly permitted mooring or private, properly permitted dock or marina without the written permission of the owner;

(7) The vessel does not display proper anchor lights;

(8) If the police chief, or his designee, determines there are safety-related or environmental reasons for denying permission during a particular period of time, or in a particular place, or in a particular manner.

(D) Within four hours of a hurricane warning being declared by the National Weather Service, anchored vessels shall not be permitted in any of the navigable waters of the Town of Beaufort except for the Town Creek Harbor of Refuge. Vessels in Town Creek during a hurricane warning must be adequately secured by at least two anchors, and all parts and contents of the vessels shall also be adequately secured.

(E) It shall be unlawful to anchor vessels without ground tackle to hold the vessel at anchor. Vessels at anchor shall maintain a firm anchor and the operator shall ensure that the vessel is not slipping anchor and changing its location.

(F) When necessary, the police chief may act or may join in action with other agencies to determine and abate any unsafe or environmentally hazardous conditions, by towing, relocating, removing any vessel, or taking any other action reasonably necessary.

(G) The police chief shall post unattended vessels which are in violation. The police chief shall then continue to monitor the violating vessel until ten days have elapsed from the date of the posting. If the person in control of the vessel returns, or contacts the office of the police chief, and abates the violation within that time, no further actions, other than payment of accrued fees, need to be taken.

(H) If the owner of any unattended vessel anchored, moored docked or stored in town waters fails to respond to notices or pay fines and fees as required by this section for more than ten days from the posting, the vessel may be taken into custody by the police chief and stored in a safe place of storage.

(I) The owner shall be responsible for the costs of towing and storage of the vessel. Any vessel towed, removed, relocated or impounded shall be subject to a lien pursuant to G.S. 44A.

(Ord. of 11-21-2019)

Sec. 97.04. - Derelict vessels prohibited.

(A) It shall be unlawful to anchor, moor or ground on the public land or waters of this town or on private property without permission of the property owner, any derelict vessel. Indicators that a vessel is derelict, include, but are not limited to, the following:

(1) Improper, non-working, or no anchor light, which is a hazard to navigation, when combined with an owner/operator who is not attending the vessel;

(2) Vessel is neglected, or substantially dismantled, or improperly maintained, or is not able to be used for navigation as intended;

(3) Vessel does not comply with current registration requirements, when combined with an owner/operator who is not attending the v el;

7

1.

(4) Vessel is barnacle-laden;

(5) Vessel interior is exposed to the elements (rain, waves, etc.);

(6) Vessel is listing;

(7) Vessel is aground;

(8) Vessel is in danger or breaking its mooring; or

(9) Vessel is sinking.

(B) Upon identifying a derelict vessel, the police chief shall post a notice on board the vessel, and shall attempt to notify the owner by certified mail or personal delivery of notice. The notice shall:

(1) Describe the vessel and location of the vessel, however the notice posted aboard the vessel need not include description and location;

(2) Identify the condition(s) that must be corrected;

(3) Inform the owner that the identified conditions must be corrected, or the vessel must be removed from the waters or public lands and the affected surrounding environmental area restored, within ten days of the date the notice is posted aboard the vessel;

(4) Inform the owner that failure to meet the ten-day deadline will result in the vessel being deemed abandoned, subject the owner to civil/criminal penalties, and that all costs associated with removal and disposition of the vessel and restoration of the affected surrounding environmental areas will be the responsibility of the owner;

(5) Inform the owner that within ten calendar days of the posting of the notice above-described he may request a hearing before the town's manager regarding the status of the vessel, with the right to appeal any order adverse to such owner within ten calendar days to Carteret County District Court.

(6) The notice provisions of this section may be waived by the police chief in circumstances in which identifying the owner of a vessel is impractical (by way of example, for vessels not displaying state or federal registration/documentation) or under circumstances in which posting a notice on a vessel is impractical (by way of example, for vessels which are completely or mostly submerged or located such that approaching the vessel for the purposes of affixing or posting a notice gives a risk of damage to a town vessel or a risk of harm to the police chief or other town representative).

(C) Failure of the owner to correct the dangerous condition, or remove the vessel from the waters or public lands of the town within ten days, after notice, shall cause the vessel to be defined as an abandoned vessel, and disposed pursuant to section 97.05.

(Ord. of 11-21-2019)

Sec. 97.05. - Abandoned vessels prohibited.

(A) It shall be unlawful to abandon a vessel on the public land, submerged land, or waters of this Town or on private property without permission of the property owner. This section does not apply to persons who abandon a vessel in an emergency for the safety of the persons onboard; however, after the emergency is over, the owner and operator of the abandoned vessel shall notify the town police chief's office or the United States Coast Guard and must remove the vessel within ten days.

(B) Upon identifying an abandoned vessel, the po 8 chief shall post a notice on board the vessel, and shall

1.

attempt to notify the owner by certified mail or personal delivery of notice.

(1) Describe the vessel and location of the vessel, however the notice posted aboard the vessel need not include description and location;

(2) Inform the owner that the vessel must be removed from the waters or public lands and the affected surrounding environmental area restored, and/or claimed upon payment of all fines and fees, within ten days of the date the notice is posted aboard the vessel;

(3) Inform the owner that failure to meet the ten-day deadline will result in the vessel being deemed abandoned, subject the owner to civil/criminal penalties, and that all costs associated with publication of notice, removal and disposition of the vessel and restoration of the affected surrounding environmental areas will be the responsibility of the owner.

(4) Inform the owner that within ten calendar days of the posting of the notice above-described he may request a hearing before the town manager regarding the status of the vessel, with the right to appeal any order adverse to such owner within ten calendar days to Carteret County District Court.

(5) The notice provisions of this section may be waived by the police chief in circumstances in which identifying the owner of a vessel is impractical (by way of example, for vessels not displaying state or federal registration/documentation) or under circumstances in which posting a notice on a vessel is impractical (by way of example, for vessels which are completely or mostly submerged or located such that approaching the vessel for the purposes of affixing or posting a notice gives a risk of damage to a town vessel or a risk of harm to the police chief or other town representative).

(C) After the notice and hearing provisions described above, any abandoned vessel located on or below any navigable waters, or beached, or grounded adjacent thereto may be removed or relocated and impounded by the police chief.

(D) The owner shall be responsible for all costs of towing, relocation, removal and storage of the vessel, and restoration of the area surrounding the vessel, including costs owed to a third party, and costs incurred by the town or the police chief. Any vessel towed, removed, relocated or impounded shall be subject to a lien pursuant to G.S. 44A.

(Ord. of 11-21-2019)

Sec. 97.06. - Enforcement responsibility and authority.

(A) The police chief of the town, or any law enforcement officer with territorial jurisdiction is authorized and empowered to enforce this article.

(B) Upon obtaining an administrative warrant in accordance with the provisions of G.S. Ch. 15, Art. 4A (G.S. 15-27.2), the police chief is authorized to board any vessel as required to enforce the provisions of this article, or any federal or state law, and such boarding in the performance of official duties shall not constitute a trespass.

(C) The police chief is authorized to seize, tow, remove or relocate from the public waters, and to store or dock the vessel in a safe place that, as a result of arresting the operator, or taking any enforcement action that would render the vessel unattended, or without an operator of suitable age, discretion and competence.

(D) The police chief is authorized to remove and dispose of crab traps, anchor lines, anchors, mooring buoys similar objects which violate the provisions of section 96.03(A) above.

(E) The town or the police chief may use staff, equipment, and material under its control or provided by any cooperating federal, state, or local government or agency; may authorize or contract with any private agent or contractor it deems appropriate; or may authorize or contract with any federal, state, or local government or agency for the removal, storage, or disposal of an abandoned vessel and restoration of the affected area.

(F) The method of removal, storage or disposal of the abandoned vessel, whether by the owner, a third party, the police chief, the town or the state, must comply with all applicable federal and state laws, regulations, and rules.

(G) The owner shall be responsible for all costs of towing, relocation, removal and storage of the vessel, including costs owed to a third party, and costs incurred by the town or the police chief.

(H) The town, elected officials, the town police chief, any law enforcement officer, or any contractor or any employee or agent thereof, acting under this article to remove or relocate a vessel from public waters shall be held harmless for all damages to the vessel resulting from such removal or relocation, unless the damage results from gross negligence or willful misconduct.

(Ord. of 11-21-2019)

Sec. 97.07. - Penalties for violation.

(A) *Criminal penalties.*

(1) A violation of this chapter shall be deemed a class 3 misdemeanor punishable to the extent provided in G.S. 14-4, and shall carry a fine of $100.00 per offense. A violation that either reoccurs or continues without cessation 24 hours after a person has been criminally charged, either by arrest or citation, shall constitute a separate offense.

(2) A conviction under this section does not bar the assessment and collection of the civil remedies provided in this article.

(B) *Civil remedies.* In addition to, or in lieu of any criminal penalties set forth herein, any person, firm or corporation violating any provisions of this article shall be subject to civil penalties as follows:

(1) A violation of sections 97.03, 97.04, and 97.05 of this article shall be subject to a civil remedy in the amount of $500.00 per offense. A violation that either reoccurs or continues without cessation after a 24-hour period shall constitute a separate offense.

(2) Civil remedies shall be used in the recovery of the costs expended enforcing this article.

(3) Any civil remedy may be appealed to the town police chief, or his designee, within ten days of the issuance of the civil remedy. A hearing shall be held within fifteen (15) working days of the appeal.

(4) Any decision of the town police chief, or his designee, may be appealed to the District Court of Town of Carteret County within ten days.

(Ord. of 11-21-2019)

Sec. 97.08. - Disposition/disposal of abandoned vessels.

1.

(A) A vessel having an estimated value less than $2,000.00 may be disposed at any suitable solid waste facility.

(B) A vessel having an estimated value of $2,000.00 or greater shall be disposed as provided in G.S. 44A, with the proceeds paying for the towing, removal, and storage charges, accrued civil fines, environmental restoration costs. The remaining proceeds, if any, shall be deposited into the general fund of the town and designated for use to abate, or remove abandoned vessels and restore environmental damage resulting from abandoned vessels.

(C) Any vessel, cargo, tackle, or equipment remaining unsold after being offered at public sale, may be disposed at any suitable solid waste facility.

(D) Within ten days following the disposal or public sale of any vessel previously registered in any state, or meeting the requirements for registration prior to operation in North Carolina, the police chief shall provide notice to the North Carolina Wildlife Resources Commission, and the agency responsible for registration in the state of any previously registered vessel. The contents of the notice, shall include, if available:

(1) Vessel registration number;

(2) Manufacturer, model, year;

(3) NC title number (if applicable);

(4) Hull identification number;

(5) A description of the reason for being disposed or sold as an abandoned vessel;

(6) Type of disposition and location (e.g., Public sale—Town of Beaufort Police Chief's Office, or Discarded —Carteret County Landfill);

(7) Full name and address of the purchaser (if applicable); and

(8) Date of sale and sale price (if applicable).

(Ord. of 11-21-2019)

Sec. 97.09. - Severability.

If any article, section, subsection, sentence, or clause of this article is adjudged to be unconstitutional or invalid, such adjudication shall not affect the validity of the remaining portions of this article. It is hereby declared that this article would have been passed, and each article, section, subsection, sentence, or clause hereof, irrespective of the fact that any one or more articles, sections, subsections, sentences, or clauses might be adjudged to be unconstitutional or for any other reason invalid.

(Ord. of 11-21-2019)

Penalties

• Violation of ordinance is a class 3 misdemeanor and carries a fine of $100 per offense plus any other judgments from the court.

• Violation of the regulations regarding anchoring, docking, mooring, derelict vessels, and abandoned vessels are subject to a civil remedy of $500 per offense, per day.

• Unclaimed vessels, or vessels for which the owner does not pay the costs of removal, storage, environmental restoration and civil remedies, will be disposed of or sold, with proceeds used to offset unpaid costs.

Appeals

• Vessel owners in violation may request an appeal hearing before the Police Chief or his designee within 10 days of the posting of a violation notice

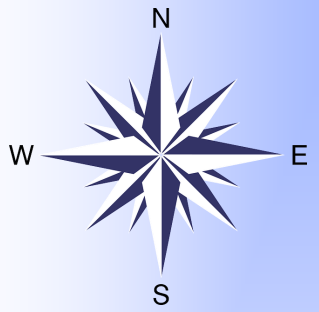
• Vessel owners have the right to appeal any order considered adverse to the Carteret County District Court within 10 days.

Enforceable pursuant to G.S. 160A-175

All waters within the yellow line are inside the Town of Beaufort's jurisdiction.

12

Town of Beaufort Navigable Waters



The waters around Beaufort are an incredible asset. We want everyone to enjoy their beauty and the recreational opportunities they provide, and also to help us preserve this natural resource for future generations.

The regulations described in this brochure apply to all the navigable waters within the boundaries of the Town, as shown on the map within. Enforcement is provided through the Beaufort Police Department.

(252) 728-4561

REGULATIONS

Anchoring, Docking, Mooring

It is unlawful to:

- Anchor, moor, raft-up, or operate any vessel, or carry on any activity in such a way as to constitute a hazard to navigation or interfere with another vessel
- Carry on any regulated activity without the proper government-issued permit (placing of moorings, pilings, docks, etc.)
- Anchor, dock, moor, or store any vessel for more than 10 days in a thirty-day period, except at a private dock or marina

Permission is granted to anchor vessels for up to 10 days in a 30 day period.

Permission will be revoked for:

- Dragging anchor; being moored or anchored in unauthorized areas, or in a marked channel
- No evidence of current registration
- Leaving vessel unattended for more than 24 hours
- A vessel that is slept on but not equipped with a holding tank; or the owner cannot produce receipts for weekly pump-outs of holding tank
- Complaint calls to police for disturbances or violations of law on or around the vessel
- A vessel that is within 75 feet of another vessel, dock, or marina
- A vessel that doesn't display proper anchor lights
- Other safety related or environmental reasons as determined by the Police Chief

Derelict and Abandoned Vessels Prohibited

▶ A derelict vessel is one that has been left unattended and is in significant disrepair that may affect its seaworthiness, safety of the public, or the environment.

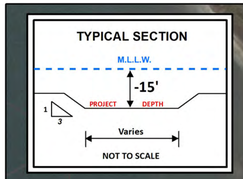
▶ An abandoned vessel is one that is unattended for more than 10 consecutive days; or is in danger of sinking, has sunk, is a hazard to navigation, or is a danger to other vessels.

Upon identifying a derelict or abandoned vessel, notice of the violations will be posted on vessel (if feasible).

If known, owner will be informed that vessel must be removed and affected surrounding environmental area restored (if applicable) within 10 days.

Failure to meet deadline will result in vessel being deemed abandoned; vessel will be impounded and owner subject to criminal and civil penalties plus costs of removal of vessel, disposition, and environmental restoration.

Notice provisions may be waived if identifying the owner is impractical.



34°42'40"N
34°42'20"N
76°45'20"W
76°45'40"W

Range 3
Bulkhead Channel
Range 1
2
8
Range 2A
7
BH
2A
6
Range 2
3
4
Range B
3A
3B
Radio Island

1:2,000
150 75 0 150 300 450 600 Feet

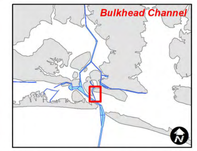
NOTES:

1. ELEVATIONS ARE IN FEET AND REFER TO NOAA'S REPORTED MEAN LOWER LOW WATER (MLLW) RELATIVE TO THE 1983-2001 TIDAL EPOCH.
2. PROJECT SURVEYED WITH DISTRICT SURVEY VESSEL "BEAUFORT ", USING RTK GPS HORIZONTAL POSITIONING EQUIPMENT AND 200 KHZ SOUNDING EQUIPMENT.
3. HORIZONTAL DATUM NAD 1983. VERTICAL DATUM M.L.L.W..
4. TIDE GAGE LOCATED AT: DUKE MARINE LAB
   USE OF TIDE VALUES FOR THIS GAGE ARE RESTRICTED TO QUALITY ASSURANCE PURPOSES FOR VERIFICATION OF RTK TIDES. THE WILMINGTON DISTRICT WILL ONLY USE STAFF GAGE TIDAL VALUES FOR FINAL MAPPING AND QUANTITY CALCULATIONS IF RTK GPS IS UN-AVAILABLE AT THE TIME OF SURVEY.
5. THIS PROJECT WAS DESIGNED BY THE WILMINGTON DISTRICT OF THE U.S. ARMY CORPS OF ENGINEERS. THE INITIALS AND SIGNATURES AND REGISTRATION DESIGNATIONS OF INDIVIDUALS APPEAR ON THESE PROJECT DOCUMENTS WITHIN THE SCOPE OF THEIR EMPLOYMENT AS REQUIRED BY ER1110-1-8152.
6. THE INFORMATION DEPICTED ON THIS SURVEY MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME. THESE CONDITIONS ARE SUBJECT TO RAPID CHANGE DUE TO SHOALING EVENTS. A PRUDENT MARINER SHOULD NOT RELY EXCLUSIVELY ON THE INFORMATION PROVIDED HERE. REQUIRED BY 33 CFR 209.325
7. NAVIGATION AIDS LOCATED WITH DISTRICT SURVEY VESSEL, ACCURACY +/- 3 METERS.
8. FOR THE MOST UP TO DATE INFORMATION PLEASE CHECK OUR WEBSITE AT: WWW.SAW.USACE.ARMY.MIL

LEGEND

Aids to Navigation	Depth In Feet
Can	4 and Shallower
Nun	6 - 4
Green Lighted Buoy	7 - 6
Red Lighted Buoy	8 - 7
Junction Marker	10 - 8
Green Light	12 - 10
Red Light	14 - 12
Green Daybeacon	15 - 14
Red Daybeacon	15 and Deeper
Danger Sign	Navigation Channel
Mileboard	

US Army Corps of Engineers
Wilmington District



SURVEY DATE: 10 MAY 2021	SURVEYED BY: CRP, RW
MAP DATE: 12 MAY 2021	MAPPED BY: K7OPNDJM
	PROCESSED BY: K7OPNDJM
MAP SCALE: 1:2,000	
IMAGERY DATE: 5 MAY 2021	
	MAP FILE NAME: BH_01_BH1_20210510_CS

HYDROGRAPHIC SURVEY
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
WILMINGTON, NORTH CAROLINA

Bulkhead Channel Ranges 1 - 2A

BEAUFORT, NORTH CAROLINA

NOTES:

1. ELEVATIONS ARE IN FEET AND REFER TO NOAA'S REPORTED MEAN LOWER LOW WATER (MLLW) RELATIVE TO THE 1983-2001 TIDAL EPOCH.
2. PROJECT SURVEYED WITH DISTRICT SURVEY VESSEL "BEAUFORT ", USING RTK GPS HORIZONTAL POSITIONING EQUIPMENT AND 200 KHZ SOUNDING EQUIPMENT.
3. HORIZONTAL DATUM NAD 1983. VERTICAL DATUM M.L.L.W..
4. TIDE GAGE LOCATED AT: DUKE MARINE LAB
USE OF TIDE VALUES FOR THIS GAGE ARE RESTRICTED TO QUALITY ASSURANCE PURPOSES FOR VERIFICATION OF RTK TIDES. THE WILMINGTON DISTRICT WILL ONLY USE STAFF GAGE TIDAL VALUES FOR FINAL MAPPING AND QUANTITY CALCULATIONS IF RTK GPS IS UN-AVAILABLE AT THE TIME OF SURVEY.
5. THIS PROJECT WAS DESIGNED BY THE WILMINGTON DISTRICT OF THE U.S. ARMY CORPS OF ENGINEERS. THE INITIALS AND SIGNATURES AND REGISTRATION DESIGNATIONS OF INDIVIDUALS APPEAR ON THESE PROJECT DOCUMENTS WITHIN THE SCOPE OF THEIR EMPLOYMENT AS REQUIRED BY ER1110-1-8152.
6. THE INFORMATION DEPICTED ON THIS SURVEY MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME. THESE CONDITIONS ARE SUBJECT TO RAPID CHANGE DUE TO SHOALING EVENTS. A PRUDENT MARINER SHOULD NOT RELY EXCLUSIVELY ON THE INFORMATION PROVIDED HERE. REQUIRED BY 33 CFR 209.325
7. NAVIGATION AIDS LOCATED WITH DISTRICT SURVEY VESSEL, ACCURACY +/- 3 METERS.
8. FOR THE MOST UP TO DATE INFORMATION PLEASE CHECK OUR WEBSITE AT: WWW.SAW.USACE.ARMY.MIL

US Army Corps of Engineers
Wilmington District

NORTH CAROLINA

Bulkhead Channel

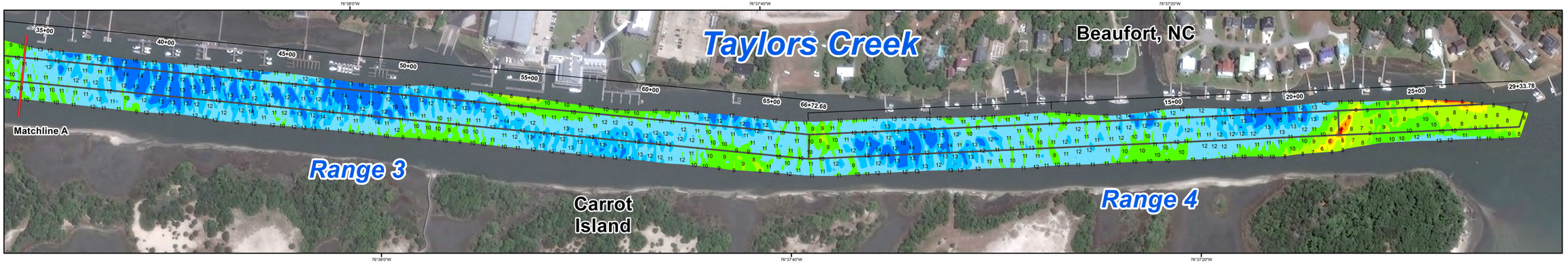
SURVEY DATE: 27 MAY 2021
MAP DATE: 27 MAY 2021
MAP SCALE: 1:2,000
IMAGERY DATE: 05 MAY 2021

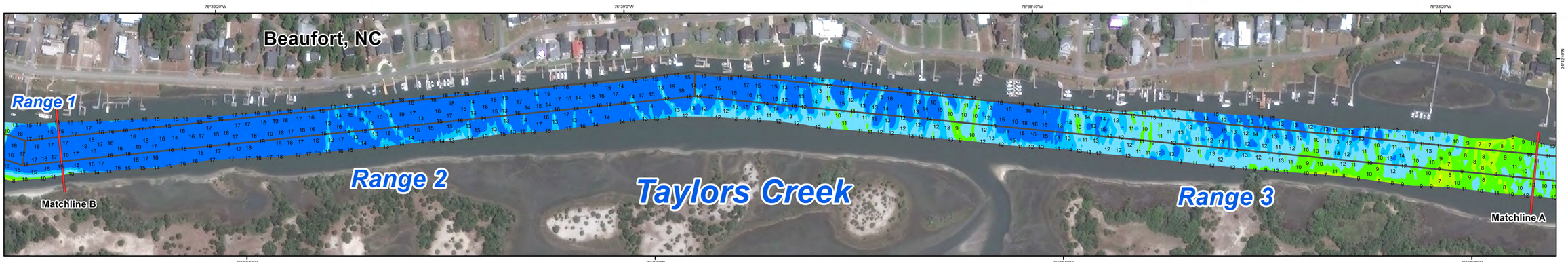
SURVEYED BY: CRP, RW
MAPPED BY: K7PDPSGD
PROCESSED BY: K7PDPSGD
MAP FILE NAME: BH_01_BH3_20210527_CS

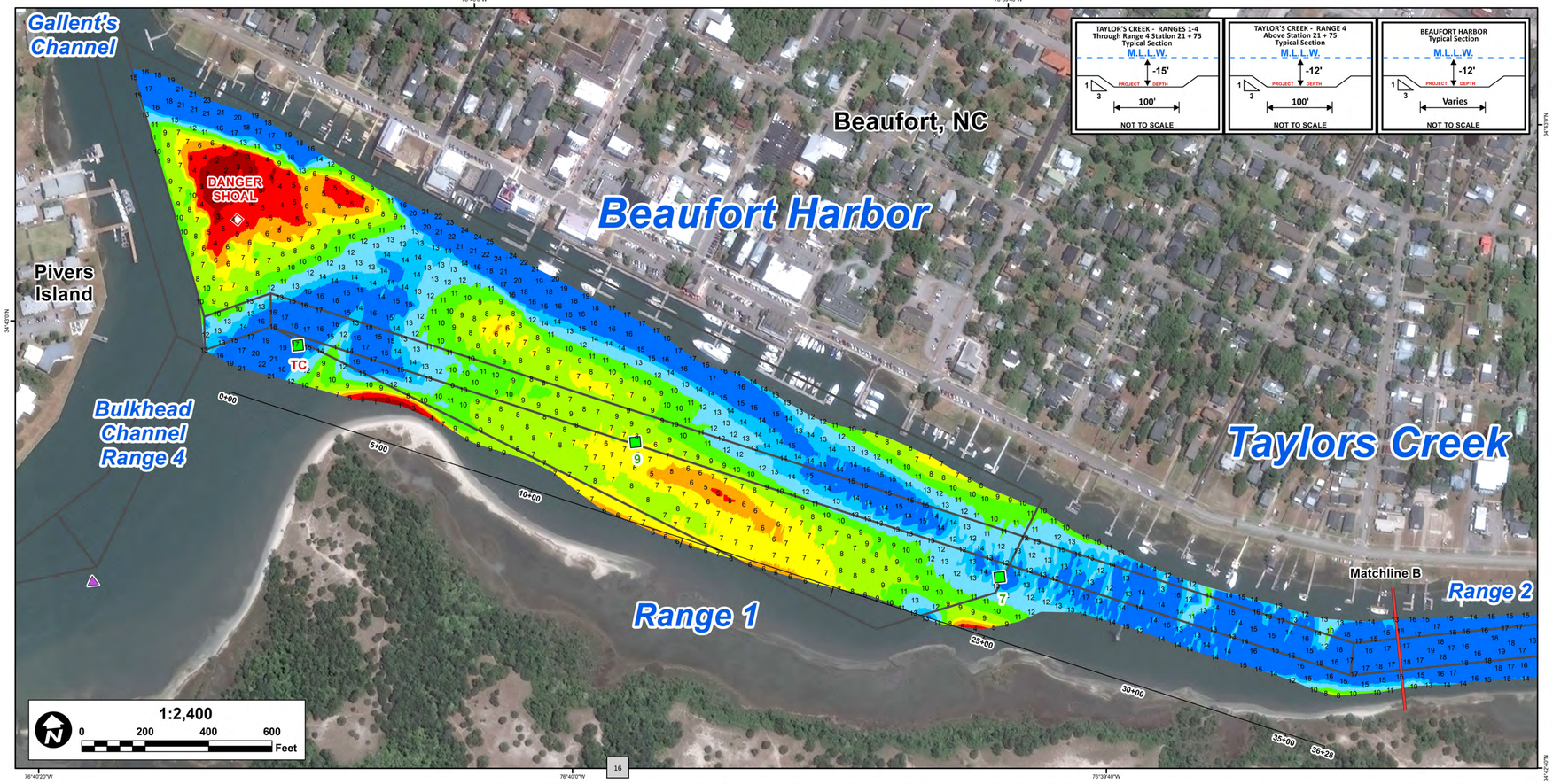
HYDROGRAPHIC SURVEY

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
WILMINGTON, NORTH CAROLINA

Bulkhead Channel
Ranges 3 - 6
BEAUFORT, NORTH CAROLINA







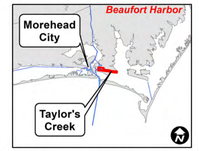
LEGEND

Aids to Navigation	Depth In Feet
Can	4 and Shallower
Nun	6 - 4
Green Lighted Buoy	7 - 6
Red Lighted Buoy	8 - 7
Junction Marker	10 - 8
Green Light	12 - 10
Red Light	14 - 12
Green Daybeacon	15 - 14
Red Daybeacon	15 and Deeper
Danger Sign	Matchlines
Mileboard	Navigation Channel

NOTES:

1. ELEVATIONS ARE IN FEET AND REFER TO NOAA'S REPORTED MEAN LOWER LOW WATER (MLLW) RELATIVE TO THE 1983-2001 TIDAL EPOCH.
2. PROJECT SURVEYED WITH DISTRICT SURVEY VESSEL "BEAUFORT ", USING RTK GPS HORIZONTAL POSITIONING EQUIPMENT AND 200 KHZ SOUNDING EQUIPMENT.
3. HORIZONTAL DATUM NAD 1983. VERTICAL DATUM M.L.L.W..
4. TIDE GAGE LOCATED AT: DUKE MARINE LAB
   USE OF TIDE VALUES FOR THIS GAGE ARE RESTRICTED TO QUALITY ASSURANCE PURPOSES FOR VERIFICATION OF RTK TIDES. THE WILMINGTON DISTRICT WILL ONLY USE STAFF GAGE TIDAL VALUES FOR FINAL MAPPING AND QUANTITY CALCULATIONS IF RTK GPS IS UN-AVAILABLE AT THE TIME OF SURVEY.
5. THIS PROJECT WAS DESIGNED BY THE WILMINGTON DISTRICT OF THE U.S. ARMY CORPS OF ENGINEERS. THE INITIALS AND SIGNATURES AND REGISTRATION DESIGNATIONS OF INDIVIDUALS APPEAR ON THESE PROJECT DOCUMENTS WITHIN THE SCOPE OF THEIR EMPLOYMENT AS REQUIRED BY ER1110-1-8152.
6. THE INFORMATION DEPICTED ON THIS SURVEY MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME. THESE CONDITIONS ARE SUBJECT TO RAPID CHANGE DUE TO SHOALING EVENTS. A PRUDENT MARINER SHOULD NOT RELY EXCLUSIVELY ON THE INFORMATION PROVIDED HERE. REQUIRED BY 33 CFR 209.325
7. NAVIGATION AIDS LOCATED WITH DISTRICT SURVEY VESSEL, ACCURACY +/- 3 METERS.
8. FOR THE MOST UP TO DATE INFORMATION PLEASE CHECK OUR WEBSITE AT: WWW.SAW.USACE.ARMY.MIL

US Army Corps of Engineers
Wilmington District

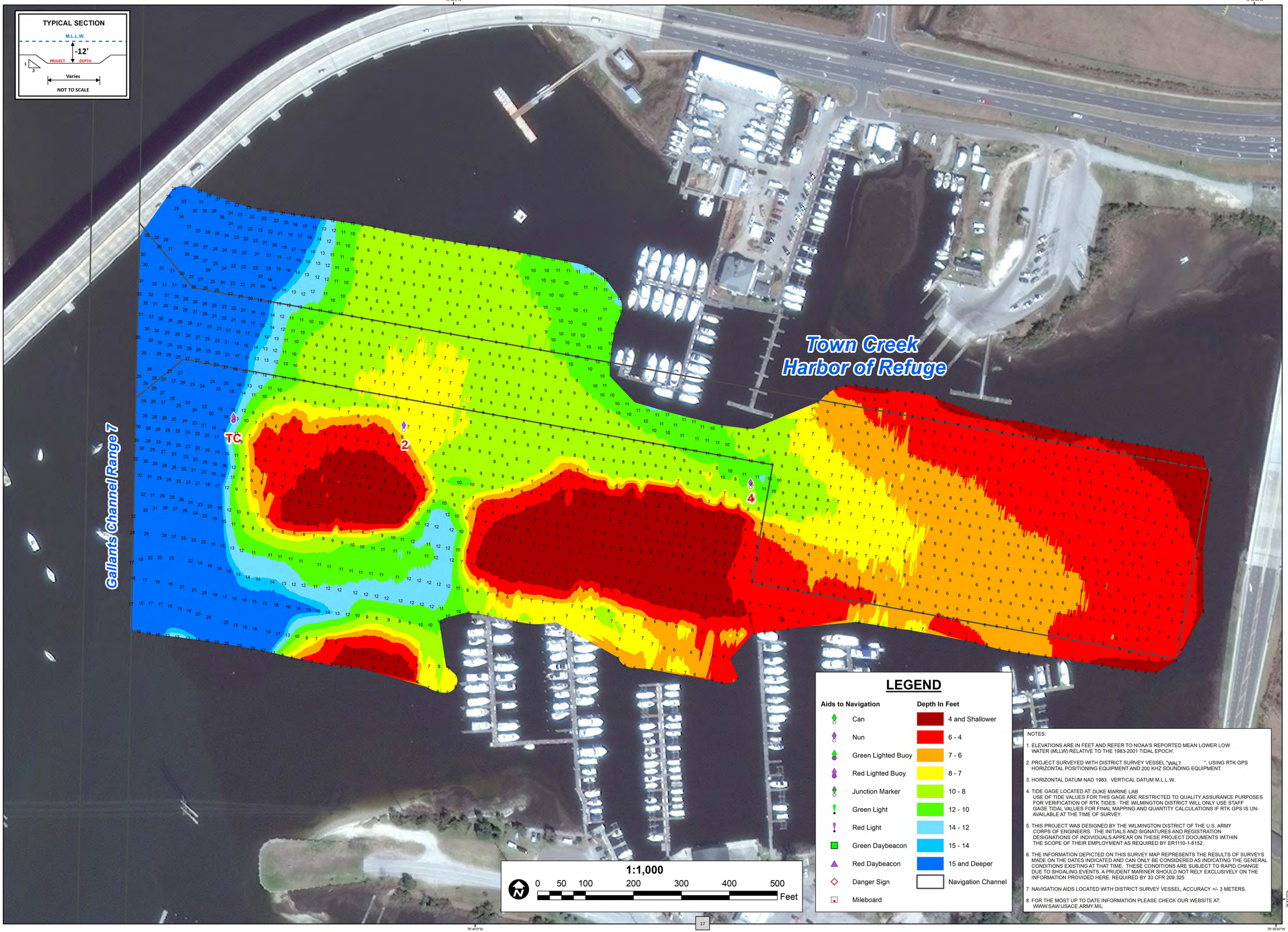


SURVEY DATE: 11 & 17 MAY 2021
SURVEYED BY: RW, CRP
MAP DATE: 18 MAY 2021
MAPPED BY: K7PDPSGD
PROCESSED BY: K7PDPSGD
MAP SCALE: 1:2,400
IMAGERY DATE: 05 MAY 2021
MAP FILE NAME: BH_04_TBH_20210511_CS

HYDROGRAPHIC SURVEY
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
WILMINGTON, NORTH CAROLINA

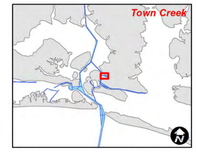
BEAUFORT HARBOR TAYLOR'S CREEK

BEAUFORT, NORTH CAROLINA



US Army Corps of Engineers
Wilmington District

NORTH CAROLINA

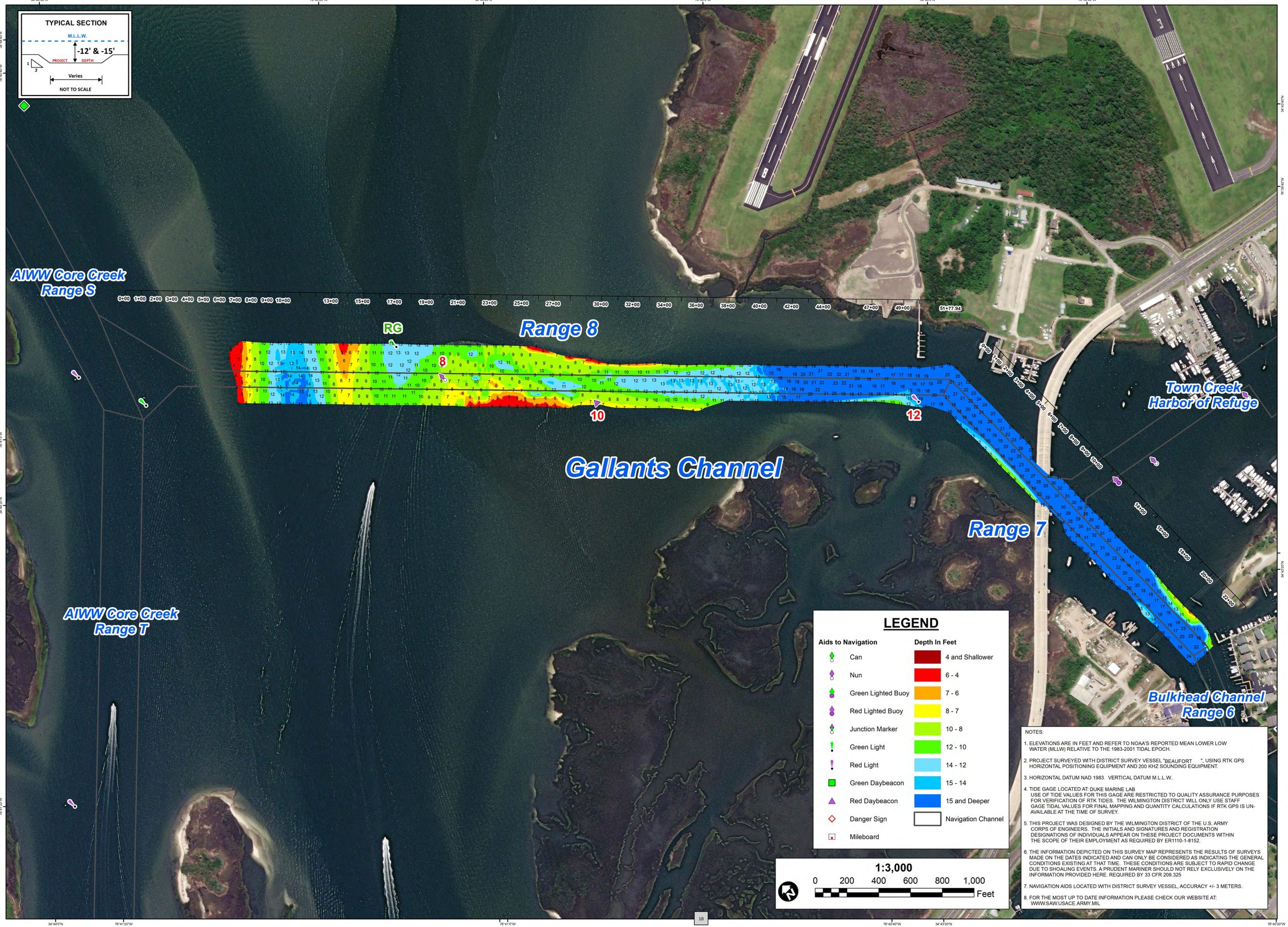


SURVEYED BY: CRP, RW
MAPPED BY: K7OPNLAC
PROCESSED BY: K7OPNLAC
MAP FILE NAME: BH_06_TCR_20210304_CS
SURVEY DATE: 04 MARCH 2021
MAP DATE: 05 MARCH 2021
MAP SCALE: 1:1,000
IMAGERY DATE: 04 MARCH 2021

HYDROGRAPHIC SURVEY
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
WILMINGTON, NORTH CAROLINA

Town Creek Harbor of Refuge

BEAUFORT, NORTH CAROLINA



LEGEND

Aids to Navigation	Depth In Feet
Can	4 and Shallower
Nun	6 - 4
Green Lighted Buoy	7 - 6
Red Lighted Buoy	8 - 7
Junction Marker	10 - 8
Green Light	12 - 10
Red Light	14 - 12
Green Daybeacon	15 - 14
Red Daybeacon	15 and Deeper
Danger Sign	Navigation Channel
Mileboard	

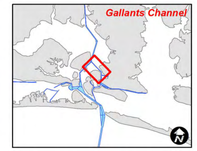
1:3,000

0 200 400 600 800 1,000 Feet

NOTES:

1. ELEVATIONS ARE IN FEET AND REFER TO NOAA'S REPORTED MEAN LOWER LOW WATER (MLLW) RELATIVE TO THE 1983-2001 TIDAL EPOCH.
2. PROJECT SURVEYED WITH DISTRICT SURVEY VESSEL "BEAUFORT ", USING RTK GPS HORIZONTAL POSITIONING EQUIPMENT AND 200 KHZ SOUNDING EQUIPMENT.
3. HORIZONTAL DATUM NAD 1983. VERTICAL DATUM M.L.L.W.
4. TIDE GAGE LOCATED AT: DUKE MARINE LAB
   USE OF TIDE VALUES FOR THIS GAGE ARE RESTRICTED TO QUALITY ASSURANCE PURPOSES FOR VERIFICATION OF RTK TIDES. THE WILMINGTON DISTRICT WILL ONLY USE STAFF GAGE TIDAL VALUES FOR FINAL MAPPING AND QUANTITY CALCULATIONS IF RTK GPS IS UN-AVAILABLE AT THE TIME OF SURVEY.
5. THIS PROJECT WAS DESIGNED BY THE WILMINGTON DISTRICT OF THE U.S. ARMY CORPS OF ENGINEERS. THE INITIALS AND SIGNATURES AND REGISTRATION DESIGNATIONS OF INDIVIDUALS APPEAR ON THESE PROJECT DOCUMENTS WITHIN THE SCOPE OF THEIR EMPLOYMENT AS REQUIRED BY ER1110-1-8152.
6. THE INFORMATION DEPICTED ON THIS SURVEY MAP REPRESENTS THE RESULTS OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE CONSIDERED AS INDICATING THE GENERAL CONDITIONS EXISTING AT THAT TIME. THESE CONDITIONS ARE SUBJECT TO RAPID CHANGE DUE TO SHOALING EVENTS. A PRUDENT MARINER SHOULD NOT RELY EXCLUSIVELY ON THE INFORMATION PROVIDED HERE. REQUIRED BY 33 CFR 209.325
7. NAVIGATION AIDS LOCATED WITH DISTRICT SURVEY VESSEL, ACCURACY +/- 3 METERS.
8. FOR THE MOST UP TO DATE INFORMATION PLEASE CHECK OUR WEBSITE AT: WWW.SAW.USACE.ARMY.MIL

US Army Corps of Engineers
Wilmington District



SURVEY DATE: 25 JANUARY 2021	SURVEYED BY: RW, CRP
MAP DATE: 26 JANUARY 2021	MAPPED BY: K7OPNLAC
	PROCESSED BY: K7OPNLAC
MAP SCALE: 1:3,000	
IMAGERY DATE: 16 DECEMBER 2020	
© 2020 DIGITALGLOBE NEXTVIEW LICENSE	MAP FILE NAME: BH_02_GAL_20210125_CS

HYDROGRAPHIC SURVEY

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
WILMINGTON, NORTH CAROLINA

Gallants Channel

BEAUFORT, NORTH CAROLINA

GEOTECHNICAL APPENDIX A
ENVIRONMENTAL ASSESSMENT
BULKHEAD CHANNEL

Location: Bulkhead and Morgan Creek Channels are located within Carteret County, North Carolina. Bulkhead Channel is a shallow draft navigation channel that branches off of Morehead City Harbor to east side of Radio Island (Figure A-1). Morgan Creek Channel branches off of Bulkhead Channel in the vicinity of Range 2A (Figure A-2). Bulkhead Channel has a project depth of -15 feet Mean Lower Low Water (MLLW), while Morgan Creek project depth is -14 feet MLLW. The channels have a cumulative length of 2.6 miles which wind around the back-barrier shallow waters between the Town of Beaufort, Radio Island, Carrot Island, and Pivers Island. Two near shore disposal areas that are designated for sandy dredge material are located immediately offshore and adjacent to the Morehead City Harbor ship channel (see Figure A-1).

Background: USACE plans to dredge portions of Bulkhead Channel and Morgan Creek Channel which contain supporting geotechnical soils information, utilizing a government plant in the first quarter of FY2019 (Figure A-2). Historically, USACE dredged Bulkhead Channel with its own fleet and conducted near shore disposal as part of its beneficial use of dredged material initiative. In 2018, Wilmington District conducted a limited environmental assessment of Bulkhead Channel in order to gain formal environmental clearance to dispose of sandy material in the near shore placement area while using a government plant.

The channel segments shown in Figure A-2 were evaluated for the best disposal option, based on existing geotechnical information. Current disposal options include; 1) near-shore placement areas on either side of Morehead City Harbor - Range A; or 2) utilizing an upland disposal area. Material removed from channel segments that do not contain supporting geotechnical data will be designated for upland disposal by default.

Geologic Setting and Stratigraphy: The project site lies within the North Carolina coastal plain, which generally consists of an eastward dipping and thickening sequence of sand, silt, clay and limestone, with varying degrees of consolidation and cementation. Figure A-1 shows geologic exposures in the vicinity of Bulkhead Channel, consisting of surficial Quaternary deposits of sand, clay, gravel and peat, which were deposited originally in marine, fluvial, aeolian, and lacustrine environments (NCGS, 1998).

Subsurface Investigations: USACE re-evaluated vibracore borings that were originally drilled in Bulkhead Channel in 2006 and 2008. USACE has not conducted any additional subsurface exploration in the area. Wilmington District Navigation Section identified areas of active shoaling that regularly impinge upon the project depth in Bulkhead Channel, Ranges 1 and 2 using historical survey and dredging records (Figure A-3). Material that was removed from these areas were placed in near-shore disposal areas due to its high sand content. In 2018, Carteret County contracted a subsurface investigation through Moffatt and Nichol to determine the sediment quality within other in-shoal areas of Bulkhead Channel, namely, Ranges 5, 6 and 7, and Morgan Creek in an effort to incorporate them into the government's upcoming dredging operation. Moffatt and Nichol's subcontractor, Athena Technologies, drilled three vibracores into Bulkhead Channel Ranges 5 to 7, and four vibracores within the southern extent of Morgan Creek; the results of which are included in Attachment 1. The location of all vibracores drilled to date in Bulkhead and Morgan Creek Channels is shown in Figure A-4. Drilling logs and lab data are included in Attachments 1 and 2.

GEOTECHNICAL APPENDIX A
ENVIRONMENTAL ASSESSMENT
BULKHEAD CHANNEL

Field Methods: No new fieldwork was conducted by USACE; the only recent fieldwork conducted was commissioned by Carteret County, NC. The field methods employed by the contractor generally involved using a 35-foot research vessel that was immobilized to the seabed using a triple point anchor system. Once on station, the crew geolocated the boring location using Hypack software, and the depth determination and tidal corrections were conducted using a Champion TKO Global Navigation Satellite System. All boring elevations were referenced to MLLW. The crew advanced a 3-inch diameter steel sample barrel through the seabed to termination depth or vibracore refusal. The power to advance the vibracore sampler was applied using a generator with a mechanical vibrating head. Vibracore refusal is defined as penetration of less than 0.1 feet per 10 seconds interval. All of the recently drilled borings penetrated to -17.5 feet, MLLW (project depth is -15 feet, MLLW).

The vibracores were split open, photographed, logged and the soils were visually classified in accordance with the Unified Soil Classification System. Drilling logs were provided to USACE as a professional courtesy. The contractor identified and composited soil samples that lie between the channel bottom and maximum project depth, and sent it off to a third-party lab for gradation and % carbonate testing. A total of seven samples were tested and the results are provided in Attachment 1. Drilling logs and gradation testing from the 2006 and 2008 USACE vibracores are also provided in Attachment 2, for reference.

Evaluation: Bulkhead Channel was evaluated based on a combination of survey and dredging history and vibracore sampling that was historically conducted by USACE, and recently by Carteret County. The evaluation of material quality for near shore placement is constricted to a few areas in Bulkhead and Morgan Creek Channel where natural tidal/current influence causes deposition of sandy shoals which impinge upon the project depth of the navigation channel. Wilmington District, Navigation Section identified two areas in Bulkhead Channel, Ranges 1 and 2, where persistent sedimentation has regularly impinged upon the established project depth (Figure A-3). Because of the historical precedence in dredging material from these areas, and past geotechnical sampling, there is a reasonably high degree of confidence in the material quality present within the present-day shoal formation.

In contrast, Morgan Creek Channel is infrequently dredged by USACE and there is no historical geotechnical data on file to provide insight to the character of sedimentation within Morgan Creek channel. Historical records indicate that the last time Morgan Creek Channel was dredged was in 1999. On April 30, 2013, Wilmington District conducted a before dredge survey but no after dredge survey was conducted. A condition survey taken on October 21, 2013 shows little to no change in the channel bottom, indicating that the planned dredging was canceled for unknown reasons. No other information is known regarding the upper reaches of Morgan Creek Channel.

A total of 13 vibracores spanning 2006 to 2018 were used to evaluate the quality of the shoal material within the sampled channel ranges. The soils that were sampled by the vibracores are summarized in Table 2. Soils that are considered desirable for near shore beneficial use disposal are: SP, SW, SP-SM, SW-SM or SM.

Table 1. Geotechnical Data Summary, Bulkhead & Morgan Creek Channel Borings

Boring ID	Drilling Agency	Boring Type	Predominant Material Sampled	USCS	% Gravel	% Sand	% Fines
MHC-06-29	USACE	vibracore	Fine-medium poorly graded sand	SP	0	> 99.0	< 0.1
MHC-06-30	USACE	vibracore	Fine-medium poorly graded sand	SP	2	> 98.0	< 0.1
MHC-08-V-62	USACE	vibracore	Fine-medium poorly graded sand	SP	< 2	> 97.0	0.6
MHC-08-V-63	USACE	vibracore	Fine poorly-graded sand	SP	0	99.0	< 1.0
MHC-08-V-64	USACE	vibracore	Fine poorly-graded sand	SP	0	99.0	1.0
MHC-08-V-65	USACE	vibracore	Fine poorly-graded sand	SP	< 0.1	99.0	1.0
BHC-01	Athena Technologies	vibracore	Fine-medium poorly-graded sand	SP	0.18	98.51	1.31
BHC-02	Athena Technologies	vibracore	Fine poorly-graded sand and silty fine sand	SP-SM	0.00	92.55	7.45
BHC-03	Athena Technologies	vibracore	Fine poorly-graded sand	SP	0.00	98.38	1.62
MC-01	Athena Technologies	vibracore	Fine poorly-graded sand	SP	1.21	97.52	1.27
MC-02	Athena Technologies	vibracore	Fine-medium poorly-graded Sand	SP	0.08	97.40	2.52
MC-03	Athena Technologies	vibracore	Fine poorly-graded sand	SP	0.01	97.21	2.78
MC-04	Athena Technologies	vibracore	Fine poorly-graded sand	SP	2.08	95.90	2.02

Refer to Figure A-5 and Table 1. The amount of shoaling present within Bulkhead Channel Ranges 1 and 2 is relatively small as shown by the color-coded bathymetry. Ranges 1 and 2 lie west of a perpetual sand shoal located offshore of Carrot Island, and east of a stone jetty that protects the shoreline of Radio Island, making them ideal sediment traps. The geotechnical data indicates that accumulated shoal material consists of clean, fine to medium-grained poorly graded sand (SP). This material was is thought to be derived from Carrot Island and its perpetual offshore sand shoal. It is considered likely that future material accumulation will consist of similar sandy material. With exception to the two shoaling areas in Ranges 1 and 2 (Figure A-5), most of the channel bottom of Bulkhead Channel lie at or below the project depth of -15 feet MLLW, and should not require maintenance dredging. Historical records indicate that the proposed channel widener in Range 1 has been previously dredged to project depth several times. Based upon its dredging record and down drift proximity to Carrot Island and Bulkhead Channel, Range 1, dredged material from the proposed widener can be designated for near shore placement.

Bulkhead Channel Ranges 4 through 6 are not usually dredged, however; historical records indicate the last dredging activity conducted was in 2003. A limited amount of shoaling is shown on the color contoured bathymetry map in Figure A-5. Three borings were drilled by Athena Technologies, which penetrated and sampled these shoals (see Table 1 and Attachment 1). BHC-01 and BHC-03 indicate that the accumulated material is composed of predominantly fine-grained, poorly graded sand (SP), with some fine silty sand (SM) at -14.2 feet MLLW in BHC-02. Gradational soils testing indicates that the overlying strata is predominantly sandy and is

suitable for beach disposal. However, there is no historical data (dredging record or geotechnical sampling) to provide a trend assessment of what future in-shoal material would be in these channel segments. Source material for in-shoal material may be a sand dominated island, or alternatively a nearby mud flat or sub-aerially exposed mud bed. Beyond the shoal areas color contoured light blue to light green (Figure A-5), there is little active accumulation. Much of the channel bottom lies at or below the project depth of -14 feet MLLW.

Most of Morgan Creek Channel has significant shoal accumulation above -12 feet MLLW (Figure A-5). Borings that were drilled by Athena Technologies only sampled the shoal material that lies within Range 1. The sampled shoal material consists of fine-grained poorly graded sand with lenses of fine poorly graded sand with silt (SP-SM). Due to the lack of borings in Ranges 2 and 3, no characterization can be made. Material dredged from these ranges should only be disposed of in an upland site, until additional sampling can verify material suitability.

Recommendations:

1. Accumulated shoal material found within Bulkhead Channel Ranges 1 (vicinity Sta. 14+50 to Sta. 26+00) and 2 (vicinity Sta. 2+50 to Sta. 9+00) to include the proposed widener may be utilized for near shore placement indefinitely, barring a major ecological or physical change in the coastal system.

2. Accumulated shoal material within the confines of the navigation channel, in Bulkhead Channel Ranges 4, 5, and 6 may be utilized for a one-time near shore disposal. Future beneficial use determination and disposal practices must be augmented by vibracore sampling to verify material quality in order to establish a predictive sedimentation trend.

3. Accumulated shoal material from Morgan Creek Channel, Range 1 may be used for a one-time near shore disposal. Future beneficial use determination and disposal practices must be augmented by vibracore sampling to verify material quality in order to establish a predictive sedimentation trend.

4. The sediment characteristics of Morgan Creek Channel, Ranges 2 and 3 remain unknown. Until additional sampling in these ranges is conducted, any dredged material from these ranges should be disposed of in an upland site.

5. Channel segments that do not have supporting geotechnical soils information that characterizes the shoal material to be removed by dredging, is to be disposed of in an upland disposal site.

Reference Cited:

The North Carolina Dept. of Environment, Health, and Natural Resources, Division of Land Resources, NC Geological Survey, in cooperation with the NC Center for Geographic Information and Analysis, 1998 (updated 2007), Geology - North Carolina (1:250,000), coverage data file geol250.

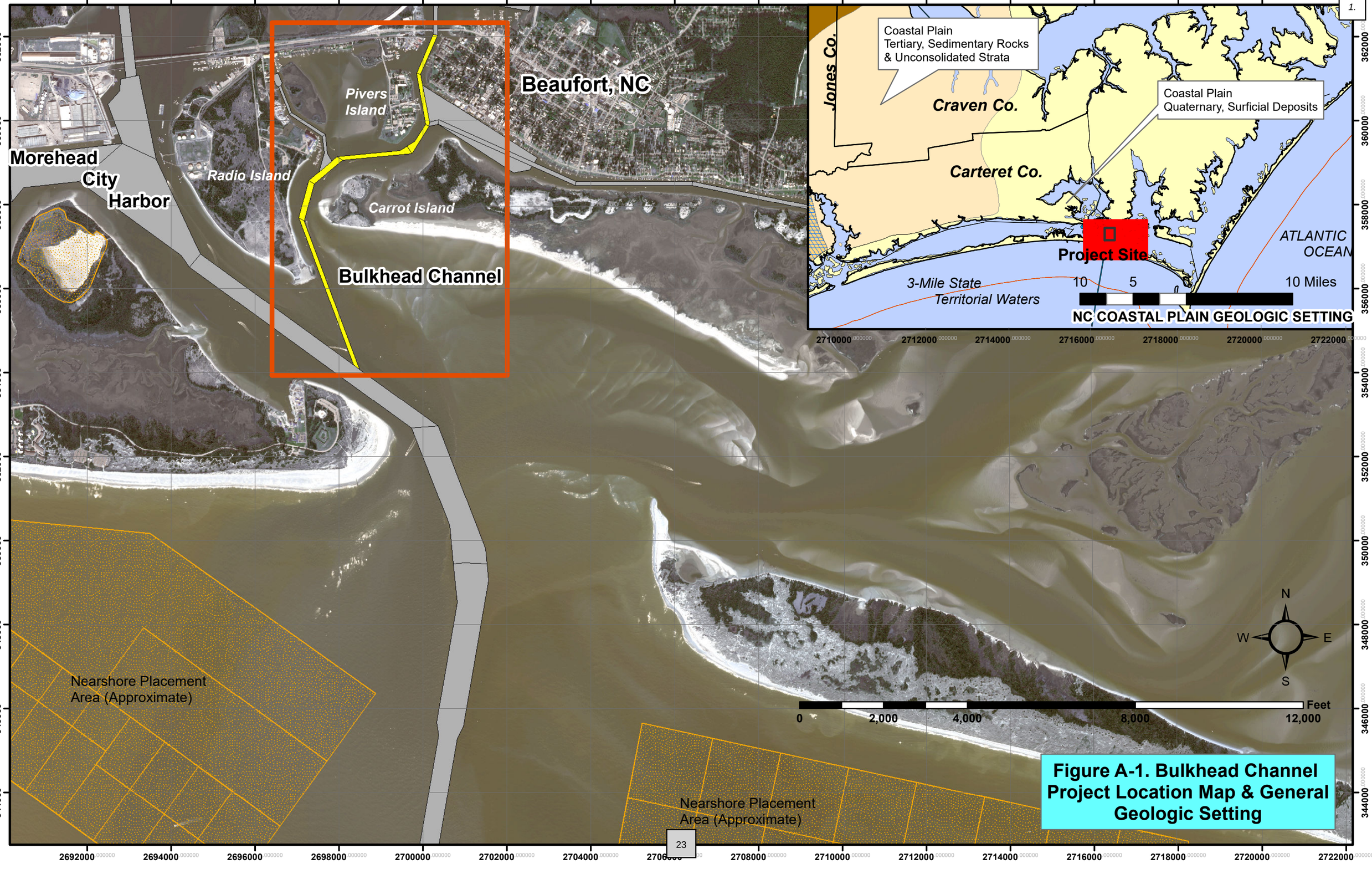


Figure A-1. Bulkhead Channel Project Location Map & General Geologic Setting

2692000 2694000 2696000 2698000 2700000 2702000 2704000

362000 360000 358000 356000

MC- Turning Basin
MC- Range 3
Morgans Creek
Channel
MC - Range 2
MC- Range 1
Pivers Island
BC-Range 6
Beaufort, NC
BC-Range 5
BC-Range 4
BC-Range 3
BC-Range 2A
BC-Range 2
Carrot Island
Morehead City Harbor
Radio Island
Bulkhead Channel
BC-Range 1
Goat Island

N
W E
S

0 1,000 2,000 4,000 6,000 Feet

Legend

- Channels outside project area
- Bulkhead Channel -15 MLLW
- Morgan Creek Channel -14 MLLW

Figure A-2. Bulkhead Channel and Morgan's Creek Channel Ranges Subject to USACE Government Plant Dredging

2696000 000000 | 2698000 000000 | 2700000 000000

358000 000000 | 356000 000000

Bulkhead Channel
Range 2A

8+73.
5+00
0+00

9+15.63
5+00
0+00

Bulkhead Channel
Range 2

Carrot Island

Radio Island

41+11.19.00
35+00
30+00
25+00
20+00
15+00

Rock Jetty

Bulkhead Channel
Range 1

Morehead
City
Harbor

Rock Jetty

Persistant Shoals

Legend

- Channels outside project area
- Channels to be dredged by USACE plant

Historical Dredging Areas by Government Plant

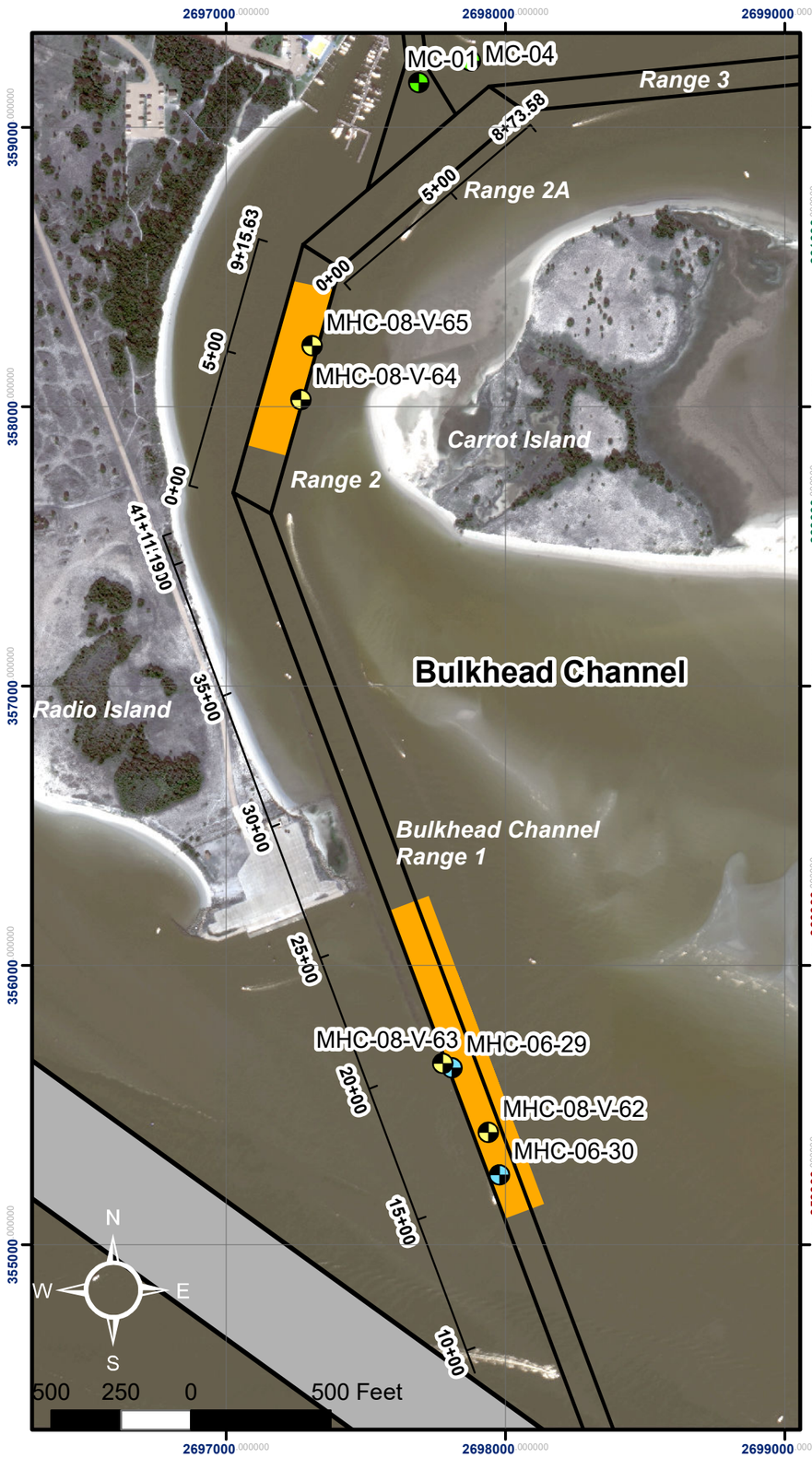
- Historical Dredging Areas by Government Plant

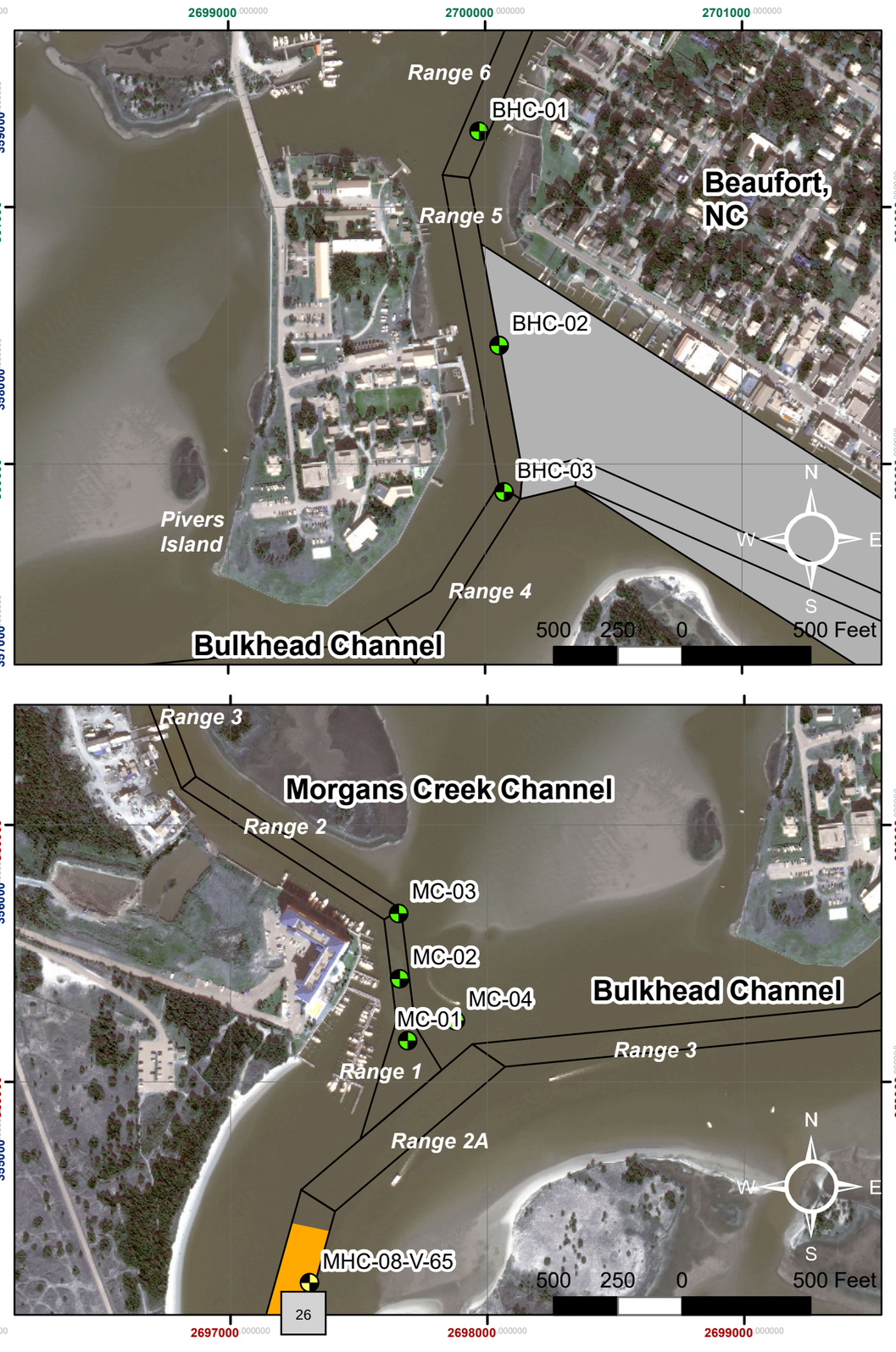
N
W E
S

0 500 1,000 2,000 3,000 Feet

Figure A-3. Bulkhead Channel Historical Government Plant Dredging Areas

Figure A-4. Bulkhead and Morgan's Creek Channel Geotechnical Boring Locations vs. Historical Dredging Areas





Legend

Geotechnical Borings

Year Drilled/Drilling Agency

- 2006-USACE
- 2008-USACE
- 2018-Athena Technologies

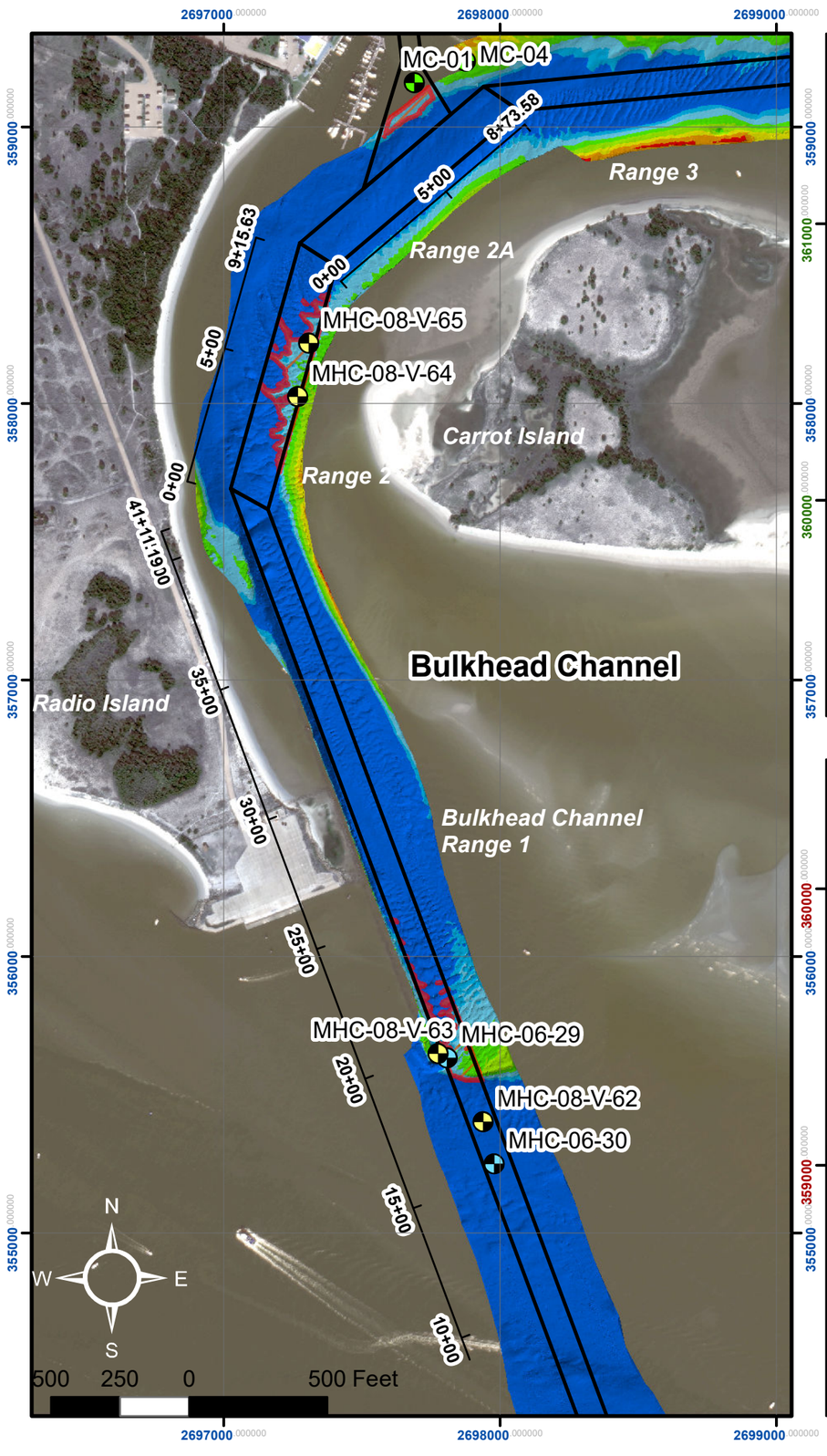
Navigation Channel

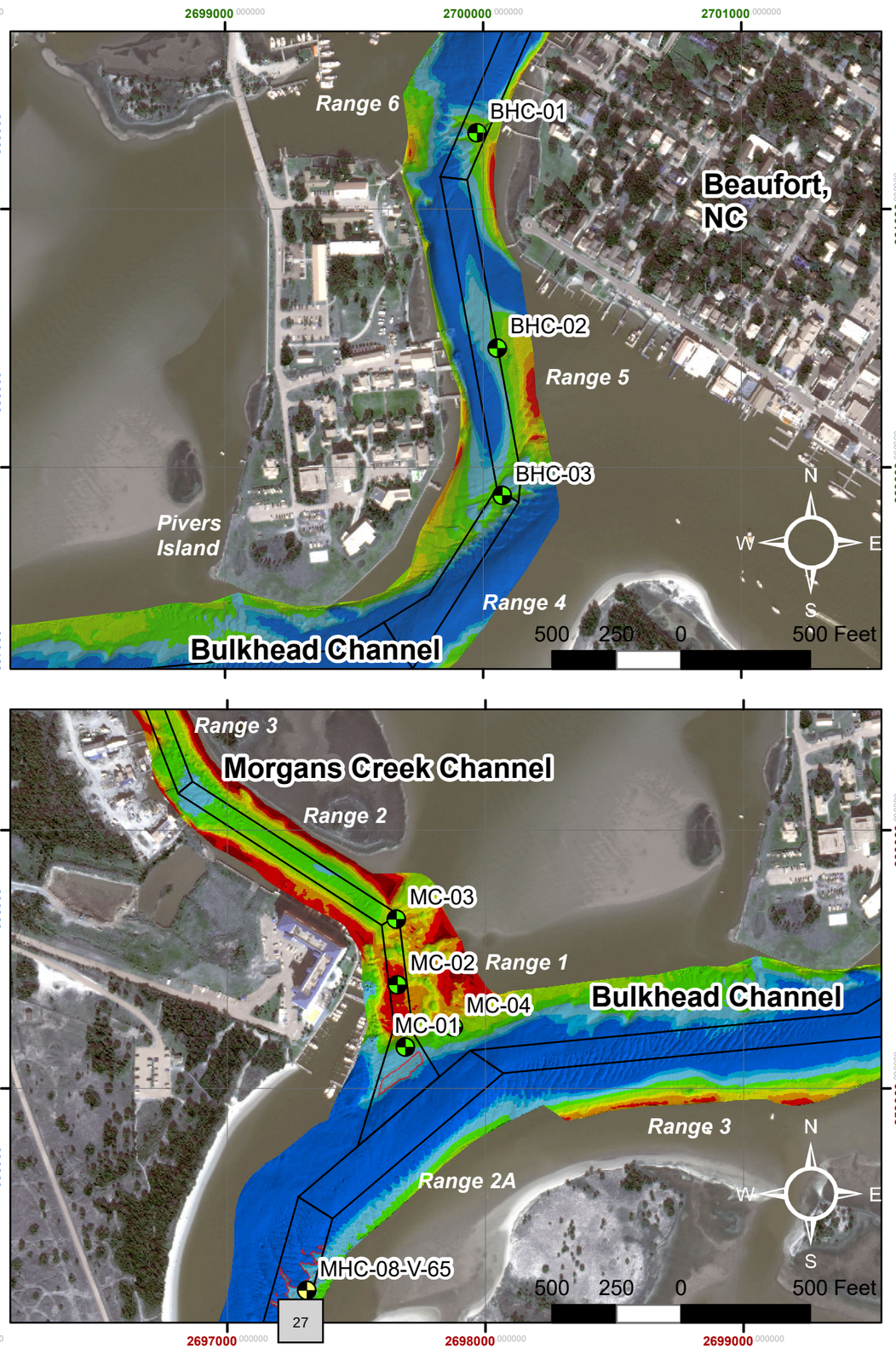
- Channels outside project area

Bulkhead & Morgan's Creek Channels

- Authourized Channel Limits
- Historical Dredging Areas by Government Plant

Figure A-5. Bulkhead and Morgan's Creek Channel Geotechnical Boring Locations and Bathymetric Surveys





Legend

Geotechnical Borings

Year Drilled/Drilling Agency

- 2006-USACE
- 2008-USACE
- 2018-Athena Technologies

Navigation Channel

Bulkhead & Morgan's Creek Channels

- Authorized Channel Limits

Bathymetric Condition Survey 20180522

Depth In Feet

- 4 and Shallower
- 6 - 4
- 7 - 6
- 8 - 7
- 10 - 8
- 12 - 10
- 14 - 12
- 15 - 14
- 15 and Deeper

Bulkhead Channel
Project Depth -15 MLLW

Morgan's Creek Channel
Project Depth -14 MLLW

ATTACHMENT 1 TO GEOTECHNICAL APPENDIX

ATHENA TECHNOLOGIES

FIELD REPORT OF FINDINGS

BULKHEAD CHANNEL AND

MORGAN CREEK

FOR MOFFITT & NICHOL, LLC

16 April 2018

Mr. Robert Neal
Moffatt & Nichol
272 N. Front Street, Suite 204
Wilmington, NC 28401

RE: Geotechnical Data Summary
Bulkhead Channel and Morgan Creek
Carteret County Navigation Project
North Carolina

Dear Mr. Neal,

Athena Technologies, Inc. is pleased to submit this Preliminary Data Summary for the abovementioned project areas. Should you have any questions or concerns regarding the attached data summary, please don't hesitate to contact me via the information below.

Respectfully,

J. Adam Freeze
Vice President / Geologist

1293 Graham Farm Road, PO Box 68
McClellanville, South Carolina 29458
(843) 887-3800
www.athenatechnologies.com

GEOTECHNICAL DATA SUMMARY

BULKHEAD CHANNEL AND MORGAN CREEK
CARTERET COUNTY NAVIGATION PROJECT
NORTH CAROLINA

TABLE OF CONTENTS

APPENDICES

1293 Graham Farm Road, PO Box 68
McClellanville, South Carolina 29458
(843) 887-3800
www.athenatechnologies.com

TABLE 1
HORIZONTAL AND VERTICAL DATA CONVERSION SUMMARY
BULKHEAD CHANNEL AND MORGAN CREEK CHANNEL

Boring ID	Data Conversion Input Parameters [1]			Data Conversion Output Parameters		
	State Plane Coordinates [2]		Elevation [3] (NAVD 88)	Geographic Coordinates		Elevation (MLLW)
	East (x)	North (y)		Latitude	Longitude	
BHC-01	2,699,976.13	361,294.74	1.19	34.7201236	-76.6703167	3.24
BHC-02	2,700,053.30	360,461.41	1.23	34.7178283	-76.6701271	3.31
BHC-03	2,700,073.21	359,890.95	1.06	34.7162457	-76.6701178	3.16
MC-01	2,697,688.84	359,160.59	0.85	34.7144471	-76.6780866	2.99
MC-02	2,697,647.45	359,401.03	0.32	34.7151335	-76.6782540	2.46
MC-03	2,697,654.27	359,655.53	1.12	34.7157788	-76.6781633	3.26
MC-04	2,697,874.49	359,238.35	-0.84	34.7146488	-76.6774597	1.30
Notes	[1] = Coordinate and elevation conversion conducted via the National Oceanic and Atmospheric Administration's (NOAA) Vertical Datum Transformation (VDatum) software, Version 3.6.1.					
	[2] = Horizontal coordinates were recorded in the field and are referenced to North American Datum of 1983, State Plane Coordinate System, North Carolina (Zone 3200), US Survey Feet.					
	[3] = Elevation data were recorded in the field using a Champion TKO Global Navigation Satellite System unit interfaced with the North Carolina Continuously Operating Reference Station (CORS) Network.					
	NAVD 88 = North American Vertical Datum of 1988					
	MLLW = Mean Lower Low Water					

1293 Graham Farm Road, PO Box 68
McClellanville, South Carolina 29458
(843) 887-3800
www.athenatechnologies.com

TABLE 2
GEOTECHNICAL VIBRACORE SUMMARY
BULKHEAD CHANNEL AND MORGAN CREEK CHANNEL

Boring ID	Collection Date	Time	Coordinates [1]		Tide Elevation [2] (ft MLLW)	Water Depth (ft)	Sediment Surface Elevation (ft MLLW)	Bottom Elevation of Recovered Core (ft MLLW)	Penetration (ft)	Recovery (ft)	Notes
			East (x)	North (y)							
BHC-01	3/22/2018	11:47	2,699,976.13	361,294.74	3.24	13.2	-9.9	-18.4	9.0	8.5	
BHC-02	3/22/2018	12:42	2,700,053.30	360,461.41	3.31	14.8	-11.5	-18.8	8.0	7.3	Moved location to edge of channel to reach shallower water.
BHC-03	3/22/2018	13:20	2,700,073.21	359,890.95	3.16	14.3	-11.2	-18.8	8.5	7.7	
MC-01	3/22/2018	10:52	2,697,688.84	359,160.59	2.99	15.5	-12.5	-20.1	8.5	7.6	
MC-02	3/22/2018	9:43	2,697,647.45	359,401.03	2.46	7.1	-4.6	-18.7	15.0	14.1	
MC-03	3/22/2018	11:17	2,697,654.27	359,655.53	3.26	10.7	-7.4	-20.2	14.0	12.8	
MC-04	3/22/2018	8:11	2,697,874.49	359,238.35	1.30	10.2	-8.9	-18.8	11.0	9.9	

Notes	
	[1] = Coordinates were recorded in North American Datum of 1983, State Plane Coordinate System, North Carolina (Zone 3200), US Survey Feet.
	[2] = Elevation data were recorded in the field using a Champion TKO Global Navigation Satellite System unit interfaced with the North Carolina Continuously Operating Reference Station (CORS) Network.
	ft = feet
	MLLW = Mean Lower Low Water

1293 Graham Farm Road, PO Box 68
McClellanville, South Carolina 29458
(843) 887-3800
www.athenatechnologies.com

TABLE 3
SUMMARY OF PHYSICAL PARAMETERS
BULKHEAD CHANNEL AND MORGAN CREEK CHANNEL

Boring ID	Sample ID	Sample Interval (ft bss)	Sample Interval (ft MLLW)	Laboratory USCS Classification	Percent Gravel-Size Fraction [1]	Percent Sand-Size Fraction [2]	Percent Fine-Grained Fraction [3]	Percent Carbonate [4]
BHC-01-0318	C2	0 to 7.6	-9.9 to -17.5	SP	0.18	98.51	1.31	7.1
BHC-02-0318	C2	0 to 6.0	-11.5 to -17.5	SP-SM	0.00	92.55	7.45	3.9
BHC-03-0318	C2	0 to 6.3	-11.2 to -17.5	SP	0.00	98.38	1.62	3.8
MC-01-0318	C1	0 to 5.0	-12.5 to -17.5	SP	1.21	97.52	1.27	11.7
MC-02-0318	C2	0 to 12.9	-4.6 to -17.5	SP	0.08	97.40	2.52	7.6
MC-03-0318	C1	0 to 10.1	-7.4 to -17.5	SP	0.01	97.21	2.78	4.7
MC-04-0318	C2	0 to 8.6	-8.9 to -17.5	SP	2.08	95.90	2.02	12.1

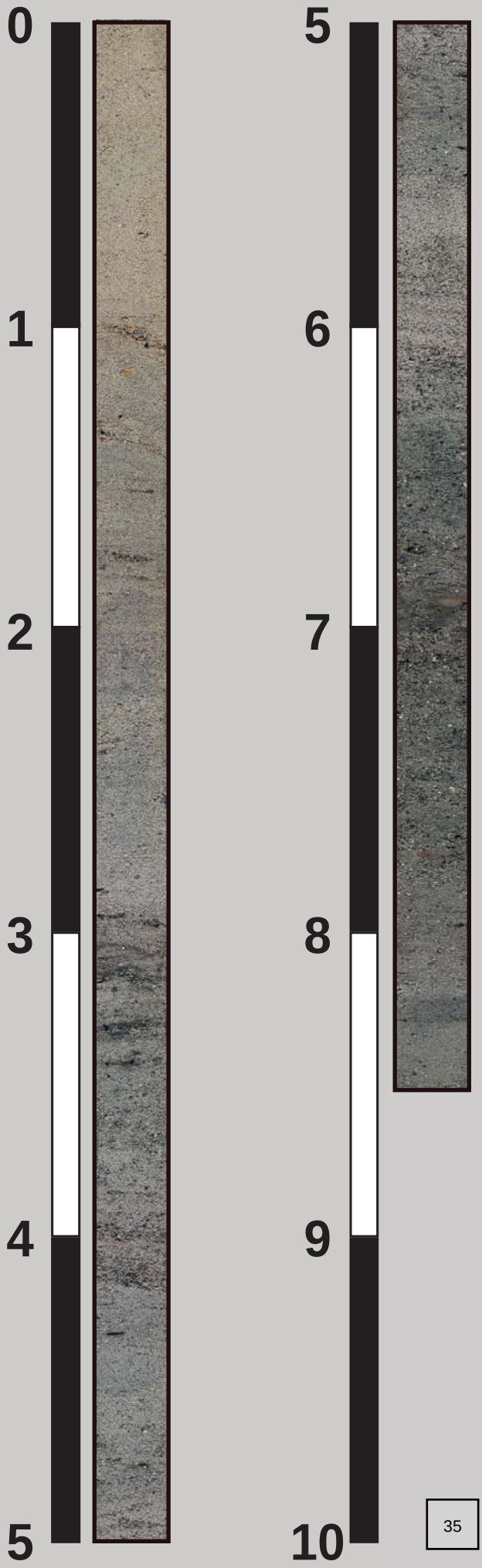
Notes

ft bss = feet below sediment surface
ft MLLW = feet relative to mean lower low water
USCS = Unified Soil Classification System
[1] = Defined as the sample fraction which is retained on the Number 4 sieve (i.e., greater than 4.75 millimeters).
[2] = Defined as the sample fraction that is retained on various sieves between the Number 4 and Number 200 sieves (i.e., size between 4.75 and 0.074 millimeters, respectively).
[3] = Defined as the sample fraction which passes the Number 200 sieve (i.e., less than 0.074 millimeters).
[4] = Percent carbonate determined using the Twenhofel and Tyler acid digestion method (1941).
C = composite sample

1293 Graham Farm Road, PO Box 68
McClellanville, South Carolina 29458
(843) 887-3800
www.athenatechnologies.com

Appendix A:
Core Photographs and Logs

1293 Graham Farm Road, PO Box 68
McClellanville, South Carolina 29458
(843) 887-3800
www.athenatechnologies.com



BHC-01

Bulkhead Channel, Carteret County Navigation Project, North Carolina

Moffatt & Nichol, Inc.

Notes:
Scale in Feet
Photo Mosaic Image

ATHENA TECHNOLOGIES, INC.

Athena Technologies, Inc.
1293 Graham Farm Road
McClellanville, SC 29458
www.athenatechnologies.com
(843) 887-3800

Boring Designation BHC-01

DRILLING LOG	CLIENT	PROJECT OWNER	SHEET 1 OF 1 SHEETS
	Moffatt & Nichol	Carteret County, North Carolina	

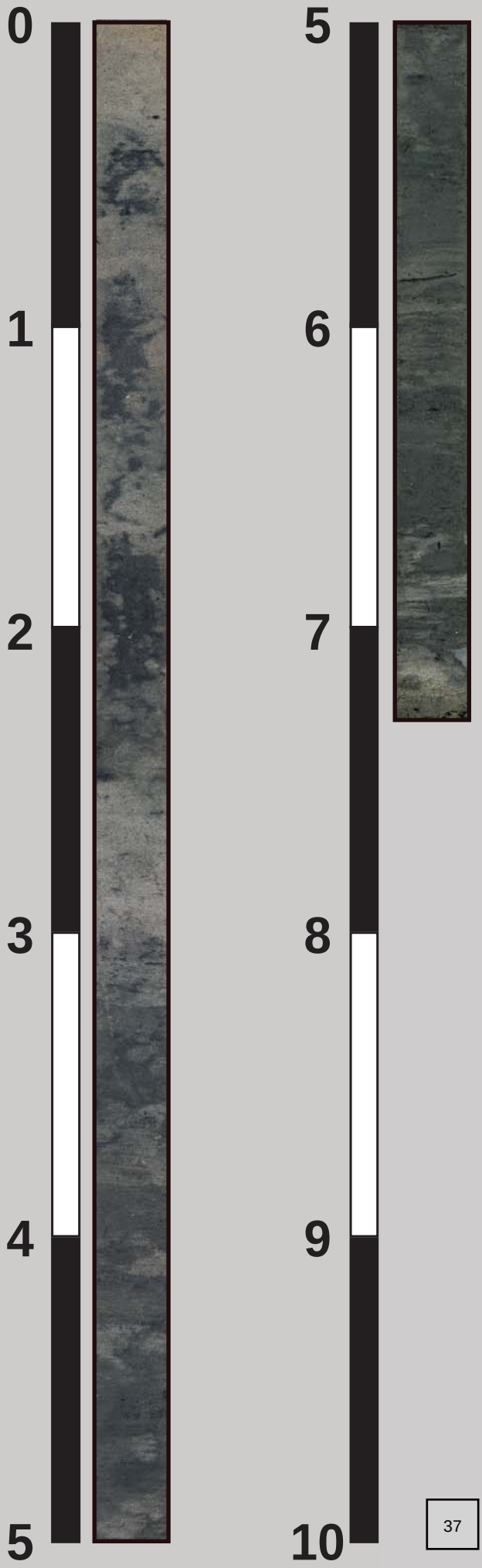
1. PROJECT: Carteret County Sediment Project, Carteret County, North Carolina		9. SIZE AND TYPE OF BIT: 3.0 In.	
		10. COORDINATE SYSTEM/DATUM: NC State Plane	HORIZONTAL: NAD 1983 / VERTICAL: MLLW
2. BORING DESIGNATION: BHC-01	LOCATION COORDINATES: X = 2,699,976 Y = 361,295	11. MANUFACTURER'S DESIGNATION OF DRILL	☐ AUTO HAMMER ☐ MANUAL HAMMER
3. DRILLING AGENCY: Athena Technologies, Inc.	CONTRACTOR FILE NO.	12. TOTAL SAMPLES	DISTURBED: 1 / UNDISTURBED (UD):
4. NAME OF DRILLER: P. McClellan		13. TOTAL NUMBER CORE BOXES	
5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED	DEG. FROM VERTICAL / BEARING	14. WATER DEPTH: 13.2 Ft.	
		15. DATE BORING	STARTED: 03-22-18 11:47 / COMPLETED: 03-22-18
6. THICKNESS OF OVERBURDEN: 0.0 Ft.		16. ELEVATION TOP OF BORING: -9.9 Ft.	
7. DEPTH DRILLED INTO ROCK: 0.0 Ft.		17. TOTAL RECOVERY FOR BORING: 8.5 Ft.	
8. TOTAL DEPTH OF BORING: 9.0 Ft.		18. SIGNATURE AND TITLE OF INSPECTOR: A. Freeze	

ELEV. (ft)	SCALE (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-9.9	0.0					
			Fine quartz SAND, trace fine to coarse sand-sized shell (primarily in thin [<0.1'] layers), trace organic and inorganic silt in occasional burrow, poorly graded, loose, subrounded, light brownish gray (2.5Y-6/2), (SP).			
-12.9	3.0					
			Fine to medium, quartz SAND, trace fine to coarse sand-sized shell, trace inorganic silt in laminations (primarily between 3.0-3.4'), organic silt rip-up at 3.4', poorly graded, loose, subrounded, gray (5Y-5/1), (SP).		C2	Sample #C2, Depth = 7.6' Mean (mm): 0.33, Phi Sorting: 0.73 Carbonate: 7.1%, Fines (#200) - 1.31 (SP)
-14.1	4.2					
			Fine, grading to fine to medium, quartz SAND, few fine to coarse sand-sized shell, trace inorganic and organic silt in occasional burrow, poorly graded, loose, subrounded, gray (5Y-5/1), (SP).			
-16.1	6.2					
			Fine to medium quartz SAND, few fine to coarse sand-sized shell, trace inorganic silt in matrix and burrows, wood debris and fine gravel-sized charcoal clast at 6.9', poorly graded loose, subrounded (Borderline SP-SM), dark gray (5Y-4/1), (SP).			
-18.0	8.1					
-18.4	8.5		Fine quartz SAND, trace inorganic silt in occasional burrow, trace fine to coarse sand-sized shell, poorly graded, loose, subrounded, gray (5Y-5/1), (SP).			
			End of Boring			

0 5 10 15

FLORIDA DEP ROSS 2018-04-05 M&N CARERET COUNTY NC WORKING COPY JNW.GPJ FL DEP ROSS.GDT 4/16/18

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DE JUN 04



BHC-02

Bulkhead Channel, Carteret County Navigation Project, North Carolina

Moffatt & Nichol, Inc.

Notes:
Scale in Feet
Photo Mosaic Image

ATHENA TECHNOLOGIES, INC.

Athena Technologies, Inc.
1293 Graham Farm Road
McClellanville, SC 29458
www.athenatechnologies.com
(843) 887-3800

Boring Designation BHC-02

DRILLING LOG

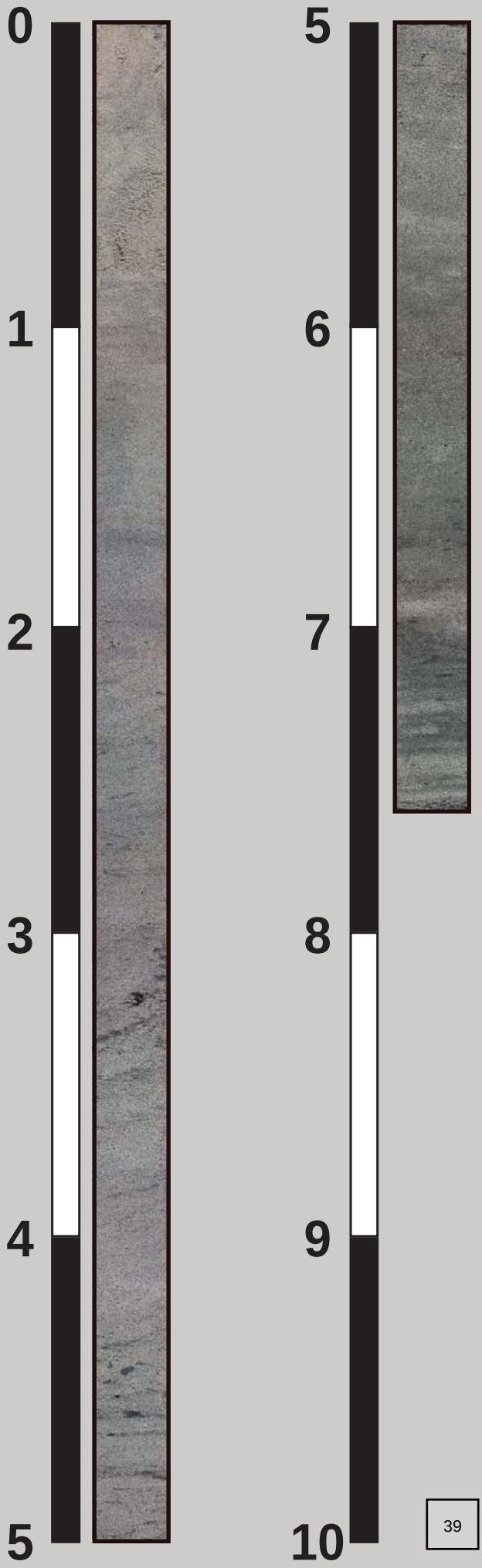
CLIENT	Moffatt & Nichol
PROJECT OWNER	Carteret County, North Carolina
SHEET	1 OF 1 SHEETS
1. PROJECT	Carteret County Sediment Project Carteret County, North Carolina
9. SIZE AND TYPE OF BIT	3.0 In.
10. COORDINATE SYSTEM/DATUM	NC State Plane
HORIZONTAL	NAD 1983
VERTICAL	MLLW
2. BORING DESIGNATION	BHC-02
LOCATION COORDINATES	X = 2,700,053 Y = 360,461
11. MANUFACTURER'S DESIGNATION OF DRILL	☐ AUTO HAMMER ☐ MANUAL HAMMER
3. DRILLING AGENCY	Athena Technologies, Inc.
CONTRACTOR FILE NO.	
12. TOTAL SAMPLES	DISTURBED 1 / UNDISTURBED (UD)
4. NAME OF DRILLER	P. McClellan
13. TOTAL NUMBER CORE BOXES	
5. DIRECTION OF BORING	☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL	
BEARING	
14. WATER DEPTH	14.8 Ft.
15. DATE BORING	STARTED 03-22-18 12:42 / COMPLETED 03-22-18
6. THICKNESS OF OVERBURDEN	0.0 Ft.
16. ELEVATION TOP OF BORING	-11.5 Ft.
7. DEPTH DRILLED INTO ROCK	0.0 Ft.
17. TOTAL RECOVERY FOR BORING	7.3 Ft.
8. TOTAL DEPTH OF BORING	8.0 Ft.
18. SIGNATURE AND TITLE OF INSPECTOR	A. Freeze

ELEV. (ft)	SCALE (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-11.5	0.0					
-13.2	1.7		Fine quartz SAND, trace inorganic silt in matrix and burrows, trace fine to medium sand-sized shell, poorly graded, loose, subrounded, olive gray (5Y-5/2), (SP).			
-14.0	2.5		Fine quartz SAND, trace inorganic silt in matrix, poorly graded, loose, subrounded, heavily bioturbated, dark gray (5Y-4/1), (SP).			Sample #C2, Depth = 6.0' Mean (mm): 0.15, Phi Sorting: 0.46 Carbonate: 3.9%, Fines (#200) - 7.45 (SP-SM)
-14.7	3.2		Fine quartz SAND, trace inorganic silt in burrows, poorly graded, loose, subrounded, gray (5Y-5/1), (SP).		C2	
-18.8	7.3		Silty, fine quartz SAND, little inorganic silt in matrix, laminations and burrows, trace fine sand-sized shell, organic silt rip-ups at 5.8' & 6.3', clay rip-ups at 7.1', poorly graded, loose, subrounded, heavily bioturbated, very dark gray (5Y-3/1), (SM).			
			End of Boring			

0 5 10 15

FLORIDA DEP ROSS 2018-04-05 M&N CARERET COUNTY NC WORKING COPY JNW.GPJ FL DEP ROSS.GDT 4/16/18

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DE JUN 04



BHC-03

Bulkhead Channel, Carteret County Navigation Project, North Carolina

Moffatt & Nichol, Inc.

Notes:
Scale in Feet
Photo Mosaic Image

ATHENA TECHNOLOGIES, INC.

Athena Technologies, Inc.
1293 Graham Farm Road
McClellanville, SC 29458
www.athenatechnologies.com
(843) 887-3800

Boring Designation BHC-03

DRILLING LOG

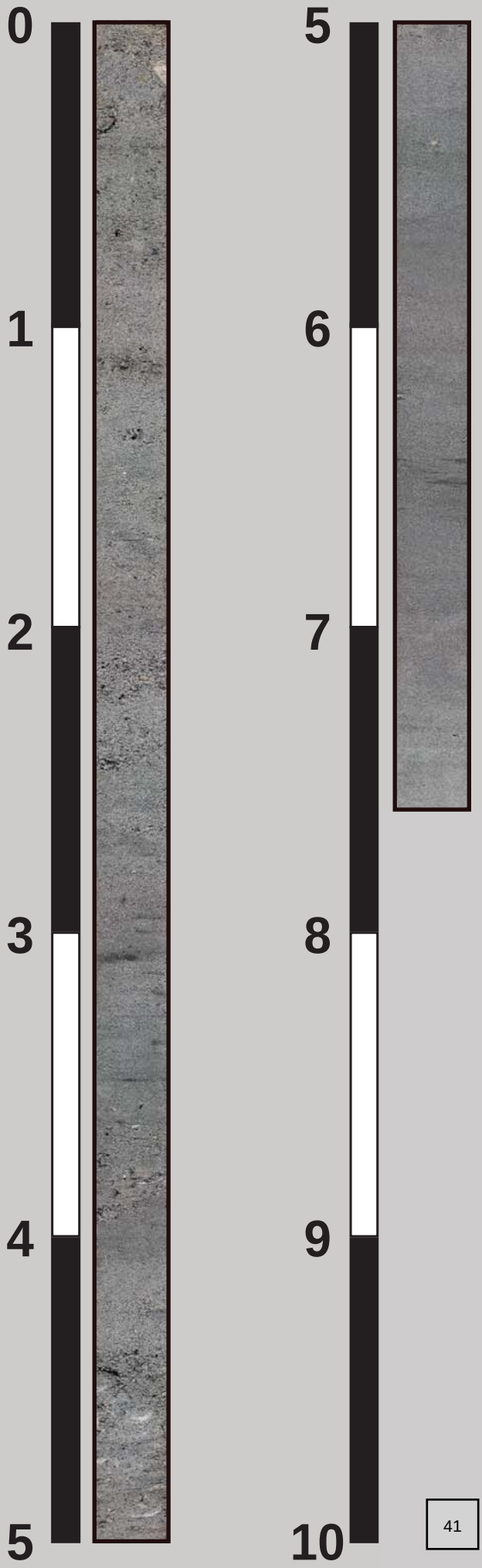
CLIENT	Moffatt & Nichol
PROJECT OWNER	Carteret County, North Carolina
SHEET	1 OF 1 SHEETS
1. PROJECT	Carteret County Sediment Project Carteret County, North Carolina
2. BORING DESIGNATION	BHC-03
LOCATION COORDINATES	X = 2,700,073 Y = 359,891
3. DRILLING AGENCY	Athena Technologies, Inc.
CONTRACTOR FILE NO.	
4. NAME OF DRILLER	P. McClellan
5. DIRECTION OF BORING	☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL	
BEARING	
6. THICKNESS OF OVERBURDEN	0.0 Ft.
7. DEPTH DRILLED INTO ROCK	0.0 Ft.
8. TOTAL DEPTH OF BORING	8.5 Ft.
9. SIZE AND TYPE OF BIT	3.0 In.
10. COORDINATE SYSTEM/DATUM	NC State Plane
HORIZONTAL	NAD 1983
VERTICAL	MLLW
11. MANUFACTURER'S DESIGNATION OF DRILL	☐ AUTO HAMMER ☐ MANUAL HAMMER
12. TOTAL SAMPLES	DISTURBED: 1 / UNDISTURBED (UD):
13. TOTAL NUMBER CORE BOXES	
14. WATER DEPTH	14.3 Ft.
15. DATE BORING	STARTED: 03-22-18 13:20 / COMPLETED: 03-22-18
16. ELEVATION TOP OF BORING	-11.2 Ft.
17. TOTAL RECOVERY FOR BORING	7.6 Ft.
18. SIGNATURE AND TITLE OF INSPECTOR	A. Freeze

ELEV. (ft)	SCALE (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-11.2	0.0		Fine quartz SAND, trace inorganic silt in occasional burrow and rip-up, trace fine sand-sized shell, trace organic silt rip-ups at 2.2', 3.2', 4.6', 6.8', & 7.0', poorly graded, loose, subrounded, color grades to gray (5Y 5/1) from, light olive gray (5Y-6/2), (SP).		C2	Sample #C2, Depth = 6.3' Mean (mm): 0.20, Phi Sorting: 0.49 Carbonate: 3.8%, Fines (#200) - 1.62 (SP)
-18.8	7.6		End of Boring			

0
5
10
15

FLORIDA DEP ROSS 2018-04-05 M&N CARERET COUNTY NC WORKING COPY JNW.GPJ FL DEP ROSS.GDT 4/16/18

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DE JUN 04



MC-01

Morgan Creek, Carteret County Navigation Project, North Carolina

Moffatt & Nichol, Inc.

Notes:
Scale in Feet
Photo Mosaic Image

ATHENA TECHNOLOGIES, INC.

Athena Technologies, Inc.
1293 Graham Farm Road
McClellanville, SC 29458
www.athenatechnologies.com
(843) 887-3800

Boring Designation MC-01

DRILLING LOG

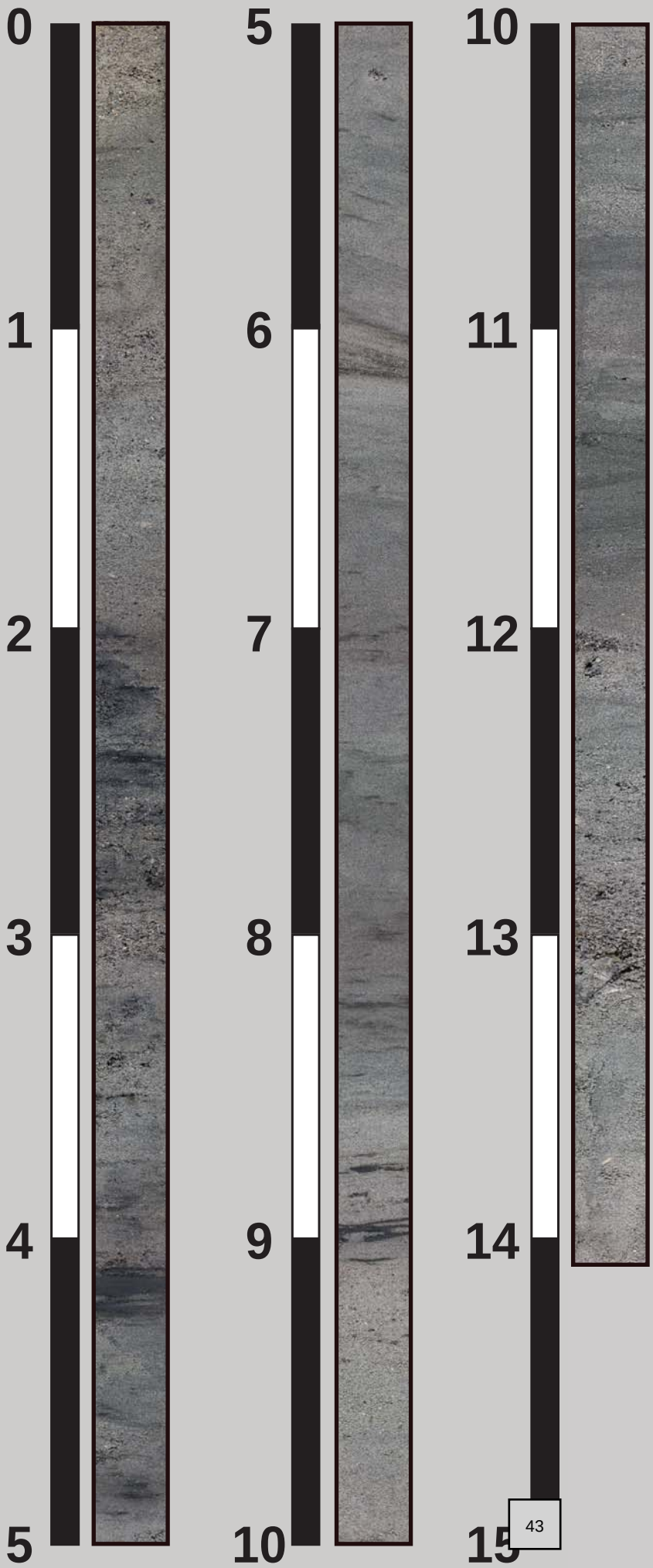
CLIENT	Moffatt & Nichol
PROJECT OWNER	Carteret County, North Carolina
SHEET	1 OF 1 SHEETS
1. PROJECT	Carteret County Sediment Project Carteret County, North Carolina
9. SIZE AND TYPE OF BIT	3.0 In.
10. COORDINATE SYSTEM/DATUM	NC State Plane / HORIZONTAL: NAD 1983 / VERTICAL: MLLW
2. BORING DESIGNATION	MC-01
LOCATION COORDINATES	X = 2,697,689 Y = 359,161
11. MANUFACTURER'S DESIGNATION OF DRILL	☐ AUTO HAMMER ☐ MANUAL HAMMER
3. DRILLING AGENCY	Athena Technologies, Inc.
CONTRACTOR FILE NO.	
12. TOTAL SAMPLES	DISTURBED: 1 / UNDISTURBED (UD):
4. NAME OF DRILLER	P. McClellan
13. TOTAL NUMBER CORE BOXES	
5. DIRECTION OF BORING	☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL	
BEARING	
14. WATER DEPTH	15.5 Ft.
15. DATE BORING	STARTED: 03-22-18 10:52 / COMPLETED: 03-22-18
6. THICKNESS OF OVERBURDEN	0.0 Ft.
16. ELEVATION TOP OF BORING	-12.5 Ft.
7. DEPTH DRILLED INTO ROCK	0.0 Ft.
17. TOTAL RECOVERY FOR BORING	7.6 Ft.
8. TOTAL DEPTH OF BORING	8.5 Ft.
18. SIGNATURE AND TITLE OF INSPECTOR	A. Freeze

ELEV. (ft)	SCALE (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-12.5	0.0					
-15.0	2.5		Fine quartz SAND, few fine to coarse sand-sized shell, trace inorganic silt in occasional burrow, poorly graded, loose, subrounded, gray (5Y-5/1), (SP).		C1	Sample #C1, Depth = 5.0' Mean (mm): 0.26, Phi Sorting: 0.97 Carbonate: 11.7%, Fines (#200) - 1.27 (SP)
-16.9	4.4		Fine quartz SAND, few fine to medium sand-sized shell, trace inorganic silt in burrows, trace coarse sand to fine gravel-sized shell (primarily in layer at 3.8'), poorly graded, loose, subrounded, gray (5Y-5/1), (SP).			
-17.5	5.0		Fine quartz SAND, little fine sand to coarse gravel-sized shell, trace inorganic silt in matrix, poorly graded, medium dense, subrounded, gray (5Y-5/1), (SP).			
-20.1	7.6		Fine quartz SAND, trace inorganic silt (primarily in laminations at 6.4-6.6'), trace fine to medium sand-sized shell, poorly graded, loose, subrounded, gray (5Y-6/1), (SP).			
			End of Boring			

0 5 10 15

FLORIDA DEP ROSS 2018-04-05 M&N CARERET COUNTY NC WORKING COPY JNW.GPJ FL DEP ROSS.GDT 4/16/18

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DE JUN 04



MC-02

Morgan Creek, Carteret County Navigation Project, North Carolina

Moffatt & Nichol, Inc.

Notes:
Scale in Feet
Photo Mosaic Image

ATHENA TECHNOLOGIES, INC.

Athena Technologies, Inc.
1293 Graham Farm Road
McClellanville, SC 29458
www.athenatechnologies.com
(843) 887-3800

Boring Designation MC-02

DRILLING LOG

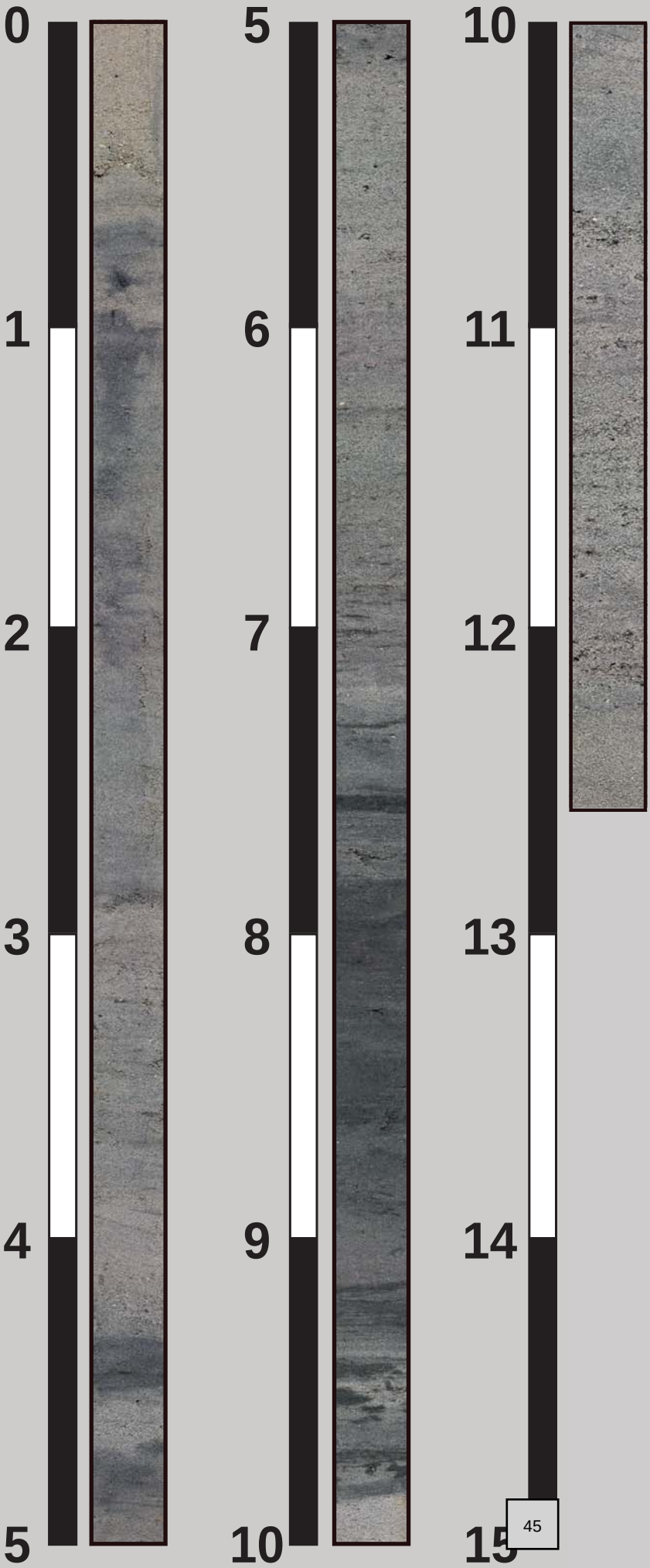
CLIENT	Moffatt & Nichol
PROJECT OWNER	Carteret County, North Carolina
SHEET	1 OF 1 SHEETS
1. PROJECT	Carteret County Sediment Project Carteret County, North Carolina
2. BORING DESIGNATION	MC-02
LOCATION COORDINATES	X = 2,697,647 Y = 359,401
3. DRILLING AGENCY	Athena Technologies, Inc.
CONTRACTOR FILE NO.	
4. NAME OF DRILLER	P. McClellan
5. DIRECTION OF BORING	☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL	
BEARING	
6. THICKNESS OF OVERBURDEN	0.0 Ft.
7. DEPTH DRILLED INTO ROCK	0.0 Ft.
8. TOTAL DEPTH OF BORING	15.0 Ft.
9. SIZE AND TYPE OF BIT	3.0 In.
10. COORDINATE SYSTEM/DATUM	NC State Plane
HORIZONTAL	NAD 1983
VERTICAL	MLLW
11. MANUFACTURER'S DESIGNATION OF DRILL	☐ AUTO HAMMER ☐ MANUAL HAMMER
12. TOTAL SAMPLES	1
DISTURBED	
UNDISTURBED (UD)	
13. TOTAL NUMBER CORE BOXES	
14. WATER DEPTH	7.1 Ft.
15. DATE BORING	STARTED 03-22-18 09:43
COMPLETED	03-22-18
16. ELEVATION TOP OF BORING	-4.6 Ft.
17. TOTAL RECOVERY FOR BORING	14.1 Ft.
18. SIGNATURE AND TITLE OF INSPECTOR	A. Freeze

ELEV. (ft)	SCALE (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-4.6	0.0					
			Fine to medium quartz SAND, few fine to coarse sand-sized shell, trace inorganic silt in burrows, poorly graded, loose, subrounded, gray (5Y 5/1) and, olive gray (5Y-5/2), (SP).			
-8.2	3.6					
			Fine quartz SAND, trace inorganic silt in burrows, laminations, and flaser beds, trace fine sand-sized shell, notable silt layer at 4.1-4.2', poorly graded, loose, subrounded, gray (5Y-5/1), (SP).		C2	Sample #C2, Depth = 12.9' Mean (mm): 0.21, Phi Sorting: 0.77 Carbonate: 7.6%, Fines (#200) - 2.52 (SP)
-13.7	9.1					
			Fine quartz SAND, trace fine to coarse sand-sized shell, trace inorganic silt (primarily in laminations between 10.2-10.3'), poorly graded, loose, subrounded, gray (5Y-6/1), (SP).			
-15.3	10.7					
			Fine quartz SAND, trace inorganic silt in laminations and burrows, trace fine to medium sand-sized shell, bidirectional bedding at 11.5', poorly graded, loose, subrounded, gray (5Y-5/1), (SP).			
-16.6	12.0					
			Fine to medium quartz SAND, little fine sand to coarse gravel-sized shell, trace coarse quartz sand, poorly graded, loose, subrounded, gray (5Y-6/1), (SP).			
-17.9	13.3					
			Fine quartz SAND, trace fine to coarse sand-sized shell, trace inorganic silt in matrix, poorly graded, loose, subrounded, gray (5Y-6/1), (SP).			
-18.7	14.1					
			End of Boring			

0 5 10 15

FLORIDA DEP ROSS 2018-04-05 M&N CARERET COUNTY NC WORKING COPY JNW.GPJ FL DEP ROSS.GDT 4/16/18

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DE JUN 04



MC-03

Morgan Creek, Carteret County Navigation Project, North Carolina

Moffatt & Nichol, Inc.

Notes:
Scale in Feet
Photo Mosaic Image

ATHENA TECHNOLOGIES, INC.

Athena Technologies, Inc.
1293 Graham Farm Road
McClellanville, SC 29458
www.athenatechnologies.com
(843) 887-3800

Boring Designation MC-03

DRILLING LOG	CLIENT	PROJECT OWNER	SHEET 1 OF 1 SHEETS
	Moffatt & Nichol	Carteret County, North Carolina	

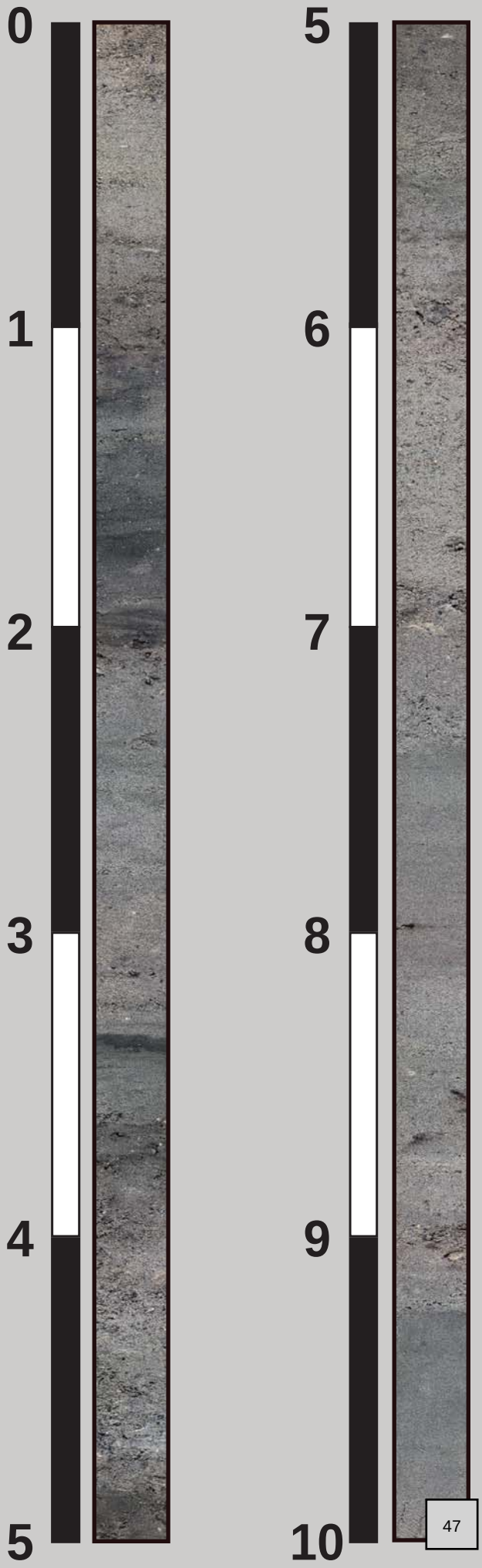
1. PROJECT: Carteret County Sediment Project, Carteret County, North Carolina		9. SIZE AND TYPE OF BIT: 3.0 In.	
		10. COORDINATE SYSTEM/DATUM: NC State Plane	HORIZONTAL: NAD 1983 / VERTICAL: MLLW
2. BORING DESIGNATION: MC-03	LOCATION COORDINATES: X = 2,697,654 Y = 359,656	11. MANUFACTURER'S DESIGNATION OF DRILL	☐ AUTO HAMMER ☐ MANUAL HAMMER
3. DRILLING AGENCY: Athena Technologies, Inc.	CONTRACTOR FILE NO.	12. TOTAL SAMPLES	DISTURBED: 1 / UNDISTURBED (UD):
4. NAME OF DRILLER: P. McClellan		13. TOTAL NUMBER CORE BOXES	
5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED	DEG. FROM VERTICAL:	BEARING:	14. WATER DEPTH: 10.7 Ft.
		15. DATE BORING	STARTED: 03-22-18 11:17 / COMPLETED: 03-22-18
6. THICKNESS OF OVERBURDEN: 0.0 Ft.		16. ELEVATION TOP OF BORING: -7.4 Ft.	
7. DEPTH DRILLED INTO ROCK: 0.0 Ft.		17. TOTAL RECOVERY FOR BORING: 12.6 Ft.	
8. TOTAL DEPTH OF BORING: 14.0 Ft.		18. SIGNATURE AND TITLE OF INSPECTOR: A. Freeze	

ELEV. (ft)	SCALE (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-7.4	0.0					
			Fine quartz SAND, trace fine to coarse sand-sized shell, trace inorganic silt in burrows, lamination, and flaser beds, organic silt rip-up at 3.2', number of burrows increases with depth, poorly graded, loose, subrounded, gray (5Y-5/1), (SP).		C1	Sample #C1, Depth = 10.1' Mean (mm): 0.19, Phi Sorting: 0.59 Carbonate: 4.7%, Fines (#200) - 2.78 (SP)
-14.9	7.5					
			Fine quartz SAND, few inorganic silt in matrix, laminations, and burrows, trace fine sand-sized shell, heavily bioturbated, poorly graded, loose, subrounded, dark gray (5Y-4/1), (SP-SM).			
-17.2	9.8					
			Fine to medium quartz SAND, few fine to coarse sand-sized shell, poorly graded, loose, subrounded, gray (5Y-6/1), (SP).			
-20.0	12.6					
			End of Boring			

0 5 10 15

FLORIDA DEP ROSS 2018-04-05 M&N CARERET COUNTY NC WORKING COPY JNW.GPJ FL DEP ROSS.GDT 4/16/18

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DE JUN 04



MC-04

Morgan Creek, Carteret County Navigation Project, North Carolina

Moffatt & Nichol, Inc.

Notes:
Scale in Feet
Photo Mosaic Image

ATHENA TECHNOLOGIES, INC.

Athena Technologies, Inc.
1293 Graham Farm Road
McClellanville, SC 29458
www.athenatechnologies.com
(843) 887-3800

Boring Designation MC-04

DRILLING LOG

CLIENT	Moffatt & Nichol
PROJECT OWNER	Carteret County, North Carolina
SHEET	1 OF 1 SHEETS
1. PROJECT	Carteret County Sediment Project Carteret County, North Carolina
9. SIZE AND TYPE OF BIT	3.0 In.
10. COORDINATE SYSTEM/DATUM	NC State Plane / HORIZONTAL: NAD 1983 / VERTICAL: MLLW
2. BORING DESIGNATION	MC-04
LOCATION COORDINATES	X = 2,697,874 Y = 359,238
11. MANUFACTURER'S DESIGNATION OF DRILL	☐ AUTO HAMMER ☐ MANUAL HAMMER
3. DRILLING AGENCY	Athena Technologies, Inc.
CONTRACTOR FILE NO.	
12. TOTAL SAMPLES	DISTURBED: 1 / UNDISTURBED (UD):
4. NAME OF DRILLER	P. McClellan
13. TOTAL NUMBER CORE BOXES	
5. DIRECTION OF BORING	☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL	
BEARING	
14. WATER DEPTH	10.2 Ft.
15. DATE BORING	STARTED: 03-22-18 08:11 / COMPLETED: 03-22-18
6. THICKNESS OF OVERBURDEN	0.0 Ft.
16. ELEVATION TOP OF BORING	-8.9 Ft.
7. DEPTH DRILLED INTO ROCK	0.0 Ft.
17. TOTAL RECOVERY FOR BORING	10 Ft.
8. TOTAL DEPTH OF BORING	11.0 Ft.
18. SIGNATURE AND TITLE OF INSPECTOR	A. Freeze

ELEV. (ft)	SCALE (ft)	LEGEND	CLASSIFICATION OF MATERIALS Depths and elevations based on measured values	% REC.	BOX OR SAMPLE	REMARKS
-8.9	0.0					
-9.7	0.8		Fine quartz SAND, few fine to coarse sand-sized shell, poorly graded, loose, subrounded, light olive gray (5Y-6/2), (SP).			
-10.9	2.0		Fine quartz SAND, trace inorganic silt in burrows, laminations, and matrix, trace fine to coarse sand-sized shell, poorly graded, loose, subrounded, dark gray (5Y 4/1) and, gray (5Y-5/1), (SP).			
-12.1	3.2		Fine quartz SAND, trace fine sand to fine gravel-sized shell, trace inorganic silt in occasional burrow, poorly graded, loose, subrounded, gray (5Y-6/1), (SP).			
-12.6	3.7		Fine quartz SAND, trace inorganic silt in laminations, trace fine sand-sized shell, poorly graded, loose, subrounded, gray (5Y-5/1), (SP).			
-13.6	4.7		Fine quartz SAND, little fine sand to coarse gravel-sized shell, trace inorganic silt in matrix, trace coarse quartz sand, poorly graded, medium dense, subrounded, gray (5Y-5/1), (SP).		C2	Sample #C2, Depth = 8.6' Mean (mm): 0.26, Phi Sorting: 1.17 Carbonate: 12.1%, Fines (#200) - 2.02 (SP)
-14.8	5.9		Fine quartz SAND, few inorganic sailt in matrix and burrows, trace fine sand to fine gravel-sized shell, poorly graded, loose, subrounded, silt content decreases with depth, color grades to gray (5Y 5/1) from, dark olive gray (5Y-3/2), (SP-SM).			
-16.3	7.4		Fine quartz SAND, few fine sand to coarse gravel-sized shell, poorly graded, loose, subrounded, gray (5Y-6/1), (SP).			
-18.9	10.0		Fine quartz SAND, trace fine to coarse sand-sized shell, trace inorganc silt in occassional burrow, organic silt rip-ups at 8.0',8.6', and 9.0', poorly graded, loose, subrounded, gray (5Y-6/1), (SP).			
			End of Boring			

0 5 10 15

FLORIDA DEP ROSS 2018-04-05 M&N CARERET COUNTY NC WORKING COPY JNW.GPJ FL DEP ROSS.GDT 4/16/18

SAJ FORM 1836 JUN 02 MODIFIED FOR THE FLORIDA DE JUN 04

Appendix B:
Laboratory Analytical Reports – Physical Analyses

1293 Graham Farm Road, PO Box 68
McClellanville, South Carolina 29458
(843) 887-3800
www.athenatechnologies.com

Terracon
Consulting Engineers & Scientists

Carbonate Content Data

Project Name: Carteret County Navigation Project
Project Number: EQ185047
Date: 4/11/2018

Station No.	Sample No.	Depth Range, Feet	Tare No.	Beaker No.	Dry Sample Wt.		Percent Carbonate
					Before	After	
BHC-01-0318-C2	BHC-01	0-7.6	486	5	103.63	96.25	7.1
BHC-02-0318-C2	BHC-02	0-6	470	2	90.76	87.23	3.9
BHC-03-0318-C2	BHC-03	0-6.3	10	12	117.42	112.90	3.8
MC-01-0318-C1	MC-01	0-5	438	10	116.62	103.00	11.7
MC-02-0318-C2	MC-02	0-12.9	219	16	120.08	110.91	7.6
MC-03-0318-C1	MC-03	0-10.1	290	1	119.73	114.13	4.7
MC-04-0318-C2	MC-04	0-8.6	218	13	112.09	98.58	12.1

Tested By: CRM Sr.

Reviewed By: TES

Terracon
9655 Florida Mining Boulevard West
Jacksonville, Florida 32257
(904) 900-6494 (Tel) · (904) 268-5255 (Fax)

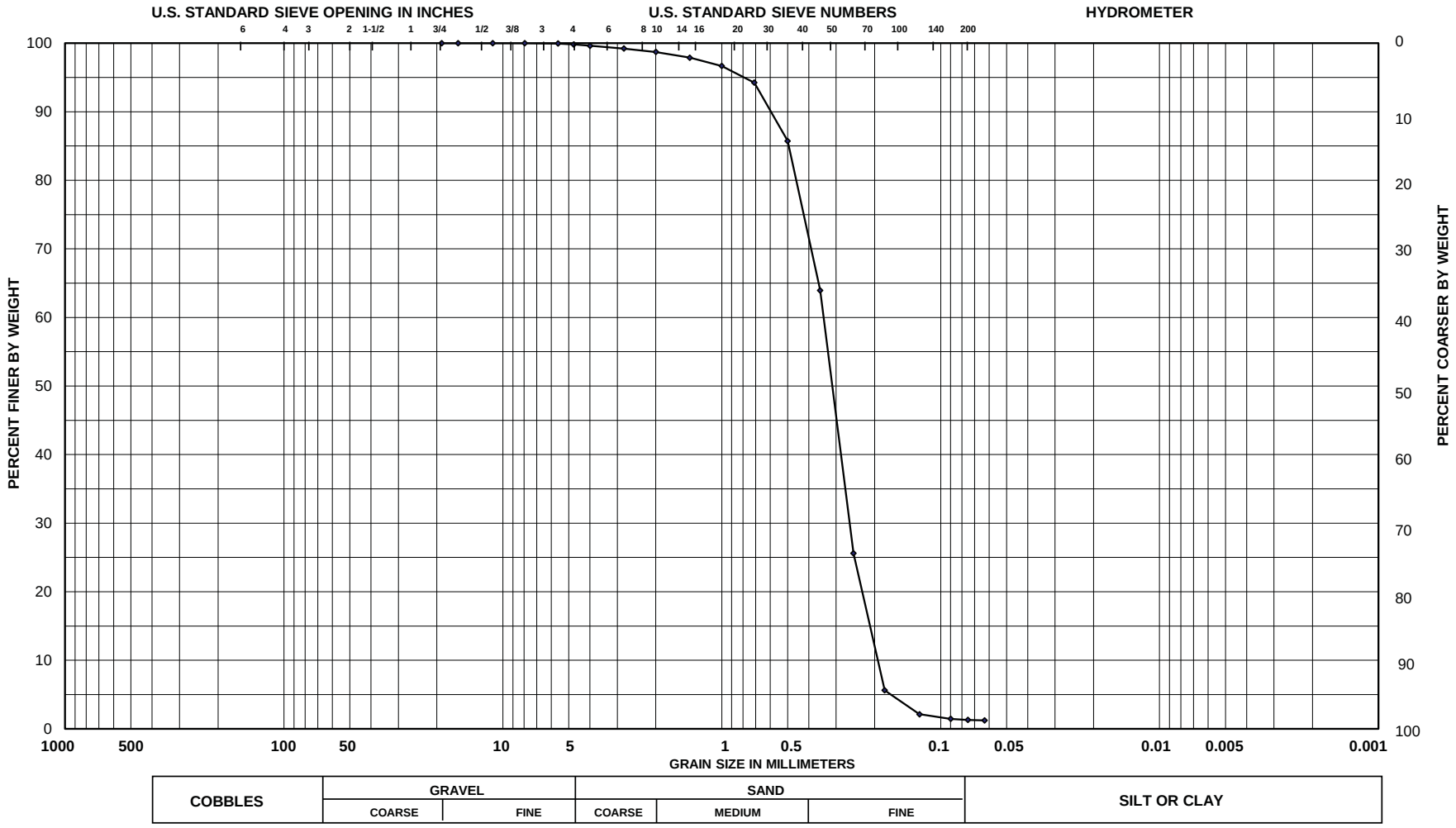
VISUAL SHELL CONTENT

GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	**Carteret County Navigation Project**	**Depth:**	**0-7.6**
Project No.:	**EQ185047**	**Date:**	**4/13/2018**
Boring No.:	**BHC-01-0318-C2**		
Sample No.:	**BHC-01**		
Description:	**SAND, poorly-graded, mostly medium to fine-grained quartz, little coarse to fine sand-sized shell fragments, trace silt (SP) 5Y 5/1**		

Tare Weight, (g):	51.80	
Dry Wt. Before Washing (g):	208.76	(with tare)
Dry Weight After Washing (g):		(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
5/8"	16.000	0.00	100.00	0	0.00
7/16	11.112	0.00	100.00	0	0.00
5/16	7.938	0.00	100.00	0	0.00
#3.5	5.600	0.09	99.94	100	0.09
#4	4.750	0.20	99.82	100	0.20
#5	4.000	0.31	99.62	100	0.31
#7	2.800	0.62	99.22	100	0.62
#10	2.000	0.81	98.71	100	0.81
#14	1.400	1.28	97.89	100	1.28
#18	1.000	1.93	96.66	90	1.74
#25	0.710	3.79	94.25	70	2.65
#35	0.500	13.37	85.73	40	5.35
#45	0.355	34.20	63.94	20	6.84
#60	0.250	60.18	25.60	5	3.01
#80	0.180	31.35	5.63	0	0.00
#120	0.125	5.49	2.13	0	0.00
#170	0.090	1.04	1.47	0	0.00
#200	0.075	0.25	1.31	0	0.00
#230	0.063	0.12	1.23	0	0.00
Total Shell Content:		**15**		**%**	



Sample No.	Elev. Or Depth	Classification	% CO_3	G_s	Shell	LL	PL	PI
◆ BHC-01	0-7.6	SAND, poorly-graded, mostly medium to fine-grained quartz, little coarse to fine sand-sized shell fragments, trace silt (SP) 5Y 5/1	7.1		15			

Project Carteret County Navigation Project

Area

Boring No. BHC-01-0318-C2

Date 4/13/2018

GRADATION CURVES

ENG FORM 2087
MAY 63

** The USC classification is based on laboratory grain size distribution and visual classification*

Terracon
9655 Florida Mining Boulevard West
Jacksonville, Florida 32257
(904) 900-6494 (Tel) · (904) 268-5255 (Fax)

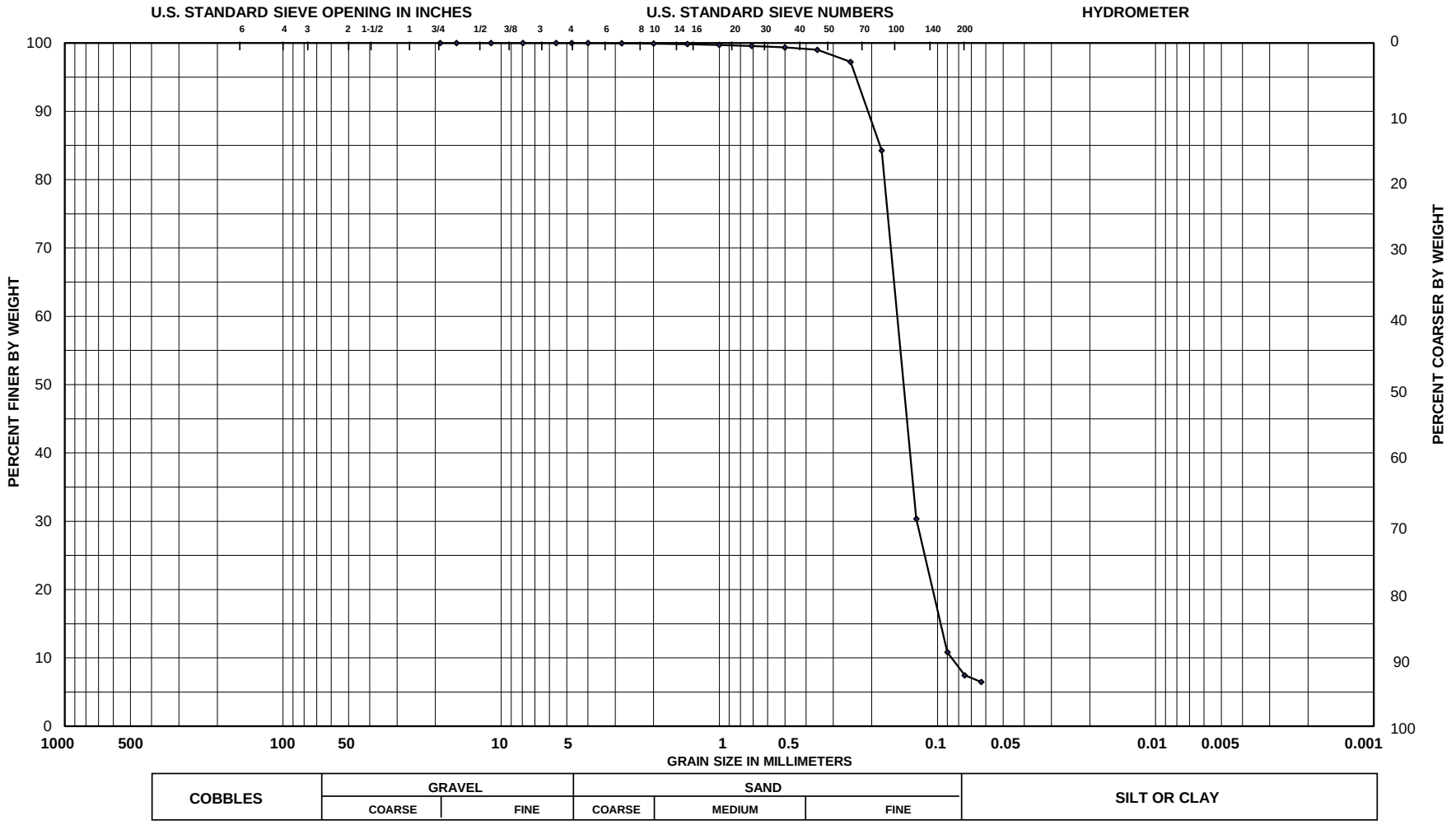
VISUAL SHELL CONTENT

GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	**Carteret County Navigation Project**	**Depth:**	**0-6.0**
Project No.:	**EQ185047**	**Date:**	**4/13/2018**
Boring No.:	**BHC-02-0318-C2**		
Sample No.:	**BHC-02**		
Description:	**SAND, poorly-graded with silt, mostly fine-grained quartz, few silt, few medium to fine sand-size shell fragments (SP-SM) 5Y 5/1**		

Tare Weight, (g):	51.05	
Dry Wt. Before Washing (g):	171.13	(with tare)
Dry Weight After Washing (g):		(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
5/8"	16.000	0.00	100.00	0	0.00
7/16	11.112	0.00	100.00	0	0.00
5/16	7.938	0.00	100.00	0	0.00
#3.5	5.600	0.00	100.00	0	0.00
#4	4.750	0.00	100.00	0	0.00
#5	4.000	0.02	99.98	0	0.00
#7	2.800	0.02	99.97	0	0.00
#10	2.000	0.07	99.91	10	0.01
#14	1.400	0.09	99.83	10	0.01
#18	1.000	0.13	99.73	20	0.03
#25	0.710	0.20	99.56	40	0.08
#35	0.500	0.24	99.36	60	0.14
#45	0.355	0.43	99.00	80	0.34
#60	0.250	2.12	97.24	70	1.48
#80	0.180	15.57	84.27	40	6.23
#120	0.125	64.73	30.36	0	0.00
#170	0.090	23.45	10.83	0	0.00
#200	0.075	4.07	7.45	0	0.00
#230	0.063	1.17	6.47	0	0.00
Total Shell Content:		**7**		**%**	



Sample No.	Elev. Or Depth	Classification	% CO_3	G_s	Shell	LL	PL	PI
◆ BHC-02	0-6.0	SAND, poorly-graded with silt, mostly fine-grained quartz, few silt, few medium to fine sand-size shell fragments (SP-SM) 5Y 5/1	3.9		7			

Project Carteret County Navigation Project

Area

Boring No. BHC-02-0318-C2

Date 4/13/2018

GRADATION CURVES

ENG FORM 2087
MAY 63

** The USC classification is based on laboratory grain size distribution and visual classification*

Terracon
9655 Florida Mining Boulevard West
Jacksonville, Florida 32257
(904) 900-6494 (Tel) · (904) 268-5255 (Fax)

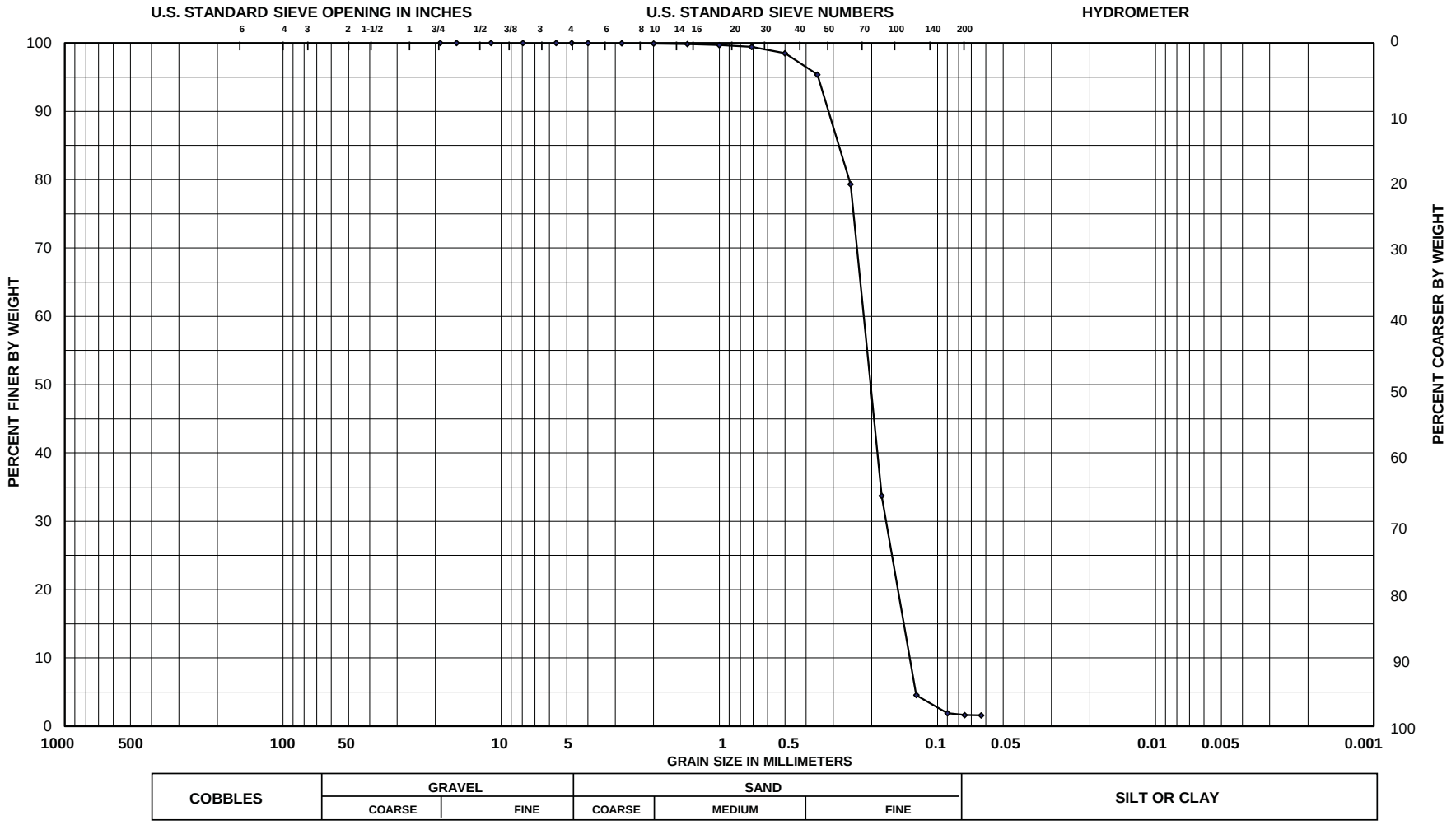
VISUAL SHELL CONTENT

GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	**Carteret County Navigation Project**	**Depth:**	**0-6.3**
Project No.:	**EQ185047**	**Date:**	**4/13/2018**
Boring No.:	**BHC-03-0318-C2**		
Sample No.:	**BHC-03**		
Description:	**SAND, poorly-graded, mostly medium to fine-grained quartz, trace medium to fine sand-sized shell fragments, trace silt (SP) 5Y 7/2**		

Tare Weight, (g):	51.43	
Dry Wt. Before Washing (g):	195.59	(with tare)
Dry Weight After Washing (g):		(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
5/8"	16.000	0.00	100.00	0	0.00
7/16	11.112	0.00	100.00	0	0.00
5/16	7.938	0.00	100.00	0	0.00
#3.5	5.600	0.00	100.00	0	0.00
#4	4.750	0.00	100.00	0	0.00
#5	4.000	0.00	100.00	0	0.00
#7	2.800	0.06	99.96	100	0.06
#10	2.000	0.07	99.91	90	0.06
#14	1.400	0.08	99.85	70	0.06
#18	1.000	0.23	99.69	60	0.14
#25	0.710	0.38	99.43	50	0.19
#35	0.500	1.35	98.49	30	0.41
#45	0.355	4.49	95.38	20	0.90
#60	0.250	23.17	79.31	15	3.48
#80	0.180	65.75	33.70	0	0.00
#120	0.125	42.02	4.55	0	0.00
#170	0.090	3.83	1.89	0	0.00
#200	0.075	0.39	1.62	0	0.00
#230	0.063	0.05	1.59	0	0.00
Total Shell Content:		**4**		**%**	



Sample No.	Elev. Or Depth	Classification	% CO_3	G_s	Shell	LL	PL	PI
◆ BHC-03	0-6.3	SAND, poorly-graded, mostly medium to fine-grained quartz, trace medium to fine sand-sized shell fragments, trace silt (SP) 5Y 7/2	3.8		4			

Project Carteret County Navigation Project

Area

Boring No. BHC-03-0318-C2

Date 4/13/2018

GRADATION CURVES

ENG FORM 2087
MAY 63

** The USC classification is based on laboratory grain size distribution and visual classification*

Terracon
9655 Florida Mining Boulevard West
Jacksonville, Florida 32257
(904) 900-6494 (Tel) · (904) 268-5255 (Fax)

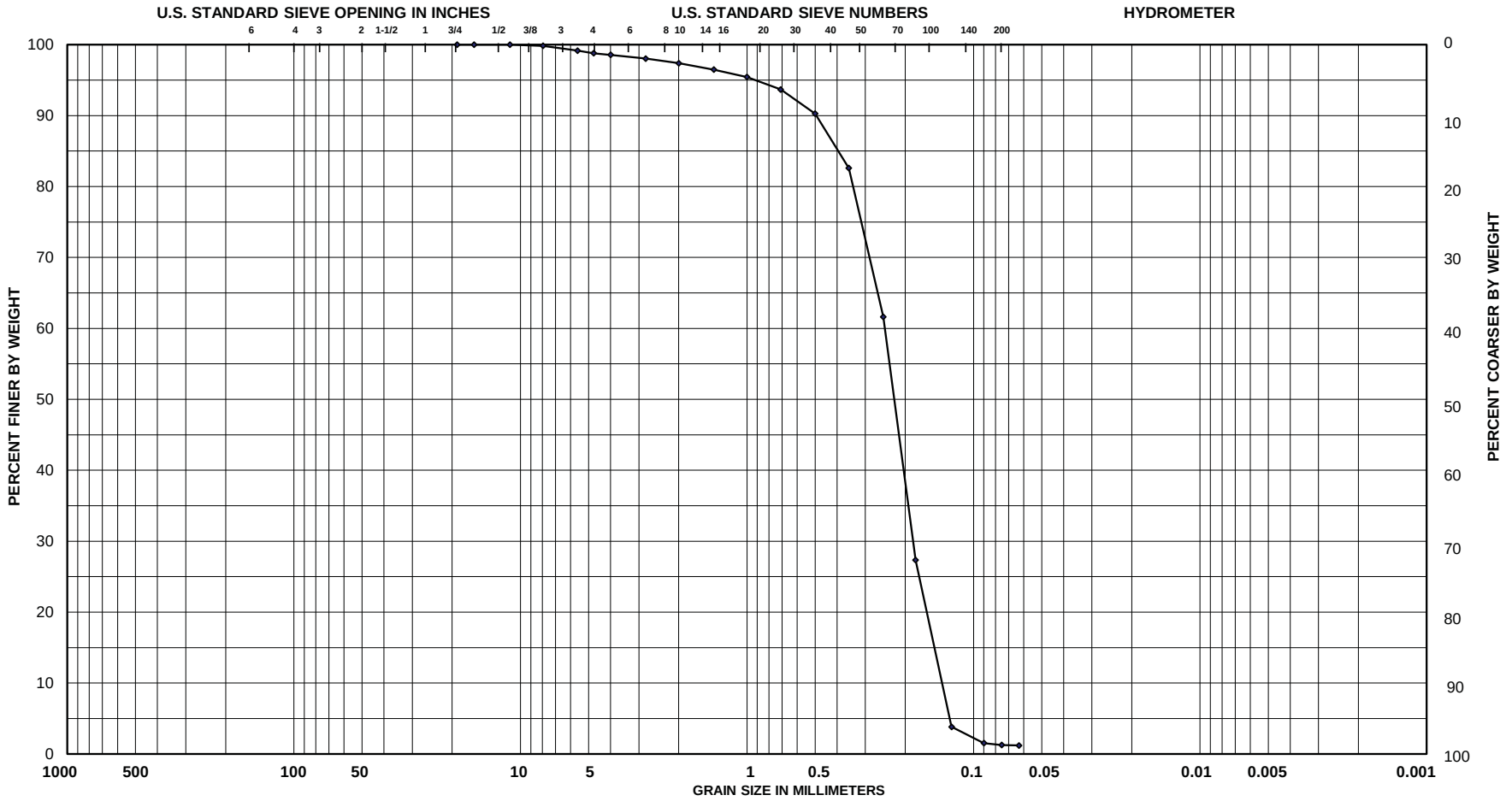
VISUAL SHELL CONTENT

GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	**Carteret County Navigation Project**	**Depth:**	**0-5**
Project No.:	**EQ185047**	**Date:**	**4/13/2018**
Boring No.:	**MC-01-0318-C1**		
Sample No.:	**MC-01**		
Description:	**SAND, poorly-graded, mostly medium to fine-grained quartz, few coarse to fine sand-sized shell fragments, trace silt, trace fine gravel-**		

Tare Weight, (g):	51.48	
Dry Wt. Before Washing (g):	211.07	(with tare)
Dry Weight After Washing (g):		(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
5/8"	16.000	0.00	100.00	0	0.00
7/16	11.112	0.00	100.00	0	0.00
5/16	7.938	0.26	99.84	100	0.26
#3.5	5.600	1.08	99.16	100	1.08
#4	4.750	0.59	98.79	80	0.47
#5	4.000	0.37	98.56	90	0.33
#7	2.800	0.83	98.04	90	0.75
#10	2.000	1.05	97.38	80	0.84
#14	1.400	1.44	96.48	70	1.01
#18	1.000	1.67	95.43	60	1.00
#25	0.710	2.80	93.68	60	1.68
#35	0.500	5.45	90.26	40	2.18
#45	0.355	12.25	82.59	20	2.45
#60	0.250	33.48	61.61	5	1.67
#80	0.180	54.71	27.33	0	0.00
#120	0.125	37.51	3.82	0	0.00
#170	0.090	3.65	1.54	0	0.00
#200	0.075	0.42	1.27	0	0.00
#230	0.063	0.10	1.21	0	0.00
Total Shell Content:		**9**		**%**	



Sample No.	Elev. Or Depth	Classification	% CO_3	G_s	Shell	LL	PL	PI
◆ MC-01	0-5	SAND, poorly-graded, mostly medium to fine-grained quartz, few coarse to fine sand-sized shell fragments, trace silt, trace fine gravel-size shell fragments (SP) 5Y 6/1	11.7		9			

Project Carteret County Navigation Project

Area

Boring No. MC-01-0318-C1

Date 4/13/2018

GRADATION CURVES

ENG FORM 2087
MAY 63

** The USC classification is based on laboratory grain size distribution and visual classification*

Terracon
9655 Florida Mining Boulevard West
Jacksonville, Florida 32257
(904) 900-6494 (Tel) · (904) 268-5255 (Fax)

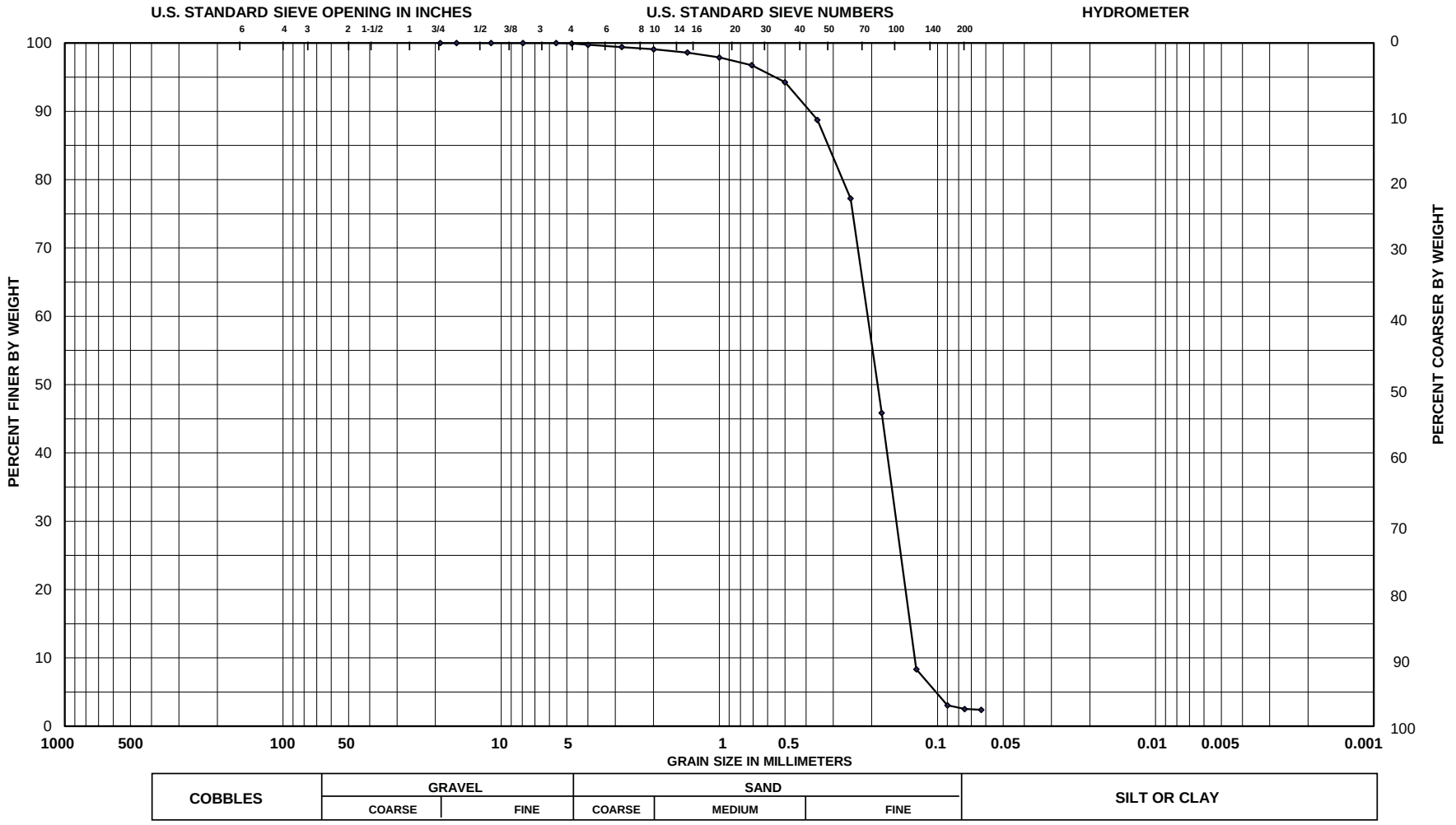
VISUAL SHELL CONTENT

GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	**Carteret County Navigation Project**	**Depth:**	**0-12.9**
Project No.:	**EQ185047**	**Date:**	**4/13/2018**
Boring No.:	**MC-02-0318-C2**		
Sample No.:	**MC-02**		
Description:	**SAND, poorly-graded, mostly medium to fine-grained quartz, few coarse to fine sand-sized shell fragments, trace silt, (SP) 5Y 5/1**		

Tare Weight, (g):	49.43	
Dry Wt. Before Washing (g):	193.43	(with tare)
Dry Weight After Washing (g):		(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
5/8"	16.000	0.00	100.00	0	0.00
7/16	11.112	0.00	100.00	0	0.00
5/16	7.938	0.00	100.00	0	0.00
#3.5	5.600	0.00	100.00	0	0.00
#4	4.750	0.11	99.92	100	0.11
#5	4.000	0.27	99.74	100	0.27
#7	2.800	0.46	99.42	100	0.46
#10	2.000	0.48	99.08	80	0.38
#14	1.400	0.70	98.60	60	0.42
#18	1.000	1.02	97.89	45	0.46
#25	0.710	1.64	96.75	40	0.66
#35	0.500	3.59	94.26	30	1.08
#45	0.355	7.95	88.74	30	2.39
#60	0.250	16.56	77.24	15	2.48
#80	0.180	45.17	45.87	1	0.45
#120	0.125	54.04	8.34	0	0.00
#170	0.090	7.62	3.05	0	0.00
#200	0.075	0.76	2.52	0	0.00
#230	0.063	0.18	2.40	0	0.00
Total Shell Content:		**6**		**%**	



Sample No.	Elev. Or Depth	Classification	% CO_3	G_s	Shell	LL	PL	PI
◆ MC-02	0-12.9	SAND, poorly-graded, mostly medium to fine-grained quartz, few coarse to fine sand-sized shell fragments, trace silt, (SP) 5Y 5/1	7.6		6			

Project Carteret County Navigation Project

Area

Boring No. MC-02-0318-C2

Date 4/13/2018

GRADATION CURVES

ENG FORM 2087
MAY 63

** The USC classification is based on laboratory grain size distribution and visual classification*

Terracon
9655 Florida Mining Boulevard West
Jacksonville, Florida 32257
(904) 900-6494 (Tel) · (904) 268-5255 (Fax)

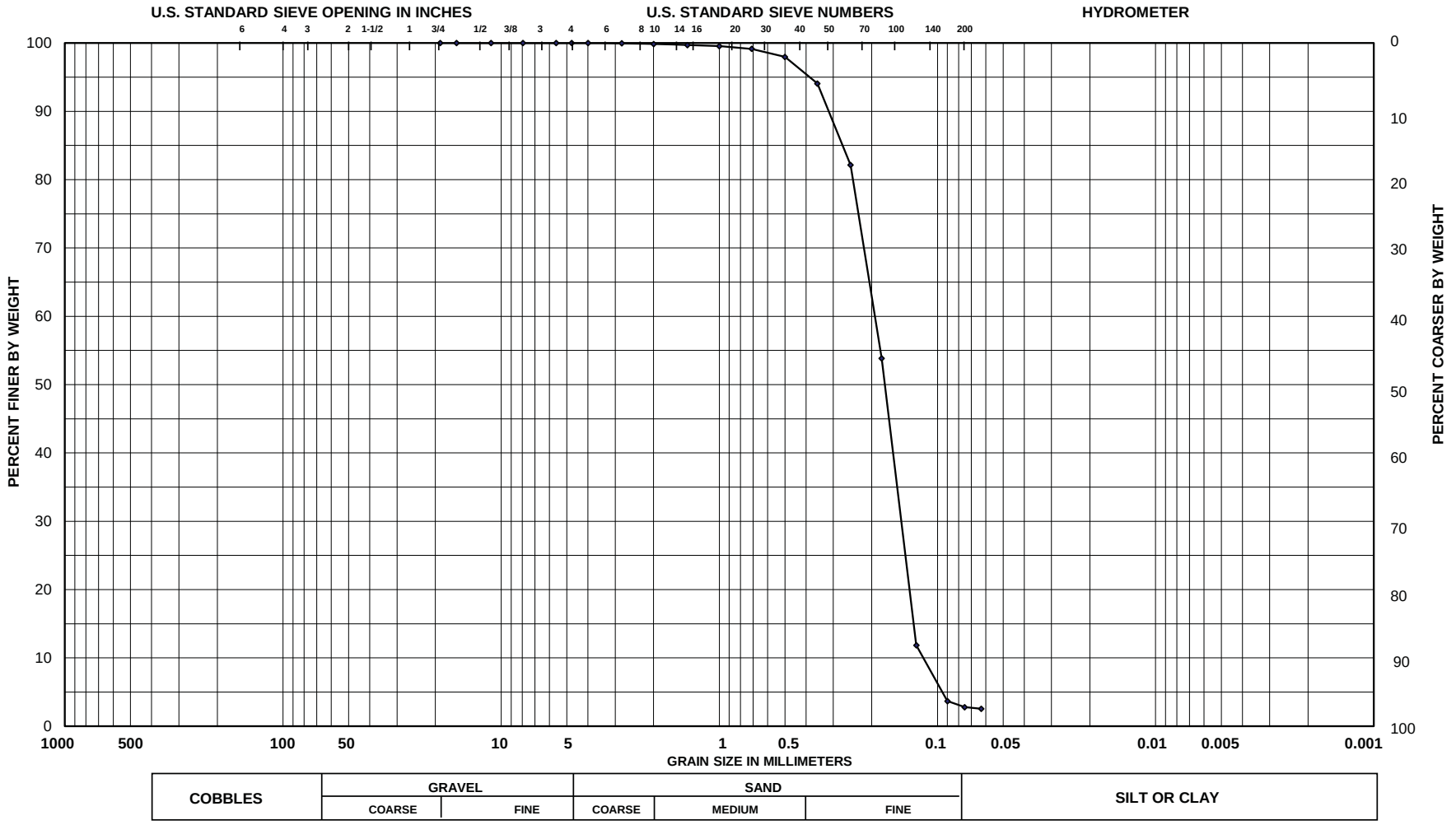
VISUAL SHELL CONTENT

GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	**Carteret County Navigation Project**	**Depth:**	**0-10.1**
Project No.:	**EQ185047**	**Date:**	**4/13/2018**
Boring No.:	**MC-03-0318-C1**		
Sample No.:	**MC-03**		
Description:	**SAND, poorly-graded, mostly medium to fine-grained quartz, trace medium to fine sand-sized shell fragments, trace silt (SP) 5Y 6/1**		

Tare Weight, (g):	51.27	
Dry Wt. Before Washing (g):	213.92	(with tare)
Dry Weight After Washing (g):		(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
5/8"	16.000	0.00	100.00	0	0.00
7/16	11.112	0.00	100.00	0	0.00
5/16	7.938	0.00	100.00	0	0.00
#3.5	5.600	0.00	100.00	0	0.00
#4	4.750	0.02	99.99	100	0.02
#5	4.000	0.00	99.99	0	0.00
#7	2.800	0.04	99.96	100	0.04
#10	2.000	0.19	99.85	90	0.17
#14	1.400	0.23	99.70	70	0.16
#18	1.000	0.27	99.54	60	0.16
#25	0.710	0.66	99.13	50	0.33
#35	0.500	1.90	97.96	40	0.76
#45	0.355	6.33	94.07	20	1.27
#60	0.250	19.43	82.13	5	0.97
#80	0.180	46.03	53.83	0	0.00
#120	0.125	68.27	11.85	0	0.00
#170	0.090	13.30	3.68	0	0.00
#200	0.075	1.46	2.78	0	0.00
#230	0.063	0.37	2.55	0	0.00
Total Shell Content:		**2**		**%**	



Sample No.	Elev. Or Depth	Classification	% CO_3	G_s	Shell	LL	PL	PI
◆ MC-03	0-10.1	SAND, poorly-graded, mostly medium to fine-grained quartz, trace medium to fine sand-sized shell fragments, trace silt (SP) 5Y 6/1	4.7		2			

Project Carteret County Navigation Project

Area

Boring No. MC-03-0318-C1

Date 4/13/2018

GRADATION CURVES

ENG FORM 2087
MAY 63

** The USC classification is based on laboratory grain size distribution and visual classification*

Terracon
9655 Florida Mining Boulevard West
Jacksonville, Florida 32257
(904) 900-6494 (Tel) · (904) 268-5255 (Fax)

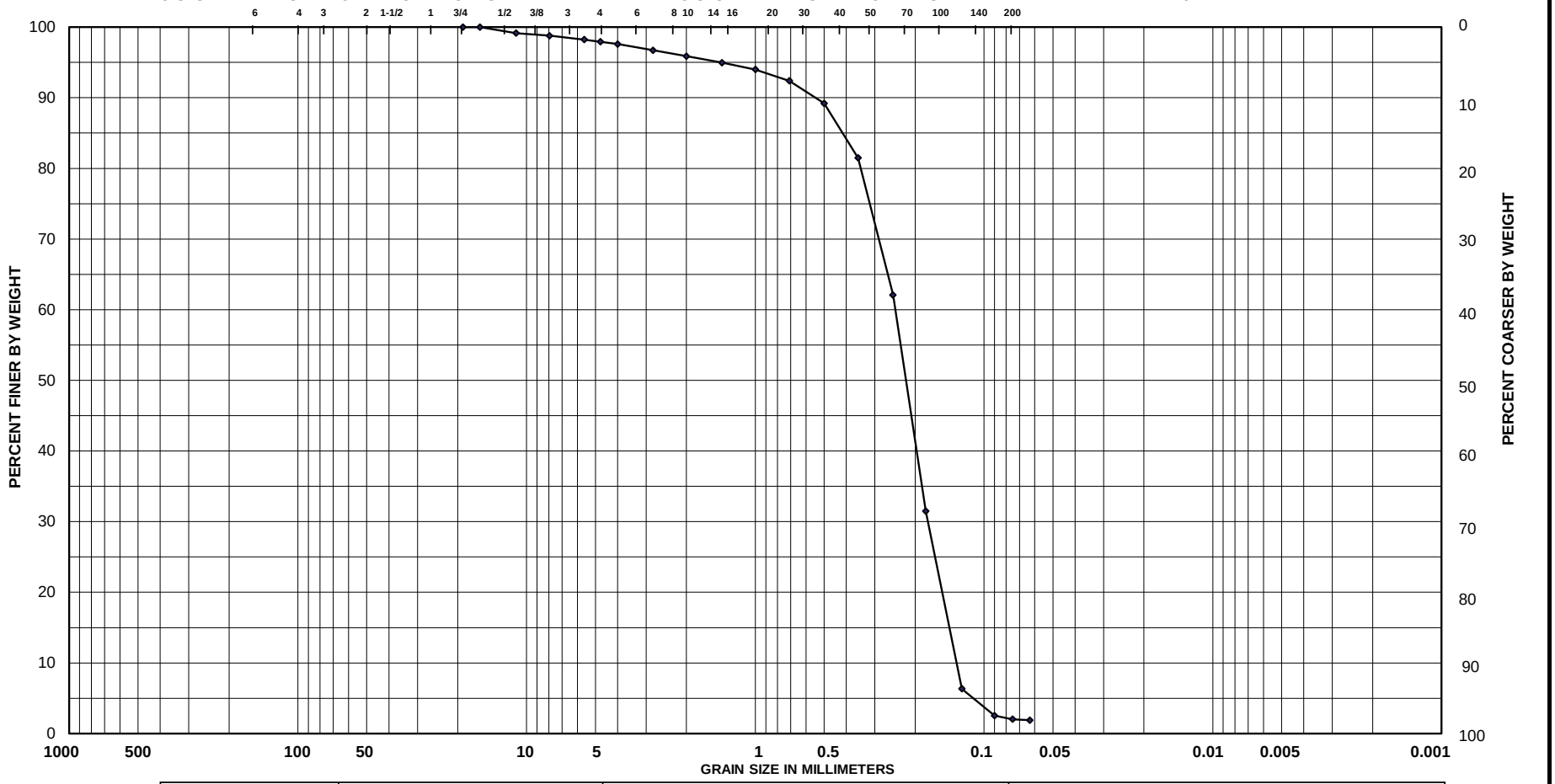
VISUAL SHELL CONTENT

GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	**Carteret County Navigation Project**	**Depth:**	**0-8.6**
Project No.:	**EQ185047**	**Date:**	**4/13/2018**
Boring No.:	**MC-04-0318-C1**		
Sample No.:	**MC-04**		
Description:	**SAND, poorly-graded, mostly medium to fine-grained quartz, few coarse to fine sand-sized shell fragments, trace silt, trace fine gravel-**		

Tare Weight, (g):	49.81	
Dry Wt. Before Washing (g):	198.60	(with tare)
Dry Weight After Washing (g):		(with tare)

Sieve Size (Name)	Sieve Size (mm)	Weight Retained (g)	% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
5/8"	16.000	0.00	100.00	0	0.00
7/16	11.112	1.29	99.13	100	1.29
5/16	7.938	0.53	98.78	100	0.53
#3.5	5.600	0.82	98.23	100	0.82
#4	4.750	0.46	97.92	100	0.46
#5	4.000	0.48	97.59	100	0.48
#7	2.800	1.31	96.71	80	1.05
#10	2.000	1.24	95.88	80	0.99
#14	1.400	1.35	94.97	60	0.81
#18	1.000	1.47	93.98	50	0.74
#25	0.710	2.38	92.39	40	0.95
#35	0.500	4.72	89.21	25	1.18
#45	0.355	11.50	81.48	10	1.15
#60	0.250	28.87	62.08	1	0.29
#80	0.180	45.53	31.48	0	0.00
#120	0.125	37.41	6.34	0	0.00
#170	0.090	5.65	2.54	0	0.00
#200	0.075	0.77	2.02	0	0.00
#230	0.063	0.18	1.90	0	0.00
Total Shell Content:		**7**		**%**	



Sample No.	Elev. Or Depth	Classification	% CO_3	G_s	Shell	LL	PL	PI
◆ MC-04	0-8.6	SAND, poorly-graded, mostly medium to fine-grained quartz, few coarse to fine sand-sized shell fragments, trace silt, trace fine gravel-size shell fragments (SP) 5Y 6/1	12.1		7			

Project Carteret County Navigation Project

Area

Boring No. MC-04-0318-C1

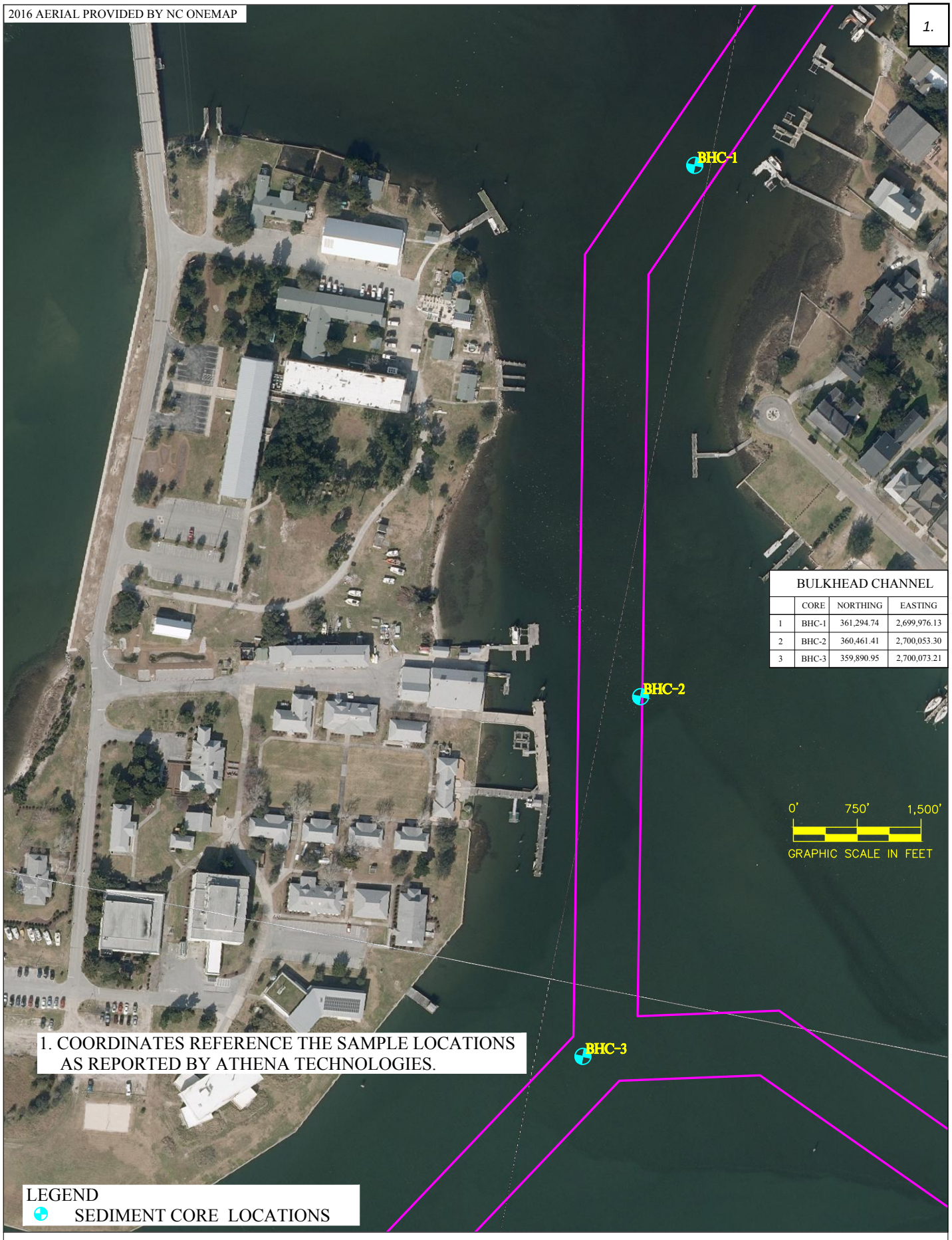
Date 4/13/2018

GRADATION CURVES

** The USC classification is based on laboratory grain size distribution and visual classification*

ENG FORM 2087

MAY 63



BULKHEAD CHANNEL

	CORE	NORTHING	EASTING
1	BHC-1	361,294.74	2,699,976.13
2	BHC-2	360,461.41	2,700,053.30
3	BHC-3	359,890.95	2,700,073.21

CARTERET COUNTY
NAVIGATION PROJECT
BULK D CHANNEL
LO ON MAP

2016 AERIAL PROVIDED BY NC ONEMAP

MORGAN CREEK			
	CORE	NORTHING	EASTING
1	MC-1	359,160.59	2,697,688.94
2	MC-2	359,401.03	2,697,647.45
3	MC-3	359,655.53	2,697,654.27
4	MC-4	359,238.35	2,697,874.49

1. COORDINATES REFERENCE THE SAMPLE LOCATIONS AS REPORTED BY ATHENA TECHNOLOGIES.

LEGEND

PRIORITY CORE LOCATIONS

CARTERET COUNTY
NAVIGATION PROJECT
MC N CREEK
LO ON MAP

ATTACHMENT 2 TO GEOTECHNICAL APPENDIX

USACE BORINGS & LAB DATA

BULKHEAD CHANNEL VICINITY

Hole No. MHC-06-29

1.

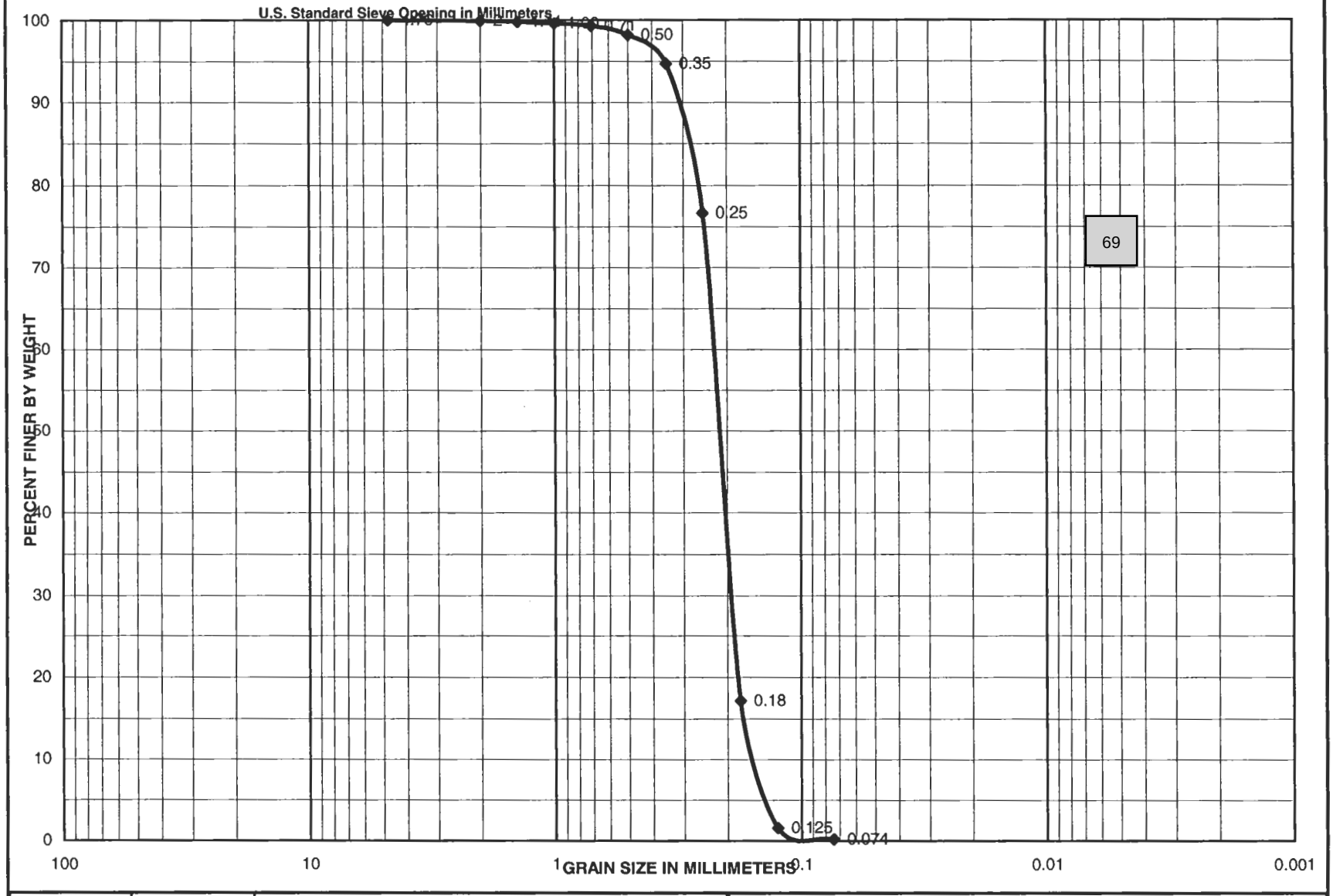
DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS
1. PROJECT MOREHEAD CITY INNER HARBOR		10. SIZE AND TYPE OF BIT 4" Dia. Vibracore	
2. LOCATION (Coordinates or Station) NC COORD E 2697808.3 N 355633.8 NAD83		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MLLW	
3. DRILLING AGENCY WILMINGTON DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL VIBRA CORE SNELL	
4. HOLE NO. (As shown on drawing title and file number) MHC-06-29		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED 0	UNDISTURBED
5. NAME OF DRILLER LESTER GAUGHF CRANE OPERATOR		14. TOTAL NUMBER CORE BOXES N/A	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER N/A	
		16. DATE HOLE STARTED 05/14/06	COMPLETED 05/14/06
7. THICKNESS OF OVERBURDEN N/A (17.4' Water)		17. ELEVATION TOP OF HOLE 0.0' MLLW	
8. DEPTH DRILLED INTO ROCK 0.0'		18. TOTAL CORE RECOVERY FOR BORING N/A %	
9. TOTAL DEPTH OF HOLE 27.4		19. SIGNATURE OF INSPECTOR K. BENTON AND K.KALTENBACH	

ELEVATION MLLW	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
0.0	0		0.0' TO 17.4' WATER			Time begin vibracoring: 0742 hrs. Soils described by Larry Benjamin, Civil Engr. Tech.
			RIVER BOTTOM @17.4'		17.4'	
-17.4	17.4		SP-Tan, coarse, poorly-graded sand		1	Scale changed @ 18.0'
	18.0				17.9'	NOTE: TOP OF HOLE is de- with shell fragments and compensation is made for the tide such that top of Hole is 0.0 EL MLLW.
	20.0				20.0	VIBRACORE BORING From 0.0' to 27.4' Ran 20.0' Rec: 7.0'
					2	
					20.5	Top of vibracore soil sample is logged as beginning at Ocean Bottom. When Run is greater than Recovery, the difference is depicted as Assumed No Recovery.
			21.2' with shell fragments			
	22.0				22.0	
					3	
					22.5	
					23.9	
	24.0		24.4'		4	
			No Recovery		24.4	LAB CLASSIFICATION Jar Number 1 Classification SP
	26.0					
-27.4	27.4		BOTTOM OF HOLE @ -27.4' SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT MOREHEAD CITY INNER HARBOR | HOLE NO. MHC-06-29

...\PART2 MHC-06.dgn 7/6/2006 12:57:49 PM



Sample No.	Depth (ft)	Classification	
1	17.4-17.9	Olive gray poorly graded sand with trace shells, SP	**Project** USACOE Various Sites
		1.80% Shells	**Area** Morehead City Harbor
			CATLIN Geotechnical Laboratory
			Boring No. MHC-06-V-29
			Date 6/16/2006

Hole No. MHC-06-30

DRILLING LOG	DIVISION SOUTH ATLANTIC	INSTALLATION WILMINGTON DISTRICT	SHEET 1 OF 1 SHEETS
1. PROJECT MOREHEAD CITY INNER HARBOR		10. SIZE AND TYPE OF BIT 4" Dia. Vibracore	
2. LOCATION (Coordinates or Station) NC COORD E 2697978.2 N 355250.3 NAD83		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MLLW	
3. DRILLING AGENCY WILMINGTON DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL VIBRA CORE SNELL	
4. HOLE NO. (As shown on drawing title and file number) MHC-06-30		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED 0	UNDISTURBED
5. NAME OF DRILLER LESTER GAUGHF CRANE OPERATOR		14. TOTAL NUMBER CORE BOXES N/A	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER N/A	
		16. DATE HOLE STARTED 05/14/06	COMPLETED 05/14/06
7. THICKNESS OF OVERBURDEN N/A (16.7' Water)		17. ELEVATION TOP OF HOLE 0.0' MLLW	
8. DEPTH DRILLED INTO ROCK 0.0'		18. TOTAL CORE RECOVERY FOR BORING N/A %	
9. TOTAL DEPTH OF HOLE		19. SIGNATURE OF INSPECTOR K. BENTON AND K.KALTENBACH	

ELEVATION MLLW	DEPTH feet	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
0.0	0		0.0' TO 16.6' WATER			Time begin vibracoring: 0807 hrs. Soils described by Larry Benjamin, Civil Engr. Tech.
	16.0		RIVER BOTTOM @16.6'		16.6	
-16.6	16.6		SP- Tan, coarse, poorly-graded sand with shell fragments		1	NOTE: TOP OF HOLE is defined as surface of water and compensation is made for the tide such that top of Hole is 0.0 EL MLLW.
	17.0				17.1	
					18.6	VIBRACORE BORING From 0.0' to 26.6' Ran 20.0' Rec: 6.4'
	19.0				2	
					19.1	Top of vibracore soil sample is logged as beginning at Ocean Bottom. When Run is greater than Recovery, the difference is depicted as Assumed Not Recovered.
					20.6	
	21.0				3	
					21.1	
					22.5	
			23.0'		4	
	23.0		No Recovery		23.0	
	25.0					
-26.6	26.6		BOTTOM OF HOLE @ -26.6' SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			

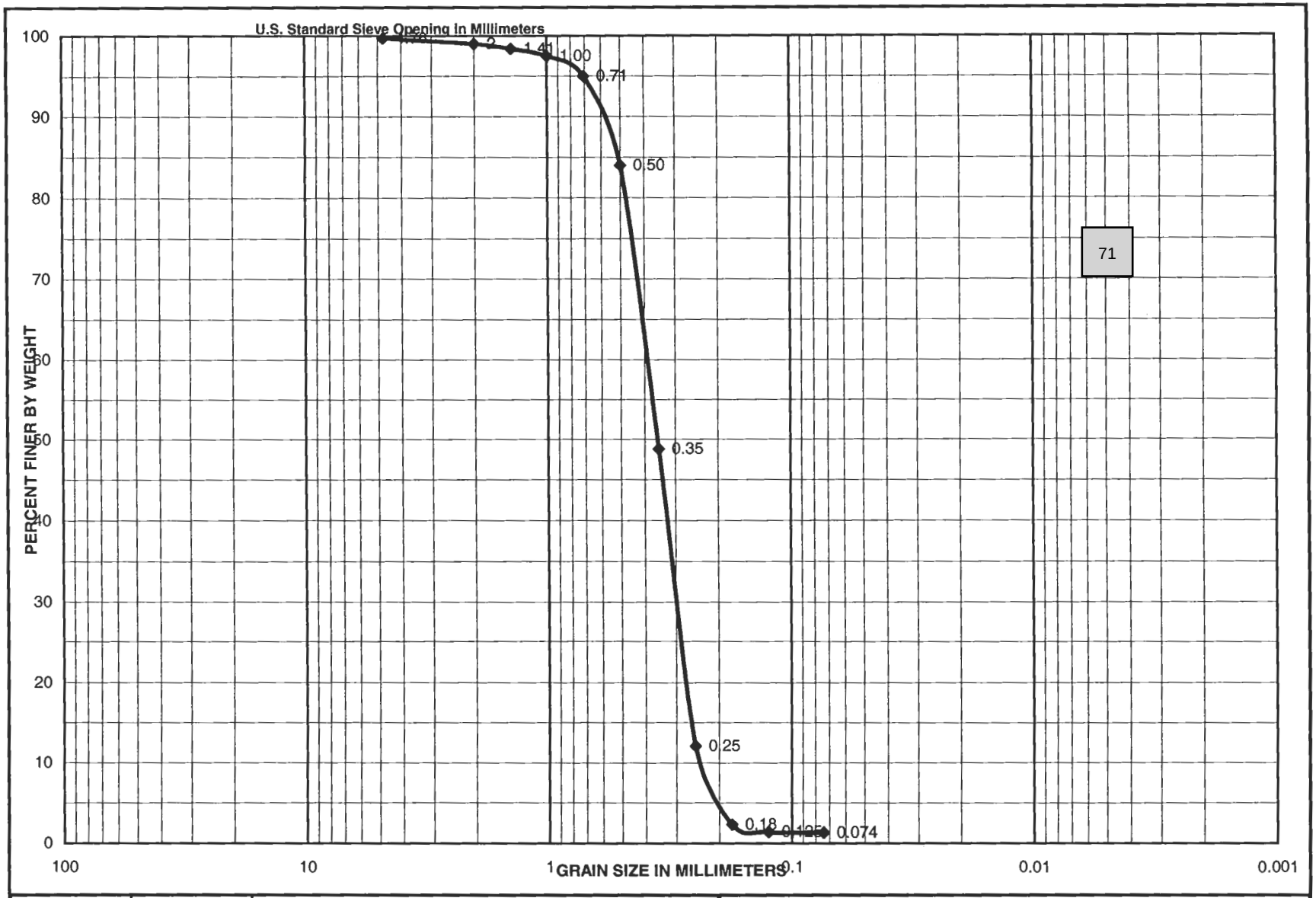
LAB CLASSIFICATION

Jar Number	Classification
1	SP
2	SP

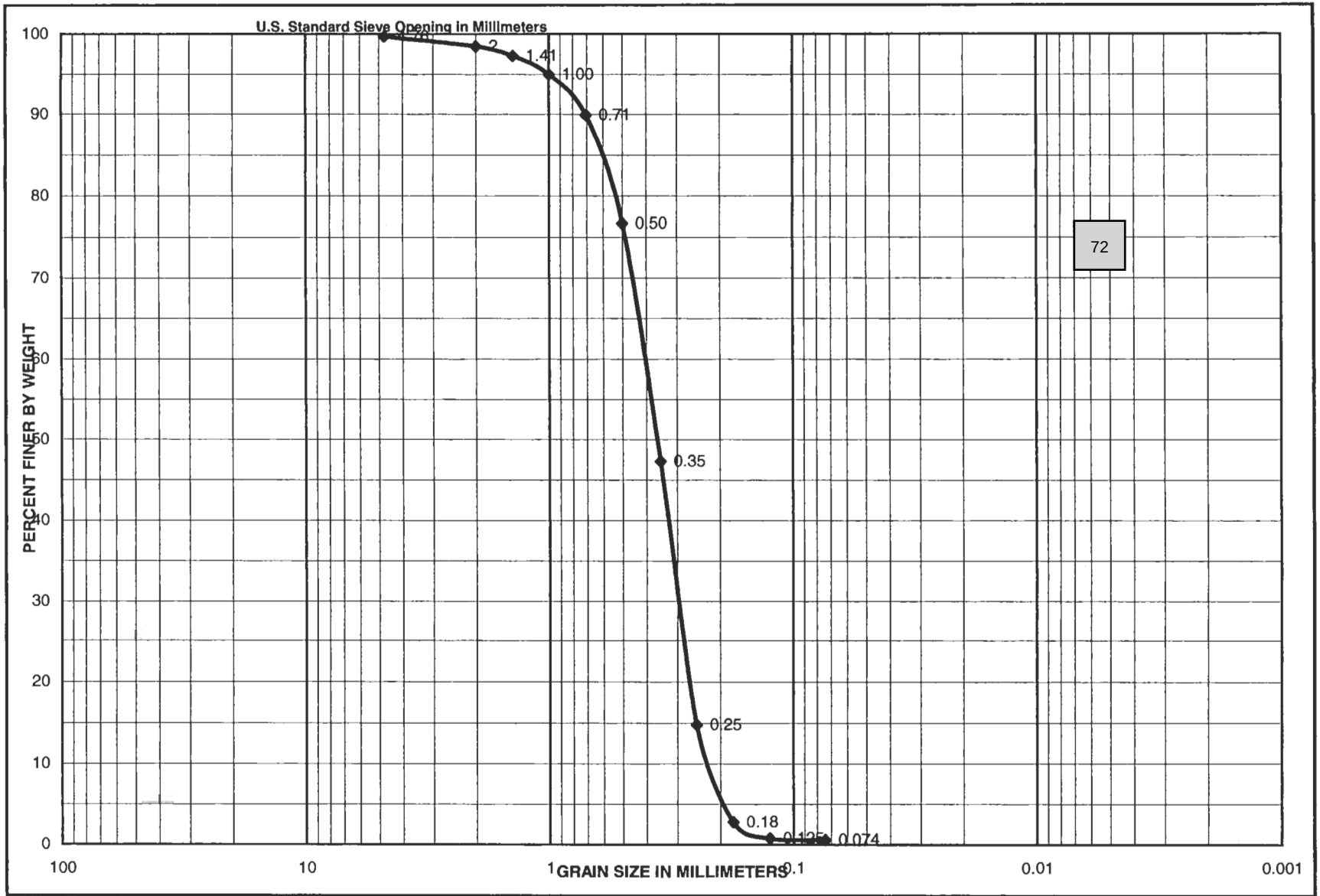
ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT MOREHEAD CITY INNER HARBOR | HOLE NO. MHC-06-30

...\PART2 MHC-06.dgn 7/6/2006 12:59:54 PM



Sample No.	Depth (ft)	Classification	
1	16.6-17.1	Olive gray poorly graded sand with trace shells, SP	**Project** USACOE Various Sites
		4.99% Shells	**Area** Morehead City Harbor
			CATLIN Geotechnical Laboratory
			Boring No. MHC-06-V-30
			Date 6/16/2006



Sample No.	Depth (ft)	Classification
2	18.6-19.1	Olive gray poorly graded sand with few shells, SP
		10.07% Shells

Project	USACOE Various Sites
Area	Morehead City Harbor
CATLIN Geotechnical Laboratory	
Boring No.	MHC-06-V-30
Date	6/15/2006

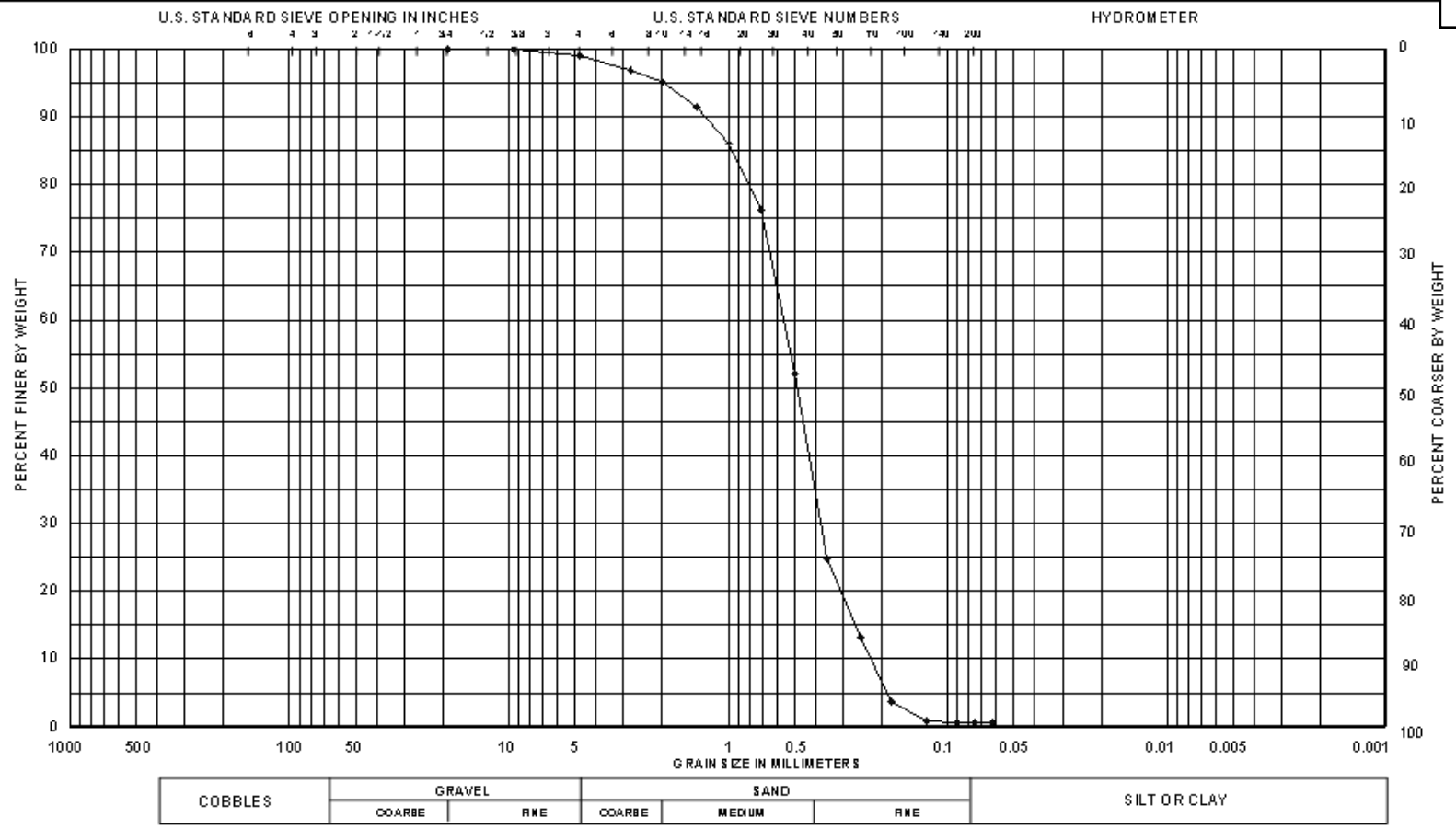
DRILLING LOG | DIVISION: SOUTH ATLANTIC | INSTALLATION: WILMINGTON DISTRICT | SHEET 1 OF 1 SHEETS

1. PROJECT: MOREHEAD CITY RANGE B
2. LOCATION (Coordinates or Station): NC Coord. N355403 E2697938 (NAD 83)
3. DRILLING AGENCY: WILMINGTON DISTRICT
4. HOLE NO. (As shown on drawing title and file number): MHC-08-V-62
5. NAME OF DRILLER: LESTER GAUGHF CRANE OPERATOR
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: N/A (13.7 of Water)
8. DEPTH DRILLED INTO ROCK: 0.0'
9. TOTAL DEPTH OF HOLE: 23.7'
10. SIZE AND TYPE OF BIT: 4" Dia. Vibracore
11. DATUM FOR ELEVATION SHOWN (BM or MSL): MLLW
12. MANUFACTURER'S DESIGNATION OF DRILL: VIBRA CORE SNELL
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 5 UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: N/A
15. ELEVATION GROUND WATER: N/A
16. DATE HOLE: STARTED 9/08/08 COMPLETED 9/08/08
17. ELEVATION TOP OF HOLE: 0.0' MLLW
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR: KELLEY KALTENBACH

ELEVATION MLLW	DEPTH feet	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	0		0.0' TO 13.7' WATER			Time begin vibracoring: 1458 hrs. Soils described by Larry Benjamin, Civil Engr. Tech.
	13.0					
-13.7	13.7		RIVER BOTTOM @ 13.7'		13.7'	
			SP Tan, coarse poorly graded sand with tiny shell fragments		1	NOTE: TOP OF HOLE is defined as surface of water and compensation is made for the tide such that top of Hole is 0.0 EL MLLW.
	15.0				14.2'	
					15.5'	VIBRACORE BORING From 0.0' to 10.0' Ran 10.0' Rec: 9.0'
					2	
	17.0				16.0'	Top of vibracore soil sample is logged as beginning at Ocean Bottom. When Run is greater than Recovery, the difference is depicted as Assumed Not Recovered.
					17.5'	
			18.2' Trace of shell fragments		3	
	19.0				18.0'	
					19.5'	NOTE: Commercial soils lab classified samples according to ASTM D2457
					4	
					20.0'	
	21.0				21.5'	LAB CLASSIFICATION
					5	Jar Number / Classification: 1 SP; 2 SP; 3 SP
			22.7'		22.0'	
	23.0		ASSUME NOT RECOVERED			
-23.7	23.7		BOTTOM OF HOLE AT 23.7' SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			NOTE: HOLE TERMINATED AT PREDETERMINED DEPTH AT 10.0'

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT: MOREHEAD CITY RANGE B | HOLE NO.: MHC-08-V-62



Sample No.	Elev. Or Depth	Classification	%VS	G_s	Nat w%	LL	PL	PI
◆ 1	13.7 - 14.2'	SAND, poorly-graded, mostly medium to fine-grained quartz, some fine-gravel to medium sand-size shell fragments, trace silt, grayish brown 2.5Y 5/2 (SP)	35					

Project Moorehead City DMMP

Area

Boring No. MHC-08-V-62

Date 11/23/2008

GRADATION CURVES

** The USC classification is based on laboratory grain size distribution and visual classification*

ENG FORM 2087

MAY 63

WOLF TECHNOLOGIES, INC.
3047-4 St. Johns Bluff Road S.
Jacksonville, Florida 32246
(904) 997-1400 (Tel) • (904) 997-9150 (Fax)

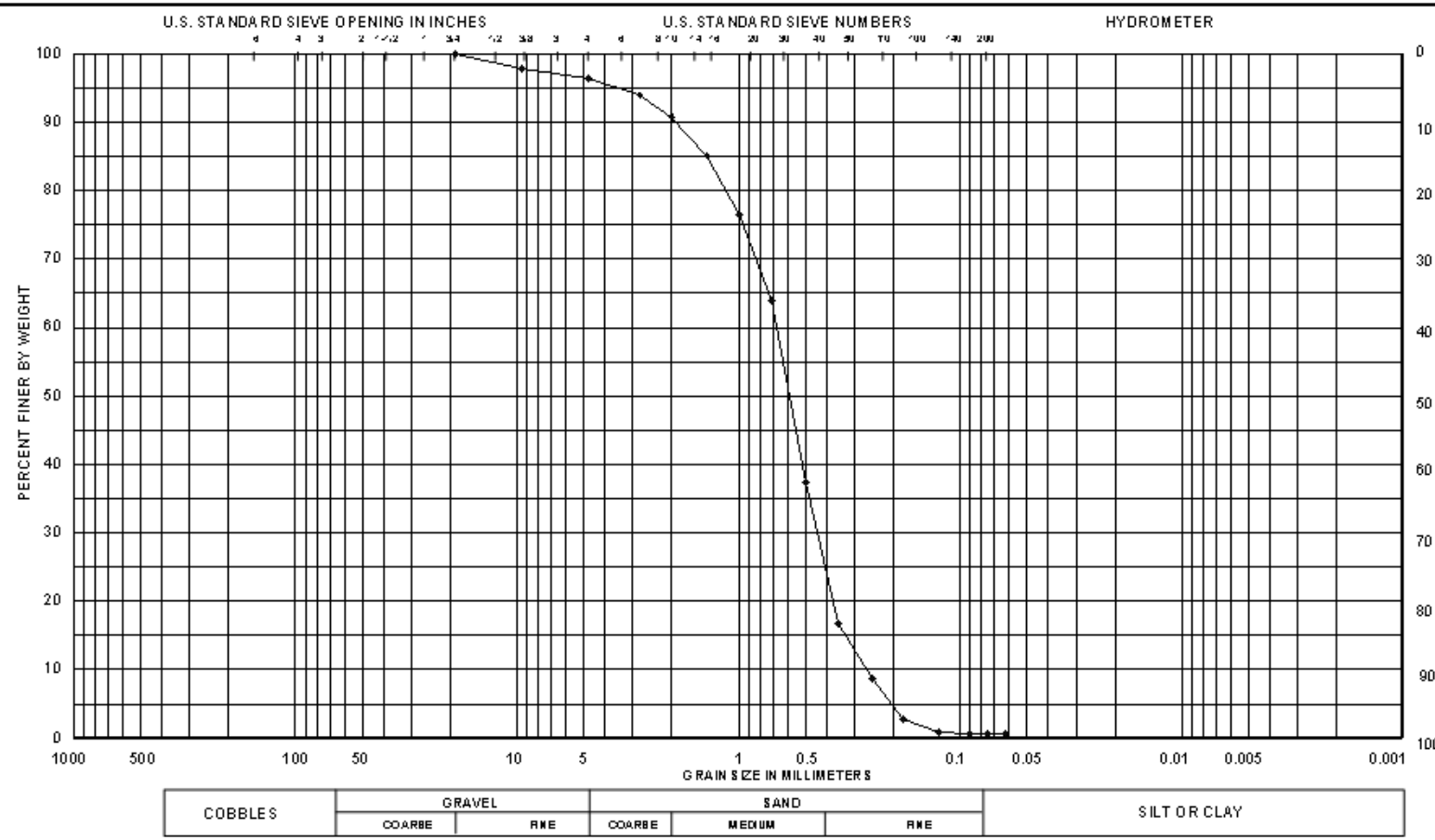
VISUAL SHELL CONTENT

GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	**Moorehead City DMMP**	**Depth:**	**13.7 - 14.2'**
Project No.:	**WPC6308.00103**	**Date:**	**11/23/2008**
Boring No.:	**MHC-08-V-62**		
Sample No.:	**1**		
Description:	**SAND, poorly-graded, mostly medium to fine-grained quartz, some fine-gravel to medium sand-size shell fragments, trace silt, grayish brown**		

Tare Weight, (g):	49.69	
Dry Wt. Before Washing (g):	230.37	(with tare)
Dry Weight After Washing (g):	229.28	(with tare)

Sieve Size (Name)	Sieve Size (mm)		% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.26	99.86	100	0.26
#4	4.750	1.65	98.94	100	1.65
#7	2.800	3.61	96.94	100	3.61
#10	2.000	3.31	95.11	100	3.31
#14	1.400	6.50	91.52	90	5.85
#18	1.000	9.85	86.06	80	7.88
#25	0.710	17.82	76.20	60	10.69
#35	0.500	43.74	51.99	40	17.50
#45	0.355	49.30	24.71	20	9.86
#60	0.250	20.69	13.26	10	2.07
#80	0.180	17.38	3.64	5	0.87
#120	0.125	4.87	0.94	0	0.00
#170	0.090	0.42	0.71	0	0.00
#200	0.075	0.05	0.68	0	0.00
#230	0.063	0.03	0.66	0	0.00
Total Shell Content:		**35**		**%**	



Sample No.	Elev. Or Depth	Classification	%VS	G_s	Nat w%	LL	PL	PI
◆ 2	15.5' - 16.0'	SAND, poorly-graded, mostly medium to fine-grained quartz, some fine-gravel to medium sand-size shell fragments, trace silt, grayish brown 2.5Y 5/2 (SP)	45					

Project Moorehead City DMMP

Area

Boring No. MHC-08-V-62

Date 11/23/2008

GRADATION CURVES

** The USC classification is based on laboratory grain size distribution and visual classification*

ENG FORM 2087

MAY 63

WOLF TECHNOLOGIES, INC.
3047-4 St. Johns Bluff Road S.
Jacksonville, Florida 32246
(904) 997-1400 (Tel) • (904) 997-9150 (Fax)

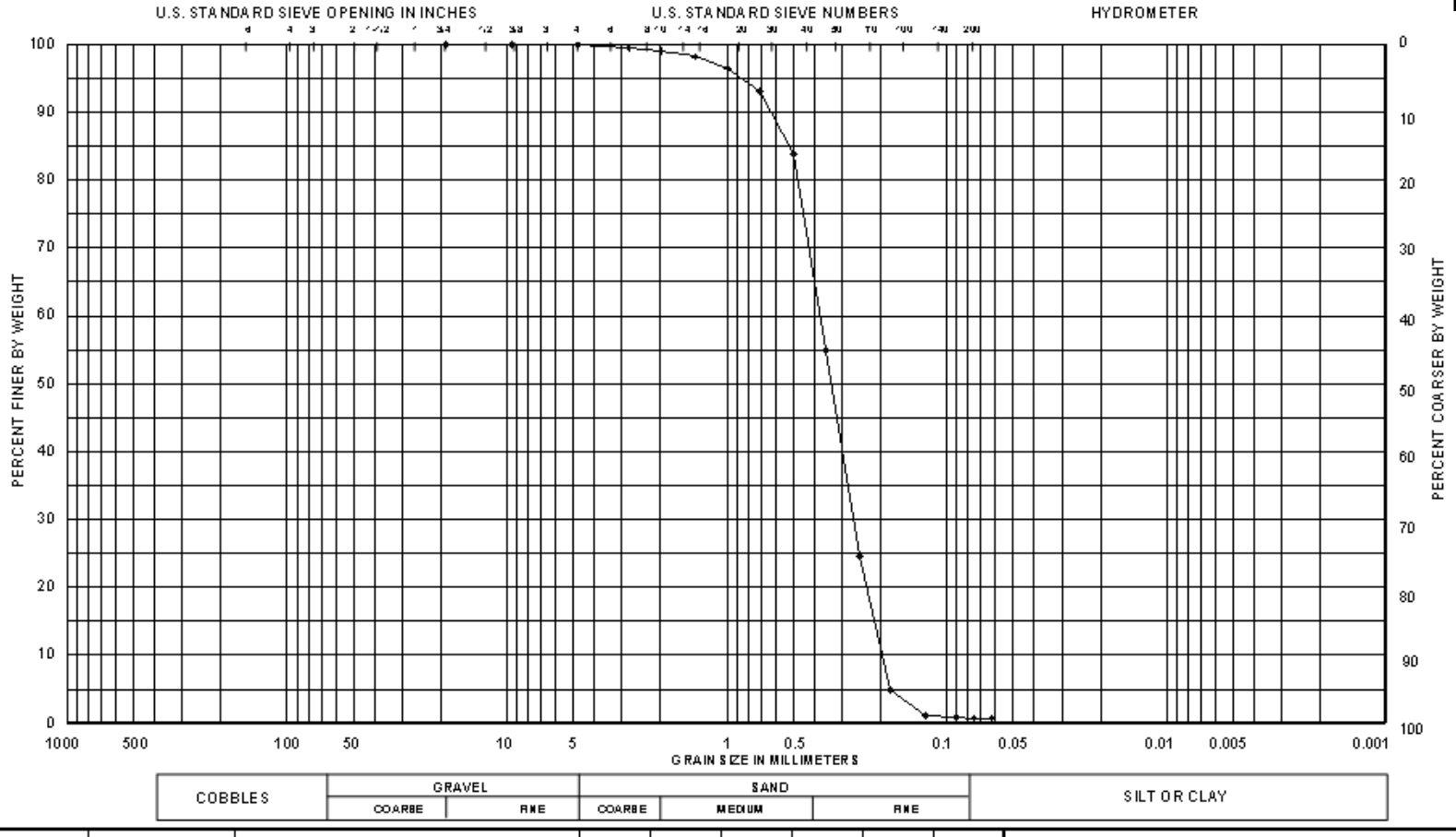
VISUAL SHELL CONTENT

GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	**Moorehead City DMMP**	**Depth:**	**15.5' - 16.0'**
Project No.:	**WPC6308.00103**	**Date:**	**11/23/2008**
Boring No.:	**MHC-08-V-62**		
Sample No.:	**2**		
Description:	**SAND, poorly-graded, mostly medium to fine-grained quartz, some fine-gravel to medium sand-size shell fragments, trace silt, grayish brown**		

Tare Weight, (g):	50.72	
Dry Wt. Before Washing (g):	246.3	(with tare)
Dry Weight After Washing (g):	245.18	(with tare)

Sieve Size (Name)	Sieve Size (mm)		% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	4.39	97.76	100	4.39
#4	4.750	2.52	96.47	100	2.52
#7	2.800	4.92	93.95	100	4.92
#10	2.000	6.19	90.79	100	6.19
#14	1.400	11.07	85.13	90	9.96
#18	1.000	17.04	76.41	80	13.63
#25	0.710	24.29	63.99	60	14.57
#35	0.500	51.99	37.41	40	20.80
#45	0.355	40.44	16.73	20	8.09
#60	0.250	15.78	8.67	10	1.58
#80	0.180	11.63	2.72	5	0.58
#120	0.125	3.75	0.80	0	0.00
#170	0.090	0.17	0.72	0	0.00
#200	0.075	0.17	0.63	0	0.00
#230	0.063	0.02	0.62	0	0.00
Total Shell Content:		**45**		**%**	



Sample No.	Elev. Or Depth	Classification	%VS	G_s	Nat w%	LL	PL	PI
• 3	17.5' - 18.0'	SAND, poorly-graded, mostly medium to fine-grained quartz, little fine-gravel to medium sand-size shell fragments, trace silt, gray 5Y 5/1 (SP)	15					

Project Moorehead City DMMP

Area

Boring No. MHC-08-V-62

Date 11/23/2008

GRADATION CURVES

ENG FORM 2087

MAY 63

** The USC classification is based on laboratory grain size distribution and visual classification*

WOLF TECHNOLOGIES, INC.
3047-4 St. Johns Bluff Road S.
Jacksonville, Florida 32246
(904) 997-1400 (Tel) • (904) 997-9150 (Fax)

VISUAL SHELL CONTENT

GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	**Moorehead City DMMP**	**Depth:**	**17.5' - 18.0'**
Project No.:	**WPC6308.00103**	**Date:**	**11/23/2008**
Boring No.:	**MHC-08-V-62**		
Sample No.:	**3**		
Description:	**SAND, poorly-graded, mostly medium to fine-grained quartz, little fine-gravel to medium sand-size shell fragments, trace silt, gray 5Y 5/1**		

Tare Weight, (g):	49.02	
Dry Wt. Before Washing (g):	224.25	(with tare)
Dry Weight After Washing (g):	222.99	(with tare)

Sieve Size (Name)	Sieve Size (mm)		% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.27	99.85	100	0.27
#7	2.800	0.43	99.60	100	0.43
#10	2.000	0.92	99.08	99	0.91
#14	1.400	1.58	98.17	90	1.42
#18	1.000	2.92	96.51	80	2.34
#25	0.710	5.88	93.15	70	4.12
#35	0.500	16.47	83.75	40	6.59
#45	0.355	50.54	54.91	20	10.11
#60	0.250	53.24	24.53	1	0.53
#80	0.180	34.47	4.86	0	0.00
#120	0.125	6.66	1.06	0	0.00
#170	0.090	0.45	0.80	0	0.00
#200	0.075	0.04	0.78	0	0.00
#230	0.063	0.02	0.76	0	0.00
Total Shell Content:		**15**		**%**	

Hole No. MHC-08-V-63

1.

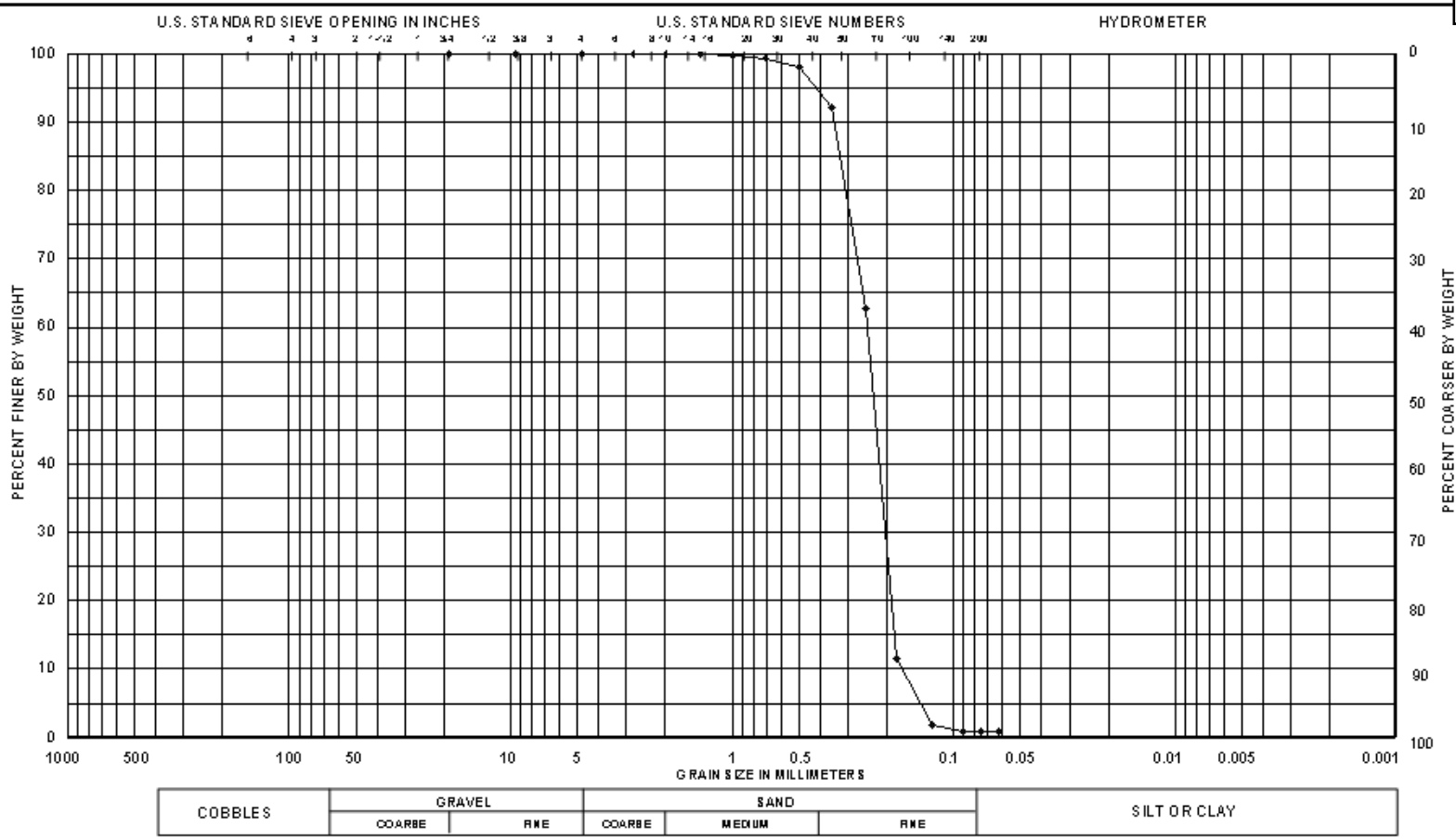
DRILLING LOG | DIVISION: SOUTH ATLANTIC | INSTALLATION: WILMINGTON DISTRICT | SHEET 1 OF 1 SHEETS

1. PROJECT: MOREHEAD CITY RANGE B
2. LOCATION (Coordinates or Station): NC Coord. N355650 E2697776 (NAD 83)
3. DRILLING AGENCY: WILMINGTON DISTRICT
4. HOLE NO. (As shown on drawing title and file number): MHC-08-V-63
5. NAME OF DRILLER: LESTER GAUGHF CRANE OPERATOR
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: N/A (12.2 of Water)
8. DEPTH DRILLED INTO ROCK: 0.0'
9. TOTAL DEPTH OF HOLE: 22.2'
10. SIZE AND TYPE OF BIT: 4" Dia. Vibracore
11. DATUM FOR ELEVATION SHOWN (BM or MSL): MLLW
12. MANUFACTURER'S DESIGNATION OF DRILL: VIBRA CORE SNELL
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 4 UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: N/A
15. ELEVATION GROUND WATER: N/A
16. DATE HOLE: STARTED 9/08/08 COMPLETED 9/08/08
17. ELEVATION TOP OF HOLE: 0.0' MLLW
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR: KELLEY KALTENBACH

ELEVATION MLLW	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		0.0' TO 12.2' WATER			Time begin vibracoring: 1514 hrs. Soils described by Larry Benjamin, Civil Engr. Tech.
	12.0		RIVER BOTTOM @ 12.2'		12.2'	
-12.2	12.2		SP Tan, coarse poorly graded sand		1 12.7'	NOTE: TOP OF HOLE is defined as surface of water and compensation is made for the tide such that top of Hole is 0.0 EL MLLW.
	14.0				14.5' 2 15.0'	VIBRACORE BORING From 0.0' to 10.0' Ran 10.0' Rec: 7.3' Top of vibracore soil sample is logged as beginning at Ocean Bottom. When Run is greater than Recovery, the difference is depicted as Assumed Not Recovered.
	16.0				16.5' 3 17.0'	
	18.0		18.2' With shell fragments		18.5' 4 19.0'	NOTE: Commercial soils lab classified samples according to ASTM D2457
			19.5' ASSUME NOT RECOVERED			LAB CLASSIFICATION: Jar Number 1 2 3 — Classification SP SP SP
	20.0					
	22.0					
-22.2	22.2		BOTTOM OF HOLE AT 22.2' SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			NOTE: HOLE TERMINATED AT PREDETERMINED DEPTH AT 10.0'

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT: MOREHEAD CITY RANGE B | HOLE NO.: MHC-08-V-63



Sample No.	Elev. Or Depth	Classification	%VS	G_s	Nat w%	LL	PL	PI
* 1	12.2' - 12.7'	SAND, poorly-graded, mostly fine-grained quartz, little coarse to fine sand-size shell fragments, trace silt, olive gray 5Y 5/2 (SP)	12					

Project Moorehead City DMMP

Area

Boring No. MHC-08-V-63

Date 11/23/2008

GRADATION CURVES

**The USC classification is based on laboratory grain size distribution and visual classification*

ENG FORM 2087

MAY 63

WOLF TECHNOLOGIES, INC.
3047-4 St. Johns Bluff Road S.
Jacksonville, Florida 32246
(904) 997-1400 (Tel) • (904) 997-9150 (Fax)

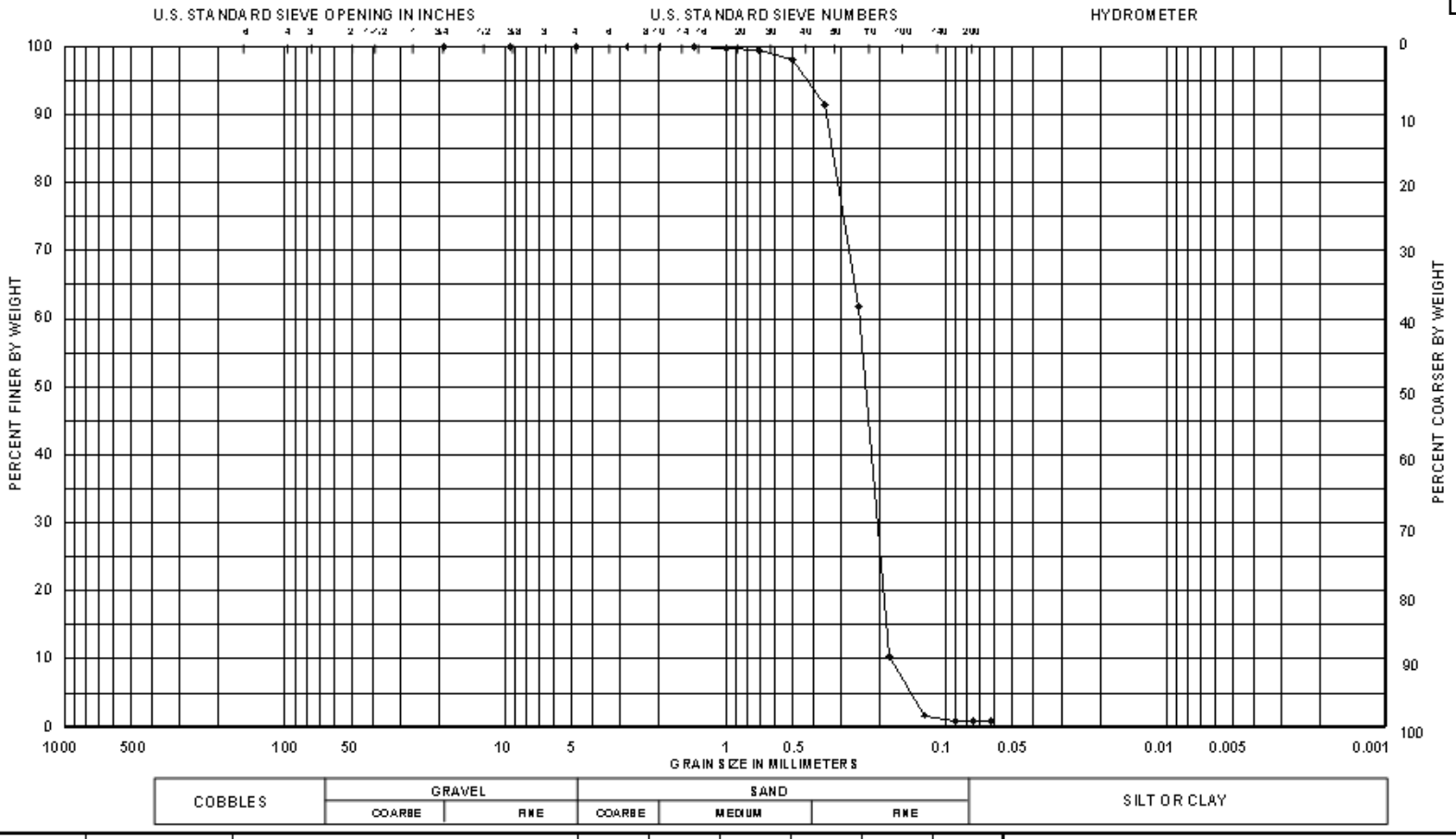
VISUAL SHELL CONTENT

GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	**Moorehead City DMMP**	**Depth:**	**12.2' - 12.7'**
Project No.:	**WPC6308.00103**	**Date:**	**11/23/2008**
Boring No.:	**MHC-08-V-63**		
Sample No.:	**1**		
Description:	**SAND, poorly-graded, mostly fine-grained quartz, little coarse to fine sand-size shell fragments, trace silt, olive gray 5Y 5/2 (SP)**		

Tare Weight, (g):	50.11	
Dry Wt. Before Washing (g):	241.66	(with tare)
Dry Weight After Washing (g):	239.88	(with tare)

Sieve Size (Name)	Sieve Size (mm)		% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.00	100.00	0	0.00
#7	2.800	0.02	99.99	100	0.02
#10	2.000	0.11	99.93	100	0.11
#14	1.400	0.15	99.85	99	0.15
#18	1.000	0.29	99.70	95	0.28
#25	0.710	0.66	99.36	90	0.59
#35	0.500	2.35	98.13	80	1.88
#45	0.355	11.32	92.22	40	4.53
#60	0.250	56.40	62.78	20	11.28
#80	0.180	98.04	11.59	5	4.90
#120	0.125	18.63	1.87	0	0.00
#170	0.090	1.70	0.98	0	0.00
#200	0.075	0.19	0.88	0	0.00
#230	0.063	0.06	0.85	0	0.00
Total Shell Content:		**12**		**%**	



Sample No.	Elev. Or Depth	Classification	%VS	G_s	Nat w%	LL	PL	PI
• 2	14.2' - 15.0'	SAND, poorly-graded, mostly fine-grained quartz, little coarse to fine sand-size shell fragments, trace silt, olive gray 5Y 5/2 (SP)	13					

Project Moorehead City DMMP

Area

Boring No. MHC-08-V-63

Date 11/23/2008

GRADATION CURVES

ENG FORM 2087

MAY 63

**The USC classification is based on laboratory grain size distribution and visual classification*

WOLF TECHNOLOGIES, INC.
3047-4 St. Johns Bluff Road S.
Jacksonville, Florida 32246
(904) 997-1400 (Tel) • (904) 997-9150 (Fax)

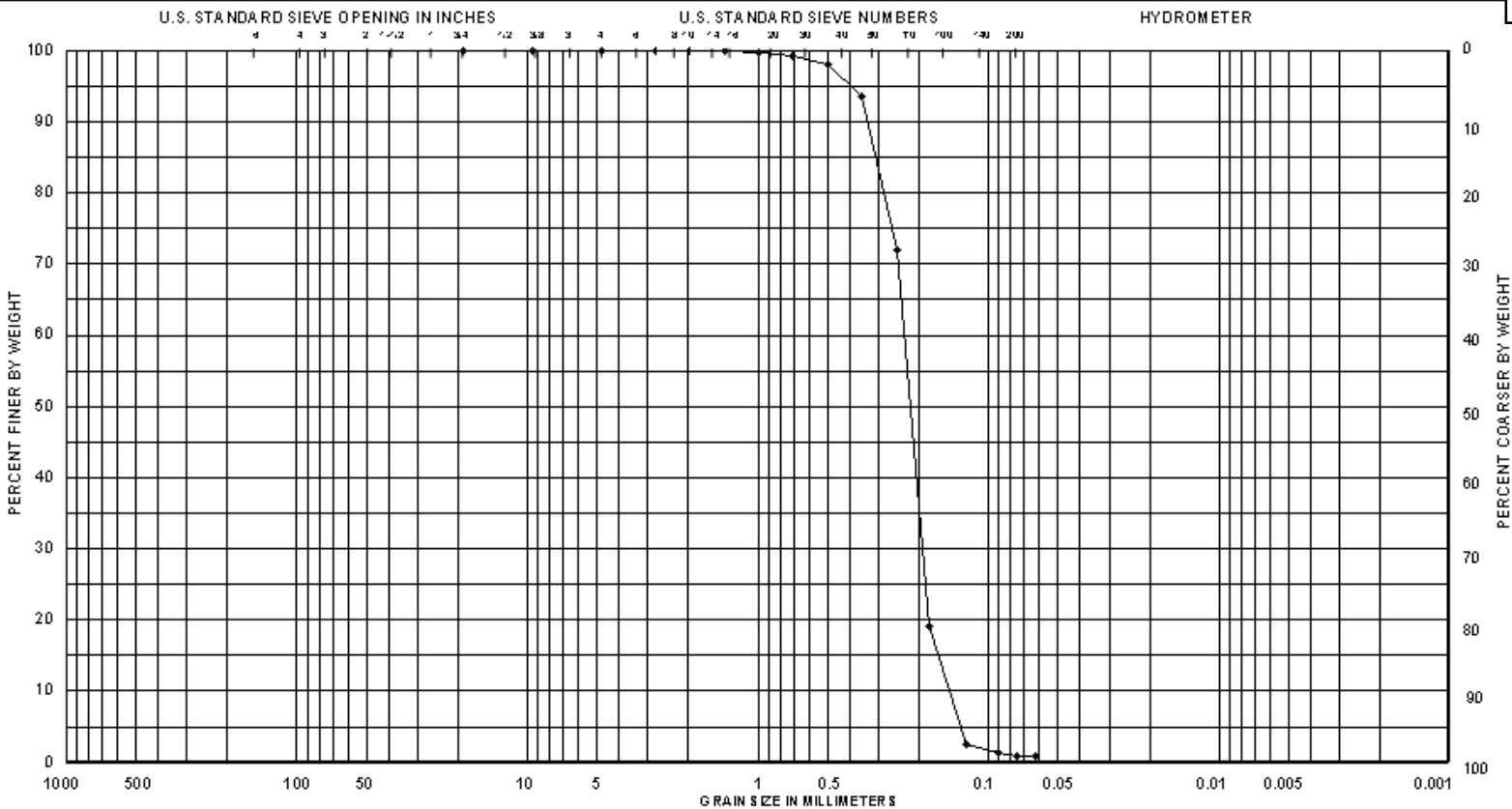
VISUAL SHELL CONTENT

GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	**Moorehead City DMMP**	**Depth:**	**14.2' - 15.0'**
Project No.:	**WPC6308.00103**	**Date:**	**11/23/2008**
Boring No.:	**MHC-08-V-63**		
Sample No.:	**2**		
Description:	**SAND, poorly-graded, mostly fine-grained quartz, little coarse to fine sand-size shell fragments, trace silt, olive gray 5Y 5/2 (SP)**		

Tare Weight, (g):	50.40	
Dry Wt. Before Washing (g):	219.59	(with tare)
Dry Weight After Washing (g):	218.05	(with tare)

Sieve Size (Name)	Sieve Size (mm)		% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.00	100.00	0	0.00
#7	2.800	0.00	100.00	0	0.00
#10	2.000	0.00	100.00	0	0.00
#14	1.400	0.09	99.95	100	0.09
#18	1.000	0.23	99.81	100	0.23
#25	0.710	0.70	99.40	90	0.63
#35	0.500	2.14	98.13	60	1.28
#45	0.355	11.44	91.37	40	4.58
#60	0.250	50.02	61.81	20	10.00
#80	0.180	86.97	10.40	5	4.35
#120	0.125	14.70	1.71	0	0.00
#170	0.090	1.32	0.93	0	0.00
#200	0.075	0.08	0.89	0	0.00
#230	0.063	0.04	0.86	0	0.00
Total Shell Content:		**13**		**%**	



Sample No.	Elev. Or Depth	Classification	%VS	G_s	Nat w%	LL	PL	PI
◆ 3	16.5' - 17.0'	SAND, poorly-graded, mostly fine-grained quartz, few coarse to fine sand-size shell fragments, trace silt, gray 5Y 5/1 (SP)	11					

Project Moorehead City DMMP

Area

Boring No. MHC-08-V-63

Date 11/23/2008

GRADATION CURVES

**The USC classification is based on laboratory grain size distribution and visual classification*

ENG FORM 2087

MAY 63

WOLF TECHNOLOGIES, INC.
3047-4 St. Johns Bluff Road S.
Jacksonville, Florida 32246
(904) 997-1400 (Tel) • (904) 997-9150 (Fax)

VISUAL SHELL CONTENT

GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	**Moorehead City DMMP**	**Depth:**	**16.5' - 17.0'**
Project No.:	**WPC6308.00103**	**Date:**	**11/23/2008**
Boring No.:	**MHC-08-V-63**		
Sample No.:	**3**		
Description:	**SAND, poorly-graded, mostly fine-grained quartz, few coarse to fine sand-size shell fragments, trace silt, gray 5Y 5/1 (SP)**		

Tare Weight, (g):	49.52	
Dry Wt. Before Washing (g):	217.24	(with tare)
Dry Weight After Washing (g):	215.75	(with tare)

Sieve Size (Name)	Sieve Size (mm)		% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.00	100.00	0	0.00
#7	2.800	0.04	99.98	100	0.04
#10	2.000	0.06	99.94	100	0.06
#14	1.400	0.14	99.86	100	0.14
#18	1.000	0.27	99.70	95	0.26
#25	0.710	0.64	99.31	95	0.61
#35	0.500	2.11	98.06	80	1.69
#45	0.355	7.52	93.57	60	4.51
#60	0.250	36.33	71.91	20	7.27
#80	0.180	88.71	19.02	5	4.44
#120	0.125	27.48	2.64	0	0.00
#170	0.090	2.35	1.23	0	0.00
#200	0.075	0.53	0.92	0	0.00
#230	0.063	0.06	0.88	0	0.00
Total Shell Content:		**11**	**%**		

DRILLING LOG

DIVISION: SOUTH ATLANTIC

INSTALLATION: WILMINGTON DISTRICT

SHEET 1 OF 1 SHEETS

1. PROJECT: MOREHEAD CITY DMMP
2. LOCATION (Coordinates or Station): NC Coord. N358025 E2697267 (NAD 83)
3. DRILLING AGENCY: WILMINGTON DISTRICT
4. HOLE NO. (As shown on drawing title and file number): MHC-08-V-64
5. NAME OF DRILLER: LESTER GAUGHF CRANE OPERATOR
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: N/A (10.2 of Water)
8. DEPTH DRILLED INTO ROCK: 0.0'
9. TOTAL DEPTH OF HOLE: 20.2'
10. SIZE AND TYPE OF BIT: 4" Dia. Vibracore
11. DATUM FOR ELEVATION SHOWN (BM or MSL): MLLW
12. MANUFACTURER'S DESIGNATION OF DRILL: VIBRA CORE SNELL
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 5 UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: N/A
15. ELEVATION GROUND WATER: N/A
16. DATE HOLE: STARTED 9/08/08 COMPLETED 9/08/08
17. ELEVATION TOP OF HOLE: 0.0' MLLW
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR: KELLEY KALTENBACH

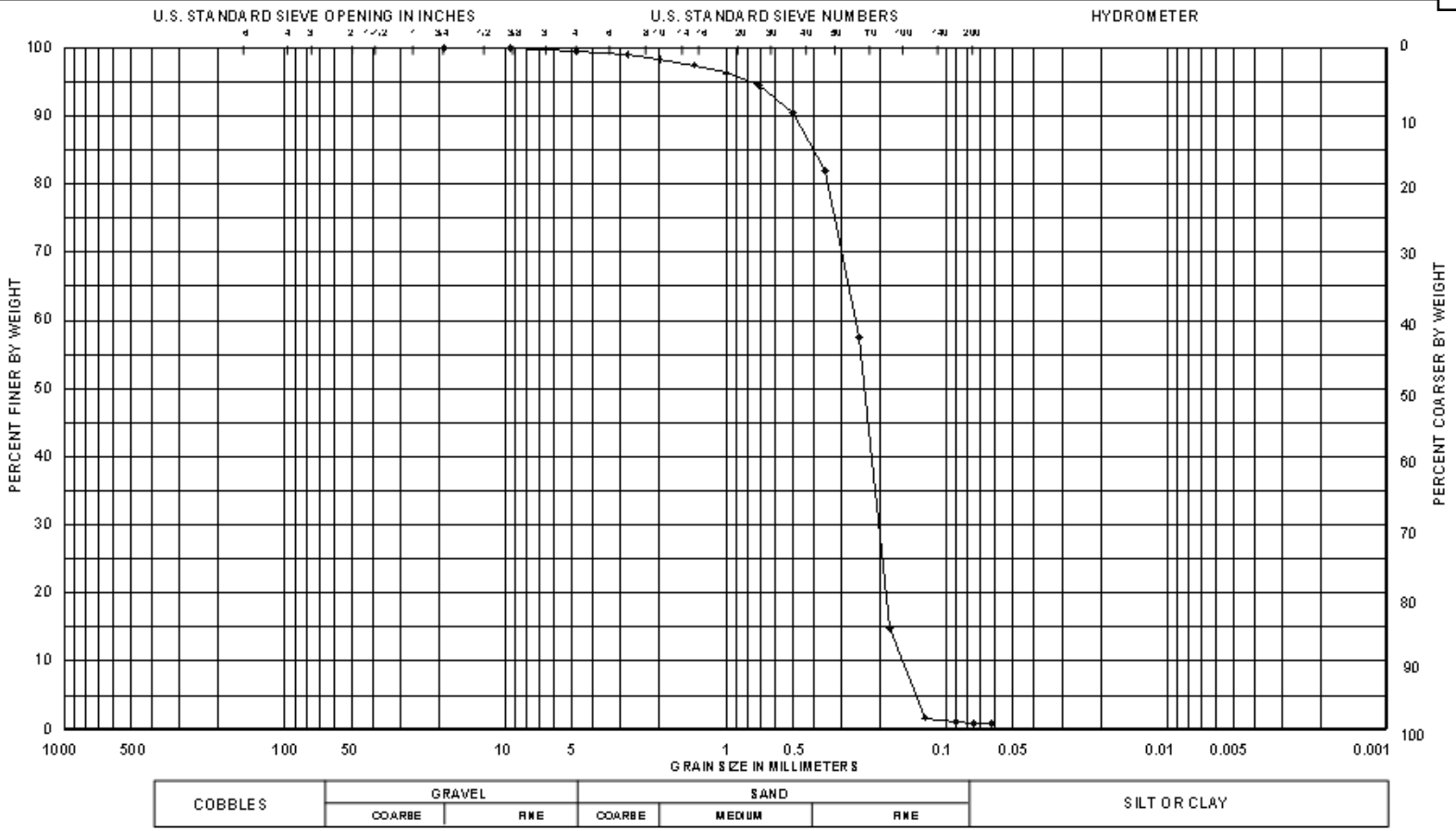
ELEVATION MLLW	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		0.0' TO 10.2' WATER			Time begin vibracoring: 1532 hrs. Soils described by Larry Benjamin, Civil Engr. Tech.
	10.0		RIVER BOTTOM @ 10.2'		10.2'	
-10.2	10.2		SP Tan, coarse poorly graded sand		1	NOTE: TOP OF HOLE is defined as surface of water and compensation is made for the tide such that top of Hole is 0.0 EL MLLW.
					10.7'	
	12.0				12.0'	
					2	VIBRACORE BORING From 0.0' to 10.0' Ran 10.0' Rec: 8.3'
					12.5'	
	14.0				14.0'	Top of vibracore soil sample is logged as beginning at Ocean Bottom. When Run is greater than Recovery, the difference is depicted as Assumed Not Recovered.
					3	
					14.5'	
	16.0				16.0'	
					4	NOTE: Commercial soils lab classified samples according to ASTM D2457
					16.5'	
	18.0				18.0'	LAB CLASSIFICATION
			18.5'		5	Jar Number / Classification: 1 SP; 2 SP; 3 SP; 4 SP
			ASSUME NOT RECOVERED		18.5'	
	20.0					
-20.2	20.2		BOTTOM OF HOLE AT 20.2'			NOTE: HOLE TERMINATED AT PREDETERMINED DEPTH AT 10.0'

SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT: MOREHEAD CITY DMMP

HOLE NO.: MHC-08-V-64



Sample No.	Elev. Or Depth	Classification	%VS	G_s	Nat w%	LL	PL	PI
◆ 1	10.2' - 10.7'	SAND, poorly-graded, mostly fine-grained quartz, little fine-gravel to fine sand-size shell fragments, trace silt, olive gray 5Y 5/2 (SP)	15					

Project Moorehead City DMMP

Area

Boring No. MHC-08-V-64

Date 11/23/2008

GRADATION CURVES

ENG FORM 2087

MAY 63

**The USC classification is based on laboratory grain size distribution and visual classification*

WOLF TECHNOLOGIES, INC.
3047-4 St. Johns Bluff Road S.
Jacksonville, Florida 32246
(904) 997-1400 (Tel) • (904) 997-9150 (Fax)

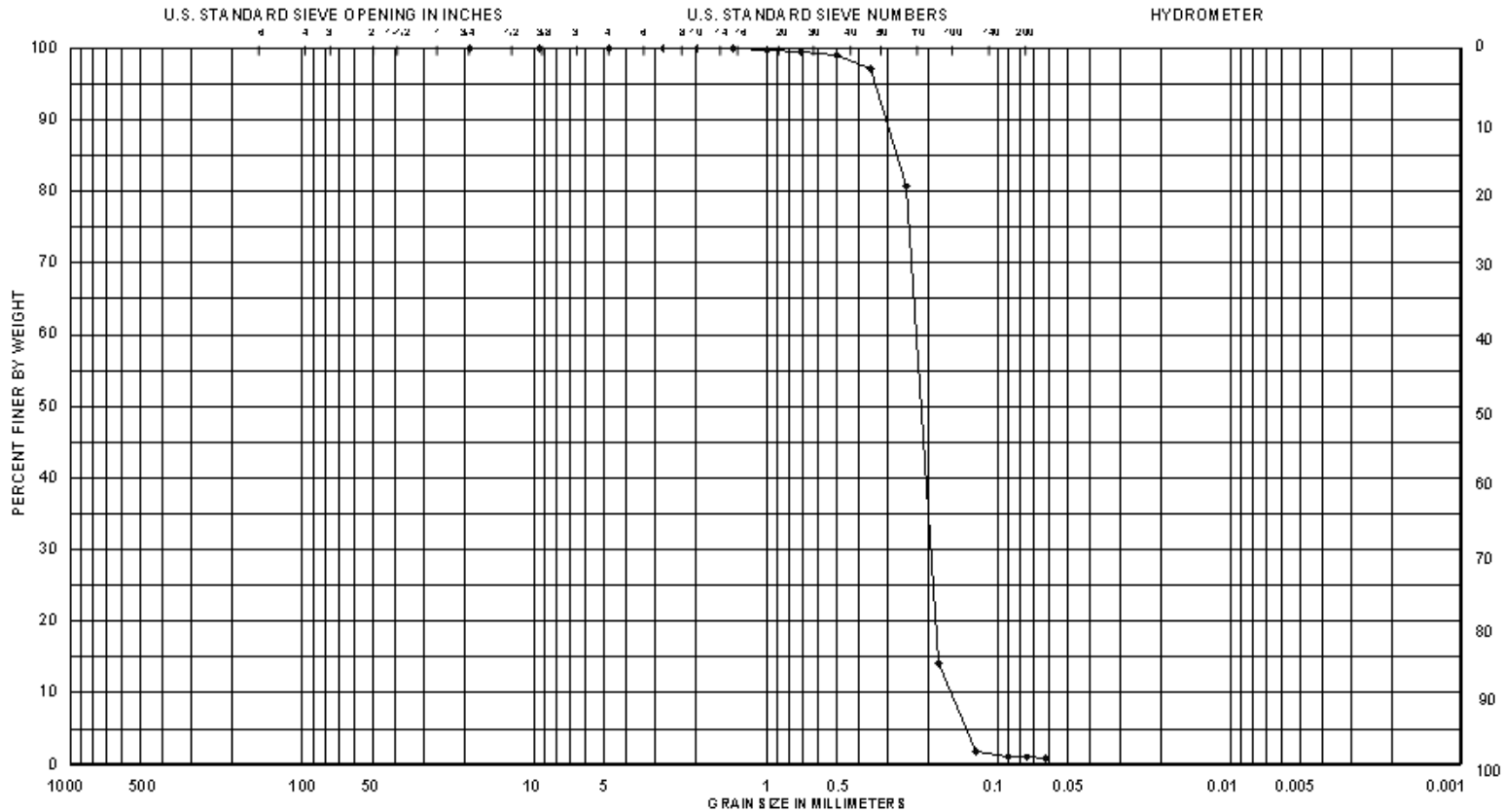
VISUAL SHELL CONTENT

GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	**Moorehead City DMMP**	**Depth:**	**10.2' - 10.7'**
Project No.:	**WPC6308.00103**	**Date:**	**11/23/2008**
Boring No.:	**MHC-08-V-64**		
Sample No.:	**1**		
Description:	**SAND, poorly-graded, mostly fine-grained quartz, little fine-gravel to fine sand-size shell fragments, trace silt, olive gray 5Y 5/2 (SP)**		

Tare Weight, (g):	49.79	
Dry Wt. Before Washing (g):	214.5	(with tare)
Dry Weight After Washing (g):	213.11	(with tare)

Sieve Size (Name)	Sieve Size (mm)		% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.70	99.58	100	0.70
#7	2.800	1.07	98.93	100	1.07
#10	2.000	0.97	98.34	100	0.97
#14	1.400	1.44	97.46	95	1.37
#18	1.000	1.94	96.28	90	1.75
#25	0.710	2.84	94.56	80	2.27
#35	0.500	6.76	90.46	60	4.06
#45	0.355	13.99	81.96	20	2.80
#60	0.250	40.38	57.45	15	6.06
#80	0.180	70.05	14.92	5	3.50
#120	0.125	21.77	1.70	0	0.00
#170	0.090	0.95	1.12	0	0.00
#200	0.075	0.28	0.95	0	0.00
#230	0.063	0.03	0.93	0	0.00
Total Shell Content:		**15**		**%**	



Sample No.	Elev. Or Depth	Classification	%VS	G_s	Nat w%	LL	PL	PI
♦ 2	12.0' - 12.5'	SAND, poorly-graded, mostly fine-grained quartz, few coarse to fine sand-size shell fragments, trace silt, olive gray 5Y 5/2 (SP)	11					

Project Moorehead City DMMP

Area

Boring No. MHC-08-V-64

Date 11/23/2008

GRADATION CURVES

**The USC classification is based on laboratory grain size distribution and visual classification*

ENG FORM 2087

MAY 63

WOLF TECHNOLOGIES, INC.
3047-4 St. Johns Bluff Road S.
Jacksonville, Florida 32246
(904) 997-1400 (Tel) • (904) 997-9150 (Fax)

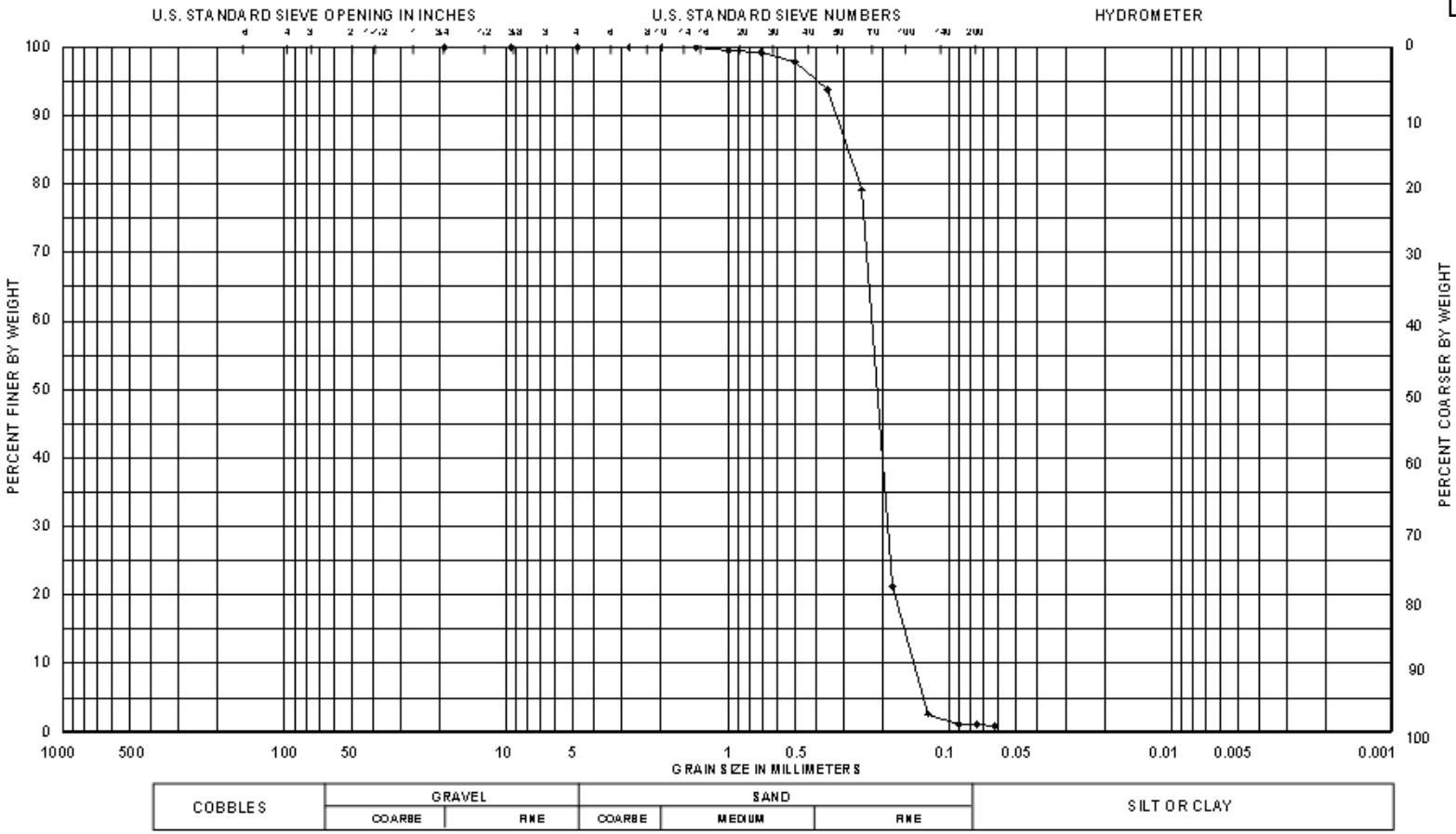
VISUAL SHELL CONTENT

GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	**Moorehead City DMMP**	**Depth:**	**12.0' - 12.5'**
Project No.:	**WPC6308.00103**	**Date:**	**11/23/2008**
Boring No.:	**MHC-08-V-64**		
Sample No.:	**2**		
Description:	**SAND, poorly-graded, mostly fine-grained quartz, few coarse to fine sand-size shell fragments, trace silt, olive gray 5Y 5/2 (SP)**		

Tare Weight, (g):	50.02	
Dry Wt. Before Washing (g):	226.59	(with tare)
Dry Weight After Washing (g):	224.93	(with tare)

Sieve Size (Name)	Sieve Size (mm)		% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.00	100.00	0	0.00
#7	2.800	0.00	100.00	0	0.00
#10	2.000	0.09	99.95	100	0.09
#14	1.400	0.12	99.88	90	0.11
#18	1.000	0.19	99.77	80	0.15
#25	0.710	0.41	99.54	80	0.33
#35	0.500	1.02	98.96	70	0.71
#45	0.355	3.31	97.09	40	1.32
#60	0.250	29.03	80.65	20	5.81
#80	0.180	117.21	14.27	10	11.72
#120	0.125	21.80	1.92	0	0.00
#170	0.090	1.50	1.07	0	0.00
#200	0.075	0.11	1.01	0	0.00
#230	0.063	0.05	0.98	0	0.00
Total Shell Content:		**11**		**%**	



Sample No.	Elev. Or Depth	Classification	%VS	G_s	Nat w%	LL	PL	PI
◆ 3	14.0' - 14.5'	SAND, poorly-graded, mostly fine-grained quartz, few coarse to fine sand-size shell fragments, trace silt, olive gray 5Y 5/2 (SP)	11					

Project Moorehead City DMMP

Area

Boring No. MHC-08-V-64

Date 11/23/2008

GRADATION CURVES

**The USC classification is based on laboratory grain size distribution and visual classification*

ENG FORM 2087

MAY 63

WOLF TECHNOLOGIES, INC.
3047-4 St. Johns Bluff Road S.
Jacksonville, Florida 32246
(904) 997-1400 (Tel) · (904) 997-9150 (Fax)

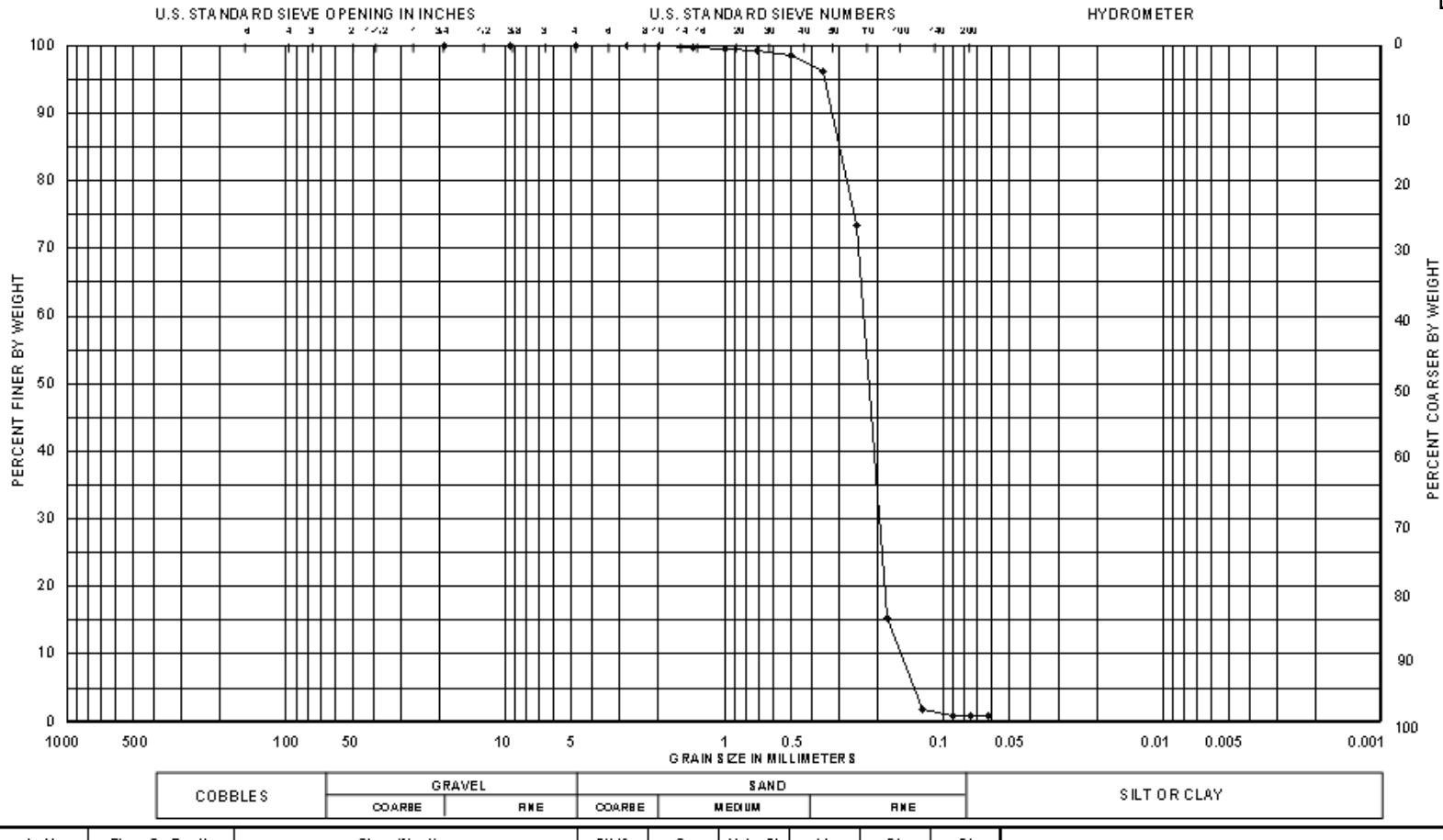
VISUAL SHELL CONTENT

GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	**Moorehead City DMMP**	**Depth:**	**14.0' - 14.5'**
Project No.:	**WPC6308.00103**	**Date:**	**11/23/2008**
Boring No.:	**MHC-08-V-64**		
Sample No.:	**3**		
Description:	**SAND, poorly-graded, mostly fine-grained quartz, few coarse to fine sand-size shell fragments, trace silt, olive gray 5Y 5/2 (SP)**		

Tare Weight, (g):	50.36	
Dry Wt. Before Washing (g):	197.89	(with tare)
Dry Weight After Washing (g):	196.31	(with tare)

Sieve Size (Name)	Sieve Size (mm)		% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.00	100.00	0	0.00
#7	2.800	0.02	99.99	100	0.02
#10	2.000	0.06	99.95	100	0.06
#14	1.400	0.16	99.84	95	0.15
#18	1.000	0.35	99.60	90	0.32
#25	0.710	0.57	99.21	80	0.46
#35	0.500	1.89	97.93	10	0.19
#45	0.355	6.20	93.73	40	2.48
#60	0.250	21.42	79.21	20	4.28
#80	0.180	85.38	21.34	10	8.54
#120	0.125	27.58	2.64	0	0.00
#170	0.090	2.13	1.20	0	0.00
#200	0.075	0.22	1.05	0	0.00
#230	0.063	0.08	1.00	0	0.00
Total Shell Content:		**11**		**%**	



Sample No.	Elev. Or Depth	Classification	%VS	G_s	Nat w%	LL	PL	PI
◆ 4	16.0' - 16.5'	SAND, poorly-graded, mostly fine-grained quartz, fewcoarse to fine-sand-size shell fragments, trace silt, olive gray 5Y 5/2 (SP)	10					

Project Moorehead City DMMP

Area

Boring No. MHC-08-V-64

Date 11/23/2008

GRADATION CURVES

ENG FORM 2087

MAY 63

** The USC classification is based on laboratory grain size distribution and visual classification*

WOLF TECHNOLOGIES, INC.
3047-4 St. Johns Bluff Road S.
Jacksonville, Florida 32246
(904) 997-1400 (Tel) • (904) 997-9150 (Fax)

VISUAL SHELL CONTENT

GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	**Moorehead City DMMP**	**Depth:**	**16.0' - 16.5'**
Project No.:	**WPC6308.00103**	**Date:**	**11/23/2008**
Boring No.:	**MHC-08-V-64**		
Sample No.:	**4**		
Description:	**SAND, poorly-graded, mostly fine-grained quartz, few coarse to fine-sand-size shell fragments, trace silt, olive gray 5Y 5/2 (SP)**		

Tare Weight, (g):	49.86	
Dry Wt. Before Washing (g):	205.01	(with tare)
Dry Weight After Washing (g):	203.78	(with tare)

Sieve Size (Name)	Sieve Size (mm)		% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.00	100.00	0	0.00
#7	2.800	0.04	99.97	100	0.04
#10	2.000	0.11	99.90	100	0.11
#14	1.400	0.18	99.79	100	0.18
#18	1.000	0.30	99.59	100	0.30
#25	0.710	0.50	99.27	90	0.45
#35	0.500	1.01	98.62	80	0.81
#45	0.355	3.87	96.13	60	2.32
#60	0.250	35.20	73.44	20	7.04
#80	0.180	90.13	15.35	5	4.51
#120	0.125	20.85	1.91	0	0.00
#170	0.090	1.55	0.91	0	0.00
#200	0.075	0.11	0.84	0	0.00
#230	0.063	0.03	0.82	0	0.00
Total Shell Content:		**10**		**%**	

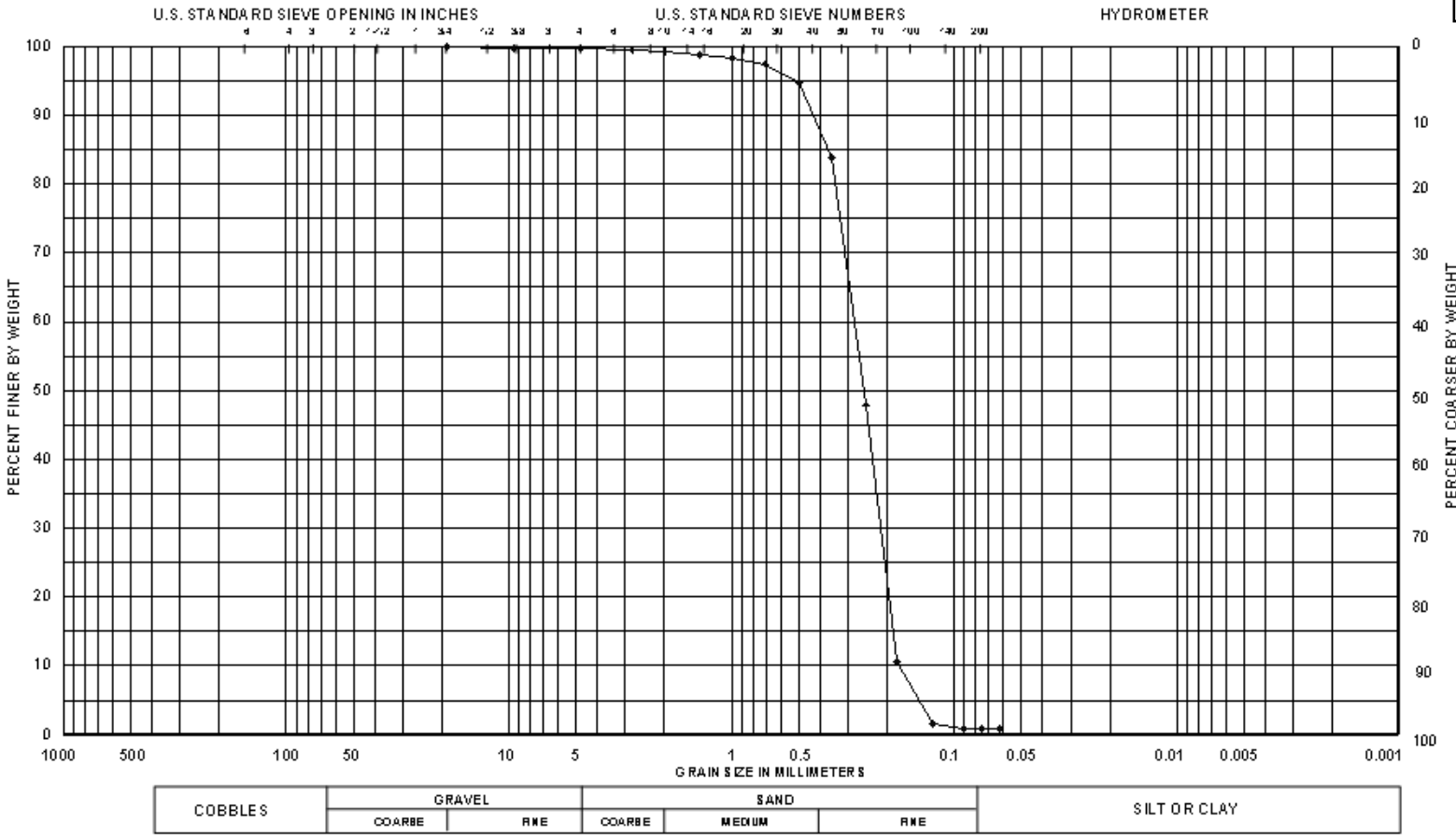
DRILLING LOG | DIVISION: SOUTH ATLANTIC | INSTALLATION: WILMINGTON DISTRICT | SHEET 1 OF 1 SHEETS

1. PROJECT: MOREHEAD CITY DMMP
2. LOCATION (Coordinates or Station): NC Coord. N355403 E2697938 (NAD 83)
3. DRILLING AGENCY: WILMINGTON DISTRICT
4. HOLE NO. (As shown on drawing title and file number): MHC-08-V-65
5. NAME OF DRILLER: LESTER GAUGHF CRANE OPERATOR
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: N/A (13.6 of Water)
8. DEPTH DRILLED INTO ROCK: 0.0'
9. TOTAL DEPTH OF HOLE: 23.6'
10. SIZE AND TYPE OF BIT: 4" Dia. Vibracore
11. DATUM FOR ELEVATION SHOWN (BM or MSL): MLLW
12. MANUFACTURER'S DESIGNATION OF DRILL: VIBRA CORE SNELL
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 5 UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: N/A
15. ELEVATION GROUND WATER: N/A
16. DATE HOLE: STARTED 9/08/08 COMPLETED 9/08/08
17. ELEVATION TOP OF HOLE: 0.0' MLLW
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR: KELLEY KALTENBACH

ELEVATION MLLW	DEPTH feet	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		0.0' TO 13.6' WATER			Time begin vibracoring: 1542 hrs. Soils described by Larry Benjamin, Civil Engr. Tech.
	13.0					
-13.6	13.6		RIVER BOTTOM @ 13.6'		13.6'	
			SP Tan, coarse poorly graded sand with trace shell fragments		1	NOTE: TOP OF HOLE is defined as surface of water and compensation is made for the tide such that top of Hole is 0.0 EL MLLW.
					14.1'	
	15.0				15.5'	VIBRACORE BORING From 0.0' to 10.0' Ran 10.0' Rec: 8.2'
					2	
					16.0'	
	17.0					Top of vibracore soil sample is logged as beginning at Ocean Bottom. When Run is greater than Recovery, the difference is depicted as Assumed Not Recovered.
					17.5'	
					3	
					18.0'	
	19.0				19.5'	NOTE: Commercial soils lab classified samples according to ASTM D2457
					4	
					20.0'	
	21.0				21.3'	LAB CLASSIFICATION Jar Number: 1 SP; 2 SP
			21.8'		5	
			ASSUME NOT RECOVERED		21.8'	
	23.0					
-23.6	23.6		BOTTOM OF HOLE AT 23.6' SOILS ARE FIELD VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM			NOTE: HOLE TERMINATED AT PREDETERMINED DEPTH AT 10.0'

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT: MOREHEAD CITY DMMP | HOLE NO.: MHC-08-V-65



Sample No.	Elev. Or Depth	Classification	%VS	G_s	Nat w%	LL	PL	PI
◆ 1	13.6' - 14.1'	SAND, poorly-graded, mostly fine-grained quartz, little fine-gravel to fine sand-size shell fragments, trace silt, olive gray 5Y 5/2 (SP)	12					

Project Moorehead City DMMP

Area

Boring No. MHC-08-V-65

Date 11/23/2008

GRADATION CURVES

ENG FORM 2087

MAY 63

** The USC classification is based on laboratory grain size distribution and visual classification*

WOLF TECHNOLOGIES, INC.
3047-4 St. Johns Bluff Road S.
Jacksonville, Florida 32246
(904) 997-1400 (Tel) • (904) 997-9150 (Fax)

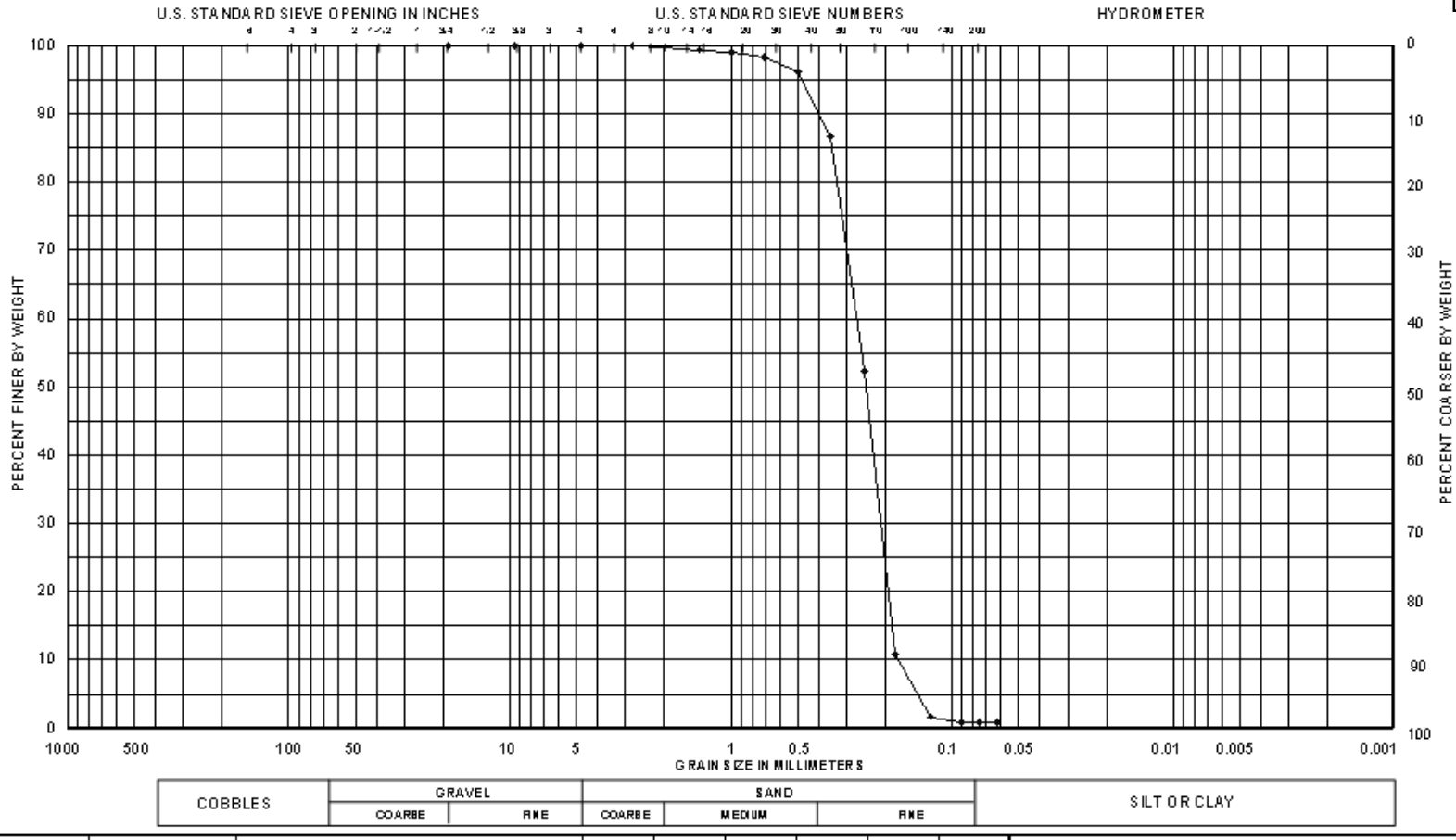
VISUAL SHELL CONTENT

GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	**Moorehead City DMMP**	**Depth:**	**13.6' - 14.1'**
Project No.:	**WPC6308.00103**	**Date:**	**11/23/2008**
Boring No.:	**MHC-08-V-65**		
Sample No.:	**1**		
Description:	**SAND, poorly-graded, mostly fine-grained quartz, little fine-gravel to fine sand-size shell fragments, trace silt, olive gray 5Y 5/2 (SP)**		

Tare Weight, (g):	49.96	
Dry Wt. Before Washing (g):	205.3	(with tare)
Dry Weight After Washing (g):	203.87	(with tare)

Sieve Size (Name)	Sieve Size (mm)		% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.34	99.78	100	0.34
#4	4.750	0.07	99.74	100	0.07
#7	2.800	0.33	99.52	100	0.33
#10	2.000	0.49	99.21	100	0.49
#14	1.400	0.55	98.85	100	0.55
#18	1.000	0.80	98.34	90	0.72
#25	0.710	1.36	97.46	80	1.09
#35	0.500	4.35	94.66	60	2.61
#45	0.355	16.82	83.84	20	3.36
#60	0.250	55.76	47.94	10	5.58
#80	0.180	57.97	10.62	5	2.90
#120	0.125	13.89	1.68	0	0.00
#170	0.090	1.10	0.97	0	0.00
#200	0.075	0.11	0.90	0	0.00
#230	0.063	0.03	0.88	0	0.00
Total Shell Content:		**12**		**%**	



Sample No.	Elev. Or Depth	Classification	%VS	G_s	Nat w%	LL	PL	PI
• 2	15.5' - 16.0'	SAND, poorly-graded, mostly fine-grained quartz, few fine-gravel to fine sand-size shell fragments, trace silt, olive gray 5Y 5/2 (SP)	11					

Project Moorehead City DMMP

Area

Boring No. MHC-08-V-65

Date 11/23/2008

GRADATION CURVES

ENG FORM 2087

MAY 63

** The USC classification is based on laboratory grain size distribution and visual classification*

WOLF TECHNOLOGIES, INC.
3047-4 St. Johns Bluff Road S.
Jacksonville, Florida 32246
(904) 997-1400 (Tel) • (904) 997-9150 (Fax)

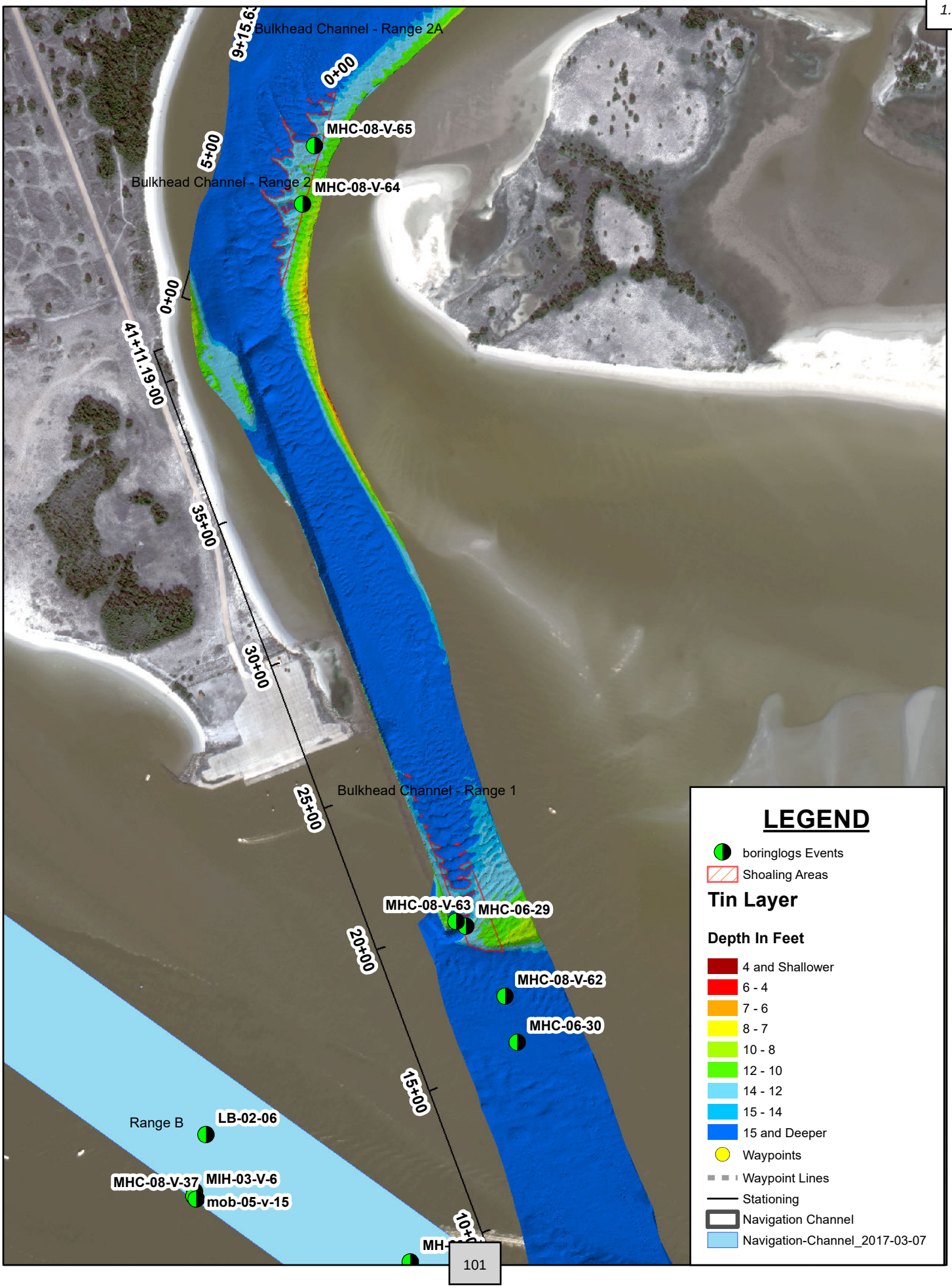
VISUAL SHELL CONTENT

GRAIN SIZE AND VISUAL SHELL CONTENT

Project:	**Moorehead City DMMP**	**Depth:**	**15.5' - 16.0'**
Project No.:	**WPC6308.00103**	**Date:**	**11/23/2008**
Boring No.:	**MHC-08-V-65**		
Sample No.:	**2**		
Description:	**SAND, poorly-graded, mostly fine-grained quartz, few fine-gravel to fine sand-size shell fragments, trace silt, olive gray 5Y 5/2 (SP)**		

Tare Weight, (g):	48.32	
Dry Wt. Before Washing (g):	211.12	(with tare)
Dry Weight After Washing (g):	209.65	(with tare)

Sieve Size (Name)	Sieve Size (mm)		% Passing	Approx. Visual Shell %	Approx. Visual Shell Wt. (g)
3/4"	19.000	0.00	100.00	0	0.00
3/8"	9.500	0.00	100.00	0	0.00
#4	4.750	0.08	99.95	100	0.08
#7	2.800	0.10	99.89	100	0.10
#10	2.000	0.38	99.66	100	0.38
#14	1.400	0.52	99.34	100	0.52
#18	1.000	0.62	98.96	95	0.59
#25	0.710	1.17	98.24	90	1.05
#35	0.500	3.44	96.12	70	2.41
#45	0.355	15.35	86.70	30	4.61
#60	0.250	55.80	52.42	10	5.58
#80	0.180	67.82	10.76	5	3.39
#120	0.125	14.74	1.71	0	0.00
#170	0.090	1.25	0.94	0	0.00
#200	0.075	0.11	0.87	0	0.00
#230	0.063	0.06	0.84	0	0.00
Total Shell Content:		**11**		**%**	


Bulkhead Channel - Range 2A
9+15.63
0+00
MHC-08-V-65
5+00
Bulkhead Channel - Range 2
MHC-08-V-64
0+00
41+11.19.00
35+00
30+00
Bulkhead Channel - Range 1
25+00
MHC-08-V-63
MHC-06-29
20+00
MHC-08-V-62
MHC-06-30
15+00
Range B
LB-02-06
MHC-08-V-37
MIH-03-V-6
mob-05-v-15
10+
MH-
LEGEND
boringlogs Events
Shoaling Areas
Tin Layer
Depth In Feet
4 and Shallower
6 - 4
7 - 6
8 - 7
10 - 8
12 - 10
14 - 12
15 - 14
15 and Deeper
Waypoints
Waypoint Lines
Stationing
Navigation Channel
Navigation-Channel_2017-03-07

Washington Yacht Club
Marina Development Plan

Prepared for:

Washington Yacht Club

1500 M Street SE
Washington, DC 2003

Prepared by:

moffatt & nichol

June 29, 2020

MN #10916

DISCLAIMER

Moffatt & Nichol has devoted effort consistent with (1) the level of diligence ordinarily exercised by competent professionals practicing in the area under the same or similar circumstances and (2) the time and budget available for its work, to ensure that the data contained in this report is accurate as of the date of its preparation. In preparing this professional assessment, Moffatt & Nichol used estimates, assumptions, and other information developed by Moffatt & Nichol from its independent research, general knowledge of the industry and information provided by the Washington Yacht Club and other third-parties. Moffatt & Nichol does not assume responsibility for inaccuracies in reporting by any third-party data source used in the preparation of this report. Likewise, Moffatt & Nichol undertakes no obligation to update the information contained herein or to notify recipients of events occurring after the date on the front cover that might change the content or conclusion of this report.

Moffatt & Nichol does not accept any liability for the consequences of this document being used for a purpose other than for which it was commissioned. This document should not be relied upon for any other project without the prior written consent of Moffatt & Nichol. Any recipient of this document other than the Washington Yacht Club, by their acceptance or use of this document, releases Moffatt & Nichol and its affiliates from any liability for direct, indirect, consequential or special loss or damage whether arising in contract, warranty (express or implied), tort or otherwise, and irrespective of fault, negligence and strict liability.

No party other than the Washington Yacht Club shall be entitled to rely on any reports or recommendations provided by Moffatt & Nichol as part of the Services ("Reports") without Moffatt & Nichol's separate written consent, and Moffatt & Nichol shall have no liability for the use of any Reports by any party for any purpose other than the Project.

DOCUMENT VERIFICATION

Client	Washington Yacht Club
Document title	Marina Development Plan
Status	**Final**
Date	29 June 2020
Project number	10916
File reference	MN10916 Memo WYC Marina Development Plan Jun2020 Final.docx

Revision	Description	Issued by	Date	Checked
00	Marina Development Plan	J. McIntyre	06/29/20	M. Pirrello

Table of Contents

1 Introduction

Washington Yacht Club is a private club with a marina in Washington, DC. The facility is located on the northern bank of the Anacostia River between The Navy Yard and 11th Street Bridges to the west (downstream) and the John Phillip Sousa Bridge (Pennsylvania Avenue) to the east (upstream). The existing facility consists of a clubhouse and parking lot landside and 40 slips for vessels 20 to 50 feet in length on floating timber docks. WYC, first established in 1910, has been in existence for over 100 years and is one of the oldest yacht clubs in the District, receiving designation from the District as the 1st Historic Yacht Club on the Anacostia River. WYC encompasses approximately 290 feet of shoreline with dock extension approximately 200 feet into the river. The federal channel abuts the existing waterward property limits. To the north (upriver) and south (downriver), the submerged lands are owned by the District with landside operations for DC Water and in-water storage for the DC trash collection boats.

The goal of this scope of work is to provide WYC with a marina development plan and implementation strategy to redevelop its waterside infrastructure including expansion of approximately 450 feet to the south and 250 to the north for a total project length of approximately 1000 feet. This document presents the existing physical and environmental conditions at the site, proposed marina development program, master concept plan, and implementation strategy for the proposed project. A summary of the February 13, 2020 site visit and meeting is included in Attachment A. Graphical representations of the existing conditions at the site and in the vicinity and the proposed marina concept plan as well as images showing similar marina access, floating dock structures, materials, and amenities and shoreline stabilization alternatives are included in Attachment B.

Existing Washington Yacht Club Marina

2 Site Analysis

The following describes existing physical and environmental conditions at the project site. Information was obtained through available online resources, nearby project data and information provided by WYC. Additional information, such as boundary, topographic, and bathymetric surveys; geotechnical investigation; and benthic/aquatic resources survey will be required for the redevelopment design at a later stage.

Physical Site Conditions

The following describes the existing physical conditions at the project site. Constraints, such as property and channel boundaries, are applicable to the redevelopment and expansion of the marina. Exhibits 1 and 2 (Attachment B) illustrate the physical site conditions in the vicinity of the project.

Jurisdictional Boundaries

- The federal Anacostia River Basin Channel (Anacostia Channel) extends from below the WYC property limits to Bladensburg, MD. The channel measures 80 feet wide with an authorized project water depth of 8 feet Mean Lower Low Water (MLLW) for its entire length. The Washington Harbor Channel abuts the Anacostia Channel at the WYC property with a channel width of 200 feet to its confluence at the Potomac River and an authorized project water depth of 24 feet and two (2) turning basins – one at the Navy Yard and one at its terminus at adjacent to WYC.
- The US Army Corps of Engineers (ACOE) sets minimum setbacks for fixed and floating structures adjacent to a federal channel. For this section of the channel, the minimum approved setback is 25 feet for the Anacostia Channel (WYC and upriver) and 75 feet for the Washington Harbor Channel (downriver of WYC). A variance from ACOE may be required if encroachment of the channel setback is desired. Additionally, any modification to the channel alignment will require a Congressional amendment of the current Federal channel alignment (deauthorization request). *Note: The District Department of the Environment, as part of their Anacostia Remediation Efforts, may be seeking a Congressional amendment to the Washington Harbor Channel with respect to channel depth and alignment, including the channel at the project area.*
- The pierhead line in the District is generally set at 200 feet from the bulkhead line. Development outside this limit may require a variance from the District and/or ACOE. Note that the pierhead line (marina facilities between WYC and 11th Street Bridge) is located the bounds of the Washington Harbor Channel.
- Current District zoning classification for the land space bounded by Water Street SE and M Street SE, the Anacostia River, 11th Street Bridge and Sousa Bridge is "Unzoned". The District's Comprehensive Plan - Future Land Use Map designates this area as "Parks, Recreation and Open Space".

Bridge Clearances

- Vessel access to the marina is controlled by one (1) swing bridge (Frederick Douglas Memorial Bridge) and two (2) fixed bridges (11th Street Bridge and Navy Yard Bridge/I-695) from the entrance at the Potomac to the project site (~3 miles). Note: a new fixed bridge is currently under construction, scheduled to be complete end of 2021 and will replace the existing Frederick Douglas Memorial Bridge.
- The minimum horizontal clearance is 149 feet, located at the Frederick Douglas Bridge (~1.5 miles from WYC). The new bridge will have a similar horizontal clearance.
- The minimum vertical clearance is 28 feet, located at the 11th Street Bridge (~0.5 miles from WYC).

Existing Site Operations

- There are approximately 38 vessels currently docked at WYC. Relocation of these vessels will be required during construction.
- DC Water stores its skim boats on docks upstream of WYC (in the proposed project limits). Relocation of these vessels is required prior to construction (proposed location: ACOE docks south of project site).
- DC Water has a sewer collection site adjacent to the WYC parking lot (water space in the proposed project limits). Waterside access is not required, but landside access is required to be maintained during and post construction.
- Landside and waterside access to the District Yacht Club (adjacent to DC Water site) is required to be maintained during and post construction.

Waterside Infrastructure

- The shoreline of WYC is lined with a timber crib or concrete block wall topped with stacked concrete blocks, up to 4 feet in height. The bulkhead is in poor condition and in need of significant repair/reinforcement. The shoreline of the District properties on both sides of WYC is vegetated with rip rap.
- The existing docks at WYC are timber decked with metal framing and exposed Styrofoam floatation supported by timber piles. The dock configuration consists of an 8-foot wide marginal walkway parallel to the shore and two (2) dock trees with double loaded slips on both sides and at the T-head end of each tree. The dock tree spines (main piers) are 8 feet wide, finger piers 4.5 feet wide, and T-head slip finger piers 3 feet side. Access to the marina is a via two (2) non-ADA compliant timber gangways.

River Conditions

- Soil conditions in the Anacostia River are generally defined by a thick layer of clayey fine sand near the river bottom with layers of coarse grain sand and medium dense clay below followed by very dense and stiff clay and rock layer. As geotechnical conditions can vary greatly over an area, it is recommended that a site specific geotechnical investigation be conducted at a later date.
- Water depths at the project site range approximately from 3 to 9 feet with water depths less than 5 feet generally located between the shoreline and walkway pier.

Environmental Site Conditions

The following describes the current environmental conditions at the site and are recommended to formulate the environmental criteria to be used as a basis for the analysis of the new structures.

Current & Waves

- Tidal currents in the Anacostia River are weak and variable according to NOAA Tidal Current Tables. Hydrodynamic modeling (completed by MN for The Yards Marina, January 2010) results indicate that tidal currents in the Anacostia River are generally very slow with a maximum tidal current of 0.1 knot (0.2 feet per second). Under high flow conditions, the hydrodynamic model indicates that tidal currents are essentially identical to the tidal flow currents with the primary direction of the current downstream regardless of tidal condition.
- Waves in the Anacostia River are generated either by passing vessels (maximum vessel speed of 6 miles per hour) or winds. Wind-generated waves are fetch-limited with the maximum fetch of approximately 0.5 miles to the southeast (downstream).

Water Levels

- Tidal information was obtained from the National Oceanic and Atmospheric Administration (NOAA), National Ocean Service (NOS) Station 8594900 Washington, Potomac River, 1983-2001 Epoch.

Table: Tidal Water Levels at Washington Yacht Club

Water Levels	Elevation (ft) by Datum	
	NAVD88	DCDPW
Highest Observed Water Level	9.66	9.67
Mean Higher High Water (MHHW)	1.77	1.87
Mean High Water (MHW)	1.54	1.64
Mean Sea Level (MSL)	0.15	0.25
North American Vertical Datum 1988 (NAVD88)	0.00	0.10
DC Department of Public Works Datum (DCDPW)	-0.10	0.00
Mean Low Water (MLW)	-1.24	-1.14
Mean Lower Low Water (MLLW)	-1.40	-1.30
Lowest Observed Water Level	-6.44	-6.34

- Flood elevations are based on the elevations provided on the FEMA FIRM Map No. 1100010038C, dated September 27, 2010
    - Flood Zone Classification = AE
    - Base flood Elevation (100 yr Flood)= EL +11.0 feet NAVD88 or EL +11.1 feet DCDPW

- Still water level elevations are determined from the NOAA tidal information and FEMA Flood Insurance Study (FIS). The FIS for Washington, DC is 110001V00A dated September 27, 2010.

- **Table: Still Water Levels at Washington Yacht Club**

Water Levels	Elevation (ft) by Datum	
	NAVD88	DCDPW
1-year Still Water Level (SWL)	2.87	2.97
10-year SWL	5.50	5.60
50-year SWL	8.25	8.35
100-year SWL	10.10	10.20

- Future sea level rise should be taken into consideration when determining water levels and structure elevations. ACOE has developed a method to estimate potential seal level rise design life of structure ("Sea-Level Change Considerations for Civil Works Programs", ACOE, 2011).

Wind

- Wind pressure is applied to both the berthed vessels and marina infrastructure with consideration for occupied and unoccupied conditions.

- Using record data from Reagan Airport, the typical storm wind speed for the District is 40-knot sustained (30-minute) wind. It is recommended that this wind speed be used for the fully occupied (vessels at all berths) condition. For winds in excess of this design speed, it is recommended that alternate mooring arrangements shall be employed, or vessels shall vacate the marina.

- The ASCE 7 maximum design wind speed for structures is 115 mph (miles per hour) 3-second gust. It is recommended this wind speed be used for the unoccupied (no vessels) condition.

Ice & Snow

- Winters in the District can lead to build-up of ice in the Anacostia River. This can have a negative impact on both the dock

infrastructure and vessels. Employment of bubblers or deicers is recommended to mitigate potential ice build-up within the marina.

- The basic snow load shall be 30 psf equivalent uniform load per DCMR 12 A, Chapter 16.

Data Collection Sources

ACOE Hydrographic Surveys. Anacostia River Basin, 2010 & Washington Harbor, 2015. https://www.arcgis.com/apps/opsdashboard/index.html#/4b8f2ba307684cf597617bf1b6d2f85d

ACOE Special Public Notice 11-17. *Minimum Setbacks for Structures along Federally Authorized Navigation Channels Within the U.S. Army Corps of Engineers Baltimore District Civil Works Boundaries*. March 2011. https://www.nab.usace.army.mil/Portals/63/docs/Regulatory/Pubs/spn11-17.pdf

District of Columbia, Office of Tax and Revenue. Real Property Web Map. https://dcgis.maps.arcgis.com/apps/webappviewer/index.html?id=9a5c11c11dd347cc9c05d64499cc98ee

District of Columbia, Office of Zoning. Zone District Maps. http://maps.dcoz.dc.gov/zr16/

District of Columbia, Office of Planning. Future Land Use Comprehensive Map. October 2010. https://planning.dc.gov/page/comprehensive-plan-future-land-use-maps.

FEMA Flood Insurance Rate Map. No. 1100010038C District of Columbia. September 2010. https://msc.fema.gov/portal/home

FEMA Flood Map Service Center. Flood Insurance Study Number 110001V00A Washington, DC. September 2010. https://msc.fema.gov/portal/home

NOAA. US Coast Pilot Volume 3, Chapter 12, 53rd Edition. 2020. https://nauticalcharts.noaa.gov/publications/coast-pilot/index.html

NOAA Tides & Currents. Tidal Benchmark Information, Station 8594900 Washington, DC. April 2018. https://tidesandcurrents.noaa.gov/benchmarks.html?id=8594900

NOAA Tidal Current Tables, District of Columbia. https://tidesandcurrents.noaa.gov/noaacurrents/Stations?g=468

The Yards – Hydrodynamic and Sedimentation Study. Moffatt & Nichol. January 2010.

3 Marina Program

The following describes the recommended performance and design criteria for the proposed marina.

Configuration

Marina Layout

- Marginal walkway parallel shore with dock trees extending into river.
- Marginal walkways and main piers shall have a minimum width of 10 feet.
- Finger piers shall have a minimum width of 4 feet. Finger pier lengths shall be 38 feet and 45 feet.
- End piers shall have a minimum width of 8 feet and shall extend the same length as the adjacent finger piers.
- Fairways shall have a minimum clear distance of 1.5 times the longest vessel for slips or 2 times the largest vessel beam for side ties.
- Fender piles shall be placed in slips – one pile at the end of the finger pier and one inset 1/3 of the finger pier length. Timber piles to be used.
- Utility service equipment and dock amenities to be located within footprint of dock structure or on exterior floats or triangle frames.
- Utility pedestals to be located mid slip on main piers and T-head slips, set for double vessel service.

Berthing Arrangement

- Slips shall be doubly loaded.
- Slips sizes shall be comprised of two (2) classes:
    - 38-foot class for vessels 35 to 41 feet in length
    - 45-foot class for vessels 42 to 50 feet in length
- Slip configuration shall be based on 35% 38-foot class, 55% 45-foot class & 10% larger vessels (T-heads).
- Cleats shall be provided on all mooring faces. Each vessel shall have a minimum of 4 cleats. For 38-foot fingers, 3 cleats shall be provided on each side of each finger and 1 cleat on the main pier. For 45-foot finger piers, 4 cleats shall be provided on each side of each finger and 1 cleat on the main pier. For end ties, 8 cleats shall be provided at equal spacing on the outboard face.

Structural Elements

Dock System

- Floating dock system shall be employed at the project site.
- Dock modules shall be timber or metal-framed with timber, composite, or hardwood decking. Floatation shall be fully encased with HDPE or similar material.
- Dock system to be anchored with coated steel pipe piles. Piles to be located at the end of finger and end piers, mid-slip along main piers and on the shore side of the marginal walkway.
- Dock freeboard shall be 18 inches minimum under dead load only.
- Live load (pedestrian) capacity shall be 30 psf minimum with freeboard under full live load not less than 8 inches.

Gangways

- Gangways shall be aluminum and designed in accordance with current ADA standards with slope calculated for full range of operational water levels. Consideration for landside access point elevation shall be included in analysis.

- Gangway length shall not exceed 80 feet.
- Gangway live load to be equal to 100 psf.

Utility Services & Dock Amenities

Electrical Service

- 480 volt, 3-phase and 120/240 volt single phase
- Utility pedestals shall have the following receptacle arrangements:
  - 38-foot slips: 2-30A receptacles per vessel (double vessel service)
  - 45-foot slips: 1-30A & 1-50A receptacles per vessel (double vessel service)
  - T-head slips: 2-30A & 2-50A receptacles per slip (double vessel service)
- Electrical meters for each slip
- Light bollards on marginal walkway
- 20A GFCI convenience outlet in each pedestal and light bollard (deicers will utilize GFCI outlets)
- Ground fault monitoring (GFM) will be consistent with NEC 555.3 requirements.
- CATV & Ethernet outlets at each pedestal – 1 each per vessel for future use.

Potable & Winter Water service

- Two (2) hose bibbs for each utility service pedestal
- Hose bibb station at centralized pump-out station
- Potable water service shutoff during winter weather conditions.
- Limited winter water service option: 1 station 75-90 feet on center on each dock tree. System is not designed to supply continuous flow to individual boats.

Sanitary Sewer Service

- Centralized vessel sewer system option 1: one station located on one T-head or on marginal walkway; pump out unit on marginal walkway in line with station
- Centralized vessel sewer system option 2: 1 station per 4-8 boats on each main pier; pump out unit(s) on marginal walkway
- Not serviceable when potable water service discontinued due to winter weather conditions.

Fire Protection

- Dry standpipe system, maximum spacing 150 feet on center
- Fire extinguishers, maximum spacing 75 feet on center
- Fire department connections at head of gangway(s), within 100 feet of landside hydrant.

Life Safety Equipment

- Secure access gates at head of each gangway leading to docks. Key, card or code access to be determined.
- Navigation lights at outboard corners of each dock end pier
- Ladders, 150-foot spacing, locate at end of finger piers and near gangway landings.
- Life Rings at equal interval to fire standpipes

4 Concept Plan

The following describes the development process for the redevelopment plan of the WYC Marina. Note: master plan development of the landside, including utility service connections, parking and buildings, are excluded from this scope of work.

Waterway Limits

Exhibit 2 (Attachment B) illustrates the existing water depths and channel alignment within the project boundaries.

Marina Basin Depth

As stated previously, water depths range from 3 to 8 feet within the project limit. It is unknown if the water depths at WYC are static or are changing with sediment movement in the river (shallowing or deepening over time). Industry standard for water depths are generally 5 feet minimum at MLLW with vessel drafts estimated at 10% of the overall vessel length. For this project, while the existing water depths are sufficient for the majority of the vessel sizes (under 50 feet), the current water depths may limit vessel access to some slips. Dredging of the marina could help to alleviate this condition and also mitigate any potential shallowing of the marina due to sedimentation. It is easier to conduct dredging when there are no structures or vessels in place but not a requirement.

Channel Alignment

As illustrated in Exhibit 2 (Attachment B), the riparian area downstream of the existing WYC property is located within the limits of the existing federal channel (Washington Harbor Channel). In order to expand the marina in this area, a partial deauthorization of the channel is required. Coordination with the District, in particular DOEE, is recommended for this activity as (1) it requires a Congressional amendment and (2) DOEE is seeking a partial deauthorization of the channel as well. Exhibit 3 illustrates the limits of the deauthorized area required for this project as well as the proposed deauthorized area included in the DOEE request.

Shoreline Stabilization

As stated previously, the WYC shoreline is formed by a combination of timber crib or concrete block wall and stacked concrete blocks and the adjacent properties with rip rap (stone revetment). The condition of the shoreline features is poor – broken and missing concrete blocks and overgrown rip rap – and in need of repair. Further investigation of the condition of the shoreline is required before a definitive repair plan can be realized but at a minimum installation of new rip rap for the length of the project area, including at the base the WYC wall, is recommended to stabilize the existing shoreline. Additional shoreline stabilization that may be required at the WYC property include a new concrete retaining wall or a sheet pile bulkhead. Considerations in the development of a shoreline stabilization plan include landside use – loading, flood plain – and geotechnical conditions. Note that landside development may require elevation of landside infrastructure, in particular building ground floors to above the FEMA Flood elevation of +11 feet.

Marina Layout

Utilizing the slip distribution and sizing guidelines defined in the previous Marina Program section, three alternative concept plans were developed and reviewed with WYC board. The three options were similar in slip number and configuration with the main differences being the distribution of slips in the marina and orientation of the docks relative to the landside and channelside boundaries. Additionally, a plan of the marina within the limits of the existing WYC property was also explored. The final results of this exercise are shown in Exhibits 4 and 5 (Attachment B). A summary of the slip distribution follows.

Note: existing slip mix includes 26 vessels 20 to 39 feet in length and 14 vessels 40 to 49 feet in length.

Table: Slip Summary

Slip Size	Existing		Goal	WYC Slips *Exhibit 4*		Full Buildout *Exhibit 5*	
38 Class	26	65%	35%	15	47%	33	37%
45 Class	14	35%	55%	13	41%	44	49%
End Tie			10%	4	13%	12	13%
Total	40			32		89	

The selected marina concept plan (Exhibit 5) consists of a long walkway pier, oriented parallel to shore and in a similar location as the existing infrastructure, and six (6) dock trees with slips for vessels up to 50 feet in length and side tie slips at each end pier for vessels up to 100 feet in length. As shown in Exhibit 4, two of the dock trees (Docks C & D) can be designated for WYC members with secure access points, if desired, along the walkway pier. In-water storage for personal watercraft (PWC) such as kayaks and dinghies are available along the landside edge of the walkway pier. Access to the marina is via a single access pier extending from the WYC parking lot and two (2) ADA-compliant gangways. A wide platform float is provided at the upstream access point to serve as a boater services (gathering) area.

Exhibit 6 (Attachment B) illustrates a plan view rendering of the full build out marina concept plan with some basic landside feature identified. Exhibit 7 (Attachment B) shows a sample of precedent images for a selection of the marina features identified with in the rendering:

(A) Marina access piers with multiple gangways
(B) Floating dock types, materials and amenities
(C) Shoreline stabilization alternatives

Construction Cost

An opinion of probable construction costs was developed to assist WYC with preparing a budget plan for this project. The following table presents a summary of the estimated costs, broken down by base bid, landside allowances, and bid alternatives for dock type, dredging, shoreline stabilization and vessel utility services. Below costs are limited to in-water infrastructure with the exception of allowances for landside utility service connections and equipment costs, which are included in this summary as a point of reference.

Table: Opinion of Probable Construction Cost Summary

Description		WYC Property Exhibit 4	Full Buildout Exhibit 5
Base Cost: Demolition, Rip Rap Revetment, Timber/Metal Framed Floating Dock System, Vessel Power & Water Services, Centralized Sewer, Fire Protection, Access Pier & Gangways		$ 3,403,000.00	$ 7,296,000.00
Allowance 01: Landside Utility Service Connections & Upgrades - Electrical		$ 125,000.00	$ 125,000.00
Allowance 01: Landside Utility Service Connections & Upgrades - Electrical		$ 75,000.00	$ 75,000.00
Add Alternate 01: Floating Docks - Concrete		$ 296,000.00	$ 733,000.00
Add Alternate 02: Shoreline Stabilization - WYC Retaining Wall		$ 312,000.00	$ 312,000.00
Add Alternate 03: Shoreline Stabilization - WYC Sheet Pile Wall		$ 780,000.00	$ 780,000.00
Add Alternate 04: Sewer Pumpout System - In-Slip Service		$ 10,000.00	$ 31,000.00
Add Alternate 05: Winter Water Service		$ 49,000.00	$ 148,000.00
Add Alternate 06: Dredging, -6' MLLW		$ 178,000.00	$ 592,000.00
Add Alternate 07: Dredging, -8' MLLW		$ 533,000.00	$ 1,777,000.00
Total Construction Cost	*Min*	$ 3,403,000.00	$ 7,296,000.00
	Max	$ 5,271,000.00	$ 10,965,000.00

The approximate construction cost ranges from $7.3M to $11.0M for the Full Build Out option and $3.4M to $5.3M for the WYC Property option depending on the allowances and alternatives selected.

In addition to the costs associated with construction of the project, there are a number of outside consultant services WYC may require during the District coordination, permitting, design and construction phases of the marina redevelopment project, such as existing condition surveys and studies, permitting, design and construction support services. To assist WYC with developing an overall planning budget for this project, the following table presents a range of estimated fees for typical services necessary for a project of this type and magnitude:

Table: Opinion of Probable Construction Cost Summary

Service	Estimated Fee
District & regulatory agency coordination	$5-15K, T&M
Grant applications	$5-10K per application
Topographic & bathymetric surveys	$5-15K, lump sum
Aquatic resources investigation	$5-10K, lump sum
Geotechnical investigation	$15-30K, lump sum
ACOE & DOEE permitting	$10-15K, lump sum
RFP package & bid solicitation	$40-60K, lump sum
Construction support services	$25-50K, T&M
Total fee estimate	$115K to 205K

5 Implementation Strategy

The following presents a strategy for implementation of the marina master plan for the Washington Yacht Club. This strategy plan assumes full buildout of the proposed plan as described in the previous section, but similar considerations would be required should WYC opt to only rebuild their existing facility.

Regulatory Requirements

Marina redevelopment requires significant coordination with a myriad of agencies on the local, state and federal level before the first board is demolished. Some of this process is restricted to the waterside elements – such as ACOE permitting – while others – such as DCRA permitting – tie in the landside elements as well.

Regulatory Permitting

Federal and District agency approvals are required for in-water work in the Anacostia River. Two agencies, ACOE and DOEE, issue approvals for this type of work with other agencies, such as NOAA and USCG, providing input during the permit review process. This process occurs typically in the beginning of the design phase and must be complete prior to start of construction. In addition, construction activities require notification of several agencies for construction specific activities, including FAA for cranes, DOEE for in-water work waivers, and USCG for notice to mariners.

Utility services for the marina require separate review and approvals from the District Fire Marshall, DC Water, PEPCO, and DCRA. These may be completed in concert with or separate from any landside development.

The marina work would also be included with any landside development approvals through the District Planning and Zoning departments.

Jurisdictional Boundaries

The proposed plan includes water space not currently under a ground lease agreement between WYC and the District. Extension of this ground lease requires coordination with the District. In addition, the area downstream of the WYC property is currently within the limits of a Federal channel.

Construction within a channel and its setback is prohibited by the ACOE without a modification of the channel and/or a variance request. Congress has sole authority to modify channel limits; therefore, coordination with the District and the District's Congressional delegation is required to change the channel limits in this area. Note that DOEE is also interested in modifying the channel as part of their remediation efforts for the Anacostia River. A variance for construction within the channel setback requires a request to ACOE for consideration.

Funding Opportunities

There are opportunities for WYC to partner with federal, state and private entities to cost share a portion of the redevelopment costs through various grant programs. The following presents a selection of grant programs for which this project may qualify. These programs are limited to the marina infrastructure described in this scope of work. Additional funding opportunities may be available for landside redevelopment work.

Recreational boating

Boating Infrastructure Grant Program (BIG): offered to publicly accessible boating facilities with designated dockage for transient (15-day maximum stay) boaters. Annual award with two tiers of funding – Tier 1 State up to $200K for each state, district or federal territory and Tier 2 National up to $1.5M per project. Minimum match of 25% of eligible costs are required. Applications due to the District beginning of

August each year with funding (if awarded) available the following summer. Funding available for 3 years from award. Offered by US Fish and Wildlife Service.

Land and Water Conservation Fund (LWCF): offered to public outdoor recreational spaces, including marinas, for acquisition and/or development. Annual award with maximum request of $250K. Requires 50% match. Applications due to District typically March of year with funding (if awarded) available the following March. Project completion required within 3 years of award. Offered by National Park Service.

Environmental Remediation

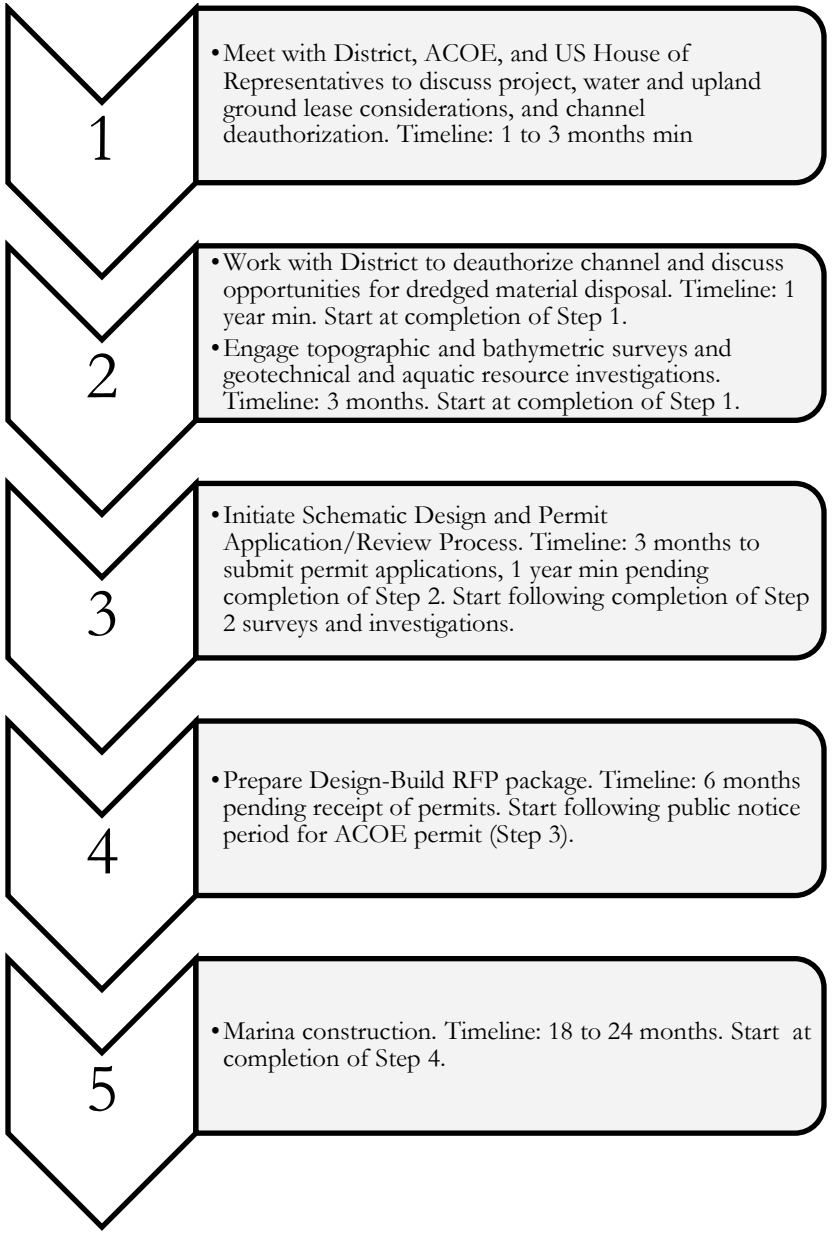
Clean Vessel Act Grant Program (CVA): offered to boating facilities with publicly accessible vessel pumpout service. May be used for installation, operation, and/or maintenance costs. Offered annually with opportunity to request funding each year for same facility. Applications due to the District December each year with funding (if awarded) available the following October. Project completion required within one (1) District fiscal year. Offered by US Fish and Wildlife Service.

Maritime Heritage

Play Space Grant Program (PLAY): offered to publicly-owned spaces in underserved communities for development of recreational facilities, including community engagement and volunteerism. Annual award with applications due March of each year with funding (if awarded) available that summer. Maximum award of $30K with minimum match of 50% required. Project completion required within the same calendar year of award. Offered by National Recreation and Park Association.

Implementation Steps

The following itemizes the next steps for the redevelopment of the WYC marina.



Attachment A: Site Visit Notes

The following is a summary of the discussions held during the site visit conducted by Mark Pirrello of Moffatt & Nichol on February 13, 2020 at the Washington Yacht Club in Washington, DC. Steve Ricks, Commodore of WYC and other club members were in attendance.

- WYC's goal is to renovate the existing marina and look to expand to the north and south of their property.
- The property to the south is owned by DC Water. The property to the north is owned by the District of Columbia.
- All sovereign submerged lands in the Anacostia River is owned by the District of Columbia, except for Federal channel.
- WYC, established in 1910, has received designation as the first Historic Yacht Club landmark located on the Anacostia River by the District. WYC has approximately 35 members.
- WYC recognizes the need and opportunity to expand affordable community boating in the District for its members and the general public.
- WYC envisions the future of the Anacostia River Waterfront and its future development. As such WYC seeks to acquire the water lease areas to the south and north of WYC from the District to expand their marina for public use with WYC as the developer and marina operator.
- Expansion north is predicated on working with the District to relocate the skim boat (marine trash collection vessels) south to the USACE survey boat facility.

Site Conditions

- Water depths at the shoreline are quite shallow (<3 feet @ MLLW) but then there is a deeper hole/trough generally in line with the marginal docks (~ 8 feet) before shallowing up heading riverward for the next 40 feet (~ 5 feet). Water depth increases again heading riverward (7 to 9 feet).
- The federal channel limits for the Anacostia River north of the bridge (11th Street) are almost bank to bank. They narrow down south of the bridge. WYC indicates that they can go riverward with docks because no one enforces the channel limits (MN to confirm with Graham McAllister at Baltimore District).
- There are shoals in the Anacostia River (marked with buoys) downriver of the site but these do not affect navigation at site. USACE indicate they will dredge Anacostia at some future time (MN to confirm with Baltimore District).
- The existing bulkhead is not in good shape. Below the waterline, the bulkhead appears to be a timber crib or concrete block wall. It appears that stacked stone blocks (gravity wall) were used to raise the existing bulkhead by 3 to 4 feet. Several stacked blocks are missing.
- The existing marina was constructed approximately 15 years ago by members of the yacht club. The floating docks are hand-built (timber framed and decked) with unknown flotation. There was a comment by one of the members that it may be been high density Styrofoam as he indicated it tends to fall apart.
- The marina consists of approximately 8-foot-wide marginal dock that connects two dock trees. The main walkways on the two dock trees are also 8-foot wide and house all the electrical metering/receptacle boxes (homemade), dock boxes, safety equipment, and trash.

- The finger piers are generally 4.5-foot wide though there appears to be a few narrower fingers on the outer (riverward edge) of the docks (closer to 3 feet).
- All floating docks are restrained by timber piles.
- Existing electrical service is generally 30 amp 120V service to each power center. WYC indicated that they may require a few 50 amp service.
- A pile support boat lift was placed in one slip near the club house. WYC indicated that they may or may not allow it in the future.
- Safety equipment includes ladders and some fire extinguishers. No firewater system on docks.
- Two wood gangways (non-ADA) connect the marginal docks to the land and parking lot. There are security gates on the landward side of the gangways.

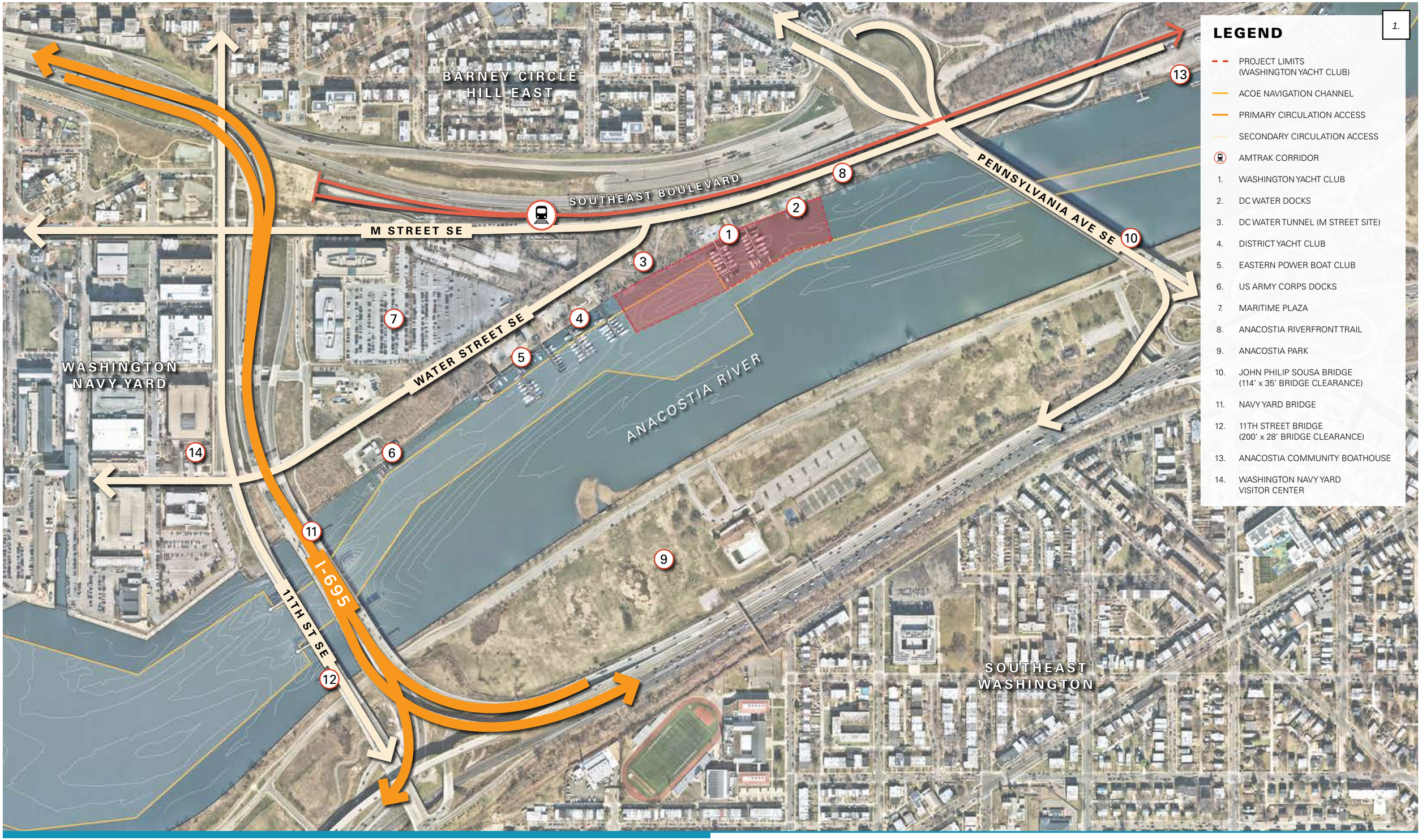
Proposed Improvements

- New marina to support club members and general public. Slips will be reserved for the club with additional slips generally open to the public.
- The marina will support vessels in two main classes – 38-foot class that spans boats from 35 feet to 41 feet and a 45-foot class that supports moorings of 42 to 50 foot vessels. Approximately 35% should be the smaller class and 55% the larger class. The remaining 10% will be for larger vessels.
- Dock configuration shall be similar to existing with marginal walkway along the shore, dock trees extending into the river, and slips oriented parallel to the river flow. The marina shall have large T-heads at the end to support large vessels (no shore perpendicular slips like the existing configuration).
- The marina shall expand to the north and south as much as possible without compromising fairways at the District Marina (to the south). The north extent shall be the existing PVC white pole that is approximately near the skim boat berths.
- Width of main piers and marginal walkway discussed. Decided on 10 feet to allow placement of power centers, dock, boxes, etc. without inhibiting the people and cart movement.
- The fingers should be minimum of 4 feet wide though WYC amenable to 5-foot width for larger slips as long as it does not compromise slip capacity.
- The new marina shall extend riverward as far as possible without compromising navigation. MN to call the Baltimore District Navigation branch to discuss the navigation channel and future dredging.
- WYC would like to be competitive with other new marinas in the area and utilize concrete floats but are willing to evaluate timber and/or aluminum framed docks based on pricing considerations. For the timber system, decking that was RCL or IPE was discussed though the latter may be cost prohibitive. Decking options for the aluminum framed system was also discussed.
- Slips shall include two mooring piles separating slips in a double slip configuration. The first mooring pile will be even with finger pier length and the 2nd mooring pile will be positioned a minimum of 1/3 waterward of the slip end.
- Electrical service upgrade is the primary goal. WYC preference is two 30 amp receptacles (60-amp capacity) for their slips. However, it was discussed that 50 amp service for boats larger than 45 feet is desirable so a 30 amp/50 amp receptable combination would be better. It is assumed that the T-head slips will house either one large vessel or two smaller vessels. For the larger vessel, the possibility of two 50 amp receptacles or a power center that has twin 30 amp receptacles on one side

and twin 50 amp receptacles on the other side. The power center shall be metered for individual slips.

- Ground Fault monitoring at the slip level will be added to meet code.
- Power center design shall consist of power-coated aluminum and/or stainless-steel case with hose hangar, twin hose bibs and LED Lighting.
- Potable water and firewater shall be provided with the latter based on District FD requirements.
- Need for winter water discussed. MN to price out a cost and WYC will decide in the future.
- Sanitary sewer – discussed desired to have a hydrant system in lieu of a single point pump out system. MN to price both options.
- Seawall – Depending on geotechnical considerations, a riprap revetment may be more cost effective to stabilize existing gravity bulkhead.

Attachment B: Exhibits



LEGEND

- PROJECT LIMITS (WASHINGTON YACHT CLUB)
- ACOE NAVIGATION CHANNEL
- PRIMARY CIRCULATION ACCESS
- SECONDARY CIRCULATION ACCESS
- AMTRAK CORRIDOR

1. WASHINGTON YACHT CLUB
2. DC WATER DOCKS
3. DC WATER TUNNEL (M STREET SITE)
4. DISTRICT YACHT CLUB
5. EASTERN POWER BOAT CLUB
6. US ARMY CORPS DOCKS
7. MARITIME PLAZA
8. ANACOSTIA RIVERFRONT TRAIL
9. ANACOSTIA PARK
10. JOHN PHILIP SOUSA BRIDGE (114' x 35' BRIDGE CLEARANCE)
11. NAVY YARD BRIDGE
12. 11TH STREET BRIDGE (200' x 28' BRIDGE CLEARANCE)
13. ANACOSTIA COMMUNITY BOATHOUSE
14. WASHINGTON NAVY YARD VISITOR CENTER

WASHINGTON YACHT CLUB MARINA DEVELOPMENT PLAN

WASHINGTON, D.C.

moffatt & nichol | JUNE 2020 | EXHIBIT 1: EXISTING CONDITIONS (CONTEXT)

GRAPHIC SCALE IN FEET
RATIO 1":400' @11x17

0 100 200 400 800

LEGEND

- PROJECT LIMITS (WASHINGTON YACHT CLUB)
- WASHINGTON YACHT CLUB APPROX. PARCEL LIMITS
- ACOE NAVIGATION CHANNEL
- PIERHEAD LINE (200' OFFSET FROM BULKHEAD)

1. WASHINGTON YACHT CLUB
2. DC WATER DOCKS
3. DC WATER TUNNEL
4. DISTRICT YACHT CLUB
5. ANACOSTIA RIVERFRONT TRAIL

M STREET SE

SOUTHEAST BOULEVARD

WATER STREET SE

75' SETBACK (WASHINGTON HARBOR CHANNEL)

PROPOSED PROJECT LIMITS

+/- 200'

WASHINGTON HARBOR CHANNEL

200'

25' SETBACK (ANACOSTIA CHANNEL)

-7ft

-6ft

-5ft

-6ft

-5ft

+/- 455'

+/- 360'

+/- 290'

+/- 185'

25' SETBACK (ANACOSTIA CHANNEL)

ANACOSTIA CHANNEL

80'

ANACOSTIA RIVER

WASHINGTON HARBOR CHANNEL TURNING BASIN

WASHINGTON YACHT CLUB MARINA DEVELOPMENT PLAN

WASHINGTON, D.C.

GRAPHIC SCALE IN FEET
RATIO 1":90' @11x17

0 22.5 45 90 180

LEGEND

- PROJECT BOUNDARY (WASHINGTON YACHT CLUB)
- WASHINGTON YACHT CLUB APPROX. PARCEL LIMITS
- ACOE NAVIGATION CHANNEL
- PIERHEAD LINE (200' OFFSET FROM BULKHEAD)
- ACOE NAVIGATION CHANNEL MODIFICATION LIMITS
- ACOE NAVIGATION CHANNEL PROPOSED DE AUTHORIZATION ZONE

1. WASHINGTON YACHT CLUB
2. DC WATER DOCKS
3. DC WATER TUNNEL
4. DISTRICT YACHT CLUB
5. ANACOSTIA RIVERFRONT TRAIL

M STREET SE
SOUTHEAST BOULEVARD
WATER STREET SE
DOWNSTREAM BOUNDARY OF PROJECT AREA
UPSTREAM BOUNDARY OF PROJECT AREA
+/- 460'
WASHINGTON HARBOR CHANNEL
200'
75' SETBACK (WASHINGTON HARBOR CHANNEL)
25' SETBACK (ANACOSTIA CHANNEL)
+/- 118'
+/- 230'
WYC PROPOSED DE AUTHORIZATION AREA
-7ft
-6ft
-5ft
-6ft
+/- 160'
-5ft
DOEE PROPOSED DE AUTHORIZATION AREA
25' SETBACK (ANACOSTIA CHANNEL)
ANACOSTIA CHANNEL
80'
ANACOSTIA RIVER

WASHINGTON YACHT CLUB MARINA DEVELOPMENT PLAN

WASHINGTON, D.C.

moffatt & nichol | JUNE 2020 | EXHIBIT 3: PROPOSED CHANNEL MODIFICATION

GRAPHIC SCALE IN FEET
RATIO 1":90' @11x17

0 22.5 45 90 180

ID	SLIP CLASS	VESSEL SIZE	WYC SLIPS	% SLIPS
38	38′ CLASS	35 to 41 LOA	15	47%
45	45′ CLASS	42 TO 50 LOA	13	40%
		SLIP TOTAL	**28**	
LF	END TIE	40 to 100 LOA	4	13%
		TOTAL	**32**	

Average Slip Size = 41.7 Linear Feat
Average Max Slip Size = 45.2 Linear Feet

LEGEND

1. PROJECT BOUNDARY (WASHINGTON YACHT CLUB)
2. WASHINGTON YACHT CLUB APPROX. PARCEL LIMITS
3. ACOE NAVIGATION CHANNEL
4. PIERHEAD LINE (200′ OFFSET FROM BULKHEAD)
5. ACOE NAVIGATION CHANNEL SETBACK LIMIT
6. FAIRWAY LINE APPROX. LIMITS
7. WASHINGTON YACHT CLUB
8. DC WATER DOCKS (TO BE RELOCATED)
9. DC WATER TUNNEL
10. DISTRICT YACHT CLUB
11. ANACOSTIA RIVERFRONT TRAIL

SOUTHEAST BOULEVARD
GANGWAY LANDING FLOAT (TYP.)
GANGWAY (80′ LONG TYP.)
MARINA ACCESS LANDING (20′ WIDE X 25′ LONG)
WALKWAY PIER (10′ WIDE TYP.)
DOWNSTREAM BOUNDARY OF PROJECT AREA
UPSTREAM BOUNDARY OF PROJECT AREA
66′
-5ft
66′
-7ft
-6ft
-5ft
-6ft
WASHINTON YACT CLUB GROUND LEASE EXTENSION
C
D
45′ CLASS FINGER PIER (4 x 45′ TYP.)
MAIN PIER (10′ WIDE TYP.)
60′
38′ CLASS FAIRWAY
90 LF
90 LF
25′ CHANNEL SETBACK
25′ CHANNEL SETBACK
WASHINGTON HARBOR CHANNEL
ANACOSTIA CHANNEL
-5ft
END PIER (8′ WIDE TYP.)
38′ CLASS FINGER PIER (4 x 38′ TYP.)
ANACOSTIA RIVER

NOTE: DOUBLE SLIPS ABLE TO ACCOMMODATE BOAT LIFTS AS NEEDED.

WASHINGTON YACHT CLUB MARINA DEVELOPMENT PLAN

WASHINGTON, D.C.

GRAPHIC SCALE IN FEET
RATIO 1":90′ @11x17
0 22.5 45 90 180

ID	SLIP CLASS	VESSEL SIZE	FULL BUILD OUT SLIPS	% SLIPS
38	38' CLASS	35 to 41 LOA	33	37%
45	45' CLASS	42 TO 50 LOA	44	49%
		SLIP TOTAL	**77**	
LF	END TIE	40 to 100 LOA	12	14%
		TOTAL	**89**	

Average Slip Size = 42.6 Linear Feat
Average Max Slip Size = 46.2 Linear Feet

LEGEND

- PROJECT BOUNDARY (WASHINGTON YACHT CLUB)
- WASHINGTON YACHT CLUB APPROX. PARCEL LIMITS
- ACOE NAVIGATION CHANNEL
- PIERHEAD LINE (200' OFFSET FROM BULKHEAD)
- ACOE NAVIGATION CHANNEL SETBACK LIMIT
- FAIRWAY LINE APPROX. LIMITS

1. WASHINGTON YACHT CLUB
2. DC WATER DOCKS (TO BE RELOCATED)
3. DC WATER TUNNEL
4. DISTRICT YACHT CLUB
5. ANACOSTIA RIVERFRONT TRAIL

SOUTHEAST BOULEVARD
GANGWAY LANDING FLOAT (TYP.)
GANGWAY (80' LONG TYP.)
MARINA ACCESS LANDING (20' WIDE X 25' LONG)
WALKWAY PIER (10' WIDE TYP.)
MAIN PIER (10' WIDE TYP.)
WALKWAY PIER (10' WIDE TYP.)
DOWNSTREAM BOUNDARY OF PROJECT AREA
PWC STORAGE
PWC STORAGE
UPSTREAM BOUNDARY OF PROJECT AREA
MAIN PIER (10' WIDE TYP.)
25' CHANNEL SETBACK
25' CHANNEL SETBACK
90'
39' MIN.
35' MIN.
A
B
C
D
E
F
-7ft
-6ft
-5ft
-6ft
-5ft
-5ft
100 LF
100 LF
90 LF
90 LF
90 LF
90 LF
75'
45' CLASS FAIRWAY
60'
38' CLASS FAIRWAY
WASHINGTON HARBOR CHANNEL
ANACOSTIA CHANNEL
ANACOSTIA RIVER
45' CLASS FINGER PIER (4 x 45' TYP.)
END PIER (8' WIDE TYP.)
END PIER (8' WIDE TYP.)
38' CLASS FINGER PIER (4 x 38' TYP.)

NOTE: DOUBLE SLIPS ABLE TO ACCOMMODATE BOAT LIFTS AS NEEDED.

WASHINGTON YACHT CLUB MARINA DEVELOPMENT PLAN

WASHINGTON, D.C.

moffatt & nichol | JUNE 2020 | EXHIBIT 5: MARINA CONCEPT LAYOUT - FULL BUILD OUT

GRAPHIC SCALE IN FEET
RATIO 1":90' @11x17
0 22.5 45 90 180

LEGEND

1. WASHINGTON YACHT CLUB
2. DC WATER DOCKS (TO BE RELOCATED)
3. DC WATER TUNNEL
4. DISTRICT YACHT CLUB
5. ANACOSTIA RIVERFRONT TRAIL

A. MARINA ACCESS
B. FLOATING DOCK
C. SHORELINE STABILIZATION
D. RECREATIONAL BOAT SLIP
E. BOATER SERVICES AREA
F. PERSONAL WATERCRAFT & TEMPORARY TIE-UP AREA
G. SIDE TIE DOCKAGE
H. MARINA PARKING
I. WASHINGTON YACHT CLUB CLUBHOUSE
J. MARINA SERVICES BUILDING

SOUTHEAST BOULEVARD

WASHINGTON HARBOR CHANNEL

ANACOSTIA CHANNEL

ANACOSTIA RIVER

-5ft

-7ft

-6ft

-5ft

-6ft

-5ft

WASHINGTON YACHT CLUB MARINA DEVELOPMENT PLAN

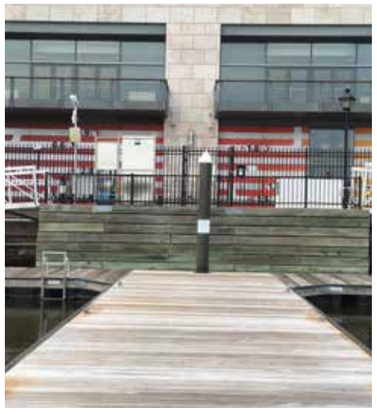
WASHINGTON, D.C.

GRAPHIC SCALE IN FEET
RATIO 1":90' @11x17

0 22.5 45 90 180

A

MARINA ACCESS



B

FLOATING DOCK

C

SHORELINE STABILIZATION

moffatt & nichol

Creative People, Practical Solutions.®

4700 Falls of Neuse Road, Suite 300
Raleigh, NC 27609
(919) 781-4626
www.moffattnichol.com

CITY OF ELIZABETH CITY
WATERFRONT MASTER PLAN

moffatt & nichol chipley

05.22.2018

ACKNOWLEDGEMENTS

The Elizabeth City Waterfront Master Plan is an initiative sponsored by City of Elizabeth City. The planning team leading the effort consists of Moffatt & Nichol and Chipley Consulting. A nine-member Project Steering Committee comprised of citizens, business owners and elected officials from Elizabeth City helped guide this process.

Kaitlen Alcock, Planner

Bettie Parker, Mayor

Deborah Malenfant, Exec. Elizabeth City Downtown Inc Director

Jeffery Simpson, Parks Superintendent

Amanda Boone, Asst Public Utilities Director

Carol Terryberry, Sailing/ Boating Enthusiast

Christina Rehklau, Exec. Elizabeth City CVB Director

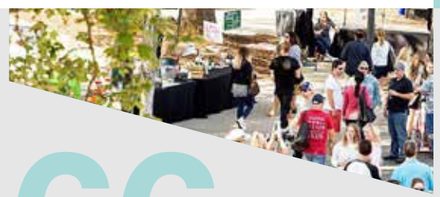
Wayne Harris, Exec. Director Economic Development

Warren Judge, Base Commander, Elizabeth City Coast Guard Base

PROJECT CONSULTANTS:

moffatt & nichol

chipley



CONTENTS

OVERVIEW

Elizabeth City loves its waterfront!

Nestled along the banks of the Pasquotank River, Elizabeth City's location played an important role in its history as a thriving seafood, timber and shipping regional hub. The city's direct link to the water provided the foundation for its growth and evolution as it changed from a water-based industry hub to a varied economic sector. Today, its waterfront is the meeting ground of the city's active life. From commerce and culture to open space and institution, cityscape and landscape co-mingle along the Charles Creek and river bend creating the "Harbor of Hospitality" as a robust and quaint experience.

The Waterfront Planning Process

Creating a vision requires the steadfast determination of the community along with the guidance and knowledge of the design team. Like all great planning projects, community input and engagement is at the core of this master plan vision; the City of Elizabeth City Waterfront Master Plan is a culmination of the collaboration between local citizens and design consultants to create a vision that will propel the waterfront development forward while maintaining a sense of sustainability and place.

Design processes are iterative due to their evolving nature and layering of input. Research and analysis set the foundation for the project, presenting strengths, weaknesses, opportunities, and constraints for the project site. Outlets like community engagement and public input surveys help extract the desires and concerns of the citizens, lending a voice to the mission and objectives. Benchmark meetings with the public and steering committee members ensures the design and consulting team are on course and provide a further in-depth perspective regarding the needs of the project site. Through a series of work sessions, public open houses and steering committee meetings, the design and consulting team captured the essence of Elizabeth City's past, present and future to create the master plan presented in this Vision Book. The waterfront planning process for Elizabeth City is a by-product of these input layers, creating a rich, vibrant, and economically and environmentally resilient plan for the City's future as the "Harbor of Hospitality" welcomes new growth and opportunities.

LEGEND

1. Charles Creek Park
2. Charles Creek
3. Waterfront Park
4. Mariners' Wharf Park
5. Veteran's Park
6. Machelhe Island
7. Downtown Elizabeth City
8. Mid Atlantic Christian University (MACU)
9. Museum of the Albemarle
10. Coast Guard Park / Sailing Center
11. Elizabeth City Shipyard

PROJECT LIMITS

- Waterfront Master Plan
- Charles Creek Flooding Mitigation Plan

THE HARBOR OF HOSPITALITY: PAST, PRESENT & FUTURE

Locals lend a hand and most share a smile. Sailboats glisten against the evening sunset. Mariners' Wharf sets the stage for downtown's farmer's market, film festival, and outdoor concert series offering programming and open space activation for most of the year. The welcoming atmosphere, complimentary wi-fi and 48-hour boat docking, as well as impromptu Rose Buddies parties at the visitor's center have contributed to the nickname, "The Harbor of Hospitality." Elizabeth City's waterfront is walkable to restaurants, shopping, accommodations and attractions, against the scenic backdrop of the Pasquotank River.

Historical Data

Incorporated in 1793 initially as the town of Redding, Elizabeth City has a long-standing history of shipping due to its strategic location at a narrowed bend of the Pasquotank River. Redding's name changed to Elizabethtown in 1794 and finally to Elizabeth City in 1801. The City prospered early on as a mercantile center primarily due to its proximity to the Dismal Swamp Canal – the oldest man-made canal in the United States – before shifting into a more industrial and commercial focus. These new opportunities established Elizabeth City as a prosperous deep-water port, with a variety of industries including lumbering, shipbuilding, grain, fish and oyster processing, landmarking the city as a formidable regional economic center rivalling Norfolk, VA and Baltimore, MD at the time. The onset of the Norfolk Southern Railway rendered water-based shipping less relevant, and created a shift in trade as many waterside industries relocated to the Piedmont which impacted coastal cities' ability to compete for trade.

World War II re-energized Elizabeth City's industries, mainly in shipbuilding, textiles and aeronautics. The Coast Guard Air Station Elizabeth City was established in 1940 and became the largest US Coast Guard base in the nation, even to this day. Elizabeth City Shipyard played an integral role in ship construction for the war effort, building the largest number of subchasers for the war and setting record construction time for the SC-class vessels.

The end of the war levelled the economy in Elizabeth City, forming the service, government and agriculture-dominant industries seen today. Revival efforts in tourism and civic revitalization commenced in the late 1990s have brought increasing economic stability for downtown and the city's six historic districts.

Elizabeth City is recognized as a regional shopping destination and its restaurant scene has been growing in recent years, offering opportunities for residents and families to enjoy both downtown Elizabeth City and the waterfront. The city is home to a variety of higher education institutions including Elizabeth City State University, the College of the Albemarle, and Mid-Atlantic Christian University.

1

2

3

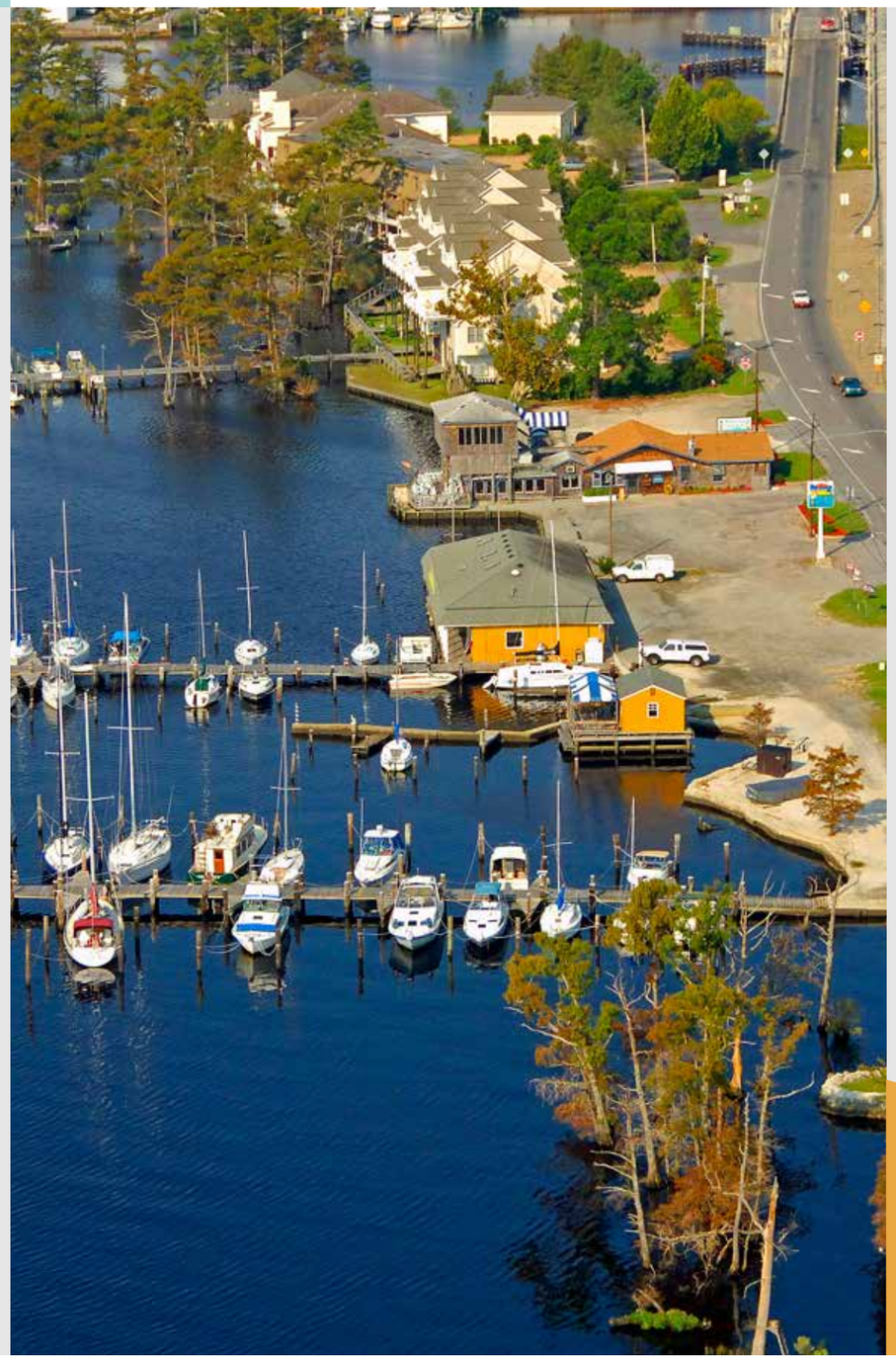
6

1. Elizabeth City Waterfront
2. Old Elizabeth City Weather Tower
3. Coast Guard Air Station
4. Town Aerial
5. US Navy Blimp
6. Pasquotank County Court House
7. Elizabeth City NC Potato Festival

4

5

7



From Work to Recreation: The Waterfront Today

Like most other coastal cities, Elizabeth City's waterfront provided the framework and structure for the city to commence and thrive due to its water-based shipping industry. Over the years, nearby cities grew and competed for economic prosperity, while the railroad was formed and waterside industries relocated to the interior of the State. The waterfront evolved from a single-tier industry to a multi-faceted one, offering other opportunities to enhance Elizabeth City beyond its shipping past and create a context for residents and visitors alike to shop, gather and play.

The waterfront today offers a range of amenities and a host of economic opportunities. Cultural attractions such as the Museum of the Albemarle and the Arts of the Albemarle are centrally located and pay homage to the past. An Academic institution anchors the northernmost point of the city's waterfront, attracting young minds and new talent every year. Machelhe Island and Causeway Park offer a beautiful natural ecological attraction on the other side of the harborfront and present an amenity for ecotourism. Additionally, Charles Creek and its park demonstrate flood mitigation challenges that must be planned for with sustainable interventions in the event of rising water levels.

The expansive waterfront itself is the scenic watery edge of downtown, both ripe for renewal and revitalization. There are currently eight public parks located on the downtown waterfront for citizens to enjoy for active recreation, events or relaxing. Certain key features, like the Coast Guard Park and the Elizabeth City Shipyard site offer promising redevelopment potential, while enhancements and connections to parks and open space strengthen the link between downtown and its harborfront.

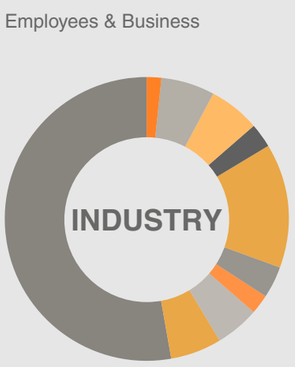
THE HARBOR OF HOSPITALITY: PAST, PRESENT & FUTURE

Economic & Social Considerations

EMPLOYMENT BY INDUSTRY

Elizabeth City is one of the 110 communities in North Carolina designated as a Main Street City or Associate. The National Main Street Center was established in 1980 by the National Trust for Historic Preservation to address issues facing historic downtowns. Elizabeth City Downtown, Inc. is the 501c3 non-profit that administers the program following a comprehensive four-point approach that is based on design, promotion, organization, and economic revitalization. The Main Street Program in Elizabeth City is managed by a volunteer board and board of directors and one full-time paid Executive Director. The program aims to create a healthy downtown through economic development, beautification, and restoration efforts.

The unemployment rate in Elizabeth City is 11% (ESRI Business Analyst - Elizabeth City), with the majority of its labor force in a white-collar job. A breakdown of employment by industry is shown in the chart to the right.



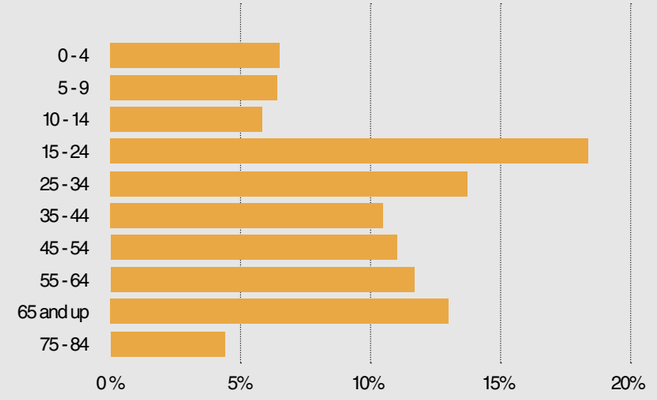
Clockwise from top:

Agriculture/Mining	1.7%
Construction	6.1%
Manufacturing	5.9%
Wholesale Trade	2.8%
Retail Trade	14.1%
Transportation/Utilities	3.8%
Information	2.2%
Finance/Insurance/Real Estate	4.8%
Public Administration	5.8%
Services	52.7%

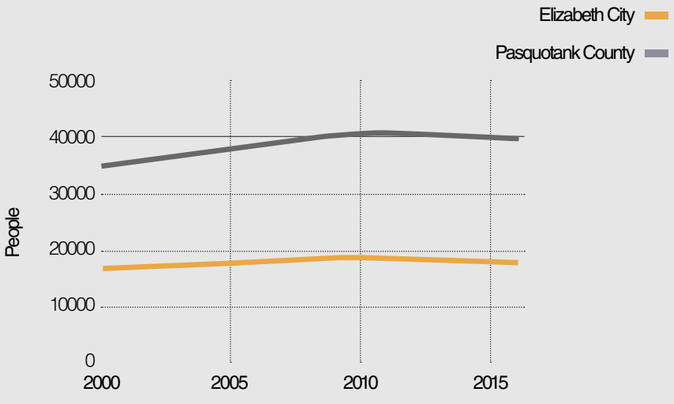
TOTAL POPULATION

Based on data from the 2016 Census estimates, the population of Elizabeth City was 18,025 and the median age was 32.7. Population has been declining in Elizabeth City and Pasquotank County over the last few years. According to the U.S. Census Bureau, between 2010 and 2016 Elizabeth City saw a 3.8% decline in population while Pasquotank County saw a 2% decline, primarily due to a significant drop in enrollment at ECSU.

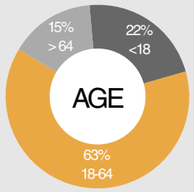
The dominant age groups of both Elizabeth City and Pasquotank County are similar in size between geographies. There is a general sense in Elizabeth City that it is particularly attractive to many retirees, while the Census data show that those 65 and older make up a smaller portion of the population. Broken down even further, it's important to note that 18.5% of the population is between ages 15-24. This is likely due, at least in part, to the higher education presence.



2017 Population by Age

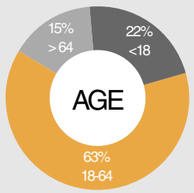


Population Change



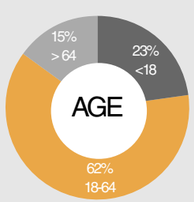
ELIZABETH CITY

Median Age
32.4
Total Population
17,836



PASQUOTANK COUNTY

Median Age
37.8
Total Population
39,909



NORTH CAROLINA

Median Age
38.3
Total Population
9,940,828

2016 Data

INCOME (2016)

Elizabeth City's median household income is substantially lower than the county as well as the state. Based on the 2016 American Community Survey, the per capita income in Elizabeth City is $16,783 — lower than Pasquotank County and North Carolina:

ELIZABETH CITY

$33,398
Median Household

$16,783
Per Capita

PASQUOTANK COUNTY

$45,750
Median Household

$22,187
Per Capita

NORTH CAROLINA

$48,256
Median Household

$28,156
Per Capita

CIVILIAN LABOR

According to the American Community Survey, of those in the labor force (ages 16 and older) in Elizabeth City 74.2% worked in their county of residence and 11.3% worked outside their state of residence (VA).

Percent of population ages 16+ in work force

54.3%

56%

61.5%

EMPLOYEES AND BUSINESSES

1,017
Total Business

10,870
Total Employees

8,588
Commute into Elizabeth City for Employment

4,361
Commute out of Elizabeth City for Employment

Note: The best available data was used whenever applicable and, as a result, a discrepancy between data points may exist. Total business and employee data are based on 2017 estimates from ESRI Business Analyst, while employee commuting data is based on the 2015 Longitudinal Employer-Household Dynamics data provided by the U.S. Census Bureau.

EDUCATION ATTAINMENT (2016)

ELIZABETH CITY

91.6%
High School Grad or Higher

2.8%
Bachelor's Degree or Higher

PASQUOTANK COUNTY

86.8%
High School Grad or Higher

6.4%
Bachelor's Degree or Higher

NORTH CAROLINA

85.3%
High School Grad or Higher

9.5%
Bachelor's Degree or Higher

ECONOMIC INVESTMENT OVERVIEW

Elizabeth City serves as a regional hub for residents in the surrounding counties. People will come in to town to shop, dine, and perhaps visit the Museum of the Albemarle or one of the waterfront parks. A recent branding effort has been done by Elizabeth City-Pasquotank County Tourism Development Authority to position Elizabeth City as a hub of the Albemarle region. This approach is to encourage visitors to stay longer and explore not only Elizabeth City but surrounding attractions in the area.

Historically, the largest employer has been the Coast Guard. However, in 2012, the Coast Guard made substantial reductions in staff and operations at the base. Currently, the largest employer type is in the Services industry.

A large chunk of the waterfront is part of the downtown. While some of the waterfront is technically outside the boundaries of the downtown, locals consider it to still be an extension of the area. For example, the Pelican Marina and the restaurant Paradiso on the Camden Causeway are downtown attractions. Ghost Harbor Brewing Company has opened in downtown, with another microbrewery and brewpub coming to the waterfront in 2018, adding to the economic development potential of downtown Elizabeth City.

POPULATION GROUPINGS

Tapestry segmentation*: Below are marketing industry descriptions of the most common demographic groups in the City of Elizabeth City. They are typically labeled with clever names.

*"Tapestry is a geodemographic segmentation system that integrates consumer traits with residential characteristics to identify markets and classify US neighborhoods. Neighborhoods with the most similar characteristics are grouped together, while neighborhoods with divergent characteristics are separated. Internally homogeneous, externally heterogeneous market segments depict consumers' lifestyles and lifestages. Tapestry Segmentation combines the "who" of lifestyle demography with the "where" of local geography to create a classification model with 67 distinct, behavioral market segments." Source: https://doc.arcgis.com/en/esri-demographics/data/tapestry-segmentation.htm

MIDDLEBURG

"Middleburg" residents make up 23.5% of the Elizabeth City population. They are conservative, family-oriented consumers. They prefer to buy American products and enjoy travelling in the US.

KEY TRAITS:

Median age: 35.3 ~ Average household size: 2.73 ~ 66% with a high school diploma or some college ~ Unemployment rate low ~ Median household income: $55,000

THE NEIGHBORHOOD:

- Traditional values are the norm here: faith, country and family
- Prefer to buy American-made products for a good price
- Include a number of mobile homes
- Semi-rural locales within metropolitan areas

CITY COMMONS

"City Commons" folks make up 17.6% of the total population in Elizabeth City. This segment is one of the youngest and largest markets, made up of single-parent and single-person households. More than a third have at least spent some time in college, while almost a third have not completed high school. This profoundly impacts their circumstances. Unemployment is very high at 24%.

KEY TRAITS:

Median age: 27.6 ~ Average household size: 2.66 ~ Labor force participation rate low at 54% ~ Median household income: $17,000

THE NEIGHBORHOOD:

- Neighborhoods are older, with high vacancy rates
- Many households own one vehicle or none
- Single parents, primarily mothers, head these young households

OLD AND NEWCOMERS

This market makes up 17.3% of the City's population, and features singles' lifestyles, on a budget. The focus is more on convenience than consumerism, economy over acquisition. "Old and Newcomers" is composed of neighborhoods in transition, populated by renters who are just beginning their careers or retiring. Some are still in college; some are taking adult education classes.

KEY TRAITS:

Median age: 38.5 ~ Average household size: 2.11 ~ Unemployment 7.8% ~ Median household income: $39,000

THE NEIGHBORHOOD:

- 54% of homes are renter occupied
- Predominantly single households
- Consumers are price aware and coupon clippers, but also are open to impulse buys
- 45% of housing units are single-family dwellings, 44% are multi-unit dwellings built before 1980.

HOUSING ANALYSIS

EMPTY NESTERS

One of the oldest tapestry segments, this group makes up 9.6% of the City's population. Empty Nesters is an older market located in cities across the country. Over one-third of householders here are aged 65 or older and dependent on low, fixed incomes, primarily Social Security. In the aftermath of the Great Recession, early retirement is now a dream for many approaching the retirement age; wages and salary income in this market are still earned. Residents live alone in low-rent buildings, located in or close to business districts that attract heavy daytime traffic.

KEY TRAITS:

Median age: 44.2 ~ Average household size: 1.72 ~ Median household income: $16,000

THE NEIGHBORHOOD:

- Many residents live alone in this older market; 19% of householders are aged 75 and older; another 17% are 65 to 74 years old.
- Multi-unit rental properties with affordable rents are predominant

The consultant conducted a basic housing analysis to determine how much new housing the City of Elizabeth City may need to accommodate population growth. Elizabeth City grew by 8.70% between 2000 and 2010, but decreased by 3.52% between 2010 and 2016. The average rate of growth between 2000 and 2016 is 0.03%.

The UNC Carolina Population Center reports, "Of North Carolina's 553 municipalities, 225, or about 41%, experienced population decline from 2010-2016…The northeast corridor of the state has been the hardest hit, as the top 10 municipalities with greatest percentage declines from 2010-2016 have been from Bertie, Northampton, or Washington counties." However, the Population Center also reports that some cities, including Elizabeth City, reported modest gains from 2015-2016. Since Elizabeth City has had modest gains and is actively deploying strategies to recruit new residents, particularly retirees, the housing model uses a modest positive growth projection - the growth factor between 2000 and 2016 - 0.03%; resulting in a 2026 population of 18,573.

Given the estimated population growth (18,573), the current and projected number of households, the current and projected number of housing units, current household size, and the current vacancy rate* (see page 18), and single family residential building permit history (see Elizabeth City Housing), the City of Elizabeth City has a projected housing surplus of 694 units if Single Family Residential Development continues at a similar pace (approximately 35 units per year, post-recession). Even if Elizabeth City added no new units, it would still have a housing surplus of 344 units, meaning all new residents to Elizabeth City could "fit" in the existing housing stock. However, housing preferences of baby boomers, millennials, and other cohorts are changing – just because Elizabeth City has existing housing stock does not mean that it is the type, quality, size, or in the location that potential.

NORTH CAROLINA

Occupied

$165,400
Median value of owner occupied housing units

4,540,697
Housing Units

3,904,999
Owned

2,499,199
Rented

$40.1K
Home value compared to Elizabeth City

ELIZABETH CITY

Occupied

$125,300
Median value of owner-occupied housing units

8,234
Housing Units

2,833
Owned

3,754
Rented

PASQUOTANK COUNTY

Occupied

$158,800
Median value of owner-occupied housing units

16,865
Housing Units

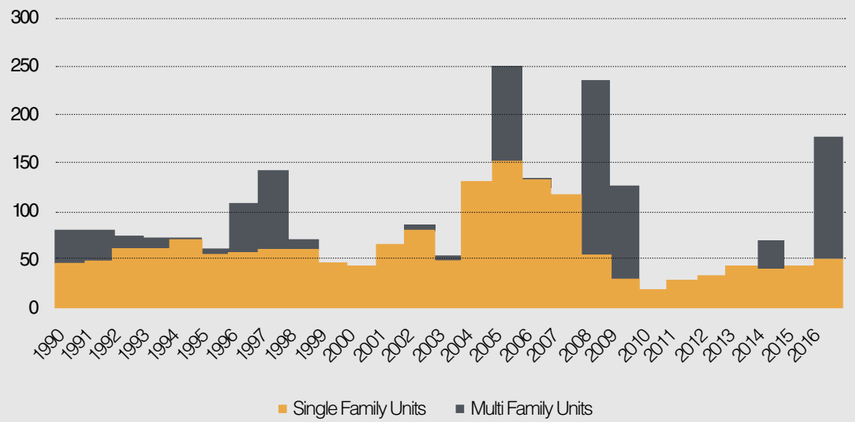
9,137
Owned

5,366
Rented

$33.5K
Home value compared to Elizabeth City

ELIZABETH CITY, NC HOUSING PROJECTION		DATA NOTES
Projected Number of Households		
Current Population	18,025	2016 Est. Population - American Community Survey
Current Households	6,561	2016 Est. Households - American Community Survey
Forecasted Population (10 Years)*	18,573	0.3% per year to 2026
Percent in Group Quarters	9.0%	2010 Group Qtrs - Decennial Census
Minus Number in Group Quarters	1,672	
Adjusted Future Population (Projected Population - Population in Group Quarters)	16,901	
Average Household (HH) Size	2.38	2010 Average Household (HH) Size
Projected HHs (Average HH Size Divided by Projected Population)	7,101	
Times Desired Vacancy Rate	1.09	See Note in Text
Projected # Housing Units Needed for Population	7,741	
(<1% for seasonal use - didn't factor in)		
Projected Number of Housing Units	8,167	Used 2010 because 2016 was off (+/- 216 units)
Units Beyond Repair	82	Used 1% 2010 Census - Units without complete plumbing or kitchen (<1%)
Units in the Pipeline (under construction, buildings approved, lots approved)	-	Unknown
Current Available Units	8,085	
Anticipated New Units per Year (Units per year multiplied by 10 years), Based on SFR Building Permits	350	Average 35 Single Family Residential Units per Year, Post Recession Average, Post-recession multi-family development has been minimal.
Units Available for Projected Year	8,435	
Housing Units Needed - Surplus/(Deficit)	694	Housing Surplus in 2020

TABLE: ELIZABETH CITY HOUSING PROJECTION



RESIDENTIAL DEVELOPMENT, 1990 - 2016 ANNUAL BUILDING PERMITS

*Currently, Elizabeth City has 6,561 households and 8,167 housing units, as well as a 18.1% vacancy rate. While there is no magic vacancy rate, a stable rate is around 7-8%. Very low vacancy rates (2-3%) drive up housing costs. At the other end of the spectrum, very high vacancy rates can indicate neighborhoods that are struggling. In Elizabeth's City's case, it's high vacancy rate (18%) may be an indication of neighborhood decline, an indication of vacation rentals (the US Census reports that less than 1% of vacant housing units are for seasonal use), or a combination of both. While a housing study is needed to determine the likely cause of the high vacancy rate, we used a mid-range (9%) vacancy rate for our model.

RETAIL DEMAND ANALYSIS GEOGRAPHIES

For the purposes of this study, several different geographies were compared to determine trends and opportunity for new retail development for the Waterfront area of Elizabeth City. The map below shows three geographies for the analysis, with the center point lying just south of the 158 bridge to Machelhe Island on N. Water Street. Often, market analyses will be completed by using concentric rings from the study area point, but since we don't want to have Pasquotank River in the analysis, we used drive times instead. The 10-minute drive time captures the waterfront, downtown, and close surrounding areas (red). The 20- and 30-minute drive time (green and blue) reflect the local market that the waterfront has the potential to capitalize on.

In the 10-minute radius, the largest retail gaps are for specialty food stores and a home furnishings shop. Based on this analysis, people are coming from outside the area to visit, eat, drink and shop. The gaps become more apparent with the Primary Trade Area (PTA), the 20-minute drive time radius. In addition to specialty food stores and home furnishings, there is significant leakage in the PTA for drinking establishments and eateries. This could be an opportunity to capitalize on in the near future on the waterfront. In the Secondary Trade Area (STA) or 30- minute drive time radius, there is a lot more leakage in the following categories:

- Home furnishings (flooring, kitchenware, window treatment, houseware, bath shops)
- Boutique Clothing Stores
- Drinking establishments & eateries

While Elizabeth City can certainly capitalize on individuals living within the STA, Elizabeth City is encouraged to continue to market themselves as a regional destination where folks from the surrounding counties continue to visit to do their retail shopping, outdoor recreation, visiting historical attractions, and eating and drinking along the waterfront.

10, 20 AND 30 MINUTE DRIVE TIME AREAS

DEVELOPMENT/POLICY RECOMMENDATIONS

After taking a hard look at the makeup of residents in Elizabeth City and reviewing the retail demand results, it is important to be realistic about the types of changes recommended. If the City is working toward improving the quality of life for all residents in Elizabeth City, improvements to the waterfront should be focused on experience and not be cost prohibitive for residents to take part in. They should be focused on activities that residents are interested in. If, however, the City wants the waterfront to cater to visitors, such as folks stopping by on their way to vacation on the Outer Banks, there is likely more disposable income that could be spent along the waterfront for tours, shopping at local retail, and getting drinks or lunch. We recommend that a mix of the two approaches, catering to locals and tourists alike, be taken by the City.

1. Continue to attract and support local businesses to locate along the waterfront.

Vacant properties along S. Water Street should be filled so that they are occupied. This is the street most often associated with the waterfront, and when there are vacancies visitors may be inclined to think the entire waterfront is vacant. To offset this, food and drinking establishments could be excellent candidates on S. Water Street to maintain a sense of vibrancy.


Beaufort, SC

2. Address Vacancies and Non-Retail Space.

Addressing waterfront vacancies and non-retail space is, in part, a relationship building exercise. Create a list of names and addresses of property owners of the vacant retail spaces. Contact property owners about the space to find out potential plans. Assess their willingness to activate vacant or non-retail space that does not currently contribute to street vitality. Some communities minimize the effect of vacancies or dead space by introducing window art programs which place photos or other eye-catching displays in the windows, or install temporary murals. Non-retail business should present a “retail face” to the street. A well-maintained business front, a colorful awning, window displays, and lighting can make an impact and maintain visual interest for the downtown visitor. From the public side, the City should make sure the public realm is well-maintained and attractive.

Medina, WA

3. Establish water-based businesses.

Support the development of local tours of the Pasquotank River that people can sign up for when they visit. Often, visitors will drop by the tourism office and request a day-of tour. This could make a big difference during summertime, when visitors are stopping by the waterfront for a short trip or on their way to final destinations.


Bend, OR


Kennebunkport, ME

4. Establish continuous walking paths along the waterfront.

Complete a bicycle/pedestrian plan with a grant from NCDOT. Focus especially on the waterfront area so that recommendations will include improvements in this study area. Increased walkability and bike improvements were the most popular responses from individuals who completed the waterfront survey. Improvements would lead to numerous benefits from both residents and visitors.


Beaufort, NC

5. Promote activities, events, and destinations that appeal to everyone.

This recommendation was especially popular among respondents to the survey. Since much of the City's population desires community-building activities, we recommend that the downtown association, stakeholders, and city staff work to program more events at the waterfront. Residents of all income levels and backgrounds could enjoy activities such as festivals, cultural events, art walks, or even food trucks and live music. They do not all have to be large-scale productions, rather small-scale events centered around Elizabeth City's strengths of history, arts, and sciences. This will also benefit summertime residents who are visiting during peak months. Visitors may initially be attracted to the event, but also stay to shop and dine in the adjoining downtown.

6. Continue to Manage for Waterfront Retail.

This study was not designed to assess the waterfront and larger downtown management practices; however, a strong retail environment depends on a well-managed waterfront and downtown. The waterfront community should continue to engage stakeholders in discussions about strategies to improve overall experience. Examples of elements to maintain the area for a strong retail environment include:

- establishing a waterfront funding mechanism, such as a business improvement district;

- cooperative retail management and promotions, such as coordinated business hours, common area maintenance, retailer location strategies, window merchandising, and customer service training;

- continuing to improve and explore retail recruitment and incentive strategies that defray the cost of construction/ rehabilitation or business relocation; examples include regulatory incentives (zoning and permitting, clear development process), financial incentives (investment in public space to improve the retail environment, public investment tools such as a revolving loan fund), and design incentives (façade grants, design assistance/review); and

- marketing, education, and coordination to develop retail clusters throughout downtown, such as clustering businesses that share customers with similar characteristics.


Elizabeth City, NC

7. Review housing options and types in Elizabeth City and conduct a housing study.

The City should evaluate its housing options and types and determine a new housing strategy that may include infill housing near downtown and the waterfront. (See housing analysis section for more information). There is a surplus of housing except the options do not meet the needs of the current purchasers and renters.

Case Studies

NEW BERN, NC

New Bern, the county seat of Craven County is one city identified as a comparison to Elizabeth City. The waterfront city has a population of 30,101 and has fully taken advantage of their location along the Trent and Neuse Rivers. The city has a bustling waterfront with activities that range from paddle boarding tours, to history walks and art activities. These happenings are also offered at a variety of prices for visitors and residents with different budgets. Interestingly, Elizabeth City has significantly more residents living within a quarter mile of the waterfront area than New Bern (237 people vs. 170), which Elizabeth City should work to capitalize on. However, the household income between these two waterfronts is vastly different, Elizabeth City at $16,855 and New Bern at $38,997. It is important for Elizabeth City to make sure they offer activities at a range of price points for both the residents and visitors passing through or staying overnight.

EDENTON, NC

Edenton, NC is a second town that was identified as a case study that Elizabeth City could learn from. Although the town is much smaller than Elizabeth City (population 4,846), Edenton has a very active series of fun events throughout the spring, summer, and fall seasons. There are also a lot of restaurants to choose from, as well as a variety of options for lodging, including bed and breakfasts, hotels, vacation rentals, and campgrounds for visitors on a budget. The town has capitalized on the waterfront as an asset for folks to recreate. These activities, shopping and dining experiences, and lodging opportunities provide great ideas for Elizabeth City to explore further.

WASHINGTON, NC

Washington, NC has a population of 9,801 and is located along the Tar and Pamlico Rivers. Elizabeth City and Washington, NC have something in common: they both have a lot of retirees living close to the waterfront (173 within a quarter-mile radius of the waterfront in Elizabeth City and 184 in Washington). Folks are either moving to these towns to retire or staying for a reason. A children's park, boardwalk, gathering spots, the NC Estuarium, and boat slips are highlights of Washington's waterfront. They also have a lot of opportunities for folks to recreate along the water. Providing visitors and residents of all ages with opportunities to have fun is important when Elizabeth City is working to make improvements to its waterfront.

How to Transform a Waterfront...

Concluding recommendations for transforming a waterfront that is from the people, for the people of the City of Elizabeth City.

Invigorate a waterfront rich with tradition and coastal flavour, provide new opportunities for recreation and commerce, while supporting a strong community through thoughtfully designed public spaces.

As a point of reference, the organization, Project for Public Spaces, outlines principles needed to transform a waterfront. They are not hard and fast laws, but rules of thumb drawn from years of experience working to improve urban waterfronts around the world. These ideas can serve as the framework for Elizabeth City's efforts to create a vibrant public waterfront, and by extension, a vibrant city.

How to transform a waterfront:

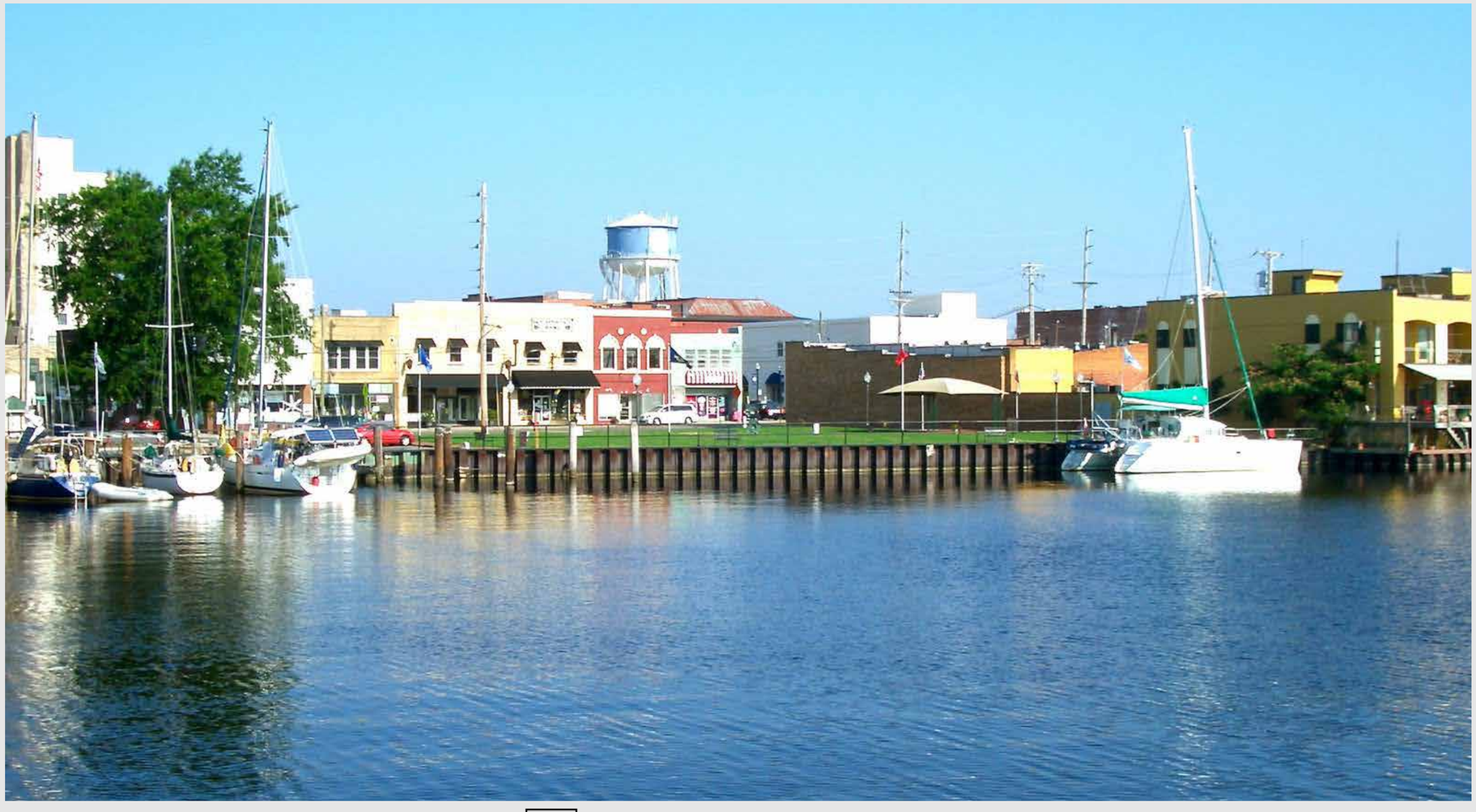
- Make public goals the priority
- Create a shared community vision for the waterfront
- Create multiple destinations... both on land and in-water
- Connect the destinations
- Optimize public access
- Ensure that new development fits within the community's vision
- Encourage 24-hour activity by limiting residential development
- Use parks to connect destinations, not as destinations unto themselves
- Design and program buildings to engage the public space
- Support multiple modes of transportation and limit vehicular access
- Integrate seasonal activities into each destination
- Make stand-alone, iconic buildings serve multiple functions
- Manage, manage, manage

"SUPPORT A STRONG COMMUNITY THROUGH THOUGHTFULLY DESIGNED PUBLIC SPACES"

The Use of the Waterfront

Elizabeth City and its waterfront have a solid framework in place; a variety of complimentary uses string together along the banks of the Pasquotank River. With downtown at its core, Water Street connects commerce and culture with academia to the north and to the south, while open space as parks and preserve are nestled in between. This blend of activity and refuge indicates a promising master plan slated with potential.

The project area, as noted by the red overlay region on page 25, is made up of four districts — the University, the causeway of Machelhe Island, the harborfront and the Charles Creek preserve. By treating each of these districts together under the lens of one master plan, opportunities for connectivity, wayfinding and enhancements are strengthened. Analyzing the city's amenities and shortcomings revealed opportunities and constraints indicative of the plan. Our intention is to build off what is present by proposing small scale investments and sustainably ecological interventions. This will elevate what is existing to create an attractive future for Elizabeth City.



LEGEND

- Institution
- Park & Open Space
- Preserve
- Retail / Commercial
- Cultural Attraction
- Sailing Center
- Industrial Marina
- Creek
- Scenic Overlook

1. Charles Creek Park
2. Charles Creek
3. Waterfront Park
4. Mariners' Wharf Park
5. Veteran's Park
6. Machelhe Island
7. Downtown Elizabeth City
8. Mid Atlantic Christian University (MACU)
9. Museum of the Albemarle
10. Coast Guard Park / Sailing Center
11. Elizabeth City Shipyard

PROJECT LIMITS

- Waterfront Master Plan
- Charles Creek Flooding Mitigation Plan

Opportunities for Betterment

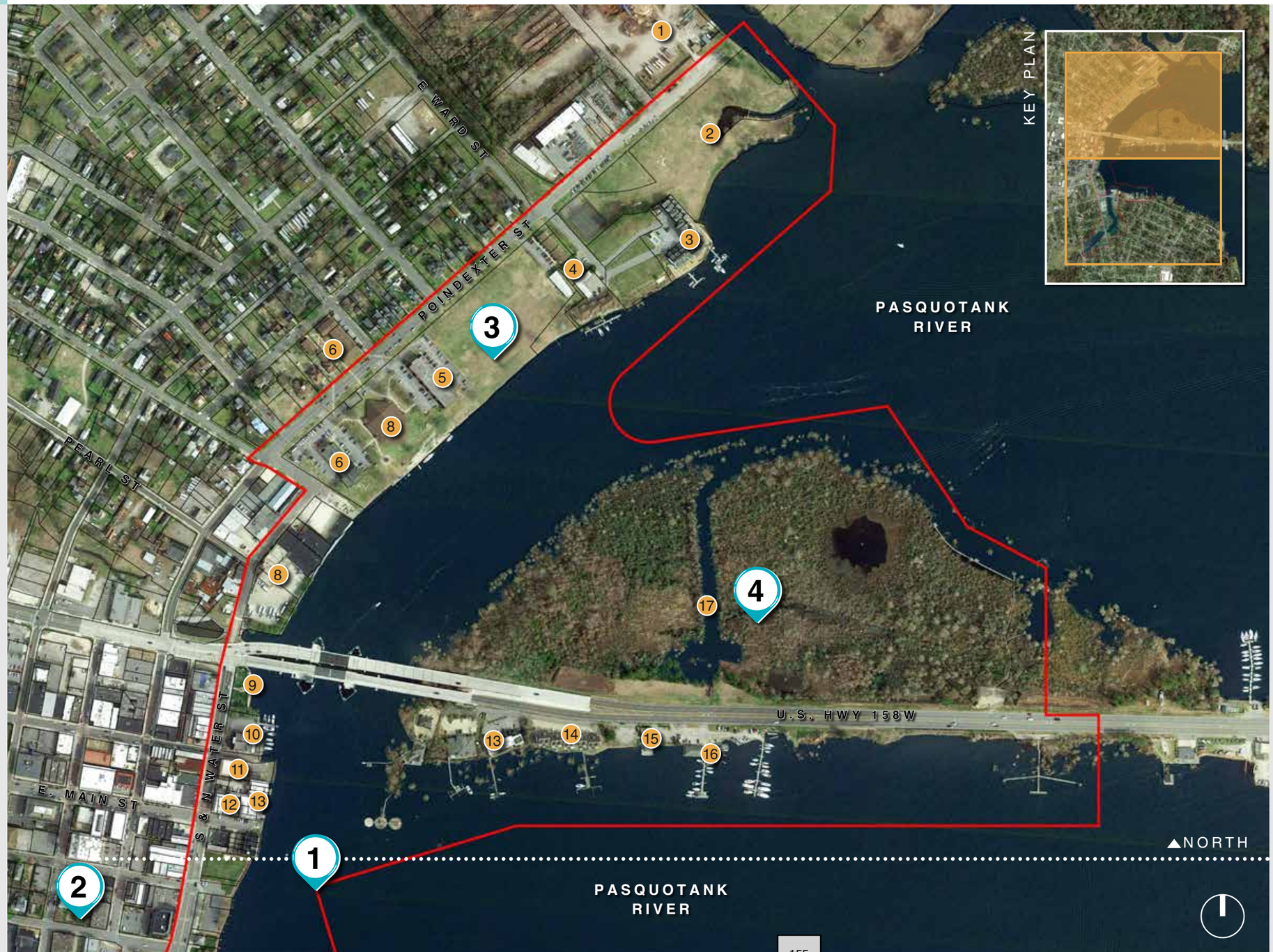
Keeping true to the "Harbor of Hospitality," our goal is to support what's already there by building upon the strengths of the city and overcoming the challenges of its context. Learning from the past and looking to the future, we can understand the evolution of Elizabeth City and provide recommendations for betterment with the city's best interest in mind.

With prime views of pristine waterfront and preserve from the entirety of Elizabeth City's urban edge, there is great potential for enhanced and ecologically sensitive development near downtown. Machelhe Island and the Pasquotank River, to the east, offer a beautiful backdrop, a rare gem, for the city to have as natural amenities to gaze out upon. Charles Creek to the south must be treated with sustainability in mind as flood mitigation and rising water levels prove a challenge for the city's future. Fusing stormwater engineering with landscape architecture interventions will create an engaging place to preserve and offer a spotlight opportunity to showcase the story that so many coastal towns have come to deal with as they battle rising tides.

To the north, Mid Atlantic Christian University's collaboration with additional academic institutions demonstrates promising growth and energy. At its core, downtown Elizabeth City is ripe with opportunity for small scale investment, with projects like a new micro-brewery and the addition of Weatherly Lofts, a 45-unit planned residential development to be completed in early 2019. Strengthening the relationship of downtown to its waterfront and adding more in-water facilities will unify the district. Additionally, unifying cultural amenities, like the Museum of the Albemarle, to the harbor will create a strong celebratory space for the community as artwork, events and functions trickle out into the public realm. To the south, the shipyard, sailing center and low-lying parcels are prime areas for renewed investment, but will need to be upgraded with bulkheads, boardwalks, open space improvements, drainage and stormwater interventions to ensure the viability of future development.

THE HARBOR OF HOSPITALITY: PAST, PRESENT & FUTURE

THE HARBOR OF HOSPITALITY: PAST, PRESENT & FUTURE



LEGEND

1. JW Jones Chip Mill
2. Open Space
3. Residential Condominiums
4-7. Mid Atlantic Christian University (MACU)
   - 4 Tennis Facilities
   - 5 Student Apartments
   - 6 Classroom / Lodging
   - 7 Gymnasium
8. Jennette Brothers
9. Veteran's Park
10. Trimpi & Nash LLP
11. Proposed Brewery and Brewpub
12. The Flour Girls Cafe and Bakery
13. Residential Condominiums / Apartments
14. Residential Condominiums
15. Paradisio - Italian Restaurant
16. Pelican Marina
17. Machelhe Island / Causeway Park

1 The Harborfront

Ripe with opportunity for small scale investment, with projects ongoing such as a new micro-brewery and loft residential uses. A deeper engagement of the water's edge along with new in-water facilities will continue to strengthen the overall appeal of downtown and the harborfront.

2 Anchoring Downtown

Parcels between East Church, South Water, East Ehringhaus and South Martin Luther King Streets present a prime area for renewal and anchoring of the southern extent of downtown. Parcels, however, are low lying and require upgrades to drainage and other stormwater BMPs.

3 Mid Atlantic Christian University

Primary landowner MACU, in collaboration with the College of The Albemarle and Elizabeth City State University, could bring about heightened vibrancy and new academic, athletic, residential and other related uses.

4 Machelhe Island / Causeway Park

Southern stretches of the Island provide opportunity for expanded marina and servicing facilities; to the north, heightened hand powered exploration of habitat zones along with preservation activities.

THE HARBOR OF HOSPITALITY: PAST, PRESENT & FUTURE

LEGEND

1. Mariners' Wharf Park
2. Surface Parking
3. Stormwater Pump Station
4. Grouper's Restaurant
5. Waterfront Park
6. Museum of the Albemarle
7. Elizabeth City Shipyard
8. Charles Creek Park
9. Charles Creek
10. Coast Guard Park / Sailing Center
11. New Hollywood Cemetery

1 Maritime Recreation Center

The sailing center, boat launch and other activities at Coast Guard Park make credible continued investment to allow this area to evolve into a primary center of maritime recreation. Investments could be linked to renewal of the Elizabeth City Shipyard.

2 Shipyard Renewal

Elizabeth City Shipyard is an essential redevelopment parcel, with renewal and activation of the site holding the greatest promise for transformation of the harborfront. Environmental issues will need to be addressed on the site.

3 Celebration Space

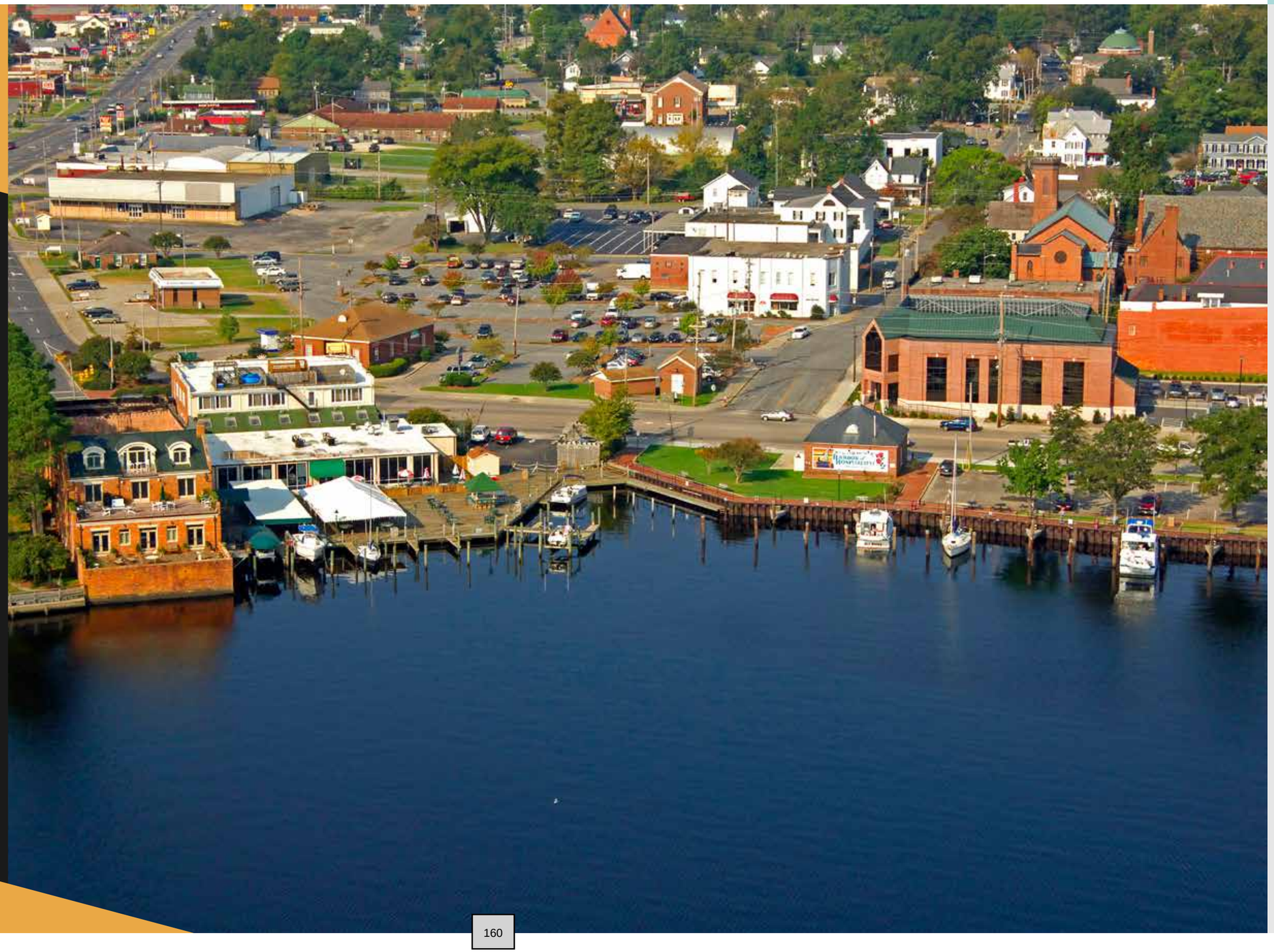
Strengthening the link between the Museum of the Albemarle and the harbor is valuable for several reasons, from bringing art outdoors to activating this area, creating a strong “celebration space” for community events and functions.

4 Charles Creek

Flood mitigation is essential along Charles Creek, with the potential for natural and engineered approaches to help protect private property and increase community resilience. Improvements should blend with park, open space and natural habitat zones.

COMMUNITY PRIORITIES

Elizabeth City's waterfront has the potential to be a lively public destination that keeps people coming back and helps the City thrive economically. As cities and towns of all sizes across the world have revitalized waterfronts, we have come to understand the common elements that lead to economically successful waterfronts. As page 23 of this Waterfront Master Plan document outlines the Project for Public Spaces' principles needed to transform a waterfront, these ideas can serve as the framework for Elizabeth City's efforts to create a vibrant public waterfront, and by extension, a vibrant city.



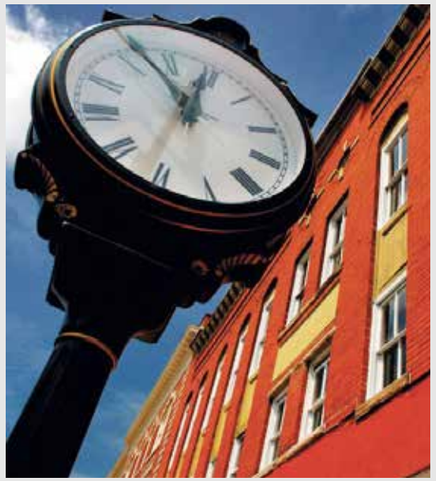
Public Engagement

A series of community work sessions were held over the course of several months to solicit community feedback from the citizens of Elizabeth City. Engaging local citizens, through steering committees, work sessions and surveys as part of any master planning process is vital to the success of the plan. Citizens play an enormous, important role in being able to successfully plan for the long-term future of their city, as citizens are able to provide context and knowledge, while sharing concerns and aspiring visions.

During work session #1, held on October 18th, 2017, the consultant team gave a public presentation on the Waterfront Master Plan and Charles Creek Flood Mitigation effort. The team provided an overview of how other communities are planning for both waterfront revitalization and flooding mitigation to share lessons and insight on how best to proceed. After the group was briefed, participants were engaged and prompted with their response to the question, “What are the essential outcomes from these efforts?”

There was an opportunity for those who could not attend to participate in the online survey. This supplemental tool enabled the consultant and design team to capture a greater audience from Elizabeth City, providing further detail and direction for how best to move the master plan forward.

Work session #2, held over a two-day period on January 17th-18th, 2018, dived further into the visioning process to extract as much feedback from the citizens of Elizabeth City. Eight zones – in the north: Mid-Atlantic Christian University, Machelhe Island/Causeway Park, The Harborfront, and downtown; in the south: Coast Guard Park, Elizabeth City Shipyard, Celebration Space, and Charles Creek – were identified as initial priority areas for the master plan. Economic and social analysis was presented, portraying demographics and data for how Elizabeth City’s growth relates to the County and State. From the economic analysis prepared, the following observations and gaps were identified. Each of these items help to inform the designation of branded districts and planning concepts for the waterfront.



• Elizabeth City is a regional destination for folks living outside the City. Consumers arrive, run errands, shop, support local restaurants and taverns, take part in cultural events, and participate in other activities. The City and its waterfront should continue to market themselves as a regional destination.

• Within the Primary Trade Area (PTA)—which equates to a 20-minute drive time from the waterfront and downtown—several gaps were identified for consideration for the planning area. These include: speciality-type (such as boutique and locally owned small businesses) stores; furnishings shops; and food and beverage establishments and taverns.

• For the Secondary Trade Area (STA)—a 30-minute drive time—there are larger commercial gaps. These include: furnishings shops; clothing stores; drinking establishments and taverns; specialty food services; and electronics. Note, that for electronics and similar stores, we don't recommend adding these shops within Elizabeth City as Walmart likely captures sales in this category.

• Recreational boating and other water dependent leisure pursuits have positive demand, especially as residential populations within downtown and surrounding the harbor increase and seasonal visitation expands. Boat clubs are of specific interest.

• Quality waterfront residential units will expand the diversity and development mix of downtown and its waterfront. A unique, boutique hotel offering with a modicum of ballroom and related support facilities may also have merit over the long term if implemented. However, in the event a hotel is not viable, a multi-family residential project with activated ground floor commercial uses would be acceptable.

The waterfront should:

• Continue to attract and support local businesses (e.g., restaurants, specialty stores) along the waterfront and extending back into downtown. Market demand supports reuse of existing buildings and—over the long term—some degree of new, mixed-use construction.

• Expand the breadth of quality waterfront and downtown residential units.

• Work to fill vacant properties along S. Water Street to anchor the entirety of downtown and the southern edges of the harborfront.

• Grow a variety of recreational tours of the Pasquotank River, including those that people can sign up for the day of the event.

Precedent imagery and ideas such as "anchor the waterfront with an event space" to "promote access by bike, foot, or boat" were shown for citizens to weigh in and comment on their attributes. From there, participants could comment on the mission statement and core project tenets. The master plan was slowly revealed through a series of boards, walking participants through the design process. Initially, the project site area was broken down into four zones of interest, or "the districts": University, Harborfront, Gateway, The Preserve. These districts were the foundation for the master plan vision, culminating from citizen feedback in the first work session, survey results and the consultant team's design and research efforts. Additionally, one concept presented various flooding mitigation options for Charles Creek.

The follow on City Public Presentation held on March 5th, 2018, presented to the public the revised master plan vision. The latest vision incorporated the summation of feedback given from the previous two work sessions, specifically focusing on certain key areas and redevelopment opportunities.

Mission Statement

For Elizabeth City's Waterfront, We Will...

Deliver on our promise as North Carolina's Harbor of Hospitality by providing new opportunities for recreation, boating and commercial activity while supporting a strong community through thoughtfully designed public spaces and environmental preservation areas.

Core Tenets

To achieve the Mission, we will achieve the following. . .

1

Provide A Welcoming Harbor

...Promote a diversity of welcoming harbor uses, anchored by commercial, recreation and marine uses, with the assemblage embodying the spirit and flavor of North Carolina's coastline.

2

Promote Accessibility

...Make it easy, safe and enjoyable to arrive, park, walk, bike, play and connect with the harborfront.

3

Develop Targeted Renewal

...Focus renewal efforts at key parcels to transform the water's edge into a contiguous, animated harborfront that sustains activity year-round.

4

Construct a Verdant, Resilient Shore

...Expand and connect natural landscape areas and habitat zones, providing new and strengthened greenways and blueways…the calling card of a renewed Elizabeth City.

5

Celebrate Community Heritage

...Promote the scale and story of Elizabeth City and the region through site architecture, landscape, wayfinding, and other elements.

THE VISION

The “Harbor of Hospitality” delivers on its promise by providing new opportunities for recreation, boating and commercial activity while supporting a strong community through thoughtfully designed public spaces and environmental preservation areas. By focusing on key areas and stating core project tenets, Elizabeth City’s waterfront enlivens itself with new possibilities. The harbor welcomes new uses while accessing the waterfront is promoted for all. Targeted redevelopment opportunities transform the water’s edge and sustainable resiliency efforts become a priority. The heritage of Elizabeth City is celebrated in the new city of Elizabeth City Waterfront Master Plan.

The Vision Fully Realized

The Elizabeth City Waterfront Master Plan delivers the promise of the “Harbor of Hospitality” by recommending new opportunities for recreation, boating and commercial activity while supporting a strong community through thoughtfully designed public spaces and environmental preservation areas. By focusing on key areas and stating core project tenets, Elizabeth City’s waterfront will enliven itself with new possibilities.

Five core project tenets outline the vision and provide the goals for the master plan’s efforts. A welcoming harbor promotes a diversity of boating and sailing uses, anchored by commercial, recreation and marine uses, with the assemblage embodying the spirit and flavor of North Carolina’s coastline. Promoting accessibility makes it easy, safe and enjoyable for all to arrive, park, walk, bike, play and connect with the harborfront. Targeted redevelopment zones through focused renewal efforts at key parcels transform the water’s edge into a contiguous, animated harborfront that sustains activity year-round and stimulates business and other economic activity along the waterfront, in downtown, and probably throughout the region.

Preserving a verdant, resilient shore expands and connects natural landscape areas and habitat zones, providing new and strengthened greenways and blueways, more tourists, cleaner water, better fishing, more jobs, among other advantages, demonstrating a renewed Elizabeth City. Lastly, celebrating Elizabeth City and the region’s community heritage through site architecture, landscape, wayfinding, and other elements pays homage to the past while looking to the future.

LEGEND

KEY SITE FEATURES

1. Nature Park / Conservation Zone
2. MACU Main Campus and Future Athletic Facilities
3. Jennette Brothers Targeted Redevelopment
4. Conservation Zone
5. Improved Park / Kayak Launch
6. Existing / Enhanced Gateway Signage
7. Harbor Beacon
8. Elizabeth City Harbor Esplanade
9. Community Pier (end of Main)
10. Waterfront Access Zone from Water Street
11. Mariners' Wharf Park Marina
12. Water & Ehringhaus Street Targeted Redevelopment
13. Outdoor Sculpture Garden and Enhanced Connectivity to Celebration / Waterfront Park
14. Coast Guard Park / Sailing Center
15. Charles Creek Park / Playground
16. Berms / Flood Mitigation Features
17. Recreational Fishing Pier
18. Elizabeth City Shipyard Targeted Redevelopment

LEGEND
NORTH ENLARGEMENT

1. Nature Park / Conservation Zone
2. Residential Units / Student Housing
3. MACU Boat Club
4. MACU Future Development Facilities
5. MACU Waterfront Esplanade
6. MACU Main Campus Buildings
7. MACU Campus Integration Zone
8. Jennette Brothers Targeted Redevelopment
9. Waterfront Promenade
10. Conservation Zone
11. Improved Park / Kayak Launch
12. Existing / Enhanced Gateway Signage
13. Harbor Beacon (into Elizabeth City Harbor)
14. Streetscape Enhancements along N. Poindexter Street

LEGEND

SOUTH ENLARGEMENT

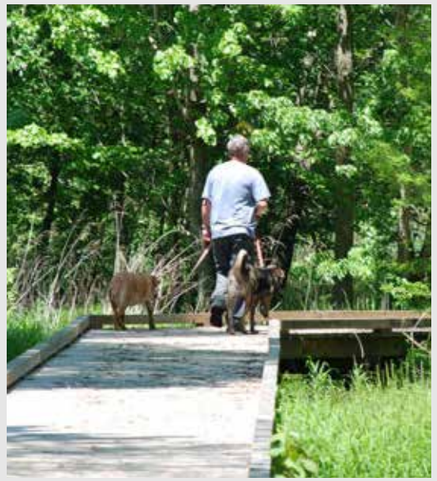
1. Strengthened Bike / Ped Link
2. Elizabeth City Harbor Esplanade
3. Community Pier (end of Main)
4. Transient Marina Berths
5. Streetscape Enhancements
6. Waterfront Access from Water Street
7. Mariners' Wharf Park Enhancements
8. Mariners' Wharf Park Marina and Boating Support Facilities
9. Water & Ehringhaus Street Targeted Redevelopment
10. Outdoor Sculpture Garden
11. Enhanced link to Celebration / Waterfront Park
12. Park, Events and Performances
13. Coast Guard Park / Sailing and Watersports Center
14. Streetscape and Infrastructure Enhancements (BMPs, bioswales, etc.)
15. Charles Creek Greenway And Trail
16. Berms and Flood Mitigation
17. Recreational Fishing Pier
18. Elizabeth City Shipyard Redevelopment Zone
19. Elizabeth City Marina
20. Waterfront Event Lawn
21. Repurposed Public & Community Event Space & Marina Services

1 // Welcoming Harbor

One of Elizabeth City's greatest assets is the entirety of its downtown cityscape directly fronts the waterfront. It's no wonder the city is coined the "Harbor of Hospitality," featuring an array of land uses strung together like placemaking pearls along the water's edge. Building upon what is a solid urban framework, the master plan intends to unify the various uses to create a welcoming harbor for all.

Four typologies of uses – academic, parks and open space, marina, retail and mixed-use – are the focus of the design with the intent to fuse these uses into a cohesive plan. Each of these nodes offers unique attributes unifying the waterfront. The University, as a district, demonstrates catalytic energy and development with the growth and expansion of its research, athletics, recreation and residential uses.

Machelhe Island and Charles Creek provide refuge and preservation, balancing out development pressure zones, while offering ecotourism recreation opportunities. Quintessential in North Carolina coastal town character, Elizabeth City's marina supports recreational boating and sailing, while being near areas of live, work and play. Transient berths factor into creating a more welcoming harbor for all. Lastly, downtown's center with retail and mixed-use is but a short walk from the harborfront, incentivizing opportunities of connection between these two main hubs of activity.



- ACADEMIC
- PARKS & OPEN SPACE
- MARINA
- RETAIL & MIXED-USE

THE VISION

LEGEND

- Institution
- Park & Open Space
- Preserve
- Retail / Commercial
- Cultural Attraction
- Sailing Center / Recreational Boating
- Recreation Marina
- Fishing

LEGEND

- Institution
- Park & Open Space
- Preserve
- Retail / Commercial
- Cultural Attraction
- Sailing Center / Recreational Boating
- Recreation Marina
- Fishing

2 // Promote Accessibility

Creating an interconnected network of various modes of transportation promotes accessibility for all. With an emphasis on bike and pedestrian connectivity, the Elizabeth City Waterfront Master Plan presents the city in its best light, with a variety of mobility abilities, enabling residents and visitors alike a chance to meander and move through the many attractions at their own leisure.

From the MACU campus heading south towards downtown, bike and pedestrian pathways connect the waterfront through the various uses to main frontage streets like Pointdexter and Water Street. Wandering through the core of Elizabeth City, accessibility to parks and open space, cultural attractions, art installations and amenities are offered by a multi-modal transportation network showcasing the essence of Elizabeth City.

To the south, ecological preservation with pathways nestled amongst creek beds and landscape berms provide a different scene and pace for all to slow down and connect to nature.

Textures change from paving to plank as one transitions between urban and natural contexts. The inclusion of both greenway and blueway activity offers exploration on different pathways as the network expands beyond pavement and path to include water-based hand-powered boating through creek and preserve. This dynamic interplay of experience results in a vibrant and resilient waterfront, as new discoveries present themselves through the changing city and natural landscape.

LEGEND

- Primary Circulation
- Secondary Circulation
- Bike / Pedestrian Network
- Art

LEGEND

- Primary Circulation
- Secondary Circulation
- Bike / Pedestrian Network
- Art

3 // Targeted Renewal

Focusing on key parcels that are slated for development stimulates strategic investment dollars to foster the greatest redevelopment opportunities. Five sites, denoted on page 53's diagram, within the project area present a range of potential. From moderate to extensive investment dollars, this section demonstrates the thought process and analysis for varied levels of development.

Three of these five targeted renewal zones are illustrated with a light, moderate and more dramatic vision: The Elizabeth City Shipyard (A) has the potential for open space preservation and adaptive reuse to a mixed-use development revamp (see pages 52 & 53). The intersection at Water Street and Ehringhaus Street (B) could benefit from redevelopment ranging from small scale revitalization and streetscape improvements to a larger lot renewal (see pages 54 & 55). The Jennette Brothers site (C) is prime real estate, situated right on the banks of the Pasquotank River and offers various low to high development scenarios, all with the intention of promoting waterfront access through the site (see pages 56 & 57). Each of these parcels offer opportunities for connection and redevelopment to enhance the overall effectiveness and implementation of the master plan.

LEGEND

- (A) Elizabeth City Shipyard
- (B) Water Street & Ehringhaus Street (Chamber Site)
- (C) Jennette Brothers Site

A. CITY OF ELIZABETH CITY SHIPYARD

For three waterfront locations, a spectrum of opportunities is available for renewal and activation. The Elizabeth City Shipyard site represents one such location.

The privately held shipyard site was once a major economic driver in the City. In its prime, the Elizabeth City Iron Works and Supply Company was a manufacturing center for sub chaser-class and other vessels, and later, served as a repair yard for small ships well into the mid-1960s. Today, due to a combination of brownfield site conditions and required investment, the Elizabeth City Shipyard property sits dormant awaiting its next life. Potential site investment can run across a spectrum of possibilities, both in terms of the amount of resources and time required to achieve desired outcomes. The degree of investment also has bearing on the volume of economic impact (job creation, local spending, property tax base) that could be derived for the community.

As shown in the accompanying figure “A”, lower investment levels could result in a renewal mix focused on open space and recreation activation along with adaptive reuse of existing sheds and other upland and in-water infrastructure. A focus on the arts and history of the site is also a community desired attribute for this zone as is the possibility of a small, business incubator space within reused sheds. Recreational boating facilities are pursued to the greatest degree possible given site contamination and other brownfield issues.

More aggressive investment and site clean-up approaches lead to more concentrated redevelopment options along the spectrum. These include a more intensive recreational approach, with an expanded number of in-water slips supported by upland investments in dry stack boat storage and commercial uses (see figure “B”). The highest investment level and likely most lengthy approach to implement (given site clean-up and permitting) involves creation of a true mixed-use development, incorporating a variety of commercial, and residential, along with a recreation marina.

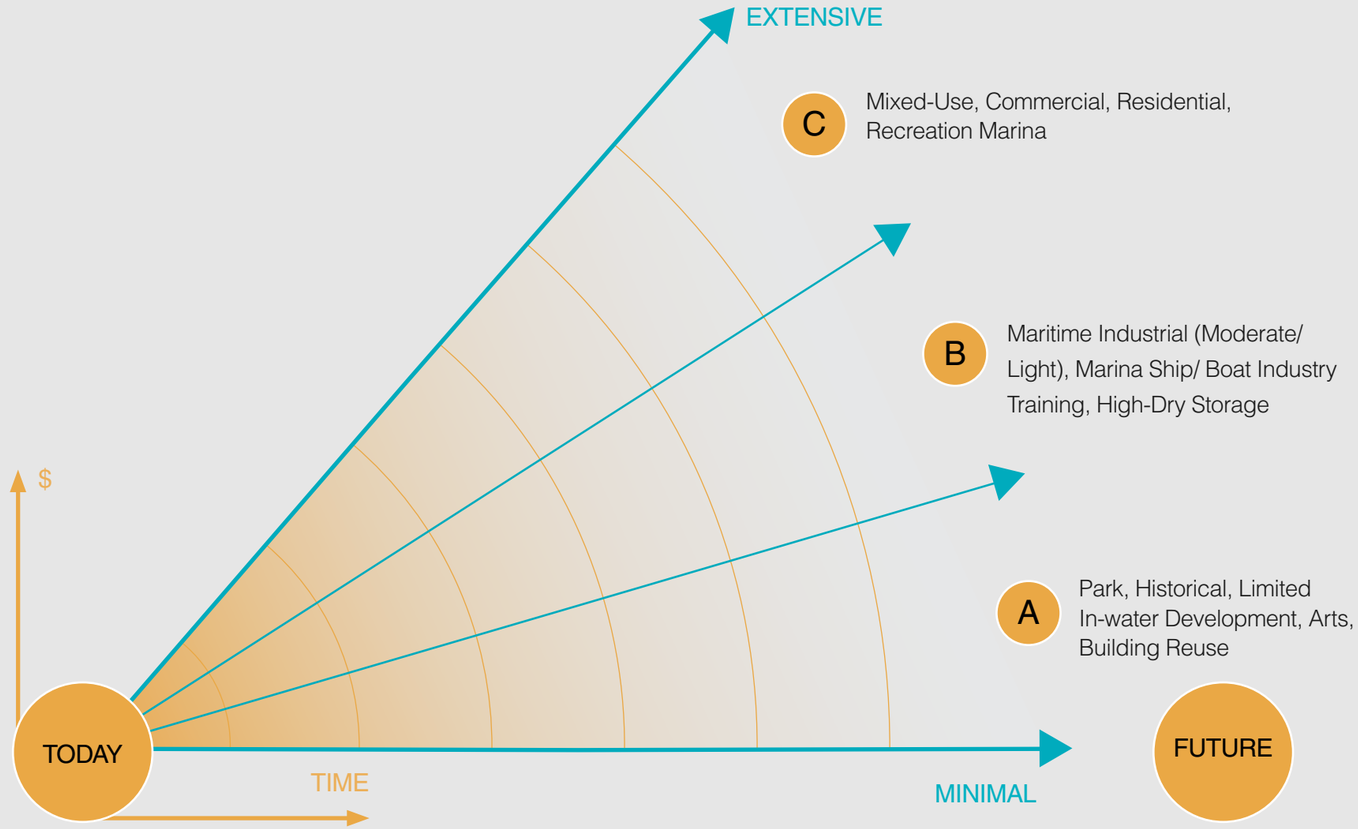


Figure A
Park, Historical, Limited In-water Development, Arts, Building Reuse

Figure B
Maritime Industrial (Moderate/ Light), Marina Ship/ Boat Industry Training, High-Dry Storage

Figure C
Mixed-Use, Commercial, Residential, Recreation Marina

B. WATER & EHRINGHAUS STREET

The grouping of properties at the intersection of Water and Ehringhaus Streets (aka Chamber of Commerce and bank sites) is a challenging renewal location. Challenges include: assembly of several small properties owned by the City and others is required to achieve any larger scale renewal effort; the location is prone to local flooding, necessitating both site and (additional) surrounding street infrastructure improvement; and the parcels are located at a transition point between the downtown and moderately valued and activated commercial and residential properties to the south.

For the vision plan, the intent is that over time, this intersection transitions into a more robust anchor for the southern portion of downtown, leveraging investment and interest to deal with localized flooding and bring about increased investment and value to surrounding parcels.

For the spectrum of potential investment, low investment levels preserve parcel sizes and focus monies to the surrounding roadway and storm water capabilities of the area to allow parcels to be more attractive for small scale, parcel-by-parcel investment (see figure “A”). At a midpoint along the spectrum, some lot assembly is encouraged as is a more aggressive reworking of E. Grice Street allows for more substantial commercial renewal to occur at E. Ehringhaus Street and S. Water Street (see figure “B”). Parcels internal to this configuration may lend themselves to small scale multi-family residential development

Under the most aggressive renewal approach along the spectrum, land is assembled to allow for a larger scale development approach to be realized, such as a limited service hotel of 60 to 80 rooms with ground floor commercial activation or a larger, mixed-use residential development (see figure “C”). This last option would likely require a public-private partnership to advance, with the City working to assemble properties and upgrade surrounding infrastructure to ready the area for investment. Realization of this final renewal approach is expected to yield the highest economic benefit to the City over the long term.

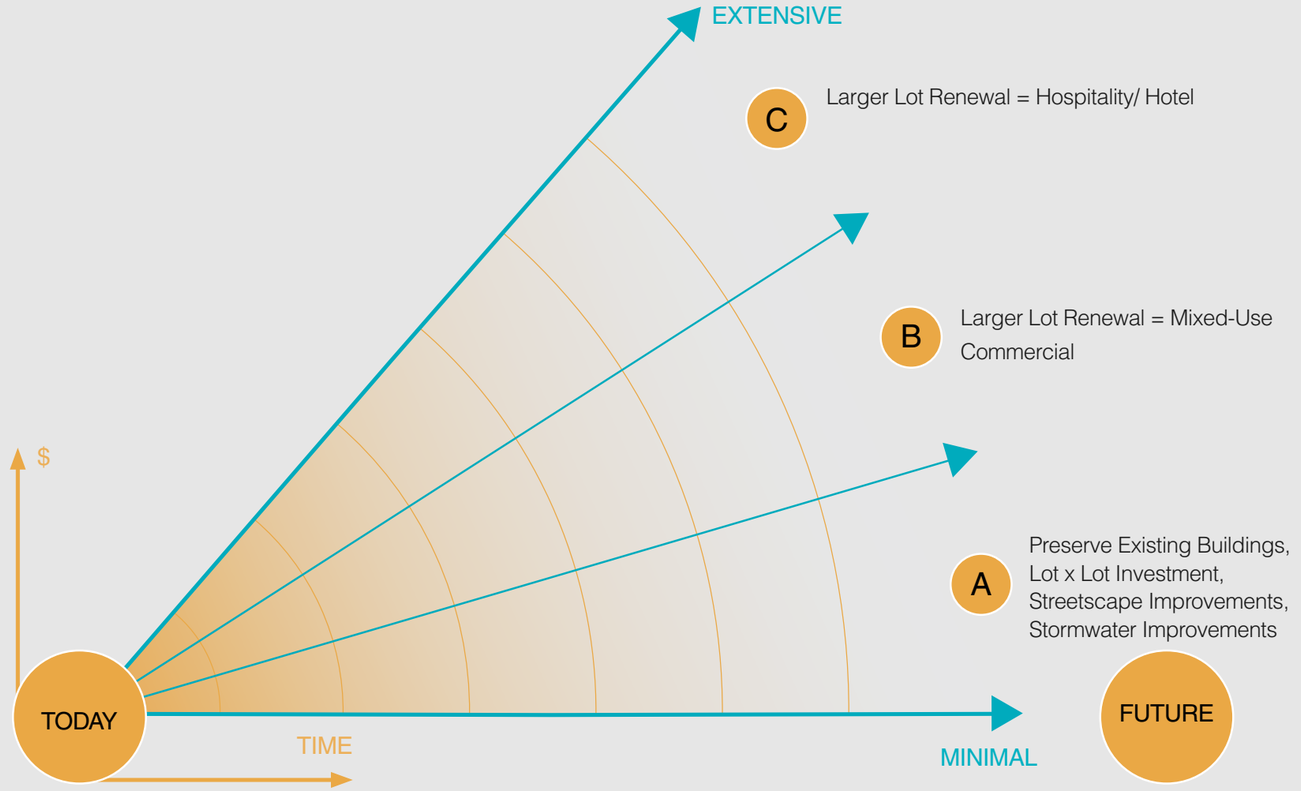


Figure A
Preserve Existing Buildings, Lot x Lot Investment, Streetscape Improvements, Stormwater Improvements

Figure B
Larger Lot Renewal = Mixed-Use Commercial

Figure C
Larger Lot Renewal = Hospitality/ Hotel

C. JENNETTE BROTHERS SITE

The Jennette Brothers site, while not a critical transformation, presents a compelling opportunity to broaden waterfront activity and engagement from one focused along the Harborfront to one that expands north of the Pasquotank River Bridge. Full or selective (and adaptive) renewal of parcels and existing buildings present the possibility for a true mix of land uses to be developed on the site, from residential units and office spaces to ground floor commercial. The vision plan contemplates options that encourage more robust access along N. Water and N. Poindexter Streets as well as the possibility for a pedestrian link under the bridge. Vessel docking parallel to the site is also suggested under each renewal approach.

Along the spectrum of investment, figure “A” calls for modest improvements to surrounding streetscape and connective elements linking the Harborfront and University districts. Over time, these public investments along with possible partnering with Jennette Brothers site owners could lead to waterside (figure “B”) and more intensive waterside and inland parcel redevelopment (figure “C”).

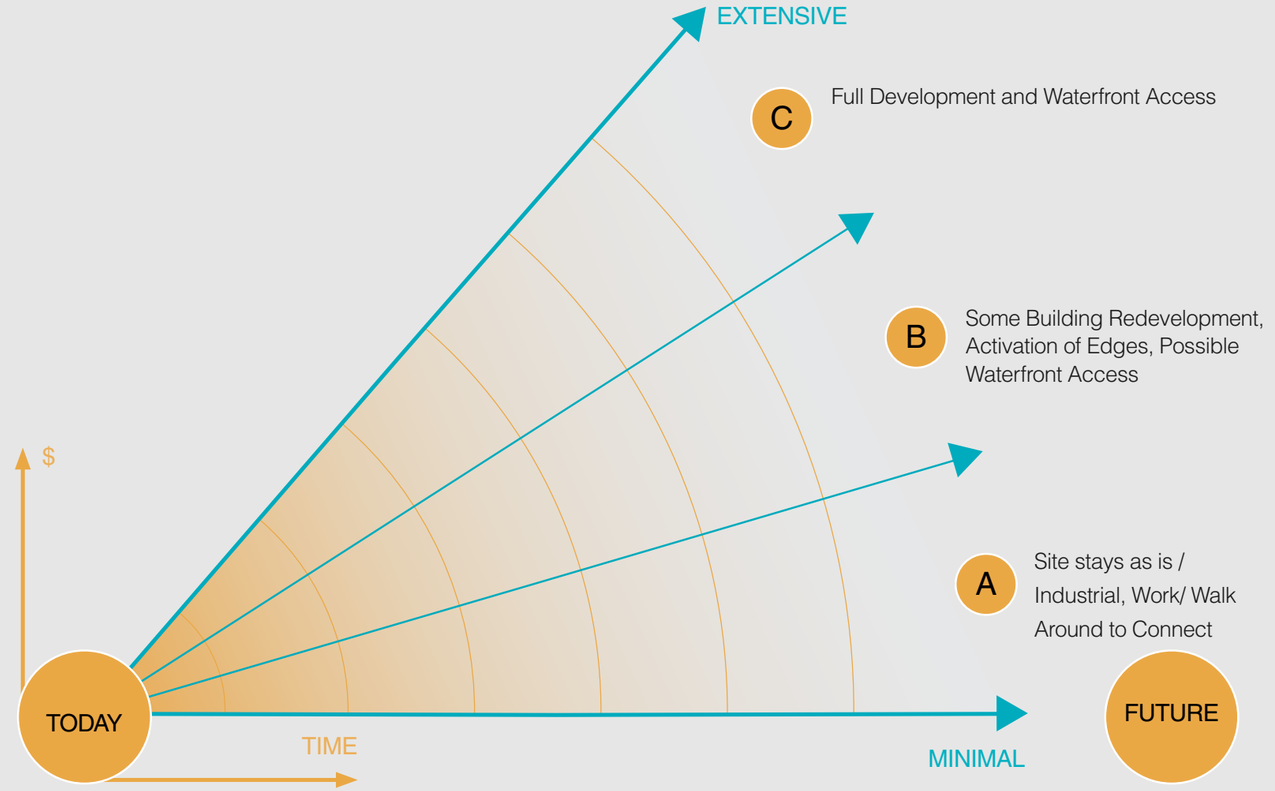
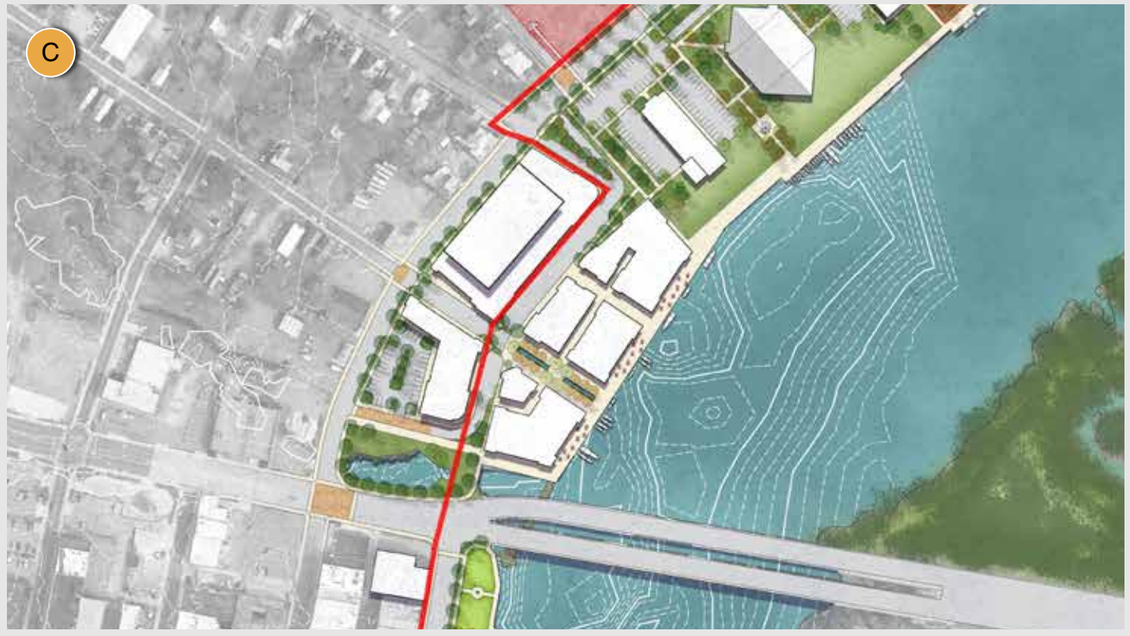


Figure A
Site stays as is / Industrial, Work/ Walk Around to Connect

Figure B
Some Building Redevelopment, Activation of Edges, Possible Waterfront Access

Figure C
Full Development and Waterfront Access



4 // Verdant, Resilient Shore

As coastal towns face the threat of rising tides, urban waterfronts must prepare for environmental future hazards and plan accordingly. The Charles Creek area of Elizabeth City is prone to flooding due to local rainfall, coastal storms, and wind tide events. The City of Elizabeth City received a grant through North Carolina Division of Coastal Management's Planning and Management Grants Program to create a plan to mitigate flooding.

In preparing the Charles Creek Flooding Mitigation Plan, an existing conditions assessment and watershed evaluation. Hydrologic/hydraulic modelling and was conducted to develop and support proposed flood mitigation alternatives in coordination with this Waterfront Master Planning effort.

Based on modeling efforts and cost analysis, the elevation or relocation of flood-prone structures and use of protective berms is one of the recommended flood mitigation alternatives. The elevation of structures provides the highest benefit-cost ratio followed by relocating structures, but the berm option also provides ancillary neighborhood connectivity and recreational benefits. A combination of flood mitigation alternatives may be used in substitute of a singular flood mitigation alternative in order to best meet the needs of the City. The revision of existing ordinances to promote the use of green infrastructure, as well as enforce specific freeboard requirements for new and existing development, would further improve resilience in Elizabeth City.

Green infrastructure is an approach to stormwater management that protects and restores the natural water cycle within the built environment. Planting trees and restoring wetlands, creating bioswales and designing stormwater systems are various green infrastructure methods. Fusing landscape architecture and stormwater mitigation, the use of protective berms and other green infrastructure improvements will promote sustainability, resilience, and betterment of Elizabeth City's development future.

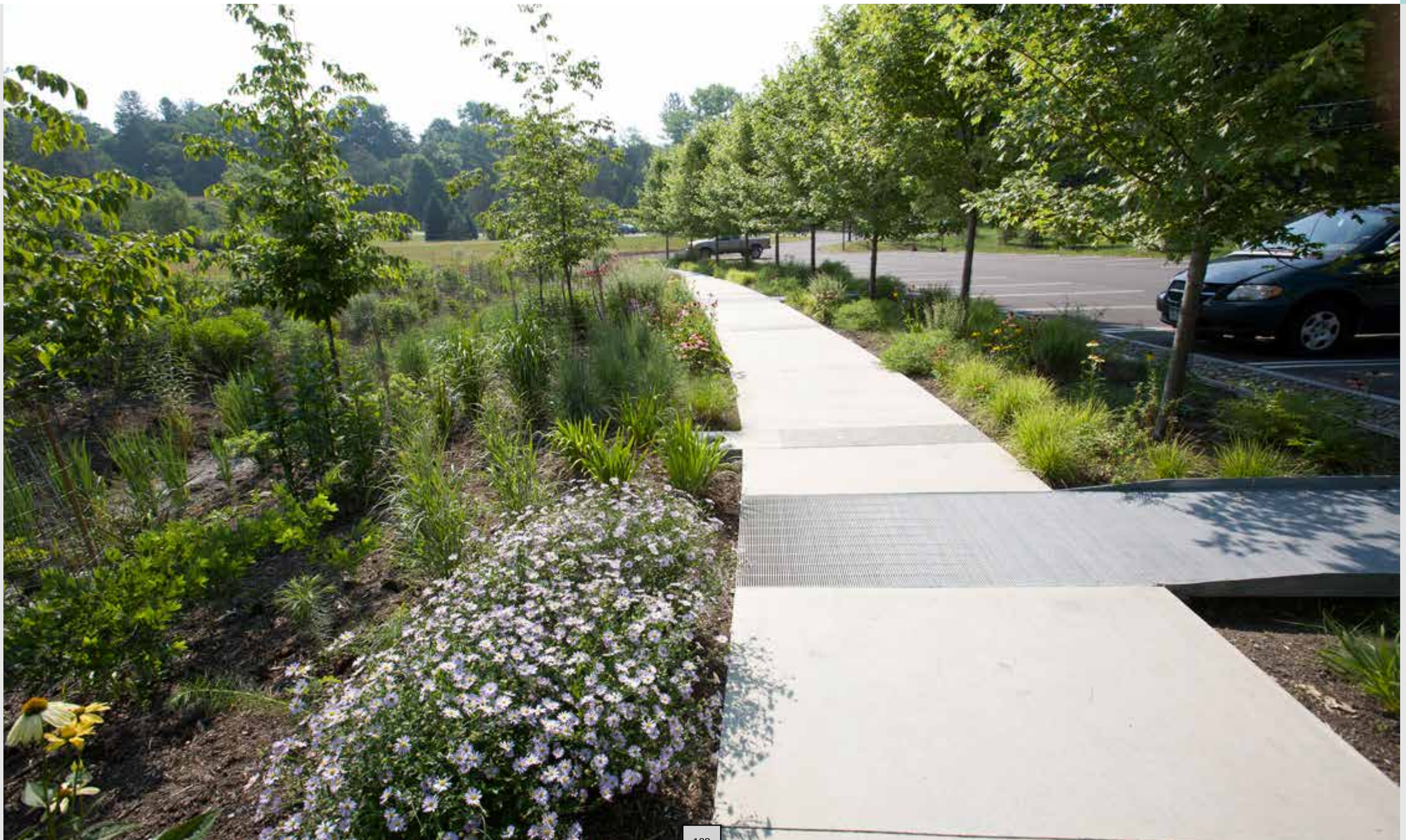
Naturalized stormwater detention areas can be both beautiful and serve a green infrastructure purpose.

Open space can be flooded with little or no damage and provide recreation spaces when not flooded.

Conserved natural areas can be attractive not only to plants and animals, but also to tourists and residents, thereby increasing business and property values.

Preserved marshlands and swamps help protect towns by providing large areas to absorb flooding during storms.

Berms protecting nearby homes from flooding with attractive landscaping.



THE VISION

LEGEND

1. Green Infrastructure (Including Low Impact Development, Rain Gardens, Bioretention Basins, Streetscape Improvements, Berming)

LEGEND

1. Protective Berms
2. Flood Gate
3. Green Infrastructure (Including Low Impact Development, Rain Gardens, Bioretention Basins, Streetscape Improvements, Berming)

This analysis focused on Charles Creek and the impact of rainfall events and tide increases. The objectives of this study included:

- Determine how rainfall and coastal flooding interact within Charles Creek watershed
- Determine appropriate level of flood resilience that is achievable given site constraints
- Develop a suite of potential green and gray infrastructure to meet flood resiliency goals
- Make recommendations to existing policies and ordinances to increase flood resilience
- Investigate and document potential permitting and funding strategies

Through a series of data collection and analysis, including the examination of low-lying ground elevations in relation to wind tides, analysis of soil levels, storm surge and precipitation levels, rising river and tide levels, several flood mitigation options were proposed and analyzed to provide a range of possible outcomes and how best to address future catastrophes.

Flood mitigation options included: protective berms, flood gate and pump system, elevating structures, buying and renovating structures, green infrastructure, and policy/ordinance revisions.

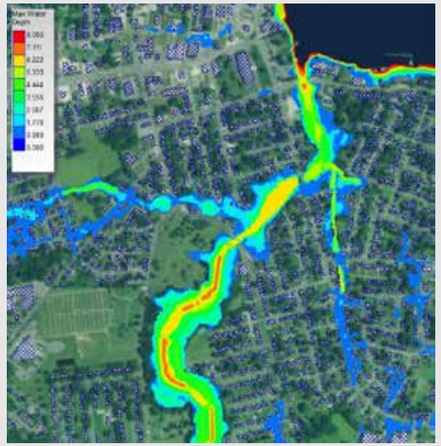
Protective berms along the Charles Creek shoreline, incorporated into the landscape, would mitigate river and wind tide flooding and help to maintain current rising water standard levels. A flood gate, immediately downstream from Riverside/ Shepard Street Bridge, would require additional pumping infrastructure to route Charles Creek water flows around the flood gate and into the Pasquotank River during major storms. Elevating, buying and renovating structures would safeguard future structures from storm surge damage.

Green infrastructure would reduce impervious surface area and decrease runoff to stormwater infrastructure systems. However, the soil conditions in this area are somewhat challenging and may not be adequate for this to be a stand-alone option. Policy and ordinance revisions were also recommended to be updated to reflect recent changes in stormwater systems. Lastly, funding options, like FEMA and other relevant grant programs, were researched to gather a sense of the types of dollars that are available to commence this work.

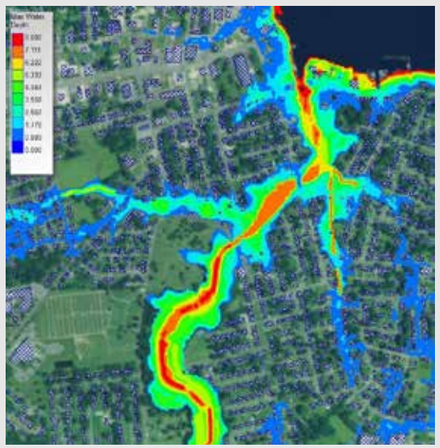
In conclusion, recommendations are:

- Elevation/relocation of structures or protective berms as the recommended flood mitigation alternatives
- Combinations of flood mitigation alternatives can be utilized
- Green infrastructure would be more of an add-on to other alternatives listed to improve existing stormwater system behavior with respect to water quantity and quality
- Update Stormwater and Flood Ordinances to better reflect 2017 stormwater rules and design guidance, and provide additional freeboard to FEMA flood elevations

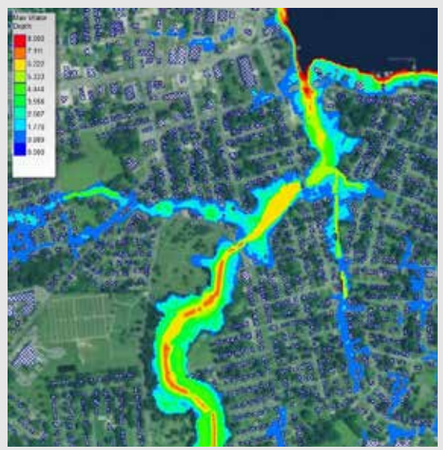
EXISTING CONDITIONS



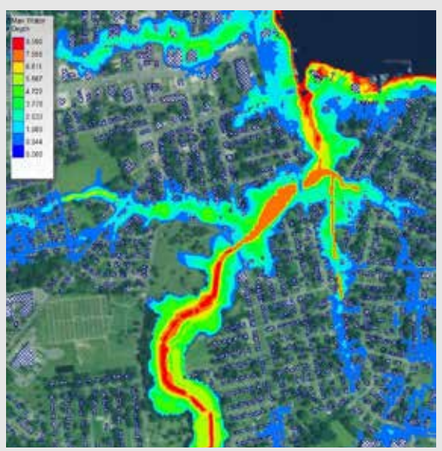
EXISTING 10 YEAR RAINFALL, 1.0' SURGE



EXISTING 25 YEAR RAINFALL, 3.0' SURGE

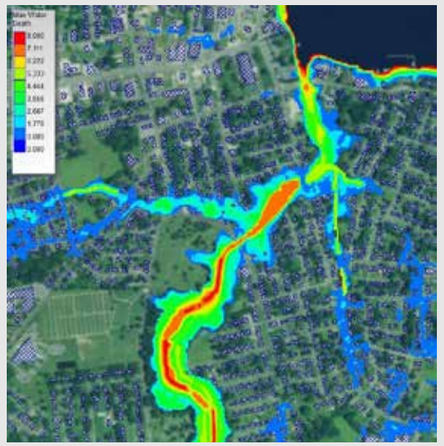


EXISTING 10 YEAR RAINFALL, 1.8' SURGE

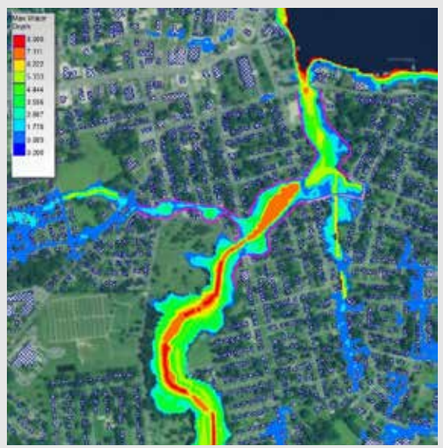


EXISTING 50 YEAR RAINFALL, 3.6' SURGE

POTENTIAL FLOOD MITIGATION 25 YEAR EVENT

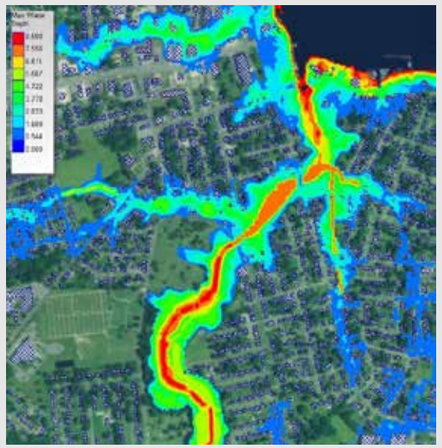


EXISTING CONDITIONS: 25 YEAR EVENT, NO SURGE

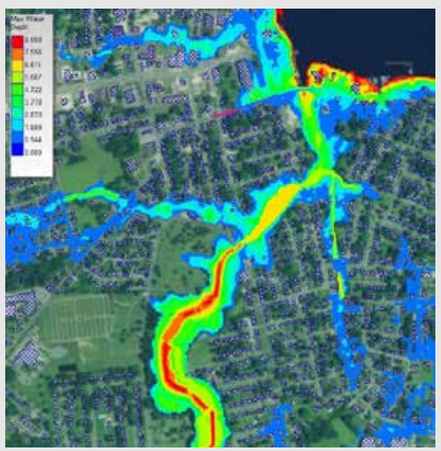


WITH PROTECTIVE BERMS: 25 YEAR EVENT, 3.'0 SURGE

POTENTIAL FLOOD MITIGATION 50 YEAR EVENT



EXISTING CONDITIONS: 50 YEAR EVENT, NO SURGE



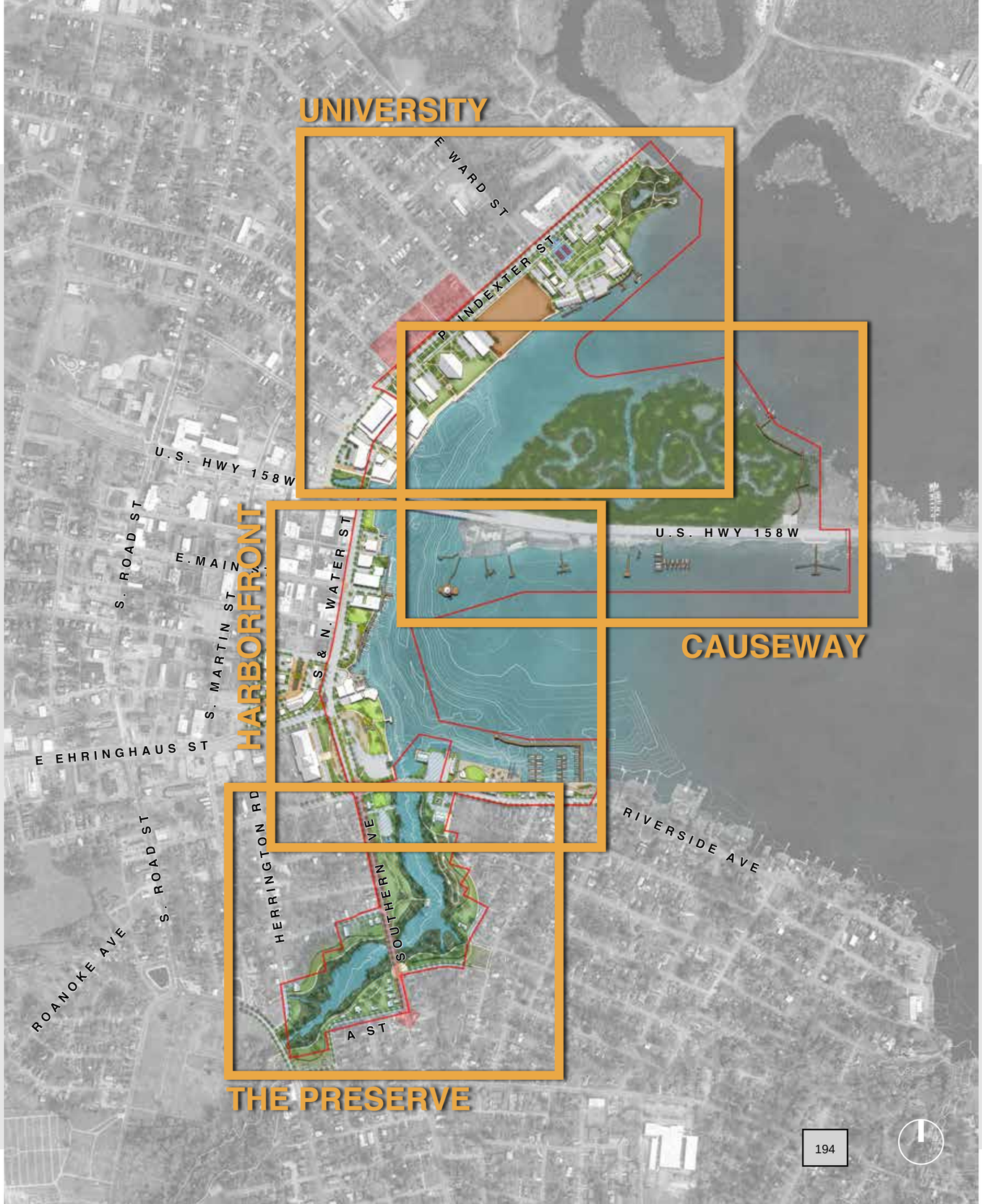
WITH FLOOD GATE / PUMP: 50 YEAR EVENT, 3.6' SURGE

5 // Celebration of Community Heritage

Elizabeth City's past, present, and future culminate in an communal place and time where locals are proud of their heritage while welcoming their future. Four redevelopment zones of interest – university, causeway, harborfront, and the preserve – make up distinct focus areas of integration for the betterment of the Elizabeth City Waterfront Masterplan.

Each zone presents an opportunity for placemaking and communal celebration. MACU campus is a meeting ground of intellect and engaging conversations, advancing the University's research and long-term growth of the area. Machelhe Island beckons to be more than just a causeway by offering ecological preservation and ecotourism discoveries. The harborfront's fifty acres is ideal for reinvestment opportunities, elevating the current cityscape to a mixed-use and diverse destination. Targeted redevelopment and revitalization efforts, coupled with enhanced landscaping and green infrastructure elevate downtown and the harborfront's appearance. Wayfinding, signage and connected pathways unify the project area, and provide opportunities to celebrate the community heritage. Charles Creek's preservation efforts are engineered to reduce flooding impacts, preserving ample area for parks and open space while demonstrating the dire need to sustain natural ecosystems.

These zones come together to create a range of integrated uses that promote a viable and sustainable vision for Elizabeth City.



◂ UNIVERSITY

The district supports expansion of research, athletics, recreation and residential uses. Mid Atlantic Christian University and other regional institutions of higher learning are catalytic to the long-term growth of this area.

◂ CAUSEWAY

A compelling welcome to Elizabeth City. Machelhe Island balances residential, maritime and ecological zones. Northern Machelhe Island evolves into an ecopark supporting hand powered water dependent recreation and other natural features.

◂ HARBORFRONT

Fifty acres of quintessential North Carolina Harborfront supporting recreational boating, sailing, restaurants, parks and open spaces, and residential living. Key landside and in-water investments are advanced by the public and private sector to support Elizabeth City's mission to be the Harbor of Hospitality.

◂ THE PRESERVE

Charles Creek and floodplain are engineered to reduce flooding impacts to southern Elizabeth City. Extensive areas are preserved for park, open space and natural habitat zones.

PLAN IMPLEMENTATION

The plan is an assemblage of places and spaces introduced over time to result in the transformation of the water's edge into a dynamic, well-loved community space. As much as we wish the entirety of this transformation could occur in one narrow development window, conducting follow-up studies, identifying funding sources, timing development to market factors, permitting, design and construction all take time. What becomes essential in large scale waterfront development effort is establishing the right initial action steps that set the foundation for future efforts. Introducing flexibility into the plan is also critical. In this section, we present the overall phasing plan for the project as well as the project schedule.

Phasing

The community vision assembled for Elizabeth City's waterfront will be implemented over time. The goal of implementing a majority of the Vision Plan project efforts will occur over the next decade. Critically setting initial actions and investments will establish a foundation for later stage projects.

Our recommended phasing strategy reflects a purposeful desire to advance those initiatives that have high community value, offer good potential for funding, and set the stage for follow-up project efforts. In several cases, listed projects can be further broken down into smaller improvement efforts tailored to the city's economic reach and the availability of grants and other public/private funding sources.

The timing of several projects rests squarely on conditions in the marketplace and the ability of the public sector to assemble a compelling public/private package on key projects and show leadership in getting the word out in the development community. There is likely no greater development effort than the one envisioned for a potential downtown hotel, illustrated for the Water and Ehringaus Street targeted redevelopment site. The upside rewards could be very sizable for Elizabeth City, but securing the right hotel deal will take creativity and perseverance.

Key private development opportunities denoted in the vision plan should also be enthusiastically supported by the government/public sector. While redevelopment of these parcels/buildings will follow private property owner wishes, the City, county and public sector should consider taking a proactive role with these owners to see what type of collaborative opportunities are available.

There are other studies and initiatives which need to be prioritized that are not depicted within the accompanying illustrations. Finally, the suggested phasing strategy presented herein has several inherent flexibilities to allow certain projects to be reprioritized and/or shuffled based on market conditions and community desire.

Funding

The following tables outline various projects and funding strategies based on the four districts. Each district is broken down into its own table, with a list of projects accompanied by a designated rating code and potential funding source.

The rating codes were deciphered as follows:

- Community Desire (CD) is a result of public input through community engagement, meetings, interviews and survey results.
- Funding (F) relates to local, state and federal grant, funding and resource opportunities available.
- Linking (LK) is based on Moffatt & Nichol's assessment of the project site through research, analysis and design.

	(1) Location Codes
(U)	University
(C)	Causeway
(H)	Harborfront
(P)	Preserve / Charles Creek

	(2) Rating Codes
(CD)	Community Desire; degree of community prioritization, with 1 (highest) to 3 (lowest)
(F)	Funding; degree to which a reliable funding source has been identified, with 1 (highest) to 3 (lowest)
(LK)	Linking; critical nature of project to other follow-on efforts, with 1 (highest) to 3 (lowest)

	(3) Funding Source Codes
(FEMA HMGP)	FEMA Hazard Mitigation Grant Program (HMGP)
(FEMA PDM)	FEMA Pre-Disaster Mitigation (PDM) Program
(FEMA FMA)	Flood Mitigation Assistance (FMA) Program
(CDBG-DR)	HUD Community Development Block Grant - Disaster Recover (CDBG-DR)
(CWMTF)	NC Clean Water Management Trust Fund (CWMTF) Grant
(NCDEQ)	NC Department of Environmental Quality (NCDEQ) Water Resources Development Program Grant
(CRG)	NOAA Coastal Resilience Grant (CRG)
(EPA UWSG)	EPA Urban Waters Small Grant (EPA UWSG)
(EPA 205)	EPA Section 205(j) Grant (EPA 205)
(NFWF 5Star)	National Fish and Wildlife Foundation Five Star and Urban Waters Restoration Grant (NFWF 5Star)
(CWSRF)	Clean Waters State Revolving Fund (CWSRF)
(NC CRFL)	NC Coastal Recreational Fishing License Grant (NC CRFL)
(RTG)	Recreational Trails Grant (RTG)
(B&WAG)	Public Beach & Waterfront Access Grant (B&WAG) (CAMA)
(NPS L&WCF)	NPS Land & Water Conservation Fund (NPS L&WCF)
(BIG)	Fish & Wildlife Service - Wildlife & Sport Fish Restoration Program Boating Infrastructure Grant (BIG)
(MSD)	Fish & Wildlife Service - Wildlife & Sport Fish Restoration Program Marine Sewage Pumpout and Dump Grant (MSD)
(NCDOT BP)	NCDOT Bike and Pedestrian Planning Grant (NCDOT BP)
(TAP)	FHA Transportation Alternatives Program (TAP)
(NC P&R)	NC Parks and Recreation Fund (PARTF)
(CITY)	Public Sector - City of Elizabeth City
(COUNTY)	Public Sector - Pasquotank County
(PRIVATE)	Private Sector

University District // Improvements and Projects

University District Improvements and Projects focus on expansion of MACU's campus and key redevelopment opportunities:

Creating a nature park at the far northwestern edge of the harborfront will link to campus and provide connectivity throughout Elizabeth City via bike and pedestrian pathways.

Constructing a Rowing Center and adding student housing will add value to the University's campus.

Streetscape improvements along N. Pointdexter will connect to the other green infrastructure improvements occurring throughout the project site.

The Jennette Brothers site is a key target redevelopment opportunity, offering the potential for mixed-use development and wharf improvements, creating a viable destination for downtown.

Lastly, a waterfront walkway extending from the waterfront condominiums, along the MACU campus, the Jennette Brothers waterfront and under US HWY 158W, will promote accessibility by linking the entire University district to the Harborfront District and beyond.

ID	Project Name	Location (Code)[1]	Description	Rating[2]			Estimated Cost	Potential Funding Source (Code)[3]
				CD	F	LK		
1	Jennette Brothers - Wharf Redevelopment	U	Wharf redevelopment along Jennette Brothers site.	2	3	1	$1.6M - $2.4M	B&WAG, CITY, PRIVATE
2	US HWY 158W Waterfront Walkway	U	Waterfront walkway linking Jennette Brothers site to Veterans Park.	2	3	1	$240,000 - $360,000	B&WAG, CITY, COUNTY
3	University Rowing Center	U	Rowing club boat house and launch (possible link to MACU, CECSU and CA).	2	2	3	$1.2M - $1.7M	B&WAG, PRIVATE (MACU, CECSU, CA), CITY, COUNTY
4	Streetscape Improvements - N. Poindexter Street	U	Landscape, sidewalk, crossing, lighting, wayfinding and other corridor enhancements.	2	3	3	$2.3M - $3.4M	CDBG, CITY
5	Jennette Brothers - Site Redevelopment	U	Mixed-use development with GF commercial and residential above; waterfront promenade.	2	3	3	PRIVATE INVESTMENT	PRIVATE; Possible City / Grant Support for Public Realm Investments.
6	Expanded Residential Units / Student Housing	U	Residential townhomes.	3	2	3	PRIVATE INVESTMENT	
7	North University / Pasquotank River Nature Park	U	Enhanced walking trails, paths, overlook areas, parking and art.	3	3	3	$680,000 - $1M	RTG, NPS L&WCF, PRIVATE (MACU), CITY

(1) Location Codes

- (U) University
- (C) Causeway
- (H) Harborfront
- (P) Preserve / Charles Creek

(2) Rating Codes

- (CD) Community Desire; degree of community prioritization, with 1 (highest) to 3 (lowest)
- (F) Funding; degree to which a reliable funding source has been identified, with 1 (highest) to 3 (lowest)
- (LK) Linking; critical nature of project to other follow-on efforts, with 1 (highest) to 3 (lowest)

(3) Funding Source Codes

(FEMA HMGP)	FEMA Hazard Mitigation Grant Program
(FEMA PDM)	FEMA Pre-Disaster Mitigation Program
(FEMA FMA)	Flood Mitigation Assistance Program
(CDBG-DR)	HUD Community Development Block Grant Disaster Recover
(CWMTF)	NC Clean Water Management Trust Fund
(NCDEQ)	NC Department of Environmental Quality Water Resources Development Program Grant
(CRG)	NOAA Coastal Resilience Grant
(EPA UWSG)	EPA Urban Waters Small Grant
(EPA 205)	EPA Section 205(j) Grant
(NFWF 5Star)	National Fish and Wildlife Foundation Five Star and Urban Waters Restoration Grant
(CWSRF)	Clean Waters State Revolving Fund
(NC CRFL)	NC Coastal Recreational Fishing License Grant
(RTG)	Recreational Trails Grant
(B&WAG)	Public Beach & Waterfront Access Grant (CAMA)
(NPS L&WCF)	NPS Land & Water Conservation Fund
(BIG)	Fish & Wildlife Service - Wildlife & Sport Fish Restoration Program Boating Infrastructure Grant
(MSD)	Fish & Wildlife Service - Wildlife & Sport Fish Restoration Program Marine Sewage Pumpout and Dump Grant
(NCDOT BP)	NCDOT Bike and Pedestrian Planning Grant
(TAP)	FHA Transportation Alternatives Program
(NC P&R)	NC Parks and Recreation Fund (PARTF)
(CITY)	Public Sector - City of Elizabeth City
(COUNTY)	Public Sector - Pasquotank County
(PRIVATE)	Private Sector

Causeway District // Improvements and Projects

Causeway District Improvements and Projects open up opportunities for blueway and greenway expansion efforts on the island. From kayaking to an expanded boardwalk, these projects promote ecological sustainability and educational efforts. Construction of a harbor beacon will provide a notable landmark to the waterfront and can incorporate an art installation piece.

ID	Project Name	Location (Code)[1]	Description	Rating[2]			Estimated Cost	Potential Funding Source (Code)[3]
				CD	F	LK		
1	City of Elizabeth City Harbor Beacon	C	Harbor beacon / art installation	1	2	3	$200,000 - $300,000	CITY, ARTS DONATIONS
2	Causeway Island Kayak Trails and Launch Improvements	C	Expanded kayak / SUP launch capability, access walkways, and interpretive signage.	3	2	3	$1.7M - $2.5M	RTG, NPS L&WCF, CITY, COUNTY
3	Causeway Island Conservation Area Enhancements	C	Blueways trail enhancements and hazard markers.	3	2	3	$1.2M - $1.9M	RTG, NPS L&WCF, CITY, COUNTY

(1) Location Codes

- (U) University
- (C) Causeway
- (H) Harborfront
- (P) Preserve / Charles Creek

(2) Rating Codes

- (CD) Community Desire; degree of community prioritization, with 1 (highest) to 3 (lowest)
- (F) Funding; degree to which a reliable funding source has been identified, with 1 (highest) to 3 (lowest)
- (LK) Linking; critical nature of project to other follow-on efforts, with 1 (highest) to 3 (lowest)

(3) Funding Source Codes

- (FEMA HMGP) FEMA Hazard Mitigation Grant Program
- (FEMA PDM) FEMA Pre-Disaster Mitigation Program
- (FEMA FMA) Flood Mitigation Assistance Program
- (CDBG-DR) HUD Community Development Block Grant Disaster Recover
- (CWMTF) NC Clean Water Management Trust Fund
- (NCDEQ) NC Department of Environmental Quality Water Resources Development Program Grant
- (CRG) NOAA Coastal Resilience Grant
- (EPA UWSG) EPA Urban Waters Small Grant
- (EPA 205) EPA Section 205(j) Grant
- (NFWF 5Star) National Fish and Wildlife Foundation Five Star and Urban Waters Restoration Grant
- (CWSRF) Clean Waters State Revolving Fund
- (NC CRFL) NC Coastal Recreational Fishing License Grant
- (RTG) Recreational Trails Grant
- (B&WAG) Public Beach & Waterfront Access Grant (CAMA)
- (NPS L&WCF) NPS Land & Water Conservation Fund
- (BIG) Fish & Wildlife Service - Wildlife & Sport Fish Restoration Program Boating Infrastructure Grant
- (MSD) Fish & Wildlife Service - Wildlife & Sport Fish Restoration Program Marine Sewage Pumpout and Dump Grant
- (NCDOT BP) NCDOT Bike and Pedestrian Planning Grant
- (TAP) FHA Transportation Alternatives Program
- (NC P&R) NC Parks and Recreation Fund (PARTF)
- (CITY) Public Sector - City of Elizabeth City
- (COUNTY) Public Sector - Pasquotank County
- (PRIVATE) Private Sector

Harborfront District // Improvements and Projects

Harborfront District Improvements and Projects pertain to parcels, enhancements and connections that involve the waterfront. Beautification and upgrading efforts of existing open space will promote a robust and versatile waterfront experience. Streetscape improvements along major streets and key intersections will unify downtown to its harborfront, creating a dynamic interplay of use and activity. By developing targeted renewal properties, like the Elizabeth City Shipyard and E. Ehringaus (Chambers site) / Water Street Area, investment dollars will yield a greater return by capitalizing on these land acquisition opportunities.

ID	Project Name	Location (Code)[1]	Description	Rating[2]			Estimated Cost	Potential Funding Source (Code)[3]
				CD	F	LK		
1	Recreational Boating Slips at Mariners' Wharf Park	H	Renewed and updated boating slips along Mariners Wharf.	1	1	1	$320,000 - $480,000	B&WAG, BIG, MSD, CITY
2	Elizabeth City Shipyard Renewal - Land Acquisition	H	Shipyard land acquisition.	1	1	1	TBD	CWMTF, B&WAG, NC P&R, CITY
3	Museum of the Albemarle to Mariners Wharf Linkages	H	Streetscape and pedestrian linkages between the museum and Mariners Wharf; possible sculpture garden.	2	2	2	$1.7M - $2.6M	TBD
4	Mariners Wharf Enhancements	H	Open space, performance area and multi-use event upgrades.	2	2	2	$1.9M - 2.9M	B&WAG, NPS L&WCF, CITY
5	Main Street and Moth Boat Park Enhancement and Community Wharf	H	Enhancement of Moth Boat Park and public fishing pier and overlook development.	1	2	3	$1M - $1.5M	B&WAG, NPS L&WCF, CITY
6	Waterfront Parcel(s) Beautification - Veterans to Moth Boat Parks	H	Exterior beautification efforts along waterside facing structures from Veterans to Moth Boat Parks.	2	3	3	PRIVATE INVESTMENT	TBD
7	E. Ehringhaus / Water Street Redevelopment Area	H	Redevelopment of +/-4 acres of property at the corner of E. Ehringhaus and Water Street.	2	3	3	PRIVATE INVESTMENT	CITY TO SUPPORT ROW IMPROVEMENTS

(1) Location Codes

- (U) University
- (C) Causeway
- (H) Harborfront
- (P) Preserve / Charles Creek

(2) Rating Codes

- (CD) Community Desire; degree of community prioritization, with 1 (highest) to 3 (lowest)
- (F) Funding; degree to which a reliable funding source has been identified, with 1 (highest) to 3 (lowest)
- (LK) Linking; critical nature of project to other follow-on efforts, with 1 (highest) to 3 (lowest)

(3) Funding Source Codes

(FEMA HMGP)	FEMA Hazard Mitigation Grant Program
(FEMA PDM)	FEMA Pre-Disaster Mitigation Program
(FEMA FMA)	Flood Mitigation Assistance Program
(CDBG-DR)	HUD Community Development Block Grant Disaster Recover
(CWMTF)	NC Clean Water Management Trust Fund
(NCDEQ)	NC Department of Environmental Quality Water Resources Development Program Grant
(CRG)	NOAA Coastal Resilience Grant
(EPA UWSG)	EPA Urban Waters Small Grant
(EPA 205)	EPA Section 205(j) Grant
(NFWF 5Star)	National Fish and Wildlife Foundation Five Star and Urban Waters Restoration Grant
(CWSRF)	Clean Waters State Revolving Fund
(NC CRFL)	NC Coastal Recreational Fishing License Grant
(RTG)	Recreational Trails Grant
(B&WAG)	Public Beach & Waterfront Access Grant (CAMA)
(NPS L&WCF)	NPS Land & Water Conservation Fund
(BIG)	Fish & Wildlife Service - Wildlife & Sport Fish Restoration Program Boating Infrastructure Grant
(MSD)	Fish & Wildlife Service - Wildlife & Sport Fish Restoration Program Marine Sewage Pumpout and Dump Grant
(NCDOT BP)	NCDOT Bike and Pedestrian Planning Grant
(TAP)	FHA Transportation Alternatives Program
(NC P&R)	NC Parks and Recreation Fund (PARTF)
(CITY)	Public Sector - City of Elizabeth City
(COUNTY)	Public Sector - Pasquotank County
(PRIVATE)	Private Sector

Harborfront District // Improvements and Projects (Cont.)

The Elizabeth City Shipyard Renewal effort is broken up into several phases given its costly undertaking. Fortunately, there are a variety of grant and funding opportunities available to phase out the project's intent. Additionally, restoring the Elizabeth City Milling Co. Building and incorporating streetscape improvements will unify the harborfront as a distinct district. Various green infrastructure implementations along Riverside Avenue tie into the Preserve / Charles Creek improvements and extend the flood mitigation zone beyond Charles Creek, north along the water's edge in the form of park space and streetscape improvements.

ID	Project Name	Location (Code)[1]	Description	Rating[2]			Estimated Cost	Potential Funding Source (Code)[3]
				CD	F	LK		
1	Elizabeth City Shipyard Renewal - Marina (Low Options)	H	Breakwater, slips, docks, and other in-water enhancements.	1	1	1	$2.3M - $3.5M	B&WAG, BIG, MSD, CITY, PRIVATE
2	Elizabeth City Shipyard Renewal - Uplands Phase 1 (Low Options)	H	Uplands Phase 1 improvements.	1	2	1	$3M - $4.6M	B&WAG, CITY, PRIVATE
3	Elizabeth City Shipyard Renewal - Uplands Phase 2 (Low Options)	H	Uplands Phase 2 improvements.	2	3	2	$1M - $1.5M	B&WAG, NPS L&WCF, CITY, PRIVATE
4	Elizabeth City Shipyard Renewal - Uplands Phase 3 (Low Options)	H	Uplands Phase 3 improvements.	2	3	3	$2.7M - $4M	B&WAG, CITY, PRIVATE
5	Streetscape and Infrastructure Improvements - Riverside Avenue	H	Infrastructure BMPs, Landscape, sidewalk, crossing, lighting, wayfinding and other corridor enhancements.	2	2	3	$1.1M - $1.7M	CDBG, CITY
6	Streetscape Improvements - N. & S. Water Street	H	Landscape, sidewalk, crossing, lighting, wayfinding and other corridor enhancements.	2	3	3	$1.5M - $2.3M	CDBG, CITY
7	Elizabeth City Milling Co. Building Restoration	H	Adaptive reuse of the historic Elizabeth City Milling building.	3	3	3	$1.1M - $1.6M	TBD

(1) Location Codes

- (U) University
- (C) Causeway
- (H) Harborfront
- (P) Preserve / Charles Creek

(2) Rating Codes

- (CD) Community Desire; degree of community prioritization, with 1 (highest) to 3 (lowest)
- (F) Funding; degree to which a reliable funding source has been identified, with 1 (highest) to 3 (lowest)
- (LK) Linking; critical nature of project to other follow-on efforts, with 1 (highest) to 3 (lowest)

(3) Funding Source Codes

- (FEMA HMGP) FEMA Hazard Mitigation Grant Program
- (FEMA PDM) FEMA Pre-Disaster Mitigation Program
- (FEMA FMA) Flood Mitigation Assistance Program
- (CDBG-DR) HUD Community Development Block Grant Disaster Recover
- (CWMTF) NC Clean Water Management Trust Fund
- (NCDEQ) NC Department of Environmental Quality Water Resources Development Program Grant
- (CRG) NOAA Coastal Resilience Grant
- (EPA UWSG) EPA Urban Waters Small Grant
- (EPA 205) EPA Section 205(j) Grant
- (NFWF 5Star) National Fish and Wildlife Foundation Five Star and Urban Waters Restoration Grant
- (CWSRF) Clean Waters State Revolving Fund
- (NC CRFL) NC Coastal Recreational Fishing License Grant
- (RTG) Recreational Trails Grant
- (B&WAG) Public Beach & Waterfront Access Grant (CAMA)
- (NPS L&WCF) NPS Land & Water Conservation Fund
- (BIG) Fish & Wildlife Service - Wildlife & Sport Fish Restoration Program Boating Infrastructure Grant
- (MSD) Fish & Wildlife Service - Wildlife & Sport Fish Restoration Program Marine Sewage Pumpout and Dump Grant
- (NCDOT BP) NCDOT Bike and Pedestrian Planning Grant
- (TAP) FHA Transportation Alternatives Program
- (NC P&R) NC Parks and Recreation Fund (PARTF)
- (CITY) Public Sector - City of Elizabeth City
- (COUNTY) Public Sector - Pasquotank County
- (PRIVATE) Private Sector

Preserve & Charles Creek // Improvements and Projects

The Preserve / Charles Creek Improvements and Projects range from green infrastructure improvements, like protective berms, for flood mitigation to the construction of additional amenities, like greenways and a fishing pier. Streetscape improvements along Southern Avenue will help unify the southern portion of the project site to the waterfront and downtown core, while a revitalization effort for the Charles Creek Bridge will upgrade the existing bridge with further enhancements.

ID	Project Name	Location (Code)[1]	Description	Rating[2]			Estimated Cost	Potential Funding Source (Code)[3]
				CD	F	LK		
*1	Charles Creek Flood Mitigation - Relocation	P	Relocation of flood prone structures	1	1	1	$3.5M - $4M	FEMA, HMGP, FEMA PDM
*2	Charles Creek Flood Mitigation - Elevation	P	Elevation of flood prone structures	1	1	1	$1.6M - $2.1M	FEMA, HMGP, FEMA PDM
*3	Charles Creek Flood Mitigation - Berms and Flood Mitigation	P	Construction of berms with drainage infrastructure	1	1	1	$2.2M (Only practical to a 25yr event)	FEMA HMGP, FEMA PDM, FEMA FMA, CDBG-DR, CWMTF, NCDEQ, CRG, EPA UWSG, EPA 205
4	Charles Creek Park MLK Eco Walk	P	Phase 2 (southern) expansion of the MLK Eco Walk	2	2	2	$1.1M - $1.5M	RTG, CITY
5	Charles Creek Greenway and Trail Systems	P	Construction of greenway and trail park system	2	2	2	$3M - $4.5M	RTG, NCDOT BP, CITY
6	City of Elizabeth City Sailing Center Enhancements	P	Launch area improvements; building and site beautification.	1	1	3	$400,000 - $650,000	B&WAG
7	Charles Creek Fishing Pier	P	Creation of a 30’ fishing pier at Charles Creek.	1	2	3	$140,000 - $210,000	NC CRFL, CITY
8	Streetscape Improvements - Southern Avenue	P	Landscape, sidewalk, crossing &wayfinding	2	3	3	$1.1M - $1.7M	TBD

* Costs are for stand alone alternatives. A combination of these strategies may ultimately be implemented, including property acquisition

(1) Location Codes

- (U) University
- (C) Causeway
- (H) Harborfront
- (P) Preserve / Charles Creek

(2) Rating Codes

- (CD) Community Desire; degree of community prioritization, with 1 (highest) to 3 (lowest)
- (F) Funding; degree to which a reliable funding source has been identified, with 1 (highest) to 3 (lowest)
- (LK) Linking; critical nature of project to other follow-on efforts, with 1 (highest) to 3 (lowest)

(3) Funding Source Codes

- (FEMA HMGP) FEMA Hazard Mitigation Grant Program
- (FEMA PDM) FEMA Pre-Disaster Mitigation Program
- (FEMA FMA) Flood Mitigation Assistance Program
- (CDBG-DR) HUD Community Development Block Grant Disaster Recover
- (CWMTF) NC Clean Water Management Trust Fund
- (NCDEQ) NC Department of Environmental Quality Water Resources Development Program Grant
- (CRG) NOAA Coastal Resilience Grant
- (EPA UWSG) EPA Urban Waters Small Grant
- (EPA 205) EPA Section 205(j) Grant
- (NFWF 5Star) National Fish and Wildlife Foundation Five Star and Urban Waters Restoration Grant
- (CWSRF) Clean Waters State Revolving Fund
- (NC CRFL) NC Coastal Recreational Fishing License Grant
- (RTG) Recreational Trails Grant
- (B&WAG) Public Beach & Waterfront Access Grant (CAMA)
- (NPS L&WCF) NPS Land & Water Conservation Fund
- (BIG) Fish & Wildlife Service - Wildlife & Sport Fish Restoration Program Boating Infrastructure Grant
- (MSD) Fish & Wildlife Service - Wildlife & Sport Fish Restoration Program Marine Sewage Pumpout and Dump Grant
- (NCDOT BP) NCDOT Bike and Pedestrian Planning Grant
- (TAP) FHA Transportation Alternatives Program
- (NC P&R) NC Parks and Recreation Fund (PARTF)
- (CITY) Public Sector - City of Elizabeth City
- (COUNTY) Public Sector - Pasquotank County
- (PRIVATE) Private Sector

Other Studies, Improvements and Projects

The Other Studies, Improvements and Projects pertain to bike/ped and signage/wayfinding projects to strengthen connectivity in downtown and along the waterfront. Planning and designing facilities that cater to bike/pedestrian traffic increases access from downtown to the waterfront. Building off of “The Harbor of Hospitality” brand, it is recommended to create a comprehensive signage and wayfinding system for cohesion and identity within the overall project site.

Project Name	Description
City of Elizabeth City (CEC) Comprehensive Bike / Ped Program - Plan / Design	Planning and design of revitalized bicycle and pedestrian facilities along the waterfront.
CEC Comprehensive Bike / Ped Program - CAPX	Implementation of revitalized bicycle and pedestrian facilities along the waterfront.
Comprehensive Signage and Wayfinding - Plan / Design	Branding, planning and design of downtown and waterfront signage and wayfinding program.
Comprehensive Signage and Wayfinding	Implementation of downtown and waterfront signage and wayfinding program.

Next Steps

As presented, the Vision Plan identifies the following key projects that will help bring a renewed Elizabeth City to life. The plan and its respective tables also work to present linkages as to how projects are connected and require initial investment.

So what next steps need to happen to advance the vision? Recommendations in three categories are suggested as follows:

1. Starter projects and studies;
2. Funding and finance; and
3. Implementors and champions

These key starter projects are:

- Renewed and updated recreational boating slips at Mariners' Wharf Park, including Moth Boat to Mariners' Wharf Park waterfront walkway.
- Implementation of next steps for the Charles Creek Flood Mitigation Study, including: land acquisition; protective berms and flood mitigation; green infrastructure and greenways; trails and interconnected park system; beautification and amenitization improvements.
- Streetscape and pedestrian linkages between the Museum of the Albemarle and Waterfront Park, including a sculpture garden and improved wayfinding.
- Elizabeth City shipyard marina and uplands renewal, including breakwater, slips and in-water enhancements, adaptive re-use of the historic Elizabeth City Milling Co. building and landside improvements.
- Streetscape and infrastructure improvements, including infrastructure best management practices (BMPs), landscape, sidewalk, crossing, lighting, wayfinding and other corridor enhancements. The locations shown in this master plan are indicative of the general improvements and intent. Further study is required to ascertain the necessary level of improvements and propose locations for each of these improvements based on detailed analysis.
- Machelhe Island conservation area enhancements, including blueways, trails enhancements, and hazard markers.
- City of Elizabeth City sailing center enhancements, including launch area improvements, building, art/mural and site beautification.
- North University/ Pasquotank River Nature Park enhanced walking trails, paths, overlook areas and parking.

In terms of funding and finance, often funding initiatives need to be a combination of City, County, grant and public/private partnerships to be most effective. An itemized list of potential funding sources is listed on each of the designated improvements and projects tables stated in the prior pages.

The implementors and champions for these efforts need to be a combination of the City, the downtown group, and possibly other key stakeholders as deemed necessary. As a precedent, Washington, NC created a harborfront alliance that has worked to implement their vision plan into action. It is our recommendation that the City of Elizabeth City would benefit from a similar alliance formation.

moffatt & nichol

1776 Statesville Avenue,
Suite 12, Charlotte NC 28206

www.moffattnichol.com