

DEPARTMENT OF THE ARMY PERMIT

Permittee Greenfield Penobscot Estuary Remediation Trust, LLC

Permit No. NAE-2023-00413

Issuing Office New England District

NOTE: The term "you" and its derivatives, as used in this permit, means the permittee or any future transferee. The term "this office" refers to the appropriate district or division office of the Corps of Engineers having jurisdiction over the permitted activity or the appropriate official of that office acting under the authority of the commanding officer.

You are authorized to perform work in accordance with the terms and conditions specified below.

Project Description:

The authorized work is a mercury remediation pilot project involving the placement of a thin layer cap (TLC) over 5.9 acres of mudflat and 0.4 acre of tidal wetlands in the Penobscot River estuary. The TLC will consist of approximately 4,900 to 7,300 cubic yards of clean, predominantly coarse sand sourced from uplands. A six-inch TLC will be placed over the northern 2.6 acres of mudflat within the TLC Pilot Area. A four-inch TLC will be placed over the southern 3.3 acres of mudflat and 0.4 acre of tidal wetlands within the TLC Pilot Area. The other 0.4 acre of tidal wetlands within the TLC Pilot Area will not be capped and will serve as a control site. Adverse effects to the capped mudflat and wetlands are anticipated to be temporary.

The work is shown on and shall be performed in accordance with the enclosed plans titled "Thin Layer Cap Pilot Orrington Reach Capping Remedy" and dated 12-31-2024.

Project Location:

The project is located within the Penobscot River estuary in "East Cove 3" just west of Orrington Picnic Park off River Road in Orrington, Maine. The site coordinates are Latitude 44.720174 and Longitude -68.828865.

Permit Conditions:

General Conditions:

1. The time limit for completing the authorized work ends on **July 1, 2031**. If you find that you need more time to complete the authorized activity, submit your request for a time extension to this office for consideration at least one month before the above date is reached.
2. You must maintain the activity authorized by this permit in good condition and in conformance with the terms and conditions of this permit. You are not relieved of this requirement if you abandon the permitted activity, although you may make a good faith transfer to a third party in compliance with General Condition 4 below. Should you wish to cease to maintain the authorized activity or should you desire to abandon it without a good faith transfer, you must obtain a modification of this permit from this office, which may require restoration of the area.
3. If you discover any previously unknown historic or archeological remains while accomplishing the activity authorized by this permit, you must immediately notify this office of what you have found. We will initiate the Federal and State coordination required to determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.
4. A conditioned 401 water quality certification has been issued for your project and you must comply with the conditions specified in the certification as special conditions to this permit. For your convenience, a copy of the certification is attached.
5. You must allow representatives from this office to inspect the authorized activity at any time deemed necessary to ensure that it is being or has been accomplished in accordance with the terms and conditions of your permit.

Special Conditions:

1. The permittee shall ensure that a copy of this permit is at the work site (and the project office) authorized by this permit whenever work is being performed, and that all personnel with operational control of the site ensure that all appropriate personnel performing work are fully aware of its terms and conditions. The entire permit shall be made a part of any and all contracts and sub-contracts for work that affects areas of Corps jurisdiction at the site of the work authorized by this permit. This shall be achieved by including the entire permit in the specifications for work. The term "entire permit" means this permit (including its drawings, plans, appendices and other attachments) and also includes permit modifications.

If the permit is issued after the construction specifications, but before receipt of bids or quotes, the entire permit shall be included as an addendum to the specifications. If the permit is issued after receipt of bids or quotes, the entire permit shall be included in the contract or sub-contract. Although the permittee may assign various aspects of the work to different contractors or sub-contractors, all contractors and sub-contractors shall be obligated by contract to comply with all environmental protection provisions contained within the entire permit, and no contract or sub-contract shall require or allow unauthorized work in areas of Corps jurisdiction.

2. The permittee shall complete and return the enclosed Compliance Certification Form to this office within one month following the completion of the authorized work.

3. To limit the potential for adverse effects to federally listed threatened and endangered fish species and designated critical habitat within the action area, the in-water work window for the proposed activity is limited to July 15th to September 30th of any year.

(continued on page 4)

Further Information:

1. Congressional Authorities: You have been authorized to undertake the activity described above pursuant to:

- ☒ (X) Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403).
- ☐ () Section 14 of the Rivers and Harbors Act of 1899 (33 U.S.C. 408).
- ☒ (X) Section 404 of the Clean Water Act (33 U.S.C. 1344).
- ☐ () Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. 1413).

2. Limits of this authorization.

- a. This permit does not obviate the need to obtain other Federal, State, or local authorizations required by law.
- b. This permit does not grant any property rights or exclusive privileges.
- c. This permit does not authorize any injury to the property or rights of others.
- d. This permit does not authorize interference with any existing or proposed Federal project.

3. Limits of Federal Liability. In issuing this permit, the Federal Government does not assume any liability for the following:

- a. Damages to the permitted project or uses thereof as a result of other permitted or unpermitted activities or from Natural causes.
- b. Damages to the permitted project or uses thereof as a result of current or future activities undertaken by or on behalf of the United States in the public interest.
- c. Damages to persons, property, or to other permitted or unpermitted activities or structures caused by the activity authorized by this permit.
- d. Design or construction deficiencies associated with the permitted work.
- e. Damage claims associated with any future modification, suspension, or revocation of this permit.

4. Reliance on Applicant's Data. The determination of this office that issuance of this permit is not contrary to the public interest was made in reliance on the information you provided.

5. Reevaluation of Permit Decision. This office may reevaluate its decision on this permit at any time the circumstances warrant. Circumstances that could require a reevaluation include, but are not limited to, the following:

- a. You fail to comply with the terms and conditions of this permit.
- b. The information provided by you in support of your permit application proves to have been false, incomplete, or inaccurate (See 4 above).
- c. Significant new information surfaces which this office did not consider in reaching the original public interest decision.

Such a reevaluation may result in a determination that it is appropriate to use the suspension, modification, and revocation procedures contained in 33 CFR 325.7 or enforcement procedures such as those contained in 33 CFR 326.4 and 326.5. The referenced enforcement procedures provide for the issuance of an administrative order requiring you to comply with the terms and conditions of your permit and for the initiation of legal action where appropriate. You will be required to pay for any corrective measures ordered by this office, and if you fail to comply with such directive, this office may in certain situations (such as those specified in 33 CFR 209.170) accomplish the corrective measures by contract or otherwise and bill you for the cost.

6. Extensions. General Condition 1 establishes a time limit for the completion of the activity authorized by this permit. Unless there are circumstances requiring either a prompt completion of the authorized activity or a reevaluation of the public interested decision, the Corps will normally give favorable consideration to a request for an extension of this time limit.

Your signature below, as permittee, indicates that you accept and agree to comply with the terms and conditions of this permit.

**CYNTHIA
BROOKS**

Digitally signed by CYNTHIA
BROOKS
Date: 2026.06.25 18:01:02
-04'00'

June 25, 2026

(Permittee)

(Date)

This permit becomes effective when the Federal official, designated to act for the Secretary of the Army, has signed below.



June 26, 2026

(District Engineer)

(Date)

When the structures or work authorized by this permit are still in existence at the time the property is transferred, the terms and conditions of this permit will continue to be binding on the new owner(s) of the property. To validate the transfer of this permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below.

(Transferee)

(Date)

Special Conditions (continued from page 2):

4. The permittee shall use clean predominantly coarse sand from an upland source as the capping material.
5. The permittee shall perform turbidity monitoring in accordance with the Water Quality Monitoring Plan which is Appendix D to the enclosed "Biological and Essential Fish Habitat Assessment, National Marine Fisheries Service" document which has a final revised date of March 2026. In accordance with the contingency plan section, remedial actions will begin when turbidity levels exceed 20 nephelometric turbidity units (NTUs) above the reference value and turbidity levels will not exceed 35 NTUs above the reference value. Remedial actions to be considered for exceedances include stopping work while turbidity settles and the water column clears, deployment of localized curtains around the broadcaster (i.e., a moon pool) for turbidity control immediately surrounding the broadcaster, or other methods that are protective of the environment and feasible given weather and other conditions. If the permittee deploys a localized turbidity curtain around the broadcaster, a qualified biologist familiar with identification of federally listed species in the action area (or on-site personnel trained by the qualified biologist) will be present to monitor the site the whole time the curtain is deployed. The biologist will notify construction crews of corrective measures to be taken to minimize the potential for individual fish or schools of fish to be impacted by the curtain. In the unlikely event that the biologist observes a federally listed fish species in the action area, the permittee shall cease work until the fish has left the vicinity of its own accord. If the biologist observes any interaction between construction equipment and a federally listed species, the permittee will contact the Corps and the National Marine Fisheries Service (NMFS) within 24 hours.
6. If access is needed to East Cove 3 from Orrington Picnic Park or the staging area in the form of a gangway or stairs to be placed below the mean high water line of the Penobscot River, the structure must be the shortest needed to provide access, must not pose any navigational hindrance, and must be removed immediately when no longer needed.
7. The permittee shall use a NMFS-approved fish screen on any water intake structure prior to placing it in the Penobscot River.
8. The permittee shall minimize the use of construction equipment within tidal wetlands outside the TLC Pilot Area to the maximum extent practicable.
9. The permittee shall not use tracked vehicles on the mudflat or in tidal wetlands.
10. The capping work will generally be performed in accordance with the means and methods outlined in the enclosed "Biological and Essential Fish Habitat Assessment, National Marine Fisheries Service."
11. In order to limit impacts to federally listed threatened and endangered fish species and their critical habitat in the action area as well as to essential fish habitat, the permittee will comply with the measures outlined in the "Avoidance, Minimization, and Conservation Measures" which is Chapter 6 of the enclosed "Biological and Essential Fish Habitat Assessment, National Marine Fisheries Service."
12. In order to assess the effectiveness and stability of the thin layer cap placement along with any associated environmental impacts and recovery, the permittee shall monitor the cap placement in accordance with the enclosed "Performance Monitoring Plan" which was submitted as Appendix B to the "Biological and Essential Fish Habitat Assessment, National Marine Fisheries Service" which had a final revised date of March 2026. The following modifications and/or additions will be made to the performance monitoring plan:
 - a) Vegetated wetland area assessment- Prior to cap placement, the permittee shall perform a wetland delineation to establish the acreage of the tidal wetland area within the TLC Pilot Area and will use Global Positioning System (GPS) technology to document the location of the boundaries. The permittee will identify and estimate the percent cover of each species of plant within the delineated wetland that comprises at least 5% cover. The permittee shall further assess the vegetation using transects every 50 feet along the approximately 550-foot-long swath of shoreline adjacent to the tidal wetland in the TLC Pilot Area. These transect lines shall be GPS located so that they can be analyzed annually post-construction. Along each transect line, the permittee will randomly choose a one meter squared plot for vegetation sampling. Within this one meter squared quadrat, the permittee will identify each species present as well as the number of stems of each species. The permittee will also note the health and average height of the plants.

These procedures will be repeated in years 1, 2, 3, and, in the final year of performance monitoring in both the tidal wetland impact area and the tidal wetland control area once the cap has been installed. If any areas of the capped mudflat begin to colonize with wetland species, the permittee will add these to the annual vegetated wetland assessment area. In the final year of monitoring, the permittee will delineate the wetlands as well as the mudflat to see if any conversion from mudflat to wetlands has occurred. Annual reports with photographs will be submitted to the Corps and the Environmental Protection Agency (EPA).

Contingency- If the tidal wetlands have not returned to 80% of their original percent cover by native non-invasive wetland plants by the final year of monitoring, the permittee must submit a compensatory mitigation plan to the Corps for review and approval. The required compensatory mitigation must align with the New England District Compensatory Mitigation Standard Operating Procedures dated April 26, 2024, and could consist of on-site measures, a payment to the Maine In Lieu Fee program, or a combination of both. The requirement for compensatory mitigation will not be considered fulfilled until the Corps informs the permittee in writing that this requirement has been met.

b) Invasive species control- Prior to cap placement the permittee will perform a baseline assessment of the plant species within the current tidal wetland to be impacted by the cap and the current tidal wetland control area within the TLC Pilot Area to assess and document the presence of both native and non-native species. Tidal wetland areas adjacent to the TLC Pilot Area may also be evaluated to identify whether invasive species are present on and may spread from adjacent properties to the TLC Pilot Area. A list of Invasive and Other Unacceptable Plant Species is enclosed and is Appendix K of the New England District Compensatory Mitigation Standard Operating Procedures. In years 1, 2, and 3 after cap installation and in the final year of monitoring the permittee will actively control the introduction and/or spread of common reed (*Phragmites australis*) and tall pepperwort (*Lepidium latifolium*) within the tidal wetlands within TLC Pilot Area and within the capped mudflat if vegetation from the TLC Pilot Area begins to colonize these areas during the performance monitoring period. If these species colonize the tidal wetlands or mudflat within the TLC Pilot Area after the capping has been performed or already exist prior to the capping but spread after the work is complete, the permittee shall remove them via mechanical means and dispose of them appropriately in uplands. In addition, if any other species on the list of Invasive and Other Unacceptable Plant Species colonizes the wetlands or mudflat after the capping is completed or exists prior to the capping work and spreads to more than 5% cover after the authorized work has been completed, the permittee shall utilize mechanical control methods to remove the non-native plants and to dispose of them appropriately in an upland location.

c) Cap thickness assessment- The permittee shall perform a pre-construction elevational survey of the TLC Pilot Area as well as a post-construction as-built survey once capping has been completed. These surveys, along with confirmation cores collected during construction, will be used to determine the cap thickness achieved in the impact areas. The pre and post construction surveys will be submitted to the Corps within 90 days of cap installation along with any other information useful in determining the cap thickness achieved during the authorized work. The permittee shall also measure the cap thickness in years 1, 2, 3, and in the final year of performance monitoring to assist in assessing changes to the cap thickness. In addition, the permittee will perform an elevational survey in year 1 and in the final year of monitoring to show changes to the substrate elevation.

d) Benthic community recolonization and aquatic resource functions and values- In accordance with the performance monitoring plan, the permittee shall assess recovery of the capped areas annually via benthic surveys and vegetated tidal wetland aquatic resource functions and values assessments. If the Corps determines that adequate recovery has not occurred within the capped areas by the final year of monitoring, the permittee must submit a compensatory mitigation plan to the Corps for review and approval. The required compensatory mitigation must align with the New England District Compensatory Mitigation Standard Operating Procedures and could consist of on-site measures, a payment to the Maine In Lieu Fee program, or a combination of both. The requirement for compensatory mitigation will not be considered fulfilled until the Corps informs the permittee in writing that this requirement has been met.

e) Reports- The permittee will submit an initial report with the baseline assessments and then annual reports to the Corps and EPA assessing each of these four topics (vegetated wetland area assessment, invasive species control, cap thickness, and benthic community recolonization and aquatic resource functions and values). The reports should be marked with the title "Permit No. NAE-2023-00413 Greenfield Penobscot Estuary Remediation Trust TLC Pilot Project" and should be submitted by December 31st of each year. The reports should indicate the monitoring year plus which report is being submitted (baseline, Year, 1, etc.). The reports should be submitted digitally to the Corps at cenae-r@usace.army.mil and to the EPA at R1_CWA404_REG@epa.gov. Documents which are not marked and addressed in this manner may not reach their intended destination and do not comply with the requirements of this permit.

f) Length of Monitoring- A minimum of three years of annual monitoring will be required and monitoring will generally be required in years 1, 2, 3, and 5. However, if the mudflat and wetland recovery metrics have been met by the end of year 3 and invasive species have been adequately controlled, the permittee can submit a written request to the Corps to terminate the annual monitoring program early. Monitoring will continue through Year 5 unless the Corps responds in writing indicating that the recovery metrics have been met, invasive species control is complete, and no further monitoring is required.

[illegible]

STATE OF MAINE
STEPHEN J. BENTSEN
No. 15724
PROFESSIONAL ENGINEER
December 31, 2024



A horizontal number line representing distance in miles. It has three tick marks labeled 0, 0.25, and 0.5. Below the line, a bracket spans from 0 to 0.5, with the word "Mile" centered underneath it.

LIST OF DRAWINGS	
SHEET	TITLE
G-001	TITLE SHEET AND DRAWING INDEX
G-002	LEGEND AND NOTES
C-001	UPLAND STAGING AND SUPPORT AREA DETAILS
C-101	CAPPING PLAN
C-102	CROSS-SECTIONS (SHEET 1 OF 2)
C-103	CROSS-SECTIONS (SHEET 2 OF 2)



integral
consulting inc.

PROJECT LOCATION:

THE SITE IS LOCATED AT 44°43'13" NORTH LATITUDE
AND 68°49'49" WEST LONGITUDE IN ORRINGTON,
PENOBSCOT COUNTY, MAINE

ORRINGTON		ME
DRN	EB	DATE 12-31-2024
DES	JS	DATE 12-31-2024
CHK	SB	DATE 12-31-2024

TITLE SHEET AND DRAWING INDEX

SHEET

G-001

OF **6** REV **0**

LEGEND

 CAPPING LIMITS
 EXISTING ELEVATION CONTOUR
 EXISTING TRIBUTARY

ABBREVIATIONS

FT	FEET
TBD	TO BE DETERMINED
TY	TYPICAL

GENERAL NOTES:

THESE GENERAL NOTES SHALL APPLY TO ALL SITE ACTIVITIES. ANY CONFLICTS BETWEEN THE GENERAL NOTES, SPECIFIC NOTES IN DRAWINGS, AND/OR CONSTRUCTION OR MATERIAL SPECIFICATIONS WITHIN DRAWINGS AND CONTRACT DOCUMENTS SHALL BE RESOLVED AFTER SUBMITTAL BY THE CONTRACTOR TO THE OWNER'S REPRESENTATIVE A REQUEST FOR INFORMATION (RFI).

PROJECT NAME: THIN LAYER CAP PILOT ORRINGTON REACH CAPPING
REMEDY

OWNER: GREENFIELD PENOBSCOT ESTUARY REMEDIATION TRUST LLC,
TRUSTEE FOR PENOBSCOT ESTUARY MERCURY REMEDIATION TRUST

OWNER'S REPRESENTATIVE: TBD

ENGINEER: INTEGRAL CONSULTING INC
45 EXCHANGE ST, SUITE 200
PORTLAND, ME 04101
WWW.INTEGRAL-CORP.COM

CONSTRUCTION QUALITY ASSURANCE (CQA) REPRESENTATIVE: TBD

CONTRACTOR: TBD

PROPERTY DESCRIPTION:
THE SITE IS LOCATED AT 44°43'13" NORTH LATITUDE AND 68°49'49" WEST
LONGITUDE IN ORRINGTON, PENOBSCOT COUNTY, MAINE

TOPOGRAPHIC SURVEY BY: USGS 3DEP - 2021-2022 MIDCOAST MAINE LIDAR STUDY

BATHYMETRIC STUDY BY: 2023 MULTIBEAM BATHYMETRIC SURVEY, JUNE 2023
WSP

SURVEY DATUMS:

- STATE PLANE MAIN EAST
- HORIZONTAL DATUM: NAD83 (2011)
- VERTICAL DATUM: NAVD88
- US SURVEY FEET

1. UNLESS EXPLICITLY STATED OTHERWISE, THE CONTRACTOR SHALL PERFORM ALL WORK AS DETAILED IN THE PROJECT'S CONSTRUCTION DRAWINGS AND CONTRACT DOCUMENTS WITHIN THE AWARDED CONTRACT PRICE AND CONTRACT TIME.
2. ALL CONSTRUCTION AND MATERIALS SHALL BE IN COMPLIANCE WITH THE LATEST APPLICABLE LOCAL, STATE, AND FEDERAL REQUIREMENTS.
3. THE CONTRACTOR SHALL HAVE A MINIMUM OF ONE (1) COPY OF THE FINAL PLANS AND ONE (1) COPY OF ANY PERMITS AND ACCESS AGREEMENTS AT THE JOB SITE AT ALL TIMES.
4. THE CONTRACTOR SHALL HAVE A RESPONSIBLE PARTY ON THE PROJECT SITE DURING ALL WORK HOURS WHO SHALL HAVE THE AUTHORITY TO REPRESENT AND ACT FOR THE CONTRACTOR.
5. THE CONTRACTOR SHALL NOT DISTURB OR PLACE MATERIAL BEYOND THE LIMITS OF THE CAP PLACEMENT AREA WITHOUT THE WRITTEN PERMISSION OF THE OWNER'S REPRESENTATIVE.
6. THE CONTRACTOR SHALL WITHIN 30 DAYS OF PROJECT COMPLETION, REMOVE ALL DEBRIS, AND/OR COMBUSTIBLE MATERIALS. MATERIALS MAY NOT BE STORED, SOLD, AND/OR BURNED ON THE SITE UNLESS APPROVED BY OWNER'S REPRESENTATIVE.
7. THE CONTRACTOR SHALL CONDUCT ACTIVITIES IN SUCH A MANNER TO ENSURE MINIMUM INTERFERENCE WITH ROADS, STREETS, AND OTHER ADJACENT FACILITIES.
8. CONSTRUCTION ACTIVITIES WILL BE LIMITED TO THE HOURS OF 7:00 A.M. TO 7:00 P.M. ON WEEKDAYS. NOISE-INTENSIVE ACTIVITIES WILL NOT BEGIN BEFORE 8:00 A.M.
9. IN ACCORDANCE WITH MAINE STATUTE TITLE 23, SECTION 3360-A: PROTECTION OF UNDERGROUND FACILITIES AND AS REQUIRED BY THE MAINE PUBLIC UTILITIES COMMISSION UNDER THE CODE OF MAINE RULES 65-407 CHAPTER 895: UNDERGROUND FACILITY DAMAGE PREVENTION REQUIREMENTS, THE CONTRACTOR SHALL PROVIDE NOTICE TO UTILITIES WHICH OWN UNDERGROUND FACILITIES IN THE AREA OF GROUND PENETRATING WORK. THE CONTRACTOR SHALL NOTIFY DIG SAFE PRIOR TO THE BEGINNING OF CONSTRUCTION BY CALLING 811, AND SHALL ADDITIONALLY NOTIFY ANY NON-MEMBER OPERATORS IN THE AREA OF THE EXCAVATION, A MINIMUM OF THREE (3) FULL BUSINESS DAYS PRIOR TO LAND DISTURBANCE. THE NOTIFICATION SHALL NOT BE PROVIDED MORE THAN THIRTY (30) DAYS PRIOR TO THE BEGINNING OF LAND DISTURBANCE WORK. THE CONTRACTOR SHALL PROVIDE THE 811 TICKET AND ANY UPDATES TO THE OWNER'S REPRESENTATIVE THE NEXT BUSINESS DAY FOLLOWING RECEIPT.
10. THE CONTRACTOR SHALL REPAIR OR REPLACE ALL EXISTING FACILITIES DAMAGED OR DISTURBED BY THE CONTRACTOR'S EQUIPMENT TO LIKE OR BETTER CONDITION AT NO ADDED COST. CONTRACTOR ASSUMES FULL RESPONSIBILITY FOR PROTECTION OF EXISTING FACILITIES FROM DAMAGE DUE TO CONTRACTOR'S OPERATIONS.
11. THE INSPECTION OF, OR FAILURE TO INSPECT, ANY MATERIALS OR WORKMANSHIP SHALL IN NO WAY RELIEVE THE CONTRACTOR OF ITS RESPONSIBILITY TO PERFORM THE WORK IN ACCORDANCE WITH APPLICABLE DRAWINGS, CONTRACT DOCUMENTS, AND REGULATIONS.
12. THE CONTRACTOR SHALL NOTIFY THE OWNER'S REPRESENTATIVE IN WRITING OF ANY ACCIDENTS AND RELATED CLAIMS.
13. ALL TRUCKS HAULING WASTE DEBRIS MATERIALS OFFSITE SHALL UTILIZE TARPS.
14. TRACKING, DROPPING, OR DEPOSITING OF MATERIAL ONTO OWNER, CITY, COUNTY, OR STATE ROADWAYS, OR PAVED PARKING AREAS BY OR FROM ANY VEHICLE IS PROHIBITED. ANY INADVERTENTLY SPILLED MATERIAL SHALL BE CLEANED UP IMMEDIATELY BY THE CONTRACTOR.

15. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ENSURING THAT HAUL TRUCKS ONLY TRAVEL ON THE SPECIFIC ROADWAYS ALLOWED IN THE APPROVED TRAFFIC CONTROL PLAN.

SITE SAFETY

1. THE CONTRACTOR AND ALL SUBCONTRACTORS SHALL DESIGNATE AN INDIVIDUAL RESPONSIBLE FOR CONSTRUCTION SITE SAFETY DURING THE COURSE OF THE WORK.
2. THE 40-HOUR OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) HAZARDOUS WASTE OPERATIONS AND EMERGENCY RESPONSE (HAZWOPER) TRAINING, WITH CURRENT ANNUAL 8-HOUR REFRESHER, IS REQUIRED FOR ALL ONSITE WORKERS AND OTHER WORKERS WITH POTENTIAL FOR HANDLING OF OR EXPOSURE TO CONTAMINATED MATERIALS, WITH THE EXCEPTION OF TRUCK DRIVERS AND SURVEYORS (UNLESS THEIR ACTIVITIES REQUIRE POTENTIAL EXPOSURE TO CONTAMINATED MATERIALS).
3. THE CONTRACTOR SHALL PROCEED WITH ALL OPERATIONS IN A SYSTEMATIC AND SAFE MANNER FOLLOWING ALL APPLICABLE OSHA REQUIREMENTS TO ENSURE THE SAFETY OF THE PUBLIC, THE CONTRACTOR, AND THE CONTRACTOR'S PERSONNEL.

MAPPING AND RECORD DRAWINGS

1. THE CONTRACTOR SHALL VERIFY ALL FIELD DIMENSIONS SHOWN ON THE DRAWINGS AND SHALL NOTIFY THE OWNER'S REPRESENTATIVE OF ANY DISCREPANCIES REQUIRING CORRECTIVE ACTION PRIOR TO PROCEEDING WITH WORK.
2. RECORD DRAWINGS: THE CONTRACTOR SHALL MAINTAIN A LEGIBLE SET OF AS-BUILT DRAWINGS THROUGHOUT THE PROJECT TO BE FINALIZED AND TRANSFERRED TO THE OWNER'S REPRESENTATIVE AT CONTRACT COMPLETION. ALL ENTRIES ON THE AS-BUILT DRAWINGS SHALL BE DATED AND INITIALED. THERE SHALL BE A SET OF "RED-LINED" DRAWINGS DETAILING ALL CONSTRUCTION DEVIATIONS, INCLUDING DIMENSION/LOCATION CHANGES, CONFIGURATION CHANGES, AND SUBSTITUTIONS OF MATERIAL AND EQUIPMENT.
3. IF IT IS DISCOVERED THAT FIELD CONDITIONS DIFFER FROM CONDITIONS INDICATED ON THE DRAWINGS, THE CONTRACTOR SHALL PROVIDE WRITTEN NOTICE TO THE OWNER'S REPRESENTATIVE THAT DESCRIBES THE DISCREPANCY AND SHALL NOT PROCEED WITH CONSTRUCTION UNTIL THE DISCREPANCY IS EVALUATED AND A COURSE OF ACTION DEFINED. ANY WORK PERFORMED BY THE CONTRACTOR, WITHOUT APPROPRIATE REVIEW AND EVALUATION, SHALL BE PERFORMED "AT RISK" WITH NO LIABILITY TO THE OWNER, OWNER'S REPRESENTATIVE, ENGINEER, CQA REPRESENTATIVE, OR OTHER PROJECT REPRESENTATIVES.
4. UNAUTHORIZED DRAWING CHANGES AND USES: THE ENGINEER PREPARING THESE DRAWINGS WILL NOT BE RESPONSIBLE FOR UNAUTHORIZED USES OF OR CHANGES TO THE DRAWINGS. THE DRAWING NOTES AND TYPICAL DETAILS SHALL APPLY UNLESS SPECIFICALLY STATED OR SHOWN OTHERWISE. CONSTRUCTION DEVIATIONS FROM THE DRAWINGS MUST BE REVIEWED BY THE ENGINEER AND APPROVED BY THE OWNER'S REPRESENTATIVE.
5. ALL WORK SHALL BE COMPLETED UNDER THE APPROVAL AND TO THE SATISFACTION OF THE OWNER'S REPRESENTATIVE. ALL WORK SHALL CONFORM TO THESE DRAWINGS AND ACCOMPANYING CONTRACT DOCUMENTS. INCONSISTENCIES BETWEEN THE DRAWINGS AND CONSTRUCTION CONTRACT DOCUMENTS SHALL IMMEDIATELY BE BROUGHT TO THE ATTENTION OF THE OWNER'S REPRESENTATIVE.

CODES AND STANDARDS

1. ALL WORK SHALL CONFORM WITH THE LATEST EDITIONS OF THE CONTRACT DOCUMENTS, INCLUDING ALL REFERENCED CODES, STANDARDS, AND STATE AND LOCAL REGULATORY REQUIREMENTS.
2. THE CONTRACTOR SHALL CONFORM TO ALL PERMITS REQUIRED TO COMPLETE THE CONTRACT AND WILL REQUEST AND RECEIVE ALL REQUIRED INSPECTIONS. A COPY OF ALL PERMITS AND INSPECTION REPORTS SHALL BE SUBMITTED TO THE OWNER'S REPRESENTATIVE.

SITE CONTROLS

1. THE CONTRACTOR SHALL ESTABLISH STAGING AREAS PRIOR TO STARTING THE WORK. STAGING AREAS MUST BE REVIEWED BY THE ENGINEER AND APPROVED BY THE OWNER'S REPRESENTATIVE.
2. THE CONTRACTOR SHALL PROVIDE BARRICADES, FENCING, AND OTHER REQUIRED EQUIPMENT TO PREVENT UNAUTHORIZED PROJECT SITE ACCESS IN CONSTRUCTION AREAS AND OTHER AFFECTED WORK ZONES. SITE CONTROLS SHALL BE MAINTAINED THROUGHOUT THE WORK.

CONSTRUCTION WORK PLAN

1. EACH CONTRACTOR SHALL SUBMIT A CONSTRUCTION WORK PLAN ACCORDING TO THE SCHEDULE PROVIDED IN THE CONTRACT DOCUMENTS. THE CONSTRUCTION WORK PLAN SHALL PROVIDE DETAILED AND SPECIFIC PROCEDURES, METHODS, AND LAYOUTS FOR ACCOMPLISHMENT OF THE WORK AS SPECIFIED AND DELINEATED IN THE CONTRACT DOCUMENTS.
2. SUBMITTAL CONTROL LOG - THE SUBMITTAL CONTROL LOG SHALL INCLUDE A LISTING OF BID ITEMS FOR WHICH SUBMITTALS FOR ENGINEER REVIEW AND OWNER'S REPRESENTATIVE APPROVAL ARE REQUIRED. THE SUBMITTAL CONTROL DOCUMENT SHALL INCORPORATE REVIEW SCHEDULE PROVIDED IN CONTRACT DOCUMENTS. THE SUBMITTAL CONTROL DOCUMENT SHALL INCLUDE THE FOLLOWING:

- A. BID ITEM THAT THE SUBMITTAL REPRESENTS.
- B. CONTRACTOR SUBMITTAL IDENTIFICATION NUMBER.
- C. IDENTIFICATION OF ITEMS THAT ARE "OR EQUAL" SUBSTITUTIONS.
- D. SCHEDULED SUBMITTAL DATE.
- E. DATE WHEN BID ITEM IS NEEDED ONSITE TO MAINTAIN THE PROJECT SCHEDULE AND AVOID WORK STOPPAGE OR SLOWDOWN.

3. THE CONTRACTOR'S PROJECT APPROACH: THE CONTRACTOR'S PROJECT APPROACH SHALL DESCRIBE, IN NARRATIVE FORM, THE METHODS TO BE EMPLOYED IN THE CONSTRUCTION, INCLUDING EQUIPMENT TYPES, MODES OF OPERATION, SCHEDULES, SEQUENCE OF ACTIVITIES, PROPOSED PERSONNEL AND SUBCONTRACTORS, MATERIALS SUPPLIERS, HANDLING AND DISPOSAL METHODS, AND OTHER ASPECTS NECESSARY TO DESCRIBE HOW AND WHEN THE SPECIFIED WORK WILL BE PERFORMED. THE PLAN SHALL ALSO INCLUDE DETAILS ON HOW UTILITIES WILL BE PROTECTED AND HOW THE CONTRACTOR WILL SAFELY COMPLETE WORK ACTIVITIES DIRECTLY OVER OR BENEATH UTILITIES (IF PRESENT). DETAILS SHALL BE SUFFICIENT ENOUGH FOR THE OWNER'S REPRESENTATIVE TO FULLY EVALUATE THE UTILITY PROTECTION APPROACH.
4. TRAFFIC CONTROL PLAN: THE TRAFFIC CONTROL PLAN SHALL DETAIL HOW TRAFFIC WILL BE CONTROLLED, HOW FLAGGERS WILL BE USED, AND WHAT EFFORTS ARE BEING MADE TO MINIMIZE IMPACTS TO ROADWAY TRAFFIC OR ON THE COMMUNITY.
5. SITE-SPECIFIC CONSTRUCTION HEALTH AND SAFETY PLAN (HSP): THE SITE-SPECIFIC CONSTRUCTION HSP SHALL DESCRIBE HOW THE CONTRACTOR WILL COMPLY WITH ALL STATE AND FEDERAL HEALTH AND SAFETY REQUIREMENTS, INCLUDE MAPS SHOWING EXCLUSION ZONES, DECONTAMINATION AREAS, AND WORK AREAS, AND A LIST ALL TRAINING REQUIREMENTS.

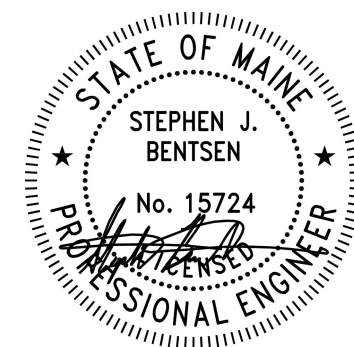
THE SITE-SPECIFIC CONSTRUCTION HSP SHALL INCLUDE THE FOLLOWING:

- A. INCORPORATE REQUIREMENTS CONTAINED IN 29 CFR. §§ 1910 AND 1926, 49 CFR. § 172.704, AND ALL OTHER APPLICABLE FEDERAL, STATE, AND LOCAL REQUIREMENTS AND INDUSTRY STANDARDS.
- B. AN IMMEDIATE INCIDENT REPORTING POLICY. ALL PERSONNEL INVOLVED IN COMPLETING THE WORK ON SITE, INCLUDING ANY SUBCONTRACTORS, MUST CERTIFY WILLINGNESS TO COMPLY WITH THE SITE-SPECIFIC CONSTRUCTION HSP.
- C. THE OWNER WILL NOT ISSUE A NOTICE TO PROCEED (NTP) UNTIL THE SITE-SPECIFIC CONSTRUCTION HSP HAS BEEN RECEIVED AND ACCEPTED BY THE OWNER. DELAY IN SUBMITTING AN ACCEPTED SITE-SPECIFIC CONSTRUCTION HSP WILL NOT CONSTITUTE GROUNDS FOR A CONTRACT SCHEDULE EXTENSION OR DELAY CLAIM. THE OWNER WILL REVIEW AND ACCEPT OR REJECT WITH WRITTEN COMMENTS ON HSPS WITHIN 14 CALENDAR DAYS.

THE SITE-SPECIFIC CONSTRUCTION HSP SHALL BE PROVIDED TO ALL SUBCONTRACTORS, AND THE CONTRACTOR SHALL OBTAIN WRITTEN ACKNOWLEDGMENT BY, ALL SUBCONTRACTORS USED IN THE COMPLETION OF THE WORK.

[illegible]

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December 31, 2024

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GREENFIELD

THIN LAYER CAP PILOT

ORRINGTON		ME
DRN	EB	DATE 12-31-2024
DES	JS	DATE 12-31-2024
CHK	SB	DATE 12-31-2024

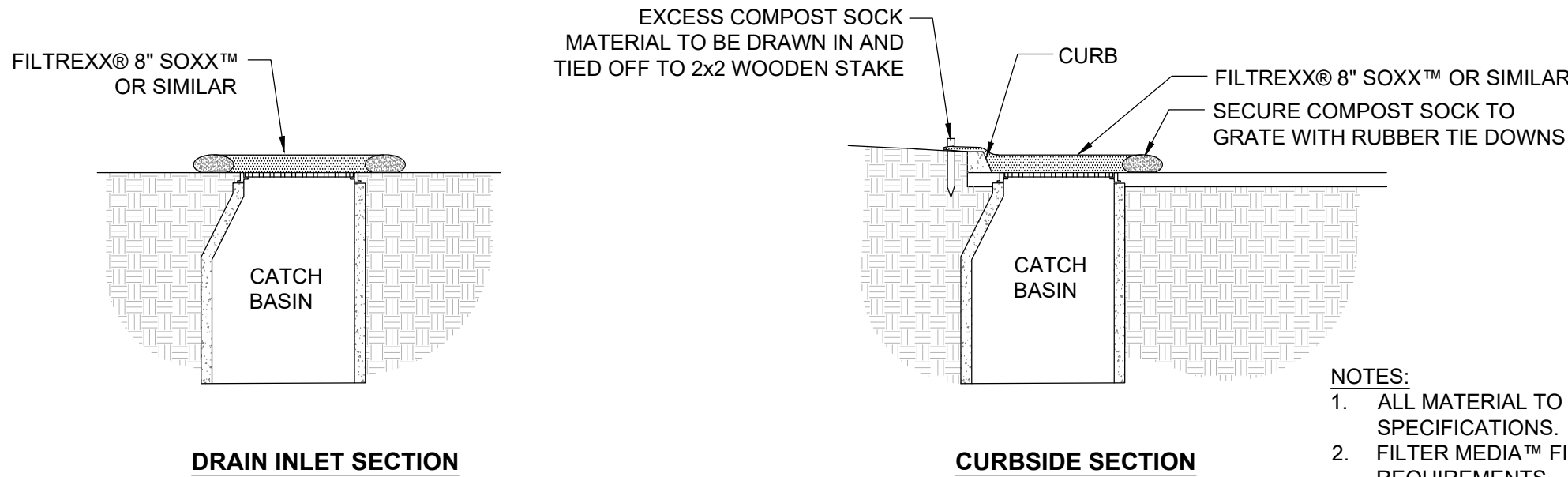
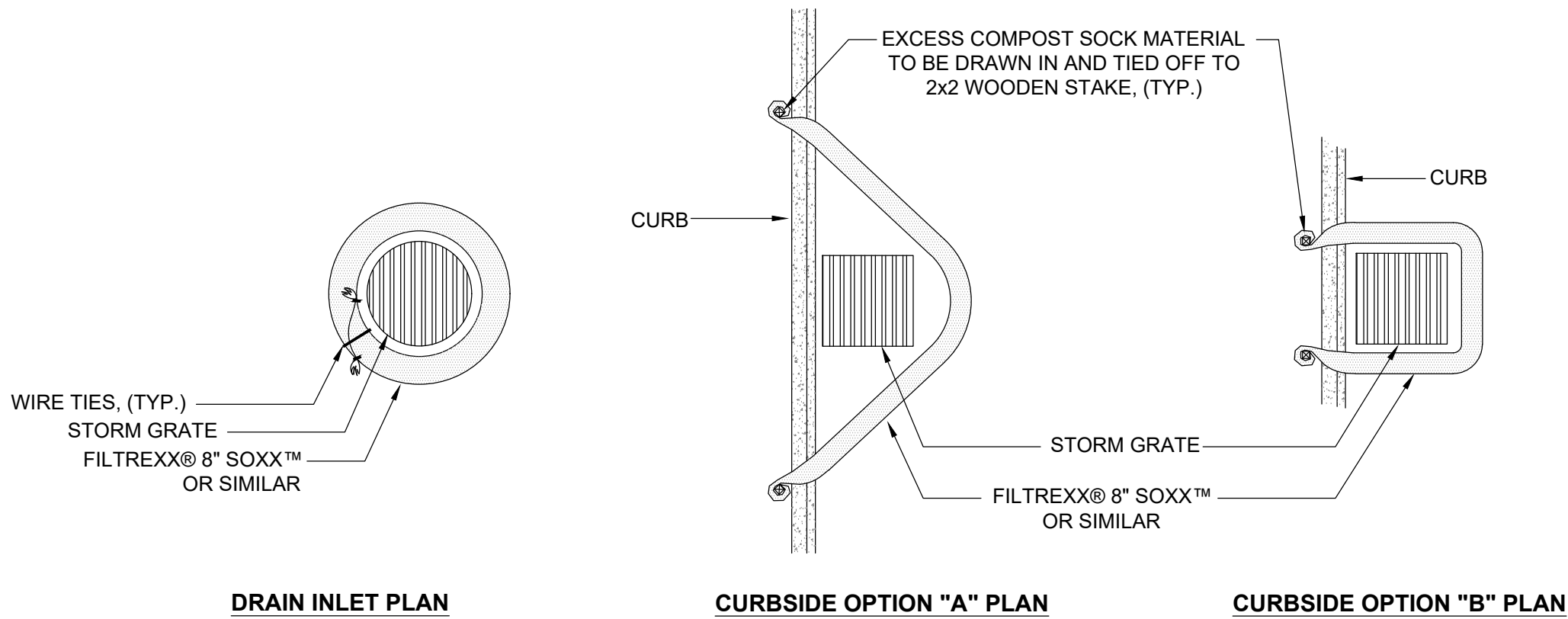
LEGEND AND GENERAL NOTES

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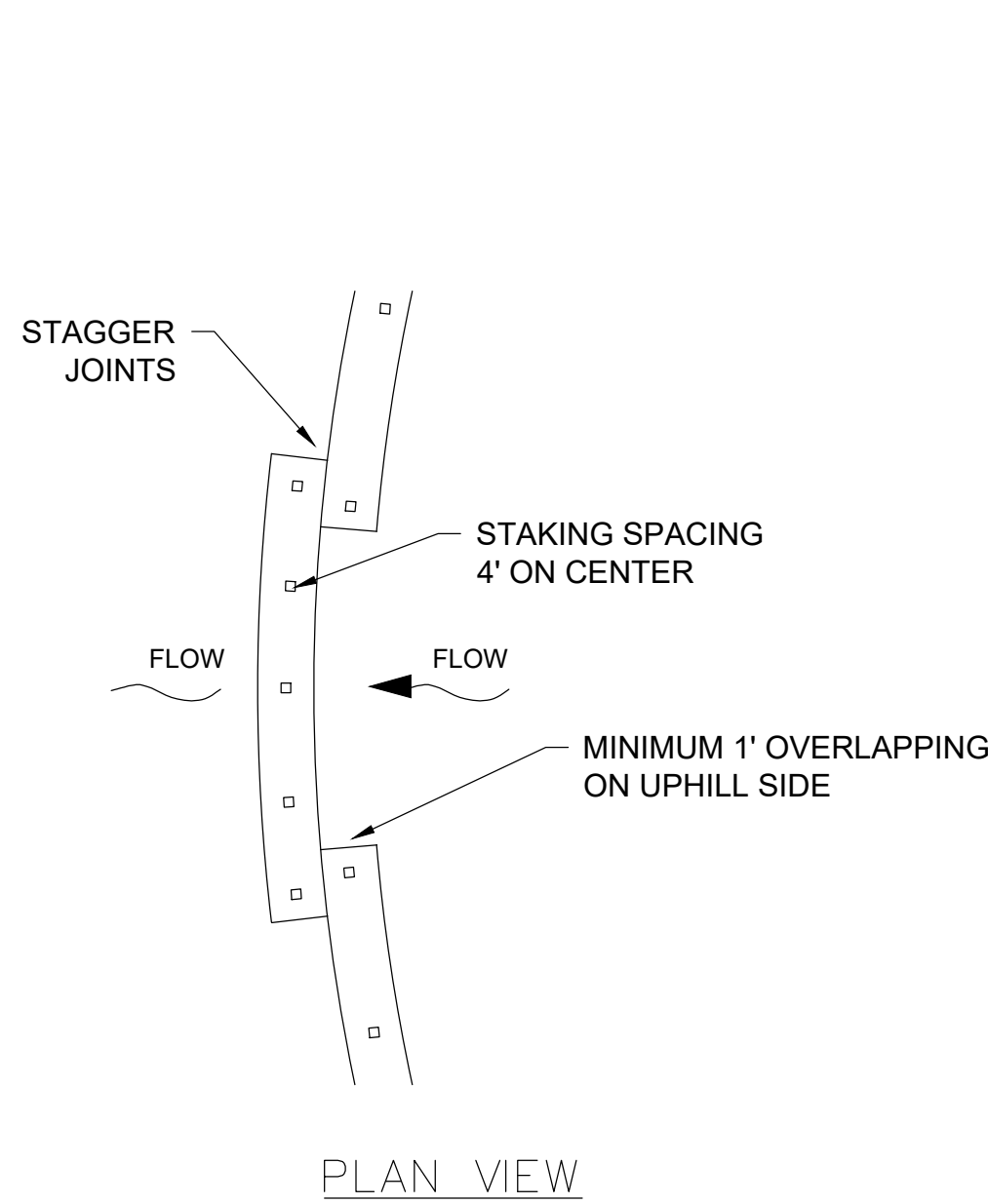
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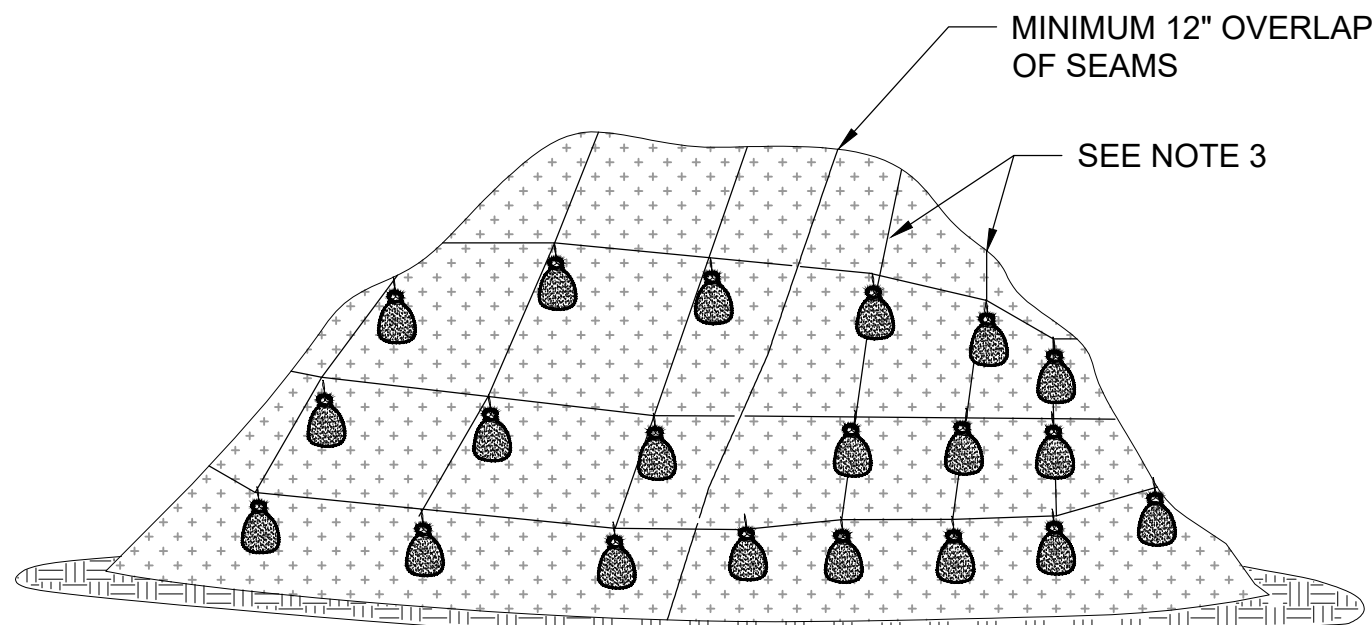


1 COMPOST SOCK INLET PROTECTION
-- NTS



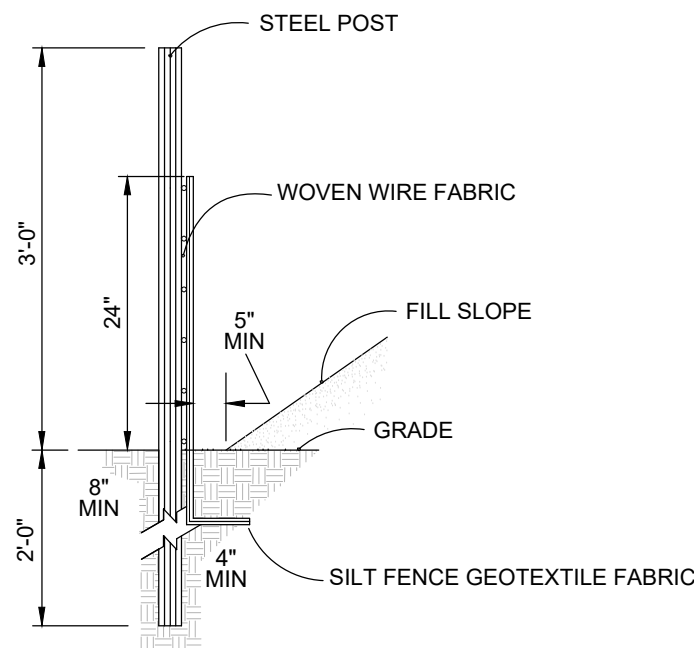
- NOTES:
- STAKING SPECIFICATIONS:
 - 1"x2" WOODEN STAKES
 - ADDITIONAL STAKES MAY BE INSTALLED ON DOWNHILL SIDE OF WATTLES, ON STEEP SLOPE OR HIGHLY ERODIBLE SOILS.
 - REMOVE ALL ROCKS, CLODS, VEGETATION OR OTHER OBSTRUCTIONS SO THAT THE INSTALLED WATTLES WILL HAVE DIRECT CONTACT WITH THE SOIL.
 - INSTALL THE WATTLES IN A 2" DEEP TRENCH, INSURING THAT NO GAPS EXIST BETWEEN THE SOIL AND THE BOTTOM OF THE WATTLE. THE ENDS OF ADJACENT WATTLES SHALL BE OVERLAPPED 1 FT. MINIMUM TO PREVENT SEDIMENT PASSING THROUGH THE FIELD JOINT.

3 STRAW WATTLE
-- NTS



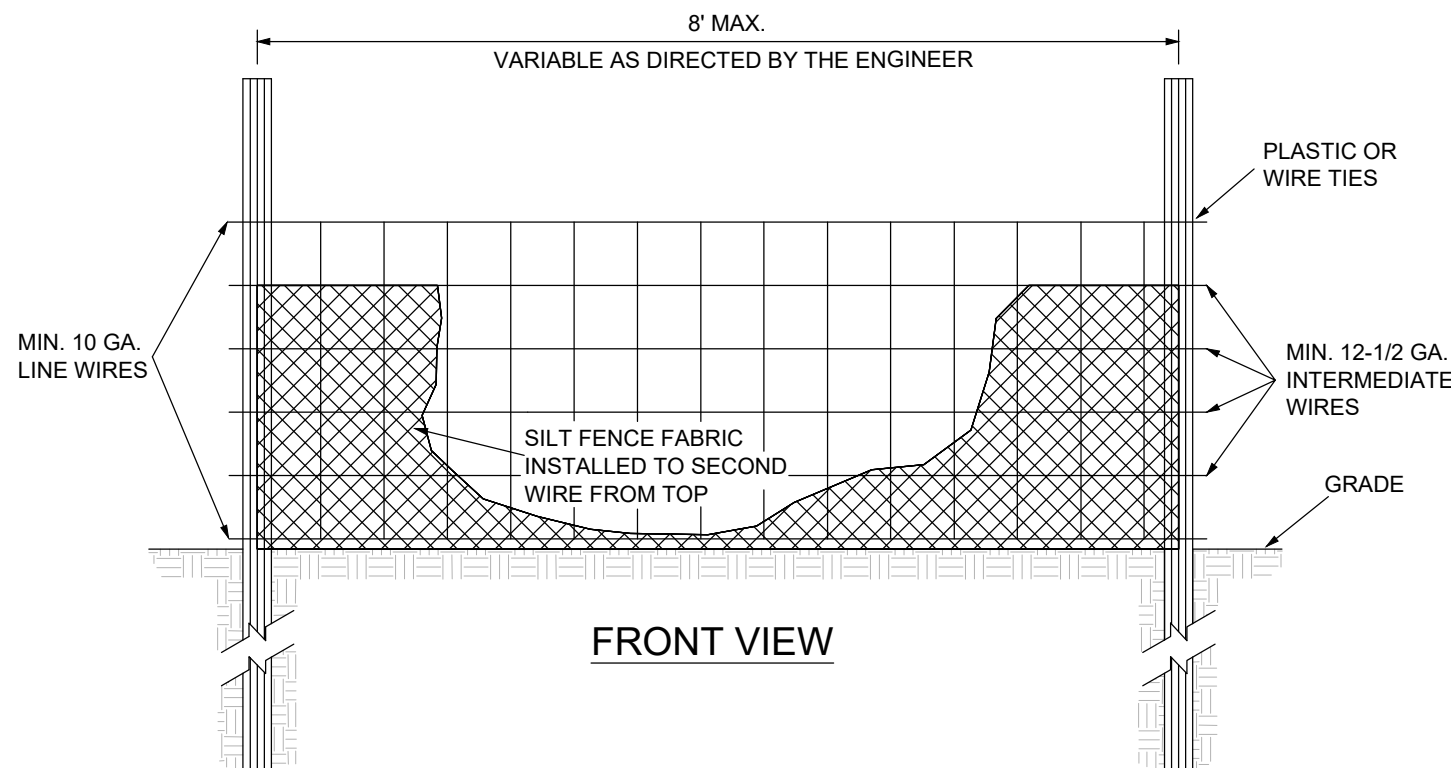
- NOTES:
- TEMPORARY STOCKPILES STORED ADJACENT TO EXCAVATIONS MAY BE COVERED WITH SHEETING AND ADDITIONAL COMPOST SOCK SEDIMENT BARRIER MAY BE INSTALLED AROUND THE STOCKPILE, IF NEEDED TO PREVENT WIND OR PRECIPITATION EROSION.
 - IF SHEETING IS USED, CONTRACTOR SHALL:
 - TEMPORARY STOCKPILES SHALL BE PLACED ON PLASTIC SHEETING.
 - PERIMETER FILTREXX® SILT SOXX™, OR SIMILAR BMP TO BE INSTALLED A MINIMUM OF 3' FROM TOE OF STOCKPILE.
 - COVERING MAINTAINED TIGHTLY IN PLACE BY USING SANDBAGS OR TIRES ON ROPES WITH A MAXIMUM 10' GRID SPACING IN ALL DIRECTIONS.
 - PLASTIC TO EXTEND MINIMUM OF 1' BEYOND TOE OF SLOPE.
 - AS APPROPRIATE, BMP'S SHALL BE INSTALLED TO CONVEY WATER DISCHARGE FROM STOCKPILE AREAS.

2 TEMPORARY STOCKPILE WITH SHEETING
-- NTS



MAINTENANCE: CLEAN OUT AT 50% CAPACITY
LIFE OF FENCING: 6-9 MONTHS

SIDE VIEW



- NOTES:
- FLOW SHALL NOT RUN PARALLEL WITH THE FENCE.
 - END OF SILT FENCE NEEDS TO BE TURNED UPHILL.
 - SEE NC DEQ SEDIMENT DESIGN MANUAL FOR CONSTRUCTION SPECIFICATIONS, WHERE PRACTICE APPLIES AND PLANNING CONSIDERATIONS.
 - SILT FENCE SHOULD NOT BE USED ALONE BELOW GRADED SLOPES GREATER THAN 10' IN HEIGHT.

4 SILT/SEDIMENT FENCE
-- NTS

APP	DESCRIPTION	DATE	REV
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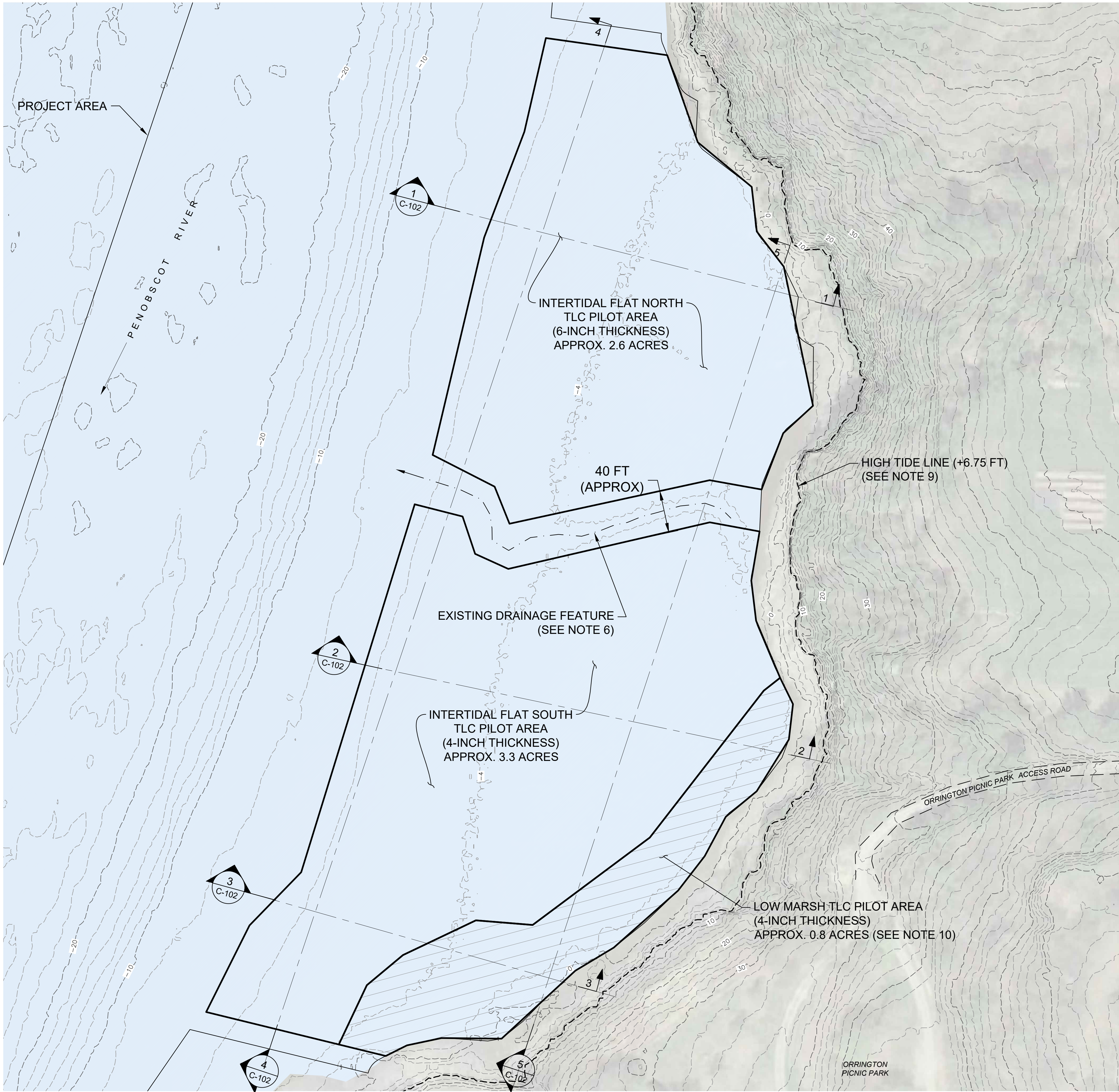
GREENFIELD
THIN LAYER CAP PILOT

ORRINGTON	ME
DRN	DATE
EB	12-31-2024
DES	DATE
JS	12-31-2024
CHK	DATE
SB	12-31-2024

UPLAND STAGING
AND SUPPORT AREA
DETAILS

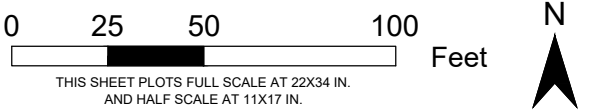
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OF 6 REV 0

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NOTES:

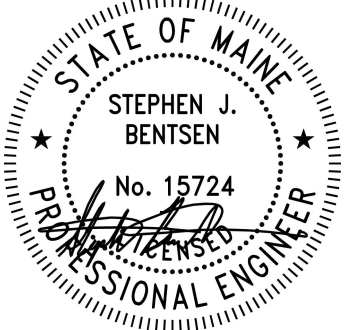
- UNLESS EXPLICITLY STATED OTHERWISE IN WRITING BY THE OWNER, THE CONTRACTOR SHALL PERFORM ALL WORK AS DETAILED IN THE PROJECT'S CONSTRUCTION DRAWINGS AND CONTRACT DOCUMENTS WITHIN THE AWARDED CONTRACT PRICE AND CONTRACT TIME.
- ALL CONSTRUCTION AND MATERIALS SHALL BE IN COMPLIANCE WITH THE LATEST APPLICABLE LOCAL, STATE, AND FEDERAL REQUIREMENTS.
- THE CONTRACTOR SHALL HAVE A MINIMUM OF ONE (1) COPY OF THE FINAL PLANS AND ONE (1) COPY OF ANY PERMITS AND ACCESS AGREEMENTS AT THE JOB SITE AT ALL TIMES.
- CAP PLACEMENT CROSS SECTIONS ARE PRESENTED ON DRAWING C-102.
- CAP THICKNESSES SHOWN ARE TARGET NOMINAL THICKNESSES ABOVE THE NATIVE SEDIMENT MATERIAL. ACCEPTANCE OF CAP THICKNESS IS SUBJECT TO THE TOLERANCES DETAILED IN THE CONSTRUCTION SPECIFICATIONS.
- THE LOCATION OF THE DRAINAGE FEATURE IDENTIFIED IN THE CAPPING PLAN IS APPROXIMATED BASED ON THE DIGITAL ELEVATION MODEL AND HISTORICAL AERIAL PHOTOGRAPHS. THE CONTRACTOR WILL BE RESPONSIBLE FOR LOCATING THIS FEATURE AS PART OF THE PRE-CONSTRUCTION SURVEY AND DOCUMENTING ITS LOCATION AND EXTENT. THE EXTENTS OF THE TLC PILOT AREA WILL BE MODIFIED TO REFLECT THE UPDATED LOCATION OF THE DRAINAGE FEATURE. AN APPROXIMATELY 20-FOOT BUFFER WITH NO CAP MATERIAL PLACEMENT WILL BE LEFT ON EITHER SIDE OF THE DRAINAGE FEATURE. IT IS ACCEPTABLE FOR SMALL AMOUNTS OF CAP MATERIAL TO ENTER THIS FEATURE IN THE PROCESS OF CONSTRUCTING THE CAP, SUBJECT TO THE JUDGMENT OF THE OWNER'S REPRESENTATIVE.
- CAP MATERIAL IS SUBJECT TO THE GRADATION AND CHEMICAL ACCEPTABILITY REQUIREMENTS DETAILED IN THE WORK DESIGN.
- CAPPING PLAN DOES NOT INCLUDE REMOVAL OF ROCKS OR OTHER DEBRIS. REQUESTS TO REMOVE ANY MATERIAL FROM THE PROJECT AREA IS SUBJECT TO REVIEW AND APPROVAL BY THE OWNER.
- HIGH TIDE LINE SHOWN CORRESPONDS TO AN ELEVATION OF 6.75 FEET NAVD88, BASED ON VISUAL OBSERVATIONS MADE ON JUNE 5, 2024.
- THE LOW MARSH TLC PILOT AREA WILL BE DIVIDED INTO TWO APPROXIMATELY 0.4-ACRE SUBAREAS. CAP MATERIAL WILL BE PLACED IN ONE SUBAREA. NO CAP MATERIAL WILL BE PLACED IN THE SECOND SUBAREA. THE CONFIGURATION OF THE TWO LOW MARSH SUBAREAS WILL BE ESTABLISHED IN THE FINAL TLC PILOT WORK DESIGN.



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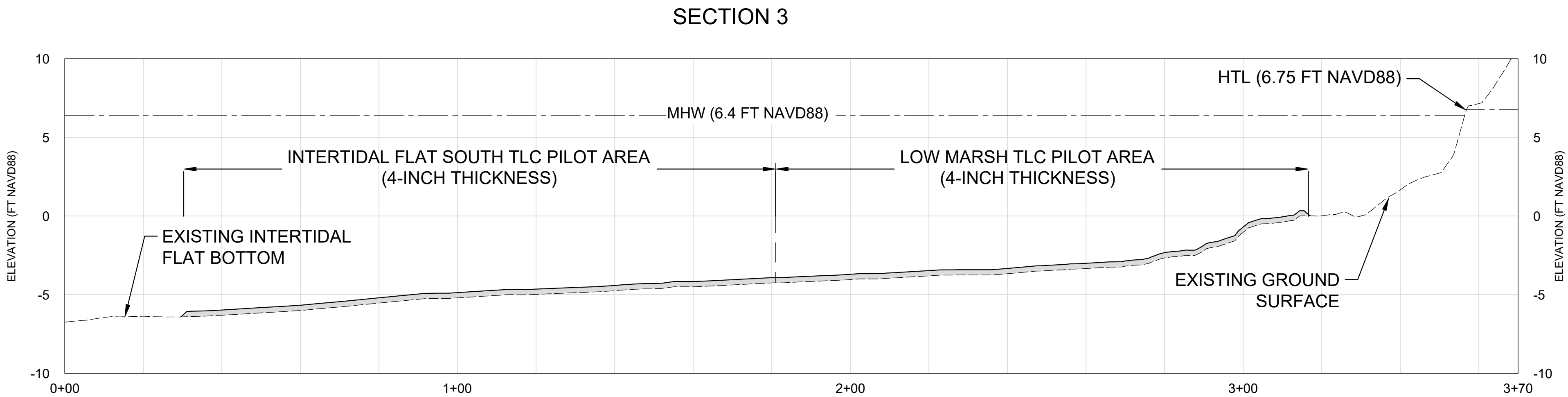
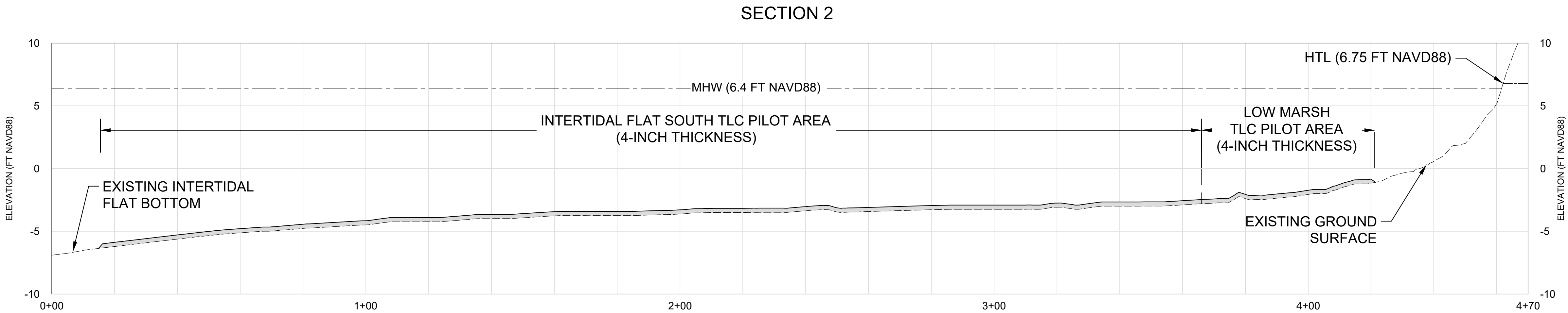
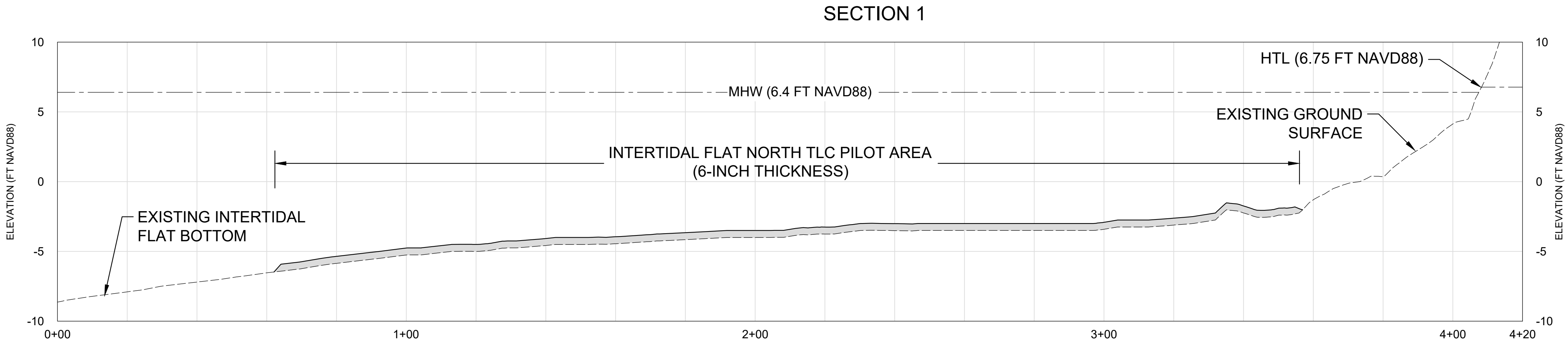
CAPPING PLAN

SHEET

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OF 6 REV 0

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0 10 20 40 Feet 4X VERTICAL EXAGGERATION
THIS SHEET PLOTS FULL SCALE AT 20X34 IN.
AND HALF SCALE AT 11X17 IN.

NOTES:

- SECTIONS INCORPORATE 4X VERTICAL EXAGGERATION.
- SLOPES SHOWN AT THE ENDS OF TLC PILOT AREA EXTENTS ARE APPROXIMATE AND REPRESENT A SLOPE THE MATERIAL WILL REACH NATURALLY UPON PLACEMENT. THE SLOPES DO NOT REPRESENT AN ENGINEERED GRADE.
- MEAN HIGH WATER (MHW) ELEVATIONS SHOWN REPRESENT THE AVERAGE OF MHW DATUMS FROM THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION BANGOR STATION (8414612) AND WINTERPORT STATION (8414781).
- HIGH TIDE LINE (HTL) SHOWN CORRESPONDS TO AN ELEVATION OF 6.75 FEET NAVD88, BASED ON VISUAL OBSERVATIONS MADE ON JUNE 5, 2024.

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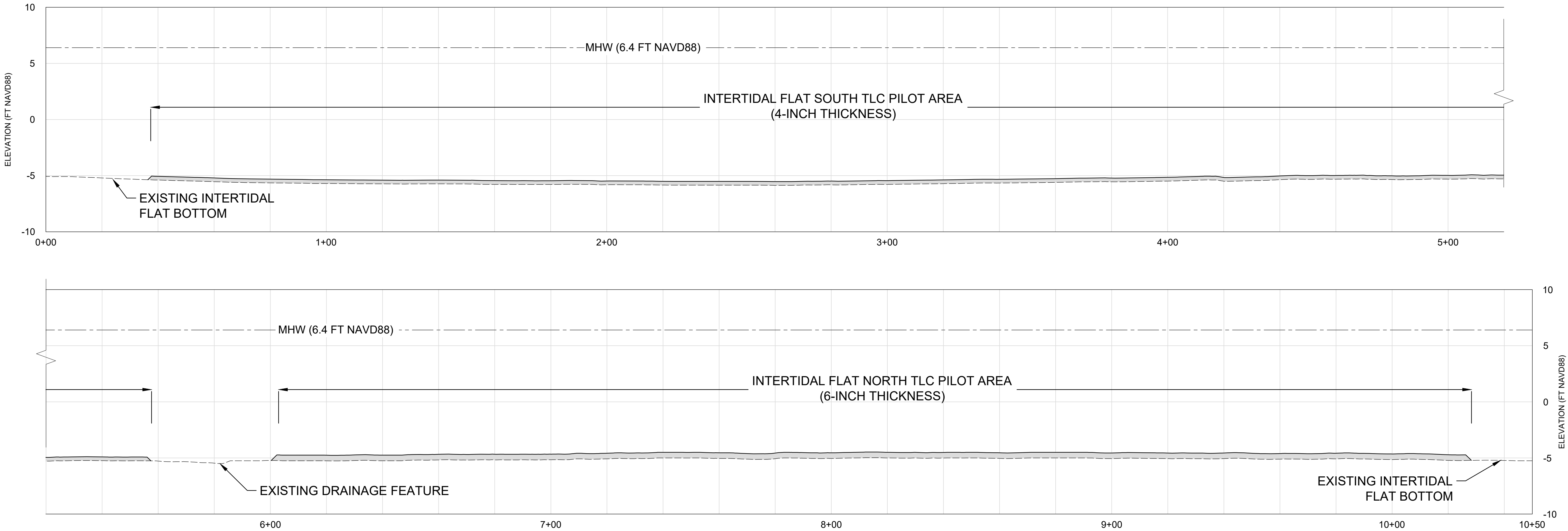
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CROSS-SECTIONS
(1 OF 2)

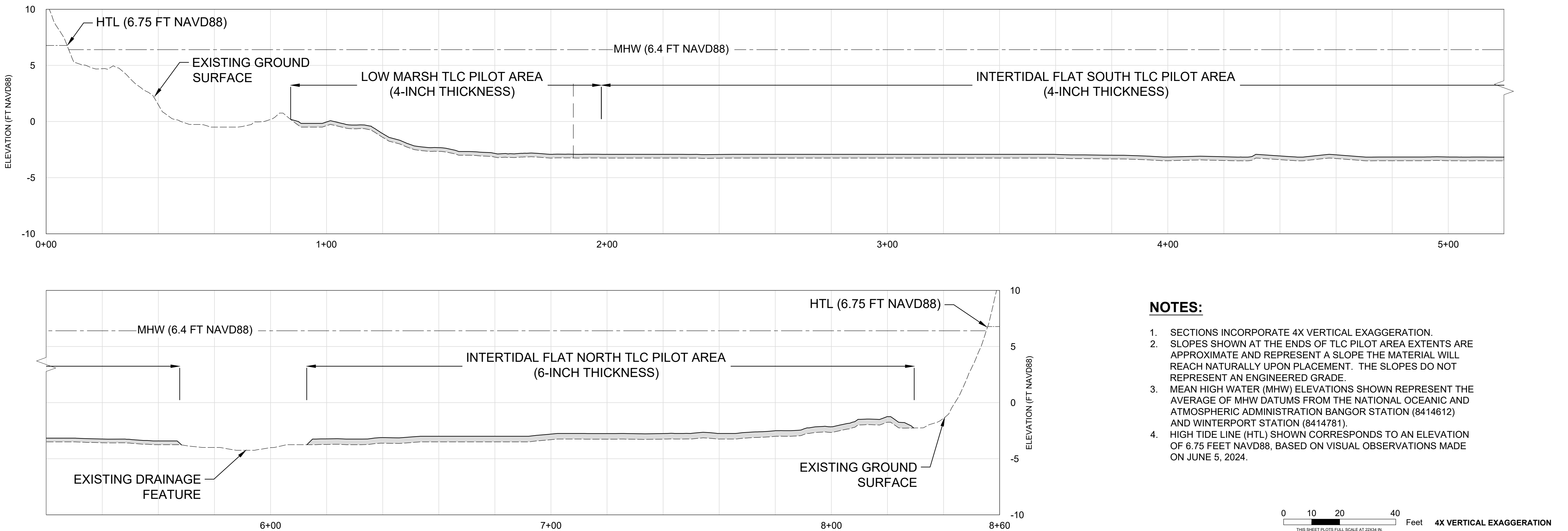
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SECTION 4



SECTION 5



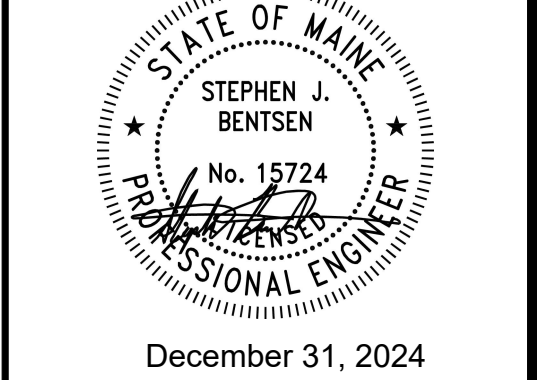
NOTES:

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0 10 20 40 Feet 4X VERTICAL EXAGGERATION

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ORRINGTON ME

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**CROSS-SECTIONS
(2 OF 2)**

SHEET

C-103

OF 6 REV 0



STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION
17 STATE HOUSE STATION AUGUSTA, MAINE 04333-0017

DEPARTMENT ORDER

IN THE MATTER OF

GREENFIELD PENOBSCOT ESTUARY	) NATURAL RESOURCES PROTECTION ACT
REMEDATION TRUST LLC	) SIGNIFICANT WILDLIFE HABITAT
Orrington, Penobscot County	) COASTAL WETLAND FILL
PENOBSCOT ESTUARY REMEDIATION	) WATER QUALITY CERTIFICATION
L-100073-4C-A-N (approval)	) FINDINGS OF FACT AND ORDER

Pursuant to the provisions of 38 M.R.S. §§ 480-A–480-JJ, Section 401 of the Clean Water Act (33 U.S.C. § 1341), and Chapters 310 and 335 of Department rules, the Department of Environmental Protection has considered the application of GREENFIELD PENOBSCOT ESTUARY REMEDIATION TRUST with the supportive data, agency review comments, public comments, and other related materials on file and FINDS THE FOLLOWING FACTS:

1. PROJECT DESCRIPTION:

A. History of Project: Mercury was illegally discharged into the Penobscot River in Orrington, Maine, by HoltraChem in the late 1960s and early 1970s. A lawsuit was filed in 2000 by Maine People's Alliance (MPA) and the Natural Resources Defense Council (NRDC) against Mallinckrodt US LLC, the remaining responsible party for the Holtrachem plant. After 22 years of negotiations and settlement discussions, a Consent Decree between MPA, NRDC, and Mallinckrodt was settled upon, and the U.S. District Court in Maine approved the multimillion-dollar settlement for the cleanup of mercury contamination in the Penobscot River Estuary (Estuary). In addition to the cleanup, the settlement includes the creation of two independent environmental response trusts with the goal to accelerate the recovery of the Estuary from the mercury discharge. MPA/NRDC and Mallinckrodt are the Beneficiaries of the two trusts. The Consent Decree requires Mallinckrodt to pay \$187 million for cleanup and other beneficial environmental projects. The settlement also provided up to \$80 million in additional contingent funding. The court appointed an independent trustee, Greenfield Penobscot Estuary Remediation Trust (Greenfield), an affiliate of Greenfield Environmental Trust Group, Inc., to implement measures identified in the Consent Decree to remediate mercury contamination in Estuary sediments. These measures include capping contaminated sediments on approximately 130 acres of intertidal flats with clean material, targeted removal of contaminated and mobile sediments, and monitoring vegetation, fish, birds, surface water, sediment, and organisms that live in sediment for the next 30 to 45 years to evaluate the recovery of the Estuary.

B. Summary: Greenfield submitted a full Natural Resource Protection Act Permit (NRPA) application for a pilot project to install a Thin Layer Cap (TLC) over approximately 6.3 acres (274,428 square feet) of intertidal sediment to help determine if the capping remedy specified in the Consent Decree is feasible, will effectively reduce

exposure to mercury, and if a TLC will protect important natural resources. Project plans submitted included a Performance Monitoring Plan (PMP). The PMP outlines pre- and post-construction monitoring for erosion and sedimentation, intertidal marsh vegetation, and benthic organisms. The pilot project site is located in one cove ("East Cove 3") off River Road in the Town of Orrington.

C. Current Use of the Site: The intertidal flat is undeveloped. The upland adjacent to the flat consists of several residential properties and the Town of Orrington Picnic Park. The abutting parcels are identified as Lots 021, 023, and 023-A on Map 005 of the Town of Orrington's tax maps.

2. EXISTING SCENIC, AESTHETIC, RECREATIONAL OR NAVIGATIONAL USES:

The Natural Resources Protection Act (NRPA), in 38 M.R.S. § 480-D(1), requires the applicant to demonstrate that the proposed project will not unreasonably interfere with existing scenic, aesthetic, recreational and navigational uses.

The proposed project is located in the Penobscot River, which is a scenic resource visited by the general public, in part, for the use, observation, enjoyment and appreciation of its natural and cultural visual qualities. This pilot project proposes capping an area of intertidal mudflats with clean sand. During installation of the cap, a barge and associated equipment will be visible at the site. The barge and associated equipment are temporary in nature and will be on site for less than 4 months. The site of the proposed thin-layer cap is located outside of the navigational channel of the river and the barge and associated equipment will not interfere with navigation. After the thin layer cap is installed, the barge and associated equipment will move from the site. The TLC on the pilot project site will not be obviously visible to the general public.

The Department determined that based on the nature of the proposed project and its location, there are no existing recreational or navigational uses of the resource that would be unreasonably impacted.

The Department finds that the proposed activity will not unreasonably interfere with existing scenic, aesthetic, recreational or navigational uses of the Penobscot River.

3. SOIL EROSION:

The NRPA, in 38 M.R.S. § 480-D(2), requires the applicant to demonstrate that the proposed project will not cause unreasonable erosion of soil or sediment nor unreasonably inhibit the natural transfer of soil from the terrestrial to the marine or freshwater environment.

Environmental controls, such as in-water turbidity controls will be deployed to minimize disturbance and movement of contaminated intertidal sediment, minimize turbidity within the water column, and prevent sedimentation and erosion from landside support areas. Monitoring of the environmental controls will be included as part of the site work to

ensure that the controls are effective in protecting natural resources and minimizing the potential for disturbance to habitat during and after the thin-layer cap is placed.

Landside staging, stockpiling, loading, and other support areas will be selected to utilize existing facilities to minimize or eliminate the need for disturbance of new areas. If soil must be disturbed to create support areas or the capping material has the potential to migrate from the support area, appropriate BMPs such as straw wattles, silt fence, or similar controls will be placed downgradient to limit erosion and prevent migration of materials off site or into water resources.

The Department finds that the activity will not cause unreasonable erosion of soil or sediment and will not unreasonably inhibit the natural transfer of soil from terrestrial to the marine or freshwater environment.

4. HABITAT CONSIDERATIONS:

The NRPA, in 38 M.R.S. § 480-D(3), requires the applicant to demonstrate that the proposed project will not unreasonably harm significant wildlife habitat, freshwater wetland plant habitat, threatened or endangered plant habitat, aquatic or adjacent upland habitat, travel corridor, freshwater, estuarine or marine fisheries or other aquatic life.

According to the Department's Geographic Information System (GIS) database there is mapped Significant Wildlife Habitat located at the site, which is Tidal Waterfowl and Wading Bird and Habitat (TWWH).

The project site is an intertidal mudflat between elevations -6.5 mean lower low water (MLLW) and -4.5 feet North American Vertical Datum of 1988 (NAVD 88) in the southern portion of East Cove 3 and -6.5 to -1.5 feet NAVD 88 in the northern portion of the intertidal flat. The intertidal flats at this site are mostly devoid of vegetation with a shoreline fringe of low marsh along the southern area of intertidal flats that is 0.8 acres (34,850 square feet) in size. The low marsh area is located between approximately -4.0 and -2.0 feet NAVD 88. The low marsh vegetation consists of primarily common three-square bulrush (*Schoenoplectus pungens*) and also includes populations of special concern freshwater tidal marsh plants Horned Pondweed (*Zanichellia palustris*), Spongy-leaved Arrowhead (*Sagittaria montevidensis* ssp. *spongiosa*), Atlantic Mudwort (*Limosella australis*), and Water Pimpernel (*Samolus valerandi* L. ssp. *parviflorus*).

The Maine Department of Inland Fisheries and Wildlife (MDIFW) reviewed the proposed project and stated that the project is located within a mapped moderate-value Tidal Waterfowl and Wading Bird Habitat (TWWH), which is a Significant Wildlife Habitat. The habitat in the area is a foraging habitat for a variety of birds. The vegetated low marsh area is an important component of the mapped habitat. As outlined in the applicant's Performance Management Plan (PMP), MDIFW supports pre-construction survey efforts for the State Rare and Endangered plant species and an annual evaluation of the movement of the thin layer cap and ecosystem services. MDIFW recommends that the construction schedule should avoid May 1 through July 15, a sensitive period for

wading bird breeding, nesting, and brood rearing, and avoid from December 15 through March 15, a critical period for coastal waterfowl over wintering. Provided the proposed construction schedule is followed, no adverse impacts to these species are anticipated during construction.

The Maine Natural Areas Program (MNAP) in its review comments, dated June 24, 2025, that the project area includes populations of rare, special concern freshwater tidal marsh plants Horned Pondweed (*Zanichellia palustris*) and Spongy-leaved Arrowhead (*Sagittaria montevidensis* ssp. *spongiosa*). MNAP stated that placing a cap of coarse sand fill over these plants would likely adversely affect these species. In response, the applicant performed a botanical site survey on September 18, 2025, which MNAP attended. Following the botanical survey and site visit, MNAP provided additional comments, dated December 24, 2025. In the additional comments, MNAP added an additional rare, special concern plant species observed at the site September 18, 2025, Atlantic mudwort (*Limosella australis*). MNAP recommended a vegetation monitoring protocol that includes the following survey metrics:

1. Initial survey to record total percent cover of all vegetation within the vegetated areas of proposed impact. This should include percent cover of all State listed rare plant species, as well as percent cover of dominant species. (The 2025 survey may suffice for this data point);
2. Subsequent yearly, post-construction surveys to quantify revegetation of dominant species and/or colonization of new species, measured as percent cover;
3. Yearly post-construction estimates of percent cover and population sizes of any State listed plant species; and
4. Measurements of the depth of silt accretion and/or depth of the mixing zone of newly deposited soils with the thin layer substrate. This is mentioned in the Performance Monitoring Plan; MNAP's interest here is the correlation of this depth with recolonization (if any) of the site's rare species.

MNAP recommended the monitoring be performed for up to five to seven years.

MNAP also recommended that the applicant develop a compensatory mitigation plan to be submitted in the event that the monitoring identifies a lack of persistence or recolonization of the rare species.

The Department of Marine Resources (DMR) stated that the project is in an area that has both commercial and recreational marine use. No shellfish, marine worm, or eelgrass resources have been mapped in this location and would not be expected to occur given the location of the site in the upper estuary. DMR visited the site October 28, 2025, and dug several sampling pits in the mudflat and did not find any commercially valuable shellfish or marine worms. Fish species that may be present in the general area include alewives, American eel, shad, menhaden, blueback herring, and striped bass. The area is mapped as Essential Fish Habitat for Atlantic salmon, Atlantic sturgeon, and shortnose sturgeon. Though there will be direct impact to marine resources and likely negative impacts to benthic species in the project footprint from the capping, DMR appreciates the effort that has been taken to reduce long-term impacts from mercury on the intertidal ecosystem. DMR stated that the overall benefit of reducing mercury exposure should increase the health of the system in the long-term. DMR agrees with the proposed time

of year work window and impacts to fish species that may utilize this location are likely to be short-term and minimal. Further, DMR stated no impact on traditional fishing, recreation, navigation, or riparian access is expected.

The Department's *Significant Wildlife Habitat* rules, 06-096 C.M.R. ch. 335 (last amended January 7, 2014), interpret and elaborate on the NRPA criteria for obtaining a permit. The rules guide the Department in its determination of whether a project's impacts would be unreasonable. A proposed project would generally be found to be unreasonable if it would degrade the significant wildlife habitat, disturb the subject wildlife, or affect the continued use of the significant wildlife habitat by the subject wildlife, either during or as a result of the activity, and there is a practicable alternative to the project that would be less damaging to the environment. Each application for a NRPA permit that involves a significant wildlife habitat alteration must provide an analysis of alternatives in order to demonstrate that a practicable alternative does not exist.

A. Avoidance. An applicant must submit an analysis of whether there is a practicable alternative to the project that would be less damaging to the environment and this analysis is considered by the Department in its assessment of the reasonableness of any impacts. The applicant submitted an alternatives analysis for the proposed project completed by Integral Consulting Inc., dated February 2025. The overall objective of the project is reducing mercury exposures and accelerating the recovery of the Estuary. The pilot project purpose is to evaluate the effectiveness of a thin layer cap (TLC) at reducing mercury concentrations and exposure in intertidal sediments, demonstrate the stability of the TLC to enable the benefits of the TLC to continue, evaluate the effect of the TLC on the ecology and habitat at the site, and evaluate the effect of the TLC on shoreline stability.

The Preferred Alternative would consist of placing a nominal 4- to 6-in.-thick layer of predominantly coarse sand material over approximately 6.3 acres of intertidal flats and a portion of low marsh in East Cove 3, as outlined above in Finding 1, Project Description. The applicant considered seven alternatives to the Preferred Alternative, including Alternative 1, No Action; Alternative 2, Alternative cap material; Alternative 3, Different or Multiple Locations; Alternative 4, Smaller Study Size; Alternative 5, Isolation Cap; Alternative 6, Amended TLC; and Alternative 7, Dredge Removal of Contaminated Sediments. Each of these alternatives were evaluated for achievement of the overall project purpose, logistical and technical practicality, cost, and environmental effects.

Alternative 1 (No Action) does not meet project purpose, is practical to implement, has no cost, and would not result in adverse effects to aquatic resources. Long-term beneficial effects from reduced mercury exposure and accelerated recovery of the Estuary would not be realized. Therefore, the no-action alternative would be less beneficial to the natural environment compared to the Preferred Alternative.

Alternative 2 (Alternative Cap Material) meets the project purpose as it is a capping remedy consistent with the Consent Decree and would provide relevant information to the full-scale remediation project.

Alternative 3 (Different or Multiple Locations) would fulfill the overall project purpose, however depending upon the size and/or locations of the capping areas, the resulting information is expected to be limited compared to the Preferred Alternative. This will limit the evaluation of construction approach options and performance of the TLC and reduce data needed to determine the scalability of the remedial action over the 130-acre extent identified in the Consent Decree. In addition, a smaller TLC pilot area would require additional TLC construction in East Cove 3 in the future if the pilot is a success and full-scale TLC construction is determined to be feasible, effective, and protective of the ecosystem. If placed in a different location or split across multiple locations, Alternative 3 introduces unacceptable schedule risk due to the uncertainty associated with seeking alternative site access at a location (or multiple locations) other than East Cove 3. Access may not be attainable in a reasonable time frame from owners of contiguous property adjacent to an intertidal area to achieve the targeted minimum capping area size. Therefore, this alternative is considered logistically impracticable. Alternative 3 would also be significantly more costly than the Preferred Alternative due to multiple mobilization events (Multiple Locations), and potentially due to time lost associated with securing site access. Alternative 3 would result in similar effects to the aquatic resources because the methodology and approximate extent of TLC placement is similar between the two alternatives. However, multiple mobilizations required for more than one location would have an adverse effect on the environment, in particular protected fish, because in water work would be extended to many locations throughout the Estuary in one construction season, thus expanding the duration of work in the water. This would increase the total amount of disturbance from vessel mobilization, positioning, and installation of supporting equipment (e.g., moored water quality stations, silt curtains [if required]) and the duration of the overall disturbance due to the increased schedule required to implement the alternative.

Alternative 4 (Smaller Study Size) would fulfill the overall project purpose, however depending upon the size and/or locations of the capping areas, the resulting information is expected to be limited compared to the Preferred Alternative. Alternative 4 would be feasible to design and construct, would cost less due to the smaller size, and would result in a reduced TLC cap area and reduce the extent of temporal impact associated with TLC placement. However, implementing a reduced size pilot study would generate less data and compromise feasibility evaluations, including evaluation of potential impacts on the natural environment.

Alternative 5 (Isolation Cap) would be feasible to design and construct, would be more expensive due to the cost and impact of additional fill material and construction considerations associated with placing multiple cap layers. Construction of an isolation cap would have negative impacts on the ecosystem from the effects of the increased cap material placement in the intertidal area. Construction of an isolation cap would require placing two to three times more clean material, in multiple lifts, within the same area.

Isolation caps also increase total cap thickness (from a 4- to 6-in.-thick TLC to a minimum 1-ft-thick or thicker isolation cap), increasing surface elevations unless dredging is performed prior to capping. Increases in surface elevations could increase flooding potential and/or erosive effects due reductions in river flood control capacity and changes in the river hydrodynamics, respectively. Selection of the minimum 1-ft-thick isolation cap would reduce inundation periods adversely affecting the intertidal system.

Alternative 6 (Amended TLC) would be feasible to design and construct, would have a substantially higher cost compared to the Preferred Alternative due to the cost of material procurement, stockpiling, amendment mixing, and cap placement. Alternative 6, which entails amending the TLC with activated carbon, may reduce mercury bioaccumulation in sediments or improvement of sediment habitat quality however it may also reduce the abundance of organisms recolonizing treated areas.

Alternative 7 (Dredge Removal of Contaminated Sediments) is not consistent with the cap placement requirement specified in the Consent Decree, presents additional logistical and technical challenges associated with dredging, processing (dewatering, stabilizing, and transport), and disposal or beneficial re-use of contaminated sediment. Processing of the dredged sediment also requires an offsite upland location that can be difficult and time intensive to identify and secure. After dredging is complete, the same challenges inherent in capping must be addressed during the backfill process. Depending on the dredge depth and the backfill design, additional construction time may be required compared to the Preferred Alternative to reach design grades, especially if an engineered slope is required or if a greater volume of backfill material is required compared to the cap material volume of the Preferred Alternative.

The above analysis demonstrates that the Preferred Alternative is the least environmentally damaging alternative. The project location, construction methods, and materials chosen for the Preferred Alternative were carefully selected to achieve the overall project purpose, be practicable to implement in a reasonable time frame, and provide the maximum net benefit to the Estuary consistent with the Consent Decree. East Cove 3 has a combination of features, making it well suited for the TLC Pilot. East Cove 3 is a relatively large area with a range of features similar to many coves within Orrington Reach (e.g., narrow and wide flat areas, drainage features, and varying sediment grain size distributions), contains an area with relatively high concentrations of mercury in surficial sediment, and is in a location where contiguous property owners have granted access for the project. The cove is large enough to accommodate a single, sufficiently sized TLC cap. East Cove 3 also includes an area of vegetated low marsh, which allows for evaluation of the benefit of placing a TLC cap within a portion of the low marsh. Existing data and literature pertaining to thin layer capping activities in marshes indicate marsh vegetation can survive or reestablish without intervention for placement of capping material up to approximately 6 in. thick. Therefore, the Preferred Alternative is anticipated to result in minimal short-term adverse environmental effects while maximizing data acquisition necessary to ensure the effective implementation of TLC capping across a larger 130-acre portion of the Estuary. Of the eight alternatives

considered, only the Preferred Alternative would meet the overall project purpose, be practicable to implement, and minimize impacts to the environment.

B. Minimal Alteration. The amount of habitat to be altered and disturbance of the subject wildlife must be kept to the minimum amount necessary for meeting the overall purpose of the project.

The project location, construction methods, and materials chosen for the Preferred Alternative were carefully selected to achieve the overall project purpose, be practicable to implement in a reasonable time frame, and provide the maximum net benefit to the Estuary consistent with the Consent Decree. East Cove 3 has a combination of features, making it well suited for the TLC Pilot. East Cove 3 is a relatively large area with a range of features similar to many coves within Orrington Reach (e.g., narrow and wide flat areas, drainage features, and varying sediment grain size distributions), contains an area with relatively high concentrations of mercury in surficial sediment, and is in a location where contiguous property owners have granted access for the project. The cove is large enough to accommodate a single, sufficiently sized TLC cap. East Cove 3 also includes an area of vegetated low marsh, which allows for evaluation of the benefit of placing a TLC cap within a portion of the low marsh. Existing data and literature pertaining to thin layer capping activities in marshes indicate marsh vegetation can survive or reestablish without intervention for placement of capping material up to approximately 6 in. thick. Therefore, the Preferred Alternative is anticipated to result in minimal short-term adverse environmental effects while maximizing data acquisition necessary to ensure the effective implementation of TLC capping across a larger 130-acre portion of the Estuary. Of the eight alternatives considered, only the Preferred Alternative would meet the overall project purpose, be practicable to implement, and minimize impacts to the environment.

C. Compensation. In accordance with Chapter 335, § 3(D)(1), if an impact to significant wildlife habitat will cause habitat functions or values to be lost or degraded, compensation is required to achieve the goal of no net loss of significant wildlife habitat functions and values.

Immediately prior to the TLC placement, and annually in the same season in which the preplacement survey is completed, for up to 5 years following construction, vegetated wetlands located within the pilot study area will be delineated in accordance with the Corps of Engineers Wetlands Delineation Manual (USACE 1987) and the associated Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (USACE 2012), and vegetation sampling will follow the recommendations for survey metrics in the MNAP comments dated December 24, 2025, as outlined above in Finding 4. The results of the post-TLC construction wetland delineation(s) and vegetation survey data will be compared to the pre-construction wetland delineation and vegetation survey data in order to assess impacts to the TWWH, a Significant Wildlife Habitat. If a reduction in the acreage of vegetated wetlands and rare vegetation is observed in the habitat area, the applicant will consult with DEP, MDIFW, DMR, and MNAP and an evaluation will be made to determine if the reduction is a result of project activities and if it can be corrected. If the impact to the vegetated

wetlands and rare vegetation cannot be corrected by the applicant, the applicant will submit a compensatory mitigation plan to the regulatory agencies for review and approval. If a compensatory mitigation plan is required, the applicant proposes to make a contribution into the In-Lieu Fee (ILF) program of the Maine Natural Resource Conservation Program (MNRCP) in an amount to be determined in consultation with the regulatory and natural resource agencies at that time.

The Department finds that the applicant has avoided and minimized Significant Wildlife Habitat impacts to the greatest extent practicable, the activity will not unreasonably harm any freshwater wetland plant habitat, threatened or endangered plant habitat, aquatic or adjacent upland habitat, travel corridor, freshwater, estuarine or marine fisheries or other aquatic life, and that the proposed project represents the least environmentally damaging alternative that meets the overall purpose of the project provided the applicant avoids construction from May 1 through July 15 and from December 15 through March 15 and if annual monitoring determines there has been a reduction of the habitat that cannot be corrected by the applicant, the applicant submits an ILF payment as described above.

5. WATER QUALITY CONSIDERATIONS:

As discussed in Finding 3, the applicant proposes to use erosion and sediment control during construction to minimize impacts to water quality from siltation.

The Department does not anticipate that the proposed project will violate any state water quality law, including those governing the classification of the State's waters.

The waters in the area are used for recreational boating and fishing. As discussed above in Section 4., and in comments from DMR, the waters affected by the proposed project are not used by shellfish or commercially valuable marine worms. Fish species that may be present in the general area include alewives, American eel, shad, menhaden, blueback herring, and striped bass. The area is mapped as Essential Fish Habitat for Atlantic salmon, Atlantic sturgeon, and shortnose sturgeon. DMR stated that the overall benefit of reducing mercury exposure should increase the health of the system in the long-term. DMR agrees with the proposed time of year work window and impacts to fish species that may utilize this location are likely to be short-term and minimal. Further, DMR stated no impact on traditional fishing, recreation, navigation, or riparian access is expected.

Based on the location of the proposed project in the intertidal zone, the construction methods, and the project design and the Findings above, the Department finds that the proposed project will maintain and protect existing uses and the level of water quality necessary to protect those existing uses, will protect the existing water quality of affected waters, will not significantly impair the viability of the existing populations of estuarine and marine life, and will not result in a significant degradation of existing recreation, fishing and commercial harvesting of such estuarine and marine species.

6. WETLANDS AND WATERBODIES PROTECTION RULES:

The applicant proposes to directly alter 6.3 acres (274,428 square feet) of an intertidal area of coastal wetland to construct the proposed thin-layer cap. Approximately 0.8 acres (34,850 square feet) of the total coastal wetland area is low marsh with the remainder being tidal mudflat. Coastal wetlands are wetlands of special significance (WOSS).

The *Wetlands and Waterbodies Protection Rules*, 06-096 C.M.R. ch. 310 (last amended November 11, 2018), interpret and elaborate on the Natural Resources Protection Act (NRPA) criteria for obtaining a permit. The rules guide the Department in its determination of whether a project's impacts would be unreasonable. A proposed project would generally be found to be unreasonable if it would cause a loss in wetland area, functions and values and there is a practicable alternative to the project that would be less damaging to the environment. Each application for a NRPA permit that involves a natural resource alteration must provide an analysis of alternatives in order to demonstrate that a practicable alternative does not exist, as discussed in Finding 4.

In this case, the Consent Decree required remediation is intended to reduce mercury exposure and accelerate recovery of the Penobscot River Estuary. The pilot project purpose is to evaluate the effectiveness of a thin layer cap (TLC) at reducing mercury concentrations and exposure in intertidal sediments, demonstrate the stability of the TLC to enable the benefits of the TLC to continue, evaluate the effect of the TLC on the ecology and habitat at the site, and evaluate the effect of the TLC on shoreline stability. As outlined above in Finding 4, the applicant proposes to monitor the pilot project site annually for up to five years, providing monitoring progress reports annually to Maine DEP, MDIFW, MNAP, and DMR as well as consult with the agencies in assessing the impacts to the habitat. Remediation of the mercury-contaminated intertidal sediment will enhance the coastal wetland, and the Department is waiving mitigation and compensation for impacts to the coastal wetland.

The Department finds that the applicant has avoided and minimized coastal wetland impacts to the greatest extent practicable, and that the proposed project represents the least environmentally damaging alternative that meets the overall purpose of the project.

7. OTHER CONSIDERATIONS:

The Department finds, based on the design, proposed construction methods, and location, the proposed project will not inhibit the natural transfer of soil from the terrestrial to the marine environment, will not interfere with the natural flow of any surface or subsurface waters, and will not cause or increase flooding. The proposed project is not located in a coastal sand dune system, is not a crossing of an outstanding river segment, and does not involve dredge spoils disposal or the transport of dredge spoils by water.

BASED on the above findings of fact, and subject to the conditions listed below, the Department makes the following conclusions pursuant to 38 M.R.S. §§ 480-A–480-JJ and Section 401 of the Clean Water Act (33 U.S.C. § 1341):

- A. The proposed activity will not unreasonably interfere with existing scenic, aesthetic, recreational, or navigational uses.
- B. The proposed activity will not cause unreasonable erosion of soil or sediment.
- C. The proposed activity will not unreasonably inhibit the natural transfer of soil from the terrestrial to the marine or freshwater environment.
- D. The proposed activity will not unreasonably harm any significant wildlife habitat, freshwater wetland plant habitat, threatened or endangered plant habitat, aquatic or adjacent upland habitat, travel corridor, freshwater, estuarine, or marine fisheries or other aquatic life provided that prior to construction the applicant makes a contribution to the In-Lieu Fee program as described in Finding 4.
- E. The proposed activity will not unreasonably interfere with the natural flow of any surface or subsurface waters.
- F. The proposed activity will not violate any state water quality law including those governing the classifications of the State's waters.
- G. The proposed activity will not unreasonably cause or increase the flooding of the alteration area or adjacent properties.
- H. The proposed activity is not on or adjacent to a sand dune.
- I. The proposed activity is not on an outstanding river segment as noted in 38 M.R.S. § 480-P.

THEREFORE, the Department APPROVES the above noted application of *Greenfield Penobscot Estuary Remediation Trust LLC* as described in Finding 1, SUBJECT TO THE ATTACHED CONDITIONS, and all applicable standards and regulations:

1. Standard Conditions of Approval, a copy attached.
2. The applicant shall take all necessary measures to ensure that its activities or those of their agents do not result in measurable erosion of soil on the site during the construction of the project covered by this approval.
3. Severability. The invalidity or unenforceability of any provision, or part thereof, of this License shall not affect the remainder of the provision or any other provisions. This

License shall be construed and enforced in all respects as if such invalid or unenforceable provision or part thereof had been omitted.

4. The applicant shall avoid construction from May 1 through July 15 and from December 15 through March 15.
5. Immediately prior to the TLC placement, and annually in the same season in which the preplacement survey is completed, for up to 5 years following construction, vegetated wetlands located within the pilot study area shall be delineated in accordance with the Corps of Engineers Wetlands Delineation Manual (USACE 1987) and the associated Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (USACE 2012), and vegetation sampling shall follow the recommendations for survey metrics in the MNAP comments dated December 24, 2025, as outlined above in Finding 4. The results of the post-TLC construction wetland delineation(s) and vegetation survey data shall be compared to the pre-construction wetland delineation and vegetation survey data in order to assess impacts to the TWWH, a Significant Wildlife Habitat. If a reduction in the acreage of vegetated wetlands and rare vegetation is observed in the habitat area, the applicant shall consult with MDEP, MDIFW, MDMR, and MNAP and an evaluation shall be made to determine if the reduction is a result of project activities and if it can be corrected. If the impact to the vegetated wetlands and rare vegetation cannot be corrected by the applicant, the applicant shall submit a compensatory mitigation plan to the regulatory agencies for review and approval. If a compensatory mitigation plan is required, the applicant shall make a contribution into the In-Lieu Fee (ILF) program of the Maine Natural Resource Conservation Program (MNRCP) in an amount to be determined in consultation with the regulatory and natural resource agencies at that time.

THIS APPROVAL DOES NOT CONSTITUTE OR SUBSTITUTE FOR ANY OTHER REQUIRED STATE, FEDERAL OR LOCAL APPROVALS NOR DOES IT VERIFY COMPLIANCE WITH ANY APPLICABLE SHORELAND ZONING ORDINANCES.

DONE AND DATED IN AUGUSTA, MAINE, THIS 28th DAY OF JANUARY, 2026.

DEPARTMENT OF ENVIRONMENTAL PROTECTION

BY: 
For: Melanie Loyzim, Commissioner

PLEASE NOTE THE ATTACHED SHEET FOR GUIDANCE ON APPEAL PROCEDURES.

DV/L100073-4C-A-N



Natural Resources Protection Act (NRPA) Standard Conditions

THE FOLLOWING STANDARD CONDITIONS SHALL APPLY TO ALL PERMITS GRANTED UNDER THE NATURAL RESOURCES PROTECTION ACT, 38 M.R.S. §§ 480-A ET SEQ., UNLESS OTHERWISE SPECIFICALLY STATED IN THE PERMIT.

- A. Approval of Variations From Plans. The granting of this permit is dependent upon and limited to the proposals and plans contained in the application and supporting documents submitted and affirmed to by the applicant. Any variation from these plans, proposals, and supporting documents is subject to review and approval prior to implementation.
- B. Compliance With All Applicable Laws. The applicant shall secure and comply with all applicable federal, state, and local licenses, permits, authorizations, conditions, agreements, and orders prior to or during construction and operation, as appropriate.
- C. Erosion Control. The applicant shall take all necessary measures to ensure that his activities or those of his agents do not result in measurable erosion of soils on the site during the construction and operation of the project covered by this Approval.
- D. Compliance With Conditions. Should the project be found, at any time, not to be in compliance with any of the Conditions of this Approval, or should the applicant construct or operate this development in any way other the specified in the Application or Supporting Documents, as modified by the Conditions of this Approval, then the terms of this Approval shall be considered to have been violated.
- E. Time frame for approvals. If construction or operation of the activity is not begun within four years, this permit shall lapse and the applicant shall reapply to the Board for a new permit. The applicant may not begin construction or operation of the activity until a new permit is granted. Reapplications for permits may include information submitted in the initial application by reference. This approval, if construction is begun within the four-year time frame, is valid for seven years. If construction is not completed within the seven-year time frame, the applicant must reapply for, and receive, approval prior to continuing construction.
- F. No Construction Equipment Below High Water. No construction equipment used in the undertaking of an approved activity is allowed below the mean high water line unless otherwise specified by this permit.
- G. Permit Included In Contract Bids. A copy of this permit must be included in or attached to all contract bid specifications for the approved activity.
- H. Permit Shown To Contractor. Work done by a contractor pursuant to this permit shall not begin before the contractor has been shown by the applicant a copy of this permit.

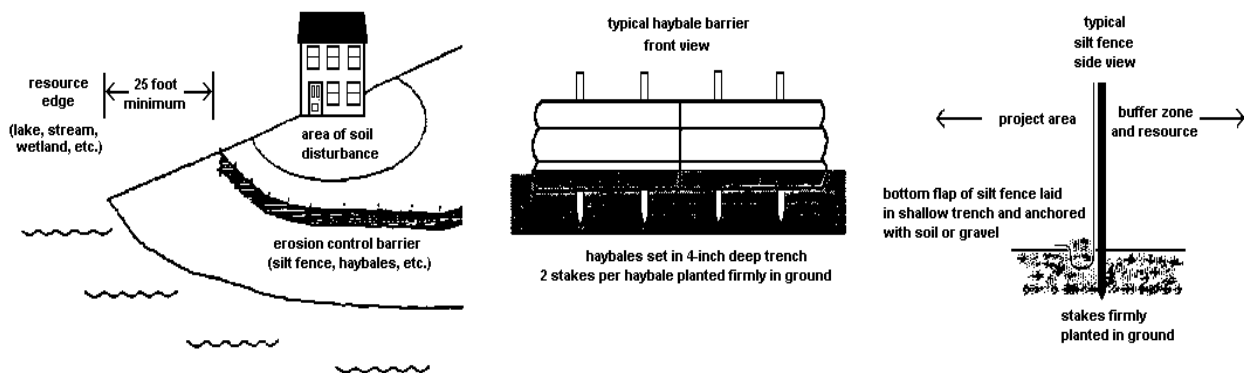


STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION
 17 STATE HOUSE STATION, AUGUSTA, MAINE 04333

Erosion Control for Homeowners

Before Construction

1. If you have hired a contractor, make sure you discuss your permit with them. Talk about what measures they plan to take to control erosion. Everybody involved should understand what the resource is, and where it is located. Most people can identify the edge of a lake or river. However, the edges of wetlands are often not so obvious. Your contractor may be the person actually pushing dirt around, but you are both responsible for complying with the permit.
2. Call around to find where erosion control materials are available. Chances are your contractor has these materials already on hand. You probably will need silt fence, hay bales, wooden stakes, grass seed (or conservation mix), and perhaps filter fabric. Places to check for these items include farm & feed supply stores, garden & lawn suppliers, and landscaping companies. It is not always easy to find hay or straw during late winter and early spring. It also may be more expensive during those times of year. Plan ahead – buy a supply early and keep it under a tarp.
3. Before any soil is disturbed, make sure an erosion control barrier has been installed. The barrier can be either a silt fence, a row of staked hay bales, or both. Use the drawings below as a guide for correct installation and placement. The barrier should be placed as close as possible to the soil-disturbance activity.
4. If a contractor is installing the erosion control barrier, double check it as a precaution. Erosion control barriers should be installed “on the contour,” meaning at the same level or elevation across the land slope, whenever possible. This keeps stormwater from flowing to the lowest point along the barrier where it can build up and overflow or destroy the barrier.



During Construction

1. Use lots of hay or straw mulch on disturbed soil. The idea behind mulch is to prevent rain from striking the soil directly. It is the force of raindrops hitting the bare ground that makes the soil begin to move downslope with the runoff water, and cause erosion. More than 90% of erosion is prevented by keeping the soil covered.
2. Inspect your erosion control barriers frequently. This is especially important after a rainfall. If there is muddy water leaving the project site, then your erosion controls are not working as intended. You or your contractor then need to figure out what can be done to prevent more soil from getting past the barrier.
3. Keep your erosion control barrier up and maintained until you get a good and healthy growth of grass and the area is permanently stabilized.

After Construction

1. After your project is finished, seed the area. Note that all ground covers are not equal. For example, a mix of creeping red fescue and Kentucky bluegrass is a good choice for lawns and other high-maintenance areas. But this same seed mix is a poor selection for stabilizing a road shoulder or a cut bank that you don't intend to mow. Your contractor may have experience with different seed mixes, or you might contact a seed supplier for advice.
2. Do not spread grass seed after September 15. There is the likelihood that germinating seedlings could be killed by a frost before they have a chance to become established. Instead, mulch the area with a thick layer of hay or straw. In the spring, rake off the mulch and then seed the area. Don't forget to mulch again to hold in moisture and prevent the seed from washing away or being eaten by birds or other animals.
3. Keep your erosion control barrier up and maintained until you get a good and healthy growth of grass and the area is permanently stabilized.

Why Control Erosion?**To Protect Water Quality**

When soil erodes into protected resources such as streams, rivers, wetlands, and lakes, it has many bad effects. Eroding soil particles carry phosphorus to the water. An excess of phosphorus can lead to explosions of algae growth in lakes and ponds called blooms. The water will look green and can have green slime in it. If you are near a lake or pond, this is not pleasant for swimming, and when the soil settles out on the bottom, it smothers fish eggs and small animals eaten by fish. There are many other effects as well, which are all bad.

To Protect the Soil

It has taken thousands of years for our soil to develop. Its usefulness is evident all around us, from sustaining forests and growing our garden vegetables, to even treating our septic wastewater! We cannot afford to waste this valuable resource.

To Save Money (\$\$)

Replacing topsoil or gravel washed off your property can be expensive. You end up paying twice because State and local governments wind up spending your tax dollars to dig out ditches and storm drains that have become choked with sediment from soil erosion.



DEP INFORMATION SHEET

Appeals to the Board of Environmental Protection

Date: November 2024 Contact: Clerk.BEP@maine.gov or (207) 314-1458

SUMMARY

This document provides information regarding a person's rights and obligations in filing an administrative or judicial appeal of: (1) a final license decision made by the Commissioner of the Department of Environmental Protection ("DEP"); or (2) an insurance claim-related decision ("Clean-up and Response Fund decision") made by the Commissioner or the Office of State Fire Marshal pursuant to [38 M.R.S. § 568-A](#).

Except as explained below, there are two methods available to an aggrieved person seeking to appeal a license decision made by the Commissioner or a Clean-up and Response Fund decision: (1) an administrative appeal before the Board of Environmental Protection ("Board"); or (2) a judicial appeal before Maine's Superior Court. An aggrieved person seeking review of a license decision or Clean-up and Response Fund decision made by the Board may seek judicial review in Maine's Superior Court.

An appeal of a license decision made by the DEP Commissioner or the Board regarding an application for an expedited wind energy development ([35-A M.R.S. § 3451\(4\)](#)), a general permit for an offshore wind energy demonstration project ([38 M.R.S. § 480-HH\(1\)](#)), or a general permit for a tidal energy demonstration project ([38 M.R.S. § 636-A](#)) must be taken to the Supreme Judicial Court sitting as the Law Court.

I. ADMINISTRATIVE APPEALS TO THE BOARD

LEGAL REFERENCES

A person filing an appeal with the Board should review the applicable rules and statutes, including the DEP's Chapter 2 rule, [Processing of Applications and Other Administrative Matters \(06-096 C.M.R. ch. 2\)](#); Organization and Powers, [38 M.R.S. §§ 341-D\(4\)](#) and [346](#); and the Maine Administrative Procedure Act, 5 M.R.S. § [11001](#).

DEADLINE TO SUBMIT AN APPEAL TO THE BOARD

Within 30 calendar days of the date of: (1) a final license decision of the Commissioner; or (2) a Clean-up and Response Fund decision, an aggrieved person may appeal to the Board for review of that decision. "Aggrieved person" means any person whom the Board determines may suffer a particularized injury as a result of a Commissioner's license decision or a Clean-up and Response Fund decision. A complete appeal must be received by the Board no later than 5:00 p.m. on the 30th calendar day of the decision being appealed. With limited exception, untimely appeals will be dismissed.

HOW TO SUBMIT AN APPEAL TO THE BOARD

An appeal to the Board may be submitted via postal mail or electronic mail (e-mail) and must contain all signatures and required appeal contents. An electronic filing must contain the scanned original signature of the appellant(s). The appeal documents must be sent to the following address.

Chair, Board of Environmental Protection
c/o Board Clerk
17 State House Station
Augusta, ME 04333-0017
Clerk.BEP@maine.gov

The DEP may also request the submittal of the original signed paper appeal documents when the appeal is filed electronically. The risk of material not being received in a timely manner is on the sender, regardless of the method used.

At the time an appeal is filed with the Board, the appellant must send a copy of the appeal to: (1) the Commissioner of the DEP (Maine Department of Environmental Protection, 17 State House Station, Augusta, Maine 04333-0017); (2) the licensee, if the appellant is not the licensee; and (3) if a hearing was held on the application, any intervenors in that hearing proceeding. For appeals of Clean-up and Response Fund decisions made by the State Fire Marshal, the appellant must also send a copy of the appeal to the State Fire Marshal. **Please contact the Board Clerk at clerk.bep@maine.gov or DEP staff at 207-287-7688 with questions or for contact information regarding a specific license or Clean-up and Response Fund decision.**

REQUIRED APPEAL CONTENTS

A written appeal must contain the information specified in Chapter 2, section 23(B) or section 24(B), as applicable, at the time the appeal is submitted. **Please carefully review these sections of Chapter 2**, which is available online at <https://www.maine.gov/sos/cec/rules/06/chaps06.htm>, or contact the Board Clerk to obtain a copy of the rule. Failure to comply with the content of appeal requirements may result in the appeal being dismissed pursuant to Chapter 2, section 23(C) or section 24(C).

OTHER CONSIDERATIONS IN APPEALING A DECISION TO THE BOARD

1. *Be familiar with the administrative record.* Generally, the record on which the Board decides an appeal is limited to the record prepared by the agency in its review of the application, any supplemental evidence admitted to the record by the Board Chair and, if a hearing is held on the appeal, additional evidence admitted during the hearing. A person who seeks to appeal a decision to the Board is encouraged to contact the DEP (or State Fire Marshal for Clean-up and Response Fund decisions made by that agency) to inspect the record before filing an appeal.
2. *Be familiar with the applicable rules and laws.* An appellant is required to identify the licensing criterion or standard the appellant believes was not satisfied in issuing the decision, the bases of the objections or challenges, and the remedy sought. Prior to filing an appeal, review the decision being appealed to identify the rules and laws that are applicable to the decision. An appellant may contact the DEP or Board staff with any questions regarding the applicable rules and laws or the appeal procedure generally.
3. *The filing of an appeal does not operate as a stay to any decision.* If a license has been granted and it has been appealed, the license normally remains in effect pending the processing of the appeal. Unless a separate stay of the decision is requested and granted (*see* Chapter 2, section 23(M)), the licensee may proceed with an approved project pending the outcome of the appeal. Any activity initiated in accordance with the approved license during the pendency of the appeal comes with the risk of not knowing the outcome of the appeal, including the possibility that the decision may be reversed or modified by the Board.
4. *Alternative dispute resolution.* If the appeal participants agree to use mediation or another form of alternative dispute resolution (“ADR”) to resolve the appeal and so notify the Board, the Board will not hear the matter until the conclusion of that effort, provided the participants engaged in the alternative dispute resolution demonstrate satisfactory progress toward resolving the issues. *See* Chapter 2, section 23(H) or contact the Board Executive Analyst (contact information below) for more information on the ADR provision.

WHAT TO EXPECT ONCE YOU FILE A TIMELY APPEAL WITH THE BOARD

The Board will acknowledge receipt of each appeal and develop a service list of appeal participants and any interested persons for use in the appeal proceeding. Electronic mail (e-mail) is the preferred method of communication during an appeal proceeding; however, the Board reserves the right to require paper copies of all filings. Once the Board Chair rules on the admissibility of all proposed supplemental evidence, the licensee (if the licensee is not the appellant) may respond to the merits of the appeal. Instructions specific to each appeal will be provided in correspondence from the Board Executive Analyst or Board Chair.

Generally, once all filings in an appeal proceeding are complete, the DEP staff will assemble a packet of materials for the Board (Board packet), including a staff recommendation in the form of a proposed Board Order. Once available, appeal participants will receive a copy of the Board packet and an agenda with the meeting location and start time. Once finalized, the meeting agenda will be posted on the Board's webpage <https://www.maine.gov/dep/bep/index.html>. Appeals will be considered based on the administrative record on appeal and oral argument at a regular meeting of the Board. *See* Chapter 2, Section 23(I). The Board may affirm all or part of the decision under appeal; affirm all or part of the decision under appeal with modifications, or new or additional conditions; order a hearing to be held as expeditiously as possible; reverse the decision under appeal; or remand the decision to the Commissioner or State Fire Marshal, as applicable, for further proceedings.

II. JUDICIAL APPEALS

The filing of an appeal with the Board is not a prerequisite for the filing of a judicial appeal. Maine law generally allows aggrieved persons to appeal final license decisions to Maine's Superior Court (*see* [38 M.R.S. § 346\(1\)](#); [Chapter 2](#); [5 M.R.S. § 11001](#); and [M.R. Civ. P. 80C](#)). A judicial appeal by a party to the underlying proceeding must be filed with the Superior Court within 30 days of receipt of notice of the Board's or the Commissioner's decision. For any other aggrieved person, an appeal must be filed within 40 days of the date the decision was rendered. An appeal to court of a license decision regarding an expedited wind energy development, a general permit for an offshore wind energy demonstration project, or a general permit for a tidal energy demonstration project may only be taken directly to the Maine Supreme Judicial Court. *See* 38 M.R.S. § 346(4), the Maine Administrative Procedure Act, statutes governing a particular license decision, and the Maine Rules of Civil Procedure for substantive and procedural details applicable to judicial appeals.

ADDITIONAL INFORMATION

If you have questions or need additional information on the appeal procedure, for administrative appeals contact the Board Clerk at clerk.bep@maine.gov or 207-287-2811 or the Board Executive Analyst at bill.hinkel@maine.gov or 207-314-1458, or for judicial appeals contact the court clerk's office in which the appeal will be filed.

Note: This information sheet, in conjunction with a review of the statutory and rule provisions referred to herein, is provided to help a person to understand their rights and obligations in filing an administrative or judicial appeal, and to comply with notice requirements of the Maine Administrative Procedure Act, 5 M.R.S. § 9061. This information sheet is not intended to supplant the parties' obligations to review and comply with all statutes and rules applicable to an appeal and insofar as there is any inconsistency between the information in this document and the applicable statutes and rules, the relevant statutes and rules apply.

Enclosure 4- Compliance Certification Form

Compliance Certification Form

File Number: NAE-2023-00413

State: Maine County: Penobscot

Permittee: Greenfield Penobscot Estuary Remediation Trust, LLC, Lauri Gorton

Date Verification Issued: 6/25/2026

Project Manager: Ruthann Brien

Within one month of completion of the activity authorized by this permit and any mitigation required by the permit (you must submit this form after mitigation is complete, but not the mitigation monitoring, which requires separate submittals), sign this certification and return it to the following address:

**US ARMY CORPS OF ENGINEERS
New England District
Attn: Ruthann Brien
442 Civic Center Drive Suite 350
Augusta, Maine 04330
or
ruthann.a.brien@usace.army.mil**

Please note that your permitted activity is subject to a compliance inspection by a U. S. Army Corps of Engineers (USACE) representative. Failure to comply with any terms or conditions of this authorization may result in the USACE suspending, modifying, or revoking the authorization and/or issuing a Class I administrative penalty, or initiating other appropriate legal action.

I hereby certify that the work authorized by the above referenced permit has been completed in accordance with the terms and conditions of the said permit including any general or specific conditions.

Date Authorized Work Started: _____ **Completed:** _____

Describe any deviations from permit (attach drawing(s) depicting the deviations):

***Note: The description of any deviations on this form does not constitute approval by the USACE.**

Signature of Permittee

Date

NRPA Permit Application
Attachment 16: Biological and
Essential Fish Habitat Assessment,
National Marine Fisheries Service

Orrington Reach Capping Remedy
Thin Layer Cap Pilot Project

Prepared for

**Greenfield Penobscot Estuary Remediation Trust LLC,
Trustee for Penobscot Estuary Mercury Remediation Trust**



Prepared by



45 Exchange Street
Suite 200
Portland, ME 04101

February 2025
Revised December 2025
Revised March 2026

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ACRONYMS AND ABBREVIATIONS

Action Area	23.7-acre area in which work will occur (see definition in Section 2.2)
AMM	avoidance and minimization measures
aRPD	apparent redox potential discontinuity
BA	Biological Assessment
BAZ	biologically active zone
BMP	best management practice
CFR	Code of Federal Regulations
DEP	Department of Environmental Protection
DOT	Department of Transportation
DPS	Distinct Population Segment
EFH	Essential Fish Habitat
EPA	U.S. Environmental Protection Agency
Estuary	Penobscot River Estuary
FESA	Federal Endangered Species Act
FMP	Fishery Management Plan
FWCA	Fish and Wildlife Coordination Act
GOM	Gulf of Maine
HPAC	Habitat Area of Particular Concern
Integral	Integral Consulting Inc.
MLLW	mean lower low water
MPA	Maine People's Alliance
NAVD 88	North American Vertical Datum of 1988
NOAA	National Oceanic and Atmospheric Administration
NRDC	Natural Resources Defense Council
Pa	pascal
PCB	polychlorinated biphenyl
PMP	performance monitoring plan
RAO	remedial action objective

ROD	record of decision
SPI	sediment profile imaging
SAV	submerged aquatic vegetation
TLC	thin layer cap
TLC Pilot Area	6.3-acre area to be capped (see definition in Section 2.1)
USACE	U.S. Army Corps of Engineers
USC	United States Code

EXECUTIVE SUMMARY

Greenfield Penobscot Estuary Remediation Trust LLC, Trustee of the Penobscot Estuary Mercury Remediation Trust has submitted a request for a Department of the Army authorization of the Thin Layer Cap Pilot Project (TLC Pilot).

LOCATION AND ACTION AREA

The TLC Pilot is located in East Cove 3 on the east side of Orrington Reach, approximately 1.2 miles downriver of Southern Cove and the former HoltraChem Facility. The Action Area includes approximately 23.7 acres within Orrington Reach of the Penobscot River Estuary, including the TLC Pilot Area (6.3 acres of intertidal area to be capped).

BACKGROUND

The U.S. District Court in Maine approved a multimillion-dollar settlement for the cleanup of mercury contamination in the Penobscot River Estuary (Estuary) and the creation of two independent environmental response trusts to accelerate the recovery of the Estuary. The Consent Decree¹ entered by the Court settles the lawsuit filed in 2000 by Maine People's Alliance (MPA) and the Natural Resources Defense Council (NRDC) against Mallinckrodt US LLC for discharging mercury in the Penobscot.

The Consent Decree provides the framework for remediation activities for three reaches of the Penobscot River, with the objectives of reducing mercury exposures and accelerating recovery of the Estuary. Work specified for Orrington Reach is capping approximately 130 acres of intertidal sediment, primarily on the east side of Orrington Reach. Orrington Reach is a portion of the Penobscot River immediately downstream of the former HoltraChem Facility in Orrington, Maine.

PROPOSED PROJECT

The purpose of the TLC Pilot is to determine the effectiveness and protectiveness of the TLC on a small scale and provide information to confirm that disturbances to the intertidal ecosystem are temporary. Information developed during the TLC Pilot will inform future design and permitting efforts of the larger capping project required by the Consent Decree. The TLC Pilot will provide site-specific data to address key data gaps and uncertainties related to remediation

¹ The Consent Decree was approved and entered by the U.S. District Court for the District of Maine (in the case *Maine People's Alliance and NRDC v. Holtrachem Manufacturing Company LLC, et al.*, No. 1:00-cv-00069-JAW (D. Me.) (ECF No.1187, October 11, 2022).

techniques, site-specific conditions that may affect remediation methods, and post-construction recovery of the intertidal flat ecosystem.

The TLC Pilot would consist of placement of a nominal 4- or 6-in.-thick layer of predominantly coarse sand material over approximately 6.3 acres of intertidal flats and low marsh in East Cove 3 (TLC Pilot Area). The TLC Pilot cap material will be transported hydraulically via pipeline from a nearby upland staging area to the spreader barge in the Action Area. The cap material will be placed from the water side of the intertidal flats using a patented Broadcast Spreader capable of distributing material in a controlled fashion to minimize turbidity and impact to the existing intertidal sediment surface.

PROTECTED SPECIES AND HABITATS CONSIDERED

Waters of the United States, the Penobscot River below the high tide line, within the Action Area provide suitable habitat to support species under the regulatory protections of the National Oceanic and Atmospheric Administration Fisheries. The species listed below were initially identified as having the potential to occur in the vicinity of the TLC Pilot. They, therefore, have the potential to be affected by the proposed action and are considered within this document. Considered species include:

- Atlantic salmon, Gulf of Maine (GOM) Distinct Population Segment (DPS), *Salmo salar*,
- Atlantic Sturgeon, GOM DPS, *Acipenser oxyrinchus oxyrinchus*, and
- Shortnose sturgeon, *Acipenser brevirostrum*.

Designated critical habitat has been established within the Action Area for Atlantic salmon GOM DPS and Atlantic sturgeon GOM DPS. The Action Area also falls within Essential Fish Habitat (EFH) for species of commercially important fish managed under three Fishery Management Plans (FMPs).

HABITAT DISTURBANCE

The TLC Pilot will temporarily disturb inter-tidal substrate associated with placement of TLC material. Natural sedimentation will occur and benthic habitat is expected to recolonize quickly after disturbance, as seen at TLC projects in other locations. Change in sediment substrate would disturb EFH in the short term. No long-term habitat or foraging opportunity losses are expected.

WORK WINDOW RESTRICTION

To minimize impacts to listed fish species during TLC placement, seasonal fish migration and spawning patterns were evaluated. Data on the Penobscot River indicate various life stages of these species may be present throughout the year (Altenritter 2015; Altenritter et al. 2017; Keenleyside and Yamamoto 1962²). The in-water work window for tidal systems, as established within the U.S. Army Corps of Engineers Nationwide Permit program (General Condition Number 24) is limited to between November 8 and April 9, when densities of protected species are observed to be the lowest (USACE 2020). However, winter conditions between December and February (e.g., weather, ice formation, freezing temperatures, short daylight hours) create safety concerns and limit daily production rates. Current estimates of TLC construction time frames indicate it is not feasible to place TLC material between the November 8 and April 9 work window. As such, it is proposed that TLC placement begin on July 15 and will be completed by September 30, when it is expected the action will have the least impact on juvenile fish hatched in the spring.

EFFECTS DETERMINATION

There is potential for the presence of three protected fish species in the Action Area, and the project, which is proposed to reduce exposure to mercury-contaminated sediment, will result in a beneficial effect on these species and their habitat. The life stages of the three species most likely to transit through the Action Area include only subadults and adults during their migration upstream or downstream. There is no spawning habitat documented within the proposed Action Area. Construction activities (limited to placing a clean sand TLC) are minor in nature, and avoidance and minimization measures (including some work restricted to occur in the season when only subadults and adults have the potential to be present) are proposed; as such, it is expected the proposed action *may affect, but is not likely to adversely affect* considered listed species.

Spawning of shortnose sturgeon has not been recently documented within the Penobscot River; similarly, Atlantic sturgeon and salmon have only been documented to spawn in tributaries to the Penobscot River and not the main stem. Also habitat requirements of all three species (water depth) are not conducive for these species to remain in the Action Area for prolonged periods but rather to use the Action Area as they transit through the Estuary. Juveniles and larval individuals of these species are not expected to be found within the proposed Action Area or

² Altenritter, M.E. 2015. Shortnose Sturgeon (*Acipenser brevirostrum*) in the Gulf of Maine: Local population dynamics and metapopulation implications. Doctoral dissertation. University of Maine, Orono, ME.

Altenritter, M.N., G.B. Zydlewski, M.T. Kinnison, and G.S. Wippelhauser. 2017. Atlantic sturgeon use of the Penobscot River and marine movements within and beyond the Gulf of Maine. *Marine and Coastal Fisheries* 9(1):216-230.

Keenleyside, M.H.A., and F.T. Yamamoto. 1962. Territorial behaviour of juvenile Atlantic salmon (*Salmo salar* L.). *Behaviour* 19:139-169.

within the Penobscot River during the time at which TLC placement is proposed to occur (after July 15). The nature of the action is unlikely to result in the mortality of fish but may cause temporary disturbance to individuals associated with minor increases in turbidity or activity in the water column. Construction actions that are typically considered to have the effect of take, such as pile driving, dredging, or dewatering, are not proposed as a part of the TLC Pilot. As such, effects to considered species are too small to be meaningfully measured, detected, or evaluated; therefore, effects are insignificant. Changes to critical habitat are expected to be insignificant (too small to detect or measure) for all species considered. The TLC Pilot has the potential to affect EFH for species managed under multiple FMPs. The TLC Pilot may affect, and is likely to adversely affect EFH, but the adverse effect would not be substantial and is expected to be temporary.

1 INTRODUCTION

This Biological Assessment (BA) has been prepared for the Thin Layer Cap (TLC) Pilot by Integral Consulting Inc. (Integral) on behalf of the Greenfield Penobscot Estuary Remediation Trust LLC (Greenfield), Trustee of the Penobscot Estuary Mercury Remediation Trust (the Remediation Trust) for Work on the Penobscot River Estuary (Estuary) located in Hancock, Penobscot, and Waldo counties (Figures 1 and 2).

The U.S. District Court in Maine approved a multimillion-dollar settlement for the cleanup of mercury contamination in the Penobscot River Estuary and the creation of two independent environmental response trusts to accelerate the recovery of the Estuary. The Consent Decree entered by the Court settles the lawsuit filed in 2000 by Maine People's Alliance (MPA) and the Natural Resources Defense Council (NRDC) against Mallinckrodt US LLC for discharging mercury in the Penobscot.

The Consent Decree provides the framework for remediation activities for three reaches of the Penobscot River, with the objectives of reducing mercury exposures and accelerating recovery of the Estuary. Work specified for Orrington Reach is capping approximately 130 acres of intertidal sediment, primarily on the east side of Orrington Reach. Orrington Reach is a portion of the Penobscot River immediately downstream of the former HoltraChem Facility in Orrington, Maine.

A TLC Pilot has been developed in accordance with the Consent Decree and appendices, including Paragraph 9 of the Statement of Work (Appendix A to the Consent Decree). To address the objective of reducing mercury exposures and enhancing recovery of the Estuary, a layer of cap material will be placed over approximately 6.3 acres of intertidal sediment in East Cove 3 between July 15 and September 30. This approach will target intertidal areas with elevated mercury concentrations in surface sediment (Figure 3).

The purpose of this BA is to provide technical information for the U.S. Army Corps of Engineers (USACE) and National Oceanic and Atmospheric Administration (NOAA) Fisheries to review the TLC Pilot in sufficient detail to determine to what extent the TLC Pilot may affect threatened or endangered species, candidate species proposed for listing as threatened or endangered, critical habitat, and Essential Fish Habitat (EFH) within the jurisdiction of the NOAA Fisheries. USACE is the federal lead and action agency. As the action agency, USACE is expected to request Federal Endangered Species Act (FESA) Section 7 consultation with NOAA Fisheries regarding these effects.

This BA describes the TLC Pilot, potential impacts on biological resources resulting from the implementation of the TLC Pilot, and proposed measures that would be implemented to avoid these potential impacts. The BA provides information to support NOAA Fisheries evaluation of

potential TLC Pilot effects on listed fish species, designated critical habitat for listed species, and EFH. This document has been prepared with reliance on the best scientific and commercial data available.

Species considered within this document include those legally protected pursuant to the following federal laws:

- FESA: 50 Code of Federal Regulations [CFR] § 402.7, Section 305(b)(4)(B),
- Magnuson-Stevens Fishery Conservation and Management Act: 16 United States Code [USC] §§ 1801–1884, and
- Fish and Wildlife Coordination Act (FWCA): 16 U.S.C. §§ 661–667e (1934, as amended).

1.1 SUMMARY OF COMMUNICATIONS TO DATE

The following is a summary of communication to date between USACE Project Managers Amanda Sayles and Ruthann Brien (current Project Manager) and NOAA Fisheries Biologists Kaitlyn Shaw and Chris Boelke (EFH consultation) and David Bean (retired) and Ryan Bernstein (Section 7 Biologist) and representatives of the project:

- June 20, 2024: Trustee held pre-application meeting with Ms. Sayles and Ms. Shaw to provide a project overview, invite early comment, and coordinate a site visit.
- July 22, 2024: Ms. Sayles invited NOAA Fisheries representatives to attend a site visit.
- July 31, 2024: Site visit coordinated by Trustee occurred and included Ms. Sayles, Ms. Shaw, and representatives from USACE, U.S. Fish and Wildlife Service, and Maine Department of Environmental Protection (DEP).
- August 13, 2024: A list of materials requested by NOAA Fisheries biologist, via email, to be included within the consultation was provided by Ms. Shaw.
- October 15, 2024: A virtual meeting was held with Ms. Sayles, Ms. Shaw, and Stacy Lander (Maine DEP) to discuss the list of requested materials to ensure each request is appropriately addressed herein.
- September 14, 2025: A virtual meeting was held with newly assigned USACE Project Manager, Ruthann Brien, NOAA Fisheries Biologist David Bean, and the project proponent to discuss a project overview. In addition, Maine DEP attended with various regulatory staff.
- September 30, 2025: NOAA Fisheries Biologist, provided comments on the EFH assessment.

- October 8, 2025: A virtual meeting was held with USACE Project Manager R. Brien, NOAA Fisheries Biologist D. Bean, and the project proponent to discuss a project overview
- January 30, 2026: A virtual meeting was held with USACE Project Manager R. Brien, NOAA Fisheries Biologists (D. Bean, R. Bernstein, and C. Boelke). The team discussed transition of the project review from D. Bean to R. Bernstein. R. Brien transmitted the Draft Biological Assessment document for NOAA Fisheries initial comment.
- February 24, 2026: A virtual meeting was held with USACE Project Manager R. Brien and NOAA Fisheries Biologist to provide an overview of the project.
- March 4, 2026: NOAA Fisheries, R. Bernstein, provided comments on the Biological Assessment.

2 ACTION AREA

The Action Area includes “all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action” [50 CFR 402.02]. The sections below provide a description of how the Action Area was defined for this analysis and the resources occurring within the Action Area.

2.1 LOCATION

The TLC Pilot is proposed for implementation in East Cove 3 on the east side of Orrington Reach, (Latitude: 44.719949, Longitude: -68.829496), approximately 1.2 miles downriver of Southern Cove and HoltraChem (Figure 1). The proposed TLC Pilot consists of placement of a nominal 4- or 6-in.-thick layer of predominantly coarse sand material over approximately 6.3 acres of intertidal flats and low marsh in East Cove 3 (TLC Pilot Area). The TLC Pilot Area includes portions of Parcel Number 005-021 (Town of Orrington), Parcel Number 005-023 (private owner), and Parcel Number 005-023-A (private owner) (Figure 2). Representative site photographs are included as Appendix A.

2.2 ACTION AREA DESCRIPTION

The Action Area includes an approximately 23.7-acre work area in the Penobscot River, including the TLC Pilot Area (Figure 3). The extent of the Action Area, including in-water equipment and staging areas, contains areas of subtidal open waters, intertidal flats, and intertidal low marsh. To accommodate consideration of indirect effects, the Action Area was expanded beyond the TLC Pilot Area (6.3-acre TLC placement area) to include areas that may be indirectly impacted by project activities. The Action Area extends landward to the high tide line along the length of the East Cove 3 shoreline. South of the TLC Pilot Area, the Action Area includes the area in front of the landside contractor staging area, located on a privately owned landside parcel adjacent to the Action Area. Support vessels, typically scows, used to transport personnel and perform surveys, may be launched from this location. Cap material will be brought to the landside contractor’s staging area parcel by trucks, stockpiled and mixed with water to form a slurry, and pumped through an HDPE pipeline fitted with a fish screen (AMM-6) directly to a hopper on the spreader barge in the TLC Pilot Area. Vessel traffic outside of the Action Area is not anticipated except for mobilization and demobilization. Riverward, the Action Area extends to subtidal areas both up- and downstream of East Cove 3 to incorporate places where barges may be temporarily moored, if necessary, for the purpose of staging equipment and cap material. Monitoring devices (e.g., for water quality tracking) may also be placed within the subtidal areas during cap placement (Figure 3). A bathymetric map of the Action Area, and the entire East Cove 3, is included as Figure 4.

While project vessels required for TLC placement (e.g., a small tugboat and personnel and support vessels) must transit to the Action Area during mobilization and demobilization, no measurable impact to listed species is anticipated to occur during transiting between the home location of the vessels and the Action Area.

During the time in which work will occur (between July 15 and September 30), the mean temperature of the river at the Action Area location is typically between 21.4°C and 23.4°C. In the intertidal area, the water depth varies from 0 to 5.3 m deep, and the typical mean salinity is measured to be between 2.86 and 3.35 practical salinity units (Section 2.2.6).

2.2.1 Baseline Levels of Mercury in Action Area Sediment

Recent sediment sampling events in East Cove 3 occurred in 2023 and 2024. In 2023, four samples were collected within the upper 0.5 ft of sediment. Sample results for mercury ranged from 520 to 1,700 ng/g. In 2024, surface sediment samples were collected from the biologically active zone, 0 to 4 in., from 11 locations. Sample results for mercury ranged from 640 to 1,400 ng/g.

Additionally, a baseline sampling event will occur prior to construction as part of the performance monitoring program described in Section 6.3 and Appendix B.

2.3 EAST COVE 3 INTERTIDAL FLATS

The surface elevation of intertidal flats in the TLC Pilot Area ranges from -6.5 ft (mean lower low water [MLLW]) to -4.5 ft North American Vertical Datum of 1988 (NAVD 88) in the southern portion of East Cove 3 and -6.5 to -1.5 ft NAVD 88 in the northern portion (Figure 4). The intertidal flats are mostly devoid of vegetation, or are sparsely vegetated, beyond the limits of the low marsh as described in Sections 2.3.1 and 2.3.2, and serve as important foraging areas for avian species.

An existing drainage feature in the intertidal flat has been selected as the division between the TLC Pilot north and south areas. Based on a review of historical aerial photographs, this feature has remained in roughly the same location of the intertidal flat over the available historical record. Topographic data, aerial photographs, and 2024 low tide photographs indicate that this feature drains water from a drainage that parallels the north side of the Orrington Picnic Park access road (Figures 5a-c). The head of the drainage feature is located at the point where the drainage discharges to East Cove 3 (Figure 5b). The appearance of washout at the point of the discharge (Figure 5c), coupled with the persistent presence and overall size of the drainage feature in the intertidal flats, suggests that it may convey water at sufficient flow velocities to mobilize cap material, if placed in this area. Therefore, an area consisting of approximately 20 ft on either side of this feature has been excluded from the capping area (Figure 3). The location of the drainage feature will be verified in the field as part of the TLC Pilot pre-construction survey,

and the boundaries of the area to be capped will be adjusted per the survey. A summary of the pre-construction survey results will be provided to the permitting agencies for general information. Though this 20-ft buffer area is not part of the defined capped area, it is considered acceptable for some cap material to enter this feature in the process of constructing the TLC.

2.3.1 Low Marsh

The 0.8 acre of low marsh in the TLC Pilot Area is shoreward of the south area of intertidal flats and occurs mostly between approximately -4.0 and -2.0 ft NAVD 88 (Figure 4). The low marsh consists of sparsely vegetated emergent marsh dominated by common three-square bulrush (*Schoenoplectus pungens*). This coastal habitat supports tidal waterfowl and wading birds and is identified by Maine Department of Inland Fisheries and Wildlife as a “Significant Wildlife Habitat,” although the area does not meet the size requirements within the regulations to be classified as such.

2.3.2 Submerged Aquatic Vegetation

Submerged aquatic vegetation (SAV) includes rooted aquatic plants that grow entirely below the surface of the water and typically includes aquatic grasses such as eelgrass. No SAV has been observed in the Action Area along the river-side edge of the intertidal flats in East Cove 3. While most of the intertidal flats in the Action Area are not vegetated, there is an observed population of horned-pondweed (*Zannichellia palustris*) on the riverside edge of the low marsh on the south side of the cove. Horned-pondweed can qualify as SAV; however, the population only occupies approximately 3,100 square feet and co-occurs with clasping-leaved pondweed (*Potamogeton perfoliatus*) and macroalgae.

2.3.3 Benthic Community

A benthic invertebrate community survey was conducted in May and June 2024 during which 10 surface sediment grab samples (0 to 10 cm in depth³) were collected at stations throughout the TLC Pilot Area following methods described in the benthic survey report (Appendix C) and summarized in Section 3.2.2. Benthic invertebrate specimens were identified to the lowest possible taxon and summarized per location. An uncontaminated reference site, with similar environmental conditions to the Action Area, does not exist within the Estuary. As such, these data on the benthic community composition were collected to serve as a pre-construction baseline condition.

The benthic invertebrate community present at all sampling locations is dominated by *Limnodrilus hoffmeisteri*, a common segmented oligochaete worm, which ranged from 51 to

³ A sediment profile imaging survey conducted in East Cove 3 concluded that the average depth of biological activity observed in the TLC Pilot Area is 10 cm (further described in Section 2.2.6).

81 percent (as the percent dominant taxon). Other species present in relative high abundance included midges (Chironomidae such as *Cryptotendipes* sp.), amphipods (Gammaridae), and snails (*Truncatelloidea*). Nematodes were identified at the two sampling locations in the East Cove 3 marsh.

The species richness (or number of taxa) ranged from 9 taxa located in the southern portion of the TLC Pilot Area, to 17 taxa at one of two locations in the low marsh area. The lowest species diversity and evenness⁴ (based on the Shannon-Weaver index, Pielou's J, and Simpson's heterogeneity metrics) was measured in the southwestern portion of East Cove 3; the benthic invertebrate community was dominated by *L. hoffmeisteri* (81 percent) at this location. Measures of species diversity and evenness of taxa observed were similar among the rest of locations and generally indicate a benthic invertebrate community that has relatively low diversity and is dominated by one or two taxa.

2.3.4 Sediment Characteristics

Surficial sediment within the TLC Pilot Area was characterized during the August 2023 Pre-Design Investigation study (Integral 2024a). Sediment was collected via ponar dredge from 0 to 0.5 ft below sediment surface from three stations within the project location. Nearly all samples were classified as predominantly (>60 percent) fine-grained material and were described by the geotechnical testing laboratory as very dark grayish brown silt.

2.3.5 Biologically Active Zone

A sediment profile imaging (SPI) survey was conducted in May and June of 2024 within the TLC Pilot Area to assess benthic environment sediment characteristics (Integral 2024b) (the SPI survey methods are further described in Section 3.2.1). The SPI images were used to characterize the physical and biological conditions of the intertidal benthic sediments, including the biologically active zone (BAZ). The BAZ is defined as the depth over which there is evidence of biological activity. In the proposed TLC Pilot Area, the BAZ ranged from 3 cm to 16 cm, with an average depth of 10 cm. BAZ depths were generally deeper in the southern and shoreward portions of the survey area, becoming shallower away from shore.

2.3.6 Salinity

Salinity was measured in Orrington Reach approximately 1 mile downstream of the TLC Pilot Area during the spring 2023 river velocity monitoring investigation (Integral 2024c). During that investigation, a YSI-EXO water quality monitor was attached to a platform that was positioned near the bottom at the center of the Penobscot River channel. The water quality

⁴ Pielou's evenness index was calculated for each location to evaluate the relative distribution of species (i.e., the number of individuals distributed across species at a given location).

monitor collected salinity, turbidity, and temperature data. Salinity fluctuated from 0.01 to 19.59 practical salinity units, consistent with the estuarine environment of the river and previous studies conducted in Orrington Reach.⁵ Periods of high salinity at the monitoring station reflect higher salinity tidal water and the presence of a salt wedge at the base of the river.

Salinity data have not been collected within the TLC Pilot Area. It is anticipated that the data collected during the 2023 river velocity monitoring investigation, from near bottom at the center of the river channel, reflect more saline conditions than those in the nearby shallow intertidal flats with surface elevations more than 30 ft higher than the nearby channel bed surface. These shallow areas are unlikely to be strongly influenced by salinity associated with the estuarine salt wedge. Marsh vegetation and benthic invertebrates identified during 2024 Pre-design Investigation studies corroborate the understanding that the Action Area is also an estuarine environment that is likely subject to fluctuating salinity.

⁵ Salinity measurements recorded in Orrington Reach during the 2016 water quality monitoring study ranged from 0.77 to 2.11 practical salinity units (Amec Foster Wheeler 2017).

3 ANALYSIS METHODS

This section summarizes biological resources inventory and site investigation methods. Modeling methods used to inform project design are also described.

3.1 SCOPE OF ANALYSIS

The purpose of this BA is to provide technical information for USACE and NOAA Fisheries to review the TLC Pilot in sufficient detail to determine to what extent the TLC Pilot may affect NOAA Fisheries protected species and habitats. The analysis provided herein extends to the Project described in Section 4 and the Action Area identified in Section 2.

As a part of the project, a TLC Pilot Performance Monitoring Plan (PMP; Appendix B) will be implemented. The Plan describes the scope and methodologies for collecting data to evaluate TLC Pilot performance relative to overall remedial objectives and to demonstrate that post-construction permitting requirements and overall beneficial effects are achieved. An annual report will be submitted to USACE, Maine DEP, and consulting state and federal agencies as requested. Data obtained during and after cap placement will inform decisions and plans for future phases of the TLC implementation within Orrington Reach and will further the ability to make appropriate effects determinations for those actions.

The scope of analysis for this document is limited to the TLC Pilot and does not extend to the potential future larger Orrington Reach capping project. Extending analysis beyond the pilot depends on the results of the pilot and is speculative at this time. In implementing the Consent Decree, the Remediation Trust must consider as paramount the interests of the Estuary, including the river itself, its flora and fauna, and its nearby inhabitants. As such, additional capping may not be advanced should findings of the pilot study not support an overall ecological benefit from the project.

3.2 BIOLOGICAL RESOURCES INVENTORY METHODS

Information about biological resources that could occur within the Action Area was obtained from the following sources:

- Beginning with Habitat Map Viewer
- NOAA Fisheries Listed Species, Critical Habitat, EFH, and Marine Mammal Protection Act species lists (NOAA Fisheries 2016)
- NOAA Fisheries Critical Habitat shapefiles
- NOAA Fisheries EFH shapefiles

- NOAA Fisheries EFH Mapper (NOAA Fisheries 2020)
- NOAA Fisheries Environmental Consultation Organizer
- Existing literature as cited in the text.

The above-listed resources were queried to identify federally listed endangered, threatened, and candidate species and species proposed for listing. The species identified in these searches were evaluated for likelihood of occurrence or to be adversely affected within the Action Area. To characterize the existing environmental condition, SPI and benthic infaunal survey data were collected and are summarized within the following sections.

3.2.1 Sediment Profile Imaging

SPI is a survey method to assess sediment characteristics in aquatic and marine benthic environments. SPI captures a cross-sectional image of the surficial sediment by pushing an optical prism into the sediment bed and taking a high-resolution still photograph. SPI collection obtains a cross-sectional image of the upper 2 to 7 in. of sediment. SPI images are used to assess benthic habitat and the effects of the sediment characteristics on the benthic community, which serves as the basis for fish foraging opportunities.

Replicate images are taken to characterize sediment at each sampling station, with the three highest quality images being selected for analysis. Computer-aided analysis of SPI images provides a set of standard measurements, to allow for comparisons between samples. SPI images were collected in May and June of 2024 to characterize the physical and biological conditions of the intertidal benthic sediments in the TLC Pilot Area.

Standard SPI image analysis parameters were collected, including grain size, prism penetration, apparent redox potential discontinuity (aRPD), infaunal successional stage, lower BAZ depth, and sedimentary methane.

3.2.2 Benthic Infaunal Survey

A benthic invertebrate community survey was conducted in May and June 2024 during which 10 surface sediment grab samples (0 to 10 cm in depth⁶) were collected at stations throughout the TLC Pilot Area. The benthic survey report is included as Appendix C. A petite ponar was used to collect samples within both the intertidal flat and low marsh of the TLC Pilot Area. Samples were co-located with SPI survey data collection locations. Benthic organisms within samples were taxonomically identified to genus or species. The following metrics were

⁶ A sediment profile imaging survey conducted in East Cove 3 concluded that the average depth of biological activity observed in the TLC Pilot Area is 10 cm (further described in Section 2.2.6).

collected: percentage of dominant taxon, Shannon's diversity index, abundance, taxa richness, and evenness. The results of the survey are summarized in Section 2.2.4.

3.3 SITE INVESTIGATIONS

The following reports document the data collection and modeling investigations that were completed to refine the hydrodynamic model and inform project design: Bathymetric Survey Investigation Report (Integral 2024d), River Flow Velocity Monitoring Investigation Report (Integral 2024c), Ice Scour Investigation Report (Integral 2024e), Hydrodynamic Report (Integral 2024f), and One-Dimensional Erosion Model (Integral 2024g).⁷

3.3.1 Bathymetric Survey Investigation Report

A high resolution Multibeam Echosounder bathymetric survey was conducted of the lower Penobscot River, from Bangor to Fort Point in Stockton Springs, Maine, including Orrington Reach, in three mobilizations in June, August, and October of 2023. The data from the bathymetric survey were integrated with LiDAR data collected by the U.S. Geological Survey in 2021 to provide high-resolution mapping of riverbed elevations, including the TLC Pilot Area.

3.3.2 River Flow Velocity Monitoring Investigation Report

River flow velocity was investigated using an acoustic Doppler current profiler to record the vertical profile of velocity in the water column, along with a multiparameter water quality sonde deployed to record depth, temperature, and salinity measurements. The sonde also included an optical turbidity probe to measure water column turbidity (a qualitative measure of the suspended solids in the water column) at a depth of approximately 0.25 m above the riverbed (as discussed in Section 2.2.7). The investigation was conducted in the spring of 2023 and captured the peak velocities during the spring freshet of that year.

3.3.3 Ice Scour Investigation Report

An investigation was conducted in 2023 and early 2024 to observe and document ice formation in two coves in the Penobscot River, including the TLC Pilot location, East Cove 3. Photographs were taken at periodic time intervals by remote cameras from January 10 to February 29 of 2024, photographs were provided by residents, and observations from individuals familiar with the Estuary were collected. Images recorded by the remote cameras were reviewed for evidence of ice scour effects on the intertidal flat sediment surface, including the following conditions:

- Ice movement on and around the targeted coves

⁷ Reports are available on the Remediation Trust website: <https://www.penobscotriverremediation.com/resources>

- The nature, size, quantity, and duration of ice present within the targeted coves
- Physical effects of interaction between ice and the sediment surface.

3.3.4 Hydrodynamic Report

Shear stress on the sediment surface caused by water flow was modeled under various storm conditions. A state-of-the-science hydrodynamic model was developed to simulate conditions extending from Eddington (approximately 9.1 km [5.7 miles] upstream of Bangor) to Fort Point. The hydrodynamic model includes an unstructured grid with cell edge lengths that vary from as coarse as 75 m in the areas near the mouth of the river, to as fine as 5 m within the boundaries of East Cove 3 and the other areas in Orrington Reach that are being considered for capping in the future. The model was calibrated and validated based on river flow velocity and water level data collected during the spring 2023 River Flow Velocity Monitoring Investigation (Section 3.2.2). The calibrated/validated model was then used to simulate several scenarios, including 10-, 50-, and 100-year storm flow events, as well as high wind and sea level rise conditions.

3.3.5 One-Dimensional Erosion Model

A one-dimensional sediment transport model was developed based on the SEDZLJ sediment transport model⁸ to evaluate the behavior of the material in the TLC under the modeled conditions of the 10-, 50-, and 100-year storm flow events. The sediment transport model uses representative bed shear stresses for intertidal northern, intertidal southern, and low marsh subareas of the TLC Pilot Area (Section 4) under the specified flow events based on the output from the hydrodynamic model (Section 3.2.4). The shear stresses are applied against grain size distributions of existing materials provided by aggregate suppliers to determine the depths of erosion throughout the TLC Pilot Area under these scenarios. The outputs of the model were used to refine the specified cap material gradation and inform evaluations of the stability of the TLC under storm flow conditions.

⁸ The SEDZLJ sediment transport model used to evaluate potential TLC erosion is a peer-reviewed model originally developed by Jones and Lick (2000) that has been applied at multiple sites in the United States and abroad. SEDZLJ uses multiple size classes of sediments, incorporates a unified treatment of suspended load and bed load where applicable, and accounts for changes in the particle size distribution (i.e., bed armoring) and its effect on erosion rates. The bed armoring aspect of the model has been validated by a comparison of experimental and calculated transport rates (Jones and Lick 2000; James et al. 2010).

4 PROJECT DESCRIPTION

The purpose of the TLC Pilot is to provide site-specific data to address key data gaps and uncertainties related to remediation techniques or site-specific conditions that may affect remediation methods. The TLC Pilot will also serve as a “proof-of-concept” to demonstrate the effectiveness of a TLC remedy. The TLC Pilot will also inform evaluations of the impact of TLC construction on habitat and biota within the TLC Pilot Area and demonstrate effects are temporary. This section summarizes the design for the TLC to be constructed for the pilot.

The TLC Pilot cap material, a clean, locally sourced sand (described further in Section 4.3.1), will be placed from the water side of the intertidal flats using a patented Broadcast Spreader capable of placing material in a controlled fashion to minimize turbidity and impact to the intertidal sediment surface (Section 4.6).

The areas of fill discharge and their respective approximate acreages are as follows:

- Intertidal flat: 5.9 acres total
 - Intertidal mud flat, unvegetated (north area): 2.6 acres
 - Intertidal mud flat, unvegetated (south area): 3.3 acres
- Low marsh area, vegetated: 0.4 acre. The low marsh area is dominated by three-square bulrush (*Schoenoplectus pungens*), which occurs along the shore. Less dominant species such as clasping-leaved pondweed (*Potamogeton perfoliatus*), horned-pondweed (*Zannichellia palustris*), and macroalgae occur at the margin of the bullrush low marsh.

The 0.8-acre area of low marsh within the TLC Pilot Area will be divided into two approximately 0.4-acre subareas. TLC material will be placed in one subarea, providing a basis for evaluation of the effectiveness and potential adverse impacts of TLC placement in low marsh areas. No TLC material will be placed in the second subarea, allowing it to serve as a control for comparison against the first subarea and to support assessment of whether TLC placement on the adjacent intertidal flats adversely impacts low marsh areas that are not capped. The configuration of the two marsh subareas will be described in the final TLC Pilot design documents.

The TLC Pilot PMP (Appendix B) describes the scope and methodologies for collecting data to evaluate TLC Pilot performance relative to overall remedial objectives and to demonstrate that post-construction permitting requirements and criteria are achieved. Data obtained during and after cap placement will inform future phases of the TLC implementation within Orrington Reach. The information will be used to update feasibility evaluations, demonstrate the TLC can be placed in a manner that is protective of habitat (or that adverse impacts will be temporary), and provide design and construction information to support more efficient and effective implementation.

4.1 REMEDIAL ACTION OBJECTIVES

The remedial activities set forth in the Consent Decree are intended to reduce mercury exposures and to accelerate recovery of the Estuary. In implementing the Consent Decree, the Remediation Trust must consider as paramount the interests of the Estuary, including the river itself, its flora and fauna, and its nearby inhabitants.

Three remedial action objectives (RAOs) have been identified for the Orrington Reach capping remedy. The first two RAOs below reflect the intent of the Consent Decree. The third RAO acknowledges the importance of protecting important natural resources during remedy implementation:

- Reduce potential exposure to mercury in intertidal flat surface sediment.
- Accelerate recovery of intertidal flat surface sediment.
- Minimize potential disturbance to protected species and their habitat during and after TLC implementation.

To address these remedial action objectives, a TLC is being designed to cover intertidal sediment with a layer of clean sand. This approach will target areas with the highest mercury concentrations in surface sediment. Compared to other remedial technologies like isolation caps or dredging, a TLC is less disruptive to the ecosystem. By placing a layer of clean sand over contaminated sediment, the concentrations of mercury available for methylation and biological exposure will be reduced. The TLC design is estimated to be equivalent to over 50 years of natural sediment accumulation in Orrington Reach. Consequently, a TLC will significantly contribute to the recovery of intertidal sediment within the TLC Pilot Area.

4.2 TLC PILOT OBJECTIVES

The TLC Pilot will provide site-specific information and data to determine if the capping remedy specified for Orrington Reach in the Consent Decree is feasible and will meet the RAOs. The TLC Pilot is intended to determine the effectiveness and protectiveness of the TLC and provide information to assess the extent of temporary disturbances to the intertidal ecosystem during TLC placement. Information developed during the TLC Pilot will also support future permitting and design efforts of the full-scale project. If successful, the TLC Pilot area will contribute to achieving RAOs as part of the overall remedy for Orrington Reach.

Specific objectives of the TLC Pilot are summarized below:

- **Evaluate Cap Stability and Effectiveness.** Provide information to determine if the TLC is sufficiently stable to achieve the RAOs, evaluate TLC effectiveness at reducing mercury concentrations and associated exposures in intertidal surface sediment, and to

better refine estimates of the accumulation rate and mercury concentration of sediment being deposited on the TLC.

- **Evaluate Effect of TLC Placement on Ecology/Ecological Habitat.** Identify potential adverse effects to the local ecology and habitat associated with construction activities, if any, and demonstrate the effects are temporary.
- **Determine TLC Feasibility.** Assess the feasibility of implementing a capping remedy for Orrington Reach based on the following factors:
 - **Constructability.** Determine if the TLC can be placed in a manner that meets the performance and permit requirements (including work window restrictions) as identified in the plans and specifications.
 - **Cost to Implement.** Determine whether the full-scale capping remedy for Orrington Reach can be implemented with the available funding.

4.3 DETAILED PROJECT DESCRIPTION

The following project components are described below: cap thickness, type of material to be used, and project schedule. This section also provides details on how the TLC Pilot will be constructed.

4.3.1 Cap Material

The cap material will be predominantly sand material with a gradation based on Maine Department of Transportation (DOT) specification for Type B underdrain sand (Maine DOT 2020). The gradation specification for this material is summarized in **Table 1**.

Table 1. Gradation Specifications for Type B Underdrain Sand

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves
1-in. (25.0 mm)	95–100
0.5-in. (12.5 mm)	75–100
No. 4 (4.75 mm)	50–85
No. 20 (0.850 mm)	15–50
No. 50 (0.300 mm)	0–15
No. 200 (0.075 mm)	0–5

The cap material will be procured from local/regional aggregate suppliers to the extent possible. Cap material geotechnical and analytical sampling results will be included in pre-construction submittals to document that the material meets geotechnical criteria and is free of contaminants

consistent with the Maine Department of Environmental Protection (DEP) Remedial Action Guidelines for Contaminated Sites (Maine DEP 2023) for the soil exposure pathway.

4.3.2 Cap Thickness

The TLC Pilot will include two design thicknesses (Figure 3). The TLC in the southern area of intertidal flats and the low marsh area will have a nominal thickness of 4 in. The TLC in the northern area of intertidal flats will have a nominal thickness of 6 in.

The final thickness of the TLC material will depend in part on tolerances of the placement methods (i.e., how precisely the construction equipment can place material). The estimated range of fill volume for the TLC Pilot is between 4,900 and 7,300 cy, including intermixing of some TLC sand with native sediment during placement and placement overages associated with tolerance limits.

4.3.3 Anticipated Work Schedule

Work will be limited to daylight hours, to the extent practicable. Production rates for cap material placement, which include permit compliance activities, will determine the timeframe required to construct the TLC. Daily production rates (i.e., the area capped in a given day) will depend on the daylight, working hours, weather (including wind, storm events, and presence of ice), tidal cycles, and permit conditions. An estimated work duration for TLC construction is provided below.

The schedule presented below requires TLC placement to start July 15 and be completed by September 30 in order to complete construction in a single mobilization (**Table 2**). The rationale for this variance is provided in Section 8.3.

Table 2. TLC Pilot Implementation Schedule

Task	Example Start Date	Estimated Duration (business days)
Mobilization to Action Area, Pre-construction Survey	July 1, 2025	5 days
Erosion Control Best Management Practice (BMP) Installation	July 8, 2025	5 days
Cap Material Loading and Transport to Site	July 15, 2025	5 days
Cap Placement Including Confirmation Sampling	July 22, 2025	40 days
Post-construction Survey, Erosion Control BMP Removal	September 16, 2025	5 days
Demobilization from Action Area	September 23, 2025	5 days
Construction Completion	September 30, 2025	1 day

4.4 MOBILIZATION AND DEMOBILIZATION

The term mobilization refers to all work required prior to the start of cap placement. Local sources of sand cap material will be sampled to confirm the sand meets gradation specifications and is free of chemical contaminants. The cap material will be transported to the landside contractor staging area adjacent to the TLC Pilot Area by trucks over public roads and stockpiled. In-water equipment required for cap placement will be assembled on and launched from the landside contractor staging area. Flexifloat® portable sectional barges will be used to construct a 40 ft by 80 ft spreader barge and a 20 ft by 80 ft guide barge, both equipped with spuds. A crane will be used to launch the barges and capping equipment. A compact tugboat will push the barges to the TLC Pilot Area where the slurry pipeline from the landside staging area will be connected to the hopper on the spreader barge. The compact tugboat and additional personnel and survey vessels may be launched from nearby marinas but will not routinely transit the river once construction begins.

The remediation contractor will establish and maintain the landside staging area and support facilities as needed to support TLC placement. These facilities are expected to include offices and equipment and material storage areas. The contractor will be required to obtain required permits and implement BMPs to control material runoff and dust, and for other environmental protection measures. Following completion of the TLC Pilot, equipment will be demobilized. If the landside staging area has been disturbed, it will be restored to its pre-construction condition.

4.5 SITE ACCESS AND LAYDOWN

All construction for the TLC Pilot will be performed from the water, with access to the TLC Pilot Area provided by vessels from an existing boat launch facility or temporary dock. Temporary access (i.e., gangway, mobile stairs, etc.) to East Cove 3 from Orrington Picnic Park or an adjacent parcel may be considered, if necessary, and only with approval from the Town of Orrington. No construction material or equipment will be stored at or transported from any publicly accessible locations. No fill would be placed below the high tide line associated with site access or laydown.

Capping material will be transported to the TLC Pilot Area via barge or through pipes. Should pipes extend from the shoreline, they will not cross vegetated low marsh. The need for and location of landside staging and laydown areas will be identified by the remediation contractor. If landside staging and a laydown area is required, it will be subject to approval by Maine DEP, U.S. Army Corps of Engineers (USACE), and the applicable landowner. If landside areas are needed, details of applicable BMPs will be provided to the agencies and the BMPs will be implemented.

4.6 CAP MATERIAL PLACEMENT

The TLC Pilot cap material will be placed from the water side of the intertidal flats during all phases of the tide cycle, but primarily at higher tides, which provide water over the intertidal flats, which range in elevation from –6.5 to –4.5 ft NAVD 88 in the southern portion of East Cove 3, and –6.5 to –1.5 ft NAVD 88 in the northern portion (Figure 4 and Section 2.2.1). Based on the July 15 to September 30 work window, work is anticipated to be done during daylight hours and lighting will not be required. TLC material will mixed with water from the river to create the slurry and pumped via pipeline to a hopper on the spreader barge. The spreader barge is equipped with GPS and an onboard computer that continuously monitors and records barge position and spreader output. On the spreader barge, cap material is drawn out of the hopper by a conveyor, passes over a belt scale, and is subsequently deposited onto the dual spinners of the broadcast spreader that cast the material out over the targeted cap placement area in an overlapping pattern. The dual spinners are located just a few feet above the water surface and the sand settles through the water column over a large area and deposits on the existing sediment surface. Design TLC thicknesses are achieved by controlling the rate of placement, using instrumentation to set and monitor the speed of the conveyor and spinners. Box samplers are used to verify cap depths during placement and real time turbidity monitoring will be conducted as described in Section 6.1 and in Appendix D.

Cap material may be placed in multiple lifts to allow for initial intermixing and settlement to improve the likelihood of achieving the nominal cap thicknesses outlined in Section 4.3.2. If necessary, cap material may be spread manually at low tide using wheelbarrows and rakes. No tracked construction equipment will access the intertidal area.

A vessel is planned to move the two barges or platforms to and within the TLC Pilot Area. Cap material will be placed primarily when the intertidal flat is submerged by approximately 2.5 to 3 ft of water. If necessary, to facilitate the placement of cap material during low tide, barges or platforms may be temporarily grounded on specific sections of the intertidal flats within the TLC Pilot area. Barge or platform grounding will be limited to areas where TLC material has not yet been placed. TLC material will be placed in these areas once the grounded barges/platforms are removed from the intertidal flats. Spuds or other anchoring systems will be deployed as necessary to keep a barge or platform in place. Use of anchoring mechanisms will be minimized to the extent possible on areas where the final lift of cap material is in place. Spuds and anchoring systems will not be placed in areas with SAV (AMM-5). The equipment barge/platform may be moved throughout the Action Area to a more quiescent location to ensure the barge/platform will remain stable overnight.

Specifications for cap material placement will include location and tolerance limits to determine acceptable constructed cap thicknesses while also preventing “mounding” of cap materials. The TLC Pilot Area will be divided into multiple individual cells, which will be measured for confirmation of target cap thickness. During construction, the thickness of the cap material will

be measured using multiple techniques, such as push cores, SPI, survey stakes, and/or other methods allowing visual inspection and documentation of the placed material thickness. Measured results will be compared to the thickness requirements presented in the project plans and specifications.

A pre-construction survey of the TLC Pilot Area will be performed to establish lateral control and document elevations of the intertidal flat and low marsh surface prior to the start of construction activities. This survey will serve as the baseline for identifying changes to elevations of the intertidal flat and low marsh during performance monitoring. The pre-construction survey will also establish the location of the persistent drainage feature separating the north and south intertidal flat capping areas. The specifications for this survey, including the areas to be surveyed, survey tolerances, and timeline for the completion of the survey will be included in the project specifications.

5 BASIS FOR DESIGN

This section documents information considered in the development and design of the TLC Pilot. The purpose of the basis for design is to choose a project that accomplishes the project purpose while resulting in minimal adverse impact to the environment.

5.1 LOCATION AND EXTENT

Details regarding the intertidal flats and low marsh within the TLC Pilot extent and the acreages of fill discharge are provided in Section 2.2. Specific considerations related to the selection and sizing of the TLC Pilot area are presented in the following sections.

5.1.1 Selection of East Cove 3

The selection of East Cove 3 for the TLC Pilot considered the following:

- East Cove 3 is within Orrington Reach, as specified by the Consent Decree.
- Sediment bulk chemistry data available to date, including 2023 and 2024 pre-design investigation data, indicate that surficial sediments in East Cove 3 contain some of the highest mercury concentrations in Orrington Reach.
- Access to place the TLC was granted from owners of the three landside properties (Parcels 005-021, 005-023, and 005-023-A) adjacent to the TLC area.
- East Cove 3 has a range of geomorphologies, including intertidal drainage features, rivulets, and a low marsh area, which are representative of potential capping areas throughout Orrington Reach.

5.1.2 Determination of Capping Area Extents

The boundaries of the TLC Pilot Area (Figure 3) were determined as follows:

- The northern and southern limits of the TLC Pilot Area are defined by the boundaries of Parcels 005-021, 005-023, and 005-023-A.
- The western extent of the TLC Pilot Area is defined as approximately the MLLW elevation of -1.97 m NAVD 88. This elevation defines the intertidal/subtidal boundary.

Twenty-foot buffers from property boundaries defining the northern, southern, and eastern extents of the TLC Pilot Area were chosen to help ensure that cap material is contained within the areas where access for remedial activities has been granted. These buffers are conservative with respect to the placement of cap material and the potential movement of cap material likely under normal tidal conditions (i.e., not subjected to storm flow):

- Placing material inside a 20-ft buffer is well within the capabilities of the construction equipment being considered for the TLC Pilot.
- When placed, sand at the edges of the TLC Pilot Area will slope naturally. Assuming a typical angle of repose of approximately 30 degrees, the lateral component of the sand slope will be approximately 1 ft.
- After placement, the TLC will be subject to forces associated with river flow. The selected cap material is predominantly sand that will have limited potential to be mobilized (Section 8.2.4). Selection of a 20-foot buffer will protect against cap material being mobilized outside of the TLC Pilot Area by river flow. Some cap material may be mobilized from the TLC Pilot Area during extreme storm flow events (Section 8.2.4), but is expected to be broadly dispersed in the Estuary.

Minor deviations from the above definitions are included in the TLC Pilot Area extents in Figure 3 for the purpose of constructability (i.e., simplifying capped area polygons in areas where the criteria identified above create curves that are difficult to construct).

5.2 BASIS OF CAP MATERIAL SELECTION

Locally sourced sand has been selected for the TLC Pilot based on the following considerations:

- Sand has been used extensively as a successful capping and subaqueous backfill material in settings similar to East Cove 3 (ITRC 2023), including the use of sand as post-dredging backfill at the upriver Southern Cove Corrective Measures Implementation project at the HoltraChem site (Anchor QEA, LLC and CDM Smith, Inc. 2017). The Southern Cove project used sand with gradation specifications similar to the modified Maine DOT Type B sand proposed for the TLC.
- Studies show benthic communities successfully recolonize in sand caps across a wide range of conditions, including in estuarine systems (Polayes 1997; Merritt et al. 2009). Over time, native, fine-grained material will be deposited on the surface of the TLC. This sediment will benefit benthic organism recolonization.
- Modeling and data from other capping projects demonstrate that sand (especially, coarser fraction material), will be stable for the TLC Pilot (i.e., will not be substantially eroded by river currents). Shear stresses estimated by hydrodynamic modeling of a range of storm flow scenarios indicate the highest potential for erosion will occur along limited portions of the western TLC Pilot Area under a 100-year storm flow scenario (Section 8.2.4).
- Sand that meets Maine DOT Type B gradation is readily and locally available. Sampling will be performed to confirm that sand sources are free of contamination prior to placement.

- Sand can be placed using proven construction technologies.

The percentage of fines in the TLC material gradation has been specified to allow better control during placement and to minimize potential adverse impacts to water quality. Finer-grained materials, such as silts and clays, settle slowly, which can affect precise material placement under wet conditions and increase the potential for turbidity.

The use of dredged sediment from navigation or remediation activities in the Estuary or other nearby area as the cap material was considered but was deemed undesirable and impractical for several reasons:

- Control of material quality and properties. Because dredged sediment is typically derived from deepening harbors, marinas, or navigation channels, it may contain contaminants like metals (including mercury), polychlorinated biphenyls, and polycyclic aromatic hydrocarbons, which would not be unsuitable for the TLC Pilot or consistent with Maine DEP Remedial Action Guidelines for Contaminated Sites (Maine DEP 2023) soil contaminant concentrations.
- Compatibility with native species. Use of dredged sediment from areas outside of the Estuary could introduce invasive or non-native benthic species to the TLC Pilot Area.
- Control of material placement. To minimize water quality impacts to the Penobscot River during cap construction, cap material should have minimal fines, which can be suspended during placement and increase turbidity. Dredged river sediment often contains higher concentrations of fines and therefore would present increased challenges for placement and would increase the potential for turbidity-based water quality impacts during construction.
- Availability of material. Dependence on dredged sediment for TLC material would impose substantial schedule risk to the TLC Pilot; in the event dredging activities are not present at appropriate times to supply the dredged sediment, the TLC Pilot could not be completed.

5.3 CAP THICKNESS

The TLC Pilot will be placed in three subareas (Section 2.2.1) with two design thicknesses (Figure 3). Subdividing the TLC Pilot Area into a defined northern and southern extent allows the opportunity to place, monitor, and evaluate differing thicknesses of material in the intertidal flats. The southern portion of the TLC Pilot (including the low marsh) will receive a nominal 4-in. thick TLC. The northern portion of the TLC Pilot Area will receive a nominal 6-in. thick TLC. Both thicknesses are achievable by established construction methods based on discussions with remediation contractors to date.

The TLC design thickness is based on the observed BAZ (i.e., the zone of sediment over which benthic activity, and thus mercury exposure, occurs) thicknesses in East Cove 3 to reduce benthic organism exposure to mercury. The TLC thickness of 4 to 6 in. is recommended because it is equal to or greater than the BAZ in East Cove 3. This selected TLC thickness also limits physical changes to the intertidal flat, which could cause adverse impacts to intertidal habitat. These adverse impacts include changes in tidal inundation and frequency and the potential inability for low marsh wetland vegetation to recover after TLC placement. Minimizing physical changes to the intertidal flat also minimizes the potential for adverse impacts to shoreline erosion.

5.3.1 Minimum Thickness Required to Reduce Exposure

One of the primary goals of the TLC is to reduce mercury concentrations in surface sediment where exposure can occur. Therefore, a minimum thickness equal to or greater than the BAZ was selected to maximize the benefit of reducing exposure to mercury.

SPI was used to measure the BAZ in East Cove 3 sediment. Near-surface sediment particles are mixed by benthic infauna in a random process as a function of organism density and their structures (Francois et al. 2002). The vertical color change that signifies the apparent redox potential discontinuity (aRPD) depth measured in SPI images represents the upper, more completely mixed portion of the BAZ (Clarke et al. 2001; Solan et al. 2004). Evidence of biological activity such as burrows, voids, or biota is referred to as biogenic mixing and typically seen with SPI below the aRPD depth. Biogenic mixing is controlled by nonrandom or local particle transport by larger organisms, their biogenic structures (e.g., tube gallery as described in Francois et al. 2002), and/or their activities, such as head-down deposit feeding (Diaz and ARCADIS 2008). This lower BAZ can be estimated using SPI images by measuring the maximum depth of feeding voids, burrows, or organisms observed in the profile image (Germano & Associates 2004).

The SPI investigation identified an average aRPD of approximately 1 in. and a lower BAZ thickness of approximately 4 in., varying locally slightly deeper or shallower. These site-specific measurements are consistent with literature values for similar settings (ITRC 2023). Therefore, quantities of cap material will be placed consistent with achieving a minimum of 4 in. of cap thickness throughout the capping area for the TLC Pilot. This cap thickness will minimize the potential for benthic activity to cause mixing of underlying native sediment into the TLC material—particularly to the mixed BAZ where most benthic activity occurs.

5.3.2 Evaluation of Cap Ice Scour

Further effects of ice formation in the river and the effect of ice flows on cap persistence were assessed. Potential ice scour features that could be clearly seen, and for which there is a high

confidence in the observation, were documented in the Ice Scour Assessment Report. This assessment resulted in the following observations of apparent physical effects:

- Apparent impressions or “divots” were evident at the locations where ice blocks had been present—particularly large ice blocks. Such phenomena may be the result of consolidation of the sediment from the weight of deposited ice and/or “plucking” of surface sediment (i.e., freezing of sediment to the bottom of the deposited ice with subsequent transport during remobilization of the ice on rising tides).
- Evidence of localized erosion was observed in several photographs based on apparent gouges in the sediment surface from carving/scraping of sediment during the movement of ice (e.g., dragging).

The available information was not sufficient to perform quantitative assessments of the visible physical effects of ice movement (e.g., the depth, length, area, volume, etc., of scour and impression patterns). However, observations of physical effects of ice on the sediment surface suggest the presence of physical forces that may affect TLC stability. The recorded observations suggest that these apparent physical effects do not occur with every ice formation that deposits to or otherwise interacts with the sediment surface. When observed, the apparent effects were limited to the immediate vicinity where the ice formation had been present. Notably, when ice scours the surface of any cove with contaminated sediment there is potential for mobilization of contaminants. Placement of the TLC would result in scours mobilizing clean TLC material.

6 AVOIDANCE, MINIMIZATION, AND CONSERVATION MEASURES

The following avoidance and minimization measures (AMMs) will be followed to avoid and minimize effects on listed species, designated critical habitat, EFH, and the aquatic resource:

- **AMM-1. Worker Environmental Awareness Training:** All construction personnel (hereinafter referred to as personnel) shall attend a mandatory environmental education program facilitated by the project biologist prior to the initiation of construction activities. Training sessions shall be repeated for all new personnel before they are allowed access to the Action Area. The content of the training will include information on all of the permit AMMs, information on protected species, and their habitat, which may occur within the Action Area, and information on how the species and their habitat should be protected. All personnel shall complete the training and sign a form stating that they completed the training and understand all applicable agency regulations and the consequences of non-compliance. The forms will be kept on file and made available to the regulatory agencies upon request.
- **AMM-2. Best Management Practices:** Every reasonable precaution will be taken to protect the environment, with particular attention to protect species and habitat(s), from construction by-products and pollutants. Construction specifications will require the contractor to use all reasonable care, including but not limited to:
 - All hazardous materials shall be stored and handled in strict accordance with the safety data sheets for the products. The storage and handling of potential pollution-causing and hazardous materials shall be in accordance with all local, state, and federal requirements.
 - Construction crews shall reduce the amount of disturbance within the Action Area to the minimum necessary to accomplish the TLC Pilot.
 - Vehicles and equipment shall be fueled and serviced at an appropriate location and in an appropriate manner. For waterborne construction equipment, fueling shall be performed from a fully contained or double-walled tank on a fuel barge or “boat,” using a fuel transfer hose equipped with automatic shutoff valve. Fueling locations shall be inspected during each event to document that no spills are occurring. Incidental spills, if any, shall be cleaned up immediately.
 - Once the TLC Pilot is completed, all project support areas will be restored to a condition better than or equal to their pre-construction condition. All waste will be managed in compliance with applicable federal, state, and local laws and regulations.

- Drip pans or absorbent pads will be placed beneath parked equipment to capture potential leaks. Equipment will be inspected daily for signs of fluid leaks, and any leaking equipment will be repaired promptly or removed from service.
- Materials and equipment will be arranged to allow visual inspections and prevent stormwater from contacting potential pollutants. Any stored materials will be covered or contained to avoid exposure to precipitation.
- Trash and debris will be removed regularly, and the area will be kept free of loose materials. If stormwater controls are needed to prevent offsite runoff, measures such as perimeter wattles, berms, or existing paved drainage features will be used.
- AMM-3. Work Window: TLC placement construction activities (e.g., installation of water quality control features and TLC placement) will be performed only during the approved environmental work window between July 15 and September 30 during daylight hours.
- AMM-4. Spill Prevention: The remediation contractor will prepare a Spill Prevention Plan, meeting the requirements of 40 CFR 112, to be approved by the Remediation Trust, prior to the implementation of the TLC Pilot. This plan will specify the steps that will be taken, such as proper maintenance of equipment and vessels used to place the cap, to limit and manage any potential water quality impacts that could result from spills or releases of fuel, oil, or other hazardous materials.
- AMM-5 Anchorage Limitation: Barge spuds or anchors will not be lowered within areas of SAV.
- AMM-6 Water Intake Fish Screen: A NOAA Fisheries approved fish screen will be used on any water intake prior to placement in the Penobscot River.
- AMM-7 Biological Monitoring: Should a localized turbidity curtain be deployed around the broadcaster, a qualified Biologist, or onsite personnel trained by the Biologist, will be present to ensure individual fish or schools of fish are not impacted by the curtain. Monitoring will continue for as long as the curtain is deployed.

6.1 EROSION CONTROL

Environmental controls will be deployed as necessary to minimize disturbance of contaminated intertidal sediment, minimize turbidity within the water column, and prevent sedimentation and erosion from landside support areas. As described in the Water Quality Monitoring Plan (Appendix D), routine visual and continuous instrument monitoring will be performed to demonstrate that the environmental controls are effective in protecting important natural resources and minimizing potential disturbance to critical habitat during and after TLC implementation. The monitoring also identifies threshold turbidity values for implementing contingency actions to address turbidity.

Within upland areas (areas occurring above the Penobscot River top of bank), erosion control measures will be addressed prior to construction and will only require typical stormwater pollution prevention measures (see AMM-2). Erosion from the shoreline along the TLC Pilot Area is anticipated to be minimal due to the riprap present along the southern area and the exposed natural granite along the northern area.

Overall compliance with all permit conditions and applicable regulations is the responsibility of the Remediation Trust; the requirements for monitoring and maintaining compliance, and operation and maintenance of the landside staging area, will be incorporated into the construction contract as performance specifications. The Engineer of Record will verify whether the contractor adhered to BMPs (see AMM-2) and contract specifications and complied with monitoring limits and thresholds during placement of the TLC.

6.1.1 In-Water Turbidity Controls and Monitoring

Continuous real-time monitoring of turbidity will be performed during TLC material placement and construction activities with the potential to disturb sediment to demonstrate TLC construction is not degrading water quality and to satisfy permit requirements consistent with the Clean Water Act Section 401 Water Quality Certificate. Turbidity will be measured by at least two fixed turbidity monitoring buoys approximately 600 ft upstream and 600 ft downstream of the TLC Pilot Area. Turbidity is not expected to cross to the west side of the river as the velocities within the main channel are much higher than within the Action Area, and turbidity will move upstream or downstream and not laterally across the river. The Remediation Trust's hydrodynamic model estimates velocities in the middle of the river are 5 to 10 times higher than velocities over the intertidal flat. However, to monitor turbidity within or west of the middle of the river channel, a third monitoring buoy will be placed west of the cap area if it can be completed without impeding vessel traffic and the location approved by appropriate authorities. The Water Quality Monitoring Plan for the project presents additional details and is provided in Appendix D.

Background turbidity will be established by the collection of baseline data at each location prior to, and during, construction. Turbidity monitoring data will be evaluated against the water quality compliance criterion for turbidity established as not-to-exceed 35 nephelometric turbidity units (NTU) above the reference value at the point of compliance. The reference value will be defined as the greater of either the daily upstream measurement or an updated 90th percentile value of the baseline set. Exceedances of the turbidity reference value at the compliance point will trigger contingency response actions. Contingency response actions will be evaluated based on monitoring data, observations, and field conditions. Response actions to be considered include stopping work while turbidity settles and the water column clears, deployment of localized curtains around the broadcaster (i.e., a moon pool) for turbidity control immediately surrounding the broadcaster, or other methods that are protective of the environment and feasible given weather and other conditions in the field. A plan to control

turbidity created by the placement of cap material onto the intertidal flats and low marsh has been prepared and is included in the Water Quality Monitoring Plan Appendix D.

Continuous monitoring of turbidity during active construction periods will be required to demonstrate TLC construction is not degrading water quality and to satisfy permit requirements consistent with the Clean Water Act Section 401 Water Quality Certificate. Turbidity will be measured by fixed turbidity monitoring buoys at upstream and downstream locations outside of the cap placement area. Background turbidity will be established by the collection of baseline data at each location prior to construction activities. Turbidity monitoring data will be evaluated against turbidity limits established as part of the permitting process.

Other potential water quality impacts resulting from spills and releases related to TLC Pilot equipment and operations will be addressed by spill prevention planning.

6.1.2 Cap Material Placement Control

The TLC Pilot construction specifications will require the contractor to propose means and methods to prevent the placement of cap material beyond the TLC Pilot Area boundaries. The design includes a 20-ft buffer around the extent of the TLC Pilot Area. Maintaining a 20-ft buffer while placing material is well within the capabilities of the broadcaster construction equipment being considered for the TLC Pilot.

6.1.3 Landside Staging Erosion Control

Landside staging, stockpiling, loading, and other support areas will be selected to utilize existing facilities and minimize or eliminate the need for disturbance of new areas. If soils must be disturbed to create support areas or material has the potential to migrate from these support areas, appropriate BMPs will be implemented to limit erosion and prevent migration to the water or offsite. Such BMPs may include straw wattles, silt fence, or similar controls to be placed downgradient of areas where capping material is stockpiled or where soil will be disturbed.

6.2 CLOSEOUT AND REPORTING

Following the implementation of the TLC Pilot, a Work Completion Inspection will be conducted to ensure that all components of the project have been satisfactorily completed. Following successful inspection of the completed project, a Construction Completion Report will be prepared. This report will include the following:

- Statements by a registered Professional Engineer and by the Remediation Trust, along with supporting documentation, that construction is complete and is consistent with the

design documents, work implementation plan(s), and all contract documents and specifications

- Record drawings signed and stamped by a registered Professional Engineer
- A description of any deviations from the design documents, work implementation plan(s), and how alternative actions were undertaken
- Any other completion reporting documents required by a regulatory agency or other permitting authority as a condition of any permit or other authorization.

6.3 PERFORMANCE MONITORING

A PMP has been prepared to guide data collection in support of the Pilot Study objectives and to demonstrate that post-construction permitting requirements and overall beneficial effects are achieved (Appendix B). The PMP outlines the approach for performance monitoring by monitoring objective, defines the monitoring metrics to be used to evaluate the performance of the TLC against the objectives, and outlines the methods and approaches to be used to generate the necessary data for these evaluations. The PMP further defines the anticipated monitoring schedule and reporting and includes a framework for modifications to the PMP should conditions observed during the performance monitoring warrant such changes. Results of monitoring will be provided to NOAA Fisheries annually.

Table 3 provides a summary of the PMP's framework for monitoring effectiveness and stability of the TLC cap.

Table 3. Performance Monitoring Summary

Potential Monitoring Method ^a	Objectives	Parameters	Frequency
Sediment Cores	TLC Effectiveness	Mercury and methylmercury concentrations	Baseline (mercury and methylmercury in BAZ only)
	TLC Stability	Accumulated sediment thickness	Annual, starting at Year 0 ^b
	Benthic Recolonization	TLC thickness aRPD	
Field Survey (Visual Observations)	TLC Effectiveness	Presence of accumulated sediment	Baseline (shoreline stability only)
	TLC Stability	Evidence of sediment erosion or scour	Monthly in Year 0, quarterly thereafter
	Shoreline Stability	Evidence of shoreline erosion	Opportunistically during site visits
Drone Survey (Visual Observations)	TLC Effectiveness	Presence of accumulated sediment	Annual, starting at Year 0
	TLC Stability	Evidence of sediment erosion or scour	
	Shoreline Stability	Evidence of shoreline erosion	
Field Camera Survey (Visual Observations)	TLC Effectiveness	Presence of accumulated sediment	Throughout monitoring period starting in late 2024 at Year 0
	TLC Stability	Evidence of sediment erosion or scour	
Sediment Grab Samples	TLC Effectiveness	Mercury and methylmercury concentration in benthic tissue	Baseline
	Benthic Recolonization		Year 2 and the final year of monitoring
Sediment Grab Samples	TLC Effectiveness	Taxonomy, abundance, richness, diversity, and evenness	Baseline
	Benthic Recolonization		Annual, starting at Year 0
SPI	Benthic Recolonization	Accumulated sediment thickness	Year 2 ^b
	TLC Effectiveness	TLC thickness	
	TLC Stability	Benthic biogenic features	
		Infaunal successional stage	
		aRPD	
Biological Surveys	Wetlands Assessment	Wetland acreage	Baseline
	Aquatic Resources Assessment	Functions and values	Annual, starting at Year 0
	Rare Plant Assessment	Rare plant presence/persistence	

The TLC Pilot performance monitoring (Appendix B) will be initiated in the first summer following the completion of the TLC construction. The performance monitoring will be conducted for a minimum of 2 years and a maximum of 5 years. Reports will be submitted to the agencies annually.

7 SPECIES OCCURRENCE, ACCOUNTS, AND PROTECTED HABITATS

This section provides an assessment of the potential for protected species and habitats to occur within the Action Area. Life history and habitat requirements are further described for each species with the potential to be present in the Action Area.

7.1 PROTECTED SPECIES OCCURRENCE OUTSIDE THE RANGE OF THE ACTION AREA

Several protected species occur in the region but are not documented or expected (as further justified below) to occur within the Action Area:

- Sea turtles, including green (*Chelonia mydas*), Kemp's ridley (*Lepidochelys kempii*), leatherback (*Dermochelys coriacea*), and loggerhead (*Caretta caretta*) are known to use coastal Maine waters. However, these species are not found under estuarine conditions, which occur within the Action Area.
- Whales—finback, humpback, minke, and North Atlantic right—are found within Maine marine waters (oceans, bays, and estuaries); however, they have not been reported within the Penobscot River.
- Many dolphin species and the harbor porpoise are found within Maine coastal waters but have not been reported within the Penobscot River.
- The harbor, gray, harp, and hooded seal species are all found within Maine coastal waters and shorelines; however, they rarely travel upstream in the Penobscot River to near the Action Area.

7.2 PROTECTED SPECIES WITH POTENTIAL TO OCCUR WITHIN ACTION AREA

Three regionally known, special-status species with protected status have the potential to occur within the Action Area (**Table 4**) and are addressed within this document. These species are discussed below.

Table 4. Special-Status Wildlife Species with Potential to Occur in Action Area

Species Name, common and scientific	FESA Listing	Listing Citation and Date	Habitat Designation
Atlantic Salmon, GOM DPS, <i>Salmo salar</i>	Endangered	74 FR 29344 06/19/2009	Critical Habitat
Atlantic Sturgeon, GOM DPS, <i>Acipenser oxyrinchus oxyrinchus</i>	Threatened	77 FR 5880 02/06/2012	Critical Habitat
Shortnose Sturgeon, <i>Acipenser brevirostrum</i>	Endangered	32 FR 4001 03/11/1967	None

Notes:

DPS = Distinct Population Segment

GOM = Gulf of Maine

7.2.1 Atlantic Salmon GOM DPS

Atlantic salmon are anadromous, living primarily as territorial benthic dwellers in rivers during their early smolt stages and moving to deep marine environments during their post-smolt life stages (Keenleyside and Yamamoto 1962; Thorstad et al. 2011). Atlantic salmon can remain in freshwater environments from 1 to 3 years before ultimately migrating to the ocean in the spring-early summer, where they typically spend 1 to 2 years (Klemetsen et al. 2003; NMFS and USFWS 2005). Prior to ocean migration, Atlantic salmon undergo smolting, which enables their salt-tolerance. This process includes morphological, biochemical, physiological, and behavioral changes (Hoar 1988; Høgasen 1998; Thorpe et al. 1998; Finstad and Jonsson 2001). This transition phase is a high-mortality period for Atlantic salmon given the transition to a new habitat (Klemetsen et al. 2003; Thorstad et al. 2011a).

Within the Penobscot River, adults begin ascending the river in the spring and complete upstream migration by mid-July (NMFS and USFWS 2005; 65 FR 223). During upstream migration, Atlantic salmon seek cool water refuge (e.g., deep pools, springs, and mouths of smaller tributaries) during the summer months. In the fall, female Atlantic salmon select sites for spawning in tributaries to the passable reaches of the Penobscot River. Typical spawning areas are the head of a riffle (Beland et al. 1984), the tail of a pool, or the upstream edge of a gravel bar where water depth is decreasing and water velocity is increasing. As such, spawning is not observed within the main river, but in its tributary creeks.

After spawning, Atlantic salmon may either return to sea immediately or remain in fresh water until the following spring before returning to the sea by May (Fay et al. 2006; NMFS and USFWS 2005). The Penobscot River is host to the largest remaining population of Atlantic salmon in Maine (USASAC 2004). Within the Penobscot River, smaller tributaries are known to support Atlantic salmon, including Cove Brook, Kenduskeag Stream, and Felts Brook

(Spindle et al. 2001) (Figure 6). Although they are anadromous, it should be expected that Atlantic salmon may be present in the river year-round. The life stages most likely to pass through the proposed Action Area are adults that transit through during their migration upstream (between May and July) or downstream, and smolts moving downstream (spring and early summer).

7.2.2 Atlantic Sturgeon GOM DPS

Atlantic sturgeon are anadromous fish that inhabit the Atlantic Ocean and coastal estuaries of the Atlantic Ocean, and return to freshwater rivers and lakes only for spawning. Juveniles remain within the fresh water of natal rivers until reaching ages of 2 to 6 years old (Bain 1997; Kynard and Horgan 2002; Døvel and Berggren 1983; ASSRT 2007). Observations from residents and commercial fishing suggest adults remain near the coastline, not venturing into deeper marine environments (Moser et al. 1998; Stein et al. 2004; Laney et al. 2007). Other studies (Beardsall et al. 2016; Taylor et al. 2016) indicate adults tend to migrate to deeper marine environments during winter months. Fernandes et al. (2010) tagged eight Atlantic sturgeon, all of which had entered the Estuary from the ocean in the summer and had exited the Estuary by fall. This migration behavior has also been reported for subadults (Altenritter et al. 2017).

Atlantic sturgeon can live up to 60 years and grow up to 4 m in length (Scott and Crossman 1973; LeBreton and Beamish 2004). Males spawn every 1–5 years, beginning around the age of 12 years, while females spawn closer to every 3–5 years, typically beginning after 15 years of age (Van Eenennamm et al. 1996; Bain 1997; ASSRT 1998).

Historically, Atlantic sturgeon traveled well up the Penobscot River, as far as the Milford dam falls (Knight 1985; Fernandes et al. 2010). From 1874 to 1995, Atlantic sturgeon were limited to the lower portion of the Penobscot River due to the presence of dams. Although the last dam (Veazie Dam) was breached in 2013, Atlantic sturgeon are still more commonly spotted in the lower portion of the river (Fernandes 2008; Fernandes et al. 2010). Altenritter et al. (2017) detected 73 percent of tagged individuals within mesohaline sections of the river (approximately between 20 and 25 river kilometers) where high densities of prey are present. These studies suggest that the Penobscot River is an important foraging area for Atlantic sturgeon during the migration for spawning (Altenritter et al. 2017).

A 2-year study in the Penobscot showed Atlantic sturgeon in the river from May to October, with concentration of individuals within a very narrow segment of the river downstream of Southern Cove (Fernandes et al. 2010). The same study found the fish at a water depth of 10.3 ± 0.1 m (33 ft), which is deeper than East Cove 3 at the highest tide events (approximately 10–15 ft at the deepest location). Adults begin transition from sea to spawning grounds in the spring, with peak migration and upstream movement occurring in May.

Spawning has not been documented in the Penobscot River during a 7-year study of egg and early-life-stage sampling efforts (Wegener 2012; Altenritter 2015); it is therefore unlikely that Atlantic sturgeon are moving into the Penobscot River for spawning purposes. Atlantic sturgeon spawning has been documented in the nearby Kennebec system (Wippelhauser et al. 2017), which might serve as primary spawning habitat in the GOM much like it does for shortnose sturgeon (Wippelhauser et al. 2015). It is thought the Penobscot River may have historically supported a spawning population, but that population may have been extirpated (ASMFC 2017).

Based on the general biology of Atlantic sturgeon, they may transit through the Action Area. Documented information regarding their preferred water depth and migration patterns suggests their presence in the Action Area would be transitory. As Atlantic sturgeon are bottom feeders, there is a low expectation that they would enter the coves given the short daily period when tides allow access at maximum high tide water depths of 10–15 ft. By late summer months, the number of individuals transiting through the Action Area is observed to be at its lowest and remains low through the period when temperatures are low and ice has formed in the Estuary.

7.2.3 Shortnose Sturgeon

Like Atlantic sturgeon, shortnose sturgeon are also found in both fresh and salt water throughout their lifecycle; however, the patterns between stages in fresh and salt water for shortnose sturgeon are less predictable (McDowall 1987; NMFS 2010). Shortnose sturgeon adults and sub-adults require deep channel sections (2 to 65 ft deep) of large rivers for unimpeded swimming (Dadswell et al. 1984; Dadswell 1979). Shortnose sturgeon tracked during a study in the Penobscot River were found in an average water depth of 6.4 ± 0.05 m (21 ft) (Fernandes et al. 2010), which is deeper than water in East Cove 3 at the highest tide events (approximately 10–15 ft at the deepest location). They feed on a variety of benthic and epibenthic invertebrates, including mollusks, crustaceans (amphipods, chironomids, isopods), and oligochaete worms.

Four different migration patterns for shortnose sturgeon have been documented in the Penobscot River:

- i) River residents that remain within the Penobscot River and Estuary
- ii) Spring coastal emigrants that leave the Penobscot River all together in the spring
- iii) Fall coastal emigrants that leave the Penobscot River in the fall for neighboring rivers
- iv) Summer coastal emigrants that leave Penobscot River in the summer (Dionne et al. 2013).

Telemetric tracking of shortnose sturgeon in the Penobscot River before Veazie Dam was removed showed them overwintering upstream of Southern Cove, migrating downstream by April, and then moving upstream again in late June (Fernandes et al. 2010).

As of 1998, spawning was documented primarily in the Sheepscot-Kennebec-Androscoggin River complex (NMFS 1998). Spawning habitat for shortnose sturgeon has not been documented downstream of the former Veazie Dam but may exist above the site of the former Veazie Dam (UMaine 2015). The recent removal of Veazie Dam may have opened up additional historical habitat to shortnose sturgeon, with sturgeon documented between Veazie and Orono in October 2015 (UMaine 2015).

While forage opportunities are present within East Cove 3, the depth of the river is conducive to adults only at the highest tide events. Due to migration patterns, densities of the shortnose sturgeon transiting through the Action Area are predicted to be at the seasonal lowest in the late summer when TLC placement is proposed to occur.

7.3 DESIGNATED CRITICAL HABITAT WITHIN ACTION AREA

Critical habitat is designated by the NOAA Fisheries to protect areas that are essential to the survival of federally listed wildlife species. Critical habitat designated within the Action Area is described herein to facilitate an assessment of the impacts to the designated Critical Habitat.

All waters within the Action Area are critical habitat for Atlantic salmon GOM DPS and Atlantic sturgeon GOM DPS; this includes the stream channels within the designated stream reaches and a lateral extent as defined by the ordinary high-water line (33 CFR 329.11) (Figure 7). Critical habitat within estuarine environments is defined by the perimeter of the water body or the elevation of extreme high water, whichever is greater.

The Action Area contains habitat components that support one or more life stages (i.e., subadult and adult) for Atlantic salmon GOM DPS (74 FR 29300, June 19, 2009; corrected 74 FR 39903, August 10, 2009) and Atlantic sturgeon GOM DPS (82 FR 39160).

7.4 SUBMERGED AQUATIC VEGETATION

A small area (approximately 3,105 square feet) qualifying as SAV occurs within the Action Area, a portion of which will be temporarily disturbed during construction. The SAV occurs on the outward boundary of the proposed TLC area. It is anticipated that approximately half of the SAV will be buried during TLC placement. Within approximately 1.5 years after TLC placement, sediment will re-accrete and conditions should return to allow for recolonization of SAV. Further, a portion of the population occurs beyond the boundary of the TLC, which will serve as a propagule source for SAV recovery.

7.5 ESSENTIAL FISH HABITAT, HABITAT AREA OF PARTICULAR CONCERN, AND FISH AND WILDLIFE COORDINATION ACT PROTECTED FISH SPECIES

The NOAA Fisheries Greater Atlantic Regional Fisheries Office EFH Assessment & Fish and Wildlife Coordination Act Consultation Worksheet (August 2021 rev) has been completed to assess the effects of the proposed actions on EFH (Appendix E). The Action Area contains EFH for Atlantic salmon under the New England Fishery Management Council Atlantic Salmon FMP.

Table 5 lists fish species identified for management in a Fishery Management Plan (FMP), including respective life stages, with the potential to occur within the Action Area. Habitat requirements described for each species in the EFH mapper's provided text description were compared to site conditions (Section 2.2). EFH to be advanced for further consideration are advanced. The Action Area lies within the Atlantic salmon Habitat Area of Particular Concern (HPAC). The FWCA requires that federal agencies consult with wildlife agencies for activities that affect, control, or modify waters of any stream or bodies of water, to minimize the adverse impacts of such actions on fish and wildlife resources and habitat. Diadromous fish species known to occupy the Penobscot River, including alewife, blueback herring, American shad, American eel, and rainbow smelt, would require review under the Act. These species are also addressed within **Table 5**.

Table 5. Species Identified for Management under a Fisheries Management Plan or Protected Pursuant to FWCA with Potential to Occur within Action Area

Common Name	EFH Is Designated/Mapped for (Life Stage)	Management Council	FMP	Habitat Suitability within the Action Area
Alewife	N/A	N/A	N/A	Suitable Habitat: This species inhabits intertidal zones and may occur within the Action Area.
American Plaice	Adult; Eggs; Juvenile; Larvae	New England	Amendment 14 to the Northeast Multispecies FMP	Limited Habitat Suitability: For each life stage, lower salinity conditions are required. Between July 15 and September 30 the Action Area is expected to be more saline than will be tolerated by American plaice. As such this species may transition past the Action Area in the deeper portions of the river, but is unlikely to forage within the Action Area.
Atlantic Butterfish	Adult	Mid-Atlantic	Atlantic Mackerel, Squid, & Butterfish Amendment 11	Limited Habitat Suitability: This species inhabit deeper waters than occur within the Action Area; however, water temperatures and salinity are suitable for this species. Atlantic butterfish may transition past the Action Area in the deeper portions of the river, but is unlikely to forage within the Action Area.
Atlantic Cod	Adult; Juvenile; Larvae	New England	Amendment 14 to the Northeast Multispecies FMP	Habitat Not Suitable: This species is likely located within the lower portions of the watershed where waters are deeper and more saline and is not expected to occur within the Action Area.
American Eel	N/A	N/A	N/A	Suitable Habitat: This species inhabits shallow intertidal zones and may occur within the Action Area.
Atlantic Herring	Adult; Juvenile; Larvae	New England	Amendment 3 to the Atlantic Herring FMP	Habitat Not Suitable: This species is likely in higher abundance within the lower portions of the watershed in deeper more saline

Common Name	EFH Is Designated/Mapped for (Life Stage)	Management Council	FMP	Habitat Suitability within the Action Area
				conditions and is not expected to occur within the Action Area.
Atlantic Mackerel	Adult; Juvenile	Mid-Atlantic	Atlantic Mackerel, Squid, & Butterfish Amendment 11	Habitat Not Suitable: Both adult and juvenile individuals prefer deeper water (between 10 and 110 m compared to the depth of the Action Area 0 to 5.3 m) and cooler temperatures (between 5°C and 20°C) compared to water conditions currently present (21.4°C to 23.4°C) and therefore this species is not expected to occur within the Action Area.
American Shad	N/A	N/A	N/A	Suitable Habitat: This species may transition past the Action Area within the deeper portions of the river.
Atlantic Sea Scallop	All	New England	Amendment 14 to the Atlantic Sea Scallop FMP	Habitat Not Suitable: This species generally avoids water conditions currently present in the Action Area (e.g., water temperatures above 10°C). Spawning also takes place on the bottom, generally at depths of 5 to 90 m. As such, the Action Area is both too warm and shallow and this species is not expected to occur within the Action Area.
Atlantic Wolfish	All	New England	Amendment 14 to the Northeast Multispecies FMP	Habitat Not Suitable: This species generally avoids shallow water and is restricted to sub-tidal habitat and is not expected to occur within the Action Area.
Blueback Herring	N/A	N/A	N/A	Suitable Habitat: This species inhabits intertidal zones and may occur within the Action Area.
Bluefish	Adult; Juvenile	Mid-Atlantic	Bluefish	Suitable Habitat: This species is highly migratory and can tolerate a wide range of conditions with a preference for a “mixing” zone and may occur within the Action Area.

Common Name	EFH Is Designated/Mapped for (Life Stage)	Management Council	FMP	Habitat Suitability within the Action Area
Little Skate	Adult; Juvenile	New England	Amendment 2 to the Northeast Skate Complex FMP	Suitable Habitat: This species inhabits intertidal zones and may occur within the Action Area.
Ocean Pout	Adult; Eggs; Juvenile	New England	Amendment 14 to the Northeast Multispecies FMP	Habitat Not Suitable: Eggs are found in hard bottom habitats with high salinity. Limited Habitat Suitability: Juveniles: tolerate a wider variety of substrates Habitat Not Suitable: Adults are found in deeper sub-tidal habitats. Only Juveniles may occur within the Action Area.
Pollock	Juvenile	New England	Amendment 14 to the Northeast Multispecies FMP	Habitat Not Suitable: This species prefers rocky bottom habitats and also requires eelgrass beds in shallow water and is not expected to occur within the Action Area.
Rainbow Smelt	N/A	N/A	N/A	Suitable Habitat: This species inhabits intertidal zones and may occur within the Action Area.
Red Hake	Adult; Eggs/Larvae/ Juvenile	New England	Amendment 14 to the Northeast Multispecies FMP	Habitat Not Suitable: Requires bottom habitat that provides shelter opportunity, which does not occur in the Action Area. This species is not expected to occur within the Action Area.
Silver Hake	Adult	New England	Amendment 14 to the Northeast Multispecies FMP	Habitat Not Suitable: Requires waters deeper than 35 m. This species is not expected to occur within the Action Area.
Smooth Skate	Juvenile	New England	Amendment 2 to the Northeast Skate Complex FMP	Habitat Not Suitable: Requires water between 100 and 400 m deep. This species is not expected to occur within the Action Area.

Common Name	EFH Is Designated/Mapped for (Life Stage)	Management Council	FMP	Habitat Suitability within the Action Area
Thorney Skate	Juvenile	New England	Amendment 2 to the Northeast Skate Complex FMP	Habitat Not Suitable Requires water between 80 and 300 m deep. This species is not expected to occur within the Action Area.
White Hake	Adult; Juvenile	New England	Amendment 14 to the Northeast Multispecies FMP	Suitable Habitat: Juveniles: This species inhabits intertidal zones, tolerates a range of saliently, and also uses soft bottom habitats. This species may occur within the Action Area. Limited Habitat Suitability: Adults: prefer sub-tidal habitats. As such this species may transition past the Action Area in the deeper portions of the river, but is unlikely to forage within the Action Area.
Windowpane Flounder	Adult; Eggs; Juvenile; Larvae	New England	Amendment 14 to the Northeast Multispecies FMP	Suitable Habitat: This species inhabits intertidal zones, tolerates a range of saliently, and also uses soft bottom habitats. Limited Habitat Suitability: Adults prefer sub-tidal habitats. As such adult windowpane flounder may transition past the Action Area in the deeper portions of the river, but is unlikely to forage within the Action Area.
Winter Flounder	Eggs; Juvenile; Larvae/Adult	New England	Amendment 14 to the Northeast Multispecies FMP	Suitable Habitat: This species inhabits intertidal zones, tolerates a range of saliently, and also uses soft bottom habitats. This species may occur within the Action Area.
Winter Skate	Juvenile	New England	Amendment 2 to the Northeast Skate Complex FMP	Limited Habitat Suitability: Typically found in sub-tidal habitats and also high salinity zones. As such this species may transition past the Action Area in the deeper portions of the river, but is unlikely to forage within the Action Area.

7.5.1 EFH, HPAC, and FWCA Protected Species Further Considered

The following species, identified within the NOAA EFH mapper, have the potential to occur and have suitable habitat within the Action Area:

- America plaice
- Atlantic butterfish
- Bluefish
- Little skate
- Ocean pout; juveniles
- White hake
- Windowpane flounder
- Winter flounder
- Winter skate

The Action Area is also HPAC for Atlantic salmon.

The following species, requiring consideration pursuant to the FWCA, are also further considered:

- Alewife
- American eel
- American shad
- Blueback herring
- Rainbow smelt.

8 EFFECTS OF THE ACTION

This section describes the potential beneficial and adverse effects of the proposed action. These effects are discussed below by type of ecological effect expected and the activity causing the potential effect. Effects are considered for each species with the potential to occur within the Action Area. In-water construction activities and AMMs (e.g., BMPs) to minimize these effects are also discussed.

8.1 BENEFICIAL EFFECTS

Although short-term construction-related impacts will occur during TLC placement, they will be outweighed by the immediate and long-term benefit of remediation activities (i.e., reduced mercury exposure and contributions to accelerated recovery of the Estuary). A reduction in mercury within the BAZ, and in turn, the benthic community, represents an improvement in fish foraging quality. Implementation of the TLC Pilot is expected to reduce potential exposure to mercury in, and accelerate the recovery of, intertidal surface sediment by the placement of material with substantially lower concentrations of mercury in the BAZ. Over time, the short-term changes to the substrate caused by the placement of the TLC will be progressively lessened by the natural deposition of sediment. Naturally deposited sediment will be consistent with the current intertidal sediment and will accrete on top of the TLC resulting in the isolation of mercury in the current native sediment beneath the TLC material. In addition, the TLC Pilot will generate essential information about the site-specific performance of a TLC that will be used to evaluate the feasibility and potential benefits of further TLC placement in Orrington Reach and throughout the system.

8.1.1 Analogous Case Studies

To support the expectation that TLC placement in a riverine system will result in a long-term benefit from remediation activities (i.e., reduced mercury exposure and contributions to accelerated recovery of the Estuary), two case studies review reports are summarized:

- **Enhanced Monitored Natural Recovery (EMNR) Case Studies Review (Merritt et al. 2009):** This report provides a detailed overview of three sites where TLC was applied to enhance natural recovery, as well as a more general discussion of several additional sites.
- **Habitat Considerations for Large-Scale Sediment Capping Projects (Ecology 1997):** This report provides a summary of the state of understanding regarding benthic community recolonization of large capping sites and includes several case studies where benthic recovery was evaluated. The report concludes that benthic recovery typically occurs within months to a few of years.

Case Study Highlight 1: Lower Duwamish Site

The following discussion provides information that is available at the U.S. Environmental Protection Agency (EPA) website for the Lower Duwamish Waterway Site (<https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=1002020>), unless otherwise noted.

The Lower Duwamish Waterway Superfund site is in the lower portion of the Duwamish River, within the south industrial section of Seattle, Washington. The river has been impacted by decades of industrial activity, and sediment in the river is contaminated, with the primary contaminant being polychlorinated biphenyls (PCBs).

Numerous areas were identified for early action, including the “Duwamish/Diagonal CSO/SD” area. As part of this early action in 2003-2004, 3–5 ft of contaminated sediment was dredged from the area, and the area was backfilled with clean materials to form a cap. Post-completion monitoring found that a 4-acre area of the cap had been recontaminated with residuals generated during the dredging. A TLC was identified as the best way to quickly reduce the elevated PCB values within the 4-acre dredge residual area. The TLC was placed in February 2005 and consisted of clean sand with a minimum thickness of 6 in. and an average thickness of 9 in. Monitoring has demonstrated that the TLC is stable and has reduced the time frame for the area to recover by 10 to 20 years (Stern et al.).

EPA issued a record of decision (ROD) in 2014 for the broader waterway (USEPA 2014). The ROD includes placement of a TLC to enhance natural recovery of over 48 acres. The TLC will include 6 to 9 in. of clean material over contaminated sediments in the waterway. As part of the remedial design, a pilot study was conducted to evaluate whether adding activated carbon to the TLC material would achieve cleanup goals over a TLC consisting solely of sand or sand and gravel (USEPA 2021). The pilot study involved construction of several 1-acre test plots and monitoring for a 3-year period.

The monitoring showed that the test plots were stable, and the benthic community was recolonized within 1 year of the TLC placement (Magar et al. 2023). Further, the monitoring showed that all the plots were effective at reducing the bioavailability of PCBs and that the addition of activated carbon did not have a measurable benefit (USEPA 2021).

The findings of the pilot study are being considered as part of the remedial design for the waterway. Construction was anticipated to start in 2025.

Case Study Highlight 2: Peninsula Harbor Site

The Peninsula Harbor Site is located on Lake Superior in Ontario, Canada. The harbor was impacted by historical inputs from pulp mill operations and a chlor-alkali plant. These inputs resulted contamination of the harbor sediment with mercury and other contaminants, and the impairment of the fish and benthic communities.

A TLC was selected as the remedy to address the contaminated sediment over a 57-acre area of the harbor (Chambers et al. 2022). The TLC design included a 15–20 cm (6–8 in.) thick TLC of medium-grained sand in lower energy areas and a 12.5–37.5 cm (5–15 in.) thick TLC of coarse-grained sand in areas where higher energy was expected (e.g., where vessel traffic could lead to prop wash) (Kim et al. 2012). The TLC was placed in 2012.

A monitoring assessment was completed in 2017 to evaluate the TLC performance with respect to stability, effectiveness, and ecological recovery. This assessment concluded that the TLC has been effective at reducing mercury concentrations below the cleanup goal and has reduced the risk to ecological receptors. The TLC was found to be stable and is preventing mercury migration from underlying sediment to surface water. The monitoring has shown that natural sediment has deposited to and accumulated on the TLC. The monitoring assessment, completed 5 years after the TLC placement, found that the TLC has been recolonized with benthic invertebrates, and aquatic vegetation has increased in the TLC area over time (George 2021).

8.1.2 Additional Case Study Resources

Appendix F provides summary tables of specific sites where capping was applied or is planned. The focus of these summaries is on sites involving TLC placement in river, lake, or estuary (subtidal and/or intertidal) settings. A total of 10 sites are listed and the following information provided: a general description of the site and the TLC performance, the TLC parameters (e.g., area, cap thickness, and cap material), and, where available, information regarding the recovery of the benthic invertebrate community following the TLC placement. For each site, links are included to reports or other documentation (e.g., presentations, fact sheets, abstracts) that provide information about the site and the TLC. Appendix F also includes a reference table for several reports that present compilations of capping case studies. Reports provide a general overview of numerous TLC and capping sites, including sites where a TLC has been placed in intertidal marshes to combat loss of coastal wetlands due to sea level rise.

8.2 ADVERSE EFFECTS

Potential adverse direct and indirect effects are associated with construction and changes to benthic substrate and are expected to be temporary based on review of TLC placement at other sites. Project temporary effects to both the species and the habitat that the species use are further described in this section.

8.2.1 Evaluation of Effects on Tidal Inundation

The characteristics of intertidal habitats are, by definition, closely linked to tidal inundation duration. Placement of a TLC will raise the elevation of the sediment bed of the intertidal flats and low marsh more abruptly than natural deposition processes, and tidal inundation

frequency may change and potentially affect intertidal habitat. To evaluate this potential, pre- and post-construction elevations in each capping area were compared to the water level data from July 20, 2023, to July 19, 2024. Evaluation of a 1-year time frame captures the range of tidal conditions over a representative timescale for this comparison. Using these tidal data, placement of a 4- or 6-in.-thick TLC would reduce the time that the intertidal flats and low marsh in East Cove 3 are tidally inundated by less than 5 percent. With these selected TLC design thicknesses, intertidal portions of the capping area would retain their intertidal characteristic.

8.2.2 Effects of TLC Placement on Low Marsh Plant Recovery

The TLC Pilot is designed to minimize disturbances to the ecosystem during construction and provide critical data regarding the effects of the TLC placement on intertidal flats in Orrington Reach. Effects of disturbance and recovery of the benthic and marsh habitat in the TLC Pilot Area are expected to be specific to the project location. Often the extent of marsh habitat is seasonally variable, demonstrating this plant community is resilient to disturbance.

To evaluate if the placement of material would affect plant growth in the low marsh, the TLC design thickness for this area was selected with consideration of cap thicknesses used in similar settings reported in literature. Studies of thin-layer placement of sediment in tidal marshes suggest that tidal marsh plants can recover through as much as 6 in. of sediment addition (Raposa et al. 2020). This finding suggests that marsh vegetation in areas where 4-6 in. of TLC is placed should emerge through the cap quickly. The inclusion of a control area within the low marsh subarea will allow for the comparison of the effects on marsh plants both within and adjacent to TLC Pilot Area.

8.2.3 Shoreline Erosion Potential

Placement of the TLC will increase the elevation of the sediment bed by 4 to 6 in. in the TLC Pilot Area. A change in sediment bed elevation has the potential to alter hydrodynamic conditions in East Cove 3. Generally, altering hydrodynamic conditions (e.g., by substantially changing the river channel cross-sectional area) could change localized river flow patterns and velocities that could increase shoreline erosion. Hydrodynamic modeling indicates the TLC Pilot's minimal change in sediment bed elevation will not noticeably increase current velocities along the shoreline, and thus not noticeably increase shoreline erosion. Further, while visual observations suggest that localized shoreline erosion is occurring within certain areas of Orrington Reach, no such erosion is apparent in East Cove 3 as its shoreline consists of bedrock or placed riprap. Consequently, the TLC is not predicted to meaningfully impact shoreline erosion in East Cove 3.

8.2.4 Hydrodynamics and Erosion Considerations

Hydrodynamic modeling was conducted to evaluate shear stresses across a range of river flows, including the 10-, 50-, and 100-year storm flow events.⁹ The modeled shear stresses were compared to an estimated critical shear stress (i.e., the shear stress at which individual grains of a material with a certain diameter can be moved) of 1.0 pascal (Pa), which is representative of an unmixed, coarse sand with a diameter of 1.5 mm (Vermont ANR 2004). Information from the model simulations has identified conditions and areas with a greater potential for TLC erosion.

As summarized in **Table 6**, the hydrodynamic model output indicates maximum shear stresses across most of the TLC Pilot area are less than 1.0 Pa. Figures 8a-c present iso-contour lines of the model-predicted maximum shear stress across the TLC Pilot extent.¹⁰ The modeling-predicted maximum shear stresses exceed 1.0 Pa for the channel-side (western) portion of the TLC Pilot area under a 50-year or greater storm flow condition, indicating a greater potential for erosion.

Table 6. Hydrodynamic Model-Predicted Maximum Shear Stresses across Most of the TLC Pilot Area

Model Storm Return Period (years)	Percent of Capping Subarea Subject to Modeled Shear Stresses Exceeding Specified Values			
	Shear Stress	Intertidal Flat North	Intertidal Flat South	Low Marsh
10	0.5	40%	33%	0%
	1.0	15%	20%	0%
	1.5	5%	11%	0%
50	0.5	59%	57%	9%
	1.0	37%	38%	2%
	1.5	21%	28%	0%
100	0.5	59%	59%	14%
	1.0	40%	43%	4%
	1.5	26%	33%	1%

A one-dimensional sediment erosion model was used to evaluate the potential erosive loss for a cap. The use of hydrodynamic model results to inform subsequent modeling is consistent with

⁹ Discharges associated with these return periods were previously developed as part of the Phase III engineering study (Amec Foster Wheeler 2018).

¹⁰ The iso-contours presented in Figures 5a-c represent the breakpoint where the majority of the modeled maximum shear stresses are below a given threshold. Higher maximum shear stresses are predicted to locally occur in limited areas.

industry standard approaches linking hydrodynamic and sediment transport modeling (Kalin and Hantush 2003; Quantitative Environmental Analysis, LLC 2008; RPS 2022). The sediment erosion modeling was applied to estimate the depth of erosion that will occur for five representative shear stresses (1.0, 2.0, 3.0, 4.0, and 5.0 Pa). These results were then combined with the distribution of shear stresses predicted in the TLC Pilot Area to estimate the extent of potential erosion in different areas of the TLC Pilot Area (Figures 9a-b). Potential erosion was modeled using two material gradations meeting the cap material specification (Section 4.3.1).

The output of the sediment erosion model indicates there is minimal potential for erosion of the cap material under the 10-year storm flow model scenario, as 84 percent of the TLC Pilot Area is predicted to lose zero to 0.24 in. of cap material. Although greater shear stresses and associated potential cap erosion are predicted for the 50- to 100-year storm flow events, most of the erosive loss of cap material is predicted to be limited to a small percentage of the TLC Pilot Area (Figures 9a-b). For example, more than 80 percent of the TLC Pilot Area is predicted to lose less than 1 in. of material under the 100-year storm event. The areas of greatest predicted erosion are located in the far western and southwestern portions of the TLC Pilot Area, corresponding to the areas of greatest predicted shear stress (Figures 9a-b).

Collectively, the modeling shows that a TLC consisting of material meeting the specified gradation would be sufficiently stable to achieve the TLC Pilot objectives:

- The model results indicate that the maximum shear stresses will be less than 1.5 Pa under the 100-year storm flow condition across more than 70 percent of the intertidal flat and most of the low marsh area. Further, at least 75 percent of the cap material is predicted to remain in more than 80 percent of the TLC Pilot Area under a 100-year storm event. Greater predicted losses are limited to the far west and southwest portions of the intertidal flat south area.
- The loss of cap material under these extreme storm flow conditions is not expected to compromise TLC effectiveness. Even with a loss of 50 percent of the cap material in small, localized areas, mercury concentrations in the BAZ (see Section 2.2.6) would be reduced by 50 percent relative to current surface sediment conditions. Therefore, the TLC will immediately reduce exposure to mercury in intertidal surface sediment.
- Losses from the TLC during extreme storm flows would primarily consist of the fine-grained fractions of the cap material. This change in material gradation would be consistent with previously modeled results and experimental observation (James et al. 2010). The remaining cap material would therefore be less susceptible to future losses during subsequent extreme river flow events. The loss of fine-grained material in portions of the TLC is not expected to prevent recolonization by benthic organisms (Section 5.2).

8.2.5 Water Quality Effects

Placement of the TLC has the potential to result in temporary increased turbidity levels in the Action Area primarily due to dispersion of fine grained components of the TLC material and disturbance of the river sediment bed. Increases to turbidity levels are expected to be minor, very short-term (due to river flow velocities and volume of water), and localized to the immediate work area.

It is unlikely that increases to turbidity from the TLC Pilot activity would have an adverse impact on Penobscot River protected fish species. Both sturgeon and Atlantic salmon are primarily bottom feeders that are highly adapted for preying on benthic invertebrates. The diet of Atlantic salmon, Atlantic sturgeon, and shortnose sturgeon is known to include invertebrates, such as crustaceans, worms, and mollusks, and bottom-dwelling fish, such as sand lance. Because their foraging behavior exposes them to riverbed and suspended sediment, these species generally tolerate high levels of suspended sediment and are less likely to be disturbed by sediment plumes. As such, Atlantic salmon, Atlantic sturgeon, and shortnose sturgeon are adapted to foraging in turbid benthic habitats, and temporary increases in turbidity would not significantly reduce foraging behavior within the Action Area. Further, the expanse of open water immediately adjacent to the Action Area is expected to provide opportunity for salmon, sturgeon, and other fish, to avoid the immediate vicinity of active TLC construction and any associated plume of increased turbidity.

While all three protected species considered have the potential to be present year-round, in various life stages, each is anticipated to occur in the lowest abundance during the time of year when the TLC placement is planned to occur. In addition, habitat within East Cove 3 is used primarily for foraging (Sections 7.2.1 to 7.2.3) as there has been no documentation of spawning far downstream in the Estuary. As a result, this temporary alteration in habitat is expected to primarily affect commonly occurring species, and effects to protected species are expected to be infrequent and minimal in nature.

8.2.6 Foraging Habitat Effects

TLC material placement will disturb and bury benthic invertebrates and the substrate they use, temporarily reducing the diversity and productivity of the benthic community within the TLC Pilot Area. In addition, cap placement in portions of the low marsh will bury tidal marsh vegetation and temporarily reduce the productivity of marsh vegetation in the TLC Pilot Area. These impacts to the benthic community and marsh vegetation will temporarily reduce the prey resources and foraging habitat available for fish, birds, and mammals. Temporary loss of benthic prey species will occur throughout a comparatively small foraging area for salmon and sturgeon relative to the remainder of the river, Estuary, and bay which continue to support foraging opportunities.

Recolonization of benthic habitat following capping is affected by many physical and ecological factors, including site-specific bathymetry, hydrodynamics, depth of deposited sediment, the spatial scale of the disturbance, sediment type, and the timing and frequency of the disturbance (Wilber and Clark 2001). The proposed remediation design is not expected to change factors that affect benthic recolonization in the long-term (i.e., bathymetry or hydrodynamics). Only temporary changes will occur, including depth of deposited sediment and sediment type. As such, it is expected that as native material accretes, benthic recolonization will occur.

Benthic communities are known to be resilient, with rapid recolonization rates promoted by proximity to adjacent undisturbed communities that provide colonizing larvae (Rosenberg et al. 2002; Dernie et al. 2003). A 2003 study on the recovery of soft sediment communities and habitat following physical disturbance demonstrated insignificant changes in environmental parameters between control and disturbed sediment locations as early as 14 days after disturbance, with recovery of associated species assemblages trailing behind and correlated with infill rates of disturbed sites (Dernie et al. 2003). The capped areas are expected to be replenished with habitable sediments (due to natural accretion) within several months to a few years (Oliver et al. 1977; Watling et al. 2001). Following capping, the deposition of sediments, comparable to pre-remediation conditions, would begin almost immediately, and the benthic community inhabiting those sediments would be expected to recover within a few months to up to 2 years, depending on when disturbance occurs and other ecological factors affecting recolonization (Newell et al. 1998; Blake et al. 1996).

As described in Section 8.2.2, studies of thin-layer placement of sediment in tidal marshes suggest that tidal marsh plants can recover through as much as 6 in. of sediment addition (Raposa et al. 2020). As such, the low marsh vegetation is expected to recover based on the TLC design thickness of 4 in. for this area. In addition, a control area within the low marsh subarea will allow for the comparison of the effects on marsh plants both within and adjacent to the TLC Pilot Area. Temporary alterations to benthic prey communities are unlikely to result in measurable effects to Penobscot protected sturgeon and salmon species.

8.2.7 Entrapment or Entrainment

The TLC would be placed using broadcast methods and is not expected to result in entrainment or entrapment of fish. Typical construction methods that often result in entrainment or stranding, such as coffer dams, water bypass, or turbidity curtains bisecting the channel, are not proposed as a part of the project. Water intakes (hoses and pumps) would be required to provide water to slurry with the TLC prior to placement. The intake hose would be protected with a NOAA Fisheries-approved screen (see AMM-6) to prevent fish entrainment. Traditional turbidity curtains around the Action Area or bisecting the river are not proposed for water quality control measures. A localized curtain may be deployed immediately around the broadcast spreader (e.g., a moon pool). As the broadcast spreader would cause fish to disperse from the Action Area while active, it is not expected that fish would become entrained in a

curtain that is immediately surrounding the broadcaster. If a localized curtain is deployed, monitoring will occur to ensure individual fish or schools of fish are not impacted by the curtain (see AMM-7).

8.3 CONSIDERATION OF PROJECT TIMING—WORK WINDOW

Feasibility of placement of TLC material is dependent on weather, tides, and daylight hours. In-water work is most feasible and safest when temperatures stay above freezing and the combination of tides and daylight hours provide for longer daily work periods. Weather and daylight conditions between November 8 and April 9¹¹ do not meet these requirements. In Bangor (just north of Orrington), the average low temperature is 32°F on November 8 and 30°F on April 9, indicating that freezing air temperatures will be present throughout much of the work window presenting safety (e.g., freezing water on work decks) and logistical issues (e.g., equipment freezing and startup delays). Further, less than 10 hours of daylight is typically available throughout most of the work window, presenting additional safety (e.g., visibility) and logistical (e.g., reduced work time) issues. Starting as soon as July 15 would mean more favorable weather and daylight conditions, providing safer working conditions and allowing the TLC Pilot to be completed within one construction season as a single mobilization.

If the TLC Pilot was restricted to the standard in-water work window, construction would be split into two mobilizations to avoid freezing conditions. The first mobilization would begin on November 8 and cease when conditions become infeasible to continue working (anticipated to occur within only a few weeks). The second mobilization could potentially begin in the late spring of the following year when temperatures have increased. A mobilization at this time would also need to avoid the spring freshet, when the warming temperatures and associated snow melt lead to high river flow velocities that could limit the ability to safely execute the work. Also, out migrating fish will begin to transit through the Action Area just after the spring freshet. The timing of the spring freshet varies depending on climate conditions, but typically occurs in March. As such, it is likely that the second mobilization would not begin until November 8 of the following year.

Completing the TLC Pilot in one season lessens the potential for adverse impacts to natural resources by minimizing construction disturbances associated with multiple mobilizations. The additional mobilization/demobilization cycle would include the movement of construction vessels and installation and deployment of construction equipment. An additional mobilization/demobilization cycle would involve more time spent performing in-water work, doubling the associated activities and time necessary for equipment transportation, installation, and retrieval or removal. This increased level of activity would increase the potential for disturbance within species habitat, increasing adverse impacts to the species. Further, this

¹¹ The standard practice for tidal waters, as referenced within USACE General Permits for the State of Maine, General Condition 24, is an in-water work window beginning November 8 and ending April 9 (USACE 2020).

additional work would increase the costs and may impact the feasibility of implementing the full-scale project.

The following are examples of activities anticipated to have the greatest adverse effect from two mobilizations:

- An additional mobilization/demobilization cycle is estimated to require an additional 15 days of overall construction presence in the TLC Pilot Area (Section 4.4), which would require the equipment be on the river for a longer period.
- The demobilization from the initial construction season would involve the transportation of cap placement equipment and the associated work platforms to a location where they can be removed from the water. The additional movement and subsequent removal of this equipment associated with two work seasons would increase the potential for disturbance to the Action Area.
- Deployed equipment, including erosion control and turbidity-related BMPs (should they be required), must be retrieved as part of demobilization. The equipment must be reinstalled in the second construction season, introducing additional potential disturbance to the Action Area.
- An additional mobilization should not occur during the spring freshet, when high river flow velocities could limit the ability to control and safely execute the work.

Based on seasonal migration and spawning patterns, a TLC placement between July 15 and September 30 will minimize adverse impacts to protected fish species (i.e., Atlantic salmon, Atlantic sturgeon, and shortnose sturgeon) compared to TLC placement in the spring. Within the Penobscot River, various life stages of these species may be present throughout the year. During the typical work window, between November through April, it is believed that densities of protected species are the lowest. However, due to feasibility constraints discussed above (e.g., weather, day length, and safety), it is not possible to restrict TLC material placement to the typical work window. As such, it is proposed that TLC placement begin on July 15 when it is expected that project activities will have the least impact on juvenile fish that hatch in early April and May (Altenritter 2015; Altenritter et al. 2017).

8.4 CRITICAL HABITAT AND ESSENTIAL FISH HABITAT

The Action Area is located within designated critical habitat for federally listed fish species and also contains EFH; however, project effects on both critical habitat and EFH are expected to be minimal in the short-term, and beneficial in the long-term (Section 8.1). The placement of the TLC would result in no loss of critical habitat or EFH but would cause a temporary disturbance to substrate used by foraging species. While TLC placement will be permanent (i.e., the TLC would not be removed as a part of the action), it should not have the effect of permanently

converting the substrate type of the cove. Ultimately, natural sediment accretion will return the cove substrate to pre-construction condition supporting fish foraging opportunities.

Changes within the Action Area expected over the long term, once the Estuary substrates accrete and benthic substrate is recolonized, are expected to be minor and beneficial to the foraging habitat. Temporary water quality effects (primarily turbidity) will improve shortly after TLC placement. As such, placement of the TLC would not reduce identified habitat quality components for Atlantic salmon GOM DPS, Atlantic sturgeon GOM DPS, or EFH.

The potential loss of critical habitat and EFH from the action is expected to be insignificant because:

- The period during which the habitat would be unavailable (due to TLC placement) for use by sensitive species would be temporary until the benthic community recovers.
- The effects of the TLC on the benthic habitat substrate will be temporary.
- The TLC Pilot Area affected through placement of approximately 6.3 acres of fill is very small compared to available critical habitat within the Estuary.

In summary, changes to critical habitat or EFH are expected to be insignificant (too small to detect or measure) for all species considered.

9 DETERMINATIONS

Within the federal regulations, adverse effects are referred to as a “take,” which is defined under the FESA to mean “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct” (16 USC §1538; endangered species: 50 CFR §17.21 (c); threatened species: 50 CFR §17.31 (a)). Harm is further defined by NOAA Fisheries as an act that kills or injures fish or wildlife. Such an act may include *significant* habitat modification or degradation that kills or injures fish or wildlife by *significantly* impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR §222.102).

Atlantic salmon GOM DPS, Atlantic sturgeon GOM DPS, and shortnose sturgeon may be present within the Action Area during the fall when work is proposed to occur, but their numbers are expected to be the lowest during fall. The Action Area has not been identified as spawning habitat for any of these species (Sections 7.2.1 through 7.2.3). Although these species may be present, the nature of the proposed action (limited to placing a clean sand TLC, as discussed in Section 4.6), and avoidance and minimization measures (including restricting work to occur in the season well after spring fish hatch) reduces the potential for take of the fish, limiting species impacts to habitat alterations. Construction actions that are typically considered to have the effect of take, such as pile driving, dredging, or dewatering, are not proposed as a part of the TLC Pilot.

Water quality degradation would be short term and minor, and unlikely to result in fish mortality. Behavioral modifications may occur. Most notably, all three species are expected to disperse to adjacent available habitat during TLC placement.

The Action Area contains designated EFH; however, similar to critical habitat, project effects are expected to be minimal in the short-term, and beneficial in the long-term (Section 8.1). Also, pursuant to FWCA, more commonly occurring diadromous species (e.g., alewife, American eel, American shad, blueback herring) are known to occupy the Penobscot River. The placement of the TLC would result in temporary disturbance of EFH for a subset of species that rely on shallow water intertidal coves for essential habitat requirements, such as American plaice, Atlantic butterfish, bluefish, little skate, ocean pout (juveniles), white hake, windowpane flounder, winter flounder, and winter skate.

Changes to habitat components within the Action Area are expected to be short-term, and once the Estuary substrates accrete and benthic substrate is recolonized, EFH is expected to recover and ultimately be beneficial for foraging purposes. Temporary water quality effects (primarily turbidity) will improve shortly after TLC placement. As such, placement of the TLC would not reduce identified EFH quality.

In summary, the adverse effect on EFH is not expected to be substantial. Adverse effects would be no more than minimal, temporary, and would be alleviated by project modifications already incorporated into the Project Description (e.g., implementation of seasonal work windows and turbidity monitoring).

Based on the analysis in this BA, determinations are as follows:

- The Project **may affect, but is not likely to adversely affect** Atlantic salmon GOM DPS, Atlantic sturgeon GOM DPS, and shortnose sturgeon. Abundance of these species is estimated to be low within the Action Area, and the nature of the work would have discountable effects on the species.
- The Project **may affect, but is not likely to adversely affect** designated critical habitat. Changes to critical habitat are expected to be insignificant (too small to detect or measure) for all species considered.
- EFH adverse effects would be temporary and would not be substantial. Potential effects would be minimized through the implementation of AMMs. Potential adverse effects would be limited to temporary disturbance of Action Area substrate.

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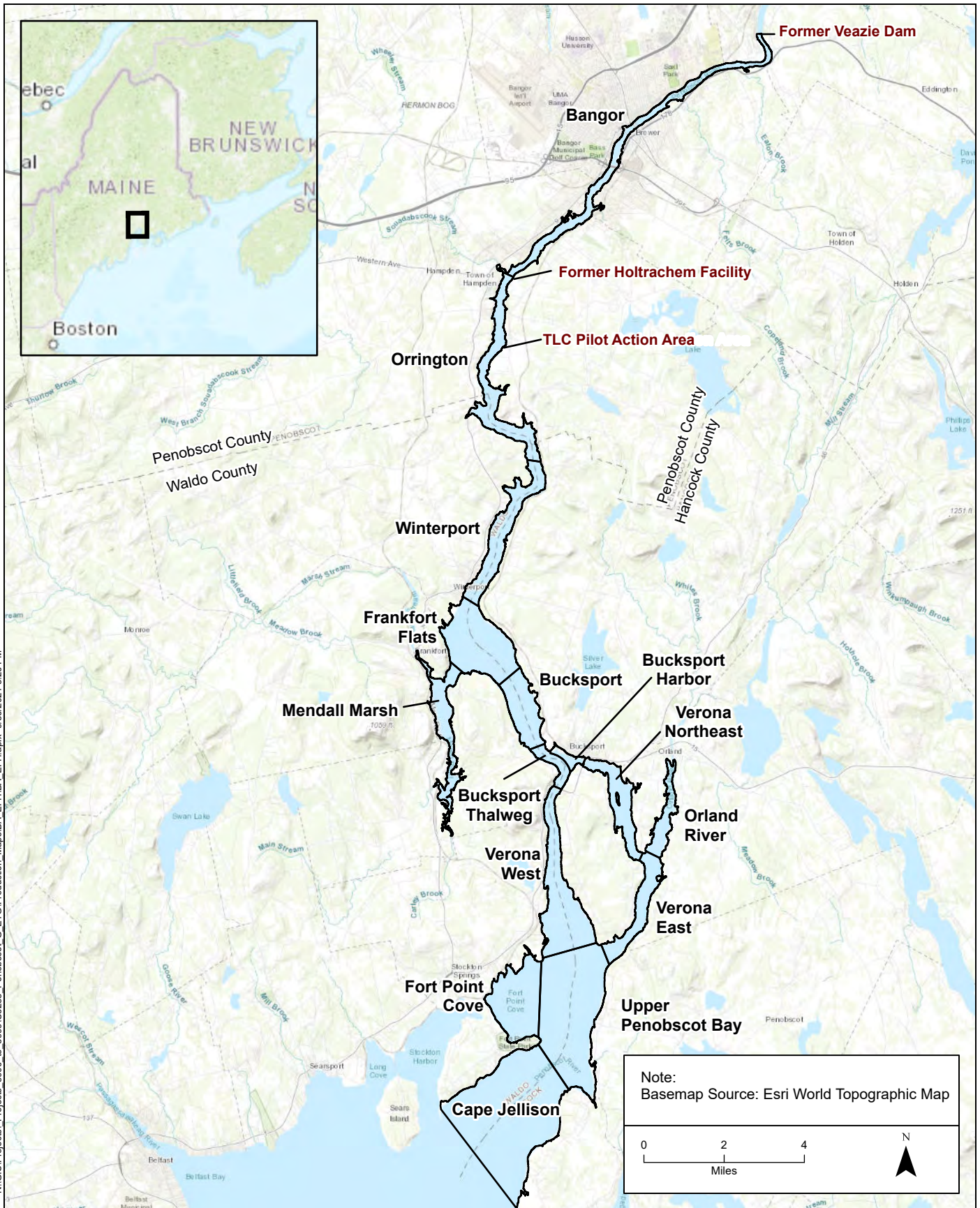
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Figures

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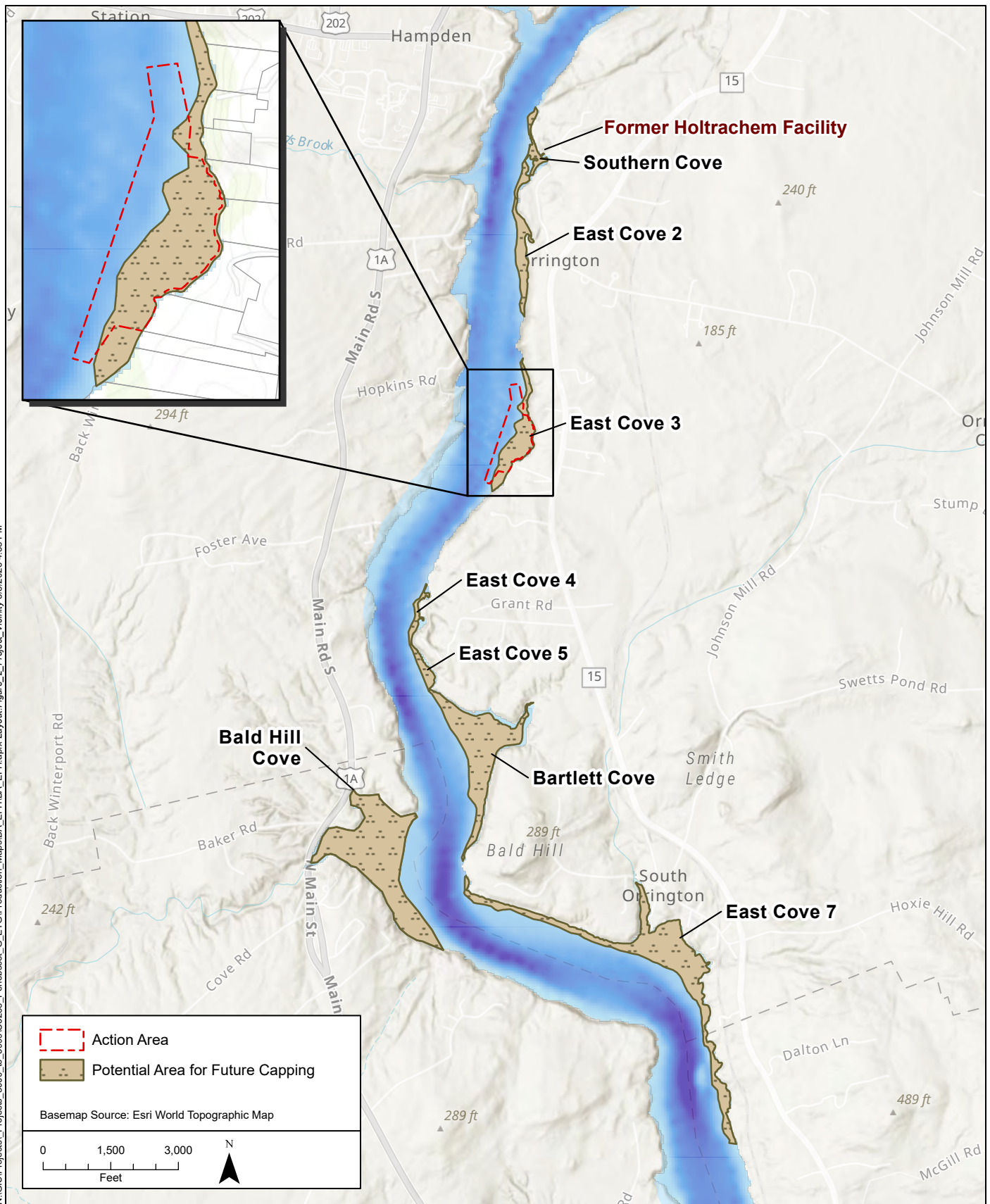
Greenfield Penobscot Estuary Remediation Trust LLC
Trustee of the Penobscot Estuary Mercury
Remediation Trust

Prepared by:



Figure 1.
Penobscot River Estuary Reaches
NRPA Permit Application: Attachment 16.
Biological and Essential Fish Habitat Assessment,
National Marine Fisheries Service
Orrington Reach Capping Remedy

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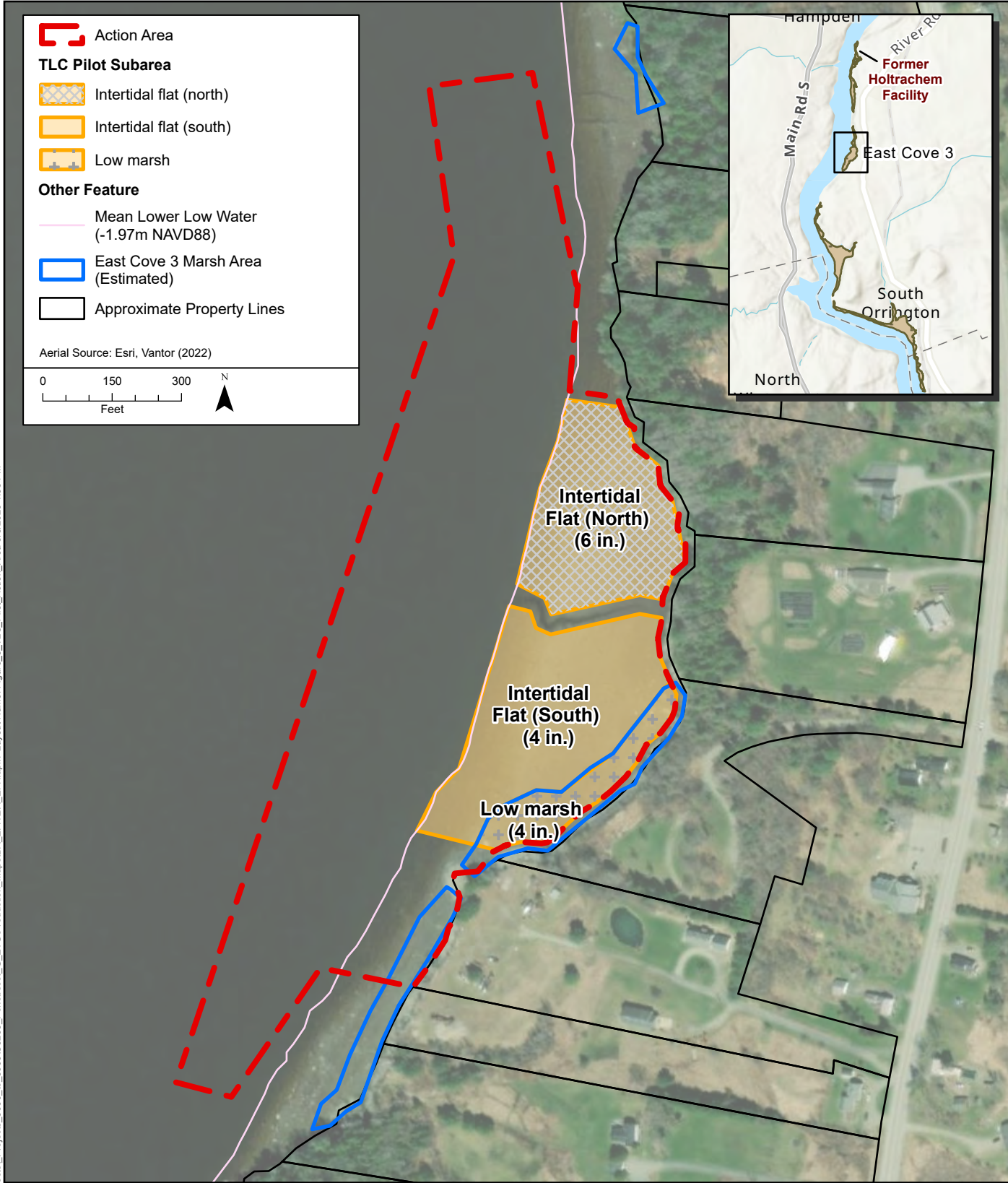


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Remediation Trust

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consulting inc.

Figure 2.
Action Area and Vicinity
NRPA Permit Application: Attachment 16.
Biological and Essential Fish Habitat Assessment,
National Marine Fisheries Service
Orrington Reach Capping Remedy

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Notes:
The low marsh subarea will be divided into two approximately 0.4-acre areas with one TLC area and one control area.

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Figure 3.
TLC Pilot Location and Action Area
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Biological and Essential Fish Habitat Assessment,
National Marine Fisheries Service
Orrington Reach Capping Remedy

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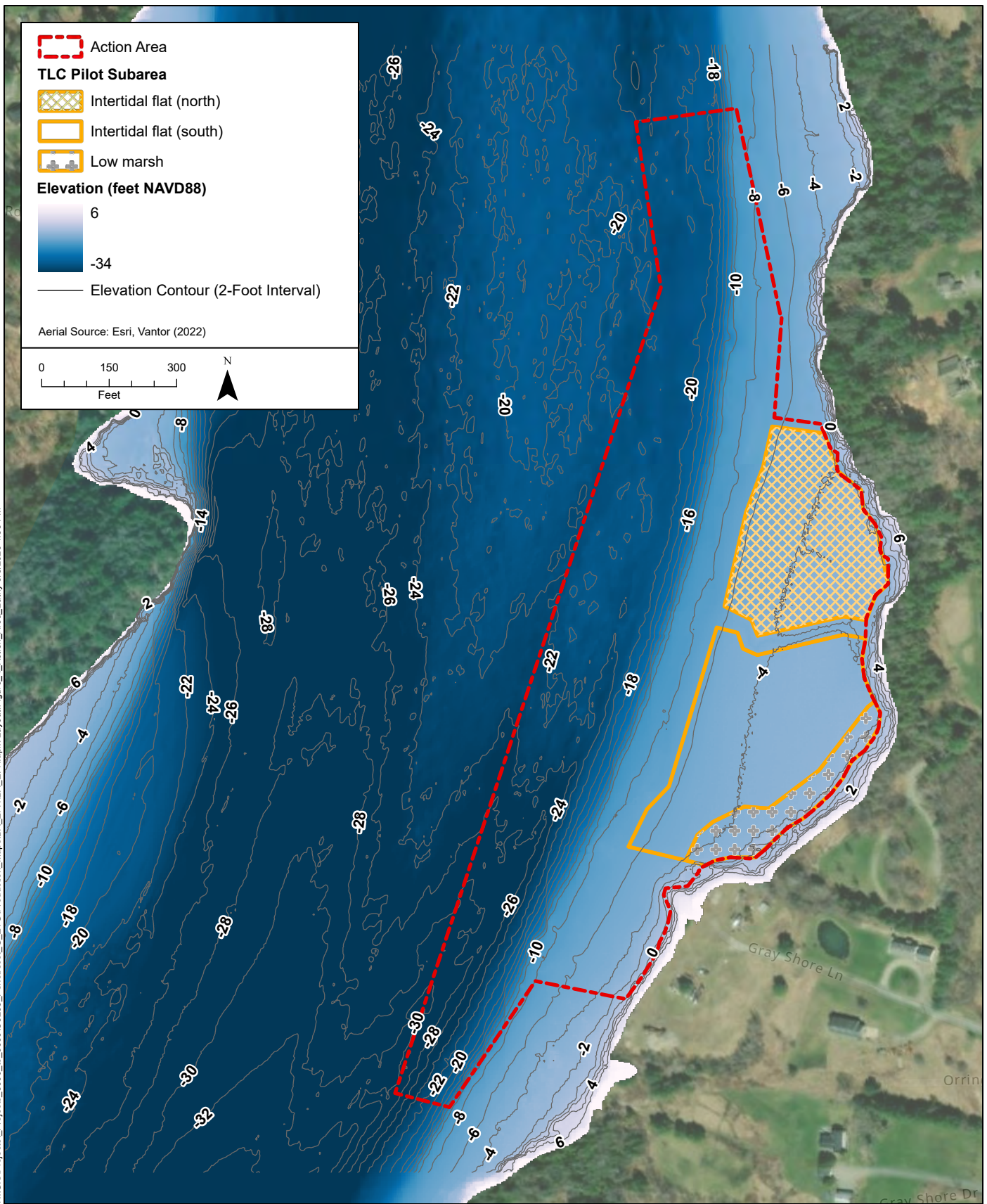
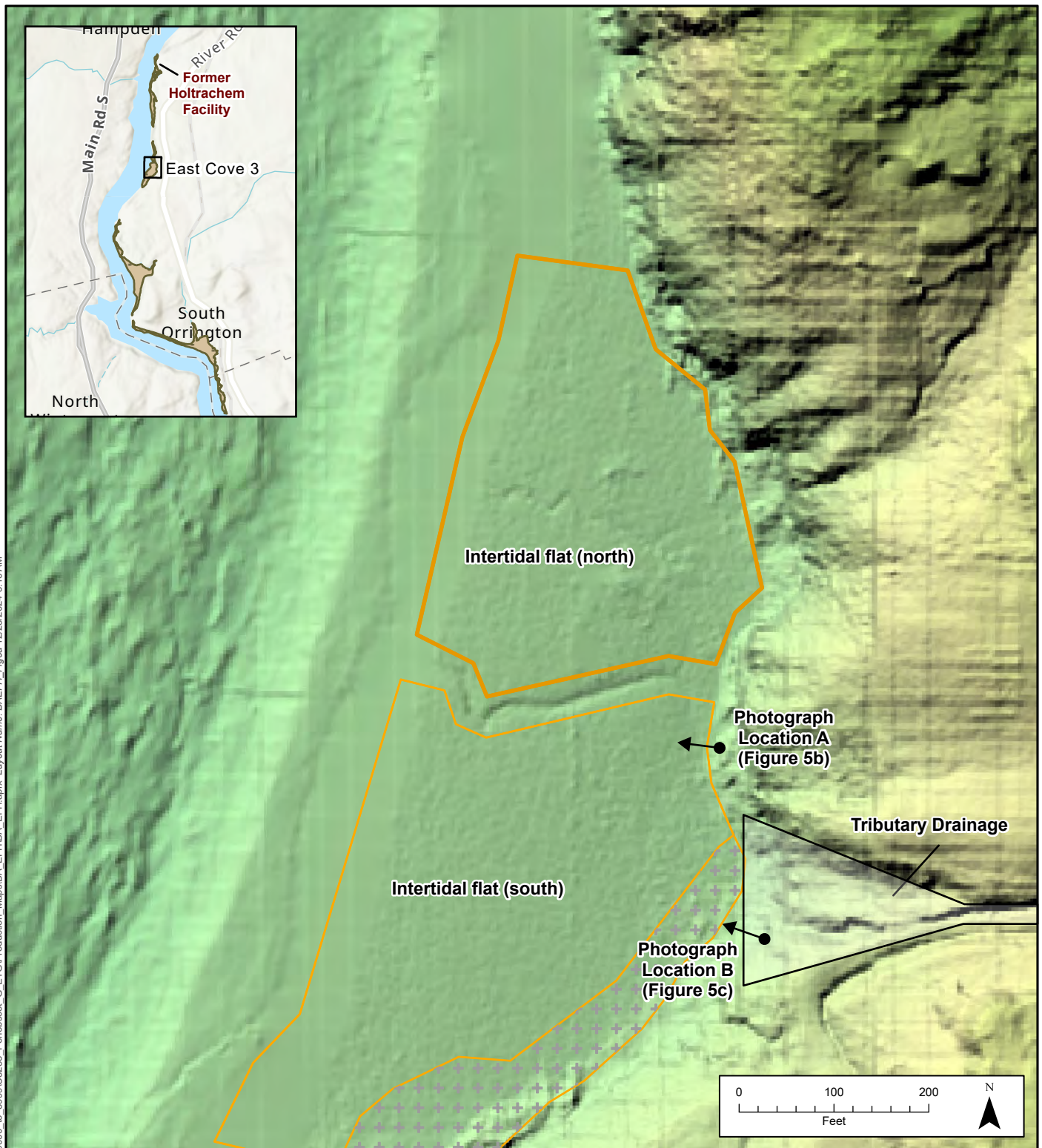


Figure 4.
Action Area Bathymetry
NRPA Permit Application: Attachment 16.
Biological and Essential Fish Habitat Assessment,
National Marine Fisheries Service
Orrington Reach Capping Remedy

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Notes:

Arrows indicate the direction of photographs taken from shoreline locations (Figures 5b and 5c).

Location A identifies a "branch" of the drainage feature extending from the tributary drainage identified at Location B.

The digital elevation model developed from bathymetry and LiDAR data is presented using ArcGIS Pro's Hillshade function using "traditional" setting. Warmer colors (e.g., yellow) represent higher elevations while cooler colors (e.g., green) represent lower elevations.

Hillshade visualization does not present absolute elevations.

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Trustee of the Penobscot Estuary Mercury
Remediation Trust

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consulting inc.

Figure 5a.
Documentation of Drainage Feature in East Cove 3
Intertidal Flat
NRPA Permit Application: Attachment 16.
Biological and Essential Fish Habitat Assessment,
National Marine Fisheries Service
Orrington Reach Capping Remedy

Figure 5a, Photograph Location A
June 6, 2024



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Remediation Trust

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Figure 5b.
Drainage Feature in East Cove 3 Intertidal Flat
NRPA Permit Application: Attachment 16. Biological and Essential Fish
Habitat Assessment, National Marine Fisheries Service
Orrington Reach Capping Remedy

Figure 5a, Photograph Location B
June 6, 2024

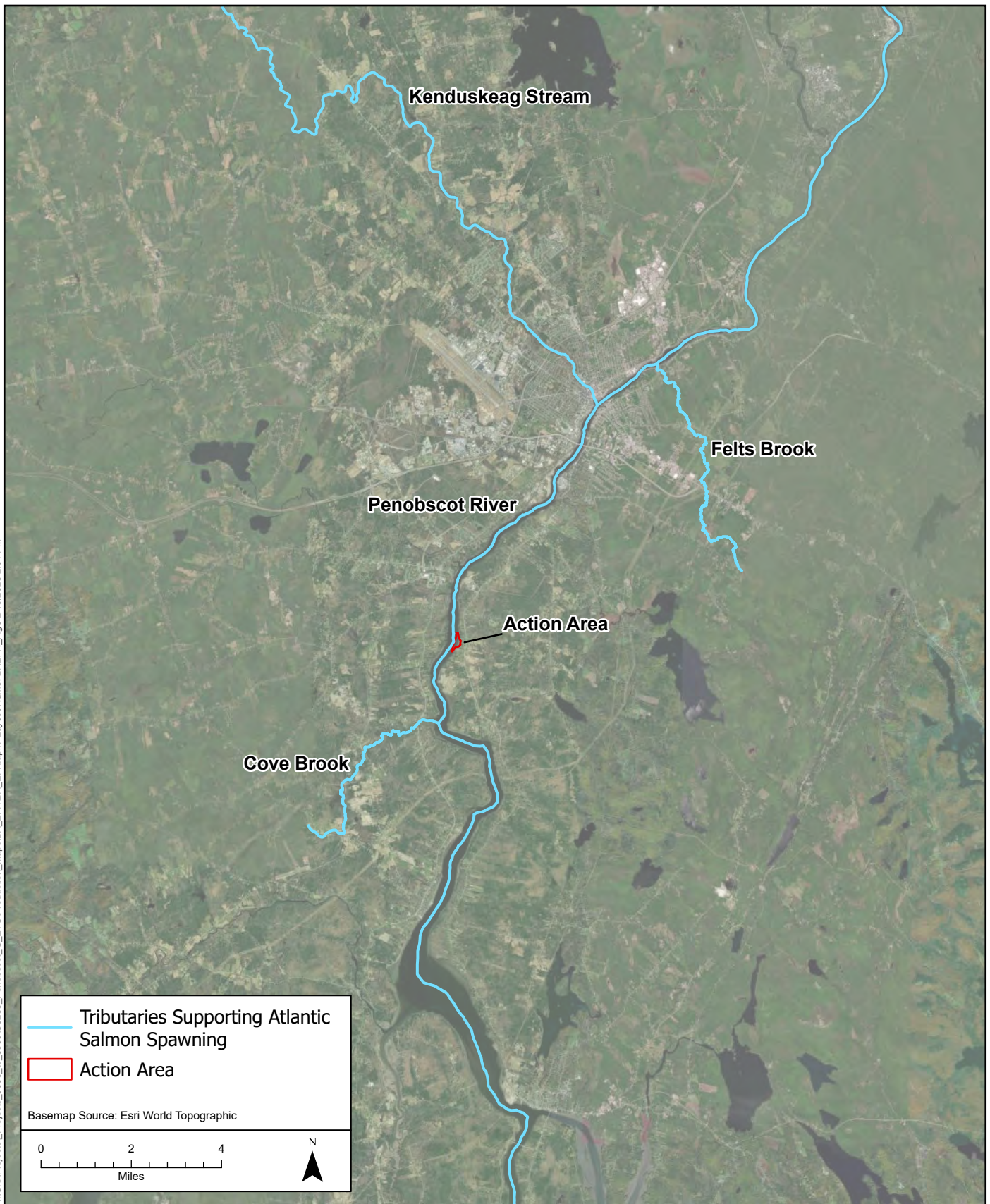


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Trustee for Penobscot Estuary Mercury
Remediation Trust

Prepared by:  integral
WHERE IS BIG

Figure 5c.
Documentation of Drainage Feature in East Cove 3 Intertidal Flat–
Upland Creek Outlet/Washout Area
NRPA Permit Application: Attachment 16. Biological and Essential
Fish Habitat Assessment, National Marine Fisheries Service
Orrington Reach Capping Remedy

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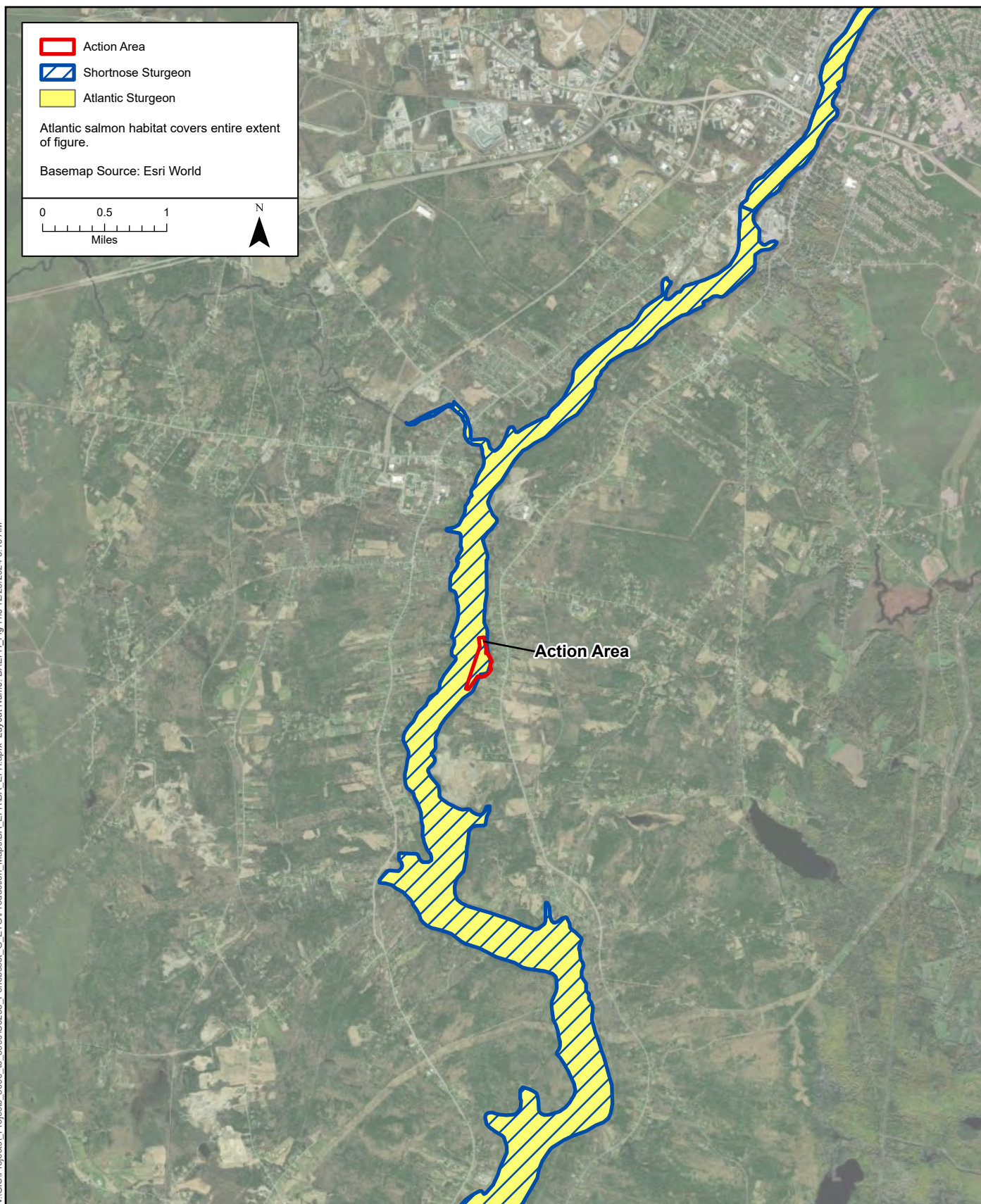


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Trustee of the Penobscot Estuary Mercury
Remediation Trust

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consulting inc.

Figure 6.
Penobscot River Tributaries Known to Support Atlantic
Salmon Spawning
NRPA Permit Application: Attachment 16.
Biological and Essential Fish Habitat Assessment,
National Marine Fisheries Service
Orrington Reach Capping Remedy

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Figure 7.

Critical Habitat Map

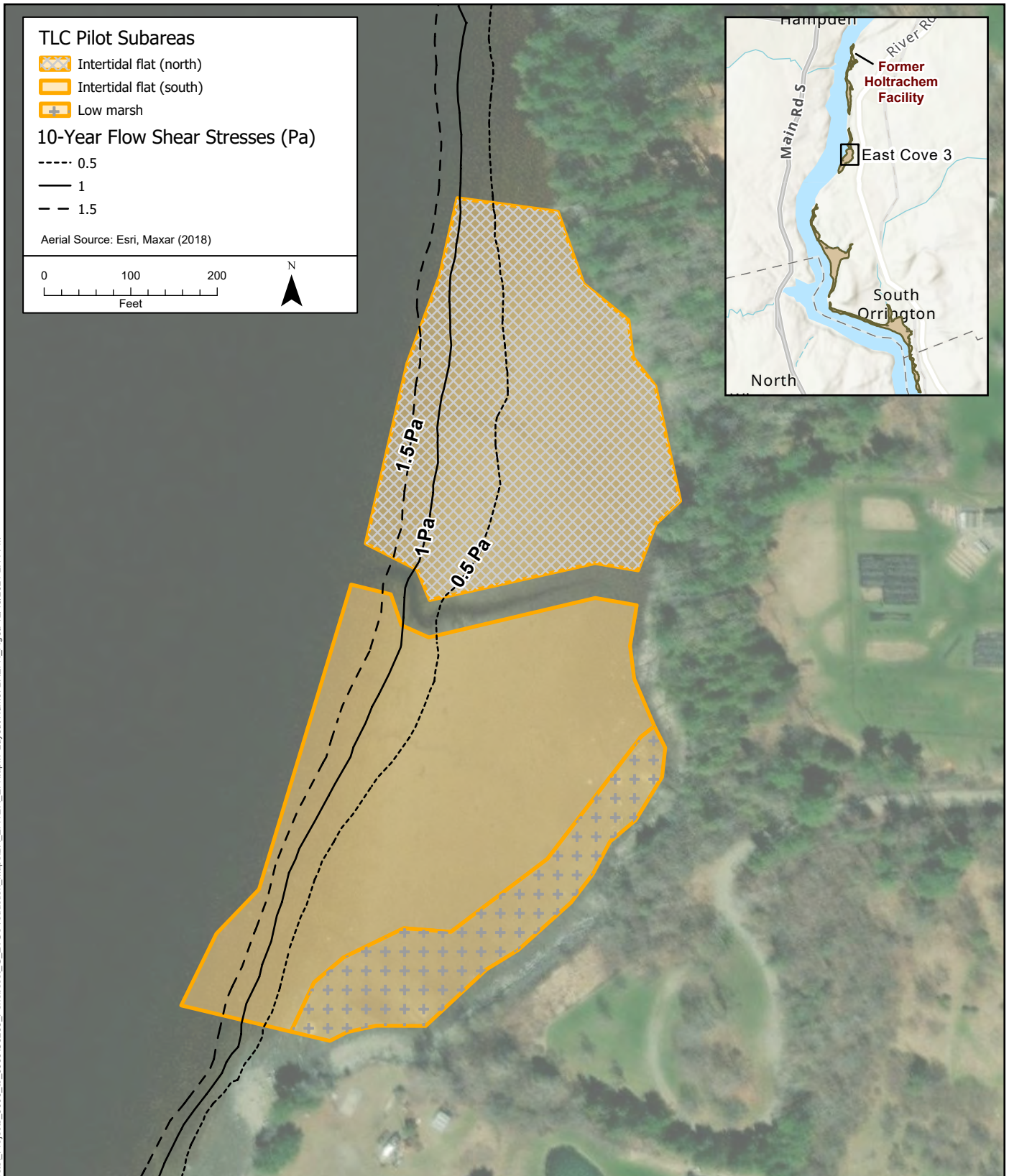
NRPA Permit Application: Attachment 16.

Biological and Essential Fish Habitat Assessment,

National Marine Fisheries Service

Orrington Reach Capping Remedy

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Notes:
The low marsh subarea will be divided into two approximately 0.4-acre areas with one TLC area and one control area.

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Trustee of the Penobscot Estuary Mercury Remediation Trust

Prepared by:  integral consulting inc.

Figure 8a.
Hydrodynamic Model Shear Stress
Contours - 10-Year Flow Event
NRPA Permit Application: Attachment 16.
Biological and Essential Fish Habitat Assessment,
National Marine Fisheries Service
Orrington Reach Capping Remedy

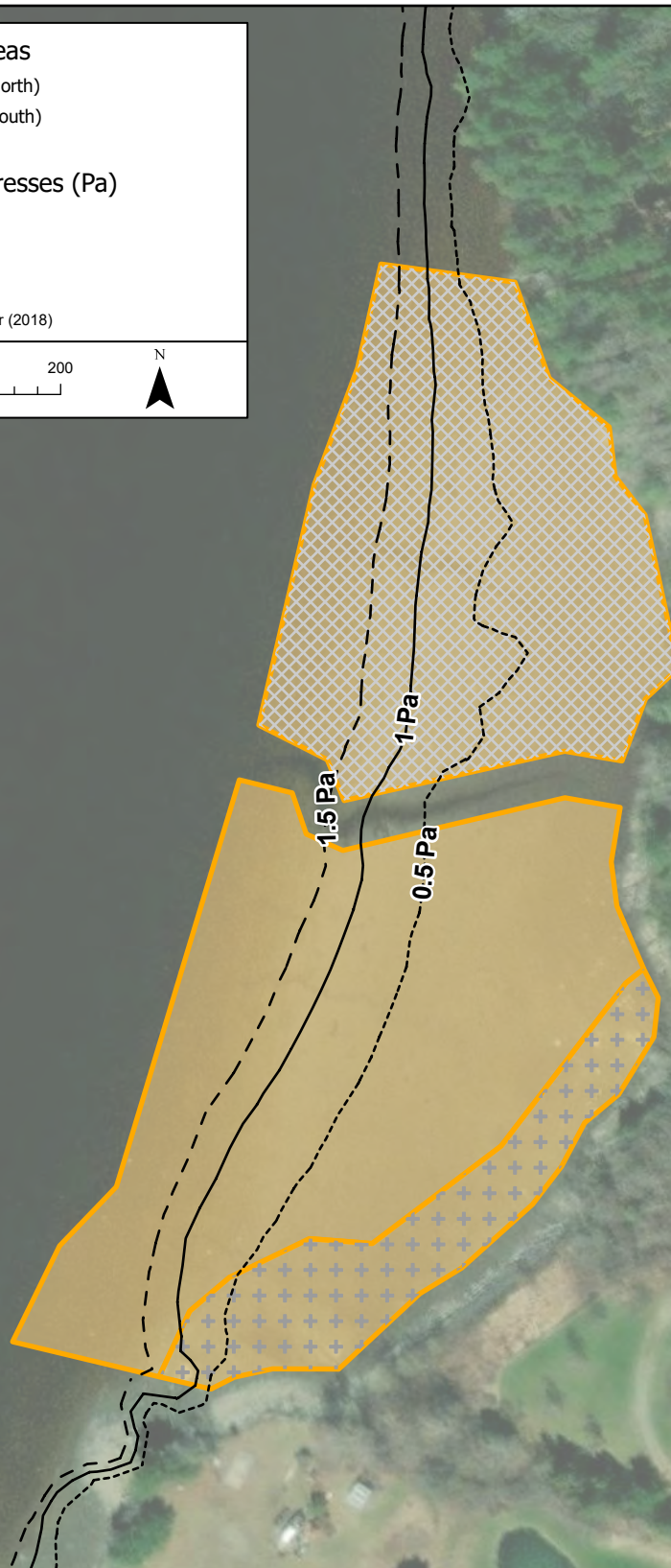
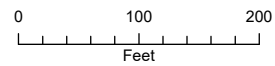
TLC Pilot Subareas

-  Intertidal flat (north)
-  Intertidal flat (south)
-  Low marsh

50-Year Flow Stresses (Pa)

-  0.5
-  1
-  1.5

Aerial Source: Esri, Maxar (2018)



Notes:

The low marsh subarea will be divided into two approximately 0.4-acre areas with one TLC area and one control area.

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Trustee of the Penobscot Estuary Mercury
Remediation Trust

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Figure 8b.

Hydrodynamic Model Shear Stress
Contours - 50-Year Flow Event
NRPA Permit Application: Attachment 16.
Biological and Essential Fish Habitat Assessment,
National Marine Fisheries Service
Orrington Reach Capping Remedy

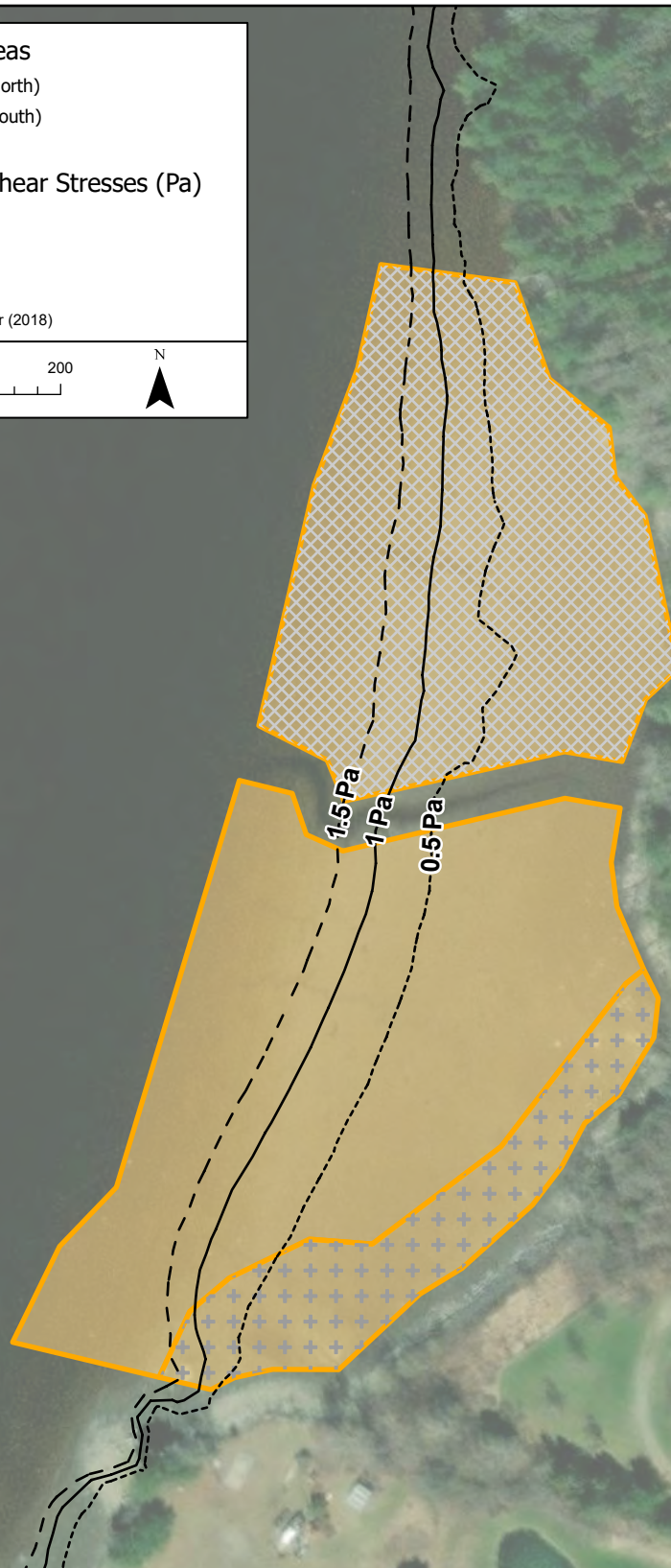
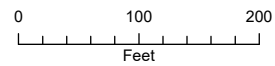
TLC Pilot Subareas

-  Intertidal flat (north)
-  Intertidal flat (south)
-  Low marsh

100-Year Flow Shear Stresses (Pa)

-  0.5
-  1
-  1.5

Aerial Source: Esri, Maxar (2018)



Notes:

The low marsh subarea will be divided into two approximately 0.4-acre areas with one TLC area and one control area.

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Trustee of the Penobscot Estuary Mercury
Remediation Trust

Prepared by:



Figure 8c.

Hydrodynamic Model Shear Stress
Contours - 100-Year Flow Event
NRPA Permit Application: Attachment 16.
Biological and Essential Fish Habitat Assessment,
National Marine Fisheries Service
Orrington Reach Capping Remedy

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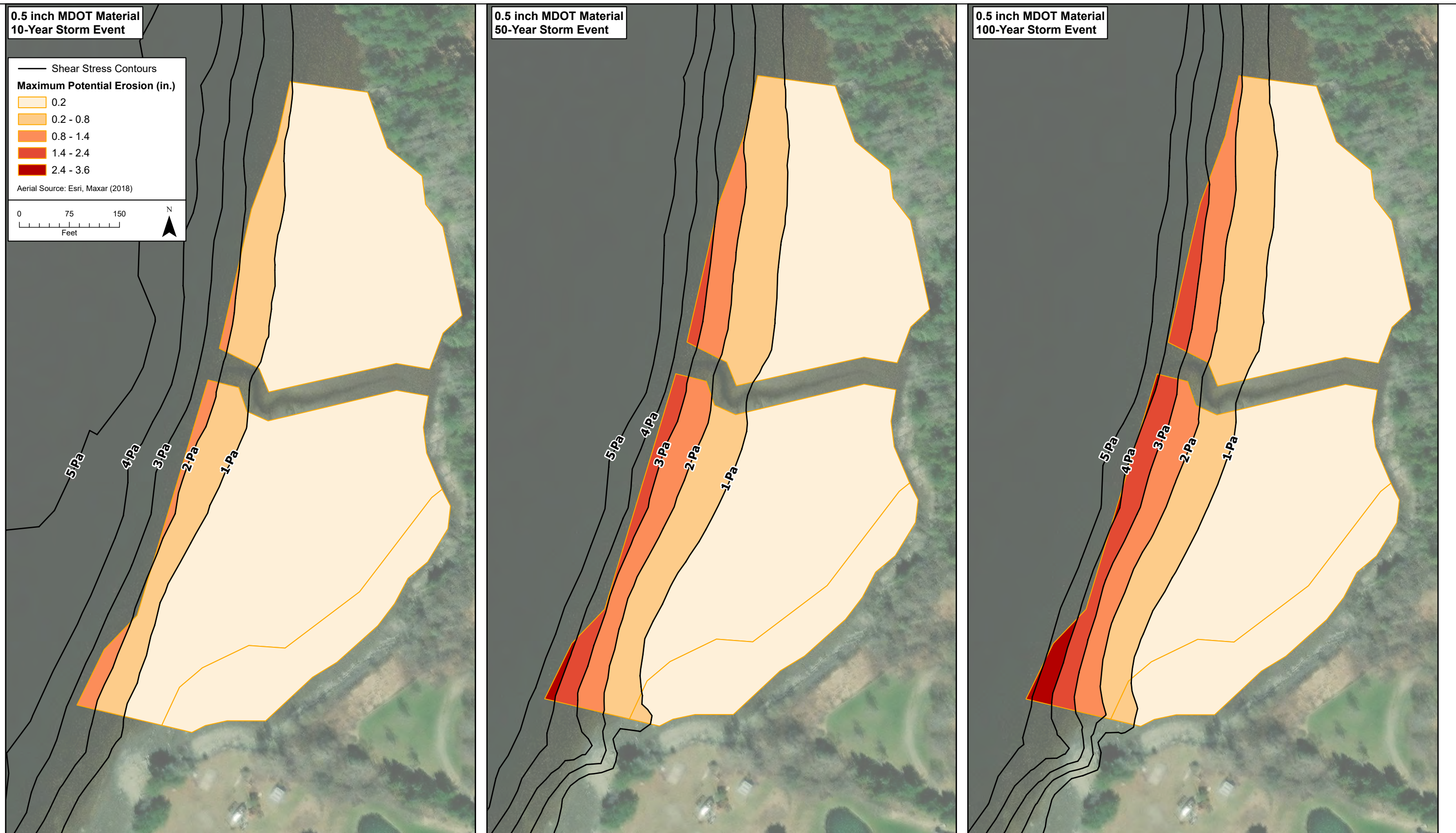


Figure 9a.
TLC Pilot Area Modeled Potential Erosion : 0.5 in. Maine DOT
NRPA Permit Application: Attachment 16.
Biological and Essential Fish Habitat Assessment,
National Marine Fisheries Service
Orrington Reach Capping Remedy

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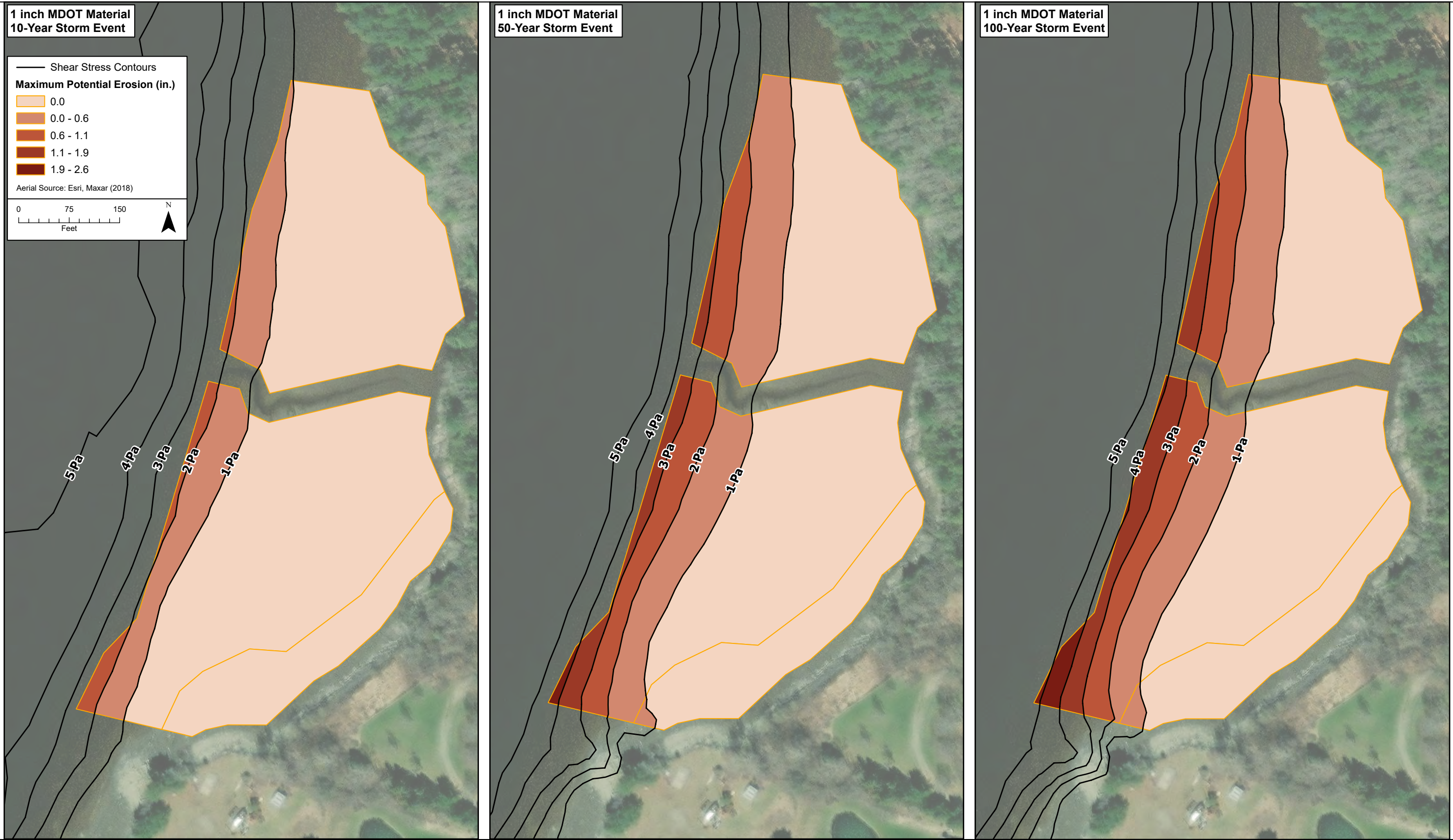


Figure 9b.
TLC Pilot Area Modeled Potential Erosion : 1 in. Maine DOT
NRPA Permit Application: Attachment 16.
Biological and Essential Fish Habitat Assessment,
National Marine Fisheries Service
Orrington Reach Capping Remedy

Appendix A

Representative Site Photographs



Photo 1: East Cove 3

ID: Overview of Project Area

Photograph 1.

Overview: Each line segment starts where the photo was taken and points in the direction the photo displays.



Photograph 2.

View: Marsh grass and rocks along shore.
Location: East Cove 3, marsh, looking south.
Date: June 6, 2024



Photograph 3.

View: Marsh grass and rocks along shore.

Location: East Cove 3, marsh, looking north.

Date: June 6, 2024



Photograph 4.

View: End of marsh grass and rocks along shore. Stream emerging from woods.

Location: East Cove 3, marsh, looking north.

Date: June 6, 2024



Photograph 5.

View: Mudflats and rocky bank.

Location: East Cove 3, mudflat, looking north.

Date: June 6, 2024



Photograph 6.

View: Chain-link fence separating Picnic Park from access to East Cove 3.

Location: Picnic Park, looking south.

Date: June 6, 2024



Photograph 7.

View: Picnic Park and chain-link fence separating Picnic Park from access to East Cove 3.

Location: Picnic Park, looking west.

Date: June 6, 2024

Appendix B

Performance Monitoring Plan

Performance Monitoring Plan

Orrington Reach Capping Remedy Thin Layer Cap Pilot

Prepared for
**Greenfield Penobscot Estuary Remediation Trust LLC,
Trustee for Penobscot Estuary Mercury Remediation Trust**



45 Exchange Street
Suite 200
Portland, ME 04101

February 2025

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2.2	EFFECT OF TLC PLACEMENT ON ECOLOGY/ECOLOGICAL HABITAT	2-2
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1 INTRODUCTION

This Performance Monitoring Plan (PMP) provides information required to evaluate the project permit application submitted to the Maine Department of Environmental Protection (DEP) pursuant to the Natural Resource Protection Act (NRPA) and to the U.S. Army Corps of Engineers (USACE) pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act. The NRPA application requirements are established within 38 Maine Revised Statutes Annotated Sections 480-A to 480-BB for Freshwater Wetland Alteration Tier 3. USACE permit application requirements are established within Title 33, Code of Federal Regulations (CFR), Parts 320 through 330.

This Thin Layer Cap (TLC) Pilot PMP has been prepared by Integral Consulting Inc. (Integral) on behalf of the Greenfield Penobscot Estuary Remediation Trust LLC (Greenfield), Trustee of the Penobscot Estuary Mercury Remediation Trust (the Remediation Trust) for Work on the Penobscot River Estuary (Estuary) located in Hancock, Penobscot, and Waldo counties, Maine. The PMP was prepared in accordance with the Consent Decree¹ and appendices, including Paragraph 6(a) of the Statement of Work (Appendix A to the Consent Decree).

One of the remedial actions specified by the Consent Decree is capping of 130 acres of intertidal sediment in Orrington Reach to reduce exposure to mercury and accelerate recovery of the Estuary. The Remediation Trust has proposed a TLC to meet these objectives by reducing mercury concentrations in surface sediment and minimizing potential negative impacts on the intertidal ecosystem. The TLC Pilot is being conducted to demonstrate the effectiveness and protectiveness of the TLC and provide information to show that disturbances to the intertidal flat ecosystem are temporary.

Specific objectives of the TLC Pilot include the following:

- **Evaluate TLC Effectiveness and Stability.** Provide information to demonstrate the TLC is effective at reducing mercury concentrations and associated exposures in intertidal surface sediment and to demonstrate that cap is sufficiently stable that these benefits persist into the future.
- **Evaluate Effect of TLC Placement on Ecology/Ecological Habitat.** Assess potential adverse effects to the local ecology and habitat associated with construction activities, if any, and demonstrate the effects are temporary.

¹ The Consent Decree was approved and entered by the U.S. District Court for the District of Maine (in the case *Maine People's Alliance and NRDC v. HoltraChem Manufacturing Company LLC, et al.*, No. 1:00-cv-00069-JAW (D. Me.) (ECF No.1187, October 11, 2022))

- **Evaluate Effect of TLC Placement on Shoreline Stability.** Assess potential adverse effects, if any, of the TLC construction on the stability of the adjacent shoreline.

Observations and data obtained during construction and performance monitoring will determine if the TLC Pilot is successful and whether the larger-scale capping of intertidal sediments in Orrington Reach, as specified in the Consent Decree, is feasible. Consistent with the Remediation Trust's adaptive management approach, if the TLC Pilot is found to be a success, monitoring results will inform and adapt future design and construction efforts, incorporating observations and data into more efficient and effective implementation.

This PMP has been prepared to guide data collection in support of the above objectives and to demonstrate that post-construction permitting requirements and criteria are achieved. This PMP outlines the approach for performance monitoring by monitoring objective, defines the monitoring metrics to be used to evaluate the performance of the TLC against the objectives, and outlines the methods and approaches to be used to generate the necessary data for these evaluations. The PMP further defines the anticipated monitoring schedule and reporting and includes a framework for modifications to the PMP should conditions observed during the performance monitoring warrant such changes.

2 PERFORMANCE MONITORING APPROACH

The following summarizes the approach that will be taken to monitor the TLC Pilot performance with respect to the three objectives presented in Section 1. The PMP incorporates a strategy to develop multiple lines of evidence utilizing the best available scientific methods to support a holistic evaluation of the TLC Pilot performance relative to the monitoring objectives.

An adaptive management framework will be employed so that the monitoring approach and/or methods are adapted, as needed and appropriate, should uncertainties emerge or as conditions change. Each year, as a part of annual reporting (Section 4), parameters, monitoring methodologies, and data trends will be evaluated to determine if any changes to the PMP are necessary and to inform design decisions for future project phase(s). Changes to the PMP may be warranted if data gaps are identified, unexpected conditions develop, or new assessment methodologies become available.

2.1 TLC EFFECTIVENESS AND STABILITY

Performance monitoring results will be used to demonstrate the TLC is effective at reducing intertidal surface sediment mercury concentrations and is sufficiently stable to maintain lower mercury concentrations in the future. Table 1 presents a framework for data collection to meet these objectives, including the monitoring metrics, data collection methods, and evaluation approach.

Monitoring of the TLC effectiveness will focus on demonstrating mercury and methylmercury concentrations in intertidal flat surface sediment and in benthic invertebrate tissue in the TLC Pilot Area have been reduced relative to pre-construction baseline and remain lower through the monitoring period. Sediment accumulating on the TLC will be evaluated to assess if recontamination of the cap is occurring and to forecast mercury concentrations over the longer-term. In addition, mercury concentrations will be evaluated in 1-in. segments to the base of the TLC to assess the degree of mixing into the TLC of 1) underlying native sediment during TLC placement and 2) sediment that has accumulated on the TLC. TLC effectiveness will be evaluated through collection of sediment and benthic invertebrate tissue samples to evaluate changes in mercury and methylmercury concentrations over time.

Table 1. Framework for Monitoring Effectiveness and Stability

Monitoring Objective	Metrics	Data Collection Method	Evaluation Approach
TLC Effectiveness			
Reduction of Mercury Concentration and Exposure	• Mercury and methylmercury concentrations in BAZ	• Cores	Compare to baseline
	• Mercury and methylmercury concentrations in benthic invertebrate tissue	• Benthic invertebrates collected from sediment grab samples	Compare to baseline
Mixing of Mercury into TLC	• Mercury concentration in TLC	• Cores sampled at 1-in. intervals to base of TLC material	Quantify vertical distribution of mercury within TLC resulting from mixing
Recontamination of TLC	• Mercury concentration in sediment accumulated on TLC	• Cores • SPI	Compare mercury concentration in accumulated sediment to baseline BAZ concentration
TLC Stability			
Presence and Thickness of TLC Material	• Thickness of TLC over time	• Cores • SPI	Quantify any change in TLC thickness over time
	• Visual evidence of erosion	• Visual Surveys	Identify and monitor location and extent of any erosion of the TLC

Notes:

BAZ = biologically active zone

SPI = sediment-profile imaging

Monitoring of TLC stability will focus on confirming that the TLC material remains in place and evaluating the influence of other natural physical forces, such as ice scour, on the TLC. The stability monitoring will include measurements of TLC material thickness over time and visual assessment of the TLC area for evidence of erosion and scour.

The monitoring approach for evaluation of TLC effectiveness and stability will involve a combination of visually based surveys (Section 3.1), sediment coring (Section 3.2), benthic invertebrate sampling (Section 3.3), and sediment-profile imaging (SPI; Section 3.4).

2.2 EFFECT OF TLC PLACEMENT ON ECOLOGY/ECOLOGICAL HABITAT

Monitoring to assess potential adverse effects to the local ecology and habitat associated with construction activities, if any, will evaluate 1) benthic community recovery, 2) changes to the extent of vegetated wetlands, 3) aquatic resource functions and values, and 4) rare plant populations. Table 2 presents a framework for data collection to meet these objectives, including the monitoring metrics, data collection methods, and evaluation approach. The monitoring approach for each of these objectives is described below.

Table 2. Framework for Monitoring Effects of TLC Placement on Ecology/Ecological Habitat

Monitoring Objective	Metrics	Data Collection Method	Evaluation Approach
Benthic Community Recolonization	• Accumulation of native substrate and mixing into TLC material	• Visual surveys • SPI • Cores (sampled in 1-in. segments)	Quantify accumulation of native sediment and mixing into TLC
	• Benthic abundance, diversity, richness	• Sediment grab sampling for benthic invertebrates	Compare to baseline
	• Benthic succession stage	• SPI	Compare to baseline
Vegetated Wetland Area Assessment	• Wetland area meeting the three parameter criteria	• Wetland delineation	Quantitatively demonstrate no net loss in vegetated wetland (low marsh area)
Aquatic Resource Functions and Values Assessment	• Fish and shellfish habitat • Sediment/toxicant retention • Nutrient removal • Production export • Sediment/shoreline stabilization • Wildlife habitat • Visual quality/ aesthetics • Endangered species habitat	• USACE Highway Methodology's Wetland Function-Value Evaluation Form • Maine DEP Visual Evaluation Field Survey Checklist • Maine DEP Coastal Wetland Characterization: Intertidal & Shallow Subtidal Field Survey Checklist	Qualitatively demonstrate long-term benefit (or no reduction) in functions and values
Rare Plant Population	• Presence and abundance of rare plants	• Visual surveys	Quantitatively demonstrate no reduction in plant population

2.2.1 Benthic Community Recolonization

The TLC will temporarily affect the benthic community in the area where the TLC material is placed. Over time, native sediment will accumulate on the TLC—supporting the re-establishment of the benthic habitat and the recolonization of the capped area with a benthic community over time.

Accumulation of native sediment onto the TLC and mixing of the accumulated sediment into the TLC will be monitored to evaluate the recovery of the benthic habitat over time. Sediment accumulation will be evaluated through visual surveys (Section 3.1) and SPI (Section 3.4). Mixing of accumulated sediment into the TLC will be evaluated through quantification of the vertical distribution of mercury concentrations in sediment cores (Section 3.2).

A survey of the benthic invertebrate community will be performed annually to support an evaluation of benthic recolonization as sediment accretes on the cap. Annual benthic surveys will support assessment of the rate of colonization and the abundance, richness, and diversity of the benthic community post-TLC placement. These data will be compared to the baseline benthic survey data and used to provide an assessment of the benthic habitat and the effects of TLC placement on the sediment characteristics and on the benthic community, which serves as the basis for fish foraging opportunities.

The benthic survey monitoring will be supported by a SPI survey in the second year of monitoring following the TLC construction. The SPI survey will provide a second line of evidence to evaluate benthic community recolonization by providing data on the presence and abundance of biogenic features (e.g., organisms, burrows, feeding voids) and the information needed to quantify the benthic infaunal successional stage.

The methods for the benthic and SPI surveys are described in Sections 3.3 and 3.4, respectively.

2.2.2 Vegetated Wetland Area Assessment

Immediately prior to the TLC placement, and annually in the same season in which the pre-placement survey is completed, for up to 5 years following construction, vegetated wetlands located within the pilot study area will be delineated in accordance with the Corps of Engineers Wetlands Delineation Manual (USACE 1987) and the associated Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (USACE 2012). The results of the post-TLC construction wetland delineation(s) will be compared to the pre-construction wetland delineation. If a reduction in the acreage of vegetated wetlands is observed, an evaluation will be made to determine if the reduction can be corrected or is a result of project activities; if necessary, the applicant will submit a compensatory mitigation plan to the regulatory agencies for approval.

2.2.3 Aquatic Resource Functions and Values Assessment

Aquatic resources (intertidal flats and low marsh) within the TLC Pilot Area provide functions (e.g., fish and shellfish habitat, sediment/toxicant retention, nutrient removal, production export, sediment/shoreline stabilization, and wildlife habitat) and values (e.g., visual quality and endangered species habitat) to society. A preliminary assessment was performed in 2023, and relevant field data are provided in Attachment 9. An annual assessment of the aquatic resources functions and values will be completed following the TLC construction and the results compared to a pre-construction assessment to be conducted immediately in advance of the TLC Pilot implementation.

In accordance with requirements of the Maine DEP Natural Resources Protection Act permit application (38 Maine Revised Statutes Annotated Sections 480-A to 480-BB), wetland functions and values will be assessed consistent with The Highway Methodology Workbook Supplement (USACE 1999) and compared to the same assessment completed immediately prior to implementation of the TLC Pilot. At least two assessment locations will be placed in each of the northern and southern intertidal flat areas and one location in the low marsh area. This assessment will include specific qualitative evaluation of functions and values, which were also evaluated in 2023 and will be re-evaluated prior to project implementation.

As part of the above assessment, the USACE Highway Methodology’s Wetland Function-Value Evaluation Form, and the Maine DEP Visual Evaluation Field Survey Checklist and Maine DEP Coastal Wetland Characterization: Intertidal & Shallow Subtidal Field Survey Checklist will be filled out, and the observations compared to those recorded in 2023 and those recorded prior to project implementation.

2.2.4 Rare Plant Population (if required)

The Beginning with Habitat Map Viewer, which provides an adaptation of Maine natural resource information, identified spongy-leaved arrowhead (*Sagittaria montevidensis*) (State Rank S3) within the project area (MDIFW 2024); however, this plant was not observed during the preliminary wetland assessment performed in 2023 (Attachment 9).

Prior to TLC placement, a survey will be conducted for spongy-leaved arrowhead and other rare plants during the appropriate blooming season (July through October). Should a rare plant be identified, the population health will be assessed post-TLC placement to determine population recovery.

2.3 EFFECT OF TLC PLACEMENT ON SHORELINE STABILITY

Increasing the elevation of the TLC Pilot Area by 4 to 6 in. is not predicted to have a significant impact on shoreline erosion in East Cove 3. Hydrodynamic modeling was done to simulate potential effects on shoreline stability resulting from a change in elevation of intertidal sediments under assumed weather events. Modeling results (see Section 5 of the Project Description, Attachment 1 to the TLC Pilot permit application) predicted no discernable change in local hydrodynamic conditions or significant increase in current velocities along the shoreline. Further, while anecdotal information from landowners and visual observations of shoreline in other Orrington Reach coves indicate that erosion is occurring in other areas of Orrington Reach, no such erosion is apparent in East Cove 3 as its shoreline consists of bedrock or placed riprap.

Visual surveys of the shoreline by field staff and through drone surveys, as summarized in Table 3 and described in Section 3.1, will be used to assess any potential shoreline erosion. If significant changes in shoreline erosion are observed post-TLC construction, an evaluation of the cause of the shoreline instability will be completed. This evaluation will include reviewing severe weather events, river flow conditions, presence of ice formations, changes in local upland drainage patterns, and other relevant factors that may have contributed to the observed conditions.

Table 3. Framework for Monitoring Effects of TLC Placement on Shoreline Stability

Monitoring Objective	Metrics	Data Collection Method	Evaluation Approach
Shoreline Stability	Visible evidence of shoreline erosion	Visual Surveys	Qualitatively evaluate for evidence of shoreline erosion resulting from TLC placement

3 METHODS

The following describes the monitoring methods to be used during the TLC Pilot performance monitoring. The specific monitoring methods and monitoring frequency may be modified based on final permit conditions.

3.1 VISUAL SURVEYS

Visually based surveys will be conducted to support the assessment of TLC effectiveness and stability, including:

- Fixed camera monitoring from the shoreline to collect daily images of the TLC area at low tide during the first year post-construction
- Monthly observations recorded and photographs taken at low tide from the shoreline by field staff
- Drone-based aerial photography of the capped area at low tide at least once per year.

The observational data collected by these methods will be evaluated for the following:

- During the first year of monitoring, sediment accumulation will be qualitatively assessed through visual observations of the TLC Pilot Area. Differences in the visual appearance of the TLC surface (lighter color, sand texture) and evidence of new sediment accumulation (darker color, silt texture) will be recorded.
- Evidence of TLC instability, including erosion, localized loss of cap material, movement of cap material, and evidence of ice scour, will be documented.
- Presence along the shoreline of erosional surfaces/features, deposits of eroded material, changes to the shoreline configuration or bank slopes, exposed tree roots, or other evidence of shoreline changes will be recorded.

3.2 SEDIMENT CORES

Sediment cores will be collected annually following TLC placement to support the evaluation of TLC effectiveness and stability. The monitoring will involve sediment coring at 25 total locations, including 10 locations each in the northern and southern intertidal flat areas and 5 locations in the low marsh area. Sediment cores will be completed to a target depth of 1 ft below the mudline using a box corer or similar device capable of collection of undisturbed cores.

Each sediment core will be inspected for distinctions between the accumulated sediment (which is expected to be fine grained, silt material) and the TLC material (coarser grained, sand material), changes in color indicative of surface mixing, and, to the extent feasible, evidence of biogenic features. These observations will support evaluation of:

- Thickness of accumulated sediment on the TLC
- Thickness of TLC material
- Mixing of accumulated sediment into the TLC material
- Mixing of TLC material into the underlying native sediment
- Apparent redox potential discontinuity (aRPD) depth²
- Lower BAZ depth.³

Sediment coring will also be used to collect sediment samples at each of the 25 locations for laboratory analysis of total mercury and total organic carbon concentrations. During each annual sampling event, cores will be collected targeting the top 1 ft of sediment and samples will be taken from the following intervals:

- The layer of accumulated sediment
- The top 4 in. of sediment (including cap material).

Sediment accumulated on the surface of the TLC will be sampled to assess the influence of deposition of sediment from the river water column on mercury concentrations in surface sediment and whether long-term sediment accumulation will result in recontamination of the capped area. The top 4 in. of sediment will be sampled to provide a basis for comparison of mercury and methylmercury concentrations to the concentrations measured in the TLC Pilot Area sediment prior to the TLC construction. The 4-in. depth is the average thickness of the lower BAZ measured in the TLC Pilot Area sediment prior to construction. This data collection will support an evaluation of the effectiveness of the TLC at reducing mercury and methylmercury concentrations within the depth of sediment most relevant to biological exposure.

An additional 1-ft sediment core will be collected at 9 of the 25 locations (3 locations in each of the northern intertidal flat, southern intertidal flat, and the low marsh areas). The cores will be

² aRPD is a measure of the depth over which the surface sediment is thoroughly mixed by biological and physical processes. It is estimated based on the thickness of oxidized sediment, as evidenced by lighter colored sediment overlying darker, anoxic sediment.

³ Lower BAZ is estimated based on the lowest depth at which evidence of biological activity is observed. The lower BAZ will be evaluated to the extent possible in sediment cores; however, it is acknowledged that biogenic features are often challenging to observe in sediment cores. SPI will be the primary line of evidence for evaluation of the lower BAZ (Section 2.2.1).

sampled at 1-in. intervals (i.e., 12 samples per core). Each sample interval will be visually inspected to qualitatively evaluate the relative abundance of material present (i.e., sediment that accumulated on the TLC, TLC material, native sediment underlying the TLC) and submitted for laboratory analysis of mercury concentration to quantify the degree of mixing resulting from bioturbation and that occurred during cap placement.

3.3 BENTHIC INVERTEBRATE SURVEY AND TISSUE SAMPLING

A survey of the benthic invertebrate community and tissue sampling will be performed to inform benthic recolonization and TLC effectiveness. Samples of the top 6 in. of sediment will be collected to survey benthic invertebrate community and to collect benthic tissue for mercury and methylmercury analyses. The samples will be collected using a petite ponar or similar device and sent to the appropriate laboratories, where the samples will be processed to separate the benthic organisms from the sediment for the following:

- Characterization of the benthic organisms present and calculation of relevant metrics, including taxonomy, abundance, richness, diversity, and evenness
- Analysis of mercury, methylmercury, and lipid concentration.

Samples for benthic invertebrate community analysis will be collected during the baseline event and annually thereafter. Samples for benthic tissue chemical analyses will be collected during the baseline event, Year 2, and the final year of monitoring. Because approximately 2.0 g of benthic invertebrate tissue sample mass are required to perform mercury and methylmercury analyses, it is possible that a sample location will not yield adequate mass to perform the analyses. If collected sample mass is insufficient to achieve analytical requirements, samples may be composited for mercury and methylmercury analysis.

3.4 SEDIMENT PROFILE IMAGING

A SPI survey will be conducted in the second year following the TLC construction to inform evaluation of benthic recolonization and TLC effectiveness and stability. The SPI survey will be performed in a manner consistent with the previous SPI survey completed in East Cove 3 (Integral 2024) and will be performed in conjunction with the Year 2 benthic invertebrate survey, at the same 25 locations. SPI data will provide:

- An assessment of benthic recolonization based on the observed presence/abundance of biogenic features (e.g., organisms, burrows, feeding voids) and an evaluation of the benthic infaunal successional stage.
- A second line of evidence for information from the sediment cores on aRPD depth, thickness of the TLC material and of sediment accumulated on the TLC, mixing of TLC

material with accumulated sediment and with underlying native sediment, and the lower BAZ depth.

4 MONITORING SCHEDULE AND REPORTING

The TLC Pilot performance monitoring will start the first summer following completion of the TLC construction, with construction completion considered Year 0. Performance monitoring will be conducted for a minimum of 2 years and a maximum of 5 years. In addition, several parameters will be monitored during a baseline (pre-construction) event. Each parameter will be monitored at the frequency outlined in Table 4.

Table 4. Performance Monitoring Summary

Potential Monitoring Method ^a	Objectives	Parameters	Frequency
Sediment Cores	TLC Effectiveness	Mercury and methylmercury concentrations	Baseline (mercury and methylmercury in BAZ only)
	TLC Stability Benthic Recolonization	Accumulated sediment thickness TLC thickness aRPD	Annual, starting at Year 0 ^b
Field Survey (Visual Observations)	TLC Effectiveness	Presence of accumulated sediment	Baseline (shoreline stability only)
	TLC Stability	Evidence of sediment erosion or scour	Monthly in Year 0, quarterly thereafter
	Shoreline Stability	Evidence of shoreline erosion	Opportunistically during site visits
Drone Survey (Visual Observations)	TLC Effectiveness	Presence of accumulated sediment	Annual, starting at Year 0
	TLC Stability Shoreline Stability	Evidence of sediment erosion or scour Evidence of shoreline erosion	
Field Camera Survey (Visual Observations)	TLC Effectiveness TLC Stability	Presence of accumulated sediment Evidence of sediment erosion or scour	Throughout monitoring period starting in late 2024 at Year 0
Sediment Grab Samples	TLC Effectiveness	Mercury and methylmercury concentration in benthic tissue	Baseline
	Benthic Recolonization		Year 2 and the final year of monitoring
Sediment Grab Samples	TLC Effectiveness	Taxonomy, abundance, richness, diversity, and evenness	Baseline
	Benthic Recolonization		Annual, starting at Year 0
SPI	Benthic Recolonization	Accumulated sediment thickness	Year 2 ^b
	TLC Effectiveness TLC Stability	TLC thickness Benthic biogenic features Infaunal successional stage aRPD Lower BAZ depth	
Biological Surveys	Wetlands Assessment	Wetland acreage	Baseline
	Aquatic Resources Assessment Rare Plant Assessment	Functions and values Rare plant presence/persistence	Annual, starting at Year 0

Notes:

^a The specific monitoring methods and monitoring frequency may be modified based on final permit conditions.

^b Data collected during the pre-design investigations will serve as the baseline data set in the evaluation of TLC Pilot performance.

TLC Pilot PMP Reports will be prepared annually to document the results of the performance monitoring, demonstrate compliance with permit conditions, and present the findings regarding how well the objectives were met. The TLC Pilot PMP Reports will include the following, as applicable to the monitoring event:

- A summary of the performance monitoring conducted, referencing consistency with this plan, and noting key deviations therefrom
- Summaries of validated data (i.e., tables and graphics)
- Laboratory data reports and data validation reports
- Narrative interpretation of data and results, including an evaluation of the results with respect to the remedial action objectives and TLC Pilot objectives
- Results of statistical and modeling analyses
- Photographs documenting the work conducted.

Starting with Year 1, the annual report will include a recommendation of whether an additional year of monitoring is needed. The annual report will also recommend modifications to the PMP, if required, based on the monitoring results to date and observed site conditions. Cessation of monitoring prior to Year 5 or modification to the PMP will not be implemented without approval from USACE and Maine DEP.

5 REFERENCES

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Appendix C

Benthic Survey

Aqua Survey, Inc.

**Taxonomic Identification of Benthic Invertebrates
From Sediment Collected from the
Orrington Reach, Penobscot River, Orrington, ME**

Prepared for:

**Integral Consultants, Inc.
45 Exchange Street, Suite 200
Portland, ME 04101**

October 23, 2024

ASI Job #: 44-072

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Information Page

Taxonomic Identification of Benthic Invertebrates From Sediment Collected from the Orrington Reach, Penobscot River, Orrington, ME

STUDY INITIATION DATE

May 31, 2024

STUDY COMPLETION DATE

October 23, 2024

PERFORMING LABORATORY

**Aqua Survey, Inc.
469 Point Breeze Road
Flemington, New Jersey 08822**

SPONSOR

**Integral Consultants, Inc.
45 Exchange Street, Suite 200
Portland, ME 04101**

LABORATORY PROJECT ID

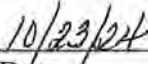
ASI Study No. 44-072

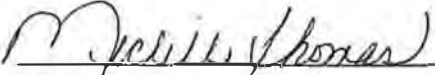
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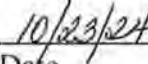
Taxonomic Identification of Benthic Invertebrates From Sediment Collected from the Orrington Reach, Penobscot River, Orrington, ME

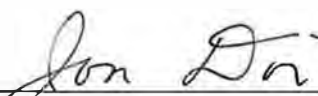
This report, as well as all records and raw data were audited and found to be an accurate reflection of the study. Copies of raw data will be maintained by Aqua Survey, Inc., 469 Point Breeze Road, Flemington, New Jersey, 08822.

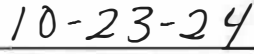

Cheryl Hall
Quality Assurance Officer


Date


Michelle Thomas
Laboratory Manager


Date


Jon Doi, Ph.D
Executive Vice President


Date

SUMMARY

Ten (10) samples of benthic invertebrate fauna were collected by ASI personnel from ten (10) locations in East Cove 3 of the Orrington Reach of the Penobscot River in Orrington, ME on May 31 to June 1, 2024 and were received at Aqua Survey's laboratory on June 7, 2024. Benthic samples were sieved and preserved in the field with formalin spiked with Rose Bengal. Once at the laboratory, the benthic samples were rinsed with tap water and sieved through a 500- μ m sieve to remove the formalin and debris prior to picking. Benthic samples were picked to remove invertebrates from the substrate and the organisms were stored in individual containers with 70% methanol until keyed. The samples were sent under chain of custody to the subcontract laboratory, EcoAnalysts, Inc. in Moscow, ID, for keying. The organisms were then counted and a subset of the total was keyed to the genus level in most cases.

This report contains a summary of the methodologies employed and an inventory of the samples keyed. The tables contain identification of all the organisms keyed as well as the relative abundance calculations and diversity and evenness measures for the organisms identified in each sample.

Taxonomic Identification of Benthic Invertebrates

1. Objective

The objective of this study was to isolate and identify to the genus level the organisms in samples of benthic substrate collected from East Cove 3 of the Orrington Reach, Penobscot River, Orrington, ME.

2. Sample Information

Table 1: Sample Identification and DGPS Coordinates

Sample Name	ASI ID number	Date sampled	Northing	Easting
OR-BIS-01	20241797	6/1/24	383932.3	898309.0
OR-BIS-02	20241798	5/31/24	384052.5	898367.7
OR-BIS-03	20241799	5/31/24	384174.7	898593.3
OR-BIS-04	20241800	5/31/24	384273.7	898389.4
OR-BIS-05	20241801	5/31/24	384379.0	898589.9
OR-BIS-06	20241802	5/31/24	384578.5	898488.3
OR-BIS-07	20241803	6/1/24	384676.6	898687.1
OR-BIS-08	20241804	5/31/24	384777.8	898586.3
OR-BIS-09	20241805	5/31/24	383911.7	898539.4
OR-BIS-10	20241806	6/1/24	384017.2	898667.2

3. Methodology

3.1 Sample Collection

Ten (10) benthic samples were collected from ten (10) locations in East Cove 3 of the Orrington Reach on the Penobscot River in Orrington, ME on May 31 to June 1, 2024. Five (5) grab samples for each location were taken and composited as one sample prior to processing the sediment. The samples were then preserved with formalin spiked with Rose Bengal and transported to ASI following chain of custody procedures.

All samples were assigned unique ASI sample numbers. See Appendix A for Sampling Logs, Appendix B for Sample Locations Map, and Appendix C for Chains of Custody.

3.2 Sample Preparation

Samples were preserved in the field with formalin spiked with Rose Bengal. At the laboratory, samples were sieved to remove excess substrate and formalin and then sorted by hand to remove all invertebrates from the substrate. This was achieved by placing small amounts of sample carefully into a glass tray and placing a light table underneath it to clearly find any organisms. Any organisms found were placed into a labeled sample vial with clean 70% ethanol. Samples were completely picked of all recognizable organisms. Subsampling techniques were employed in some cases due to the large number of organisms. Using a 200 count, all the organisms were placed in a glass tray that has a gridded template underneath with numbers on it. Using a random numbers table, a number was selected and the organisms from that square were placed in a separate vial for identification. If 200 organisms were not obtained from the first square, the process was repeated until 200 organisms were obtained.

3.3 Sample Storage

All organisms were stored in separately labeled vials filled with clean 70% ethanol. The samples will be archived at Aqua Survey, Inc. for a minimum of five years, after which the samples will be returned to the client or properly disposed.

3.4 Data Analysis

In most cases the number of identified organisms did not match the initial number of organisms subsampled due to their condition, whether as pieces of organisms or damaged and unrecognizable. Following taxonomic identification, various metrics were produced for the data from each sample.

Relative abundance for each identified taxa was determined as a percentage of all identified organisms. The total number of taxa (taxa richness) was summed. The dominant taxon was identified and its percentage of the total number of all identified organisms was calculated. Community composition and percentages of each category were determined. Diversity and evenness measures were made including Shannon-Weaver H' ($\log 10$, $\log 2$ and $\log e$), Margalef's Richness, Pielou's J' and Simpson's Heterogeneity.

3.5 Quality Assurance

All samples are clearly marked with a sample number and client job number on arrival at Aqua Survey. These numbers serve as a tracking numbers for the samples throughout the processing. Each vial was also marked with the

sample and client job numbers. Taxonomic and enumeration data for each sample were recorded bench sheets on which the sample identification was clearly marked by the subcontracted lab, EcoAnalysts, Inc. Data was transferred from the raw data into spreadsheets. Data was carefully cross-checked to guard against transcription errors.

4. Results

Table 2 presents summary data and metrics including the number of taxa, dominant taxon and percent thereof, and richness, diversity and evenness measures. Community composition data can also be found in Table 2. Tables 3a-j provide a detailed inventory of all keyed organisms per sample including each taxon name, life stage, abundance and relative abundance.

Table 2. Benthic Macroinvertebrates Summary

Sample Name:	OR-BIS-01	OR-BIS-02	OR-BIS-03	OR-BIS-04	OR-BIS-05
Sample Number:	20241797	20241798	20241799	20241800	20241801
Number of Taxa:	13	9	10	14	10
Collection Date:	06-01-2024	05-31-2024	05-31-2024	05-31-2024	05-31-2024
Dominance Measures					
Dominant Taxon	<i>L. hoffmeisteri</i>	<i>L. hoffmeisteri</i>	<i>L. hoffmeisteri</i>	<i>L. hoffmeisteri</i>	<i>L. hoffmeisteri</i>
% Dominant Taxon	51.38	81.17	59.85	51.63	65.96
Community Composition					
% Oligochaeta	51.93	81.82	60.61	56.52	65.96
% Diptera	31.49	14.29	31.06	14.67	17.02
% Chironomidae	30.39	13.64	31.06	14.13	17.02
% Polychaeta	0.00	0.00	0.00	0.00	0.00
% Crustacea	14.92	2.60	5.30	25.00	9.22
% Mollusca	1.66	1.30	3.03	3.80	7.80
% Crustacea + Mollusca	16.58	3.90	8.33	28.80	17.02
Diversity/Evenness Measures					
Shannon-Weaver H' (log 10)	0.65	0.34	0.62	0.69	0.57
Shannon-Weaver H' (log 2)	2.17	1.11	2.05	2.29	1.89
Shannon-Weaver H' (log e)	1.51	0.77	1.42	1.58	1.31
Margalef's Richness	2.31	1.59	1.84	2.49	1.82
Pielou's J'	0.59	0.35	0.62	0.60	0.57
Simpson's Heterogeneity	0.67	0.33	0.61	0.68	0.55

Table 2. Benthic Macroinvertebrates Summary (continued)

Sample Name:	OR-BIS-06	OR-BIS-07	OR-BIS-08	OR-BIS-09	OR-BIS-10
Sample Number:	20241802	20241803	20241804	20241805	20241806
Number of Taxa:	11	13	8	11	17
Collection Date:	05-31-2024	06-01-2024	05-31-2024	05-31-2024	06-01-2024
Dominance Measures					
Dominant Taxon	<i>L. hoffmeisteri</i>	<i>L. hoffmeisteri</i>	<i>L. hoffmeisteri</i>	<i>L. hoffmeisteri</i>	<i>L. hoffmeisteri</i>
% Dominant Taxon	73.28	74.21	66.3	60.4	70.09
Community Composition					
% Oligochaeta	74.81	79.47	66.30	68.46	76.34
% Diptera	12.21	15.79	29.35	30.87	12.05
% Chironomidae	11.45	15.79	29.35	29.53	9.38
% Polychaeta	0.00	0.00	0.00	0.00	0.45
% Crustacea	12.21	2.11	3.26	0.00	5.80
% Mollusca	0.00	2.63	1.09	0.00	0.89
% Crustacea + Mollusca	12.21	4.74	4.35	0.00	6.69
Diversity/Evenness Measures					
Shannon-Weaver H' (log 10)	0.47	0.49	0.47	0.60	0.59
Shannon-Weaver H' (log 2)	1.55	1.63	1.55	1.99	1.96
Shannon-Weaver H' (log e)	1.08	1.13	1.08	1.38	1.36
Margalef's Richness	2.05	2.29	1.55	2.00	2.96
Pielou's J'	0.45	0.44	0.52	0.57	0.48
Simpson's Heterogeneity	0.45	0.44	0.52	0.60	0.50

Table 3a. Inventory of Keyed Organisms

Sample Name:			OR-BIS-01		
Sample #:			20241797		
Taxon Name	Family	Community	Life Stage	Abundance (Number of Organisms)	Relative Abundance (%)
<i>Aulodrilus pluriseta</i>	Naididae	Oligochaeta	N/A	1	0.552
<i>Limnodrilus hoffmeisteri</i>	Naididae	Oligochaeta	N/A	93	51.4
<i>Truncatelloidea</i>	Truncatelloidea ¹	Mollusca	N/A	3	1.66
<i>Ceratopogoninae</i>	Ceratopogonidae	Diptera	Larvae	2	1.10
<i>Cryptotendipes sp.</i>	Chironomidae	Diptera	Larvae	38	21.0
<i>Cryptotendipes sp.</i>	Chironomidae	Diptera	Pupae	4	2.21
<i>Dicrotendipes neomodestus</i>	Chironomidae	Diptera	Larvae	1	0.552
<i>Pagastiella sp.</i>	Chironomidae	Diptera	Larvae	1	0.552
<i>Polypedilum halterale gr.</i>	Chironomidae	Diptera	Larvae	5	2.76
<i>Procladius sp.</i>	Chironomidae	Diptera	Larvae	2	1.10
<i>Psectrocladius sp.</i>	Chironomidae	Diptera	Larvae	1	0.552
<i>Pseudochironomus sp.</i>	Chironomidae	Diptera	Larvae	3	1.66
<i>Gammarus sp.</i>	Gammaridae	Crustacea	N/A	19	10.5
<i>Cyathura polita</i>	Anthuridae	Crustacea	N/A	8	4.42
Total Number of Organisms Keyed:				181	

¹ Superfamily

Table 3b. Inventory of Keyed Organisms

Sample Name:			OR-BIS-02		
Sample #:			20241798		
Taxon Name	Family	Community	Life Stage	Abundance (Number of Organisms)	Relative Abundance (%)
<i>Limnodrilus hoffmeisteri</i>	Naididae	Oligochaeta	N/A	125	81.2
<i>Tubificoides heterochaetus</i>	Naididae	Oligochaeta	N/A	1	0.649
<i>Truncatelloidea</i>	Truncatelloidea ¹	Mollusca	N/A	2	1.30
<i>Ceratopogoninae</i>	Ceratopogonidae	Diptera	Larvae	1	0.649
<i>Cryptochironomus sp.</i>	Chironomidae	Diptera	Larvae	2	1.30
<i>Cryptotendipes sp.</i>	Chironomidae	Diptera	Larvae	16	10.4
<i>Procladius sp.</i>	Chironomidae	Diptera	Larvae	3	1.95
<i>Gammarus sp.</i>	Gammaridae	Crustacea	N/A	2	1.30
<i>Cyathura polita</i>	Anthuridae	Crustacea	N/A	2	1.30
Total Number of Organisms Keyed:				154	

¹ Superfamily

Table 3c. Inventory of Keyed Organisms

Sample Name:			OR-BIS-03		
Sample #:			20241799		
Taxon Name	Family	Community	Life Stage	Abundance (Number of Organisms)	Relative Abundance (%)
<i>Aulodrilus sp.</i>	Naididae	Oligochaeta	N/A	1	0.758
<i>Limnodrilus hoffmeisteri</i>	Naididae	Oligochaeta	N/A	79	59.8
<i>Truncatelloidea</i>	Truncatelloidea ¹	Mollusca	N/A	4	3.03
<i>Chironomus sp.</i>	Chironomidae	Diptera	Larvae	19	14.4
<i>Cryptotendipes sp.</i>	Chironomidae	Diptera	Larvae	9	6.82
<i>Cryptotendipes sp.</i>	Chironomidae	Diptera	Pupae	2	1.52
<i>Polypedilum halterale gr.</i>	Chironomidae	Diptera	Larvae	6	4.55
<i>Procladius sp.</i>	Chironomidae	Diptera	Larvae	3	2.27
<i>Tanytarsus sp.</i>	Chironomidae	Diptera	Larvae	2	1.52
<i>Gammarus sp.</i>	Gammaridae	Crustacea	N/A	3	2.27
<i>Cyathura polita</i>	Anthuridae	Crustacea	N/A	4	3.03
Total Number of Organisms Keyed:				132	

¹ Superfamily

Table 3d. Inventory of Keyed Organisms

Sample Name:			OR-BIS-04		
Sample #:			20241800		
Taxon Name	Family	Community	Life Stage	Abundance (Number of Organisms)	Relative Abundance (%)
<i>Aulodrilus pluriseta</i>	Naididae	Oligochaeta	N/A	4	2.17
<i>Isochaetides freyi</i>	Naididae	Oligochaeta	N/A	1	0.543
<i>Limnodrilus hoffmeisteri</i>	Naididae	Oligochaeta	N/A	95	51.6
<i>Tubificoides heterochaetus</i>	Naididae	Oligochaeta	N/A	4	2.17
<i>Truncatelloidea</i>	Truncatelloidea ¹	Mollusca	N/A	7	3.80
<i>Ceratopogoninae</i>	Ceratopogonidae	Diptera	Larvae	1	0.543
<i>Ablabesmyia simpsoni</i>	Chironomidae	Diptera	Larvae	1	0.543
<i>Cryptochironomus sp.</i>	Chironomidae	Diptera	Larvae	1	0.543
<i>Cryptotendipes sp.</i>	Chironomidae	Diptera	Larvae	3	1.63
<i>Polypedilum sp.</i>	Chironomidae	Diptera	Larvae	3	1.63
<i>Procladius sp.</i>	Chironomidae	Diptera	Larvae	16	8.70
<i>Pseudochironomus sp.</i>	Chironomidae	Diptera	Larvae	2	1.09
<i>Gammarus sp.</i>	Gammaridae	Crustacea	N/A	40	21.7
<i>Cyathura polita</i>	Anthuridae	Crustacea	N/A	6	3.26
Total Number of Organisms Keyed:				184	

¹ Superfamily

Table 3e. Inventory of Keyed Organisms

Sample Name:			OR-BIS-05		
Sample #:			20241801		
Taxon Name	Family	Community	Life Stage	Abundance (Number of Organisms)	Relative Abundance (%)
<i>Limnodrilus hoffmeisteri</i>	Naididae	Oligochaeta	N/A	93	66.0
<i>Truncatelloidea</i>	Truncatelloidea ¹	Mollusca	N/A	11	7.80
<i>Chironomus sp.</i>	Chironomidae	Diptera	Larvae	7	4.96
<i>Cryptochironomus sp.</i>	Chironomidae	Diptera	Larvae	1	0.709
<i>Cryptotendipes sp.</i>	Chironomidae	Diptera	Larvae	4	2.84
<i>Cryptotendipes sp.</i>	Chironomidae	Diptera	Pupae	3	2.13
<i>Polypedilum sp.</i>	Chironomidae	Diptera	Larvae	1	0.709
<i>Procladius sp.</i>	Chironomidae	Diptera	Larvae	5	3.55
<i>Tanytarsus sp.</i>	Chironomidae	Diptera	Larvae	2	1.42
<i>Tanytarsus sp.</i>	Chironomidae	Diptera	Pupae	1	0.709
<i>Gammarus sp.</i>	Gammaridae	Crustacea	N/A	10	7.09
<i>Cyathura polita</i>	Anthuridae	Crustacea	N/A	3	2.13
Total Number of Organisms Keyed:				141	

¹ Superfamily

Table 3f. Inventory of Keyed Organisms

Sample Name:			OR-BIS-06		
Sample #:			20241802		
Taxon Name	Family	Community	Life Stage	Abundance (Number of Organisms)	Relative Abundance (%)
<i>Limnodrilus hoffmeisteri</i>	Naididae	Oligochaeta	N/A	96	73.3
<i>Tubificoides heterochaetus</i>	Naididae	Oligochaeta	N/A	2	1.53
<i>Macronychus glabratus</i>	Elmidae	N/A	Larvae	1	0.763
<i>Ceratopogoninae</i>	Ceratopogonidae	Diptera	Larvae	1	0.763
<i>Cryptochironomus sp.</i>	Chironomidae	Diptera	Larvae	1	0.763
<i>Cryptotendipes sp.</i>	Chironomidae	Diptera	Larvae	1	0.763
<i>Polypedilum halterale gr.</i>	Chironomidae	Diptera	Larvae	6	4.58
<i>Procladius sp.</i>	Chironomidae	Diptera	Larvae	6	4.58
<i>Tanytarsus sp.</i>	Chironomidae	Diptera	Larvae	1	0.763
<i>Gammarus sp.</i>	Gammaridae	Crustacea	N/A	13	9.92
<i>Cyathura polita</i>	Anthuridae	Crustacea	N/A	3	2.29
Total Number of Organisms Keyed:				131	

Table 3g. Inventory of Keyed Organisms

Sample Name:			OR-BIS-07		
Sample #:			20241803		
Taxon Name	Family	Community	Life Stage	Abundance (Number of Organisms)	Relative Abundance (%)
<i>Aulodrilus pluriseta</i>	Naididae	Oligochaeta	N/A	9	4.74
<i>Limnodrilus hoffmeisteri</i>	Naididae	Oligochaeta	N/A	141	74.2
<i>Tubificoides heterochaetus</i>	Naididae	Oligochaeta	N/A	1	0.526
<i>Truncatelloidea</i>	Truncatelloidea ¹	Mollusca	N/A	5	2.63
<i>Chironomus sp.</i>	Chironomidae	Diptera	Larvae	6	3.16
<i>Chironomus sp.</i>	Chironomidae	Diptera	Pupae	1	0.526
<i>Cricotopus/Orthocladius sp.</i>	Chironomidae	Diptera	Larvae	1	0.526
<i>Cryptotendipes sp.</i>	Chironomidae	Diptera	Larvae	6	3.16
<i>Cryptotendipes sp.</i>	Chironomidae	Diptera	Pupae	4	2.11
<i>Harnischia sp.</i>	Chironomidae	Diptera	Larvae	1	0.526
<i>Polypedilum halterale gr.</i>	Chironomidae	Diptera	Larvae	3	1.58
<i>Procladius sp.</i>	Chironomidae	Diptera	Larvae	7	3.68
<i>Tanytarsus sp.</i>	Chironomidae	Diptera	Larvae	1	0.526
<i>Gammarus sp.</i>	Gammaridae	Crustacea	N/A	3	1.58
<i>Cyathura polita</i>	Anthuridae	Crustacea	N/A	1	0.526
Total Number of Organisms Keyed:				190	

¹ Superfamily

Table 3h. Inventory of Keyed Organisms

Sample Name:			OR-BIS-08		
Sample #:			20241804		
Taxon Name	Family	Community	Life Stage	Abundance (Number of Organisms)	Relative Abundance (%)
<i>Limnodrilus hoffmeisteri</i>	Naididae	Oligochaeta	N/A	61	66.3
<i>Truncatelloidea</i>	Truncatelloidea ¹	Mollusca	N/A	1	1.09
<i>Cryptochironomus sp.</i>	Chironomidae	Diptera	Larvae	3	3.26
<i>Cryptotendipes sp.</i>	Chironomidae	Diptera	Larvae	19	20.7
<i>Polypedilum sp.</i>	Chironomidae	Diptera	Larvae	1	1.09
<i>Procladius sp.</i>	Chironomidae	Diptera	Larvae	4	4.35
<i>Gammaridae</i>	Gammaridae	Crustacea	N/A	1	1.09
<i>Cyathura polita</i>	Anthuridae	Crustacea	N/A	2	2.17
Total Number of Organisms Keyed:				92	

¹ Superfamily

Table 3i. Inventory of Keyed Organisms

Sample Name:			OR-BIS-09		
Sample #:			20241805		
Taxon Name	Family	Community	Life Stage	Abundance (Number of Organisms)	Relative Abundance (%)
<i>Nematoda</i>	Nematoda ¹	N/A	N/A	1	0.671
<i>Aulodrilus pigueti</i>	Naididae	Oligochaeta	N/A	7	4.70
<i>Aulodrilus pluriseta</i>	Naididae	Oligochaeta	N/A	4	2.68
<i>Isochaetides freyi</i>	Naididae	Oligochaeta	N/A	1	0.671
<i>Limnodrilus hoffmeisteri</i>	Naididae	Oligochaeta	N/A	90	60.4
<i>Ceratopogoninae</i>	Ceratopogonidae	Diptera	Larvae	2	1.34
<i>Chironomus sp.</i>	Chironomidae	Diptera	Larvae	23	15.4
<i>Chironomus sp.</i>	Chironomidae	Diptera	Pupae	2	1.34
<i>Cladopelma sp.</i>	Chironomidae	Diptera	Larvae	1	0.671
<i>Cryptotendipes sp.</i>	Chironomidae	Diptera	Larvae	4	2.68
<i>Cryptotendipes sp.</i>	Chironomidae	Diptera	Pupae	1	0.671
<i>Procladius sp.</i>	Chironomidae	Diptera	Larvae	10	6.71
<i>Tanytarsus sp.</i>	Chironomidae	Diptera	Larvae	3	2.01
Total Number of Organisms Keyed:				149	

¹Phylum

Table 3j. Inventory of Keyed Organisms

Sample Name:		OR-BIS-10			
Sample #:		20241806			
Taxon Name	Family	Community	Life Stage	Abundance (Number of Organisms)	Relative Abundance (%)
<i>Nematoda</i>	Nematoda ¹	N/A	N/A	7	3.13
<i>Naididae</i>	Naididae	Oligochaeta	N/A	1	0.446
<i>Aulodrilus pluriset</i>	Naididae	Oligochaeta	N/A	1	0.45
<i>Haber speciosus</i>	Naididae	Oligochaeta	N/A	12	5.36
<i>Limnodrilus hoffmeisteri</i>	Naididae	Oligochaeta	N/A	157	70.1
<i>Truncatelloidea</i>	Truncatelloidea ²	Mollusca	N/A	2	0.893
<i>Ceratopogoninae</i>	Ceratopogonidae	Diptera	Larvae	6	2.68
<i>Chironomus sp.</i>	Chironomidae	Diptera	Larvae	4	1.79
<i>Clinotanytus sp.</i>	Chironomidae	Diptera	Larvae	2	0.893
<i>Cryptotendipes sp.</i>	Chironomidae	Diptera	Larvae	6	2.68
<i>Harnischia sp.</i>	Chironomidae	Diptera	Larvae	1	0.446
<i>Procladius sp.</i>	Chironomidae	Diptera	Larvae	3	1.34
<i>Tanytarsus sp.</i>	Chironomidae	Diptera	Larvae	4	1.79
<i>Tanytarsus sp.</i>	Chironomidae	Diptera	Pupae	1	0.446
<i>Gammarus sp.</i>	Gammaridae	Crustacea	N/A	10	4.46
<i>Cyathura polita</i>	Anthuridae	Crustacea	N/A	3	1.34
<i>Marenzelleria viridis</i>	Spionidae	Polychaeta	N/A	1	0.446
<i>Turbellaria</i>	Turbellaria ³	N/A	N/A	3	1.34
Total Number of Organisms Keyed:				224	

¹Phylum

² Superfamily

³Class

Appendix A

Sampling Logs



AQUA SURVEY, INC.

SEDIMENT GRAB LOG

Client : Integral			Project : Penobscot River			Logger: WR		
Job#: 44-072		Date: 6/1/24		Time: 0851		Crew: JP		
Coordinates:		N 383871.8		E 898345.1		Vessel: Schuykill		
Core # : OR-BIS-01		Zone: ME-E		Datum NAD 83		Deploy: 1 2 3 4 5		
Project Depth [PD] [ft.]:				Core Penetration Length (ft.):		0.3 0.3 0.2 0.3 0.3		
Measured Water Depth [MWD] [ft.]: 9.0				Recovered Core Length (ft.):		0.3 0.3 0.2 0.3 0.3		
				Sample Length Retained (ft.):		0.3 0.3 0.2 0.3 0.3		
Bangor tide: 10.3				Core Volume Retained (gal.):		0.2 0.2 0.2 0.2 0.2		
				Collected to Project Depth:		☒ Y ☐ N		
Required Sample Core Length [SCL] [ft.]:								
All Length Measurements are in Decimal Feet								
Sample Interval (ft.)		Sample Id #		Description				
Top 0.0		20241797		Location shifted due to all rocks at original. N: 383932.3, E: 898309.0, MWD: 8.9, T/A: 9.7				
0.3								
↓ Bottom								
# of containers:				1		Core Volumes		
Type of container:		bucket	hardliner	cup	other	Nominal core-barrel		
Conditions:						diameter EST. Volume		
						3.0" .25 gal/ft		
Comments: Total volume sieved to 5 mm. Formalin added at 0945.						3.5" 8.0" .33 gal/ft		
						4.0" .50 gal/ft		
						Liner Type: Soft Hard		
						Vibracorer: P3 P5 VT6 Other		
Live Organisms Present		Y						
Oil Present		N			Pushcorer Slambar			
Odor Present		N						
Debris Present		Y	Organic		Eckman Ponar: Standard ☒ Petite			
Within 10% of Req'd Core Length		Y			Smith-Mac			
Photo		N			Box Core			
MLW #td ver 030615								



AQUA SURVEY, INC.

SEDIMENT GRAB LOG

Client : Integral			Project : Penobscot River			Logger: WR		
Job#: 44-072		Date: 5/31/24		Time: 0930		Crew: JP		
Coordinates:		N 384052.5		E 898367.7		Vessel: Schuykill		
Core # : OR-BIS-02		Zone: ME-E		Datum NAD 83		Deploy: 1 2 3 4 5		
Project Depth [PD] [ft.]:				Core Penetration Length (ft.):		0.3	0.4	0.3 0.4 0.3
Measured Water Depth [MWD] [ft.]: 6.4				Recovered Core Length (ft.):		0.3	0.4	0.3 0.4 0.3
				Sample Length Retained (ft.):		0.3	0.4	0.3 0.4 0.3
Bangor tide: 6.9				Core Volume Retained (gal.):		0.2	0.3	0.2 0.3 0.2
				Collected to Project Depth:		Y N		
Required Sample Core Length [SCL] [ft.]:								
All Length Measurements are in Decimal Feet								
Sample Interval (ft.)		Sample Id #		Description				
Top 0.0		20241798		Brown silt, w/ trace sand and gravel.				
0.4								
Bottom								
# of containers:				1		Core Volumes		
Type of container:		bucket	hardliner	cup	other	Nominal core-barrel		
						diameter		EST. Volume
						3.0"		.25 gal/ft
Conditions:						3.5" 8.0"		.33 gal/ft
						4.0"		.50 gal/ft
Comments: Total volume sieved to 0.5 mm. Formalin added at 1021.						Liner Type: Soft Hard		
						Vibracorer: P3 P5 VT6 Other		
Live Organisms Present		Y						
Oil Present		N		Pushcorer Slambar				
Odor Present		N						
Debris Present		Y		Eckman Ponar: Standard <u>Petite</u>				
Within 10% of Req'd Core Length		Y		Smith-Mac				
Photo		N		Box Core				
MLW #td ver 030615								



AQUA SURVEY, INC.

SEDIMENT GRAB LOG

Client : Integral			Project : Penobscot River			Logger: WR		
Job#: 44-072		Date: 5/31/24		Time: 1603		Crew: JP		
Coordinates:		N 384174.7		E 898593.3		Vessel: Schuykill		
Core # : OR-BIS-03		Zone: ME-E		Datum NAD 83		Deploy: 1 2 3 4 5		
Project Depth [PD] [ft.]:				Core Penetration Length (ft.):		0.3	0.5	0.5 0.3 0.4
Measured Water Depth [MWD] [ft.]: 6.5				Recovered Core Length (ft.):		0.3	0.5	0.5 0.3 0.4
				Sample Length Retained (ft.):		0.3	0.5	0.5 0.3 0.4
Bangor tide: 7.9				Core Volume Retained (gal.):		0.2	0.6	0.6 0.2 0.3
				Collected to Project Depth:		Y N		
Required Sample Core Length [SCL] [ft.]:								
All Length Measurements are in Decimal Feet								
Sample Interval (ft.)		Sample Id #		Description				
Top 0.0		20241799		Brown silt, w/ trace sand and gravel.				
0.5								
Bottom								
# of containers:				1		Core Volumes		
Type of container:		bucket	hardliner	cup	other	Nominal core-barrel diameter		EST. Volume
Conditions:					3.0"		.25 gal/ft	
					3.5" 8.0"		.33 gal/ft	
					4.0"		.50 gal/ft	
Comments: Total volume sieved to 0.5 mm. Formalin added at 1635 .					Liner Type: Soft Hard			
					Vibracorer: P3 P5 VT6 Other			
Live Organisms Present		Y						
Oil Present		N		Pushcorer Slambar				
Odor Present		N						
Debris Present		Y Organic		Eckman Ponar: Standard <u>Petite</u>				
Within 10% of Req'd Core Length		Y		Smith-Mac				
Photo		N		Box Core				
MLW #td ver 030615								



AQUA SURVEY, INC.

SEDIMENT GRAB LOG

Client : Integral				Project : Penobscot River				Logger: WR				
Job#: 44-072		Date: 5/31/24		Time: 0949		Crew: JP						
Coordinates:		N 384273.7		E 898389.4		Vessel: Schuykill						
Core # : OR-BIS-04		Zone: ME-E		Datum NAD 83		Deploy:		1	2	3	4	5
Project Depth [PD] [ft.]:				Core Penetration Length (ft.):				0.2	0.2	0.2	0.2	0.3
Measured Water Depth [MWD] [ft.]: 6.9				Recovered Core Length (ft.):				0.2	0.2	0.2	0.2	0.3
				Sample Length Retained (ft.):				0.2	0.2	0.2	0.2	0.3
Bangor tide: 6.2				Core Volume Retained (gal.):				0.2	0.2	0.2	0.2	0.3
				Collected to Project Depth:				Y N				
Required Sample Core Length [SCL] [ft.]:												
All Length Measurements are in Decimal Feet												
Sample Interval (ft.)		Sample Id #		Description								
Top 0.0		20241800		Brown silt, w/ trace gravel and coarse sand.								
0.3												
↓												
Bottom												
# of containers:				1		Core Volumes						
Type of container:		bucket	hardliner	cup	other	Nominal core-barrel		EST. Volume				
Conditions:						3.0"		.25 gal/ft				
						3.5" 8.0"		.33 gal/ft				
						4.0"		.50 gal/ft				
Comments: Total volume sieved to 0.5 mm. Formalin added at 1100.						Liner Type: Soft Hard						
						Vibracorer: P3 P5 VT6 Other						
Live Organisms Present		Y										
Oil Present		N		Pushcorer Slambar								
Odor Present		N										
Debris Present		Y		Organic		Eckman Ponar: Standard <u>Petite</u>						
Within 10% of Req'd Core Length		Y		Smith-Mac								
Photo		N		Box Core								
MLW #td ver 030615												



AQUA SURVEY, INC.

SEDIMENT GRAB LOG

Client : Integral				Project : Penobscot River				Logger: WR				
Job#: 44-072		Date: 5/31/24		Time: 1525		Crew:		JP				
Coordinates:		N 384379.0		E 898589.9		Vessel:		Schuylkill				
Core # : OR-BIS-05		Zone: ME-E		Datum NAD 83		Deploy:		1	2	3	4	5
Project Depth [PD] [ft.]:				Core Penetration Length (ft.):				0.4	0.3	0.3	0.4	0.5
Measured Water Depth [MWD] [ft.]: 3.8				Recovered Core Length (ft.):				0.4	0.3	0.3	0.4	0.5
				Sample Length Retained (ft.):				0.4	0.3	0.3	0.4	0.5
Bangor tide: 5.6				Core Volume Retained (gal.):				0.3	0.2	0.2	0.3	0.6
				Collected to Project Depth:				Y N				
Required Sample Core Length [SCL] [ft.]:												

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0	20241801	Brown silt, trace sand and gravel.
0.5		
Bottom		

# of containers:					Core Volumes						
	Type of container:	bucket	hardliner	1 cup	other	Nominal core-barrel diameter					
Conditions:						EST. Volume					
						3.0"	.25 gal/ft				
						3.5" 8.0"	.33 gal/ft				
						4.0"	.50 gal/ft				
Comments: Total volume sieved to 0.5 mm. Formalin added at 1600.						Liner Type: Soft Hard					
						Vibracorer: P3 P5 VT6 Other					

Live Organisms Present	Y					
Oil Present		N			Pushcorer	Slambar
Odor Present		N				
Debris Present	Y	Organic			Eckman	Ponar: Standard / <u>Petite</u>
Within 10% of Req'd Core Length	Y					Smith-Mac
Photo		N			Box Core	

MLW #td ver 030615



AQUA SURVEY, INC.

SEDIMENT GRAB LOG

Client : Integral			Project : Penobscot River			Logger: WR		
Job#: 44-072		Date: 5/31/24		Time: 1014		Crew: JP		
Coordinates:		N 384578.5		E 898488.3		Vessel: Schuykill		
Core # : OR-BIS-06		Zone: ME-E		Datum NAD 83		Deploy: 1 2 3 4 5		
Project Depth [PD] [ft.]:				Core Penetration Length (ft.):		0.2	0.2	0.2 0.3 0.4
Measured Water Depth [MWD] [ft.]: 5.6				Recovered Core Length (ft.):		0.2	0.2	0.2 0.3 0.4
				Sample Length Retained (ft.):		0.2	0.2	0.2 0.3 0.4
Bangor tide: 4.9				Core Volume Retained (gal.):		0.2	0.2	0.2 0.2 0.3
				Collected to Project Depth:		Y N		
Required Sample Core Length [SCL] [ft.]:								
All Length Measurements are in Decimal Feet								
Sample Interval (ft.)		Sample Id #		Description				
Top 0.0		20241802		Brown silt, trace sand and gravel.				
0.4								
Bottom								
# of containers:				1		Core Volumes		
Type of container:		bucket	hardliner	cup	other	Nominal core-barrel diameter		EST. Volume
Conditions:					3.0"		.25 gal/ft	
					3.5" 8.0"		.33 gal/ft	
					4.0"		.50 gal/ft	
Comments: Total volume sieved to 0.5 mm. Formalin added at 1125.					Liner Type: Soft Hard			
					Vibracorer: P3 P5 VT6 Other			
Live Organisms Present		Y						
Oil Present		N		Pushcorer				
Odor Present		N		Slambar				
Debris Present		Y		Eckman				
Within 10% of Req'd Core Length		Y		Ponar: Standard / <u>Petite</u>				
Photo		N		Smith-Mac				
				Box Core				
MLW #td ver 030615								



AQUA SURVEY, INC.

SEDIMENT GRAB LOG

Client : Integral			Project : Penobscot River			Logger: WR		
Job#: 44-072		Date: 6/1/24		Time: 0718		Crew: JP		
Coordinates:		N 384676.6		E 898687.1		Vessel: Schuykill		
Core # : OR-BIS-07		Zone: ME-E Datum NAD 83		Deploy:		1	2	3 4 5
Project Depth [PD] [ft.]:				Core Penetration Length (ft.):		0.4	0.3	0.4 0.3 0.3
Measured Water Depth [MWD] [ft.]: 10.7				Recovered Core Length (ft.):		0.4	0.3	0.4 0.3 0.3
				Sample Length Retained (ft.):		0.4	0.3	0.4 0.3 0.3
Bangor tide: 13.0				Core Volume Retained (gal.):		0.3	0.2	0.3 0.2 0.2
				Collected to Project Depth:		Y N		
Required Sample Core Length [SCL] [ft.]:								

All Length Measurements are in Decimal Feet

Sample Interval (ft.)	Sample Id #	Description
Top 0.0	20241803	Brown silt, trace sand and gravel.
0.4		
	Deploy:	1 2 3 4 5 Time: 0810
	Penetration:	0.3 0.4 0.3 0.3 0.4
	Recovered:	0.3 0.4 0.3 0.3 0.4
	Retained:	0.3 0.4 0.3 0.3 0.4
	Volume retained:	0.2 0.3 0.2 0.2 0.3
Bottom		

# of containers:					Core Volumes						
	Type of container:	bucket	hardliner	2 cup	other	Nominal core-barrel diameter					
Conditions:						EST. Volume					
						3.0"	.25 gal/ft				
						3.5" 8.0"	.33 gal/ft				
						4.0"	.50 gal/ft				
Comments: Total volume sieved to 5mm. Formalin added at 0750. Duplicate.						Liner Type: Soft Hard					
						Vibracorer: P3 P5 VT6 Other					

Live Organisms Present	Y					
Oil Present		N			Pushcorer	Slambar
Odor Present		N				
Debris Present	Y	Organic			Eckman	Ponar: Standard / <u>Petite</u>
Within 10% of Req'd Core Length	Y					Smith-Mac
Photo		N			Box Core	

MLW #td ver 030615



AQUA SURVEY, INC.

SEDIMENT GRAB LOG

Client : Integral				Project : Penobscot River				Logger: WR				
Job#: 44-072		Date: 5/31/24		Time: 1455		Crew: JP						
Coordinates:		N 384777.8		E 898586.3		Vessel: Schuykill						
Core # : OR-BIS-08		Zone: ME-E		Datum NAD 83		Deploy:		1	2	3	4	5
Project Depth [PD] [ft.]:				Core Penetration Length (ft.):				0.3	0.4	0.4	0.5	0.5
Measured Water Depth [MWD] [ft.]: 3.8				Recovered Core Length (ft.):				0.3	0.4	0.4	0.5	0.5
				Sample Length Retained (ft.):				0.3	0.4	0.4	0.5	0.5
Bangor tide: 4.4				Core Volume Retained (gal.):				0.2	0.3	0.3	0.6	0.6
				Collected to Project Depth:				Y N				
Required Sample Core Length [SCL] [ft.]:												
All Length Measurements are in Decimal Feet												
Sample Interval (ft.)		Sample Id #		Description								
Top 0.0		20241804		Brown silt, trace sand and gravel.								
0.5												
↓												
Bottom												
# of containers:				1		Core Volumes						
Type of container:		bucket	hardliner	cup	other							
Conditions: Breezy.						Nominal core-barrel						
						diameter		EST. Volume				
Comments: Total volume sieved to 0.5 mm. Formalin added at 1518.						3.0"		.25 gal/ft				
						3.5" 8.0"		.33 gal/ft				
						4.0"		.50 gal/ft				
						Liner Type: Soft Hard						
						Vibracorer: P3 P5 VT6 Other						
Live Organisms Present		Y										
Oil Present		N										
Odor Present		N										
Debris Present		Y Organic										
Within 10% of Req'd Core Length		Y										
Photo		N										
				Pushcorer		Slambar						
				Eckman		Ponar: Standard <u>Petite</u>						
						Smith-Mac						
				Box Core								
MLW #td ver 030615												



AQUA SURVEY, INC.

SEDIMENT GRAB LOG

Client : Integral			Project : Penobscot River			Logger: WR		
Job#: 44-072		Date: 5/31/24		Time: 0821		Crew: JP		
Coordinates:		N 383911.7		E 898539.4		Vessel: Schuykill		
Core # : OR-BIS-09		Zone: ME-E		Datum NAD 83		Deploy: 1 2 3 4 5		
Project Depth [PD] [ft.]:				Core Penetration Length (ft.):		0.5 0.5 0.4 0.4 0.5		
Measured Water Depth [MWD] [ft.]: 6.4				Recovered Core Length (ft.):		0.5 0.5 0.4 0.4 0.5		
				Sample Length Retained (ft.):		0.5 0.5 0.4 0.4 0.5		
Bangor tide: 9.4				Core Volume Retained (gal.):		0.6 0.6 0.5 0.5 0.6		
				Collected to Project Depth:		☒ Y ☐ N		
Required Sample Core Length [SCL] [ft.]:								
All Length Measurements are in Decimal Feet								
Sample Interval (ft.)		Sample Id #		Description				
Top 0.0		20241805		Brown silt w/ trace coarse sand and gravel.				
0.5								
Bottom								
# of containers:				1		Core Volumes		
Type of container:		bucket	hardliner	cup	other	Nominal core-barrel		
Conditions: Breezy.						diameter EST. Volume		
						3.0" .25 gal/ft		
Comments: Total volume sieved to 0.5 mm. Formalin added at 0915.						3.5" 8.0" .33 gal/ft		
						4.0" .50 gal/ft		
						Liner Type: Soft Hard		
						Vibracorer: P3 P5 VT6 Other		
Live Organisms Present		Y						
Oil Present		N						
Odor Present		N						
Debris Present		Y	Organic					
Within 10% of Req'd Core Length		Y						
Photo		N						
				Pushcorer		Slambar		
				Eckman		Ponar: Standard ☒ Petite		
						Smith-Mac		
				Box Core				
MLW #td ver 030615								



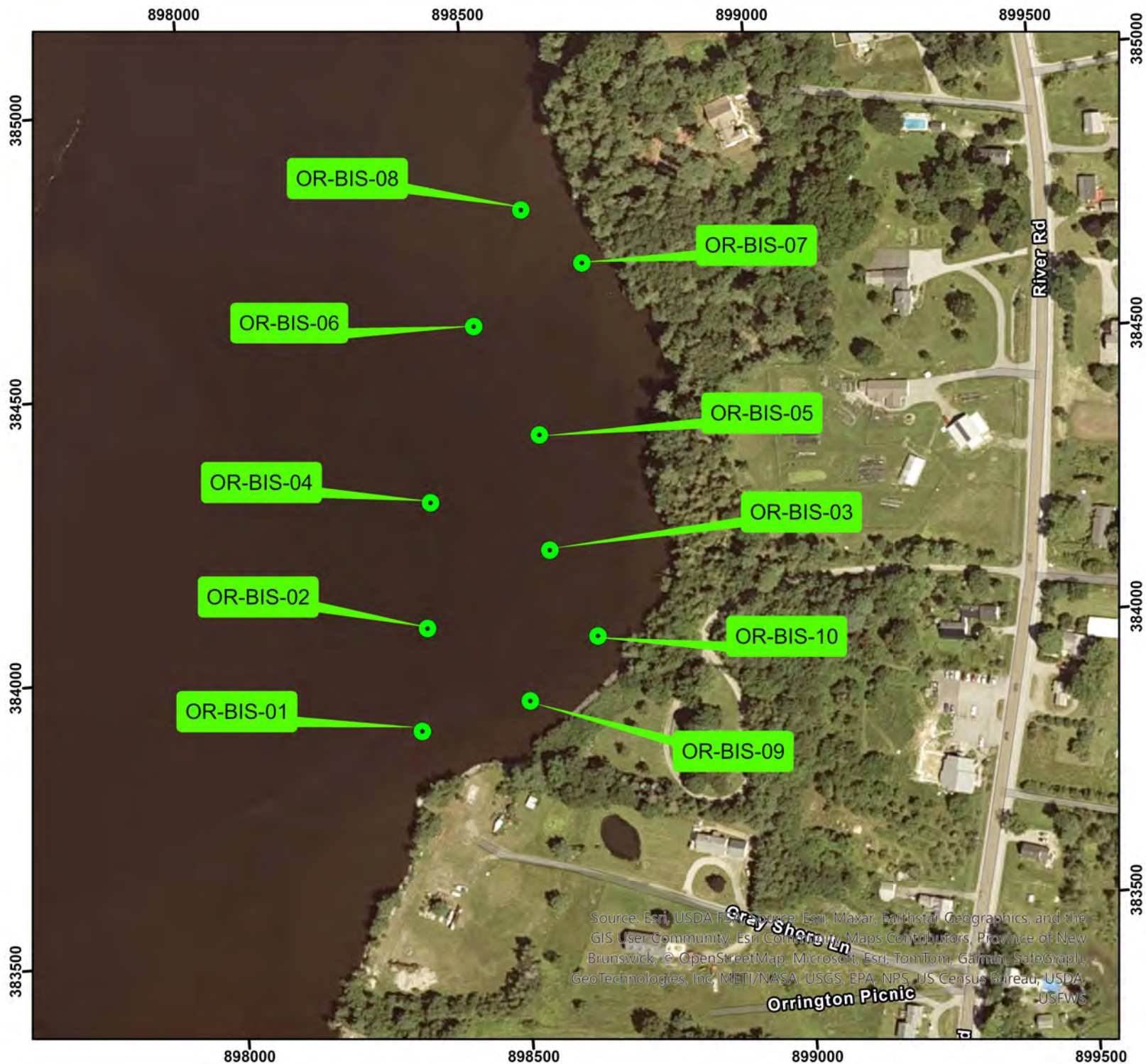
AQUA SURVEY, INC.

SEDIMENT GRAB LOG

Client : Integral		Project : Penobscot River		Logger: WR	
Job#: 44-072	Date: 6/1/24	Time: 0819	Crew: JP		
Coordinates:	N 384017.2	E 898667.2	Vessel: Schuykill		
Core # : OR-BIS-10	Zone: ME-E	Datum NAD 83	Deploy:	1	2 3 4 5
Project Depth [PD] [ft.]:		Core Penetration Length (ft.):		0.5	0.4 0.3 0.4 0.4
Measured Water Depth [MWD] [ft.]: 7.3		Recovered Core Length (ft.):		0.5	0.4 0.3 0.4 0.4
		Sample Length Retained (ft.):		0.5	0.4 0.3 0.4 0.4
Bangor tide: 11.1		Core Volume Retained (gal.):		0.6	0.3 0.2 0.3 0.3
		Collected to Project Depth:		☒ Y ☐ N	
Required Sample Core Length [SCL] [ft.]:					
All Length Measurements are in Decimal Feet					
Sample Interval (ft.)		Sample Id #		Description	
Top 0.0		20241806		Brown silt, trace sand and gravel.	
0.5					
Bottom					
# of containers:			1		Core Volumes Nominal core-barrel diameter EST. Volume
Type of container:	bucket	hardliner	cup	other	
Conditions:				3.0"	.25 gal/ft
				3.5" 8.0"	.33 gal/ft
Comments: Formalin added at 0842.				4.0"	.50 gal/ft
				Liner Type: Soft Hard	
				Vibracorer: P3 P5 VT6 Other	
Live Organisms Present		Y			
Oil Present		N	Pushcorer Slambar		
Odor Present		N			
Debris Present		Y	Organic	Eckman Ponar: Standard ☒ Petite	
Within 10% of Req'd Core Length		Y		Smith-Mac	
Photo		N	Box Core		
MLW #td ver 030615					

Appendix B

Sample Locations Map



Integral
Penobscot River
Sample Locations Map

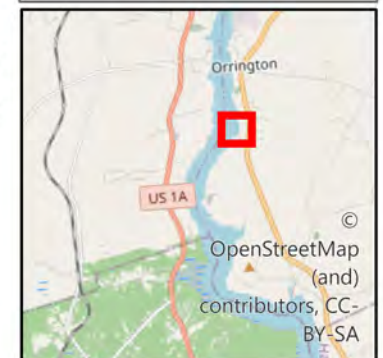
ASI Project: 44-072

Coordinate System:

State Plane NAD 83
Maine-E US Survey Foot



0 55 110 220 330
Feet



Aqua Survey Inc.
469 Point Breeze Rd.
Flemington, NJ 08822

Tel: (908) 788-8700
Fax: (908) 788-9165
www.AquaSurvey.com

Appendix C

Chains of Custody



CHAIN OF CUSTODY RECORD

AQUA SURVEY, INC.

469 POINT BREEZE ROAD
FLEMINGTON, NJ 08822
(908) 788-8700 OFFICE
(908) 788-9165 FAX

www.aquasurvey.com

1 of 2

CLIENT: <u>Integral</u>					METHOD OF SHIPMENT: <u>AUTO</u>					
PROJECT/SITE NAME: <u>Penobscot River</u>					TO: <u>Flemington, NJ</u>					
ASI JOB NUMBER: <u>44-072</u>					FROM: <u>Hampden, ME</u>					
SAMPLING & ANALYSIS AUTHORIZED BY: <u>Integral</u>								DATE: <u>5-31-24</u>	SEE WORK ORD.	
SAMPLE NUMBER	SAMPLING LOCATION AND DESCRIPTION	DATE	TIME	SAMPLE TYPE				NO. CNT.		ANALYSES REQUIRED *
				SED	WTR	COM	GRB			
<u>20241798</u>	<u>OR-BIS-02-053124-SED-0-5-C</u>	<u>5-31-24</u>	<u>0930</u>	<u>X</u>				<u>1</u>	<u>~741 org</u>	<u>-248</u>
<u>20241799</u>	<u>OR-BIS-03-053124-SED-0-5-C</u>	<u>5-31-24</u>	<u>1603</u>				<u>X</u>	<u>1</u>	<u>~763 org</u>	<u>-236</u>
<u>20241800</u>	<u>OR-BIS-04-053124-SED-0-5-C</u>	<u>5-31-24</u>	<u>0944</u>				<u>X</u>	<u>1</u>	<u>~291 org</u>	
<u>20241801</u>	<u>OR-BIS-05-053124-SED-0-5-C</u>	<u>5-31-24</u>	<u>1525</u>				<u>X</u>	<u>1</u>	<u>~850 org</u>	<u>-252</u>
<u>20241802</u>	<u>OR-BIS-06-053124-SED-0-5-C</u>	<u>5-31-24</u>	<u>1014</u>				<u>X</u>	<u>1</u>	<u>~1217 org</u>	<u>~1527 org -253</u>
<u>20241804</u>	<u>OR-BIS-08-053124-SED-0-5-C</u>	<u>5-31-24</u>	<u>1455</u>				<u>X</u>	<u>1</u>	<u>~1455 org</u>	<u>-234</u>
<u>20241805</u>	<u>OR-BIS-09-053124-SED-0-5-C</u>	<u>5-31-24</u>	<u>0821</u>				<u>X</u>	<u>1</u>	<u>~782 org</u>	<u>~970 org -241</u>
SAMPLE COLLECTED BY: <u>W. Reasoner, J. Plone</u>			DATE	TIME	EXACT SAMPLING LOCATION: <u>please see core logs for coordinates</u>					
SAMPLE RELINQUISHED BY: <u>[Signature]</u>			<u>6-7-24</u>	<u>1540</u>	SAMPLE RECEIVED BY: <u>D-C P</u>			DATE	TIME	
SAMPLE RELINQUISHED BY:					SAMPLE RECEIVED BY:			DATE	TIME	
SAMPLE RELINQUISHED BY:					SAMPLE RECEIVED BY:			DATE	TIME	
SPECIAL INSTRUCTIONS:										

* Attach Separate Sheet If Necessary

102412



CHAIN OF CUSTODY RECORD

AQUA SURVEY, INC.

469 POINT BREEZE ROAD
FLEMINGTON, NJ 08822
(908) 788-8700 OFFICE
(908) 788-9165 FAX

www.aquasurvey.com

2 of 2

CLIENT: <i>Integral</i>						METHOD OF SHIPMENT: <i>AUTO</i>						
PROJECT/SITE NAME: <i>Penobscot River</i>						TO: <i>Flemington, NJ</i>						
ASI JOB NUMBER: <i>44-072</i>						FROM: <i>Hampden, ME</i>						
SAMPLING & ANALYSIS AUTHORIZED BY: <i>Integral</i>										DATE: <i>6-1-24</i>		SEE WORK ORD.
SAMPLE NUMBER	SAMPLING LOCATION AND DESCRIPTION		DATE	TIME	SAMPLE TYPE				NO. CNT.	ANALYSES REQUIRED *		
	SED	WTR	COM	GRB								
<i>20241797</i>	<i>OR-BIS-01-060124-SED-0-5-C</i>		<i>6-1-24</i>	<i>0851</i>				<i>X</i>	<i>1</i>	<i>~749 org</i>	<i>-237 org</i>	
<i>20241803</i>	<i>OR-BIS-07-060124-SED-0-5-C</i>		<i>6-1-24</i>	<i>0718</i>				<i>X</i>	<i>2</i>	<i>~2454 org</i>	<i>~2896 org</i>	
<i>20241806</i>	<i>OR-BIS-10-060124-SED-0-5-C</i>		<i>6-1-24</i>	<i>0819</i>				<i>X</i>	<i>1</i>	<i>~1647 org</i>	<i>-280 org</i>	
SAMPLE COLLECTED BY: <i>W. Reasoner J. Plone</i>				DATE	TIME	EXACT SAMPLING LOCATION: <i>please see core logs for coordinates</i>						
SAMPLE RELINQUISHED BY: <i>[Signature]</i>				<i>6-7-24</i>	<i>1540</i>	SAMPLE RECEIVED BY: <i>[Signature]</i>				DATE <i>6-7-24</i>	TIME <i>1540</i>	
SAMPLE RELINQUISHED BY:						SAMPLE RECEIVED BY:				DATE	TIME	
SAMPLE RELINQUISHED BY:						SAMPLE RECEIVED BY:				DATE	TIME	
SPECIAL INSTRUCTIONS:												

* Attach Separate Sheet If Necessary

102412



CHAIN OF CUSTODY RECORD

469 POINT BREEZE ROAD
FLEMINGTON, NJ 08822
(908) 788-8700 OFFICE
(908) 788-9165 FAX

www.aquasurvey.com

CLIENT: <u>Integral</u>				METHOD OF SHIPMENT: <u>UPS</u>						
PROJECT/SITE NAME: <u>Penobscot River</u>				TO: <u>EcoAnalysts 1420 South Blaine St, Suite 14</u>						
ASI JOB NUMBER: <u>44-072</u>				FROM: <u>Moscow, Idaho 83843</u>						
SAMPLING & ANALYSIS AUTHORIZED BY: <u>ASI</u>				DATE: <u>7/8/24</u>						
SAMPLE NUMBER	SAMPLING LOCATION AND DESCRIPTION	DATE	TIME	SAMPLE TYPE			NO. ANALYSES REQUIRED *	SEE WORK ORD.		
				SED	WTR	COM				
20241797	OR-BIS-01-060124.SED-0.5.C Subsample	6/1/24	0851				1-402	ID	237019	
20241798	OR-BIS-02-053124.SED-0.5.C Subsample	5/31/24	0930				1-402		248019	
20241799	OR-BIS-03-053124.SED-0.5.C Subsample	5/31/24	1003				1-402		236019	
20241800	OR-BIS-04-053124.SED-0.5.C	5/31/24	0949				1-402		291019	
20241801	OR-BIS-05-053124.SED-0.5.C Subsample	5/31/24	1525				1-402		252019	
20241802	OR-BIS-06-053124.SED-0.5.C Subsample	5/31/24	1014				1-402		253019	
20241803	OR-BIS-07-060124.SED-0.5.C Subsample	6/1/24	0718				1-402		236019	
20241804	OR-BIS-08-053124.SED-0.5.C Subsample	5/31/24	1455				1-402		234019	
20241805	OR-BIS-09-053124.SED-0.5.C Subsample	5/31/24	0821				1-402		241019	
20241806	OR-BIS-10-060124.SED-0.5.C Subsample	6/1/24	0819				1-402		238019	
SAMPLE COLLECTED BY: <u>ASI</u>				EXACT SAMPLING LOCATION: <u>Hamden, ME</u>						
SAMPLE RELINQUISHED BY: <u>[Signature]</u>				DATE		TIME		DATE		TIME
SAMPLE RELINQUISHED BY: <u>[Signature]</u>				7/8/24		1700		DATE		TIME
SAMPLE RELINQUISHED BY:								DATE		TIME
SPECIAL INSTRUCTIONS:										

* Attach Separate Sheet If Necessary

102412

Appendix D

Water Quality Monitoring Plan

Water Quality Monitoring Plan

Thin Layer Cap Pilot Final Work Design

Orrington Reach Capping Remedy

Prepared for
**Greenfield Penobscot Estuary Remediation Trust LLC,
Trustee for Penobscot Estuary Mercury Remediation Trust**



Prepared by
integral
consulting inc.

45 Exchange Street
Suite 200
Portland, ME 04101

March 2025

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ACRONYMS AND ABBREVIATIONS

BMP	best management practice
DEP	Department of Environmental Protection
Greenfield	Greenfield Penobscot Estuary Remediation Trust LLC
NTU	nephelometric turbidity unit
Remediation Trust	Penobscot Estuary Mercury Remediation Trust
TLC	thin layer cap
WQMP	water quality management plan

1 INTRODUCTION

This Thin Layer Cap (TLC) Pilot Water Quality Monitoring Plan (WQMP) has been prepared by Integral Consulting Inc. (Integral) on behalf of the Greenfield Penobscot Estuary Remediation Trust LLC (Greenfield), Trustee of the Penobscot Estuary Mercury Remediation Trust (the Remediation Trust) for Work on the Penobscot River Estuary located in Hancock, Penobscot, and Waldo counties.

As part of the TLC Pilot, this WQMP details turbidity monitoring that will be performed before and during construction of the TLC to assess the temporary disturbances to the intertidal ecosystem associated with TLC placement. The WQMP also establishes compliance values to be used to determine whether contingency activities associated with this monitoring are necessary. Information collected during the water quality monitoring will document water quality conditions during the TLC construction and is intended to satisfy permit requirements consistent with the Clean Water Act Section 401 Water Quality Certification.

The construction plans and specifications will require the Contractor to implement this WQMP, and they will be required to document the means and methods in a pre-construction work plan submittal to be reviewed and approved by the Remediation Trust.

2 WATER QUALITY MONITORING PROGRAM

The objective of monitoring water quality is to monitor sediment resuspension levels to prevent damage to the local ecosystem and release of contaminants as part of construction best management practices (BMPs; Fondriest Environmental, Inc. 2014a). The TLC Pilot construction will place 4 to 6 in. of clean sand with low fines content on the intertidal flat sediment surface in East Cove 3. The TLC material will be placed from the water, and construction equipment may be operated from a barge platform that could use spuds to anchor the platform in place. No dredging or excavation will be conducted as part of the pilot. Therefore, the water quality monitoring program consists of collection of turbidity data and visual observations of potential effects on water quality during construction. A map of the TLC Pilot area in East Cove 3 and the proposed water quality monitoring locations is presented in Figure 1.

The water quality monitoring program required for in-water remedial activities for a project with similar activities and remediation goals performed in Orrington Reach at Southern Cove (Anchor QEA, LLC and CDM Smith, Inc. 2017) was reviewed to inform applicable parameters and procedures for the water quality monitoring program for this project. Additional TLC Pilot construction monitoring required by the reviewing regulatory agencies, beyond turbidity monitoring, will be identified through agency consultation or during agency permit application review. Monitoring for additional parameters will be performed if required by regulatory authorities to obtain permits for the TLC Pilot construction.

2.1 MONITORING LOCATIONS AND DEPTH

Turbidity will be measured at two fixed positions, with one location approximately 600 ft upstream and one location approximately 600 ft downstream of the work areas (Figure 1). Final monitoring station locations will be established based on the observed site conditions at the time of deployment or collection (e.g., water depth limitations, subaqueous obstructions). Each monitoring station will continuously measure turbidity 3 ft below the current water surface at the station location. The monitoring stations will also include a probe used to measure conductivity, temperature, and depth; these parameters will be used for informational purposes only and will not be used as a compliance metric. Monitoring locations have been selected where bathymetric data indicate a low tide water depth of at least 10 ft, allowing for collection of data across the full tidal cycle. This minimum water depth will also allow for routine maintenance of the probes while minimizing the disturbance or suspension of bottom sediments near the monitoring equipment.

Tide predictions will be reviewed to determine flow direction in the river, with the down-current location identified as the compliance monitoring point. During periods of ebb and slack tides, the downriver location (i.e., in the direction of the Penobscot Bay) will be the compliance point. The compliance point will shift to the upriver location during flood periods.

2.2 BASELINE MONITORING AND COMPLIANCE VALUES

Initial characterization of baseline turbidity conditions in the vicinity of the TLC Pilot will be established by monitoring turbidity prior to the start of in-water work. Baseline turbidity will be established by the collection of continuous turbidity data at each monitoring location for at least 2 weeks prior to construction activities, allowing for the collection of data during both spring and neap tides. Baseline monitoring will continue during storm events (if encountered); however, because of the unpredictable occurrence of storms, the baseline monitoring will not include the collection of turbidity data from storm events as a requirement. The baseline data collection efforts will take place at the same fixed locations identified for water quality monitoring during construction (Figure 1).

The initial baseline turbidity value for comparison during in-water work will be established at the 90th percentile concentration of the baseline data set. Data collected from the up-current construction monitoring station during construction will be added to the data set as it is collected, and the 90th percentile of the data set will be recalculated.

The water quality compliance criterion for turbidity will be established as not-to-exceed 35 nephelometric turbidity units (NTU) above the reference value at the compliance point. The reference value will be defined as the greater of the following:

- The daily upstream measurement
- The updated 90th percentile value, as described above.

Exceedances of the turbidity reference value at the compliance point will trigger contingency response actions as specified in Section 3.

2.3 TURBIDITY MONITORING METHODS

Turbidity monitoring will be accomplished through collection of turbidity measurements supplemented by visual monitoring during construction activities. The preferred method for collecting turbidity measurements will be from moored stations (e.g., buoys or similar deployment of equipment) with automatic monitoring equipment. Manual collection of turbidity measurements may be performed if site conditions or observations during construction activities warrant.

Turbidity monitoring equipment will be calibrated against a standard calibration solution prior to its use following manufacturers' instructions. In addition, standards may be measured to check the calibration throughout the day, especially if higher or lower than expected turbidity values occur. Calibration information will be recorded in the field documentation. Equipment that is faulty or not functioning properly will not be used for monitoring. Monitoring station locations will be documented using a differential global positioning system unless collected at a

previously surveyed stationary reference point. A standard operating procedure for the measurement of surface water field parameters, including turbidity, conductivity, and temperature, is included in Attachment 1.

2.3.1 Turbidity Monitoring Instrumentation

Moored water quality monitoring equipment (i.e., remote water quality buoys) are preferred for water quality compliance monitoring. Turbidity data for permit compliance, and conductivity, temperature, and depth data for informational purposes will be collected using one or more water quality monitoring instruments set 3 ft below the current water surface. To account for the strong currents in the river and tidally influenced changes in current direction, a two-point mooring deployment is expected. In this configuration, the instrument will be suspended between two marker buoys, allowing the anchor lines to be out of the way of the sensors, as shown on Figure 2. This configuration will provide improved stability and protection against entanglement between instruments and anchor lines versus a one-point mooring (Fondriest Environmental, Inc. 2014b).

Remote water quality monitoring buoy components are anticipated to include:

- Water quality monitoring sondes capable of measuring turbidity through extended deployments. If possible, the sondes will support multiparameter collection to include conductivity, temperature, and water depth to prevent the need to deploy multiple probes (e.g., YSI EXO2 or similar).
- Buoy or other platform capable of mounting the water quality monitoring sonde. This buoy will be outfitted with solar power to minimize the likelihood of power failures (e.g., NexSens CB-450 Data Buoy or similar). Platform specifications will be reviewed to ensure the selection of an appropriate platform for the river conditions.
- Remote telemetry system to enable real-time receipt of water quality measurements (e.g., NexSens WQData LIVE Web Datacenter or similar)

An example of a deployed remote water quality monitoring buoy is provided in Figure 2.

Data collection equipment will be deployed and operated in accordance with the manufacturers' specification and quality control procedures. Deployment of this monitoring method will take into consideration field conditions and vessel traffic at the monitoring locations and the ability to anchor the equipment based on river currents and tidal fluctuations.

2.3.2 Manual Turbidity Monitoring Methods

If remote water quality monitoring cannot be performed, or observed conditions warrant collection of turbidity data at other locations, manual turbidity monitoring will be conducted.

Manual turbidity monitoring will use either real-time probes (e.g., YSI 6136 turbidity sensor or similar) or turbidimeters (e.g., Hach 2100Q portable turbidimeter or similar).

When a manual field turbidity measurement is necessary, the depth to bottom will first be measured using a weighted line and recorded. Similar to the remote monitoring, turbidity measurements will be collected from approximately 3 ft below the current water surface. Turbidity will be measured using a calibrated field probe or by collection of an aliquot of water, depending on the selected measurement equipment. The station coordinates, date, time, visual flow observations, tidal stage, turbidity reading, water depth, and other observations will be recorded in the field documentation.

2.3.3 Visual Monitoring

Field personnel will observe construction areas for visual evidence of high turbidity (e.g., increased suspended sediments and turbidity plumes), sheens, and other visible contamination in the water during in-water work. Field personnel will also monitor for distressed, dying, or dead fish. Observations of the above indicators will be documented in daily construction logs and will trigger the relevant portion of the Contingency Plan (Section 3).

2.4 MONITORING FREQUENCY

Monitoring will be performed daily throughout the baseline monitoring and during in-water work. Remote water quality monitoring will be performed 24 hours per day and will report hourly averaged turbidity data. If necessary, manual turbidity sampling will only be performed during work hours. Visual monitoring will be performed as part of work activities at all times when Contractor or construction quality assurance field personnel are in the Project Area.

2.5 DATA REPORTING

Reporting required by regulatory agencies or other permitting authorities will be performed in accordance with permit conditions and consistent with Paragraph 16.b of the Statement of Work. These requirements are expected to include daily, weekly, and final reports. During the TLC Pilot, water quality data and observations documented from any of the described monitoring methods will be reported to Maine Department of Environmental Protection (Maine DEP) and other agencies as required by the approved Natural Resources Protection Act permit and may include the following communications and submittals:

- Daily reports: Reports will include exceedances of the turbidity criteria at the compliance point.
- Weekly reports: Monitoring data will be compiled into a summary table with a comparison to criteria values.

- Final reports: At the completion of construction, results for the full construction period will be compiled and submitted.

The content and frequency of reporting will be finalized prior to the start of the TLC Pilot based on finalized permit requirements.

3 CONTINGENCY PLAN

The following sections describe the responses to exceedances of turbidity compliance criteria and visual observations of indicators of potentially degraded water quality.

3.1 EXCEEDANCE OF TURBIDITY CRITERIA RESPONSE ACTIONS

As discussed in Section 2.2, the water quality compliance criterion for turbidity will be established as not-to-exceed 35 NTU above the reference value at the compliance point. If water quality monitoring indicates turbidity values greater than 20 NTU above the turbidity reference value but not indicating an exceedance of the turbidity criterion, this will trigger an evaluation of the cause and need for modifications to current construction activities (including implementation of BMPs, as described in Section 3.3) to reduce turbidity and avoid an exceedance of the compliance threshold.

If turbidity exceeds 20 NTU above the reference value at the compliance point during construction activities, the following actions may be taken, as appropriate:

- Immediately re-collect measurements at the compliance point. Collect confirmatory manual turbidity measurements as necessary.
- Evaluate the cause of the elevated value (i.e., whether the value is attributed to the construction activity or to other activities occurring within the river, such as wind waves, boat wakes, barge/ship traffic, etc.).
- Verify that the turbidity monitoring equipment is functioning correctly and that exceedances are not the result of other instrument interferences.
- Confirm that BMPs are being implemented for work activities (Section 3.3).

If turbidity exceeds 35 NTU and the exceedance is confirmed, Maine DEP will be informed of the exceedance and enhanced versions of existing BMPs and/or additional actions will be implemented as appropriate. If implementation of BMPs does not resolve the turbidity exceedance, work will be stopped.

3.2 VISUAL MONITORING OBSERVATIONS RESPONSE ACTIONS

If visual monitoring indicates the presence of elevated turbidity outside the immediate work area, the following contingency actions will be taken:

- Evaluate the source(s) of turbidity plume (i.e., construction activity or other activities occurring within the river, such as wind waves, boat wake, etc.).

- Determine if the turbidity plume is of sufficient extent (approximately 300 ft from the work area, one-half of the distance to the compliance point), and duration (i.e., 1 hour or more of visual observations) to trigger a response action.
- If the turbidity plume is attributed to the construction activity and is of sufficient extent and duration:
 - Collect manual turbidity measurements within the visual turbidity plume to determine if there is an exceedance of the trigger or compliance criteria.
 - Implement additional or enhanced versions of existing BMPs, if necessary, based on the results of manual turbidity measurements consistent with the actions outlined in Section 3.1.

3.3 CONSTRUCTION BEST MANAGEMENT PRACTICES

Construction plans and specifications will require the Contractor to construct the TLC Pilot using means and methods to minimize impacts to water quality from work activities, including procurement of cap material that meets the design specifications with a fines content of less than 5 percent to limit turbidity, and the selection of placement techniques appropriate for these materials and for the TLC Pilot location.

The following BMPs will be implemented as necessary to avoid or minimize water quality impacts during TLC construction:

- Minimizing construction impacts to the intertidal flat, including but not limited to modifications to cap material placement speed, techniques, or equipment
- Minimizing vessel traffic and equipment movement
- Using lower draft vessels and barges
- Restricting navigational speeds
- Promptly identifying changing conditions and incorporating alternative techniques (subject to appropriate notification procedures) as conditions warrant
- Identifying incoming severe weather that may impact site conditions and adjusting construction activities as appropriate.

BMPs consisting of physical turbidity barriers (e.g., silt curtains, moonpools) may not be practical. Prior project experience and discussions with remediation contractors familiar with work on rivers similar to the Penobscot River indicate that such BMPs are infeasible to maintain without substantial modification to standard designs due to high current velocities and the presence of debris in the river. Additionally, anchoring barriers such as turbidity curtains would require additional disturbance (potentially including the installation and anchoring of

piles) to subsurface sediments in the intertidal flat. Should persistent exceedance of turbidity reference values occur, the Contractor will be instructed to develop a plan to implement these BMPs.

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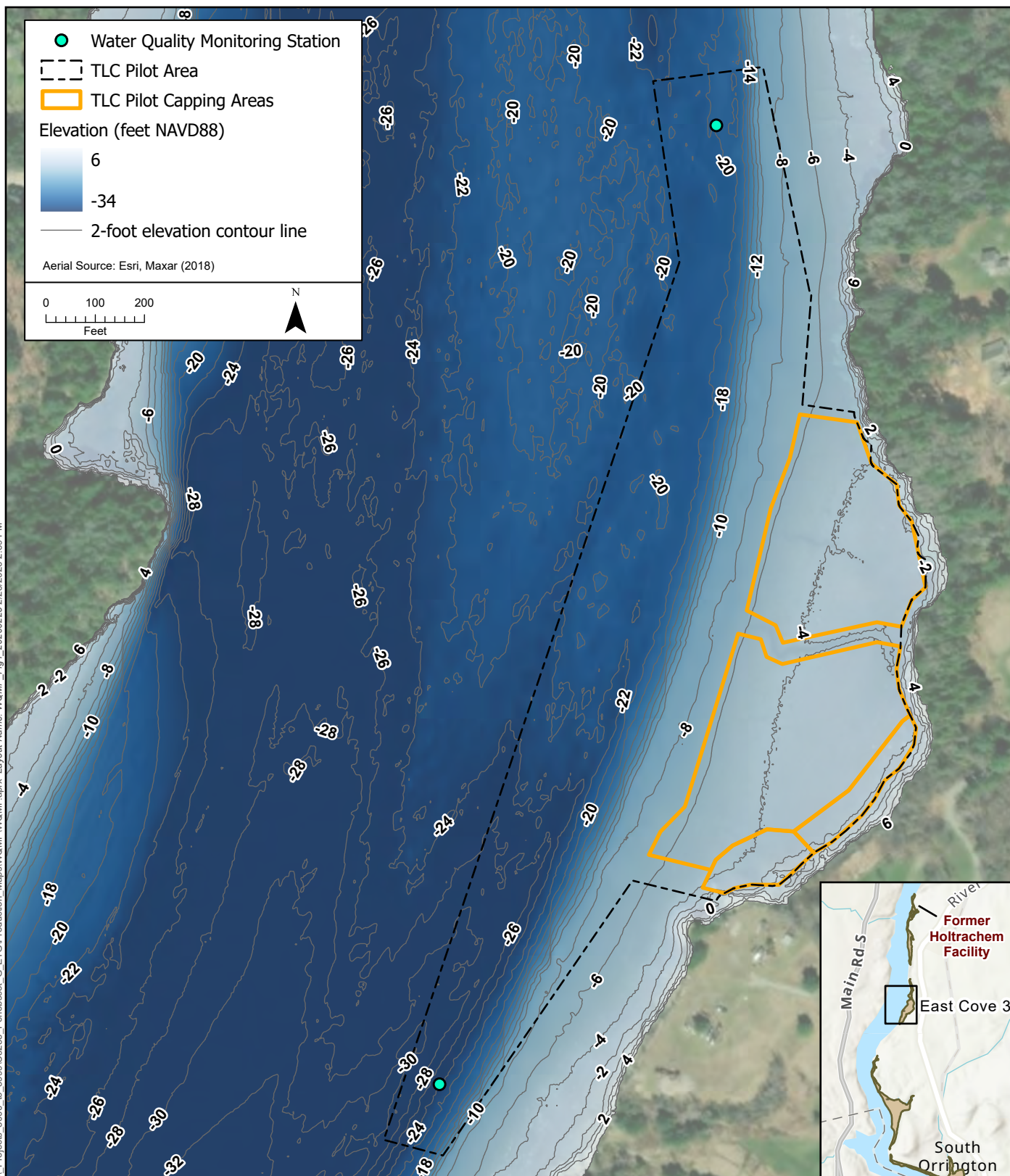
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Figures

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Notes:

Water quality monitoring stations shown are approximately 600 feet from the upstream and downstream extents of the TLC Pilot capping areas. Station locations may be adjusted as necessary based on field conditions at the time of deployment.

Prepared for:



Greenfield Penobscot Estuary Remediation Trust LLC
Trustee of the Penobscot Estuary Mercury Remediation Trust

Prepared by:



Figure 1.

Water Quality Monitoring Locations
TLC Pilot Water Quality Monitoring Plan
Orrington Reach Capping Remedy
February 2026



Notes:

Top center and bottom: Example of a remote water quality monitoring buoy deployed by the U.S. Geological Survey (USGS) New England Water Science Center in Southport Harbor, Connecticut (USGS 2022).

Upper right inset: Schematic profile view of two-point mooring system (Fondriest Environmental, Inc. 2014a).

Prepared for:  Greenfield Penobscot Estuary Remediation Trust LLC
Trustee for Penobscot Estuary Mercury Remediation Trust

Prepared by:  integral

Figure 2.
Example Remote Water Quality Monitoring Buoy
TLC Pilot Water Quality Monitoring Plan
Orrington Reach Capping Remedy

Attachment 1

Standard Operating Procedure
SW-06 Measurement of Surface
Water Field Parameters

STANDARD OPERATING PROCEDURE (SOP) SW-06

MEASUREMENT OF SURFACE WATER FIELD PARAMETERS

This SOP is based on the procedures outlined in *Field Measurements: U.S. Geological Survey Techniques of Water-Resources Investigations* (Wilde various dates).

SCOPE AND APPLICATION

Information and general instructions for field measurement of water quality parameters (pH, Eh [oxidation-reduction potential, ORP], specific conductance, dissolved oxygen, and temperature) are presented below. Because the types and complexity of water quality meters available vary widely, calibration and measurement procedures should be conducted in accordance with manufacturer's recommendations for the specific meters used. The following information describes general procedures for the measurement of water quality parameters. Where possible, sampling should be conducted first in areas expected to be least affected by constituents of interest, followed by increasingly affected areas.

EQUIPMENT AND REAGENTS REQUIRED

- Water quality parameter multimeter or meters specific to parameters of interest (i.e., temperature, dissolved oxygen, pH, transparency, turbidity, salinity, specific conductance, and ORP)
- Calibration solutions and deionized distilled water.

PROCEDURES

Before any calibration takes place, allow the probe and all calibration solutions to acclimate to the ambient field temperature along for at least 1 hour.

Calibrate the meter(s) in the field at the beginning of each day of field or laboratory work when water quality parameters will be measured. If feasible, meters must be checked for drift with calibration standards after every 4 hours of continuous use. Otherwise, a final check must be done at the end of the sampling event. If drift is evident, recalibrate.

1. Calibrate meter(s) in accordance with manufacturer's instructions using fresh (unused) calibration buffers and standards for each sensor.
2. Check slope reading with specifications (in operating manual) to verify slope is within the manufacturer's specified range.
3. Thoroughly rinse a 500-mL beaker or 8-oz jar with sample water. Discard sample water.
4. Rinse electrodes with sample water to acclimate them.
5. Fill beaker with fresh sample water.
6. Immerse electrodes in sample while swirling the sample, if needed, to provide thorough mixing. Turn on meter(s). If a flow-through cell is used, install probes and connect sample water to bottom port of flow-through cell, directing sample water up through the cell, exiting through the top port. Direct effluent tubing back in the water or into an appropriate container for storage and handling.
7. When the readings have stabilized, record the measurements displayed on the meter. It is important to determine that the correct units and unit scale are displayed on the meter and recorded for each parameter measured. Record and correct any problems encountered during measurement.
8. If available, field measurement results should be compared to previous measurements for quality control.

Several physical and chemical water parameters are best measured in the field because of the unstable nature of the parameter or because the information is needed to direct further sampling. It is frequently preferable to perform these analyses in the field, especially if the samples will not be immediately transported to the analytical laboratory (pH, in particular, should be measured in the field, if feasible). In addition, measurements of temperature and transparency can be collected accurately only in the field. Eight parameter measurements for water are described in the following sections of this SOP.

Temperature

Measure water temperature with either an alcohol or digital thermometer. It is recommended that mercury thermometers not be used to avoid possible breakage and introduction of mercury into the environment and to remove a source of possible contamination to samples collected for the analysis of mercury. Measure temperature as soon as the sample is collected to obtain a measurement that is an accurate representation of the *in situ* sample temperature. All instruments used to measure temperature should be traceable to a National Institute of Standards and Technology temperature reference. In the case of digital thermometers, follow the calibration procedure recommended by the manufacturer, if provided. Multiprobes in

general contain a temperature probe; check these probes against a calibrated thermometer before use. For more detailed procedures, see discussion in Wilde (2006).

Dissolved Oxygen

Dissolved oxygen may be measured in the field by either a dissolved oxygen polarographic-membrane type sensor or a luminescent type sensor. Dissolved oxygen can also be measured by a field-portable Winkler titration kit.

It is recommended that calibration be done at temperatures that are at least within 10°C of the ambient water temperature. The smaller the temperature difference is between the environmental water and the calibration chamber, the more accurate the calibration will be.

When using static samples (i.e., water sample collected in a container), protect samples from absorbing oxygen from the atmosphere by using a low or zero-headspace container. If using a meter and probe, calibrate the system according to the manufacturer's procedure prior to use with a zero oxygen standard and a second standard of known oxygen content. Check the second standard by performing a Winkler titration. Other probes are calibrated by percent oxygen saturation in an enclosed container with a small amount of water. When measuring dissolved oxygen with certain polarographic-membrane probe in water samples held inside zero-headspace containers, swirl or stir samples constantly until the reading stabilizes and the measurement is recorded. Stirring the sample is not necessary if a luminescent-sensor is used. For other probes, immerse the probe in the water column and monitor a constant measurement (dynamic measurement) until the readings are stabilized. Once the readings stabilize, record the oxygen concentration readings manually or digitally. For more detailed procedures, see discussion in Lewis (2006).

pH

The pH of a water column sample can be measured in the field using a pH meter. Calibrate the meter according to manufacturer's specifications with at least two standards of known pH. The pH of these standards should bracket the expected pH at the sampling site. For example, if the pH at the sampling site is expected to be basic (pH 7 to 14), standards of pH 7.00 and 10.00 should be used to calibrate the meter. The pH of the buffer solution is temperature dependent. That is, pH 10 buffers change more per unit change in temperature than do pH 4 buffers. The temperature of buffer solutions must be measured, and temperature-correction factors must be applied before calibration adjustments are made. Calibration and operating procedures differ with instrument systems—check the manufacturer's instructions. If pH measurements at the sampling site do not fall within the initial calibration range, the meter should be recalibrated with appropriate standards and sample pH remeasured for those samples that fell outside the calibration range. For more detailed procedures, see discussion in Wilde et al. (2006).

Transparency

Water column transparency is measured with a Secchi disk, which is a weighted, black-and-white or all-white disk that is lowered into the water body on a calibrated rope or line.

Always perform these measurements from the side of the boat that faces away from the sun. Lower the disk slowly until it is no longer visible and then raise it until it is visible again. Record the depth, measured from the water surface, in feet or meters. The all-white disk may be preferable when the water transparency is high. However, either disk is acceptable to use.

Turbidity

Turbidity can be measured in the field on static water samples contained in jars with a field-portable nephelometer (turbidity meter) or *in situ* with a turbidity probe mounted in a multiprobe device. Calibrate the meter prior to use with at least two standards of different but known turbidity (in nephelometric turbidity units, or NTUs). The two standards should bracket the range of turbidity measurements expected at the sampling site.

Perform field analysis for turbidity on static water samples as soon as possible after collection. If immediate analysis is not possible, agitate the sample prior to analysis to resuspend any settled solid material. If the sample temperature increases, air bubbles may form and cause erroneous values.

When performing field analysis for turbidity *in situ*, monitor the turbidity probe constantly with a remote display and record data manually or digitally.

For more detailed procedures, see Anderson (2005).

Conductivity or Salinity

Salinity can be measured in the field with a salinometer, and conductivity with a conductivity meter. There are two types of conductivity sensors as described below.

- **Contacting-type sensors with electrodes**—Electrodes contained in a dip cell can be suspended in the sample. The cell constant is the distance between electrodes (in centimeters) divided by the effective cross-sectional area of the conducting path (in square centimeters). A cell constant is chosen on the basis of the expected conductivity. The greater the cell constant, the greater the conductivity that can be measured.
- **Electrodeless-type sensors**—Conductivity is measured by inducing an alternating current in a closed loop of solution, and measuring the magnitude of the current. Measuring errors in this type of electrode are minimized because sensors do not have issues with electrode polarization or electrode fouling.

Calibrate the conductivity meter prior to use in accordance with the manufacturer's directions using a standard of known conductivity. The conductivity of the standard should be close to the expected value at the sampling site. When measuring a sample for conductivity, swirl or stir the sample until the meter is stabilized and a measurement is recorded. For more detailed procedures, see Radtke et al. (2005).

Salinity can be automatically calculated from conductivity, temperature, and barometric pressure readings in the same multiprobe and displayed on the meter of most models. Salinity may also be calculated from the measured conductivity and temperature of a sample according to Standard Method 2520B (APHA 1998). Gross salinity measurements may also be taken with a field-portable refractometer. This instrument provides salinity measurements with an accuracy of 1 to 2 parts per thousand. For more detailed procedures, see APHA (1998).

ORP or Eh

ORP or Eh may be measured in the field with an inert metal electrode and read relative to a reference electrode that is immersed in the same medium. For most multiprobe units, the inert metal electrode is a button or ring made of platinum and the Ag/AgCl reference electrode is the same one connected to the pH probe. The readout of the sensor is a voltage (relative to the reference electrode), with positive values (e.g., + 300 mV) indicating an oxidizing environment (ability to accept electrons) and negative values (e.g., -300 mV) indicating a reducing environment (ability to donate electrons) (YSI 2005).

ORP and Eh are the same parameters in that both measure the potential of the medium to transfer electrons. However, the ORP reference electrode is made of different material than the Eh standard hydrogen electrode; therefore, a voltage offset needs to be taken into account when converting ORP measurements to Eh values.

More detailed explanation on the theoretical concept, voltage offset conversions, method limitations and interferences can be found in the attached YSI Tech Note (YSI Environmental 2005) and in Nordstrom and Wilde (2005).

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ATTACHMENT 1. MEASURING ORP ON YSI 6-SERIES SONDES: TIPS, CAUTIONS AND LIMITATIONS



Measuring ORP on YSI 6-Series Sondes: Tips, Cautions and Limitations

Introduction and Basic Theory

As described in *Standard Methods for the Examination of Water and Wastewater* (Section 2580 B.), ORP is a potentiometric measurement in which the potential (or tendency) of the medium for electron transfer is sensed by an inert metal electrode and read relative to a reference electrode that is immersed in the same medium. This determination can also be referred to as a “redox” measurement (combination of REDuction and OXidation). For most multiparameter monitoring systems, the inert metal electrode is a button or ring made of platinum and the reference electrode is the same one associated with the pH sensor, usually Ag/AgCl. The readout of the sensor is a voltage (relative to the reference electrode), with positive values (e.g., +300 mV vs. Ag/AgCl) indicating an oxidizing environment (ability to accept electrons) and negative values (e.g. -300 mV) indicating a reducing environment (ability to furnish electrons).

The determination of ORP is particularly worthwhile in water which contains a relatively high concentration of a redox-active species, e.g., the salts of many metals (Fe^{2+} , Fe^{3+}) and strong oxidizing (chlorine) and reducing (sulfite ion) agents. Thus, ORP can sometimes be utilized to track the metallic pollution in ground or surface water or to determine the chlorine content of wastewater effluent. However, ORP is a nonspecific measurement, i.e., the measured potential is reflective of a combination of the effects of all the dissolved species in the medium. Because of this factor, the measurement of ORP in relatively clean environmental water (ground, surface, estuarine, and marine) has only limited utility unless a predominant redox-active species is known to be present. Users should thus be careful not to “over-interpret” ORP data unless specific information about the site is known.

ORP vs. Eh: Calibration of ORP Sensors

Many users of YSI 6-series sondes that make field or laboratory redox measurements have questions about the difference between ORP and Eh. In essence, the two parameters are the same in that both quantify the potential of the medium to transfer electrons -- the difference is the reference electrode (and thus the voltage offset) against which the potential of the platinum sensor is reported. Eh is defined as a voltage reading vs. the Standard Hydrogen Electrode (SHE), while ORP is a much less specific term in which the measurement can be made relative to any

practical or theoretical reference electrode, such as Ag/AgCl, calomel, or SHE. Generally, it is not easy to use the SHE in laboratory or field measurements and thus redox readings are made using either the Ag/AgCl or calomel reference electrodes, with Ag/AgCl being more popular in multiparameter water quality instrumentation. Thus, Eh is usually not determined directly. However, the voltages obtained as ORP readings vs. non-SHE electrodes can easily be converted into Eh values by two mechanisms:

- Adding (or subtracting) an offset voltage to the ORP readings obtained vs. a practical reference electrode to account for the fixed difference between the SHE and the other reference system. The offset voltage can easily be obtained for several practical reference electrodes in Table 2580: II of the section of *Standard Methods* on ORP. For example, the potential of Zobell solution vs. the Ag/AgCl reference electrode using 4 M KCl is +228 mV while the same solution read vs. the SHE is +428 mV. Therefore to convert ORP readings taken under these conditions to Eh, simply add 200 mV to the ORP voltage. For example, ORP readings of +150 and -172 mV translate to Eh values of +350 and +28 mV, respectively.
- Using the instrument software to automatically add the offset voltage to the ORP readings as they are displayed or logged. This method is implemented during calibration of the ORP sensor in YSI 6-series sondes. For example, when calibrating an instrument with Zobell solution that has an ORP reading of 228 versus the YSI reference electrode, enter 428 mV at the calibration prompt instead of 228. After the calibration is confirmed, 200 mV (the difference between Ag/AgCl and SHE reference electrodes) will automatically be added to all displayed and logged ORP values, effectively converting them to Eh with no further correction needed. The software in YSI 6-series sondes is likely to interpret the entry of the higher voltage value as an “out of range” calibration error and provide a warning to this effect. As long as the user is knowledgeable about the procedure, the error can be “overridden” with no ill effects.

Effect of Temperature

The temperature of the water for which ORP is being determined will affect the voltage output of the sensor. This factor definitely needs to be taken into account for calibration and should be considered when reporting field ORP values.

(continued)

For calibration, the following table can be used when using Zobell solution, the YSI-recommended standard. Thus, if the Zobell calibration standard is at 15° C instead of 25° C, enter 241 mV at the calibration prompt instead of 228 mV (the 25° C value which is commonly quoted).

Temperature, C	Zobell Solution Value, mV vs. Ag/AgCl (4 M KCl)
-5	267.0
0	260.5
5	254.0
10	247.5
15	241.0
20	234.5
25	228.0
30	221.5
35	215.0
40	208.5
45	202.0
50	195.5

The user may be able to locate similar temperature-dependence data in the literature for other ORP standards such as Light's Solution and quinhydrone standards in pH buffers.

Temperature will also clearly have an effect on field readings, but, in this case, the variation is usually not definable since the temperature effect depends on the dissolved species responsible for the ORP reading, and these species are usually not known exactly for environmental water. For this reason, ORP readings on YSI 6-series sondes are **not** temperature compensated in any manner. The user must remember that ORP variation in field water could be due to temperature changes rather than analyte compensation. Usually, however, gross changes in ORP (>100 mV) are not due to the effect of temperature.

Confirming ORP Response

Unlike pH, YSI 6-series sondes only allow a single point calibration for ORP, i.e., an offset adjustment as described above. This is almost always adequate if the ORP sensor has been maintained properly. However, some users like to confirm that their ORP system tracks changes in ORP correctly, in the same way that a pH sensor responds to immersion in pH 7 and pH 10 buffers.

To check the "slope" and response characteristics of the ORP sensor, YSI recommends that the user purchase item number B125 (ORP Calibration Kit) from the manufacturer of one of our ORP sensors:

Sensorex

Tel. +1 714 895 4344

Fax. +1 714 894 4839

Email. info@sensorex.com

Web. www.sensorex.com

The kit contains solid quinhydrone which, when added to the supplied buffers, yields two solutions with well-defined, but different, ORP values.

Problems with ORP Sensors

Although based on relatively simple theory, ORP is, unfortunately, also a measurement that can show more problems than other water quality sensors with regard to consistency between different instruments and overall accuracy. In addition, these issues are further complicated in that their extent is likely to depend on both the condition of the sensor and the makeup of the water being tested. The most common problem reported with regard to ORP determination in environmental water is that readings from various instruments (sometimes with exactly the same sensor type and electronics) differ by a significant margin (50-100 mV) even though the sensors are in the same container of water. To make the problem more perplexing, all of the sensors show identical readings in an ORP standard such as Zobell solution. The exact explanation for this paradox is sometimes elusive, but there are at least three possible reasons for its occurrence.

- First, ORP sensors can show a slow response in environmental water if the platinum button of the probe has been contaminated with extraneous material. Common contaminants include hard water deposits, oil/grease, or other organic matter. If the platinum electrodes in the above example are variably contaminated, then some of them (the more contaminated) will be likely to approach potentiometric equilibrium slower. Under this scenario, if left long enough all the sensors would read the same. However, it might take days for the contaminated sensors to reach their final value, and, therefore, they appear in the time frame of a sampling experiment (< 1 hour), to be different. Naturally, if the electrode contaminant is redox-active, either in itself or because it contains redox-active impurities, the reading from that sensor will exhibit erroneous readings that may never change unless the contaminant is removed.

(continued)

- Second, in clean environmental water, there may be very few redox-active species present, and those that are present may be in very low concentration. In many cases, the concentration can be so low that the redox influence of the species is effectively below the detection limit of the method. Under these conditions, the readings will have questionable meaning and could show this type of variation described above. Note that the ORP reading variance associated by this scenario is likely to be exacerbated if any of the electrodes is also contaminated as described above.
- Third, the makeup of the surface composition of the electrode may not be ideal for the measurement in the medium under investigation. While “platinum” ORP electrodes are primarily composed of the metal itself (in a neutral state), it is well known that the surface of the electrode (where the redox action takes place) is coated to varying extents with a molecular layer of platinum oxide (PtO). The Pt/PtO ratio can change over time, depending on the medium in which the probe is stored, and thus the surface of the electrode actually possesses its own potential that can be variable. If this surface potential is similar to the ORP potential of the medium, then electrode response can be sluggish. The cleaning procedure recommended later in this document will result in a surface characterized by a low Pt/PtO ratio and one that possesses a very positive potential. This should be suitable for most environmental measurements.

The fact that similar or identical ORP sensors read differently in environmental water yet the same in Zobell solution is due to the fact that the concentration of redox-active species (ferricyanide/ferrocyanide for Zobell) is much greater in the standards. This higher concentration usually “swamps out” the inconsistencies related to detection limit problems (caused by low amounts of redox-active species) and response time issues (caused by electrode contamination), thus all sensors respond rapidly and read within the YSI specification of ± 20 mV when in standards.

If you observe inconsistency between different sensors or experience ORP readings which seem unusual for the water being tested with your YSI 6-series multiparameter instrument, YSI recommends the following steps to identify and/or correct the problem:

First, make certain that the pH sensor is functioning properly. The reference electrode of the sonde is common to both pH and ORP sensors and, therefore, if both pH and ORP sensors are malfunctioning this is likely to be the source of the problem. Reference electrode problems usually appear as either total failure or as a slow response in both pH and ORP readings. If

a reference electrode problem is suspected, test the ORP sensor in a standard and make certain that it is within 20-30 mV of the predicted value. If reference electrode performance is indicated, clean the sensor according to the instructions shown below and then retest.

Second, if the sensor performs well in the ORP standard, remove the probe from the sonde and carry out the sequential cleaning process documented in the next section.

ORP Electrode Cleaning

The following procedure will result in removal of many common contaminants from the platinum ORP electrode. Fouling of the electrode can, however, be deployment-specific, and some contaminants from polluted water may not be dissolved by this method. The use of other solvents and reagents may be possible, but they must be selected carefully so as not to damage the reference electrode or pH glass of the combination sensors nor to leach or dissolve the CPVC body of the probe itself. Consult YSI Customer Service before using cleaning methods other than those documented below.

YSI recommends that the user perform the cleaning/reconditioning operation in the order indicated. Performance can be rechecked at the conclusion of each major section (A, B, and C) and the cleaning discontinued if, at that point, the performance problem has been corrected.

Procedure A

1. Soak the probe for 10-15 minutes in clean water containing a few drops of commercial dishwashing liquid.
2. Wipe the platinum button or ring by rubbing with a cotton swab soaked in the cleaning solution. CAUTION: For 6565 probes, be certain not to damage the glass bulb of the combination sensor during this process.
3. Rinse the probe in clean water, wipe with a cotton swab saturated with clean water, and then re-rinse with clean water.

Procedure B

1. Soak the probe for 20-30 minutes in one molar (1 M) hydrochloric acid (HCl). This reagent can be purchased from most laboratory supply dealers. Be sure to follow the safety instructions supplied with the reagent.
2. Wipe the platinum button by rubbing with a cotton swab soaked in the acid. CAUTION: For 6565 probes, be certain not to damage the glass bulb of the combination sensor during this process.
3. Rinse the probe in clean water, wipe with a cotton swab saturated with clean water, then rerinse with clean water.

(continued)

Procedure C

1. Soak the probe for approximately 1-2 hours in a 1 to 1 dilution of commercially available chlorine bleach.
2. Rinse the probe with clean water and then soak for at least 1 hour in clean water to remove residual bleach from the reference junction. **CAUTION:** If removal of the chlorine bleach is incomplete, this cleaning reagent can seep into either your calibration standards or measurement media and cause erroneous ORP readings until it is dissipated. Always err on the side of caution in the chlorine bleach removal. Soaking the probe in clean water for periods of time longer than 1 hour can do no harm, however, lesser soaking times can cause problems.
3. Dry the sonde port and probe connector with compressed air and apply a very thin coat of O-ring lubricant to all O-rings before re-installation of the probe. After the probe is reinstalled, place the sensors in Zobell solution and make certain that observed ORP readings stabilize within a few minutes and remain stable for 15-20 minutes.

Typical ORP Data in Standards and Freshwater

Probe #	Zobell Reading		
	Initial	1 hour	After Testing
1	228	228	233
2	227	226	227
3	227	227	228
4	224	224	228
5	227	227	228

Table 1. ORP sensor performance in Zobell Solution.

Experiments have been performed at YSI to demonstrate the typical performance of YSI ORP sensors in both standards and in freshwater. Five (5) new 6565 sensors were taken from stock and placed directly into Zobell solution at 22° C. As shown in Table 1 below, all sensors read within 4 mV of each other. The sensors were left in the Zobell solution for 1 hour and the values recorded again. Finally, the sensors were retested in Zobell solution after the entire regimen of testing described below was completed. The values were basically unchanged, demonstrating the stability of the sensor in redox buffer.

The sensors were then rinsed and soaked in DI water and then transferred to tap water that had been diluted with deionized water to a specific conductance of 290 uS/cm and saturated with air. The ORP readings were recorded 1 minute after transfer and then again after 2.5 hours in the low-to-medium conductivity water. Note that all readings are fairly close at 1

minute, with probe 5 showing a somewhat more positive reading. Note also that the discrepancy between probe 5 and the others increased slightly after longer-term exposure to the water sample. Cleaning the ORP platinum sensor of probe 5 with clean water and a cotton swab resulted in a decrease of the reading to 207

Probe #	ORP Reading	
	1 minute	2.5 hours
1	138	178
2	143	161
3	132	177
4	135	169
5	166	221

Table 2. ORP sensor performance in 290 uS/cm natural water.

mV -- significantly closer to the other sensors. Finally, note that all readings increased by an average of about 40 mV after longer-term exposure to the natural water. This stabilization pattern, along with some variation in probe readings, is likely to occur with all ORP sensors when used in environmental water samples. The difference in behavior between Zobell solution and the water sample is striking and demonstrates that a lower accuracy specification must be tolerated in natural water samples than in buffers. (Note that the YSI accuracy specification of +/- 20 mV refers to readings taken in redox standards.) See Table 2 for the data described in this experiment.

The sensors were then cleaned using the 1 M HCl treatment described above, soaked in DI water to remove all acid traces, and then placed back into the 290 uS/cm natural water sample. ORP readings were taken 5 minutes after placing the probes in the water. The calibration of the sensors was then checked in Zobell solution the probes returned to the natural water sample, and the readings recorded after 5 minutes. Results are shown in Table 3.

Probe #	Water Sample 5 minutes post cleaning	Zobell Solution Calibration check	Water Sample 5 minutes post cal check
1	195	233	186
2	188	227	183
3	214	228	184
4	197	228	184
5	280	228	230

Table 3. ORP sensor performance in 290 uS/cm natural water after cleaning sensors with 1 M HCl.

(continued)

Note the following from the data in Table 3:

- The results in the natural water sample are about the same after the cleaning as before -- probe #5 is still significantly higher than the other 4 that are fairly tightly bunched.
- Even after multiple exposures to standards, the natural water sample, and 1 M HCl, the probes (including probe #5) all read effectively the same in Zobell solution.
- Although the effect is relatively minor, the water sample readings are somewhat dependent on the previous reagent to which the probes were exposed. Note that the results are more consistent and slightly lower overall after the probes had been in Zobell solution (column 3) than after they had been in 1 M HCl (column 1).

Most users would consider the performance of probes 1-4 in natural water acceptable in terms of their consistency with one another, but might wonder why probe 5 always seems to read somewhat more positive than the other sensors except in Zobell solution where it has the same reading. Although difficult to prove, the difference is most likely due to a different Pt/PtO ratio on the surface of probe 5. Consistent with this hypothesis, the final experiments indicate that probe 5 responds to ORP changes and that its ORP reading in natural water becomes closer to those of the other four sensors after longer-term exposure to this medium.

In the final testing, the probes were placed in a sodium sulfite solution, a reducing environment that should produce a decrease in the ORP readings. As shown in Table 4, this effect was indeed observed. The probes were then carefully cleaned and returned to the natural water sample for 18 hours and then the ORP values recorded to conclude the test protocol. These final values are found in Table 4.

Probe #	Sodium Sulfite Solution, after 5 minute exposure	Natural Water, after 18 hour exposure
1	135	196
2	125	174
3	140	207
4	120	195
5	95	218

Table 4. ORP sensor performance in sodium sulfite solution and after long-term exposure to natural water.

YSI would consider Probe 5 as an acceptable sensor for use with our 6-series sondes for the following reasons even though it reads an average of 50 mV different from the other sensors tested:

- The sensor responds quickly and shows the proper reading in Zobell solution;
- The sensor's reading in natural water is not radically different (>100 mV) from the other sensors and becomes closer after extended exposure to this medium;
- The sensor tracks changes in ORP properly.

Summary

The determination of ORP in environmental water can provide valuable insight into the sample as long as there is a significant concentration of a redox-active species present. However, in the absence of these species, ORP can be a significantly less exact measurement than for most other sensors found in YSI 6-series sondes. The inexactness is usually due to contamination of the electrode surface (either physically or chemically), but can also be due to the lack or low concentration of redox active agent in the environmental water.

The quoted accuracy specification for the YSI ORP sensor (+/- 20 mV) refers to redox- standards, such as Zobell solution, and not to environmental water of variable, and usually unknown, content. In many cases, the +/- 20 mV specification will be met in natural water, but it cannot be guaranteed.

Periodic maintenance of your YSI ORP sensor (6032 or 6565) will increase your field consistency and accuracy, but may not overcome all problems.

The value of ORP in determining the content of environmental water is greatly enhanced if the user has some knowledge or history of the site.

For additional information please contact

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Appendix E

NOAA Fisheries Greater Atlantic
Regional Fisheries Office EFH
Assessment & Fish and Wildlife
Coordination Act Consultation
Worksheet

NOAA Fisheries Greater Atlantic Regional Fisheries Office
Essential Fish Habitat (EFH) Assessment & Fish and Wildlife
Coordination Act (FWCA) Consultation Worksheet
August 2021 rev.

Authorities

The Magnuson Stevens Fishery Conservation and Management Act (MSA) requires federal agencies to consult with NOAA Fisheries on any action or proposed action authorized, funded, or undertaken by such agency that may adversely affect essential fish habitat (EFH) identified under the MSA. This process is guided by the requirements of our EFH regulation at 50 CFR 600.905, which mandates the preparation of EFH assessments and generally outlines each agency's obligations in the consultation process.

The Fish and Wildlife Coordination Act (FWCA) requires that all federal agencies consult with NOAA Fisheries when proposed actions might result in modifications to a natural stream or body of water. The FWCA also requires that federal agencies consider the effects that these projects would have on fish and wildlife and must also provide for improvement of these resources. Under the FWCA, we work to protect, conserve and enhance species and habitats for a wide range of aquatic resources such as shellfish, diadromous species, and other commercially and recreationally important species that are not federally managed and do not have designated EFH.

It is important to note that these consultations take place between NOAA Fisheries and federal action agencies. **As a result, EFH assessments, including this worksheet, must be provided to us by the federal agency, not by permit applicants or consultants.**

Use of the Worksheet

This worksheet can serve as an EFH assessment for **Abbreviated EFH Consultations**, and as a means to provide information on potential effects to other NOAA trust resources considered under the FWCA. An abbreviated consultation allows us to determine quickly whether, and to what degree, a federal action may adversely affect EFH. Abbreviated consultation procedures can be used when federal actions do not have the potential to cause substantial adverse effects on EFH and when adverse effects could be alleviated through minor modifications.

The intent of the EFH worksheet is to provide a guide for determining the information needed to fully assess the effects of a proposed action on EFH. In addition, the worksheet may be used as a tool to assist you in developing a more comprehensive EFH assessment for larger projects that may have more substantial adverse effects to EFH. However, for large, complex projects that have the potential for significant adverse effects, an **Expanded EFH Consultation** may be warranted and the use of this worksheet alone is not appropriate as your EFH assessment.

An **adverse effect** is any impact that reduces the quality and/or quantity of EFH. Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components. Adverse effects to EFH may result from actions occurring within EFH or outside of EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions.

Consultation under the MSA is not required if there is no adverse effect on EFH or if no EFH has been designated in the project area. However, because the definition of “adverse effect” is very broad, most in-water work will result in some level of adverse effect requiring consultation with us, even if the impact is temporary or the overall result of the project is habitat restoration or enhancement. It is important to remember that an adverse effect determination is a trigger to consult with us. It does not mean that a project cannot proceed as proposed, or that project modifications are necessary. An adverse effect determination under the EFH provisions of the MSA simply means that the effects of the proposed action on EFH must be evaluated to determine if there are ways to avoid, minimize, or offset adverse effects. Additional details on EFH consultations, tools, and resources, including [frequently asked questions](#) can be found on our [website](#).

Instructions

This worksheet should be used as your EFH assessment for **Abbreviated EFH Consultations** or as a guide to develop your EFH assessment. It is not appropriate to use this worksheet as your EFH assessment for large, complex projects, or those requiring an Expanded EFH Consultation.

When completed fully and with sufficient information to clearly describe the activities proposed, habitats affected, and project impacts, as well as the measures taken to avoid, minimize or offset any unavoidable adverse effects, this worksheet provides us with required components of an EFH assessment including:

1. A description of the proposed action.
2. An analysis of the potential adverse effects on EFH and the federally managed species.
3. The federal agency’s conclusions regarding the effects of the action on EFH.
4. Proposed mitigation, if applicable.

When completing this worksheet and submitting information to us, it is important to ensure that sufficient information is provided to clearly describe the proposed project and the activities proposed. At a minimum, this should include the public notice (if applicable) or project application and project plans showing:

- location map of the project site with area of impact.
- existing and proposed conditions.
- all in-water work and the location of all proposed structures and/or fill.
- all waters of the U.S. on the project site with mean low water (MLW), mean high water (MHW), high tide line (HTL), and water depths clearly marked.
- Habitat Areas of Particular Concern (HAPCs).
- sensitive habitats mapped, including special aquatic sites (submerged aquatic vegetation, saltmarsh, mudflats, riffles and pools, coral reefs, and sanctuaries and refuges), hard bottom or natural rocky habitat areas, and shellfish beds.
- site photographs, if available.

Your analysis of effects **should focus on impacts that reduce the quality and/or quantity of the habitat or result in conversion to a different habitat type** for all life stages of species with designated EFH within the action area. Simply stating that fish will move away or that the project

will only affect a small percentage of the overall population is not a sufficient analysis of the effects of an action on EFH. Also, since the intent of the EFH consultation is to evaluate the direct, indirect, individual and cumulative effects of a particular federal action on EFH and to identify options to avoid, minimize or offset the adverse effects of that action, is it not appropriate to conclude that an impact is minimal just because the area affected is a small percentage of the total area of EFH designated. The focus of the consultation is to reduce impacts resulting from the activities evaluated in the assessment. Similarly, a large area of distribution or range of the fish species is also not appropriate rationale for concluding the impacts of a particular project are minimal.

Use the information on the our [EFH consultation website](#) and [NOAA's EFH Mapper](#) to complete this worksheet. The mapper is a useful tool for viewing the spatial distribution of designated EFH and HAPCs. Because summer flounder HAPC (defined as: “ all native species of macroalgae, seagrasses, and freshwater and tidal macrophytes in any size bed, as well as loose aggregations, within adult and juvenile summer flounder EFH”) does not have region-wide mapping, local sources and on-site surveys may be needed to identify submerged aquatic vegetation beds within the project area. The full designations for each species may be viewed as PDF links provided for each species within the Mapper, or via our website links to the [New England Fishery Management Councils Omnibus Habitat Amendment 2](#) (Omnibus EFH Amendment), the [Mid-Atlantic Fishery Management Councils FMPs](#) (MAMFC - Fish Habitat), or the [Highly Migratory Species](#) website. Additional information on species specific life histories can be found in the EFH source documents accessible through the [Habitat and Ecosystem Services Division website](#). This information can be useful in evaluating the effects of a proposed action. Habitat and Ecosystem Services Division (HESD) staff have also developed a technical memorandum *Impacts to Marine Fisheries Habitat from Non-fishing Activities in the Northeastern United States*, [NOAA Technical Memorandum NMFS-NE-209](#) to assist in evaluating the effects of non-fishing activities on EFH. If you have questions, please contact the [HESD staff member](#) in your area to assist you.

Federal agencies or their non-federal designated lead agency should email the completed worksheet and necessary attachments to the HESD New England (ME, NH, MA, CT, RI) or Mid- Atlantic (NY, NJ, PA, DE, MD, VA) Branch Chief and the regional biologist listed on the [Contact Regional Office Staff section](#) on our [EFH consultation website](#) and listed below.

We will provide our EFH conservation recommendations under the MSA, and recommendations under the FWCA, as appropriate, within 30 days of receipt of a **complete** EFH assessment for an abbreviated consultation. Please ensure that the EFH worksheet is completed in full and includes detail to minimize delays in completing the consultation. If we are unable to assess potential impacts based on the information provided, we may request additional information necessary to assess the effects of the proposed action on our trust resources before we can begin a consultation. If the worksheet is not completely filled out, it may be returned to you for completion. **The EFH consultation and our response clock does not begin until we have sufficient information upon which to consult.**

If this worksheet is not used, you should include all the information required to complete this worksheet in your EFH assessment. The level of detail that you provide should be commensurate with the magnitude of impacts associated with the proposed project. You may need to prepare a more detailed EFH assessment for more substantial or complex projects to fully characterize the effects of the project and the avoidance and minimization of impacts to EFH. The format of the EFH worksheet may not be sufficient to incorporate the extent of detail required for large-scale projects, and a separate EFH assessment may be required.

Regardless of the format, you should include an analysis as outlined in this worksheet for an expanded EFH assessment, along with any additional necessary information including:

- the results of on-site inspections to evaluate habitat and site-specific effects.
- the views of recognized experts on habitat or the species that may be affected.
- a review of pertinent literature and related information.
- an analysis of alternatives that could avoid or minimize adverse effects on EFH.

For these larger scale projects, interagency coordination meetings should be scheduled to discuss the contents of the EFH consultation and the site-specific information that may be needed in order to initiate the consultation.

Please contact our Greater Atlantic Regional Fisheries Office, [Protected Resources Division](#) regarding potential impacts to marine mammals or threatened and endangered species and the appropriate consultation procedures.

HESD Contacts*

New England - ME, NH, MA, RI, CT

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Kaitlyn Shaw - ME, NH, MA

Sabrina Pereira -RI, CT

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Mid-Atlantic - NY, NJ, PA, MD, VA

Karen Greene, Branch Chief

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Keith Hanson - NJ (Ocean Co. and south), DE and PA, Mid-Atlantic wind

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***Please check for the most current staffing list on our [contact us page](#) prior to submitting your assessment.**

EFH Assessment Worksheet rev. August 2021
Please read and follow all of the directions provided when filling out this form.

1. General Project Information

Date Submitted: 03/11/2026

Project/Application Number:

Project Name: Orrington Reach Capping Remedy, Thin Layer Cap Pilot Project

Project Sponsor/Applicant: Greenfield Penobscot Estuary Remediation Trust LLC

Federal Action Agency (or state agency if the federal agency has provided written notice delegating the authority¹): U.S Army Corps of Engineers

Fast-41:

Yes ☐

No ☒

Action Agency Contact Name: Ms. Ruthann A. Brien

Contact Phone: 978-806-7145

Contact Email: Ruthann.A.Brien@usace.army.mil

Address, City/Town, State:

USACE, Maine Project Office, 442 Civic Center Drive, Suite 350, Augusta ME 04330

2. Project Description

²Latitude: 44°43'12.88"N

Longitude: 68°49'45.76"W

Body of Water (e.g., HUC 6 name): 010200; 010500

Project Purpose:

The purpose of the TLC Pilot is to determine the effectiveness and protectiveness of the TLC on a small scale and provide information to confirm that disturbances to the intertidal ecosystem are temporary. Information developed during the TLC Pilot will inform future design and permitting efforts of the larger capping project required by the Consent Decree. The TLC Pilot will provide site-specific data to address key data gaps and uncertainties related to remediation techniques, site-specific conditions that may affect remediation methods, and post-construction recovery of the intertidal flat ecosystem

Project Description:

The TLC Pilot would consist of placement of a nominal 4- or 6-in.-thick layer of predominantly coarse sand material over approximately 6.3 acres of intertidal flats and low marsh in East Cove 3 (TLC Pilot Area). The TLC Pilot cap material will be placed from the water side of the intertidal flats. Potential technologies and methods under consideration for the placement of the TLC material using hydraulic casting. A complete description is included within the Biological Assessment

Anticipated Duration of In-Water Work including planned Start/End Dates and any seasonal restrictions proposed to be included in the schedule:

July 15 to September 30

¹ A federal agency may designate a non-Federal representative to conduct an EFH consultation by giving written notice of such designation to NMFS. If a non-federal representative is used, the Federal action agency remains ultimately responsible for compliance with sections 305(b)(2) and 305(b)(4)(B) of the Magnuson-Stevens Act. ² Provide the decimal, or the degrees, minutes, seconds values for latitude and longitude using the World Geodetic System 1984 (WGS84) and negative degree values where applicable.

3. Site Description

EFH includes the biological, chemical, and physical components of the habitat. This includes the substrate and associated biological resources (e.g., benthic organisms, submerged aquatic vegetation, shellfish beds, salt marsh wetlands), the water column, and prey species.

Is the project in designated EFH³?

☒ Yes ☐ No

Is the project in designated HAPC?

☒ Yes ☐ No

Does the project contain any Special Aquatic Sites⁴?

☒ Yes ☐ No

Is this coordination under FWCA only?

☐ Yes ☒ No

Total area of impact to EFH (indicate sq ft or acres): approximately 6.3 acres

Total area of impact to HAPC (indicate sq ft or acres): approximately 6.3 acres

Current range of water depths at MLW

0-15 ft

Salinity range (PPT):

0-25

Water temperature range (°F):

40-60

³Use the tables in Sections 5 and 6 to list species within designated EFH or the type of designated HAPC present. See the worksheet instructions to find out where EFH and HAPC designations can be found. ⁴ Special aquatic sites (SAS) are geographic areas, large or small, possessing special ecological characteristics of productivity, habitat, wildlife protection, or other important easily disrupted ecological values. These areas are generally recognized as significantly influencing or positively contributing to the general overall environmental health or vitality of the entire ecosystem of a region. They include sanctuaries and refuges, wetlands, mudflats, vegetated shallows, coral reefs, and riffle and pool complexes (40 CFR Subpart E). If the project area contains SAS (i.e. sanctuaries and refuges, wetlands, mudflats, vegetated shallows/SAV, coral reefs, and/or riffle and pool complexes, describe the SAS, species or habitat present, and area of impact.

4. Habitat Types

In the table below, select the location and type(s) for each habitat your project overlaps. For each habitat type selected, indicate the total area of expected impacts, then what portion of the total is expected to be temporary (less than 12 months) and what portion is expected to be permanent (habitat conversion), and if the portion of temporary impacts will be actively restored to pre- construction conditions by the project proponent or not. A project may overlap with multiple habitat types.

Habitat Location	Habitat Type	Total impacts (lf/ft ² /ft ³)	Temporary impacts (lf/ft ² /ft ³)	Permanent impacts (lf/ft ² /ft ³)	Restored to pre-existing conditions?*
Estuarine	Mudflat*	5.9	5.9	0	Yes
Estuarine	Wetland (emergent)*	0.4	0.4	0	Yes
Select one	Select One				Select one
Select one	Select One				Select one
Select one	Select One				Select one
Select one	Select One				Select one
Select one	Select One				Select one
Select one	Select One				Select one

*Restored to pre-existing conditions means that as part of the project, the temporary impacts will be actively restored, such as restoring the project elevations to pre-existing conditions and replanting. It does not include natural restoration or compensatory mitigation.

Submerged Aquatic Vegetation (SAV) Present?:Yes: ☒No: ☐

If the project area contains SAV, or has historically contained SAV, list SAV species and provide survey results including plans showing its location, years present and densities if available. Refer to Section 12 below to determine if local SAV mapping resources are available for your project area.

See Section 7.4 of the Biological and Essential Fish Habitat Assessment

Sediment Characteristics:

The level of detail required is dependent on your project – e.g., a grain size analysis may be necessary for dredging. In addition, if the project area contains rocky/hard bottom habitat ⁶(pebble, cobble, boulder, bedrock outcrop/ledge) identified as Rocky (coral/rock), Substrate (cobble/gravel), or Substrate (rock) above, describe the composition of the habitat using the following table.

Substrate Type* (grain size)	Present at Site? (Y/N)	Approximate Percentage of Total Substrate on Site
Silt/Mud (<0.063mm)	Yes ☐	88%
Sand (0.063-2mm)	Yes ☐	12%
Rocky: Pebble/Gravel /Cobble(2-256mm)**	Select one	
Rocky: Boulder (256-4096mm)**	Select one	
Rocky: Coral	Select one	
Bedrock**	Select one	

⁶The type(s) of rocky habitat will help you determine if the area is cod HAPC.

* Grain sizes are based on Wentworth grain size classification scale for granules, pebbles, cobbles, and boulders.

** Sediment samples with a content of 10% or more of pebble-gravel-cobble and/or boulder in the top layer (6-12 inches) should be delineated and material with epifauna/macroalgae should be differentiated from bare pebble-gravel-cobble and boulder.

If no grain size analysis has been conducted, please provide a general description of the composition of the sediment. If available please attach images of the substrate.

See Section 2.3.4 of the Biological and Essential Fish Habitat Assessment

Diadromous Fish (migratory or spawning habitat- identify species under Section 10 below):Yes: ☒No: ☐

5. EFH and HAPC Designations

Within the Greater Atlantic Region, EFH has been designated by the New England, Mid-Atlantic, and South Atlantic Fisheries Management Councils and NOAA Fisheries. Use the [EFH mapper](#) to determine if EFH may be present in the project area and enter all species and life stages that have designated EFH. Optionally, you may review the EFH text descriptions linked to each species in the EFH mapper and use them to determine if the described habitat is present at your project site. If the habitat characteristics described in the text descriptions do not exist at your site, you may be able to exclude some species or life stages from additional consideration. For example, the water depths at your site are shallower than those described in the text description for a particular species or life stage. We recommend this for larger projects to help you determine what your impacts are.

See Table 5 within the Biological and Essential Fish Habitat Assessment

Species Present	EFH is designated/mapped for: See full table: Section 6.5 Biological Assessment				What is the source of the EFH information included?
	EFH: eggs	EFH: larvae	EFH: juvenile	EFH: adults/spawning adults	
Select One ▼	☐	☐	☐	☐	Select One
Select One ▼	☐	☐	☐	☐	Select One
Select One ▼	☐	☐	☐	☐	Select One ▼
Select One ▼	☐	☐	☐	☐	Select One
Select One ▼	☐	☐	☐	☐	Select One
Select One ▼	☐	☐	☐	☐	Select One
Select One ▼	☐	☐	☐	☐	Select One
Select One ▼	☐	☐	☐	☐	Select One
Select One ▼	☐	☐	☐	☐	Select One
Select One ▼	☐	☐	☐	☐	Select One
Select One ▼	☐	☐	☐	☐	Select One
Select One ▼	☐	☐	☐	☐	Select One

6. Habitat Areas of Particular Concern (HAPCs)

HAPCs are subsets of EFH that are important for long-term productivity of federally managed species. HAPCs merit special consideration based their ecological function (current or historic), sensitivity to human-induced degradation, stresses from development, and/or rarity of the habitat. While many HAPC designations have geographic boundaries, there are also habitat specific HAPC designations for certain species, see note below. Use the [EFH mapper](#) to identify HAPCs within your project area. Select all that apply.

☐	Summer flounder: SAV ⁷	☐	Alvin & Atlantis Canyons
☐	Sandbar shark	☐	Baltimore Canyon
☐	Sand Tiger Shark (Delaware Bay)	☐	Bear Seamount
☐	Sand Tiger Shark (Plymouth-Duxbury-Kingston Bay)	☐	Heezen Canyon
☐	Inshore 20m Juvenile Cod ⁸	☐	Hudson Canyon
☐	Great South Channel Juvenile Cod	☐	Hydrographer Canyon
☐	Northern Edge Juvenile Cod	☐	Jeffreys & Stellwagen
☐	Lydonia Canyon	☐	Lydonia, Gilbert & Oceanographer Canyons
☐	Norfolk Canyon (Mid-Atlantic)	☐	Norfolk Canyon (New England)
☐	Oceanographer Canyon	☐	Retriever Seamount
☐	Veatch Canyon (Mid-Atlantic)	☐	Toms, Middle Toms & Hendrickson Canyons
☐	Veatch Canyon (New England)	☐	Washington Canyon
☐	Cashes Ledge	☐	Wilmington Canyon
☒	Atlantic Salmon		

⁷ Summer flounder HAPC is defined as all native species of macroalgae, seagrasses, and freshwater and tidal macrophytes in any size bed, as well as loose aggregations, within adult and juvenile summer flounder EFH. In locations where native species have been eliminated from an area, then exotic species are included. Use local information to determine the locations of HAPC.

⁸ The purpose of this HAPC is to recognize the importance of inshore areas to juvenile Atlantic cod. The coastal areas of the Gulf of Maine and Southern New England contain structurally complex rocky-bottom habitat that supports a wide variety of emergent epifauna and benthic invertebrates. Although this habitat type is not rare in the coastal Gulf of Maine, it provides two key ecological functions for juvenile cod: protection from predation, and readily available prey. See [EFH mapper](#) for links to text descriptions for HAPCs.

7. Activity Details

Select all that apply	Project Type/Category	
☐	Agriculture	
☐	Aquaculture - <u>List species here:</u>	
☐	Bank/shoreline stabilization (e.g., living shoreline, groin, breakwater, bulkhead)	
☐	Beach renourishment	
☐	Dredging/excavation	
☐	Energy development/use e.g., hydropower, oil and gas, pipeline, transmission line, tidal or wave power, wind	
☒	FillCapping contaminated soils	
☐	Forestry	
☐	Infrastructure/transportation (e.g., culvert construction, bridge repair, highway, port, railroad)	
☐	Intake/outfall	
☐	Military (e.g., acoustic testing, training exercises)	
☐	Mining (e.g., sand, gravel)	
☐	Overboard dredged material placement	
☐	Piers, ramps, floats, and other structures	
☐	Restoration or fish/wildlife enhancement (e.g., fish passage, wetlands, mitigation bank/ILF creation)	
☐	Survey (e.g., geotechnical, geophysical, habitat, fisheries)	
☐	Water quality (e.g., storm water drainage, NPDES, TMDL, wastewater, sediment remediation)	
☐	Other:	

8. Effects Evaluation

Select all that apply	Potential Stressors Caused by the Activity
☐	Underwater noise
☒	Water quality/turbidity/contaminant release
☒	Vessel traffic/barge grounding
☐	Impingement/entrainment
☐	Prevent fish passage/spawning
☒	Benthic community disturbance
☐	Impacts to prey species

Select all that apply and if temporary ⁹ or permanent		Habitat alterations caused by the activity
Temp	Perm	
☐	☐	Water depth change
☐	☐	Tidal flow change
☐	☒	Fill
☐	☐	Habitat type conversion
☐	☐	Other:
☐	☐	Other:

⁹ Temporary in this instance means during construction. ¹⁰ Entrainment is the voluntary or involuntary movement of aquatic organisms from a water body into a surface diversion or through, under, or around screens and results in the loss of the organisms from the population. Impingement is the involuntary contact and entrapment of aquatic organisms on the surface of intake screens caused when the approach velocity exceeds the swimming capability of the organism.

Details - project impacts and mitigation

Briefly describe how the project would impact each of the habitat types selected above and the amount (i.e., acreage or sf) of each habitat impacted. Include temporary and permanent impact descriptions and direct and indirect impacts. For example, dredging has a direct impact on bottom sediments and associated benthic communities. The turbidity generated can result in a temporary impact to water quality which may have an indirect effect on some species and habitats such as winter flounder eggs, SAV or rocky habitats. The level of detail that you provide should be commensurate with the magnitude of impacts associated with the proposed project. Attach supplemental information if necessary.

See effects determination in Section 8 of the Biological and Essential Fish Habitat Assessment

What specific measures will be used to avoid and minimize impacts, including project design, turbidity controls, acoustic controls, and time of year restrictions? If impacts cannot be avoided or minimized, why not?

See Biological and Essential Fish Habitat Assessment, Section 6.

Is compensatory mitigation proposed? Yes ☐ No ☒

If compensatory mitigation is not proposed, why not? If yes, describe plans for compensatory mitigation (e.g. permittee responsible, mitigation bank, in-lieu fee) and how this will offset impacts to EFH and other aquatic resources. Include a proposed compensatory mitigation and monitoring plan as applicable.

See Biological and Essential Fish Habitat Assessment. Effects of the action would not be substantial and are temporary.

9. Effects of Climate Change

Effects of climate change should be included in the EFH assessment if the effects of climate change may amplify or exacerbate the adverse effects of the proposed action on EFH. Use the [Intergovernmental Panel on Climate Change \(IPCC\) Representative Concentration Pathways \(RCP\) 8.5/high greenhouse gas emission scenario \(IPCC 2014\)](#), at a minimum, to evaluate the future effects of climate change on the proposed projections. For sea level rise effects, use the intermediate-high and extreme scenario projections as defined in [Sweet et al. \(2017\)](#). For more information on climate change effects to species and habitats relative to NMFS trust resources, see [Guidance for Integrating Climate Change Information in Greater Atlantic Region Habitat Conservation Division Consultation Processes](#).

1. Could species or habitats be adversely affected by the proposed action due to projected changes in the climate? If yes, please describe how:

No

2. Is the expected lifespan of the action greater than 10 years? If yes, please describe project lifespan:

No

3. Is climate change currently affecting vulnerable species or habitats, and would the effects of a proposed action be amplified by climate change? If yes, please describe how:

No

4. Do the results of the assessment indicate the effects of the action on habitats and species will be amplified by climate change? If yes, please describe how:

No

5. Can adaptive management strategies (AMS) be integrated into the action to avoid or minimize adverse effects of the proposed action as a result of climate? If yes, please describe how:

No.

10. Federal Agency Determination

Federal Action Agency's EFH determination (select one)	
☐	There is no adverse effect ⁷ on EFH or EFH is not designated at the project site. EFH Consultation is not required. This is a FWCA only request.
☒	The adverse effect ⁷ on EFH is not substantial. This means that the adverse effects are no more than minimal, temporary, or can be alleviated with minor project modifications or conservation recommendations. This is a request for an abbreviated EFH consultation.
☐	The adverse effect ⁷ on EFH is substantial. This is a request for an expanded EFH consultation. We will provide more detailed information, including an alternatives analysis and NEPA documents, if applicable.

⁷ An adverse effect is any impact that reduces the quality and/or quantity of EFH. Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components. Adverse effects to EFH may result from actions occurring within EFH or outside of EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions.

11. Fish and Wildlife Coordination Act

Under the FWCA, federal agencies are required to consult with us if actions that the authorize, fund, or undertake will result in modifications to a natural stream or body of water. Federal agencies are required to consider the effects these modifications may have on fish and wildlife resources, as well as provide for the improvement of those resources. Under this authority, we consider the effects of actions on NOAA-trust resources, such as anadromous fish, shellfish, crustaceans, or their habitats, that are not managed under a federal fisheries management plan. Some examples of other NOAA-trust resources are listed below. Some of these species, including diadromous fishes, serve as prey for a number of federally-managed species and are therefore considered a component of EFH pursuant to the MSA. We will be considering the effects of your project on these species and their habitats as part of the EFH/FWCA consultation process and may make recommendations to avoid, minimize or offset and adverse effects concurrently with our EFH conservation recommendations.

Please contact our Greater Atlantic Regional Fisheries Office, [Protected Resources Division](#) regarding potential impacts to marine mammals or species listed under the Endangered Species Act and the appropriate consultation procedures.

Fish and Wildlife Coordination Act Resources

Species known to occur at site (list others that may apply)	Describe habitat impact type (i.e., physical, chemical, or biological disruption of spawning and/or egg development habitat, juvenile nursery and/or adult feeding or migration habitat). Please note, impacts to federally listed species of fish, sea turtles, and marine mammals must be coordinated with the GARFO Protected Resources Division.
alewife	Anadromous; potentially present in transition from Bay to spawning areas upstream of the Action Area.
American eel	This species inhabits shallow intertidal zones and may occur within the Action Area.
American shad	Anadromous; potentially present in transition from Bay to spawning areas upstream of the Action Area.
Atlantic menhaden	Anadromous; potentially present in transition from Bay to spawning areas upstream of the Action Area.
blue crab	Action area is north of blue crab typical distribution.
blue mussel	Limited potential presences, Action Area is predominantly mudflat this species requires rocky substrate or structures.
blueback herring	Anadromous; potentially present in transition from Bay to spawning areas upstream of the Action Area.
Eastern oyster	Not expected within the Action Area.
horseshoe crab	Not expected within the Action Area.
quahog	Not expected within the Action Area.
soft-shell clams	Not expected within the Action Area.
striped bass	Potentially present within the Action Area.
other species:	Rainbow smelt potentially present in transition from Bay to spawning areas upstream of the Action Area.
other species:	
other species:	

12. Useful Links

[National Wetland Inventory Maps](#)

[EPA's National Estuary Program \(NEP\)](#)

[Northeast Regional Ocean Council \(NROC\) Data Portal](#)

[Mid-Atlantic Regional Council on the Ocean \(MARCO\) Data Portal](#)

Resources by State

Maine

[Maine Office of GIS Data Catalog](#)

[Town shellfish information including shellfish conservation area maps](#)

[State of Maine Shellfish Sanitation and Management](#)

[Eelgrass maps](#)

[Casco Bay Estuary Partnership](#)

[Maine GIS Stream Habitat Viewer](#)

New Hampshire

[NH Statewide GIS Clearinghouse, NH GRANIT](#)

[NH Coastal Viewer](#)

[State of NH Shellfish Program](#)

Massachusetts

[MA DMF Shellfish Sanitation and Management Program](#)

[MassGIS Data \(Including Eelgrass Maps\)](#)

[MA DMF Recommended TOY Restrictions Document](#) [Massachusetts](#)

[Bays National Estuary Program](#)

[Buzzards Bay National Estuary Program](#)

[Massachusetts Division of Marine Fisheries](#)

[Massachusetts Office of Coastal Zone Management](#)

Rhode Island

[RI Shellfish and Aquaculture](#)

[RI Shellfish Management Plan](#)

[RI Eelgrass Maps](#)

[Narragansett Bay Estuary Program](#)

[Rhode Island Division of Marine Fisheries](#)

[Rhode Island Coastal Resources Management Council](#)

Connecticut

[CT Bureau of Aquaculture](#)

[Natural Shellfish Beds in CT](#)

[Eelgrass Maps](#)

[Long Island Sound Study](#)

[CT GIS Resources](#)

[CT DEEP Office of Long Island Sound Programs and Fisheries](#)

[CT River Watershed Council](#)

New York

[Eelgrass Report](#)

[Peconic Estuary Program](#)

[NY/NJ Harbor Estuary Program](#)

[New York GIS Clearinghouse](#)

New Jersey

[Submerged Aquatic Vegetation Mapping](#)

[Barnegat Bay Partnership](#)

[NJ GeoWeb](#)

[NJ DEP Shellfish Maps](#)

Pennsylvania

[Delaware River Management Plan](#)

[PA DEP Coastal Resources Management Program](#)

[PA DEP GIS Mapping Tools](#)

Delaware

[Partnership for the Delaware Estuary](#)

[Center for Delaware Inland Bays](#)

[Delaware FirstMap](#)

Maryland

[Submerged Aquatic Vegetation Mapping](#)

[MERLIN \(Maryland's Environmental Resources and Land Information Network\)](#)

[Maryland Coastal Atlas](#)

[Maryland Coastal Bays Program](#)

Virginia

[VMRC Habitat Management Division](#)

[Submerged Aquatic Vegetation mapping](#)

Appendix F

Examples of Previous TLC Projects

Table 1. Summary of Thin Layer Cover/Placement Case Studies

		Site	Cap			
Name	Location	Overview	Thickness	Material	Benthic Recovery Evaluation	Link
Lower Duwamish	Seattle, WA	As part of an early action, a TLC consisting of 6 in. of sand was placed for ENR in 4-acre area impacted by PCB dredge residuals.	6 in. min (9 in. average)	Sand Sand and Gravel	Bioturbation depths ranged from 1.8 cm to more than 15 cm.	EPA Website
		Work was completed 2003 to 2004.			SPI and macroinvertebrate surveys showed successful Stage 3 recolonization within 1 year after placement.	Duwamish/Diagonal Sediment Remediation Project 4-Acre Residuals Interim Action Closure Report
		Monitoring showed the TLC is stable and that ENR has sped up achieving cleanup goals by 10-20 years.			Silt was typically seen to have accumulated on the ENR surface over time.	Comparison of Monitored Natural Recovery (MNR) and Enhanced Natural Recovery (ENR) Effectiveness
		Later 2014 pilot study further evaluated ENR through TLC of sand/gravel and sand/gravel + activated carbon in 1-acre plots. Study found both approaches were effective at reducing PCB biouptake, and that activated carbon amendment did not provide added benefit.				Activated Carbon-Amended Enhanced Natural Recovery (ENR): Biological Lines of Evidence from a Pilot Study in the Lower Duwamish Waterway. Magar et al. 2023. (Link is not available. File available on request)
		Selected remedy for the waterway includes TLC of 48 acres for ENR by placing 6 to 9 in. of clean material over contaminated sediments.				Summary of Study for Lower Duwamish Waterway: Enhanced Natural Recovery and Activated Carbon
Peninsula Harbour	Marathon, Ontario, Canada	TLC designed to reduce risk from and spread of contaminated sediment, and to expedite natural recovery and facilitate ecosystem recovery in a 57 acre area (predominantly subtidal).	Med Sand 15-20 cm (average 15) Coarse Sand 12.5-37.5 cm (20 cm average)	Coarse sand used in higher energy areas	Ecological monitoring found: - Species composition is similar to that outside of the AOC, and is dominated by native species. - Habitat concerns were addressed by the TLC. - Benthic communities are re-emerging post-TLC showing increasing benthics species diversity.	PENINSULA HARBOUR AREA OF CONCERN REMEDIAL ACTION PLAN
		Long-term monitoring has shown that the TLC is stable, has been effective at lowering exposure to Hg, and has supported ENR.			Sedimentation observed on the TLC, supporting ENR.	Peninsula Harbour Area of Concern Thin Layer Cap Long Term Monitoring
						Long-Term Monitoring of a Thin-Layer Sand Cap in Peninsula Harbour Area of Concern
						The Use of Thin-Layer Cap to Manage Hg and PCB Contaminated Sediments in Jellicoe Cove, Peninsula Harbour, Ontario, Canada
Silver Lake	Pittsfield, MA	TLC placed to address PCBs and other sediment contaminants across the majority of the 26-acre lake. Armoring placed along the shoreline.	14 in.	Sand and topsoil mix to achieve TOC = 0.5%	Benthic community not evaluated; however, the project included extensive restoration including construction of a shallow-water shoreline shelf to serve as a habitat layer.	EPA Website
		Monitoring indicates that the cap is effectively preventing PCB migration from the underlying sediments to the surface water of the lake.				Thin-Layer placement project sheet Silver Lake
						Final Completion Report for Silver Lake Area Removal Action
						Pilot Study Work Plan for Silver Lake Sediments

Table 1. Summary of Thin Layer Cover/Placement Case Studies

Site		Cap		Benthic Recovery Evaluation	Link
Name	Location	Overview	Thickness	Material	
Quantico Embayment Site	Potomac River, VA	TLC placement over a 10.9 acre area of DDT-impacted sediment. TLC demonstrated to be stable and resulted in significant reductions in DDT concentrations in sediment, porewater, and biota.	15 cm	Sand	No adverse effects were observed on the benthic community. Improved benthic community health observed in a short time (2 months). Fetters, K. et al. 2020. Demonstration and validation of enhanced monitored natural recovery at a pesticide-contaminated sediment site. <i>J. Soils Sediments</i> 20:204-219. (https://doi.org/10.1007/s11368-019-02386-4)
Astoria Marine Construction	Astoria, OR	Placement of a sand layer above residual sediment contamination and EMNR areas. Declared an orphan site in 2019. Does not appear that the remediation has been completed to date.	6 to 12 in.	Sand	NA Astoria Marine Construction Company - Oregon DEQ Website
Wyckoff CO./Eagle Harbor Superfund Site	Kitsap County, WA	TLC placement in select subtidal areas of Hg-impacted sediment to support EMNR, including: - Construction of 39-in. TLC over sediment with Hg between 2.1. and 5.0 mg/kg - Construction of a 6-in. cap over sediment with Hg between 0.59 and 2.1 mg/kg. Five year review found that the TLC was functioning as intended.	6 in., 39 in.	Sand	Not Reported FIFTH FIVE-YEAR REVIEW REPORT FOR WYCKOFF CO./EAGLE HARBOR SUPERFUND SITE EPA Website
Douglas Harbor	Juneau, AK	Placement of a sand cap over Hg-impacted sediment that had been dredged and disposed of in the harbor. Monitoring shows the cap has been stable, but that methylmercury concentrations exceed targets due to a regional source impacting concentrations at the surface of the cap.	Variable	Sand	Infaunal recolonization and benthic community structure and activity have returned to baseline levels 1 year following cap placement. Mapping Dredged Material and a Sand Cap at Douglas Harbor, Juneau, AK, using Sediment-Profile Imaging (SPI) and a Semi-automated Image Processing System (File available on request) 2017 MIKE PUSICH DOUGLAS HARBOR SEDIMENT CAP YEAR 1 POST-CONSTRUCTION MONITORING REPORT (File available on request)
Nyanza Superfund Site	Ashland, MA	Placement of a 6-in. TLC for ENR of Hg-impacted sediment in 80 acres in the Sudbury River. Monitoring has shown that the TLC is functioning to isolate contaminants and remains stable after 10+ years.	6 in.	Sand	Communities fully re-established in 1-24 months and are comparable to the pre-capping state. Ecological Considerations Related to Thin-layer Sand Capping Reservoir 2, Nyanza Site Operable Unit 4 Nyanza OU4 ESD

Table 1. Summary of Thin Layer Cover/Placement Case Studies

		Site	Cap		Benthic Recovery Evaluation	Link
Name	Location	Overview	Thickness	Material		
Log Pond Cleanup/Habitat Restoration Project	Bellingham, WA	Construction of a combined cleanup of Hg-impacted sediment and habitat restoration in Bellingham Bay. The project converted subtidal mudflat/debris and low intertidal riprap into clean intertidal and shallow subtidal silt and sand habitat.	Thickness varied average 3 ft	Sand	Macroinvertebrate community is well established and continues to develop towards the reference area.	YEAR 2 MONITORING REPORT INTERIM REMEDIAL ACTION LOG POND CLEANUP/HABITAT RESTORATION PROJECT BELLINGHAM, WASHINGTON
					Documented utilization by juvenile salmonids during their spring outmigration.	
		Monitoring indicates that the cap has been effective at maintaining sufficient containment of contaminated sediments.			Native eelgrass was observed colonizing the shallow subtidal elevations of the cap/habitat layer.	Year 5 Monitoring Report Interim Remedial Action Log Pond Cleanup/Habitat Restoration
LCP Chemicals Superfund Site	Brunswick, GA	TLC of sand over 11 acres of marsh to restore historically impacted intertidal creeks and marshes in Georgia's Brunswick estuary.	6-9 in.	Sand	Physical and vegetative monitoring conducted over a 2-year period indicated strong natural recolonization of vegetation and re-establishment of benthic species including fiddler crab.	Mohan, R. et al. 2021. Restoration of estuarine wetlands using thin cover placement: A pilot application in Brunswick, Georgia. <i>Shore & Beach</i> . 89(4)4-12. http://doi.org/10.34237/1008941
		Pilot study demonstrated that TLC can be effective. Full scale implementation is pending.				PROPOSED PLAN LCP CHEMICALS SUPERFUND SITE
						FEASIBILITY STUDY LCP Chemical Superfund Site, Operable Unit No. 1 (Estuary)
						EPA Website

Notes:
EMNR = enhanced monitored natural recovery
ENR = enhanced natural recovery
Hg = mercury
PCB = polychlorinated biphenyl
SPI = sediment profile imaging
TLC = thin layer cap
TOC = total organic carbon

Table 2. Reports Presenting Compilations of Thin Layer Cover/Placement Case Studies

Report Name	Description	Sites	Thickness	Material	Benthic Recovery?	Link
Enhanced Monitored Natural Recovery (EMNR) Case Studies Review	Compilation of EMNR case studies	Wyckoff/Eagle Harbor, WA (Hg)	15 cm	Sand	Not reported	Link to Report
		Ketchikan Pulp Company, AK	15-30 cm	Sand	Yes	
		Bremerton Naval Shipyard, WA	15-20 cm	Sand	Yes	
		Palos Verdes Shelf Los Angeles, CA	15 cm, 45 cm	Sand	Yes	
		Anacostia River Maryland	15 cm	Sand only and amended caps	Yes	
		Grasse River Massena, NY	30 cm	Sand and topsoil, bentonite, AquaBlok	Yes. Rapid Recovery reported	
		US Navy Manchester Annex, Manchester, WA	15-30 cm	Not reported	Not reported	
		Pier 64 Seattle, WA	30-45 cm	Sand	Not reported	
Habitat Considerations for Large-Scale Sediment Capping Projects	Compilation of Washington case studies focused on benthic recovery	Denny Way Cap	3 ft	Sand	Yes. Benthic community recolonizes within months to a few years. Diversity, biomass, and size increase over first few years. Surface of sand caps trends back to mud.	Link to Report
		Pier 53 to 55 Cap	12 in.	Sand		
		St. Paul Cap	5-20 ft	Sand		
		Eagle Harbor Cap	0.5-3.9 ft	Sand		
Environmental Effects of Dredging Technical Notes	General Report. Cites several sites in LA.	Several sites in LA	Various	Dredge materials	Yes	Link to Report
In-situ Capping of Contaminated Sediments Remedial Sediment Capping Projects, Worldwide: A Preliminary Overview	Compilation of capping case studies	Numerous	Various	Various	Not reported	Link to Report
Beneficial Use of Dredged Material for Salt Marsh Restoration and Creation in Connecticut	Compilation of case studies, mostly related to marsh restoration	Numerous	Various	Various	Not reported	Link to Report
Shore & Beach. A DEDICATED ISSUE: Building Coastal Resilience via Marsh Enhancement	Compilation of marsh restoration articles	Various	Various	Various	Not reported	Link to Report

APPENDIX K – INVASIVE AND OTHER UNACCEPTABLE PLANT SPECIES¹

a. Herbs:

<i>Aegopodium podagraria</i>	Goutweed or Bishop's weed
<i>Aira caryophyllea</i>	Silver hairgrass
<i>Alliaria petiolata</i>	Garlic mustard
<i>Allium vineale</i>	Field garlic
<i>Ampelopsis brevipedunculata</i>	Porcelain berry
<i>Anthoxanthum odoratum</i>	Sweet vernal grass
<i>Anthriscus sylvestris</i>	Chervil
<i>Arctium minus</i>	Common burdock
<i>Arthraxon hispidus</i>	Hairy joint grass
<i>Asparagus officinalis</i>	Asparagus
<i>Barbarea vulgaris</i>	Yellow rocket
<i>Bassia scoparia</i> (<i>Kochia scoparia</i>)	Summer cypress
<i>Bromus tectorum</i>	Drooping brome-grass
<i>Butomus umbellatus</i>	Flowering rush
<i>Cabomba caroliniana</i>	Fanwort
<i>Callitriche stagnalis</i>	Water-starwort
<i>Calystegia sepium</i>	Japanese bindweed
<i>Cardamine impatiens</i>	Bushy rock-cress
<i>Cardamine pratensis</i>	Cuckoo-flower
<i>Carex kobomugi</i>	Japanese sedge
<i>Centaurea stoebe</i> ssp. <i>micranthos</i> (<i>C. biebersteinii</i>)	Spotted knapweed
<i>Chelidonium majus</i>	Celandine
<i>Cirsium arvense</i>	Canada-thistle
<i>Cirsium palustre</i>	Marsh thistle
<i>Commelina communis</i>	Asiatic day-flower
<i>Cynanchum louiseae</i> (<i>Vincetoxicum nigrum</i>)	Black swallow-wort
<i>Cynanchum rossicum</i> (<i>Vincetoxicum rossicum</i>)	Black swallow-wort
<i>Cyperus esculentus</i>	Yellow nutsedge
<i>Dactylis glomerata</i>	Orchard-grass
<i>Datura stramonium</i>	Jimsonweed
<i>Echinochloa crus-galli</i>	Barnyard grass
<i>Egeria densa</i>	Giant waterweed
<i>Eichhornia crassipes</i>	Water hyacinth
<i>Eleusine indica</i>	Goosegrass
<i>Elsholtzia ciliata</i>	Elsholtzia
<i>Elymus repens</i> (<i>Elytrigia repens</i>)	Quack-grass

¹ Scientific names are those used primarily in USDA PLANTS database (<http://plants.usda.gov/>).

<i>Epilobium hirsutum</i>	Hairy willow-herb
<i>Euonymus europaeus</i>	European Euonymus/ Common Spindle Tree
<i>Euphorbia cyparissias</i>	Cypress spurge
<i>Euphorbia esula</i>	Leafy spurge
<i>Polygonum baldschuanicum</i> (<i>P. aubertii</i> , <i>Fallopia baldschuanica</i>)	Silver lace-vine
<i>Polygonum cuspidatum</i> (<i>Fallopia japonica</i>)	Japanese knotweed
<i>Polygonum sachalinense</i> (<i>Fallopia sachalinensis</i>)	Giant knotweed
<i>Festuca brevipila</i> (<i>F. ovina</i> , <i>F. trachyphylla</i>)	Sheep fescue
<i>Ranunculus ficaria</i> (<i>Ficaria verna</i>)	Lesser celandine
<i>Froelichia gracilis</i>	Slender snake cotton
<i>Geranium ibericum</i>	Nepalese crane's-bill
<i>Geranium sibiricum</i>	Siberian crane's-bill
<i>Geranium thunbergii</i>	Thunberg's geranium
<i>Glaucium flavum</i>	Sea- or horned poppy
<i>Glechoma hederacea</i>	Gill-over-the-ground
<i>Glyceria maxima</i>	Sweet reedgrass
<i>Hemerocallis fulva</i>	Tiger-lily
<i>Heracleum mantegazzianum</i>	Giant hogweed
<i>Hesperis matronalis</i>	Dame's rocket
<i>Hydrilla verticillata</i>	Hydrilla
<i>Hydrocharis morsus-ranae</i>	European frog-bit
<i>Hylotelephium telephium</i> (<i>Sedum telephium</i>)	Live-forever or Orpine
<i>Hypericum perforatum</i>	St. John's wort
<i>Impatiens glandulifera</i>	Ornamental jewelweed
<i>Iris pseudacorus</i>	Yellow iris
<i>Lamium</i> spp. (all)	Dead nettle
<i>Lepidium latifolium</i>	Tall pepperwort
<i>Leptochloa panicea</i>	Hair fescue
<i>Lotus corniculatus</i>	Birdsfoot trefoil
<i>Luzula luzuloides</i>	Oakforest woodrush
<i>Lychnis flos-cuculi</i>	Ragged robin
<i>Lysimachia nummularia</i>	Moneywort
<i>Lysimachia vulgaris</i>	Garden loosestrife
<i>Lythrum salicaria</i>	Purple loosestrife
<i>Malva neglecta</i>	Cheeses or common malva
<i>Marsilea quadrifolia</i>	Water shamrock or Eurasian water clover
<i>Mentha arvensis</i>	Field-mint
<i>Microstegium vimineum</i>	Japanese stilt-grass
<i>Miscanthus sinensis</i>	Eulalia
<i>Myosotis scorpioides</i>	True forget-me-not
<i>Myosoton aquaticum</i>	Giant chickweed

<i>Myriophyllum aquaticum</i>	Parrot feather
<i>Myriophyllum heterophyllum</i>	Variable water-milfoil
<i>Myriophyllum spicatum</i>	Eurasian water-milfoil
<i>Najas minor</i>	Lesser naiad
<i>Nasturtium microphyllum</i> (<i>Rorippa microphylla</i>)	One-row yellow cress
<i>Nasturtium officinale</i> (<i>Rorippa nasturtium-aquaticum</i>)	Watercress
<i>Nymphoides peltata</i>	Yellow floating heart
<i>Onopordum acanthium</i>	Scotch thistle
<i>Ornithogalum umbellatum</i>	Star of Bethlehem
<i>Pachysandra terminalis</i>	Japanese spurge
<i>Pastinaca sativa</i>	Wild parsnip
<i>Polygonum persicaria</i> (<i>Persicaria maculosa</i>)	Lady's thumb
<i>Polygonum perfoliatum</i> (<i>Persicaria perfoliata</i>)	Mile-a-minute vine
<i>Polygonum caespitosum</i> (<i>Persicaria posumbu</i>)	Cespitose knotweed
<i>Phalaris arundinacea</i>	Reed canary-grass
<i>Phragmites australis</i>	Reed grass, Phragmites
<i>Pistia stratiotes</i>	Water lettuce
<i>Poa compressa</i>	Canada bluegrass
<i>Poa pratensis</i>	Kentucky bluegrass
<i>Poa trivialis</i>	Rough bluegrass
<i>Potamogeton crispus</i>	Curly pondweed
<i>Puccinellia maritima</i> (<i>P. americana</i>)	Seaside alkali-grass
<i>Pueraria montana</i>	Kudzu
<i>Ranunculus repens</i>	Creeping buttercup
<i>Rorippa amphibia</i>	Great yellow cress
<i>Rorippa sylvestris</i>	Creeping yellow cress
<i>Rumex acetosella</i>	Sheep-sorrel
<i>Rumex obtusifolius</i>	Bitter dock
<i>Salvinia molesta</i>	Salvinia
<i>Securigera varia</i> (<i>Coronilla varia</i>)	Crown vetch
<i>Senecio jacobaea</i>	Tansy ragwort
<i>Setaria pumila</i> (<i>S. lutescens</i> , <i>S. glauca</i>)	Yellow foxtail or yellow bristlegrass
<i>Silphium perfoliatum</i>	Cup plant
<i>Solanum dulcamara</i>	Bittersweet nightshade
<i>Stellaria graminea</i>	Common stitchwort
<i>Tanacetum vulgare</i>	Tansy
<i>Thymus pulegioides</i>	Wild thyme
<i>Trapa natans</i>	Water-chestnut
<i>Tussilago farfara</i>	Coltsfoot
<i>Typha angustifolia</i>	Narrow-leaved cattail
<i>Typha latifolia</i>	Common or Broad-leaved cattail

<i>Typha x glauca</i>	Hybrid cattail
<i>Valeriana officinalis</i>	Garden heliotrope
<i>Verbascum thapsus</i>	Common mullein
<i>Veronica beccabunga</i>	European speedwell
<i>Xanthium strumarium</i>	Common cocklebur

b. Woody Plants:

<i>Acer ginnala</i>	Amur maple
<i>Acer platanoides</i>	Norway maple
<i>Acer pseudoplatanus</i>	Sycamore maple
<i>Actinidia arguta</i>	Kiwi vine
<i>Ailanthus altissima</i>	Tree-of-heaven
<i>Alnus glutinosa</i>	European alder
<i>Amorpha fruticosa</i>	False indigo
<i>Berberis thunbergii</i>	Japanese barberry
<i>Berberis vulgaris</i>	Common barberry
<i>Buddleja davidii</i>	Butterfly bush
<i>Catalpa speciosa</i>	Western catalpa
<i>Celastrus orbiculatus</i>	Oriental bittersweet
<i>Cytisus scoparius</i>	Scotch broom
<i>Elaeagnus angustifolia</i>	Russian olive
<i>Elaeagnus umbellata</i>	Autumn olive
<i>Euonymus alatus</i>	Winged euonymus
<i>Euonymus fortunei</i>	Climbing euonymus
<i>Fragula alnus (Rhamnus frangula)</i>	European buckthorn
<i>Humulus japonicus</i>	Japanese hops
<i>Hypericum prolificum</i>	Shrubby St. John's wort
<i>Ligustrum obtusifolium</i>	Japanese privet
<i>Ligustrum ovalifolium</i>	California privet
<i>Ligustrum sinense</i>	Chinese privet
<i>Ligustrum vulgare</i>	Common/hedge privet
<i>Lonicera japonica</i>	Japanese honeysuckle
<i>Lonicera maackii</i>	Amur honeysuckle
<i>Lonicera morrowii</i>	Morrow's honeysuckle
<i>Lonicera tatarica</i>	Tatarian honeysuckle
<i>Lonicera x bella</i>	Morrow's x Tatarian honeysuckle
<i>Lonicera xylosteum</i>	European fly-honeysuckle
<i>Morus alba</i>	White mulberry
<i>Paulownia tomentosa</i>	Princess tree or empress tree
<i>Phellodendron amurense</i>	Amur corktree
<i>Phellodendron japonicum</i>	Japanese corktree
<i>Populus alba</i>	Silver poplar
<i>Rhamnus cathartica</i>	Common buckthorn

<i>Ribes rubrum (R. sativum)</i>	Garden red currant
<i>Robinia pseudoacacia</i>	Black locust
<i>Rosa multiflora</i>	Multiflora rose
<i>Rosa rugosa</i>	Rugosa rose
<i>Rubus phoenicolasius</i>	Wineberry
<i>Salix purpurea</i>	Basket or purple-osier willow
<i>Sorbus aucuparia</i>	European mountain-ash
<i>Taxus cuspidata</i>	Japanese yew
<i>Ulmus pumila</i>	Siberian elm
<i>Wisteria floribunda</i>	Wisteria