February 22, 2024

Baltimore City, Dept. of Recreation and Parks
C/o GreenVest, LLC
Attn: Andrew Forbes, PE
4201 Northview Dr, Ste 202
Bowie, Maryland 20716

Via email: andrew@greenvestus.com

Re: Agency Interest Number: 174530
Tracking Number: 202261734
Tidal Authorization Number: 23-WQC-0038

Dear Baltimore City, Dept. of Recreation and Parks:

Your project did not qualify for approval under the Maryland State Programmatic General Permit (MDSPGP); therefore a separate review and issuance of the federal permit will be required by the U.S. Army Corps of Engineers. The federal permit is not attached.

Additionally, your project required a Wetlands License to be approved and issued by the Maryland Board of Public Works (BPW). The Wetlands License will be sent to you by BPW's Wetlands Administrator.

A project that does not qualify for approval under the MDSPGP requires an individual Water Quality Certification (WQC) to be issued by the Maryland Department of the Environment, which is attached. Please take a moment to read and review your WQC to ensure that you understand the limits of the authorized work and all of the general and special conditions.

You should not begin any work until you have obtained all necessary State, local, and federal authorizations. Please contact Matthew Wallach at matthew.wallach@maryland.gov or 410-207-0893 with any questions.

Sincerely,

Tammy Roberson

Tammy Roberson, Chief
Tidal Wetlands Division

STATE OF MARYLAND
DEPARTMENT OF THE ENVIRONMENT
WATER AND SCIENCE ADMINISTRATION
WATER QUALITY CERTIFICATION

23-WQC-0038

EFFECTIVE DATE:	**February 22, 2024**
CERTIFICATION HOLDER:	**Baltimore City, Dept. of Recreation and Parks**
ADDRESS:	**3001 East Drive** **Baltimore, MD 20716**
PROJECT LOCATION:	**Site 5a. East side of Reed Bird Island, east of the Hanover Street Bridge** **Baltimore City, MD 21225**

UNDER AUTHORITY OF SECTION 401 OF THE FEDERAL WATER POLLUTION CONTROL ACT AND ITS AMENDMENTS AND IN ACCORDANCE WITH § 9-313 THROUGH § 9-323, INCLUSIVE, OF THE ENVIRONMENT ARTICLE, ANNOTATED CODE OF MARYLAND, THE MARYLAND DEPARTMENT OF THE ENVIRONMENT, WATER AND SCIENCE ADMINISTRATION HAS DETERMINED THAT THE REGULATED ACTIVITIES DESCRIBED IN THE REQUEST FOR CERTIFICATION FOR THE PROPOSED MARSH CREATION AND AS DESCRIBED IN THE ATTACHED PLAN SHEETS DATED SEPTEMBER 5, 2023 AND ANY SUBSEQUENT MODIFICATIONS APPROVED BY THE DEPARTMENT WILL NOT VIOLATE MARYLAND'S WATER QUALITY STANDARDS, IF CONDUCTED IN ACCORDANCE WITH THE CONDITIONS OF THIS CERTIFICATION.

THIS CERTIFICATION DOES NOT RELIEVE THE APPLICANT OF RESPONSIBILITY FOR OBTAINING ANY OTHER APPROVALS, LICENSES, OR PERMITS IN ACCORDANCE WITH FEDERAL, STATE, OR LOCAL REQUIREMENTS AND DOES NOT AUTHORIZE COMMENCEMENT OF THE PROPOSED PROJECT. A COPY OF THIS REQUIRED CERTIFICATION HAS BEEN SENT TO THE CORPS OF ENGINEERS. THE CERTIFICATION HOLDER SHALL COMPLY WITH THE CONDITIONS LISTED BELOW.

The Maryland Department of Environment satisfied the statutory and regulatory public notice requirements by placing the WQC on Public Notice from November 1, 2023 to December 1, 2023 on Maryland Department of the Environment's Public Notice webpage and advertising in the Baltimore Sun on November 2, 2023. The pre-scheduled hearing notice was also published in the Maryland Register on October 20, 2023 and the informational public hearing was held on December 5, 2023.

PROJECT DESCRIPTION

Remove an existing 4.3-acres phragmites marsh, and construct approximately 1,600 linear feet of segmented stone sill, fill and grade with 13,200 cubic yards of clean sand fill and a carbon layer to contain existing legacy contaminants to create 4.3 acres of marsh enhancement and 4.4 acres of marsh creation all extending a maximum of 200 feet channelward of the existing marsh. The proposed work consists of the following:

- Marsh enhancement: placement of 3,870 cubic yards of clean fill and plant with 4.3 acres of high marsh vegetation;
- Marsh creation: placement of 9,330 cubic yards of clean fill and plant with 1.6 acres of high marsh and 2.8 acres of low marsh vegetation;
- The marsh area includes various woody debris features for both stability and habitat located within the marsh and at the sill vents and 0.12 acres of tidal weirs (unplanted sand and cobble sections to facilitate fish passage); and
- Construct a 158.5-foot long by 6-foot wide "L" walkway, which includes a 10-foot by 10-foot mid-walkway platform.

GENERAL CONDITIONS

1. All water quality-related performance standards and conditions required by the Department in any state issued authorization for activities in tidal wetlands, nontidal wetlands, their 100-year floodplains, nontidal wetlands buffers, or nontidal wetland expanded buffers to ensure that any discharges will not result in a failure to comply with water quality standards in COMAR 26.08.02 or any other water quality requirements of state law or regulation shall be met.

2. This Certification does not obviate the need to obtain required authorizations or approvals from other State, federal or local agencies as required by law.

3. All additional authorizations or approvals, including self-certifying General Permits issued by the Department, shall be obtained and all conditions shall be completed in compliance with such authorizations.

4. The proposed project shall be constructed in accordance with the approved final plan by the Department, or, if Department approval is not required, the plan approved by the U.S. Army Corps of Engineers, and its approved revisions.

5. All fill and construction materials not used in the project shall be removed and disposed of in a manner which will prevent their entry into waters of this State.

6. This Certification does not authorize any injury to private property, any invasion of rights, or any infringement of federal, state, or local laws or regulations.

7. Authorized representatives of the Department shall be provided access to the site of authorized activities during normal business hours to conduct inspections and evaluations of the operations and records necessary to assure compliance with this Certification.

8. No stockpiles of any material shall be placed in Waters of the U.S. or state or private tidal wetlands.

9. Temporary construction trailers or structures, staging areas and stockpiles shall not be located within tidal wetlands, nontidal wetlands, nontidal wetlands buffers, or the 100-year floodplain unless specifically included on the Approved Plan.

10. This Certification is valid for the project identified herein and the associated U.S. Army Corps of Engineers NAB-2022-61734, until such time as that federal approval expires or is not administratively extended.

SPECIAL CONDITIONS

1. All Critical Area requirements shall be followed and all necessary authorizations from the Critical Area Commission ("Commission") shall be obtained. This Certificate does not constitute authorization for disturbance in the 100-foot Critical Area Buffer. "Disturbance" in the Buffer means clearing, grading, construction activities, or removal of any size of tree or vegetation. Any anticipated Buffer disturbance requires prior written approval, before commencement of land disturbing activity, from local jurisdiction in the form of a Buffer Management Plan.

2. All work performed under this Water Quality Certificate shall be conducted by a marine contractor licensed by the Marine Contractors Licensing Board (MCLB) in accordance with Title 17 of the Environment Article of Annotated Code of Maryland. Licensing by MCLB shall occur prior to the beginning of construction activities. A list of licensed marine contractors may be obtained by contacting the MCLB at 410-537- 3249, by e-mail at MDE.MCLB@maryland.gov or by accessing the Maryland Department of the Environment, Environmental Boards webpage.

3. The issuance of this Certificate is not a validation or authorization by the Department for any of the existing structures depicted on the plan sheets on the subject property that is not part of the authorized work description, nor does it relieve the Certificate Holder of the obligation to resolve any existing noncompliant structures and activities within tidal wetlands.

4. The Certificate Holder shall construct the marsh establishment area in accordance with the following conditions:

    1. The Certificate Holder shall use clean substrate fill material, no more than 10% of which shall pass through a standard number 100 sieve.
    2. The marsh establishment area shall be planted within one year following completion of the filling operation.
    3. The marsh establishment project shall be maintained as a wetland, with non-nuisance species' aerial coverage of at least 85% for three consecutive years. If 85% coverage is not attained, the reasons for failure shall be determined, corrective measures shall be taken, and the area shall be replanted.
    4. If the fill is graded hydraulically, the Certificate Holder shall use a turbidity curtain around the perimeter of the instream work.
    5. If the existing bank is to be cleared or graded:
        a. The Certificate Holder shall perform all work under and in accordance with an approved Soil Erosion and Sediment Control Plan from the applicable sediment and erosion control agency; and
        b. The Certificate Holder shall perform all work under and in accordance with the Critical Area requirements of the local jurisdiction in the form of an approved Buffer Management Plan.

5. The Certificate Holder shall follow the requirements of the marsh maintenance plan as required by Wetlands License 22-WL-1109 and any subsequent modifications.

6. The Certificate Holder shall obtain a General Permit for Discharges from the Application of Pesticides from MDE by contacting the Industrial Discharge Permits Division at 410-537-3323 prior to the application of any herbicide to eradicate *Phragmites*. Toxic materials use permits

are required for any homeowner, farmer, local government or other person who wants to control aquatic life in ponds, ditches or waterways by the deliberate use of chemical products.

7. The Certificate Holder shall plant the existing ***Phragmites*** area with the high marsh, supratidal, and maritime shrub species as depicted on page 14 of the existing plans, dated September 5, 2023.

8. The Certificate Holder shall deploy and maintain a turbidity curtain tightly around and channelward of the project area prior to any excavation and backfilling along the shoreline through completion of any excavation and backfilling along the shoreline.

9. The Certificate Holder shall include the placement of an activated carbon amendment, per the guidance identified in the attached Memorandum from Dr. Upal Ghush, dated December 22, 2023.

10. The Certificate Holder shall monitor the entire middle branch as outlined in the attached habitat monitoring plan dated June 5, 2023.

11. The Certificate Holder shall not stockpile any material in State or private tidal wetlands.

CITATIONS AND STATEMENTS OF NECESSITY

1. Statement of Necessity for General Conditions 1, 2, 3, 4, and Special Conditions 1, 3: These conditions are necessary to ensure that water quality standards are met, and designated uses are maintained.

   Citations: Federal and state laws which authorize this condition include but are not limited to: 33 U.S.C. § 1341(a), (b), & (d); 33 U.S.C. § 1251(b); 33 U.S.C. § 1370; Md. Ann. Code, Env. Article, Title 1, Subtitles 3 and 4; Md. Ann. Code, Env. Article, Title 5, Subtitles 5 and 9; Md. Ann. Code, Env. Article, Title 9, Subtitle 3; Md. Ann. Code, Env. Article, Title 16; COMAR 26.08; COMAR 26.08.02.10G(3); COMAR 26.23.02.06; COMAR 26.17.01;COMAR 26.23; COMAR 26.24

2. Statement of Necessity for General Conditions 5, 8, 9: Fill or construction material within or adjacent to regulated resources may cause discharges resulting in turbidity in excess of water quality standards and interfere with designated uses of growth and propagation of fish, other aquatic life, wildlife; and other designated uses; and fail to meet general water quality criteria that waters not be polluted by substances in amounts sufficient to be unsightly or create a nuisance.

   Citation: 26.08.02.03B(l)-B(2); COMAR 26.23; COMAR 26.24; COMAR 26.17.04

3. Statement of Necessity for General Condition 6: This condition is necessary to clarify the scope of this certification to ensure compliance with water quality regulations, without limiting restrictions through other requirements.

   Citation: Federal and state laws which authorize this condition include but are not limited to: 33 U.S.C. § 134l(a), (b), & (d); 33 U.S.C. § 125l(b); 33 U.S.C. § 1370; Md. Ann. Code, Env. Article, Title 1, Subtitles 3 and 4; Md. Ann. Code, Env. Article, Title 5, Subtitles 5 and 9; Md. Ann. Code, Env. Article, Title 9, Subtitle 3; Md. Ann. Code, Env. Article, Title 16; COMAR 26.08, COMAR 26.08.02.l0E; COMAR 26.23.02.06; COMAR 26.17.04; COMAR26.23; COMAR 26.24

4. Statement of Necessity for General Condition 7: Conditions of certification involve precise actions to comply with water quality standards. Site inspection may be necessary to ensure that limits, methods, and other requirements are met to ensure that water quality standards are met and designated uses are maintained. These conditions are necessary to ensure that the activity was conducted, and project completed according to terms of the authorization/certification, while allowing for review of in-field modifications which may have resulted in discharges to ensure that water quality standards were met. Designated uses include support of estuarine and marine aquatic life and shellfish harvesting and for growth and propagation of fish, other aquatic life, and wildlife.

   Citation: Federal and state laws that authorize this condition include but are not limited to: 33 U.S.C. § 1341(a), (b), & (d); 33 U.S.C. § 1251(b); 33 U.S.C. § 1370; Md. Ann. Code, Env.Article, Title 1, Subtitles 3 and 4; Md. Ann. Code, Env. Article, Title 5, Subtitles 5 and 9; Md. Ann. Code, Env. Article, Title 9, Subtitle 3; Md. Ann. Code, Env. Article, Title 16; COMAR 26.08; COMAR 26.08.02.03B(l)(b); COMAR 26.08.02.03B(2); COMAR 26.23.02.06; COMAR 26.23; COMAR 26.24; COMAR 26.17.04

5. Statement of Necessity for General Condition 10: This condition is necessary to qualify the

period of applicability of the terms and conditions of this Certification to be protective of Maryland water quality standards.

Citations: Federal and state laws which authorize this condition include but are not limited to: 33 U.S.C. § 1341(a), (b), & (d); 33 U.S.C. § 1251(b); 33 U.S.C. § 1370; 40 C.F.R. 121, 15 C.F.R. 930, Md. Ann. Code, Env. Article, Title 1, Subtitles 3 and 4; Md. Ann. Code, Env. Article, Title 5, Subtitles 5 and 9; Md. Ann. Code, Env. Article, Title 9, Subtitle 3; Md. Ann. Code, Env. Article, Title 16; COMAR 26.08; COMAR 26.17.04; COMAR 26.23; COMAR 26.24

6. Statement of Necessity for Special Condition 2: Expertise for conducting certain activities is required to ensure that there is no violation of water quality standards nor interference with designated uses. This condition is necessary to ensure that discharges will be conducted in a manner which does not violate water quality criteria nor interfere with designated uses.

   Citation: COMAR 26.08.02.02B(2)- B(4); COMAR 26.08 02.03B(2)(d)-(e); COMAR 26.08.02.03B(l)(b); 26.08.02.03B(2); COMAR 23.02.04.04

7. Statement of Necessity for Special Conditions 4, 5: Stabilization of the site with vegetation is required to ensure that waters continue to meet designated uses. Loss of substrate fill material may result in discharges which reduce water quality and interfere with designated uses, including the support of estuarine and marine aquatic life, and the protection of shellfish harvesting, shallow water submerged aquatic vegetation, and migratory fish spawning and nurseries in tidal wetlands. Loss limits will maintain the designated use.

   Citation: 1) COMAR 26.08.02.02.B.(3) 2) COMAR 26.08.02.03-3.C.(2)d.(5); 33 U.S.C. § 1341(a), (b), & (d); 33 U.S.C. § 1251(b); 33 U.S.C. § 1370; Md. Ann. Code, Env. Article, Title 1, Subtitles 3 and 4; Md. Ann. Code, Env. Article, Title 9, Subtitle 3; Md. Ann. Code, Env. Article, Title 16; COMAR 26.08; COMAR 26.24

8. Statement of Necessity for Special Condition 6: Issuance of water quality certification does not relieve the applicant of their responsibility to comply at all times with federal and State law. Discharges of toxic materials in toxic amounts violate water quality standards.

   Citations: Title 16; Env. Article, Title 4, Subtitle 1 2) COMAR 26.08.02.02.B.(3) 3) COMAR 26.08.02.03-3.C.(2)d.(5) 4) COMAR 26.08.02.03.A.(1)(b) 5) COMAR 26.08.02.03.B.(1)-(5) 6) COMAR 26.08.02.10.E.(2) 7) COMAR 26.17.01

9. Statement of Necessity for Special Condition 7: Tidal wetlands provide essential habitat, store nutrients and sediment, maintain the health of coastal systems, control shoreline stabilization, and improve water quality. Aquatic life and wildlife often require specific habitats. A tidal plant community dominated by non-native vegetation may reduce the benefits associated with tidal wetlands and result in discharges that interfere with the designated use, including the support of estuarine and marine aquatic life, and the protection of shellfish harvesting, shallow water submerged aquatic vegetation, and migratory fish spawning and nurseries in tidal wetlands.

   Citations: 1) Title 16; Env. Article, Title 4, Subtitle 1 2) COMAR 26.08.02.02.B.(3) 3) COMAR 26.08.02.03-3.C.(2)d.(5) 4) COMAR 26.08.02.03.A.(1)(b) 5) COMAR 26.08.02.03.B.(1)-(5) 6) COMAR 26.08.02.10.E.(2) 7) COMAR 26.17.01

10. Statement of Necessity for Special Condition 8: The discharge and deposition of material within or adjacent to regulated resources may result in discharges that result in impacts to water quality and designated uses.

Citations: 1) 26.08.02.02.B.(3) 2) 26.08.02.03-3.C.(2)d.(5)

11. Statement of Necessity for Special Condition 9: Discharges may be found to violate or potentially violate water quality standards during and after the discharge. Compensatory actions which fail to meet performance criteria will result in a failure of the water to meet designated uses. Remedial measures are necessary to ensure that water quality standards are met.

    Citations: 26.08.02.02B(1) 26.08.02.03B(1)(b) 26.08.02.03B(2)(e) 26.08.02 26.08.01.02A 26.08.02.09A

12. Statement of Necessity for Special Condition 10: Activities which discharge in regulated waters must be conducted according to certain procedures to maintain water quality. Monitoring the quality, characteristics, effects, and compensatory offsets may be necessary to ensure that water quality standards are met.

    Citations: COMAR 26.08.02.10B(1)(f) COMAR 26.08.02.10B(1)(g) COMAR 26.24 COMAR 26.23 COMAR 26.17.04

13. Statement of Necessity for Specials Condition 11: This condition is necessary to ensure discharges related to the stockpiling of material does not result in additional discharges which may result in violations of water quality due to turbidity and other alterations which interfere with designated uses as well as designated use class for support of estuarine and marine aquatic life, and support of designated uses for growth and propagation of fish, shallow water submerged vegetation, other aquatic life and wildlife. Loss limits will maintain the designation use.

    Citation: Md. Ann. Code, Env. Article, Title 1, Subtitles 3 and 4; Md. Ann. Code, Env. Article, Title 5, Subtitles 5 and 9; Md. Ann. Code, Env. Article, Title 9, Subtitle 3; Md. Ann. Code, Env. Article, Title 16; COMAR 26.24; COMAR 26.08; COMAR 26.08.02.10G(3); COMAR 26.08.02.06; COMAR 26.17.04; COMAR 26.23; COMAR 26.23.02.06; 33 U.S.C. § 1341(a), (b), & (d); 33 U.S.C. § 1251(b); 33 U.S.C. § 1370; Md. Ann. Code, Env. Article, Title 1, Subtitles 3 and 4; Md. Ann. Code, Env. Article, Title 9, Subtitle 3; Md. Ann. Code, Env. Article, Title 16; COMAR 26.08; COMAR 26.24

CERTIFICATION APPROVED

D. Lee Currey, Director
Water and Science Administration

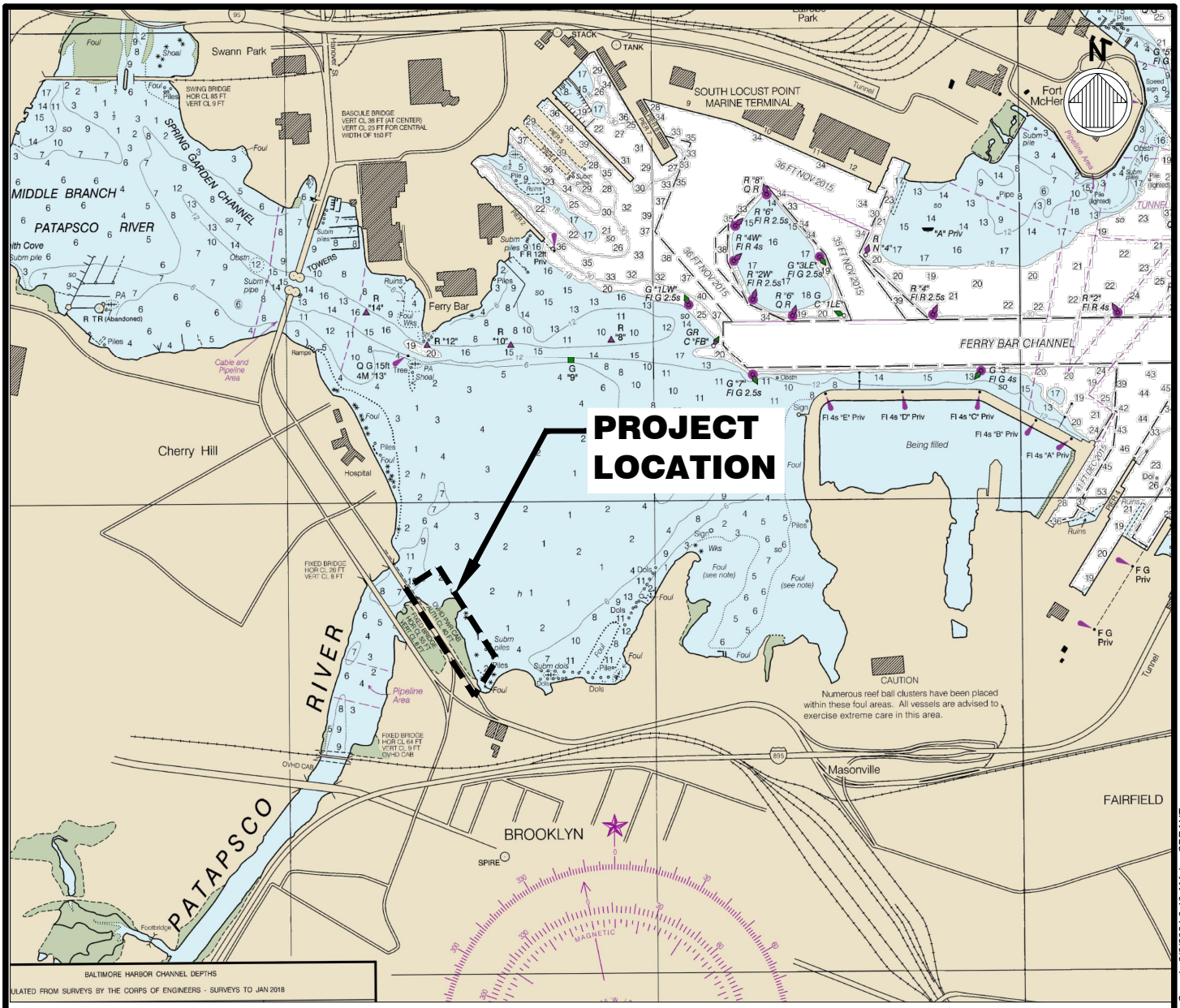
2/23/2023
Date

Tracking Number: 202261734
Agency Interest Number: 174530

Effective Date: February 22, 2024

Enclosure: Plan Sheets dated September 5, 2023

cc: WSA Inspection & Compliance Program
Army Corps of Engineers



VICINITY MAP

SUMMARY:

1. REMOVE INVASIVE PHRAGMITES AND LITTER FROM 1,500 LF OF SHORELINE.
2. CONSTRUCT 1,600 LF OF NEW BERM STRUCTURE.
3. CONSTRUCT 8.7 AC OF TIDAL WETLANDS BY PLACING 13,200 CY OF CLEAN FILL.
4. ADDITIONAL 0.12 AC OF OPEN WATER IMPACTED WITHIN PROJECT LOD.

NOTES:

BACKGROUND TAKEN FROM NOAA CHART 12281, 57TH ED., NOV. 27, 2018

APPLICATION BY:

BRIAN CRAMER
GREENVEST, LLC
4201 NORTHVIEW DRIVE, SUITE 202
BOWIE, MD 20716

AGENT/ENGINEER:

moffatt & nichol

MIDDLE BRANCH SITE 5A
WETLAND RESTORATION

PROJECT LOCATION:
MIDDLE BRANCH
BALTIMORE CITY, MARYLAND

1000' 0' 1000' 2000'

SCALE: 1"=2000'

22-WL-1109
23-WQC-0038
202261734
9-5-23

DATE: JUNE 6, 2023

SHEET 1 OF 16

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LOCATION PLAN

ADJACENT PROPERTIES

1. VULCAN MATERIALS P.O.BOX 385014 BIRMINGHAM, AL 35238

2 3 4 5 6. MAYOR AND CITY COUNCIL 100 N HOLLIDAY ST, SUITE 400 BALTIMORE, MD 21202

7. MEDSTAR HARBOR HOSPITAL 3001 S HANOVER ST BALTIMORE, MD 21225

8. STATE OF MARYLAND 401 E PRATT ST, SUITE 2000 BALTIMORE, MD 21202

APPLICATION BY:

BRIAN CRAMER
GREENVEST, LLC
4201 NORTHVIEW DRIVE, SUITE 202
BOWIE, MD 20716

AGENT/ENGINEER:

moffatt & nichol

MIDDLE BRANCH SITE 5A WETLAND RESTORATION

PROJECT LOCATION:
MIDDLE BRANCH
BALTIMORE CITY, MARYLAND

200' 0' 300' 600'

SCALE: 1"=600'

DATE: JUNE 6, 2023

22-WL-1109
23-WQC-0038
202261734
9-5-23

SHEET 2 OF 16

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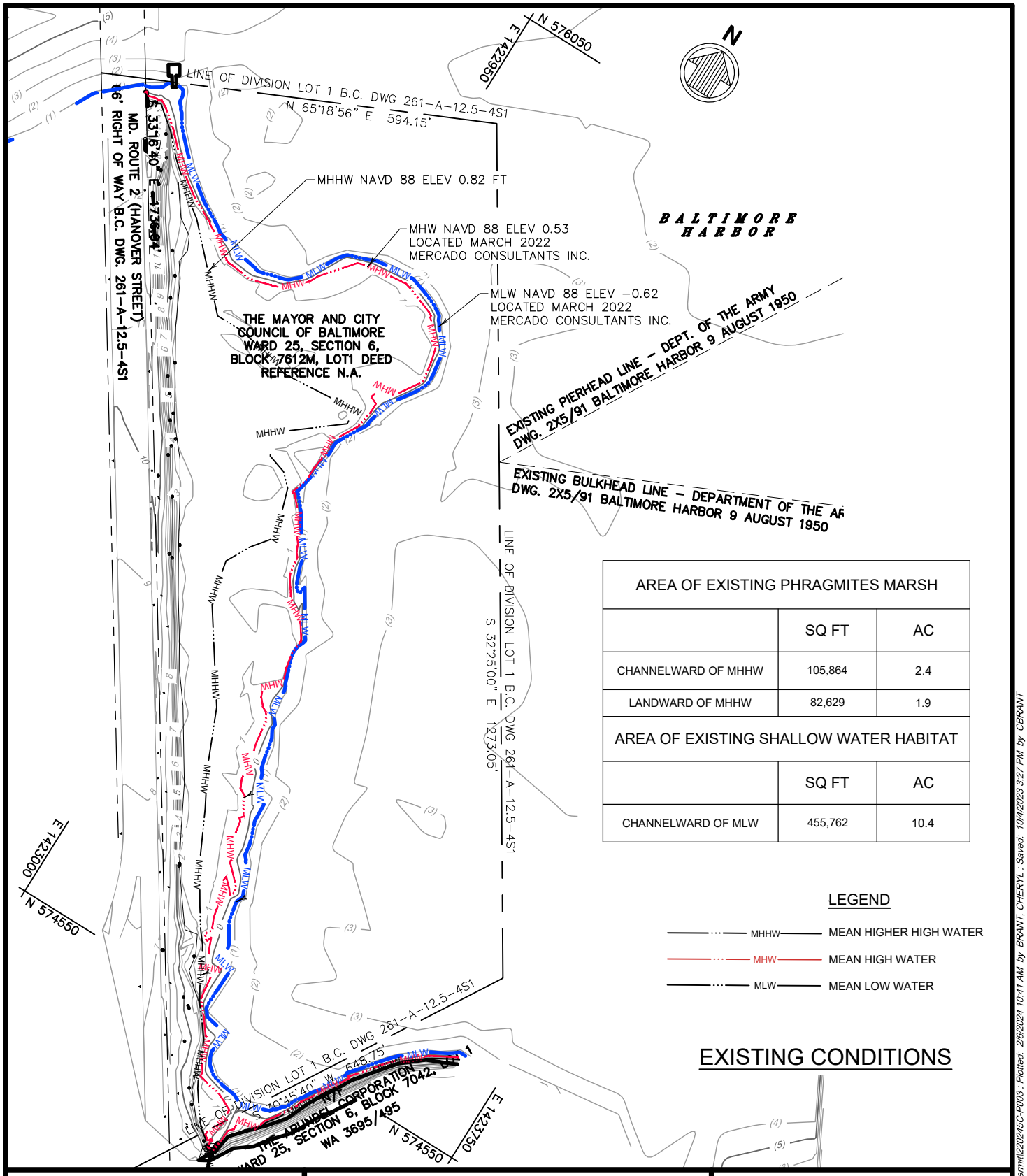

AREA OF EXISTING PHRAGMITES MARSH		
	SQ FT	AC
CHANNELWARD OF MHHW	105,864	2.4
LANDWARD OF MHHW	82,629	1.9
AREA OF EXISTING SHALLOW WATER HABITAT		
	SQ FT	AC
CHANNELWARD OF MLW	455,762	10.4

LEGEND

- MHHW — MEAN HIGHER HIGH WATER
- MHW — MEAN HIGH WATER
- MLW — MEAN LOW WATER

EXISTING CONDITIONS

APPLICATION BY:

BRIAN CRAMER
GREENVEST, LLC
4201 NORTHVIEW DRIVE, SUITE 202
BOWIE, MD 20716

AGENT/ENGINEER:

moffatt & nichol

MIDDLE BRANCH SITE 5A WETLAND RESTORATION

PROJECT LOCATION:
MIDDLE BRANCH
BALTIMORE CITY, MARYLAND

100' 0' 100' 200'
SCALE: 1"=200'

DATE: JUNE 6, 2023

22-WL-1109
23-WQC-0038
202261734
9-5-23

SHEET 3 OF 16

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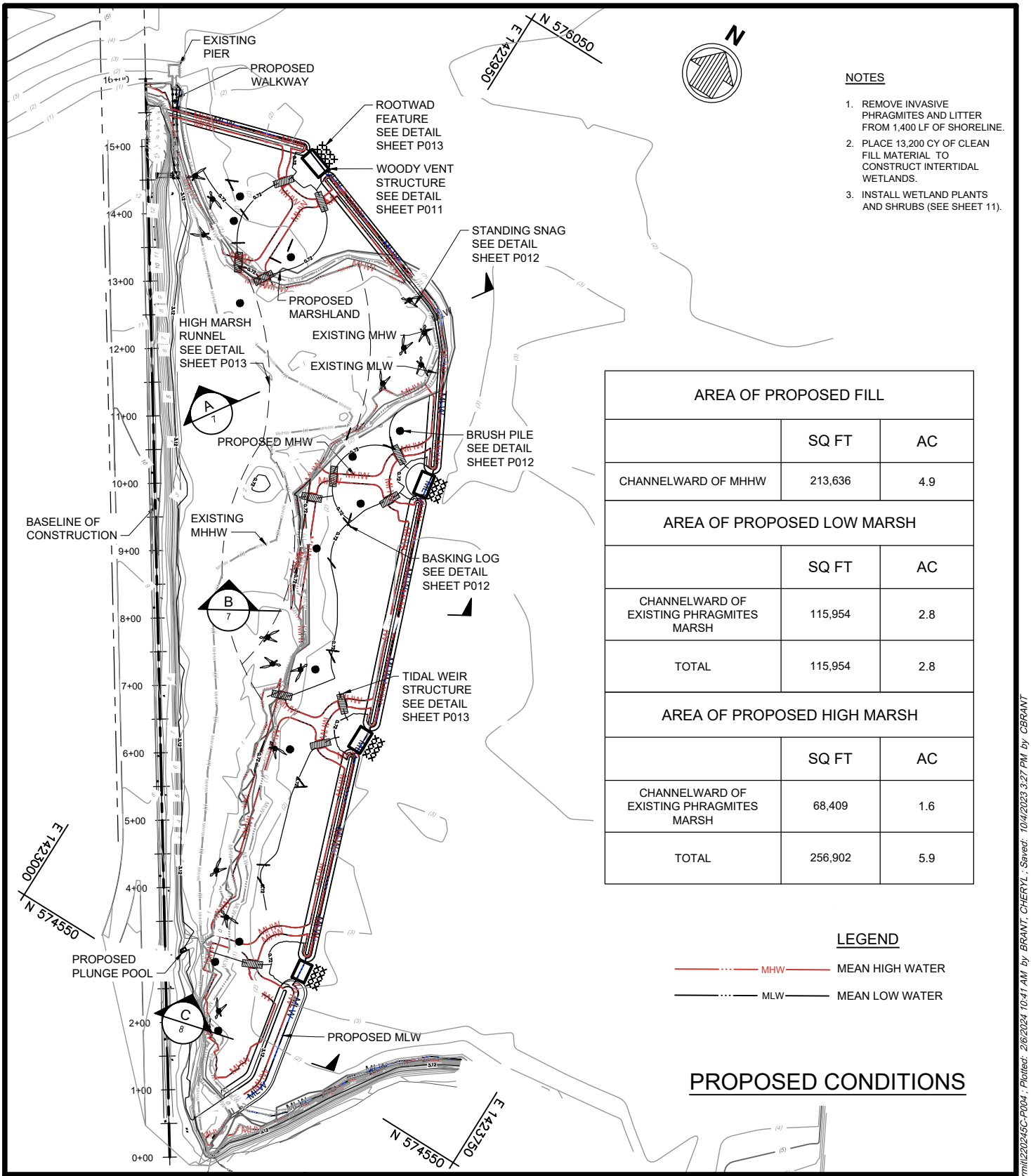

NOTES

1. REMOVE INVASIVE PHRAGMITES AND LITTER FROM 1,400 LF OF SHORELINE.
2. PLACE 13,200 CY OF CLEAN FILL MATERIAL TO CONSTRUCT INTERTIDAL WETLANDS.
3. INSTALL WETLAND PLANTS AND SHRUBS (SEE SHEET 11).

AREA OF PROPOSED FILL		
	SQ FT	AC
CHANNELWARD OF MHHW	213,636	4.9
AREA OF PROPOSED LOW MARSH		
	SQ FT	AC
CHANNELWARD OF EXISTING PHRAGMITES MARSH	115,954	2.8
TOTAL	115,954	2.8
AREA OF PROPOSED HIGH MARSH		
	SQ FT	AC
CHANNELWARD OF EXISTING PHRAGMITES MARSH	68,409	1.6
TOTAL	256,902	5.9

LEGEND

MHW — MEAN HIGH WATER

MLW — MEAN LOW WATER

PROPOSED CONDITIONS

APPLICATION BY:

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BOWIE, MD 20716

AGENT/ENGINEER:

moffatt & nichol

MIDDLE BRANCH SITE 5A
WETLAND RESTORATION

PROJECT LOCATION:
MIDDLE BRANCH
BALTIMORE CITY, MARYLAND

100' 0' 100' 200'

SCALE: 1"=200'

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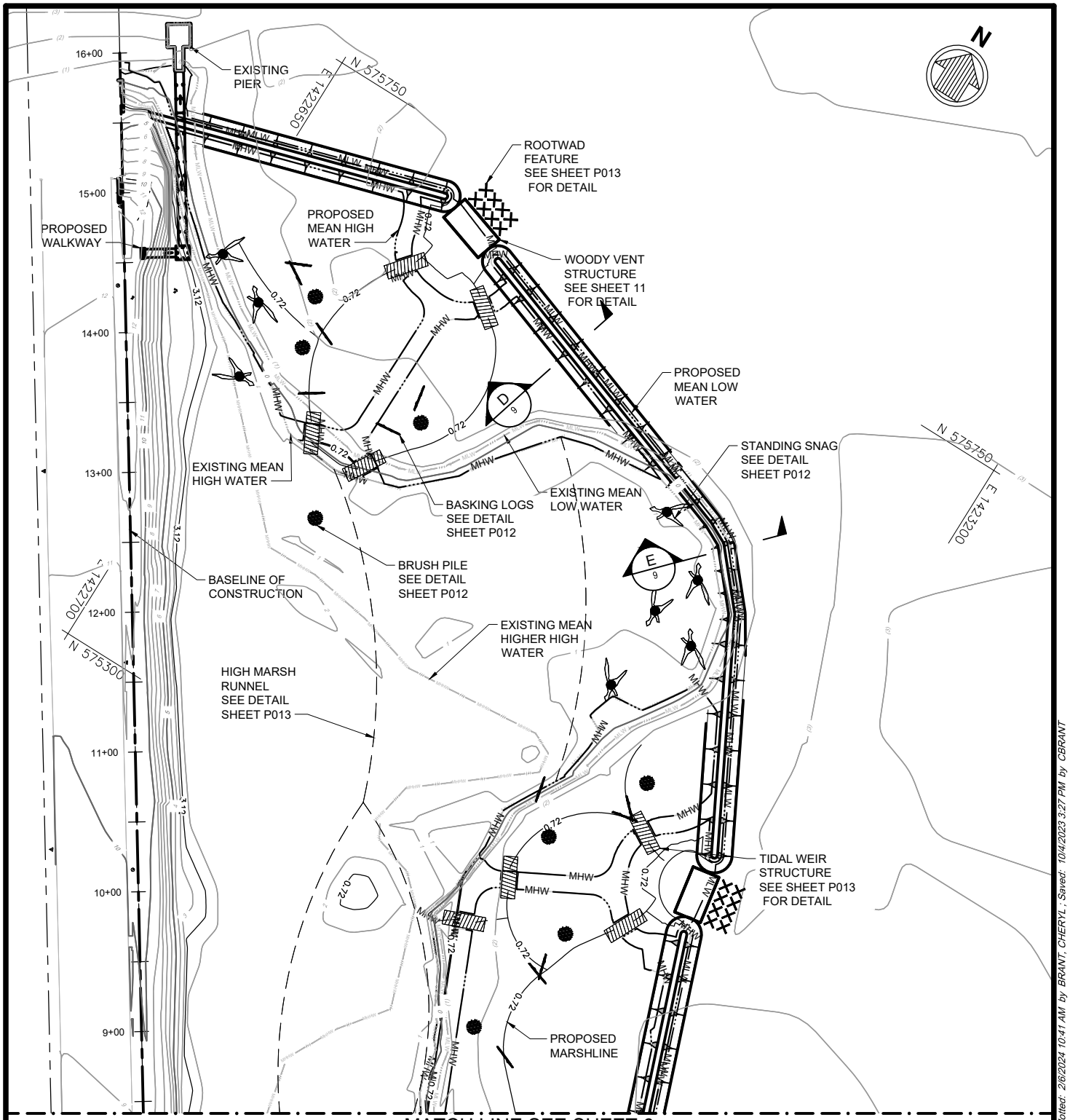
202261734
9-5-23

DATE: JUNE 6, 2023

SHEET 4 OF 16



MATCH LINE SEE SHEET 6

PROPOSED CONDITIONS

LEGEND

MHW — MEAN HIGH WATER

MLW — MEAN LOW WATER

APPLICATION BY:

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GREENVEST, LLC
4201 NORTHVIEW DRIVE, SUITE 202
BOWIE, MD 20716

AGENT/ENGINEER:

moffatt & nichol

MIDDLE BRANCH SITE 5A
WETLAND RESTORATION

PROJECT LOCATION:
MIDDLE BRANCH
BALTIMORE CITY, MARYLAND

50' 0' 50' 100'

SCALE: 1"=100'

DATE: JUNE 6, 2023

SHEET 5 OF 16

22-WL-1109
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9-5-23

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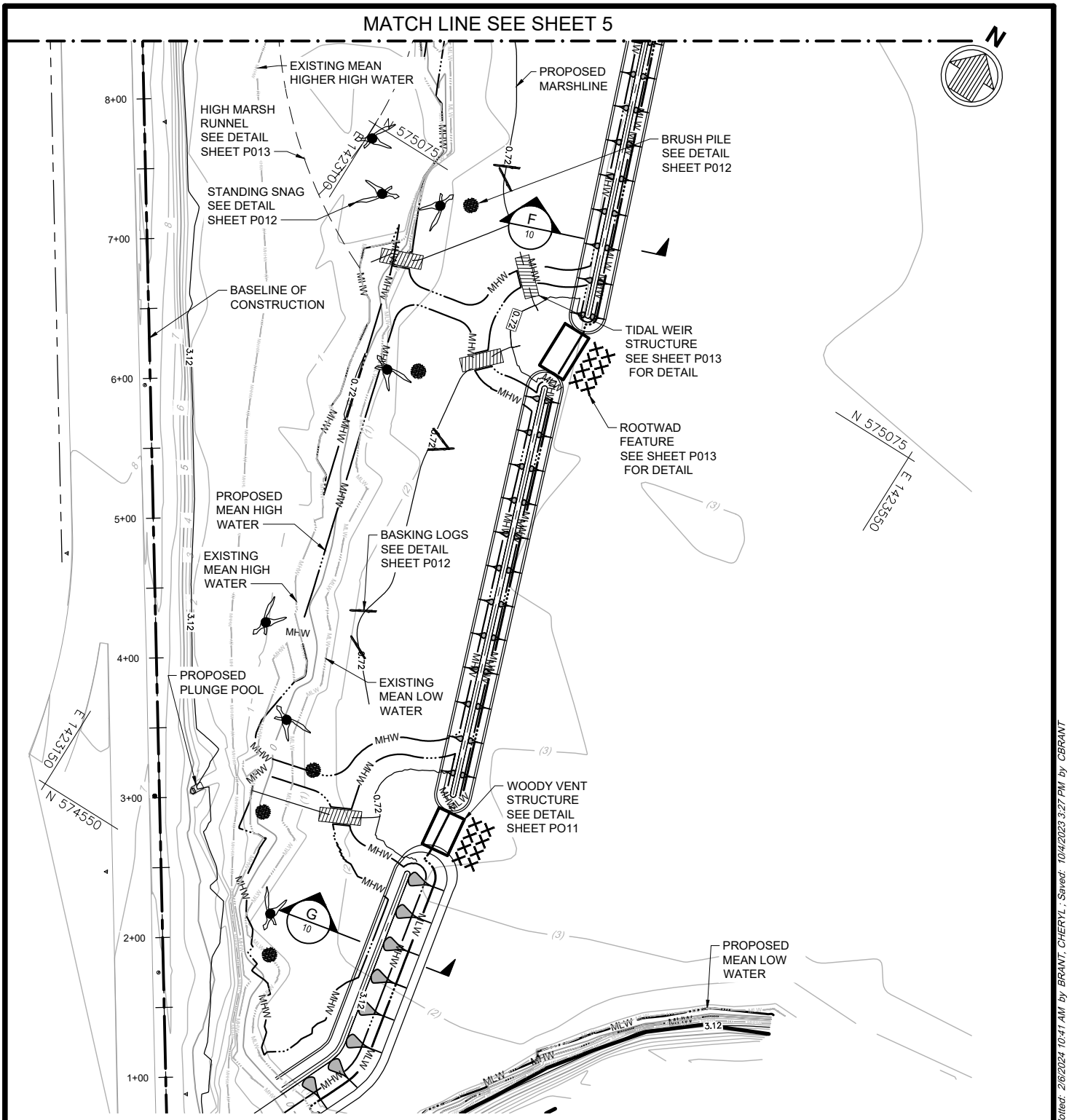

PROPOSED CONDITIONS

LEGEND

MHW — MEAN HIGH WATER

MLW — MEAN LOW WATER

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PROJECT LOCATION:
MIDDLE BRANCH
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50' 0' 50' 100'

SCALE: 1"=100'

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9-5-23

DATE: JUNE 6, 2023

SHEET 6 OF 16

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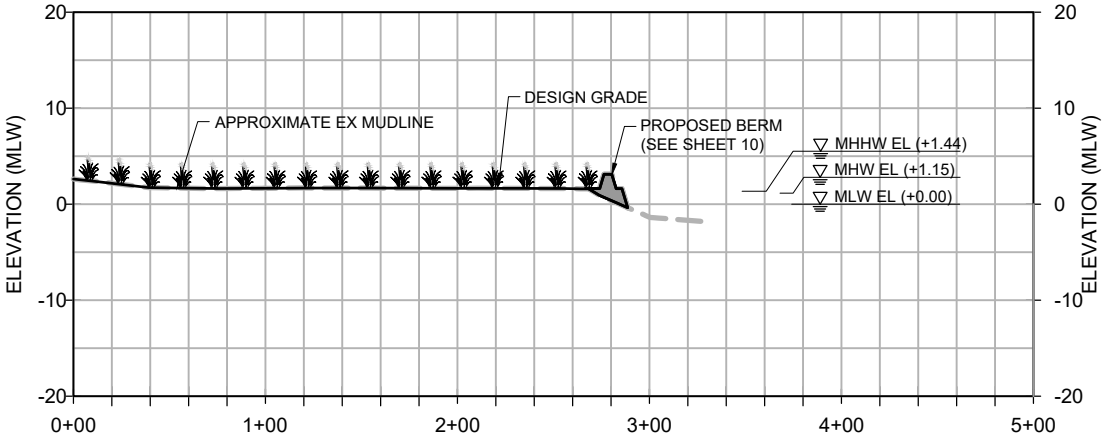
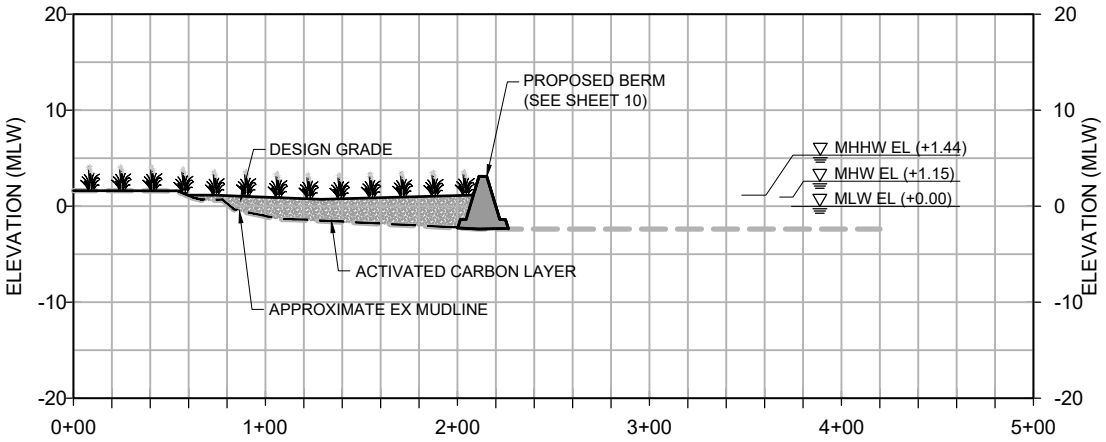


SECTION A



SECTION B

PROPOSED FILL

APPLICATION BY:

BRIAN CRAMER
GREENVEST, LLC
4201 NORTHVIEW DRIVE, SUITE 202
BOWIE, MD 20716

AGENT/ENGINEER:

moffatt & nichol

MIDDLE BRANCH SITE 5A
WETLAND RESTORATION

22-WL-1109
23-WQC-0038
202261734
9-5-23

PROJECT LOCATION:
MIDDLE BRANCH
BALTIMORE CITY, MARYLAND

50' 0' 50' 100'
SCALE: 1"=100' HOR

10' 0' 10' 20'
SCALE: 1"=20' VERT

DATE: JUNE 6, 2023

SHEET 7 OF 16

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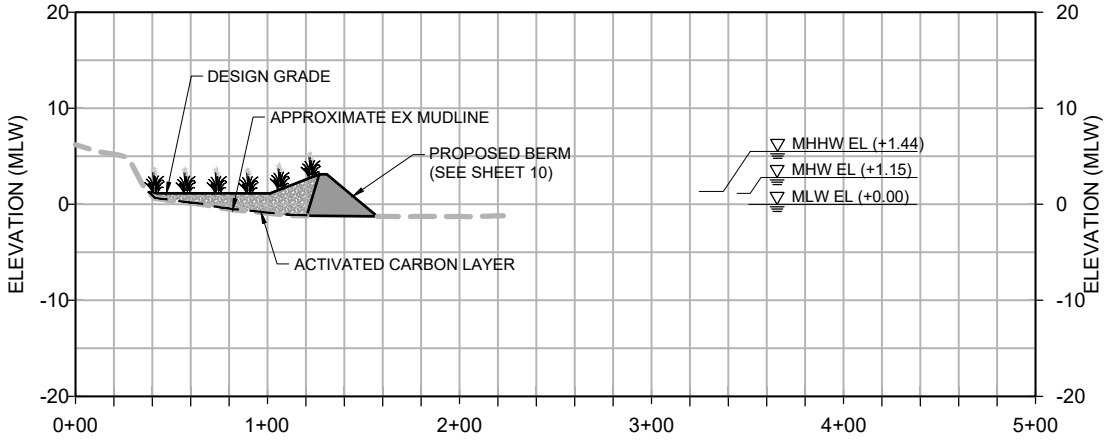


SECTION C

PROPOSED FILL

APPLICATION BY:

BRIAN CRAMER
GREENVEST, LLC
4201 NORTHVIEW DRIVE, SUITE 202
BOWIE, MD 20716

AGENT/ENGINEER:

moffatt & nichol

MIDDLE BRANCH SITE 5A
WETLAND RESTORATION

PROJECT LOCATION:
MIDDLE BRANCH
BALTIMORE CITY, MARYLAND

22-WL-1109
23-WQC-0038
202261734
9-5-23

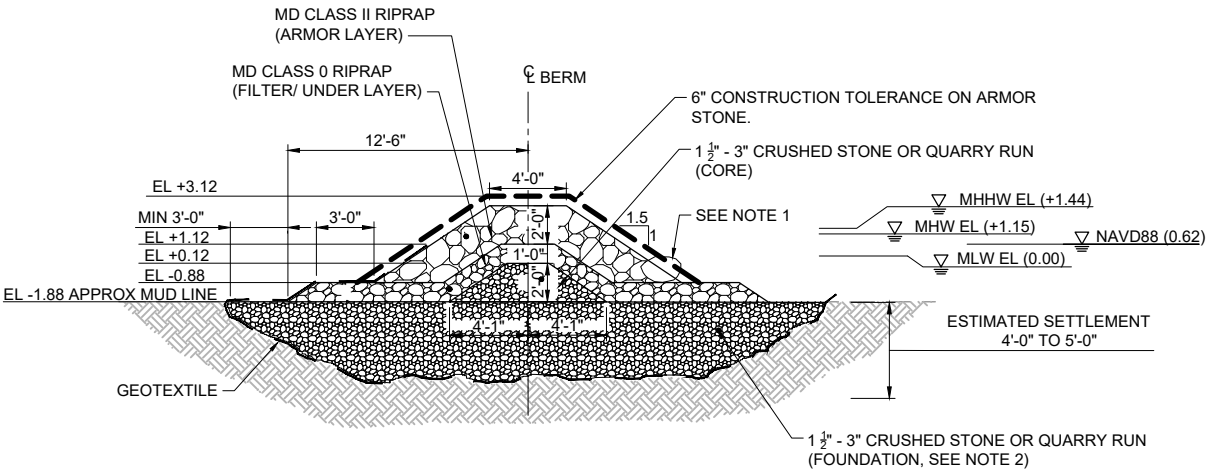
50' 0' 50' 100'
SCALE: 1"=100' HOR

10' 0' 10' 20'
SCALE: 1"=20' VERT

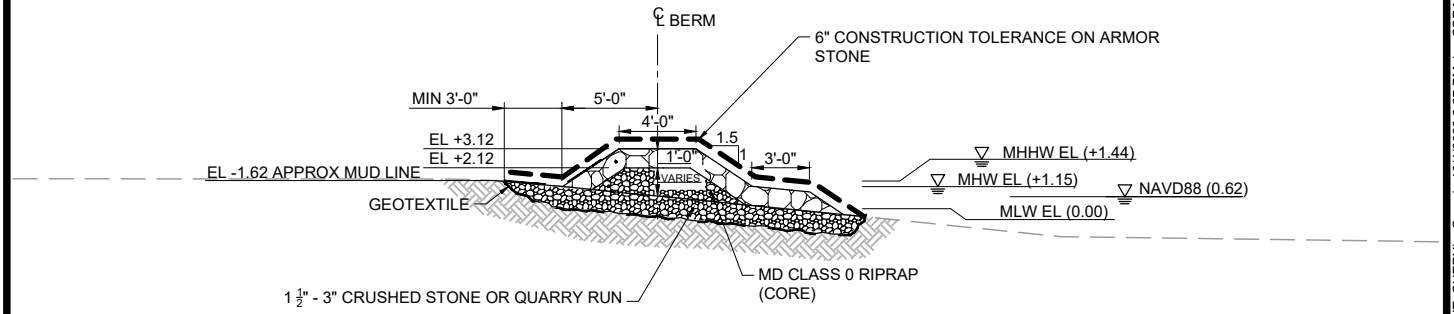
DATE: JUNE 6, 2023

SHEET 8 OF 16

File: Q:\BA\220245\20 CADD_Active_Permit\220245C-P008 ; Plotted: 2/6/2024 10:42 AM by BRANT, CHERYL ; Saved: 10/4/2023 3:27 PM by CBRANT



DETAIL - SECTION D



DETAIL - SECTION E

NOTE:

1. STONE PLACED AT EDGE OF STRUCTURE TOE SHALL BE >200 LBS.
2. ELEVATION OF APPROXIMATE BOTTOM OF FOUNDATION BASED ON SETTLEMENT CALCULATION. STRUCTURE SHALL BE SURCHARGED TO ACHIEVE STABLE FOUNDATION.

APPLICATION BY:

BRIAN CRAMER
GREENVEST, LLC
4201 NORTHVIEW DRIVE, SUITE 202
BOWIE, MD 20716

AGENT/ENGINEER:

moffatt & nichol

MIDDLE BRANCH SITE 5A
WETLAND RESTORATION

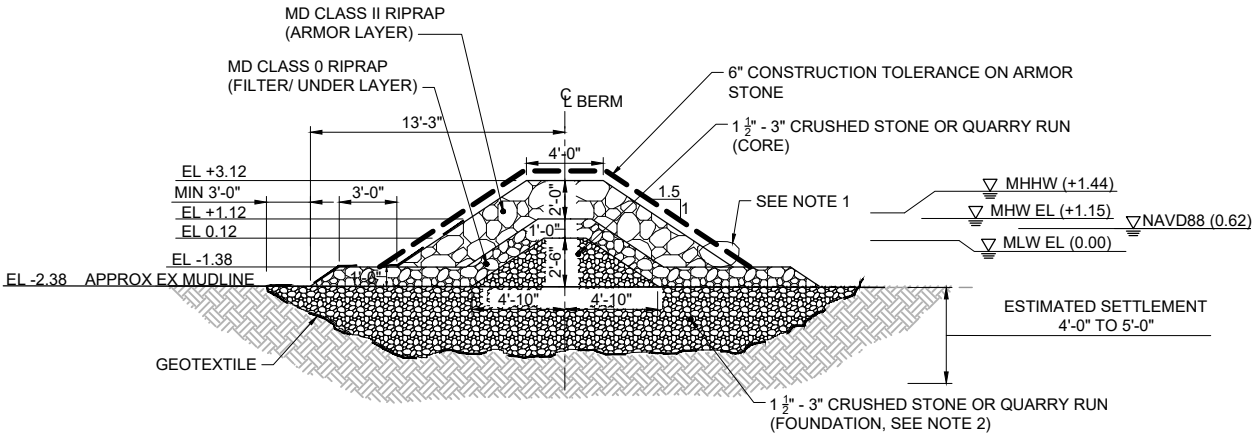
22-WL-1109
23-WQC-0038
202261734
9-5-23

PROJECT LOCATION:
MIDDLE BRANCH
BALTIMORE CITY, MARYLAND

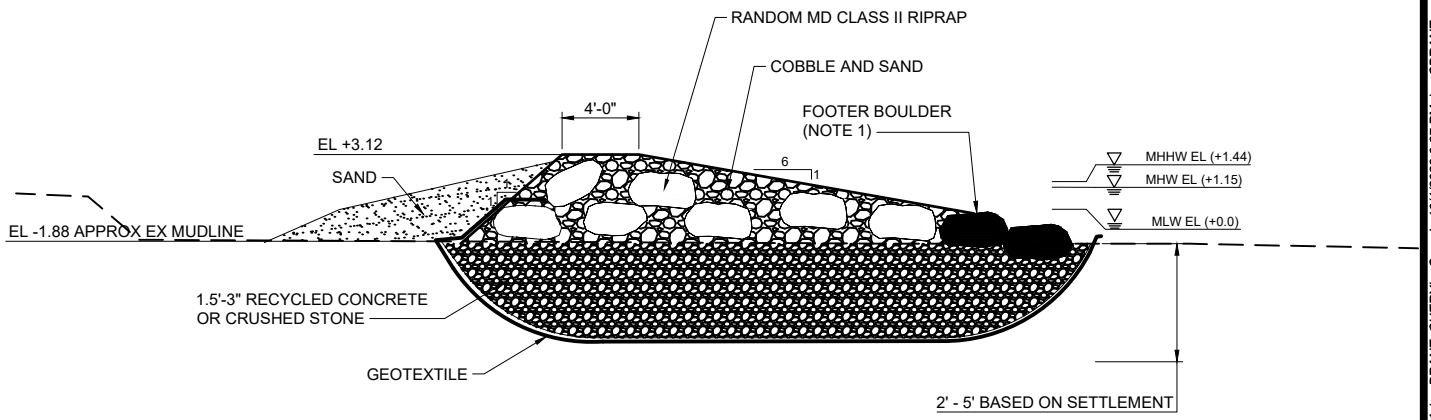
5' 0' 5' 10'
SCALE: 1"=10'

DATE: JUNE 6, 2023

SHEET 9 OF 16



DETAIL -SECTION F



DETAIL -SECTION G

NOTE:

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2. ELEVATION OF APPROXIMATE BOTTOM OF FOUNDATION BASED ON SETTLEMENT CALCULATION. STRUCTURE SHALL BE SURCHARGED TO ACHIEVE STABLE FOUNDATION.

APPLICATION BY:

BRIAN CRAMER
GREENVEST, LLC
4201 NORTHVIEW DRIVE, SUITE 202
BOWIE, MD 20716

AGENT/ENGINEER:

moffatt & nichol

MIDDLE BRANCH SITE 5A
WETLAND RESTORATION

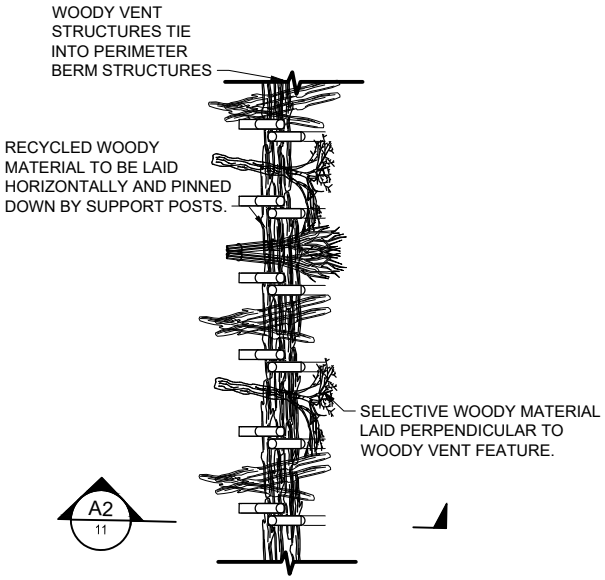
22-WL-1109
23-WQC-0038
202261734
9-5-23

PROJECT LOCATION:
MIDDLE BRANCH
BALTIMORE CITY, MARYLAND

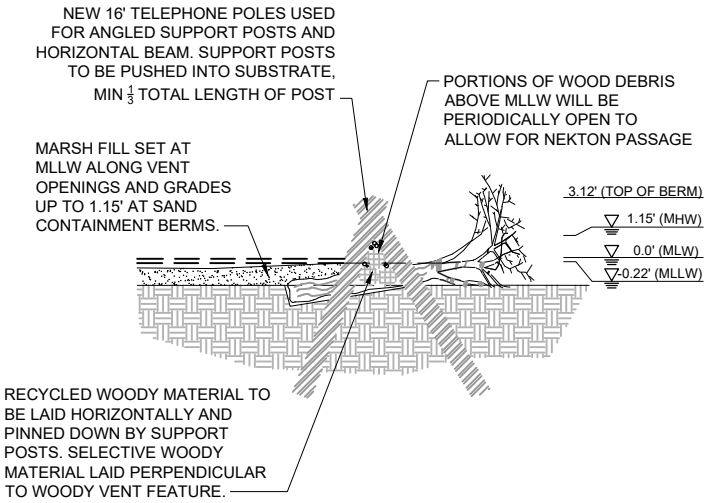
5' 0' 5' 10'
SCALE: 1"=10'

DATE: JUNE 6, 2023

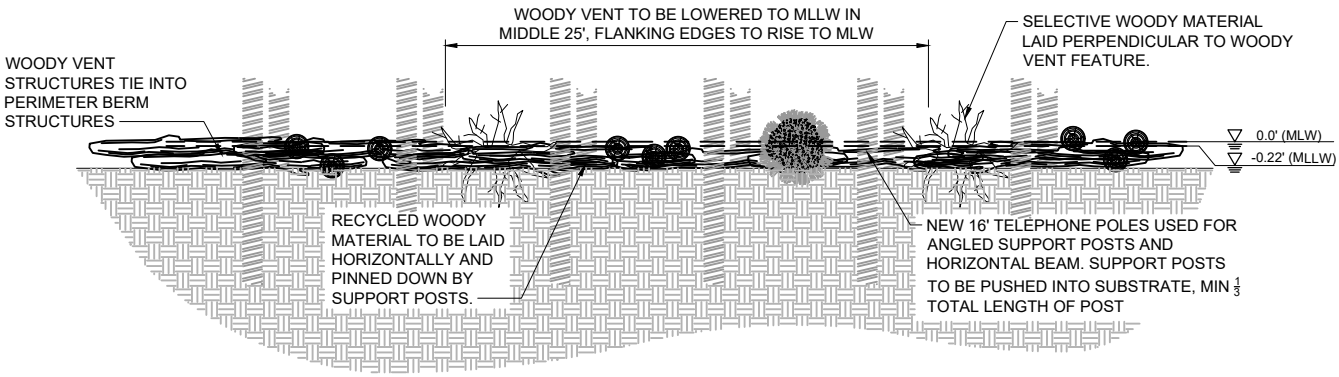
SHEET 10 OF 16



A1 P11 PLAN - WOODY VENT STRUCTURE
SCALE: NTS



A2 P11 SECTION - WOODY VENT STRUCTURE
SCALE: NTS



B1 P11 ELEVATION - WOODY VENT STRUCTURE
SCALE: NTS

APPLICATION BY:

BRIAN CRAMER
GREENVEST, LLC
4201 NORTHVIEW DRIVE, SUITE 202
BOWIE, MD 20716

AGENT/ENGINEER:

moffatt & nichol

MIDDLE BRANCH SITE 5A WETLAND RESTORATION

PROJECT LOCATION:
MIDDLE BRANCH
BALTIMORE CITY, MARYLAND

22-WL-1109
23-WQC-0038
202261734
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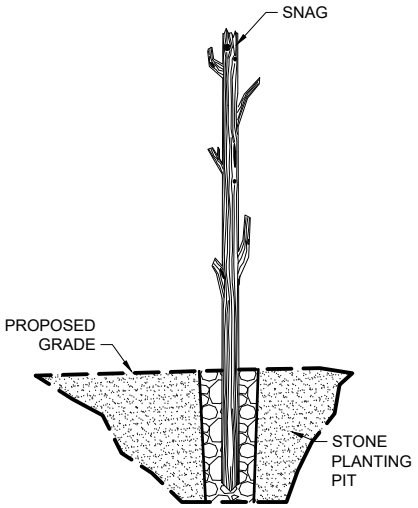
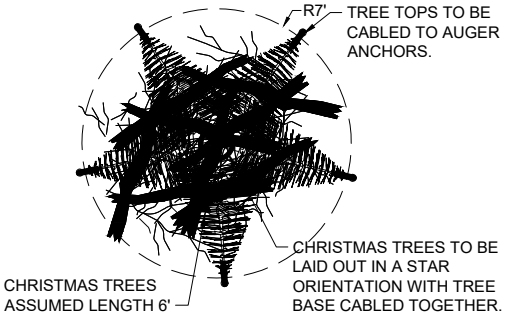
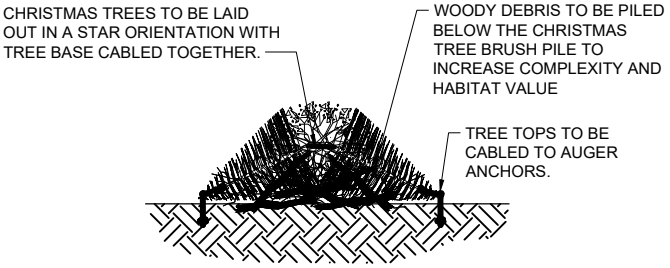
DATE: JUNE 6, 2023



A1 P12 SECTION - STANDING SNAG
SCALE: NTS



BUSH PILE PLAN

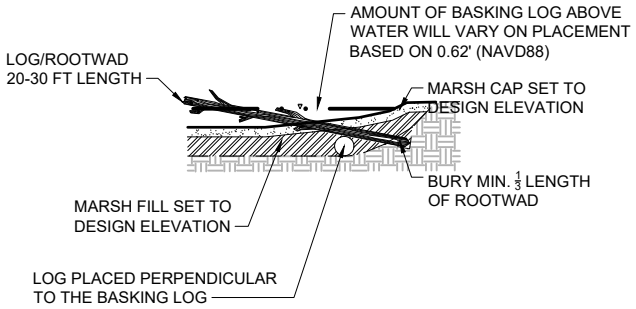


BUSH PILE SECTION

B1 P12 PLAN AND SECTION - BUSH PILE
SCALE: NTS

NOTE FOR SNAG INSTALLATION:

1. INSTALL SNAGS MIN. 1/3 OF LOG LENGTH BELOW GROUND.
2. ABOVE GROUND SNAG LENGTH TO BE 10-20'
3. ALL EXPOSED END OF LOGS TO BE BROKEN. SAWED ENDS WILL BE UNACCEPTABLE.
4. STANDING SNAG SHALL BE LOCATED A MINIMUM DISTANCE OF 1.5 TIMES THE ABOVE GROUND HEIGHT OF THE SNAG AWAY FROM ANY TRAILS OR LANDINGS.
5. ROCK SHALL BE USED IN THE "PLANTING PIT" TO STABILIZE THE UNDERGROUND PORTION OF THE SNAG.
6. PROVIDE 2 FT. MIN. WIDTH OF ROCK ON ALL SIDES OF STANDING SNAG IN PLANTING PIT.



C1 P12 SECTION - BASKING LOG WITH ANCHOR PARTIALLY BURIED
SCALE: NTS

APPLICATION BY:

BRIAN CRAMER
GREENVEST, LLC
4201 NORTHVIEW DRIVE, SUITE 202
BOWIE, MD 20716

AGENT/ENGINEER:

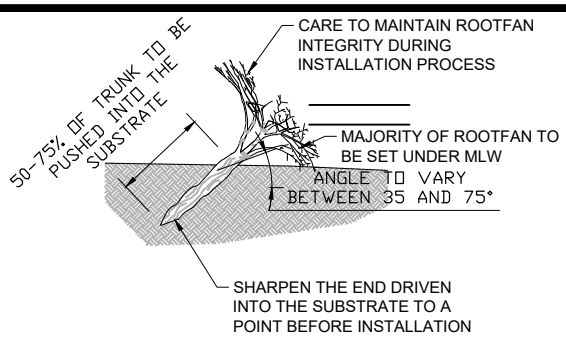
moffatt & nichol

MIDDLE BRANCH SITE 5A
WETLAND RESTORATION

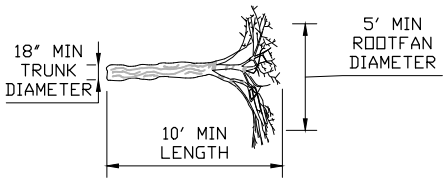
22-WL-1109
23-WQC-0038
202261734
9-5-23

PROJECT LOCATION:
MIDDLE BRANCH
BALTIMORE CITY, MARYLAND

DATE: JUNE 6, 2023

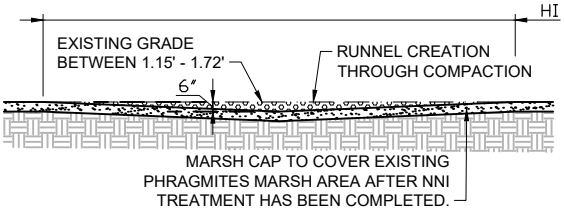


ROOTWAD SECTION

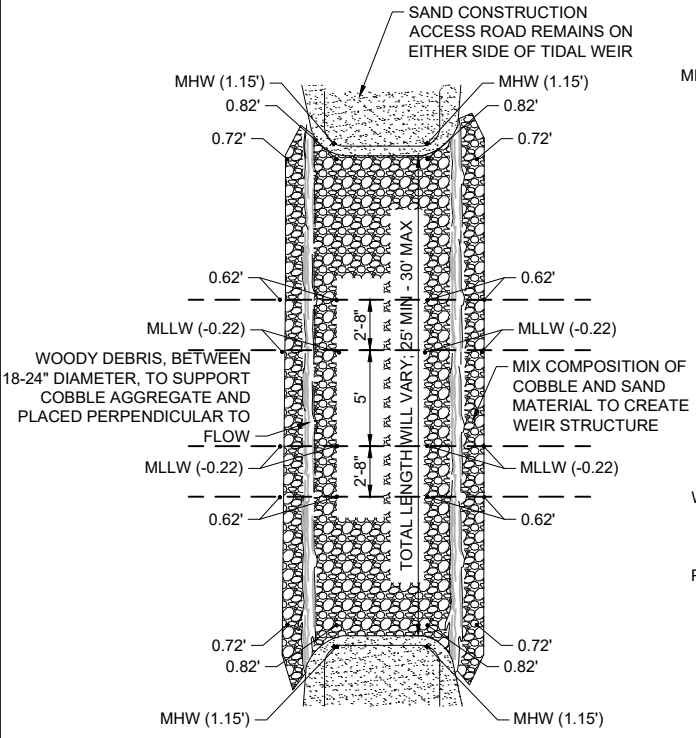


ROOTWAD PLAN

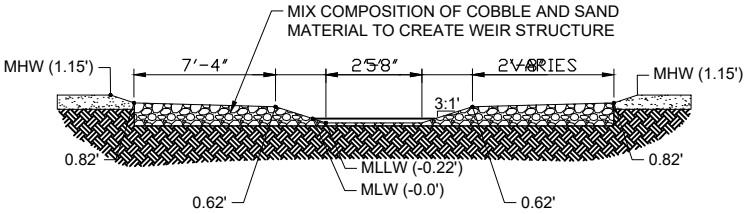
A1 P13 DETAIL - ROOTWAD
SCALE: NTS



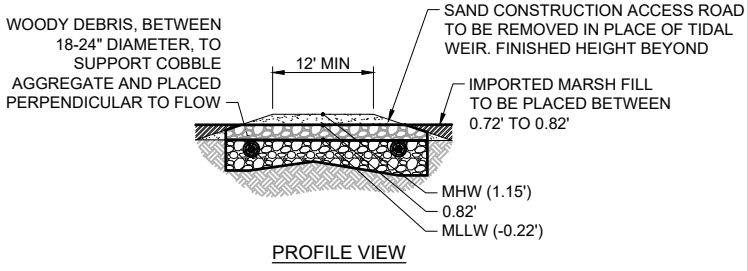
B1 P13 ELEVATION - HIGH MARSH RUNNEL
SCALE: NTS



PLAN VIEW



SECTION VIEW



PROFILE VIEW

C1 P13 DETAIL - TIDAL WEIR
SCALE: NTS

APPLICATION BY:

BRIAN CRAMER
GREENVEST, LLC
4201 NORTHVIEW DRIVE, SUITE 202
BOWIE, MD 20716

AGENT/ENGINEER:

moffatt & nichol

MIDDLE BRANCH SITE 5A WETLAND RESTORATION

22-WL-1109
23-WQC-0038
202261734
9-5-23

PROJECT LOCATION:
MIDDLE BRANCH
BALTIMORE CITY, MARYLAND

DATE: JUNE 6, 2023

SHEET 13 OF 16

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N

LOW MARSH

- BOLBOSCHOENUS ROBUSTUS (SALT BULRSH)
- SCIRPUS VALIDUS (SOFT-STEMMED BULRUSH)
- SPARTINA ALTERNIFLORA (SMOOTH CODGRASS)

HIGH MARSH

- BACCHARIS HALIMIFOLIA (GROUNDSEL TREE)
- HIBISCUS MOSCHEUTOS (MARSH HIBISCUS)
- IVA FRUTESCENS (MARSH ELDER)
- AMARANTHUS CANNABINUS (TIDALMARSH AMARANTH)
- BOLBOSCHOENUS ROBUSTUS (STURDY BULRUSH)
- DISTICHLIS SPICATA (SALTGRASS)
- HIBISCUS MOSCHEUTOS (ROSE MALLOW)
- JUNCUS ROEMERIANUS (BLACK NEEDLERUSH)
- KOSTELETZKYA PENTACARPOS (VIRGINIA SALTMARSH MALLOW)
- SCHOENOPLECTUS PUNGENS (THREE-SQUARE BULRUSH)
- SOLIDAGO SEMPERVIRENS (SEASIDE GOLDENROD)
- SPARTINA PATENS (SALTMARSH HAY)
- SYMPHYOTRICUM SUBULATUM (ANNUAL SALTMARSH ASTER)
- SYMPHYOTRICUM UNDULATUM (PERENNIAL SALTMARSH ASTER)

SUPRATIDAL

- BACCHARIS HALIMIFOLIA (GROUNDSEL TREE)
- HIBISCUS MOSCHEUTOS (MARSH HIBISCUS)
- PRUNUS MARITIMA (BEACH PLUM)
- MORELLA PENNSYLVANICA (NORTHERN BAYBERRY)
- MORELLA CERIFERA (WAX MYRTLE)
- IVA FRUTESCENS (MARSH ELDER)
- PANICUM VIRGATUM (SWITCHGRASS)
- SPARTINA PATENS (SALTMARSH HAY)
- AMARANTHUS CANNABINUS (TIDALMARSH AMARANTH)
- SOLIDAGO SEMPERVIRENS (SEASIDE GOLDENROD)
- SYMPHYOTRICUM UNDULATUM (PERENNIAL SALTMARSH ASTER)

MARITIME SHRUB

- AMORPHA FRUTICOSE (FALSE INDIGO BUSH)
- ARONIA ARBUTIFOLIA (RED CHOKEBERRY)
- BACCHARIS HALIMIFOLIA (GROUNDSEL BUSH)
- CLETHRA ALNIFOLIA (SWEET PEPPERBUSH)
- CORNUS STOLONIFERA (RED OSIER DOGWOOD)
- ILEX GLABRA (INKBERRY)
- IVA FRUTESCENS (MARSH ELDER)
- MORELLA CERIFERA (WAX MYRTLE)
- MORELLA HETEROPHYLLA (SOUTHERN BAYBERRY)
- MORELLA PENNSYLVANICA (NORTHERN BAYBERRY)
- PRUNUS MARITIMA (BEACH PLUM)
- RHUS GLABRA (SMOOTH SUMAC)
- SAMBUCUS NIGRA SSP. CANADENSIS (ELDERBERRY)
- VIBURNUM DENTATUM (ARROWWOOD)
- ANDROPOGON VIRGINICUS (BROOMSEDGE)
- PANICUM VIRGATUM (SWITCHGRASS)
- SCHIZACHYRIUM SCOPARIUM (LITTLE BLUE STEM)
- SPARTINA PATENS (SALTMEADOW HAY)
- ASTER NOVAE-ANGLIAE (NEW ENGLAND ASTER)
- ASCLEPIAS TUBEROSA (BUTTERFLYWEED)
- ECHINACEA PURPUREA (PURPLE CONEFLOWER)
- LIATRIS SQUARROSA (BLAZING STAR)
- RUDBECKIA HIRTA (BLACK-EYED SUSAN)
- SOLIDAGO SEMPERVIRENS (SEASIDE GOLDENROD)
- LOLIUM MULTIFLORUM (ANNUAL RYEGRASS)

LEGEND

- LOW MARSH
- HIGH MARSH
- SUPRATIDAL
- MARITIME SHRUB

TYPICAL MARSH PLANTINGS

APPLICATION BY:

BRIAN CRAMER
GREENVEST, LLC
4201 NORTHVIEW DRIVE, SUITE 202
BOWIE, MD 20716

AGENT/ENGINEER:

moffatt & nichol

MIDDLE BRANCH SITE 5A
WETLAND RESTORATION

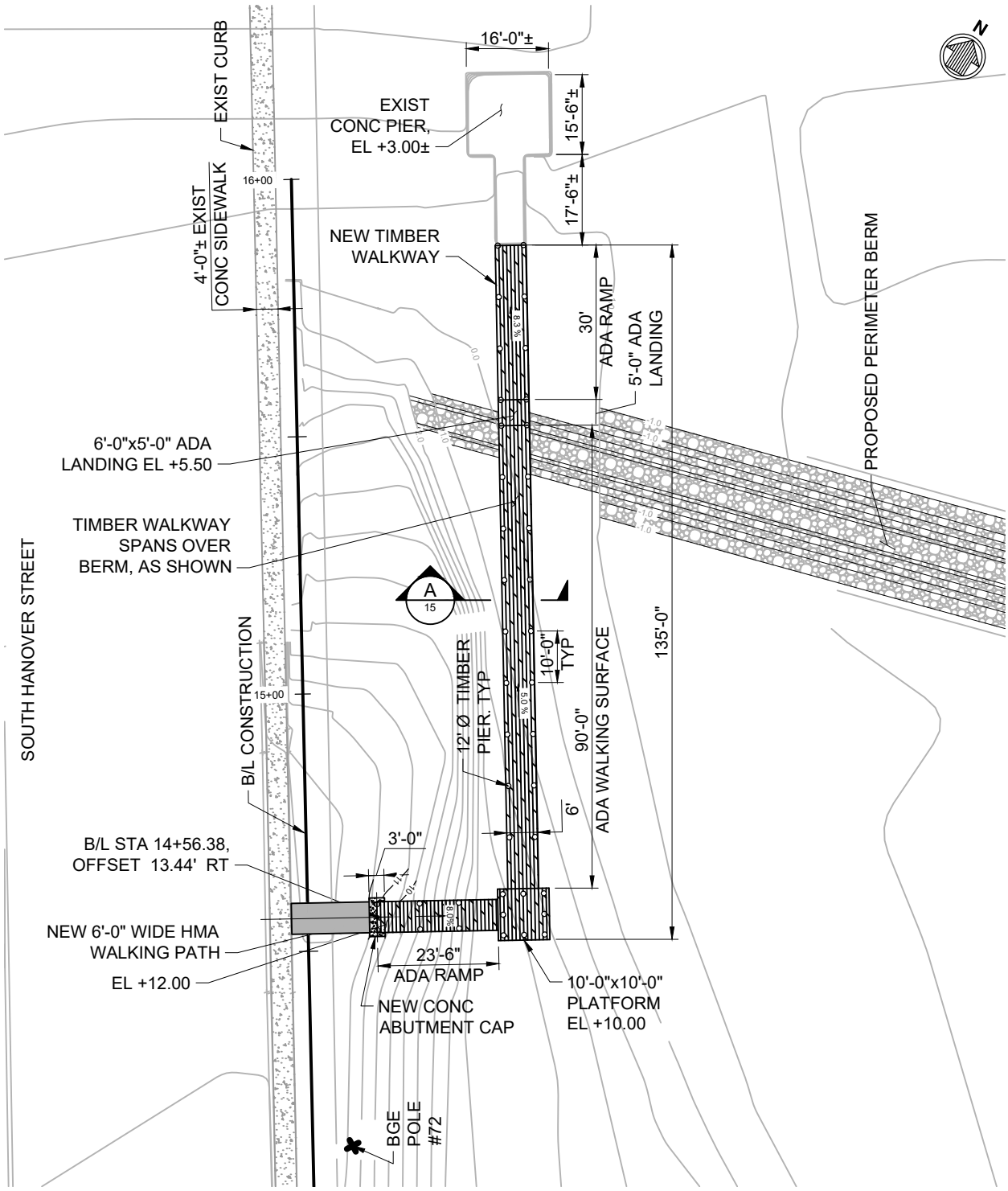
PROJECT LOCATION:
MIDDLE BRANCH
BALTIMORE CITY, MARYLAND

22-WL-1109
23-WQC-0038
202261734
9-5-23

100' 0' 100' 200'
SCALE: 1"=200'

DATE: JUNE 6, 2023

SHEET 14 OF 16



PLAN - PROPOSED TIMBER WALKWAY

APPLICATION BY:

BRIAN CRAMER
GREENVEST, LLC
4201 NORTHVIEW DRIVE, SUITE 202
BOWIE, MD 20716

AGENT/ENGINEER:

moffatt & nichol

MIDDLE BRANCH SITE 5A
WETLAND RESTORATION

22-WL-1109
23-WQC-0038
202261734
9-5-23

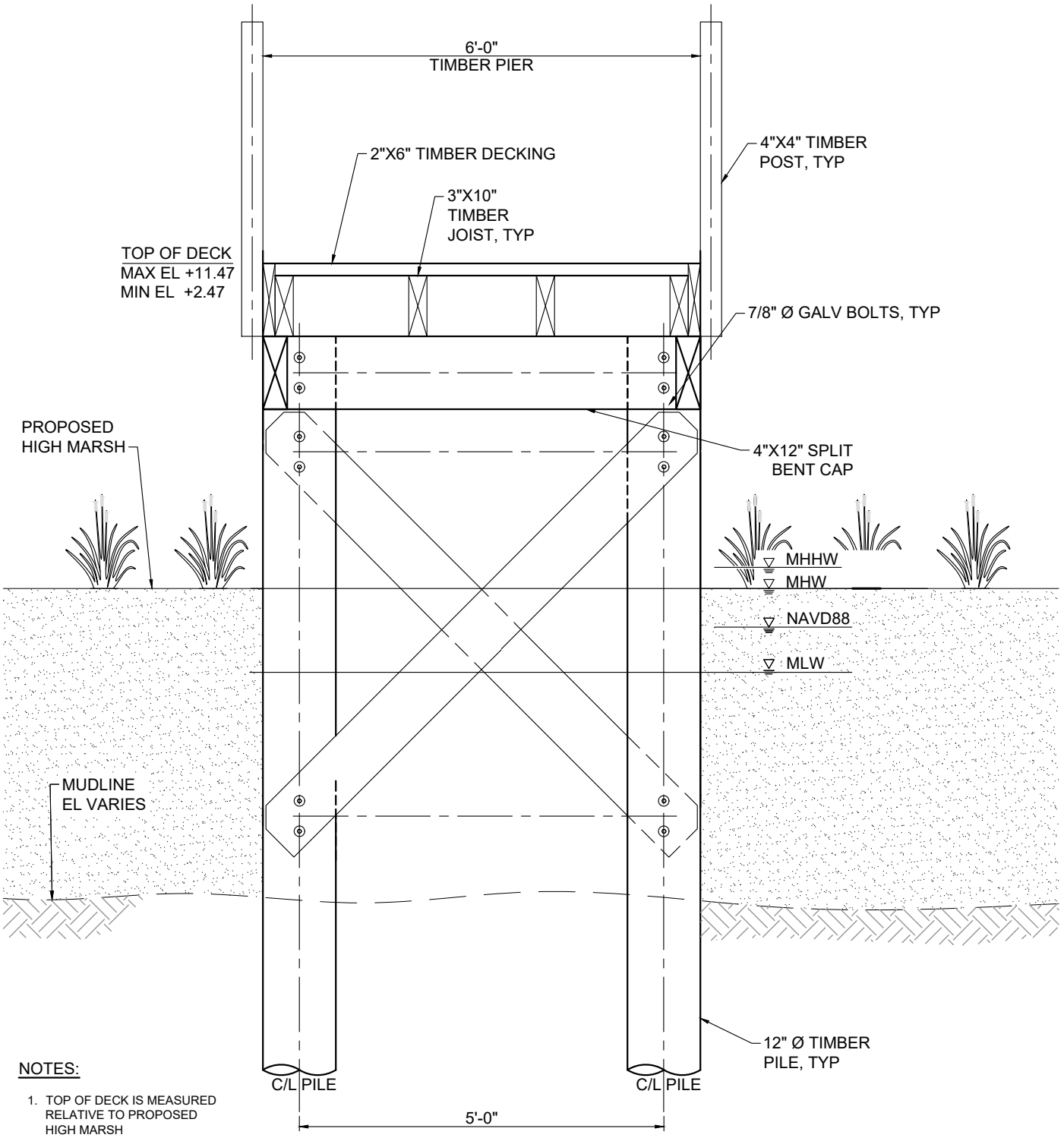
PROJECT LOCATION:
MIDDLE BRANCH
BALTIMORE CITY, MARYLAND

15' 0' 15' 30'
SCALE: 1"=30'

DATE: JUNE 6, 2023

SHEET 15 OF 16

File: Q:\BA\220245\20 CADD_Active_Permit\220245C-P015 ; Plotted: 2/6/2024 10:43 AM by BRANT, CHERYL ; Saved: 10/4/2023 3:27 PM by CBRANT



NOTES:

1. TOP OF DECK IS MEASURED RELATIVE TO PROPOSED HIGH MARSH

SECTION A - PROPOSED TIMBER WALKWAY

APPLICATION BY:

BRIAN CRAMER
GREENVEST, LLC
4201 NORTHVIEW DRIVE, SUITE 202
BOWIE, MD 20716

AGENT/ENGINEER:

moffatt & nichol

MIDDLE BRANCH SITE 5A
WETLAND RESTORATION

22-WL-1109
23-WQC-0038
202261734
9-5-23

PROJECT LOCATION:
MIDDLE BRANCH
BALTIMORE CITY, MARYLAND

1' 0' 1' 2'
SCALE: 1/2" = 1'-0"

DATE: JUNE 6, 2023

SHEET 16 OF 16

File: Q:\BA\220245\20 CADD_Active_Permit\220245C-P016 ; Plotted: 2/7/2024 10:07 AM by BRANT, CHERYL ; Saved: 2/7/2024 10:06 AM by CBRANT

GreenVest
VISION • PERFORMANCE • RESULTS

Memorandum

To: Matt Wallach, MDE, and Maria Teresi, USACE

From: Kyle Spendiff, GreenVest, LLC

Date: 09/01/2023

Re: Middle Branch Resiliency Initiative (MBRI) – Habitat Monitoring Plan

---

Introduction

The Middle Branch Resiliency Initiative (MBRI) currently proposes to construct nature-based solutions (NBS) along the coastline at five (5) locations within the Middle Branch of the Patapsco River: Site 5A, BGE Spring Gardens, Medstar Harbor Hospital (MHH,), Patapsco Delta (PDP) and Smith Cove Environmental Justice Project (SCEJP). MBRI will include a variety of NBS to address three key program goals: 1) improve coastal resiliency, 2) improve water quality, and 3) improve aquatic habitat structure and diversity. To effectively monitor the project's impact on the Middle Branch of the Patapsco, six (6) monitoring locations have been identified (Figure 1). The following memorandum details the proposed monitoring plan to be completed beginning in 2023 and lasting throughout the lifespan of the MBRI project. Monitoring will cease when the regulatory agencies determine the project is complete. The proposed monitoring plan will collect valuable site data to understand the changes to habitat, fish, benthic, sediment, and project stability metrics, at the six monitored locations.

Existing Data Review

An extensive review of publicly available information on fish communities within the Middle Branch area of Baltimore Harbor resulted in generalized lists of species that are either documented to occur or are thought to be in the area. Although no systematic surveys documenting the presence or abundance of specific species within the shallow water zone (<3 feet) of the Middle Branch were found, the structural habitat requirements of these species are well documented and were used to inform the technical approach of the project.

In addition, the MBRI team has coordinated with the Masonville Cove Habitat Restoration Project (MCHRP) to better align the MBRI habitat monitoring plan with work currently underway in the area. The MBRI team has obtained data collected as part of the Masonville project and has used that data as a guide for developing the MBRI habitat monitoring plan.

MBRI Habitat Goals and Objectives

The use of marsh edges by forage fish and macroinvertebrates is well documented, as are the high rates of productivity with coastal marshes. Through the creation of highly productive habitats that are currently lacking within the proposed project limits as well as the Middle Branch at large, the MBRI will provide levels of habitat function and value that currently do not exist. Furthermore, it is presumed that this project will yield localized benefits for forage and juvenile fish and macroinvertebrate species; organisms that form an important link in the Chesapeake Bay's food web and support many recreational and sport fisheries. This key linkage will provide habitat gaps at a critical transition between fluvial and estuarine areas that have

been subject to barrier removal and restoration actions, making this project temporally and contextually appropriate as a means to uplift aquatic dependent wildlife habitat.

While it is assumed that fish and macroinvertebrate species diversity will eventually improve post-construction, population dynamics are dependent upon many factors outside the control of the MBRI. Therefore, project goals, objectives, and monitoring will focus on the re-establishment of structural habitat characteristics that can be controlled and measured in the post construction condition. Functional characteristics (fish and macroinvertebrate species presence and abundance) will also be monitored to determine if/how species are adapting to the habitat provided to supplement the documentation of achieving structural objectives.

- Habitat Goal:
    - Improve structural habitat characteristics known to benefit macroinvertebrates and juvenile and forage fish, habitat that is currently absent in the MBRI area.
- Objective:
    - Assess existing structural habitat characteristics within near shore (<3 feet) areas.
    - Create structural habitat components known to benefit macroinvertebrate and juvenile and forage fish species along the water/land interface.
    - Monitor post-construction structural habitat components to document structural and continue observing functional improvements.

Monitoring Plan

A robust monitoring plan has been developed to collect current baseline data of existing conditions, collect data at each project location and approved locations throughout the Middle Branch at various intervals post-construction. The monitoring plan will focus on collecting data for the following items of interest:

1. Habitat assessment
2. Fish monitoring
3. Benthic Macroinvertebrate monitoring
4. Sediment sampling
5. Porewater sampling
6. Project stability

Habitat Assessment

Habitat assessment data will be collected for each sample location utilizing the survey protocols from the Evaluation of Planned Wetlands (EPW) method (Bartoldus, 1994). EPW evaluates six (6) different wetlands functions:

1. Shoreline Bank Erosion Control- Capacity to provide erosion control and to dissipate erosive forces at the shoreline bank.
2. Sediment Stabilization- Capacity to stabilize and retain previously deposited sediments.
3. Water Quality- Capacity to retain and process dissolved or particulate materials to the benefit of “downstream” surface water quality.
4. Wildlife- Degree to which a wetland functions as habitat for wildlife as described by habitat complexity.
5. Fish- Degree to which a wetland habitat meets the food/ cover, reproductive, and water quality requirements of fish.

6. Uniqueness/ Heritage- Presence of characteristics that distinguish a wetland as unique, rare, or valuable.

The structural characteristics in the pre- and post-construction condition will be compared to determine the project's effect on local habitat quality.

Fish Monitoring

To support the project goals to improve habitat for smaller forage and juvenile fish species more likely to use shallow, near shore habitats, fish samples will be collected at project locations within and in the vicinity of the MBRI prior to construction activities to establish baseline data and to monitor post-construction conditions at the MBRI projects. Fish will be collected utilizing methods that are comparable with the fish sampling efforts at the nearby MCHRP, to the extent practicable. Proposed sampling methods will include Fyke Nets, Seine Nets and Minnow Traps to collect fishes and macroinvertebrates (blue crab, mud crab, etc.) from near shore habitats.

- **Fyke Net Sampling**- The primary fish sampling method to capture juvenile and forage fishes utilizing the created tidal marsh will deploy a 3'H x 4'W x 12'L knotless ¼" mesh fyke net with 3' H x 30'L x ¼" mesh wings. To capture fish and macroinvertebrates as they egress or are flushed out of the created tidal marsh with the receding tide, the fyke net will be set in a pre-determined location at the center of the vent openings with the wings extending to the edges of the vent opening to prevent fish and macroinvertebrates from evading capture. The nets will be set at or near high tide and sampled at the end of the tide cycle/ low tide providing a sampling duration of approximately six (6) hours. Sampling on the outgoing tide will help prevent net fouling, displacement, and damage caused by multi-directional tidal flow. A representative sample of up to fifty (50) individuals per species will be measured (mm) and recorded. Finfish length measurements will be recorded using the appropriate method (total length, fork length, etc.) depending on the species, while carapace measurements will be recorded for sampled blue crabs. Other macroinvertebrates such as mud crabs and grass shrimp will be counted only. Any specimen captured that cannot be identified in the field will be photographed and/or preserved in a 95% alcohol solution for later identification.
- **Beach Seine Sampling**- To sample shallow water habitat along the living shoreline areas beach seining will be conducted at each site utilizing a 4'H x 25'L x ¼" mesh beach seine. The beach seine net will be deployed perpendicular to the shoreline in a wide arc, while maintaining contact with the bottom. Three (3) replicate hauls will be conducted at different locations at each site and catch will be sorted and processed after each haul. Captured fish will be identified to species, measured and quantified, then returned to the water. Blue crabs, mud crabs and other macroinvertebrates will also be identified and counted. A representative sample of up to fifty (50) individuals per species will be measured in millimeters (mm). Finfish length measurements will be recorded using the appropriate method (total length, fork length, etc.) depending on the species, while carapace measurements will be recorded for sampled blue crabs. Any specimen captured that cannot be identified in the field will be photographed and/or preserved in a 95% alcohol solution for later identification.
- **Minnow Trap Sampling**- To sample fish utilizing the created marsh areas that are not suitable for seeing or fyke netting "Gee-type" galvanized 17 ½" L x 9"H x 1/4" mesh minnow traps will be

deployed within channels, or pools within the created marsh. The traps will be set during or near low-tide and sampled approximately 12 hours after setting to ensure fish utilizing the marsh surface at high tide are sampled. A representative sample of up to fifty (50) individuals per species will be measured (mm) and recorded. Captured fish will be identified by species, quantified, and returned to the water. Finfish length measurements will be recorded using the appropriate method (total length, fork length, etc.) depending on the species, while carapace measurements will be recorded for sampled blue crabs. Any specimen captured that cannot be identified in the field will be photographed and/or preserved in a 95% alcohol solution for later identification.

Post-construction sampling will be continued in years one (1), three (3), and five (5), at the sampling locations within the newly created habitats of the MBRI. Post-construction data will be compared to pre-construction data at the site as well as data collected from the other MBRI sites to determine if changes in structural habitat alone are able to bring about changes in the local fish community within the MBRI. The data can also be compared with sampling efforts at MCHRP. Fish species of interest can be found in Table 1.

Table1. MBRI Fish Species of Interest

Fish Target Species	Sampling Notes
Alewife *(Alosa pseudoharengus)*	Anadromous, summer juvenile sampling.
American Eel *(Anguilla rostrata)*	Summer shallows
American Shad *(Alosa sapidissima)*	Anadromous, summer juvenile sampling
Atlantic Croaker *(Micropogonias undulatus)*	Summer shallows
Atlantic Menhaden *(Brevoortia tyrannus)*	Summer shallows
Atlantic Silverside (*Menidia menidia*)	Summer shallows
Banded Killifish *(Fundulus diaphanus***)**	Resident
Bay Anchovy *(Anchoa mitchillii)*	Summer shallows
Blueback Herring *(Alosa aestivalis)*	Anadromous, summer juvenile sampling
Bluefish *(Pomatomus saltatrix)*	Juveniles May-Oct.
Gizzard Shad *(Dorosoma cepadianum)*	Resident
Hickory Shad *(Alosa mediocris)*	Anadromous, summer juvenile sampling.
Inland Silverside *(Menidia beryllina)*	Summer shallows
Largemouth Bass *(Micropterus salmoides)*	Resident. Near shore with cover
Mummichog *(Fundulus heteroclitus)*	Resident
Sheepshead Minnow *(Cyprinodon variegatus)*	Resident
Spot *(Leiostomus xanthurus)*	Summer shallows
Spottail Shiner *(Notropis hudsonius)*	Resident
Striped Bass *(Morone saxatilis)*	Resident, Anadromous
Striped Killifish *(Fundulus majalis)*	Resident, Summer shallows
Summer Flounder *(Paralichthys dentatus)*	Juveniles, Summer shallows
White Perch *(Morone americana)*	Resident, Semi-anadromous
Windowpane Flounder *(Scopthalmus aquosus)*	Adults and juveniles
Winter Flounder *(Pleuronectes americanus)*	Juveniles, Summer shallows
Yellow Perch *(Perca flavescens)*	Resident, Semi-anadromous

Benthic Macroinvertebrate Baseline Survey

A pre-construction baseline benthic community survey will be conducted to characterize the existing community composition within the proposed project areas. Additional benthic post-construction sampling

will be conducted within the created wetlands at year one (1) year three (3) and again at year five (5)- the end of the five (5) year monitoring period which should allow time for the benthic community to re-establish post-disturbance and to make comparisons between the benthic communities found within the shallow open water and tidal low marsh.

Benthic macroinvertebrate sampling will occur prior to construction activities to determine baseline conditions in the Summer of 2023. Three (3) replicate benthic grab samples will be obtained from each site, with one additional sample taken to evaluate sediment grain size and TOC. Macroinvertebrates will be sampled using a petite ponar grab sampler or equivalent equipment. Each replicate benthic sample will be sieved in the field through a 500-micron screen to remove fine sediment particles. Individual replicates are transferred to labeled bottles and preserved in the field using 95% ethanol solution and transmitted to a laboratory for processing following industry standards. Benthic macroinvertebrates will be enumerated and identified to the lowest genomic level. The samples are then analyzed for species composition and abundance. Macroinvertebrate species of interest can be found in Table 3.

Table 2. MBRI Macroinvertebrate Species of Interest

Macroinvertebrate Target Species	Sampling Notes
Atlantic Mud Crab *(Panopeus herbstii)*	Resident
Blue Crab *(Callinectes sapidus)*	Summer shallows
Eastern Elliptio *(Elliptio complanata)*	Resident
Grass Shrimp *(Palaemonetes pugio)*	Resident

Sediment Sampling

To address concerns related to the potential remobilization of contaminants in the Middle Branch of the Patapsco River resulting from the completed projects, pre- and post-construction sediment screening for metals, polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), herbicides, and pesticides will be conducted at each site. Baseline data on contamination levels will be evaluated and compared to subsequent post-construction sampling to determine measurable increases/ decreases in contaminants within the surface sediments. If a notable increase in contamination is detected, a remediation plan will be developed and implemented with the approval of the regulatory agencies.

Surficial sediment samples will be taken at pre-determined sampling locations to a depth of 0-6 inches below the surface using a petite ponar grab or equivalent sampling equipment. Samples will be properly preserved in the field and sent to an accredited laboratory for analysis. A report summarizing the sampling results will be prepared and submitted to the agencies at the end of each monitoring year. Information obtained from the sediment monitoring will be used, when appropriate, to inform adaptive management activities. Basic water quality testing for temperature, dissolved oxygen, salinity, conductivity, and turbidity will be conducted at each sample location.

Pore Water Sampling

Pre- and post-construction pore water sampling will be conducted semi-annually at the six locations depicted in Figure 1 using the standard operating procedures outlined in the February 2013 Environmental Protection Agency, Science and Ecosystem Support Division (SESD), Pore Water Sampling (513) AF. R2 guidance document. Samples will be collected using a PushPoint sampler or similar device fitted with a watertight flange to prevent surface water intrusion. Samples will be analyzed for contaminants which may include metals, polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs), semi-volatile

organic compounds (SVOCs), herbicides, and pesticides, and all results will be included in the monitoring reports.

Project Stability Monitoring

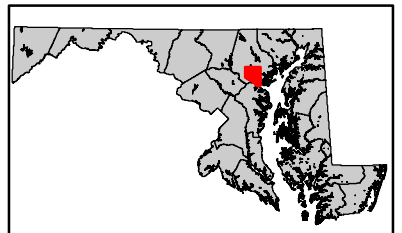
To ensure the installed breakwater structures and marsh fill contained within them are stable, regular inspections will be conducted during construction and during the post-construction monitoring period. During construction intensive monitoring of the breakwater structures will occur to ensure long term stability. When structure stability has been observed and verified, monitoring of the marsh fill materials will continue during construction to identify potential sediment releases, structural deficiencies, unexpected erosion, etc. After construction, visual inspections of the breakwater structures, marsh soils, and marsh vegetation will occur routinely during the 5-year monitoring period. Inspections of the breakwater will focus on the stability of structure elevations and components (riprap, sand, fill, stone, etc.) while marsh stability inspections will identify areas of erosion and wasting, vegetation loss, and sediment deposition. Inspections will be conducted on a quarterly basis and the findings reported to MDE and USACE upon request. If remedial action/ adaptive management is needed, corrective actions will be determined and completed using the specific project adaptive management plan.

Sampling Locations and Monitoring Schedule

Figure 1 depicts the MBRI project wide monitoring locations. Monitoring will be performed bi-annually at all sites throughout the Middle Branch (2023, 2025, 2027, 2029, 2031, 2033, etc.) and will continue until it is determined by the regulatory agencies that the Middle Branch Resiliency Project is complete. An individual marsh maintenance plan will be developed for each site where marsh development is proposed and will be monitored and maintained for a minimum period of five (5) years, with a potential to extend the monitoring period up to three (3) additional years depending on site conditions and monitoring results.

Grab Sample Orthometric View

Total grab sample volume: 0.00463 CY



Middle Branch Resiliency Initiative

Habitat and Sediment Monitoring Locations

Baltimore Harbor
Baltimore City, MD

Legend

Sample Site

NOTE:
Sediment samples will be taken with a Petite Ponar Grab (6"x6"). Each grab is 0.00463 CY.

3 grabs per site (6) = 18 grabs = total of 0.08334 CY per sampling year

N

0 675 1,350 Feet

4201 Northview Drive, Suite 202
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Date Figure Created: 8/10/2023

GreenVest
VISION • PERFORMANCE • RESULTS

Memorandum

To: Matt Wallach, MDE, and Maria Teresi, USACE
From: Andrew Forbes, PE, ENV SP, GreenVest, LLC
Date: 9/1/2023
Re: Middle Branch Resiliency Initiative Site 5a – Activated Carbon

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The following memorandum addresses the use of Activated Carbon (AC) as a treatment methodology to reduce the potential bioavailability of contaminants for the Middle Branch Resiliency Initiative (MBRI) Site 5a Project. Agency review comments have expressed concern of release, exposure, and/or bioavailability of potential sources of contaminants associated with the existing site conditions, project fill materials, and long-term ecological function of the project.

Our previous memorandum dated 6/5/2023 and submitted as part of this Joint Permit Application provided a comprehensive analysis of why AC was not a necessary amendment to the project to address the regulatory concerns of the existing contaminants. This analysis was supported by our expert consultants and academic studies and we believe the analysis provided sufficient justification to allay the regulatory concerns of the existing contaminants.

The most recent agency review comments for the project requested we reconsider adding an AC amendment to the project specifically to address the bioavailability of PCBs. We have consulted with Dr. Upal Ghosh of University of Marland Baltimore County to determine project specifications for the appropriate AC product type, dosing, and application coverage of AC for the project to mitigate the bioavailability of PCBs. Dr. Ghosh's recommendation is included in this Joint Permit Application, and we believe our reconsideration of adding an AC amendment to the project fully addresses the regulatory concerns of the existing contaminants.

The Maryland Department of the Environment (MDE) states in the review comments that "We believe that the use of Activated Carbon (AC) is unlikely to result in adverse environmental and ecological impacts." The primary goal of the project is to establish a robust tidal marsh system, so we certainly hope that MDE is correct that AC will not result in adverse environmental and ecological impacts that may limit the full growth and establishment of the tidal marsh system.

We have addressed every regulatory concern that has been raised about the project impacts through measures of avoidance, minimization, and mitigation. As a team, we strive to create a project that meets the needs of all project stakeholders. We will continue to work with the regulatory agencies throughout the entire development process for the Middle Branch Resiliency Initiative in hopes of jointly developing a comprehensive understanding and agreement of the wide range of complex environmental and ecological issues that affect the Middle Branch and the Chesapeake Bay.

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MEMORANDUM

TO: GreenVest LLC.

FROM: Dr. Upal Ghosh, Sediment Solutions LLC.

DATE: Sep 1, 2023

SUBJECT: A Review of Middle Branch Site 5A Chemical Characterization Data and Feasibility of Amendment of Activated Carbon to Address Pollutant Exposure Concerns

Introduction

GreenVest in collaboration with other partners is engaged in developing plans for and implementing a shoreline and ecological restoration project as a part of the Middle Branch Resiliency Initiative. Concerns have been raised about the potential for impacts from pollutants in existing sediments. The overall objective of this memorandum is to provide recommendations for a sustainable design that is less likely to be compromised in the future from migration of pollutants from existing sediments. Documents reviewed to develop this report include:

1) Summary of the Environmental Evaluation at Site 5A for the MRBI BRIC Redevelopment Project. Report prepared by CSI Environmental LLC. Aug 2, 2022.
2) Middle Branch Resiliency Initiative Demonstration Project (Site 5A) 90% Construction Documents.
3) Reimagine Middle Branch, Parks, Projects, and Programs to connect communities in South Baltimore. Executive Summary, Feb 2023.
4) Evaluation of Contaminants in Sediment Middle Branch Resiliency Initiative (MBRI) – Site 5A. Baltimore, MD. Yates, Environmental Sciences. May 2, 2023.

Data Review

The primary source of data for this review was the report on site chemical characterization by CSI Environmental LLC. The review also evaluated the analysis provided by Yates Environmental Sciences Inc. Site 5A is located at the mouth of the Patapsco River in Baltimore Harbor where suspended sediments from the river have formed deposits of organic matter laden fine sediments. Past industrial activities around the site likely resulted in contamination of the historically deposited sediments. The sediments have the characteristics of typical fine-grained material found at estuarine sites with a range of organic and metal pollutants present at low concentrations across the site. The general observation is that near surface sediments are cleaner than the deeper sediments. For example, the highest concentration of total PCBs (520 ug/kg) was found in deeper cores (A8 composite; collected 5-15 ft below mud line). The six surface

sediment (0-1 ft) total PCB concentrations ranged from a maximum of 240 ug/kg to ND (65 ug/kg). Similarly, for PAHs, the highest total PAHs (21 mg/kg) was found in the deeper core (A9 composite; collected 5-15 ft below mud line). The six surface sediments (0-1 ft) had a much lower concentration of total PAHs (0-4 mg/kg). A similar observation can be made for many of the other pollutants that are seen at an elevated level in deeper sediments. Thus, cleaner sediments from the Patapsco River have deposited in this area over time. The near surface sediments (top 4-6") comprise the bioactive zone in aquatic sediments and are most relevant for chemical exposure to the aquatic food web (USEPA 2003). The future contamination levels in new surface sediments at this site after restoration is likely going to be largely dictated by the chemical concentrations present in the suspended sediment in the Patapsco River and any resuspension/deposition of sediments from the Harbor.

For the set of 6 metals that often drive risk at sediment sites, the concentrations were low and potential for exposure and risk was mitigated by the high level of sulfide and organic matter in sediments. Table 1 below shows the estimation of risk from the six metals that often precipitate as sulfides in sediments (Cd, Cu, Pb, Ni, Ag, and Zn). The metals in excess of total sulfide is complexed with natural organic matter in sediments in all of these samples resulting in a low value of the key indicator parameter of available excess metals divided by the fraction of organic carbon in sediments [(SEM – AVS)/foc]. All values are below the critical value for toxicity of 130 µmole/gOC (highest is 32 µmole/gOC at SED2). Thus, these metals are likely not to be causing negative impacts on the benthic ecosystem, especially after a cover of clean fill is placed which would drive these underlying sediments more anaerobic and less prone to metals leaching.

Table 1. Risk assessment for key metals in sediments across all samples for which metal and AVS data were available. The key parameter [(SEM – AVS)/foc] is compared with the value of 130 umole/gOC below which toxicity to aquatic organisms is unlikely (*Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: Metal Mixtures (Cadmium, Copper, Lead, Nickel, Silver, and Zinc): EPA-600-R-02-011*).

	SED1	SED2	SED3	SED4	SED5	SED6		A4 (0-4 ft)	A10 (0-4 ft
TOC (%)	1.28	14.4	2.67	2.69	2.92	5.09		1.94	2.52
Sulfide	2.8	0.585	1.6	7.6	8.5	0.49		1.61	8.37
Cadmium	0	0	0.0033	0.011	0.0095	0		0	0
Copper	0.1	0.241	0.09	0.345	0.114	0.113		0.093	0
Lead	0.046	0.294	0.054	0.217	0.281	0.147		0.112	0.045
Nickel	0.104	0.121	0.044	0.142	0.178	0.061		0.136	0.151
Silver	0	0	0	0	0	0		0	0
Zinc	0.355	2.38	1.08	3.07	3.27	0.537		0.231	0.473
SEM	0.605	3.036	1.2713	3.785	3.8525	0.858		0.572	0.669
SEM/AVS	0.216	5.190	0.795	0.498	0.453	1.751		0.355	0.080
(SEM-AVS)/foc	-202	**32**	-30	-264	-276	**25**		**-65**	**-329**

The remaining metal species including mercury that are present in the existing sediments are at relatively low concentrations and unlikely to migrate or cause impacts especially after the placement of new clean fill materials.

Care will need to be taken during the construction phase of the project to minimize any major disturbance and upwelling of buried sediments that can result in exposure to air and oxidation of sulfide resulting in the leaching of some of the bound metals.

A review of the 90% design document demonstrates careful planning to stabilize the existing substrate with geotextile and armoring, allowing for sediment compaction from the weight of placed materials, followed by the placement of stones to create the offshore berm structures first, and use of clean fill materials to subsequently create the wetland environments. While the pollutant levels in sediment are low as described above, some stakeholders of the project remain concerned about the potential for the pollutants to mobilize into the created marsh habitat either during construction or in the long-term through groundwater upwelling. The remaining report addresses these concerns and explores potential approaches to consider that can minimize the transport of pollutants to the surface of the new marsh. The focus of this analysis is on hydrophobic organic pollutants such as PCBs and PAHs that are the ones most likely to be of concern from the standpoint of ecological exposure and bioaccumulation in the aquatic food web. PCBs in particular may be of concern due to the existing PCB TMDLs in the Bay that are attempting to reduce PCB loadings in the surface water and resulting human health impacts from accumulation in fish. The Reimagining Middle Branch initiative will bring the community closer to the water through water related activities that can include fishing. Thus, efforts that can reduce potential release of bioaccumulative pollutants from the underlying sediments will further the long-term objective of creating a safe and healthy environment where ecosystem and human activities can flourish together.

Project Assessment

The wetland construction will involve an offshore berm structure to shelter a set of wetland features including a Low Marsh and a High Marsh environment. These environments will be created over the existing sediments by first removing any existing invasive species, followed by the placement of a geotextile liner and gravel base structure for the berms. The wetlands will be constructed with clean fill after the berm structures are complete. Turbidity curtains will be used to contain suspended sediments mobilized during the construction activities with the goal of minimizing off site transport of sediments. The potential for ecological exposure of buried contaminants can be from the following potential pathways:

1) Buried sediments can be mobilized during debris removal and other construction related activities. Adopting best management practices during construction can minimize chances of sediment release.

2) Some mobilization of soft contaminated sediments is possible during the placement of materials used to construct the base of the berm structure and the contained wetlands.

3) Tidal pumping and subsurface groundwater discharge can result in the long-term migration of some dissolved porewater constituents through the fill material. The areas potentially prone to

such discharges are the berms constructed of stone and coarse gravel (high hydraulic conductivity), and the Low Marsh wetlands (Low Marsh more prone to tidal pumping action compared to the High Marsh – Guimond and Tamborski, 2021).

Pathways 1 and 2 can be controlled by adequate planning of the construction activities. Pathway 3 of long-term groundwater flow related exposure can be controlled by strategic placement of activated carbon amendments to create a barrier layer between the existing sediment surface and the new marsh material.

Activated Carbon Amendment Feasibility

Aquatic sediments form the ultimate repositories of past and ongoing discharges of hydrophobic organic compounds (HOCs) such as PCBs, as well as some heavy metals. Sediment HOCs can be taken up by pelagic or benthic organisms through ingestion and dermal absorption, and subsequently passed on to higher organisms and humans as illustrated in **Figure 1**. For both of these pathways, the uptake exposure depends on the bioavailability of contaminants in sediment (Luthy et al. 1997; NRC 2003). Work in the last two decades has demonstrated that "Natural" contaminant sequestration in native sediments can be greatly enhanced by the addition of clean, manufactured carbonaceous materials into sediments, such as activated carbon (AC) as illustrated in Figure 1 (Ghosh et al. 2011). Laboratory tests with a range of field sediments showed that AC amendment in the range of 2-5% by weight reduces equilibrium porewater concentration of PCBs, PAHs, DDT, dioxins, and furans in the range of 70-99%, thus reducing the driving force for the diffusive flux of HOCs into the water column and transfer into organisms. Most of the studies using benthic organisms show a reduction of biouptake of HOCs in the range of 70-90% compared to untreated control sediment (Ghosh et al 2011). Recent studies have also demonstrated the feasibility of activated carbon amendment in reducing porewater concentrations and biouptake of mercury and methylmercury in sediments with a range of effectiveness (Gilmour et al. 2013; 2018). These studies have been generally successful in demonstrating that contaminant bioavailability in sediments can be altered by engineered amendments.

Several pilot-scale and full-scale implementations of AC in sediments have demonstrated the effectiveness in reducing the bioavailability of PCBs in sediments. In a recent pilot-scale study, it was demonstrated for the first time in a contaminated river that application of activated carbon to sediments in the field reduces biouptake of PCBs in benthic organisms. After treatment with activated carbon applied at a dose similar to the native organic carbon content of sediment, bioaccumulation in freshwater oligochaete worms was reduced compared to pre-amendment conditions by 69 to 99%, and concentrations of PCBs in water at equilibrium with the sediment were reduced by greater than 93% at all treatment sites for up to three years of monitoring (Beckingham and Ghosh 2011). Demonstration in a tidal marsh environment (Sanders et al., 2019) showed that AC applied as pellets or in the form of granular carbon applied directly or mixed with sand withstood Hurricane Sandy and remained in place for the duration of the study, successfully reducing porewater PCB concentrations by 34–97%. Reductions in invertebrate bioaccumulation were observed in all amendment scenarios, with pelletized fine AC producing the most pronounced effect. In a recent full-scale project, AC was applied in a 5-acre lake using

a tele-belt (Patmont et al. 2020). Post-treatment sampling indicated an average AC concentration of 4.3% by dry weight in surface sediments. Sediment porewater and surface water measurement using passive samplers showed reductions of 60-80% of total freely dissolved PCBs and both have been reduced to below the Delaware Human Health Water Quality Criteria. Fish tissue analysis of resident fish samples collected before and 3 to 5 years after treatment showed reductions of approximately 70% on a lipid normalized basis and agree with modeled predictions (Patmont et al. 2020).

Based on the observations made in the above field applications of activated carbon, it is feasible to incorporate amendment of activated carbon into the current plans of Site 5A to minimize exposure to the buried contamination. The amendment of activated carbon to the underlying sediments is likely to be effective in reducing porewater concentrations of PCBs and other hydrophobic pollutants minimizing the risk of contamination of the new marsh habitat.

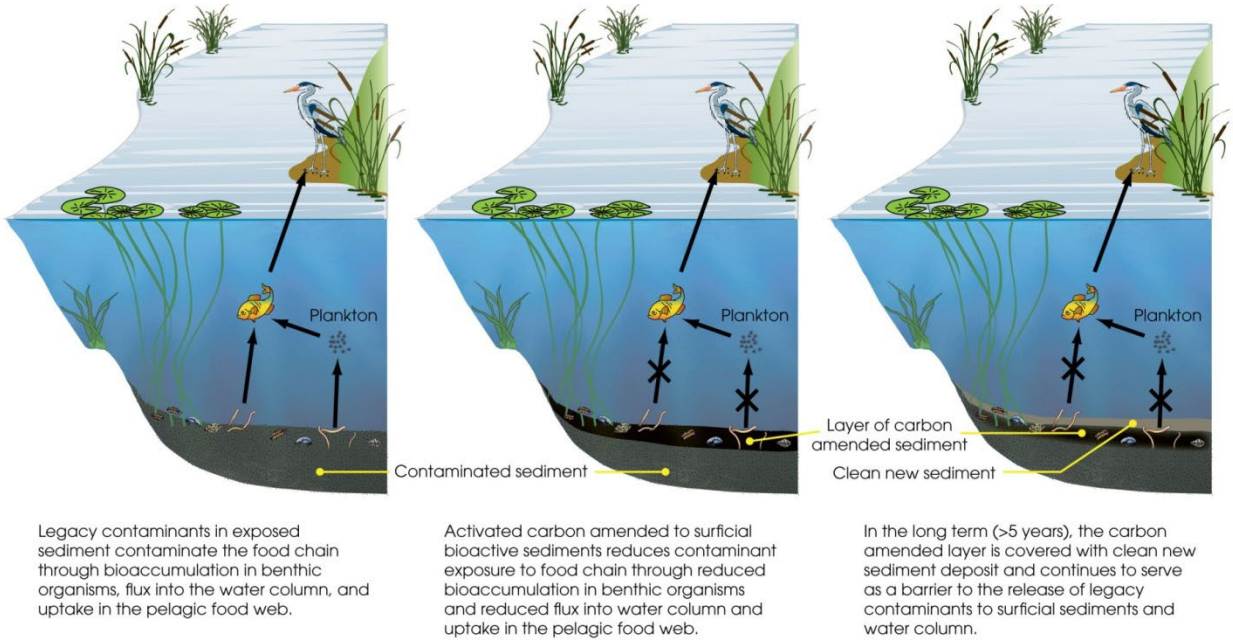

Figure 1*. Conceptual model of how sorbent amendment of sediment reduces contaminant exposure pathways of benthic organism accumulation and flux from the sediment bed. (Ghosh et al. feature article, ES&T 2011)*

Activated Carbon Amendment Recommendation

A recommended design for Activated Carbon amendments for Site 5A is based on the following assumptions:

1) The primary exposure pathway of concern is the long-term vertical migration of PCBs and other bioaccumulative pollutants from deeper sediments via groundwater upwelling.
2) PCB concentrations in sediment are low as determined in the site characterization.
3) Geotechnical considerations in the current construction design will be adequate to maintain stability of the clean fill and underlying sediments.

4) All fill materials are clean and do not contain any COCs of concern.
5) New sediments that will be deposited on the constructed marsh surface over time will be cleaner than existing sediments and will not pose exposure concerns.

While the total area undergoing restoration is about 10 acres in size, not all of that area is likely to be impacted from potential upwelling of contaminants associated with deeper sediments. The area to be filled to create marsh that lies below the MHW (Mean High Water) line is likely to be potentially prone to groundwater discharge. The proposed fill area waterward of the MHW line is 4.0 acres (Drawing # PC 101). While filling up of this area will elevate the marsh surface, the fill material is sand, gravel, and stones, which have a high hydraulic conductivity. Thus, any upwelling in this area has the potential to impact the surface of the new marsh. In contrast, the area above the MHW line is unlikely to experience much intrusion of groundwater and is also going to be largely converted into a high marsh.

The marsh areas on the waterside of the MHW line will be filled with marsh fill (mixture of sand, wood chips, gravel, and silt) followed by the placement of a marsh cap made up of sand. To address the possibility of pollutant migration through the constructed marshes, it is recommended to place a thin layer of activated carbon over the existing sediments to act as a barrier layer between sediments and the overlying cap as shown in Figure 2 (bottom).

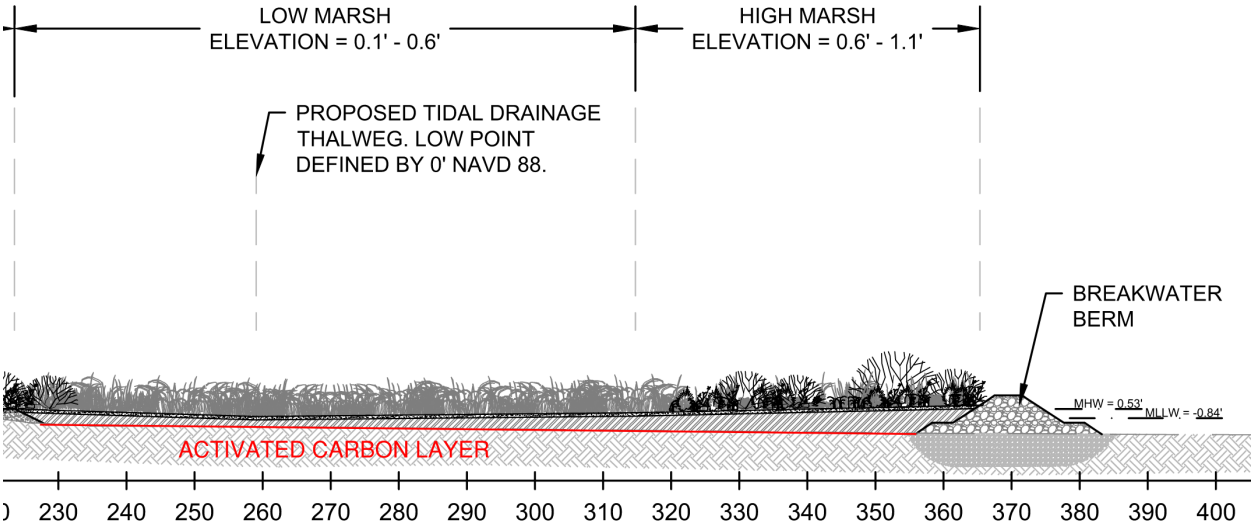

***Figure 2**. Schematic of application of thin layer of activated carbon (red line) in the areas waterside of MHW line.*

For in-situ sediment remediation applications, typical target dose is between 2-5% activated carbon in the treated bioactive layer of sediments. For a typical fine-grained, organic rich sediment, a 5% dose of AC in the top 4" of bioactive sediment translates to a dosing rate of approximately 10 MT AC per acre. For Site 5A, the target application is not a contaminated surface sediment habitat, but application in the form of a treatment layer under a cap. Thus, the cap is expected to provide additional protection from the underlying sediments and a lower range

dose of activated carbon (5 MT AC per acre) can be used. Assuming the use of a pelletized activated carbon product containing 50% activated carbon by weight, 10 metric tons of pellets can be applied every acre to provide comprehensive coverage of a thin layer of activated carbon against the in-situ sediments. For 4.0 acres of coverage of existing sediments below MHW, this results in a total application of 40 metric tons of activated carbon pellets. The application of AC as described above will create a treatment zone under the new marsh as illustrated in Figure 2 and protect the sediment habitat from potential intrusion of pollutants from groundwater discharge.

References:

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