FINAL HOYT BROOK SEEP PILOT STUDY WORK PLAN

WINTHROP LANDFILL
WINTHROP, MAINE

Prepared for:

United Technologies Corporation

Hartford, Connecticut

Prepared by:

Amec Foster Wheeler Environment & Infrastructure, Inc.
511 Congress Street, Suite 200
Portland, Maine 04101

August 18, 2015

Project Number: 3617157362

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LIST OF ACRONYMS AND ABBREVIATIONS

Agencies	USEPA and MEDEP
AMEC Foster Wheeler	Amec Foster Wheeler Environment & Infrastructure, Inc.
FFS	Focused Feasibility Study
HASP	Health and Safety Plan
µg/liter	micrograms per liter
MACTEC	MACTEC Engineering and Consulting, Inc.
MEDEP	Maine Department of Environmental Protection
mg/kg	milligram(s) per kilogram
NOEC	No Observed Effect Concentration
NRWQC	National Recommended Water Quality Criteria
PCL	Protective Concentration Limit
ROD	Record of Decision
Site	Hoyt Brook Seep, Winthrop Landfill in Winthrop, Maine
USEPA	United States Environmental Protection Agency
UTC	United Technologies Corporation

1.0 INTRODUCTION

This Pilot Study Work Plan has been prepared by Amec Foster Wheeler Environment and Infrastructure, Inc. (Amec Foster Wheeler) on behalf of United Technologies Corporation (UTC) to present the rationale, objectives, and scope of work for addressing conditions at the Hoyt Brook seep located north of the Winthrop Landfill in Winthrop, Maine (the Site). UTC and Amec Foster Wheeler have developed the approach with the United States Environmental Protection Agency (USEPA) and Maine Department of Environmental Protection (MEDEP) (collectively the Agencies) to address the Agencies' concerns about public contact with arsenic impacted sediment in the seep area. Results from the Pilot Study will provide information to determine whether direct human contact with the seep area can be eliminated without causing new contamination or seepage conditions, unacceptable erosion, or impacts to surface water.

1.1 Project History and Rationale

The Winthrop Landfill Superfund Site is located at 294 Annabessacook Road in the Town of Winthrop, Maine. The Site area was first excavated in the 1920s as a sand and gravel pit, but was later operated as the Winthrop town dump, accepting residential and industrial waste disposal from 1930 to 1982. Disposal of hazardous wastes occurred in the northern portion of the landfill from the early to mid-1970s. From the mid-1970s to 1982, the southern portion of the landfill operated as a sanitary landfill. After 1982, the Site became and continues to be inactive. The landfill portion of the Site consists of a fenced area of approximately 16 acres. A Site location map is included as Figure 1.

In 1985 the USEPA issued a Superfund Enforcement Decision Document known as the 1985 Record of Decision (ROD) to select a remedy for the Site in accordance with Superfund law. The remedy selected included, among other things, addressing volatile organic contaminants in groundwater and addressing human health risks from contact with the landfill. All remedial work at the Site has been performed by UTC and the Town of Winthrop pursuant to a 1986 Consent Decree. AMEC Foster Wheeler (formerly AMEC Environment and Infrastructure, and prior to that MACTEC Engineering and Consulting, Inc. - MACTEC) is a consultant assisting UTC with remedial work.

Many of the components of the 1985 ROD remedy have been completed. However, the Site is located in an area of very high naturally-occurring arsenic. The presence of the landfill is causing the naturally occurring arsenic to be mobilized in groundwater which flows from beneath the landfill to surface water. Once exposed to the oxygenated surface water, the arsenic deposits at seep areas where groundwater discharges into surface water bodies. USEPA and the MEDEP have determined there is a need for further remedial action at the Hoyt Brook Seep Area to address potential risk to human health where arsenic levels in sediment exceed Protective Concentration Limits (PCLs) that have been established for the Site. The Hoyt Brook Seep Area is located at the end of the northern flowpath where groundwater from beneath the landfill discharges to Hoyt Brook. The parcels adjacent to the Hoyt Brook Seep Area are privately owned and undeveloped.

The 1985 ROD (as modified in 1993 and 2007) included sediment monitoring, but did not include a sediment remediation component. For this reason, AMEC Foster Wheeler prepared a draft Focused Feasibility Study (FFS) on behalf of UTC to evaluate remedial alternatives to mitigate potential human exposure to elevated levels of arsenic in sediment at the Site, specifically at the Hoyt Brook Seep Area. The draft FFS was submitted to the Agencies in July 2013 and the Agencies provided UTC with revisions to the FFS in March 2015.

The FFS identified a range of alternatives that were evaluated using the nine criteria set out in federal regulations for Superfund sites (i.e. the National Contingency Plan at 40 C.F.R. § 300.430(e)(9)). A preferred alternative was identified for the remedy and is described in Section 2 of this report. Due to uncertainty about the effectiveness of the identified remedy, the Agencies and UTC determined that a pilot study should be completed to ensure that a successful permanent remedy can be implemented. The Pilot Study is being performed as a follow on activity to the May 2010 Site Investigation Plan for Annabessacook Lake and Hoyt Brook Points of Exposure prepared by MACTEC.

1.2 Problem Statement

The Pilot Study described herein was determined to be necessary to evaluate whether the preferred alternative for eliminating direct human contact with sediment at the seep containing naturally occurring arsenic concentrations exceeding PCLs can effectively meet the project objectives described in Section 2.

2.0 PROJECT OBJECTIVES AND SCOPE OF WORK

The scope of the pilot study was developed in consultation with the Agencies and UTC. The selected configuration (based on Alternative 5 from the FFS) consists of the following components:

1. Excavation of soil/sediment in the vicinity of the seep that contains arsenic concentrations exceeding PCLs. Excavation depth will be limited to the surface of the clay layer beneath the seep areas, taking care not to penetrate the clay layer.
2. Installation of a geotextile filter fabric and a geogrid at the base of the excavation.
3. Installation of large diameter rip rap over the approximate Pilot Study area for armoring.
4. Installation of a final cover over the armoring that will consist of a geotextile over the surface of the rip rap covered with common borrow, a blend of topsoil and erosion control mix, and application of a seed mix to establish a vegetation layer to blend in with the existing forested wetland in the area.

The Pilot Study plan of seep and soil cover layout is presented in Figure 2 and a profile (cross-section) of the seep cover is provided in Figure 3. Additional detail regarding the Pilot Study configuration and associated scope of work is provided in Section 2.1.

The objectives for the Pilot Study are to determine if:

1. the cover material becomes contaminated with arsenic over time
2. new seeps emerge outside the remediation area
3. the cover system is stable from erosion and flooding
4. the remediation results in exceedances of Evaluation Criteria (identified below) in surface water and/or sediment

2.1 Implementation

2.1.1 Pre-mobilization Activities

Henry Lane and Site Access Agreements

Access to the Pilot Study area is via Henry Lane (a private paved road) which leads to a woods road that has been improved with gravel and leads to a clearing on Lot 35B-1 (see Figures 4 and 5). A path from the clearing leads to the Pilot Study area. Amec Foster Wheeler has completed a survey and determined landownership for three project areas: 1. vehicle access to Henry Lane located on Map 2, Lot 34, 2. vehicle access and improvement to the gravel woods road through Lot 35B, and 3. equipment and supply staging, clearing of a woods path and the construction at the seep area within lot 35B-1. Access forms for each of these three access types will be mailed to land owners of the designated lots shown on Figures 4 and 5. The road commissioner of Henry

Lane, who resides at 35 Henry Lane, will be the point of contact for communication with lot owners along Henry Lane.

Subcontractor Procurement

Amec Foster Wheeler prepared a Request for Proposal package including maps, scope of work including mobilization, erosion controls, excavation and disposal of impacted soils/sediment and placement of rip rap material, site stabilization and demobilization. The package was provided to four contractors with erosion control and hazwoper personnel experience. Two contractors attended the mandatory site walk and submitted bids for the work. Based on submitted bids, EPI of Auburn, Maine, a Maine DEP-approved erosion and sedimentation control contractor, has been selected to perform the work based on their experience with the Site, staff training and certifications, and availability of equipment scaled to the work to be completed.

Permitting

The Pilot Study will be completed by an approved erosion and sedimentation control contractor (EPI) and will be completed in a manner that is consistent with applicable regulations. Because it is being completed as a Pilot Study under Superfund, the study is considered to be exempt from obtaining permits that would otherwise be needed for this type of work. However, the work must still be completed in a manner the meets the substantive requirements of the otherwise applicable permits. The Town of Winthrop and the local citizens have been informed about the project through a Community Update that was mailed to the residents. An informational meeting to provide project specific information, answer questions and address concerns will be held at the Town Hall on Thursday, August 20 at 6:30 PM. Additional information regarding the Community Update is presented in Section 2.2.4 of this report.

Health and Safety

Field activities at the Winthrop Landfill are conducted in accordance with Amec Foster Wheeler's Health and Safety Plan (HASP) for the Site. Included in the HASP are Activity Hazard Assessments for tasks specific to clearing brush and trees, excavation and backfilling, and stream and wetland work. Work zones will be established to control human and vehicle traffic at, to and from the Site. Amec Foster Wheeler's contractor (EPI) will be required to provide their own HASP that meets the requirements of the Amec Foster Wheeler plan. Each day will begin with a safety meeting to discuss tasks, equipment, hazards and how best to overcome them by using safe work practices, personal protective equipment specific to the tasks, and if needed engineering controls.

2.1.2 Site Work

Mobilization

Mobilization to the Site will include moving erosion control materials (silt fence, erosion control mix and matting, hay bales), geotextile, geogrid, interlock stone, rip rap (average diameter of 12 inch – D12), common borrow, topsoil, and rubber track equipment to the staging area for the Site.

Site Preparation, Erosion Controls and Grubbing

Site preparation will first require marking and removal of a select number of trees to ensure the minimum required access for rubber track equipment to access the seep area. The access path will be positioned to minimize or eliminate the need to remove mature trees. Laydown areas will be established in the clearing to minimize impact to existing vegetation and materials will be stockpiled at locations to provide ready access to the woods path and the seep area.

Silt fencing will be placed around wetland areas where there is a clear slope toward such areas and risk that sedimentation could occur if unchecked. Site controls delineating work areas will also be established.

Installation of Cofferdam to Divert Hoyt Brook from Work Area

A cofferdam will be needed to locally divert the flow of Hoyt Brook away from the immediate shore areas adjacent to the repair so that impacted sediment can be excavated and drainage and cover materials can be properly placed. As the mobilization and site preparations are completed, the long range weather forecast will be monitored to avoid setting the Hoyt Brook cofferdam and beginning excavation prior to a significant rain event (more than approximately 0.5 inches of rain in 24 hours). The cofferdam will be installed and secured to the bottom of the brook and shoreline areas in a manner that will allow it to be removed in the event a large storm is forecasted to avoid damage to the dam. The cofferdam will be constructed in small sections of approximately 30 feet such that the remedy can be staged in small increments and thereby reducing the magnitude of any potential dam breach or failure. With the cofferdam in place, the water between it and the shore will be allowed to settle to reduce any turbidity created during its installation.

Excavation

When excavation activities near the water are ready to begin, the cleared water will then be pumped through a filter bag (if needed) to reduce any remaining turbidity and discharged into the main channel of the brook. To the extent practical the work immediately adjacent to the shore will be performed during sequential days to minimize the duration that the cofferdam needs to be maintained. It is anticipated that three to five days of excavation activities will be required to complete the effort.

Soils will be excavated with a rubber tracked skidsteer (or similar) where terrain allows. A mini rubber tracked excavator will be used for excavating sediment in the near shore areas of the brook, where the skidsteer would have difficulty. Excavation will be staged to limit the amount of exposed open area. Excavation will remove soil/sediment in an approximate 85 x 15 foot area to a depth of approximately 9 inches, or locally greater than 9 inches to remove stained, contaminated sediment, but not deep enough to disturb or penetrate the underlying clay. If the clay is penetrated, ¼-inch diameter screened bentonite clay will be on-hand to repair the puncture and contain any seepage through the puncture. Excavated materials will be placed in a rubber tracked transporter for dumping to lined roll-off containers in the staging area. The bottom of the excavation will be sloped downward toward the brook to ensure flow of seepage to the brook.

Figures 2 and 3 provide a plan and profile of the excavation area and drainage layer detail respectively.

Waste Characterization/Management

Material excavated from the seep area will be placed in lined roll-off containers in the staging area. Soils excavated from the areas within the seep area that are known to contain the most elevated concentrations of arsenic will be separated from the surrounding excavated materials and placed in a dedicated lined roll-off container. The separation is intended to help ensure that the most impacted materials can be characterized and managed efficiently, without negatively impacting the characterization and management of surrounding excavated materials. Rip Rap that was placed in the seep area previously in 1997 will come out with the excavated sediment and will not be segregated for disposal.

Representative samples will be collected from the containers for analyses of arsenic and additional waste characteristics required for identifying disposal options including aggregate recycling, special waste or hazardous waste. All soils will be disposed of at a properly licensed facility. Excavated sediments are likely not suitable for aggregate recycling.

Geotextile and Geogrid

To support the Rip Rap and limit settlement into the underlying clay, a non-woven geotextile fabric will be placed at the base of the excavation to be overlain by a geogrid. The geotextile used on the Project shall be a non-woven polyester or polypropylene fabric. The fabric shall be GSE Environmental NW10 or an approved equal. A geogrid will be installed at the base of the excavation over the geotextile. The geogrid used on the Project shall be GSE Environmental Syntec Biaxial Geogrid SBx 15 or an approved equal. Six inches of 2-3 inch stone will be placed on top of the geogrid for effective interlocking between the rip-rap and the geogrid and will provide the primary drainage layer for seep water to migrate to Hoyt Brook. The geotextile and geogrid will be installed in general accordance with the manufacturers' specifications. Specifications for the geotextile and geogrid are included in Appendix A. The geotextile will be anchored in the stream bank as shown on Figure 3.

Rip Rap

A rip rap cover will be placed over the geogrid layer and tapered into the landscape as shown on Figures 2 and 3. The rip rap cover, which will be up to 2 feet in thickness, will be constructed using rock with an average diameter of approximately 12 inches (approximately 80 pounds per piece of rock) and is intended to prevent direct exposure to any future impacted sediments, resist erosion and limit the potential for trespassers to disturb the area. The rip rap armoring will also provide stability for the brook bank and prevent damage to the drainage layer. The rip rap will extend into Hoyt Brook to a point sufficient to provide a stable rock slope, but not enough to change flow conditions in Hoyt Brook or induce erosion on the opposite bank of Hoyt Brook. At the edge of Hoyt Brook, the rip rap will extend up an additional two feet to above the measured

high water line as shown on Figure 3 to provide further erosion control and protection for the vegetative cover. A specification for the rip rap is included in Appendix A.

Vegetative Cover

A geotextile will be placed on top of the rip rap cover. The geotextile will prevent infiltration of material above it into the rip rap drainage layer below it. An 18 inch thick layer of common borrow soil will then be placed on top of the geotextile and topped with a 6 inch thick layer of top soil blended with erosion control mix. The top soil/erosion control mix blend will serve as a substrate for the cover vegetation. Native plantings will be installed including native New England wetland plants in lower elevation areas. Topsoil and plantings will not extend over the edge of the rip rap on the Hoyt Brook side of the cover as soil at this location would be susceptible to erosion. Specifications for erosion control mix, topsoil, and seed mix are presented in Appendix A. Erosion control blankets will be installed as needed and anchored to stabilize plantings until the roots are established.

Demobilization/materials management

With construction complete, all equipment will be removed from the Site, including the woods path from the staging area to the seep area, along with any leftover materials and supplies. Gravel improvements to the woods road will be dressed with erosion control mix on either side to provide a stable access to the Pilot Study area for the monitoring.

Upon completion of the project, a record drawing signed and stamped by a Maine Professional Engineer, will be prepared for submittal to the Agencies.

2.1.3 Monitoring

The Pilot Study will include performance of monitoring to determine if the Pilot Study objectives presented in Section 2.0 are achieved. The components of the monitoring program are provided below and have been organized by objective.

Pilot Study Objective #1 – Determine if cover material becomes contaminated with arsenic over time.

A two tiered monitoring approach will be used:

1. Visual monitoring will be completed three times per year to determine if brook water levels reach cover material and result in staining.
2. If staining is observed, a sample will be collected from the cover soils for laboratory analysis and comparison to the shallow (less than 6 inches of water) sediment Evaluation Criteria (31 milligrams per kilogram [mg/kg] arsenic).

Pilot Study Objective #2 – Determine if new seeps emerge outside of the remediation area.

A two tiered monitoring approach will be used:

1. Visual monitoring will be completed three times per year for iron staining in the area of undisturbed bank proximal to the pilot study area.
2. If present, sample surface water and/or sediment for laboratory analysis and comparison to Evaluation Criteria (appropriate criteria is dependent on sample location).

Pilot Study Objective #3 – Determine if the cover system is stable from erosion and flooding.

Visual monitoring for significant erosion or unstable soils will be conducted three times per year with additional inspections during the first year following large storm events (greater than 3.5 inches of rain in 24 hours - approximately the 5-year return period storm). One of the three annual monitoring events will be times to coincide with ice-out. If erosion is observed, the areas will be noted and discussed with the Agencies. Based on the results of the first year of erosion monitoring, a recommendation for any adjustment to the frequency for monitoring other than the three events per year will be made in the 1st year monitoring report.

Pilot Study Objective #4 – Determine if the remediation results in exceedances of Evaluation Criteria (identified below) in surface water and/or sediment.

Surface water and sediment samples will be collected from the brook three times per year for laboratory analysis at the following locations for analysis of total arsenic (and dissolved arsenic at SW locations - see Figure 6):

- Upstream (background) = SW/SED-117
- proximal = SW-122
- downstream = SW/SED-11
- lake = SW-15

The following Evaluation Criteria will be used to assess results by location:

- upstream = surface water and sediment data collected to understand the range of local background concentrations
- proximal (SW-122) = National Recommended Water Quality Criteria (NRWQC) - Acute = 340 micrograms per liter (µg/liter)
- downstream (SW-11) = NRWQC - Chronic = 150 µg/liter
- downstream (SED-11) = No Observed Effect Concentration (NOEC) Sediment = 108 mg/kg (more than 6" water)
- downstream (SED-11) = PCL Sediment = 31 mg/kg (less than 6" water)
- lake (SW-15) = PCL = 5 µg/liter

Monitoring will be conducted three times per year for three years. An electronic data deliverable will be provided to the Agencies following each event with an annual written report provided after year 1 and 2. At the end of year 3, a final report will be prepared summarizing the results of the Pilot Study with text, figures and tables. Laboratory results for each location will be evaluated using statistical methods including moving averages to characterize any trends and data variability with averages or trends compared to applicable criteria by location. The final report will provide recommendations for follow up monitoring and/or actions, as necessary. Findings and recommendations from the pilot study may be made following years one or two should all parties agree that the results are consistent and the four pilot study objectives have been met.

2.1.4 Public Interaction/Support

The Pilot Study will include informing the public of the intended activities and schedule prior to mobilization. The project team (i.e., Agencies, UTC, Amec Foster Wheeler) prepared a Community Update that was distributed to the residents near the Winthrop Landfill on August 7, 2015, in keeping with previous Community Updates that have been distributed in recent years. In addition, a public informational meeting will be held at the Town Office on Thursday, August 20, 2015 at 6:30 PM.

Property Access Agreements will be secured for the project. The language for the access agreement is different depending upon the nature of the access required, as depicted in Figures 4 and 5, and discussed in subsection 2.1.1. UTC will attempt to secure access agreements from applicable property owners. However, in accordance with Section XXI, Item 37 of the 1986 Consent Decree, should UTC be unable to obtain such access after reasonable request, it is ultimately the obligation of the Town of Winthrop to secure access.

2.1.5 Schedule

The Agencies have suggested an aggressive schedule for the Pilot Study to complete the work during the summer of 2015, preferably during low water in late August, 2015. In order to meet this schedule, several milestones have been met or will be met as follows:

- Submit the Pilot Test Work Plan to Agencies for review: Draft submitted July 29, 2015; Final submitted on August 18, 2015
- Mail a Community Update letter and mail requests for Access Agreements to applicable parties – mailed August 7, 2015.

  Obtain Access Agreements prior to site work, delay project if not received on or before August 18, 2015

  - Should UTC not be able to obtain the necessary Access Agreements, the responsibility for obtaining access will be transitioned to the Town of Winthrop, which may result in project delays.
- Conduct a public informational meeting at the Winthrop Town Hall August 20, 2015

- Mobilize to Site August 24, 2015
- Demobilize on or before September 10, 2015

As noted above, the schedule is aggressive and should the project team fail to achieve any of the above milestones, the project activities will be delayed accordingly.

3.0 PILOT STUDY OUTCOMES

In order to provide a framework for evaluating the success of the Pilot Study the following three possible outcomes have been identified:

A. In the event there are no PCL exceedances during the three years of monitoring, there would be no need for new land or water use restrictions. The Pilot Study as constructed would represent a No Further Action Remedy.

B. In the event that PCL exceedances are confirmed, but there are no exceedances of sediment (NOEC) or NRWQC (acute NRWQC at SW-122, chronic at other monitoring points), and there are no exceedances of the PCL at the Lake (SW-15), it is anticipated that adequate protections can be achieved without the need for additional remedial actions at the Site. A Technical Impracticability waiver would need to be prepared for not meeting the PCLs in Hoyt Brook and additional protections (if needed) could be provided by institutional controls (e.g., modification of the Town ordinance or restrictive covenants).

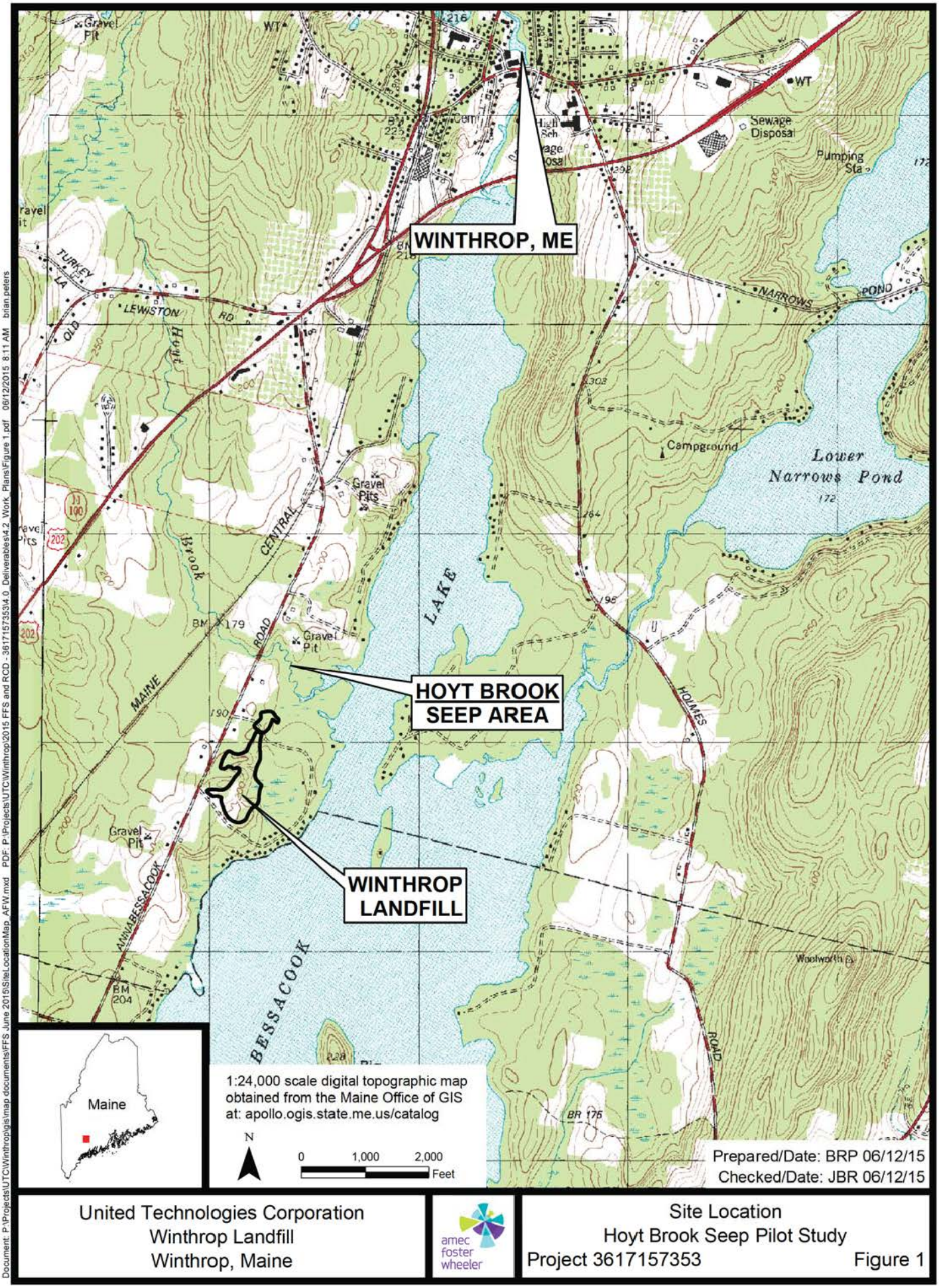
C. In the event of exceedances of NOEC in sediment and NRWQC in surface water, and/or exceedances of the PCL at Lake, additional actions will be evaluated.

Based on discussions with the Agencies, Pilot Study Outcomes A and B would require a Decision Document. Outcome C will likely also require a Decision Document following additional evaluations.

4.0 CONCLUSION

After a thorough development and review of remedial alternatives for the Hoyt Brook seep, a preferred alternative was identified. The Agencies and UTC determined that a Pilot Study should be completed to ensure that a successful permanent remedy can be implemented. This Work Plan establishes specific project objectives, the means and methods for constructing a seep cover, monitoring the performance of the constructed cover and the evaluation criteria to evaluate the success of the Pilot Study. At the end of the three year monitoring program, information will be available to determine whether additional work is needed at the Site or if the cover as constructed will serve as a successful remedy.

FIGURES



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Site Location
Hoyt Brook Seep Pilot Study
Project 3617157353 Figure 1

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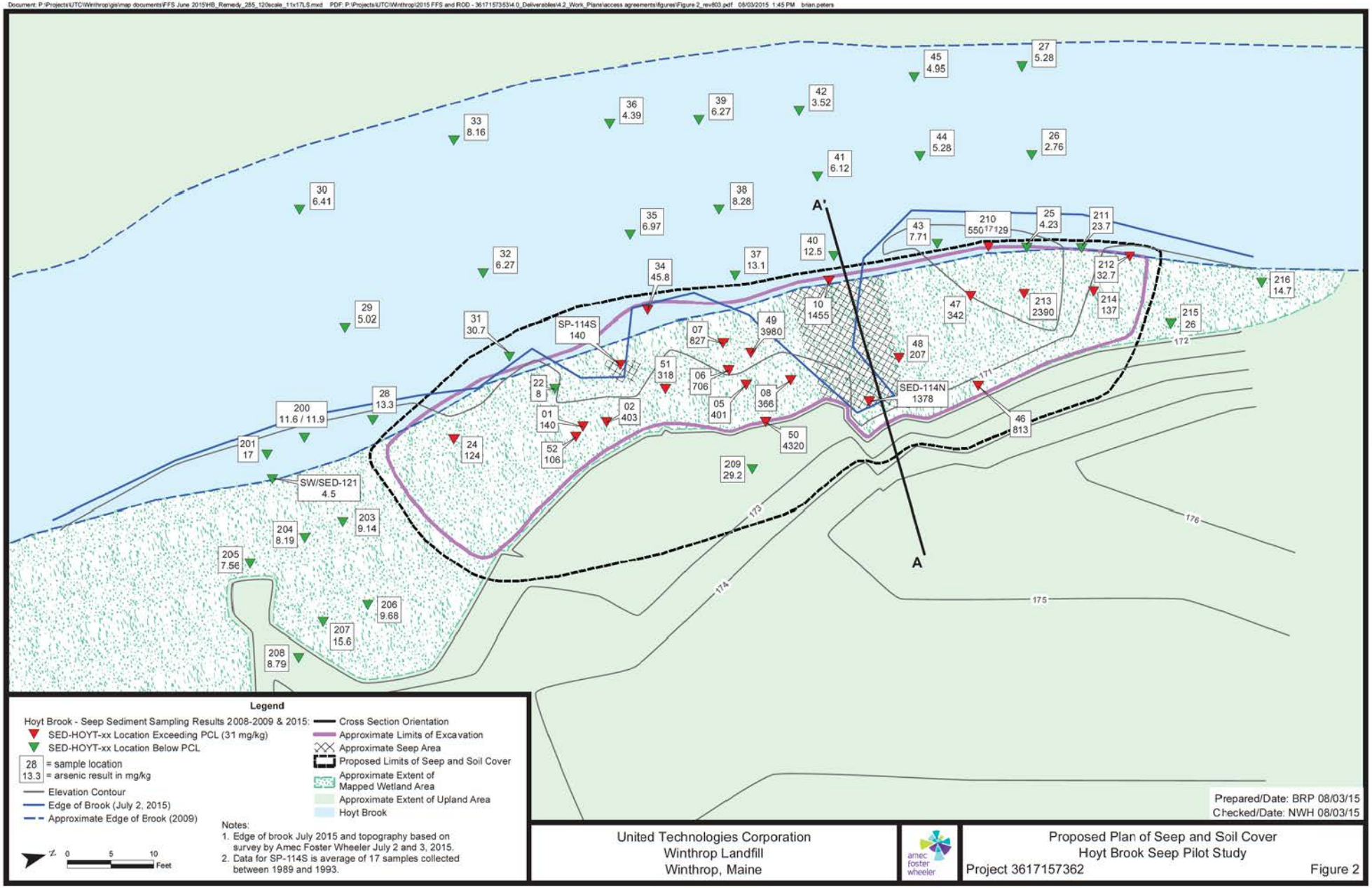

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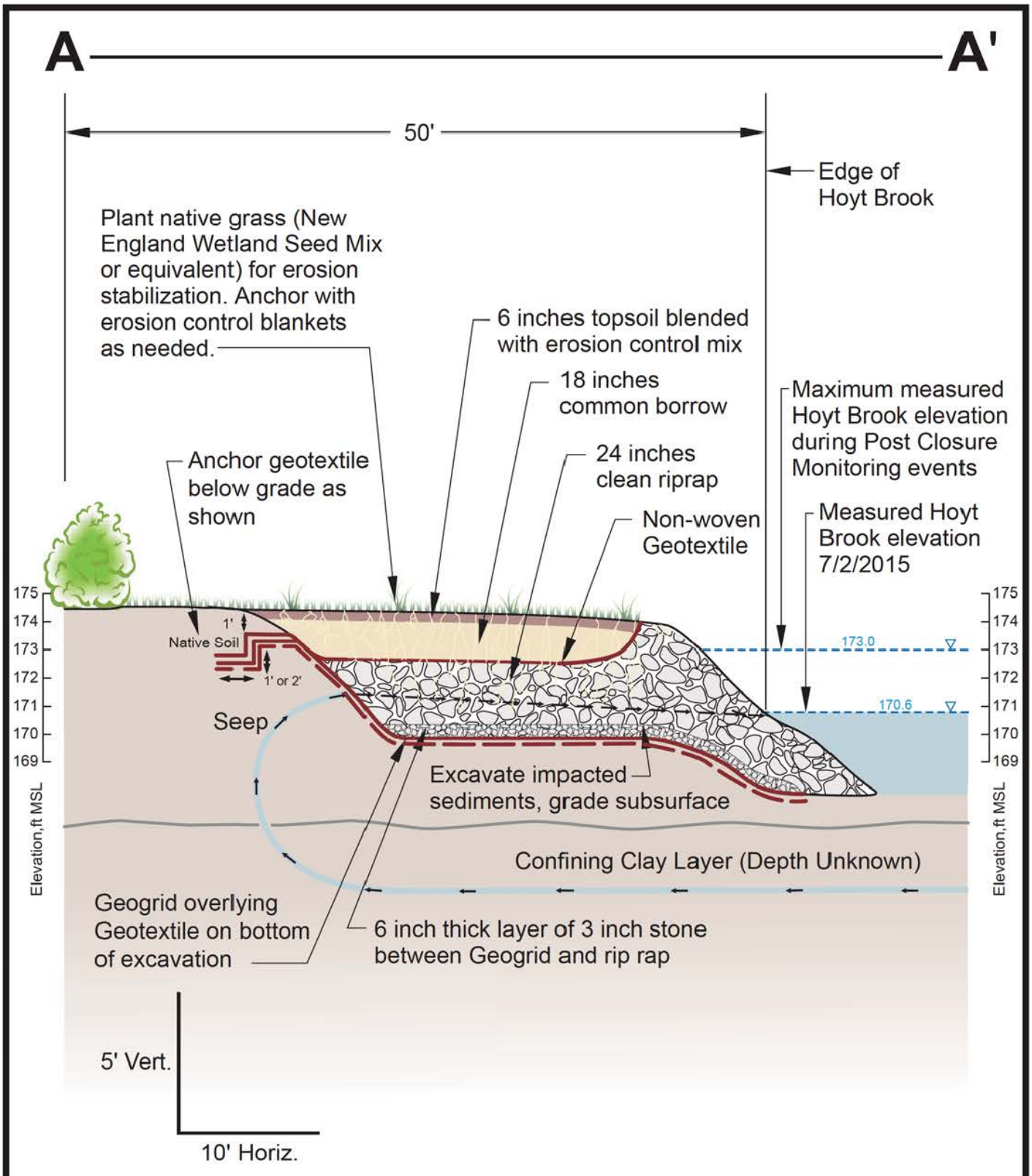
Proposed Plan of Seep and Soil Cover
Hoyt Brook Seep Pilot Study
Project 3617157362 Figure 2



Prepared/Date: EDM 8/17/15
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Proposed Profile of Seep Cover
Hoyt Brook Seep Pilot Study

Project 3617157353 Figure 3

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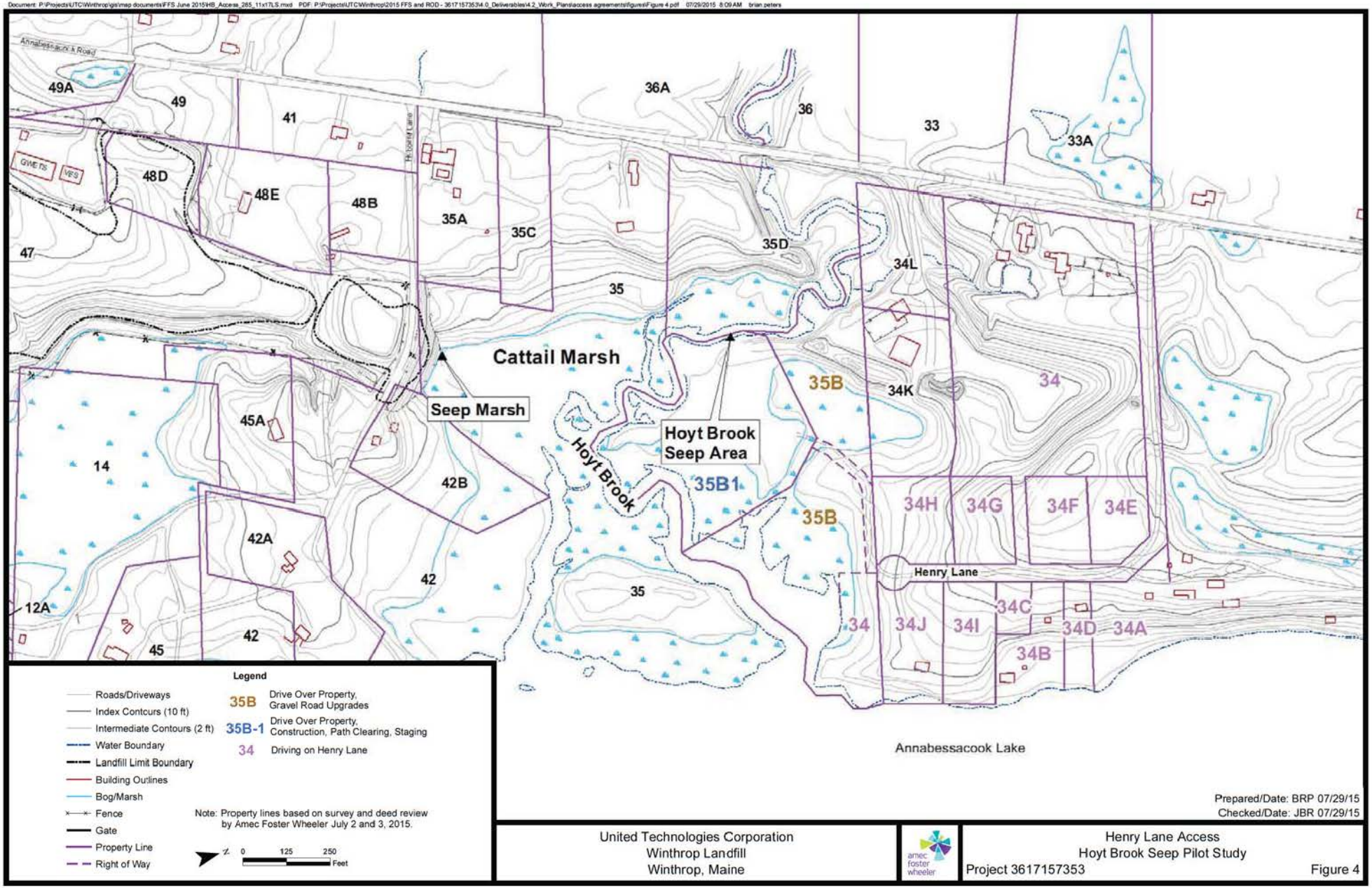

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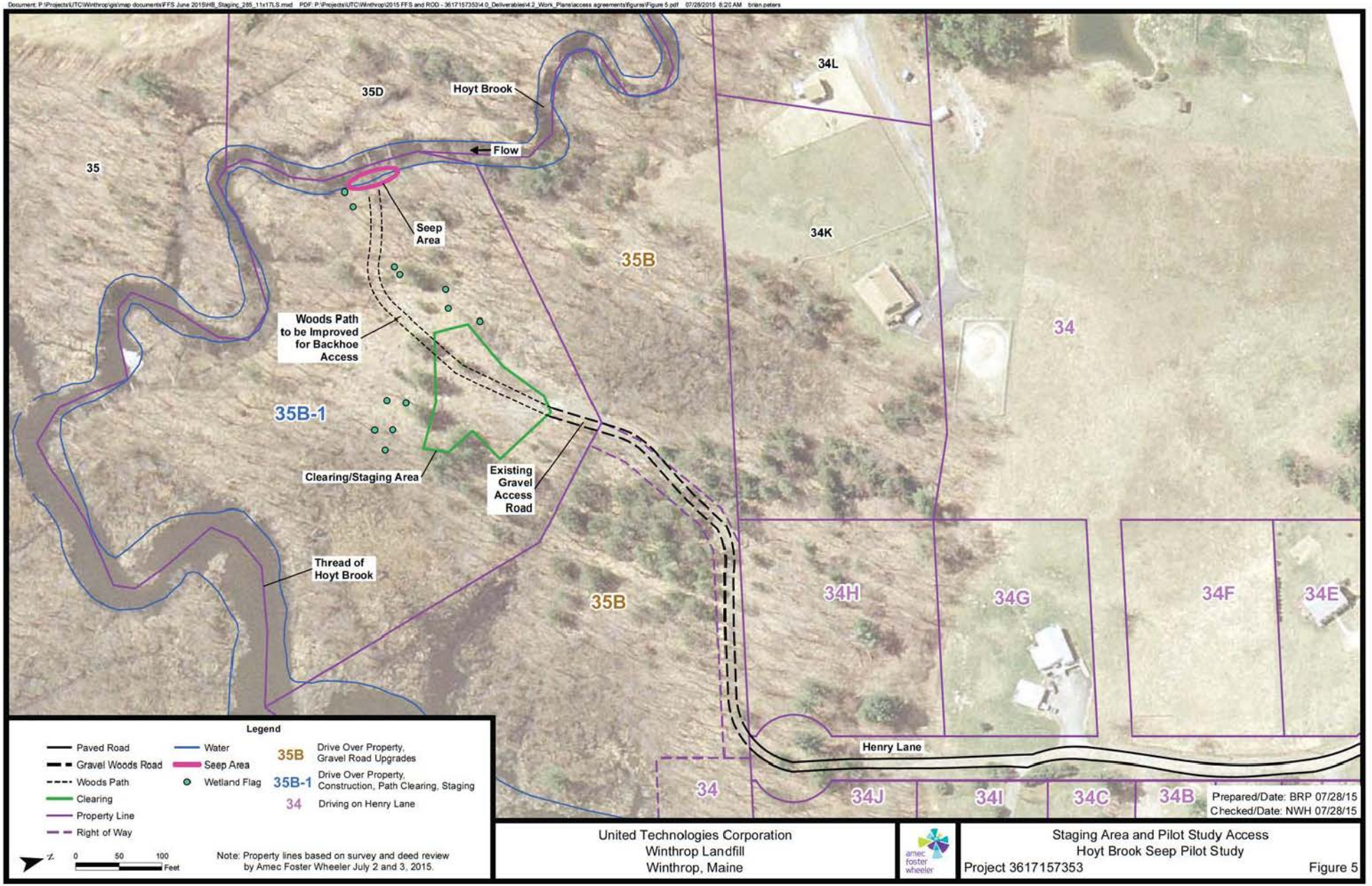
Henry Lane Access
Hoyt Brook Seep Pilot Study
Project 3617157353 Figure 4



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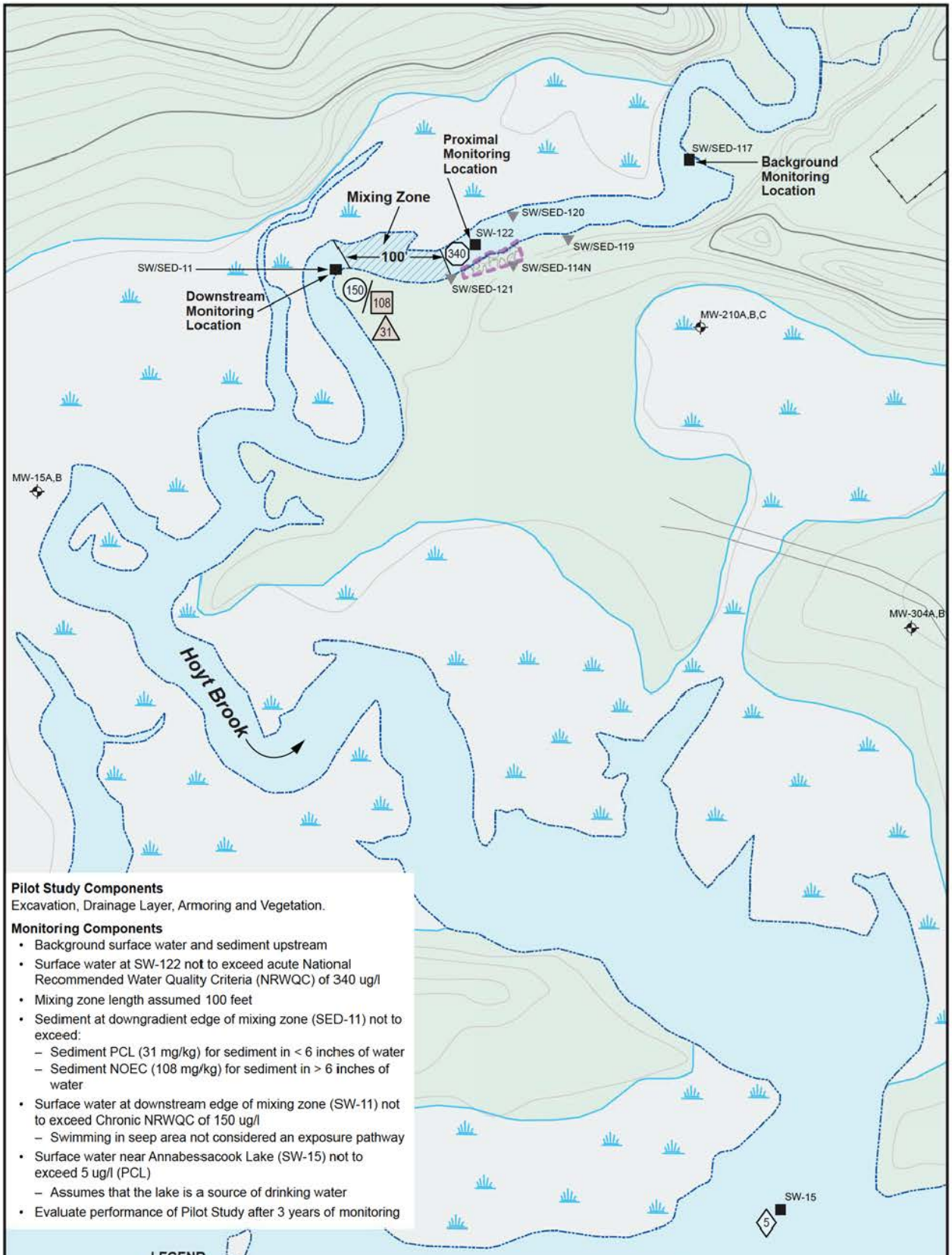
Staging Area and Pilot Study Access
Hoyt Brook Seep Pilot Study
Project 3617157353 Figure 5



Pilot Study Components

Excavation, Drainage Layer, Armoring and Vegetation.

Monitoring Components

- Background surface water and sediment upstream
- Surface water at SW-122 not to exceed acute National Recommended Water Quality Criteria (NRWQC) of 340 ug/l
- Mixing zone length assumed 100 feet
- Sediment at downgradient edge of mixing zone (SED-11) not to exceed:
  - Sediment PCL (31 mg/kg) for sediment in < 6 inches of water
  - Sediment NOEC (108 mg/kg) for sediment in > 6 inches of water
- Surface water at downstream edge of mixing zone (SW-11) not to exceed Chronic NRWQC of 150 ug/l
  - Swimming in seep area not considered an exposure pathway
- Surface water near Annabessacook Lake (SW-15) not to exceed 5 ug/l (PCL)
  - Assumes that the lake is a source of drinking water
- Evaluate performance of Pilot Study after 3 years of monitoring

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Checked/Date: JBR 5/20/15

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Proposed Pilot Study Performance Monitoring Locations
Hoyt Brook Seep Pilot Study

3617157353

Figure 6

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amec
foster
wheeler

APPENDIX A

SPECIFICATIONS

GEOSYNTHETICS

PART 1 GENERAL

1.01 SUMMARY

A. This specification includes geotextile and geogrid for subgrade improvement, reinforcement, and separation in the construction of the seep area. The CONTRACTOR shall furnish the geosynthetics as specified herein. Storing, cutting, and placing geogrid and geotextiles shall be completed in accordance with these specifications and in reasonably close conformity to the lines, grades, and dimensions shown on the Contract Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Pilot Study Work Plan

B. The Contract Riprap Specification

C. The Contract Topsoil Specification

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM)
1. ASTM D 3786 - Hydraulic Bursting Strength of Geotextile Fabrics
2. ASTM D 4354 - Practice for Sampling of Geosynthetics for Testing
3. ASTM D 4355 - Deterioration of Geotextiles from Exposure to Light, Moisture, and Heat in a Xenon-Arc Type Apparatus
4. ASTM D 4491 - Water Permeability of Geotextiles by Permittivity
5. ASTM D 4533 - Trapezoid Tearing Strength of Geotextiles
6. ASTM D 4632 - Grab Breaking Load and Elongation of Textiles
7. ASTM D 4751 - Determining Apparent Opening Size of a Geotextile
8. ASTM D 4759 - Practice for Determining the Specification Conformance of Geosynthetics
9. ASTM D 4833 - Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
10. ASTM D 4844 - Strength of Sewn or Thermally Bonded Seams of Geotextiles
11. ASTM D 4873 - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples
12. ASTM D 5199 - Grab Breaking Load and Elongation of Textiles
13. ASTM D 5261 - Standard Test Method for Measuring Mass Per Unit Area of Geotextiles
14. ASTM D 5818 - Practice for Obtaining Samples of Geosynthetics from a Test Section for Assessment of Installation Damage.
15. ASTM D 6241 - Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe
16. ASTM D 6637 - Standard Test Method for Individual Geogrid Junction Strength

17. ASTM D 7737 - Standard Test Method for Individual Geogrid Junction Strength
18. ASTM D 7748 - Standard test Method for Flexural Rigidity of Geogrids, Geotextiles and Related Products.

B. Geosynthetic Research Institute (GRI)
   1. GRI GG9 - Torsional Behavior of Bidirectional Geogrids When Subjected to In-Plane Rotation

C. U.S. Environmental Protection Agency (EPA)
   1. EPA 9090 – Compatibility Test for Wastes and Membrane Liners

1.04 SUBMITTALS

A. Submit geogrid and geotextile product data sheets and certification, and installation guidelines, from the Manufacturer that the geosynthetic products supplied meet the requirements of Part 2.01 of this Section.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Geogrid and geotextile labeling, shipment, and storage shall follow ASTM D 4873 requirements.

B. The CONTRACTOR shall check the geogrid and geotextile materials upon delivery to verify that the proper materials have been received. The geogrid and geotextile rolls shall be inspected by the CONTRACTOR to be free of flaws or damage occurring during manufacturing, shipping, or handling.

C. During all periods of storage and handling, geosynthetics shall be protected from direct sunlight, ultraviolet rays, temperatures greater than 140° F, mud, dirt, dust and debris. To the extent possible, the geosynthetic materials shall be maintained wrapped in a heavy duty protective covering until installed.

PART 2 PRODUCTS

2.01

A. Non-Woven Geotextile: Non-woven geotextile fabric used on the Project shall be a non-woven polyester or polypropylene fabric. The fabric shall be GSE Environmental NW10 or an approved equal, and shall meet the following minimum physical requirements of Table 1. Non-woven geotextile fabric shall be installed to prevent migration of fine soil particles into the rip-rap drainage layer that is in contact with the seep, as shown on the Drawings.

Table 1. Minimum Physical Properties of Non-Woven Geotextile Fabric

Property	Value	Test Method
Grab Tensile Strength	260 lb	ASTM D 4632
Grab Tensile Elongation	50 percent	ASTM D 4632
CBR Puncture Strength	725 lb	ASTM D 6241
Water Flow Rate	75 gpm/sf	ASTM D 4491
Permittivity	1.0 sec^{-1}	ASTM D 4491
Apparent Opening Size	100 Sieve	ASTM D 4751
Trapezoidal Tear	100 lb	ASTM D 4533
Unit Weight	10 oz/yd^2	ASTM D 5261
UV Resistance % Retained after 500 hrs	70	ASTM D 4355

B. Geogrid: The geogrid used on the Project shall be GSE Environmental Syntec Biaxial Geogrid SBx 15 or an approved equal. The geogrid shall be installed at the bottom of the excavation to provide reinforcement to the subgrade and embankment, as shown on the Drawings. The geogrid shall be integrally formed and deployed as a single layer having the properties listed in the Table 2 (all values are minimum average roll values unless a range or characteristic is indicated):

Table 2. Minimum Physical Properties of Geogrid

Property	Value	Test Method
Aperture Stability Modulus at 20 cm-kg (2.0 m-N)	0.75 m-N/deg	GRI GG9
Rib Shape	Rectangular or Square	Observation
Minimum Rib Thickness	0.07 in (1.78 mm)	Calipered
Nominal Aperture Dimensions	1.0 to 1.2 in (25 to 33 mm)	I.D. Calipered
Junction Efficiency	93 %	ASTM D 7737-11
Flexural Stiffness	2,000,000 mg-cm	ASTM D 7748-12
Ultimate Tensile Strength	--	ASTM D 6637-10 Method A
- MD	1,850 lb/ft (27.0 kN/m)	ASTM D 6637-10 Method A
- XMD	2,050 lb/ft (30.0 kN/m)	ASTM D 6637-10 Method A
Tensile Strength at 2% Strain	--	ASTM D 6637-10 Method A
- MD	580 lb/ft (8.5 kN/m)	ASTM D 6637-10 Method A
- XMD	690 lb/ft (10.0 kN/m)	ASTM D 6637-10 Method A
Tensile Strength at 5% Strain		ASTM D 6637-10 Method A
- MD	1,200 lb/ft (17.5 kN/m)	ASTM D 6637-10 Method A
- XMD	1,370 lb/ft (20.0 kN/m)	ASTM D 6637-10 Method A
Resistance to Long Term Degradation	100%	EPA 9090
Resistance to UV Degradation	100%	ASTM D4355-05
Resistance to Installation Damage	95%SC / 93%SW / 90%GP	ASTM D5818; ASTM D 6637

PART 3 EXECUTION

3.01 PREPARATION

A. Subgrade surface grading shall be constructed to the lines, grades and cross sections indicated on the Drawings and shall be graded relatively smooth and free of protrusions that could damage the geosynthetics, as directed by the ENGINEER. The ENGINEER

reserves the right to increase or decrease the grade elevations or make such other changes in the grading as may be deemed necessary.

D. The CONTRACTOR shall not commence geogrid and geotextile installation or cover material placement until the ENGINEER has inspected and accepted the subgrade preparation.

3.02 GEOTEXTILE INSTALLATION

A. The CONTRACTOR shall adhere to the manufacturer's recommendations and these specifications during installation of the geotextile fabrics. The surface of the prepared subgrade material shall be sufficiently smooth before placing the geotextile fabric. The geotextile fabric shall be adequately supported on the subgrade material and shall not tear or degrade during installation. The CONTRACTOR shall receive approval from the ENGINEER before geotextile fabric installation over the prepared subgrade.

B. The geotextile shall be laid at the proper elevation and alignment as shown on the Drawings.

C. The geotextile may be temporarily secured in place with ties, staples, pins, sand bags in accordance with Manufacturer's recommendations, or subgrade fill as required by fill properties, fill placement procedures or weather conditions or as directed by the ENGINEER.

D. Fill material shall be placed, spread, and compacted in such a manner that minimizes the development of wrinkles in the geotextile and/or movement of the geotextile.

E. A minimum loose fill thickness of 12 inches is required prior to operation of tracked vehicles over the geotextile. Turning of tracked vehicles should be kept to a minimum to prevent tracks from displacing the fill and damaging the geotextile. When underlying substrate is trafficable with minimal rutting, rubber-tired equipment may pass over the geotextile reinforcement at slow speeds (less than 10 mph).

F. Seams: All Seams for geotextile fabric shall have a non-sewn, minimum overlap of eighteen (18) inches. The Manufacturer's recommendations for overlap requirements shall apply if they are more stringent.

3.03 GEOGRID INSTALLATION

A. The geogrid shall be laid at the proper elevation and alignment as shown on the Drawings.

B. 6 inches of 2-3 inch stone will be placed on top of the geogrid for effective interlocking between the rip-rap and the geogrid.

C. The geogrid shall be installed in accordance with the Manufacturer's installation guidelines provided by the Manufacturer or as directed by the ENGINEER.

D. The geogrid may be temporarily secured in place with ties, staples, pins, sand bags or subgrade fill as required by fill properties, fill placement procedures or weather conditions or as directed by the ENGINEER.

E. The geogrid may be temporarily secured in place with ties, staples, pins, sand bags or subgrade fill as required by fill properties, fill placement procedures or weather conditions or as directed by the ENGINEER.

F. Fill material shall be placed, spread, and compacted in such a manner that minimizes the development of wrinkles in the geogrid and/or movement of the geogrid.

G. The geogrid shall be installed at the bottom of the excavation from the top of the slope to the toe as shown on the Drawings.

H. A minimum loose fill thickness of 12 inches is required prior to operation of tracked vehicles over the geogrid. Turning of tracked vehicles should be kept to a minimum to prevent tracks from displacing the fill and damaging the geogrid. When underlying substrate is trafficable with minimal rutting, rubber-tired equipment may pass over the geogrid reinforcement at slow speeds (less than 10 mph) when integrally-formed geogrids are used.

I. Joints: Joints for geogrids shall have a minimum overlap of 3 feet. The manufacturer's recommendations for overlap requirements shall apply if they are more stringent.

3.04 INSPECTION

A. The ENGINEER may randomly inspect geosynthetic before, during and after installation.

B. Any damaged or defective geosynthetic material (i.e. frayed coating, separated junctions, separated layers, tears, punctures, rips, etc.) will be repaired/replaced in accordance with Section 3.05.

3.05 REPAIR

A. Removal and Replacement: Any damage during installation, placement of materials or failure to cover geosynthetic materials within the specified time, shall warrant removal and replacement of the geosynthetic material by the CONTRACTOR at no additional cost to the OWNER.

B. Proper replacement shall consist of replacing the affected area adding 3 feet (1m) of geogrid or geotextile patch to either side of the affected area. Geogrid patch shall be tied in accordance with manufacturer recommendations and geotextile patch shall be secured via heat bonding or sewing.

3.06 PROTECTION

A. Place fill in a manner that prevents soil from entering the geotextile overlap zone, prevents tensile stress from being mobilized in the geosynthetics, and prevents wrinkles from folding over onto themselves. On slopes, fill shall be placed from the bottom of the slope upward. Fill shall not be dropped onto the geosynthetics from a height greater than

3 feet. No equipment shall be operated directly on top of the geosynthetics. Use equipment with ground pressures less than 5 psi over the geosynthetics. A minimum of 12 inches of soil shall be maintained between full-scale construction equipment and the geosynthetics.

B. Protection from Damage: The geosynthetic materials shall be protected at all times during construction. The Work shall be scheduled such that the covering of the geosynthetic materials with a layer of the specified material is accomplished within seven (7) calendar days or as specified by the Manufacturer after placement of the geosynthetic materials.

END OF SECTION

Riprap

PART 1 GENERAL

1.01 SUMMARY

A. This specification includes the requirements for the Riprap and 3-inch Stone required for this project. The CONTRACTOR shall furnish the rip rap and stone specified herein and as shown on the Contract Drawings

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Pilot Study Work Plan

B. The Contract Geosynthetic Specification

1.03 REFERENCES

A. Maine Erosion and Sediment Control BMP's

1.04 SUBMITTALS

A. The CONTRACTOR shall submittal gradation test results for Riprap and 3-inchStone material. Provide one test per source per material in accordance with ASTM D 5519 Method A.

PART 2 PRODUCTS

2.01 PRODUCTS

A. Riprap will be used to provide a flow path for the seep as shown on the Contract Drawings. The Riprap will be poorly graded with an approximate D50 stone size of 12-inches in diameter and a maximum stone size of 15 inches and no stone less than 8 inches in diameter. The Riprap stone shall consist of hard durable broken stone; solid and non-friable hard and such quality that in will not disintegrate on exposure to water or weathering, be chemically stable and it shall be suitable in all other respects for the purpose intended.

B. 3 inches Stone shall be used in a 6 inch layer on top of the geogrid. This is to have effective interlocking between the riprap and the geogrid. The stone will be poorly graded with an approximate gradation range of 3 to 1-1/2 inches with no stone less than 1 inches in diameter. The stone shall consist of hard durable broken stone; solid and non-friable hard and such quality that in will not disintegrate on exposure to water or weathering, be chemically stable and it shall be suitable in all other respects for the purpose intended

C. During placement over geosynthetics, Riprap shall not be dropped from more than 3 feet.

PART 1 – EXECUTION

3.01 EXAMINATION

A. Conduct verification of existing conditions before starting work.

B. Do not place stone or riprap over frozen or spongy subgrade surfaces.

3.02 PLACEMENT

A. Place riprap and stone in one consistent operation to preclude disturbance or displacement of substrate or geosynthetics. Placement shall begin at the bottom of the area to be covered and continue up slope. Subsequent loads of material shall be placed against previously placed material in such a manner as to ensure a well-graded mass of rock with the minimum practicable percentage of voids, and shall be constructed to the lines and grades shown on the drawings. Placing of riprap and stone by methods which tend to segregate the particle sizes shall not be permitted. Rearranging of individual stones shall be required to the extent necessary to obtain a well-graded distribution of stone sizes as specified above. Any damage to the surface of the geosynthetics during placement shall be repaired before proceeding with the work. Compaction of riprap and stone will not be required, but shall be finished to present an adequately event surface free from mounds or windrows.

B. During riprap placement directly on geosynthetic material, a maximum drop height of 3 feet shall be used.

C. The large stones shall be well distributed and the entire mass of stones in their final position shall be graded to conform to the gradation specified in paragraph 2.01.

D. The finished riprap shall be free from objectionable pockets of small stones and clusters of larger stones.

E. Installed thicknesses for riprap and stone as indicated on drawings, or as required to fill the pit lake and mine shaft.

3.03 INSPECTION

A. The ENGINEER may randomly inspect the Riprap and 3-inchSstone before, during and after installation.

Manufactured Topsoil

PART 1 GENERAL

1.01 SUMMARY

A. This specification covers the placement of manufactured topsoil in the seep area as part of the cover system over the riprap seep collection layer. The CONTRACTOR shall furnish the manufactured topsoil as specified herein. The cover system will consist of 18 inches of Common Borrow placed on top of the geotextile covering the riprap seep collection layer and a final 6-inch layer of a manufactured topsoil. The Manufactured Topsoil layer will consist of a 6-inch layer of an approximate 80% mix of Common Borrow and 20% Erosion Control Mix.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Pilot Study Work Plan

B. The Contract Seed Mixture Specification

C. The Contract Geosynthetic Specification

1.03 REFERENCES

A. Maine Erosion and Sediment Control BMP's

B. Maine DOT Standard Specification 619 - Mulch

C. Maine DOT Standard Specification 714.04 - Erosion Control Mix

1.04 SUBMITTALS

A. Manufactured Topsoil: Source test results.

PART 2 PRODUCTS

2.01 MANUFACTURED TOPSOIL

A. Common Borrow: Shall consist of good quality friable mineral soil consisting of a sandy silt or clay, silty or clayey fine sand that is free of stones over 3 inches and meeting the following requirements:

1. Provide mineral soil material with a minimum 20 percent and a maximum of 80 percent passing the No. 200 sieve and not more than 15 percent clay and not more than 10 percent gravel by volume.
2. Reasonably free from clay lumps, stones, brush, objectionable stumps, roots,

litter, toxic substances, noxious weeds, and other material or substances which may be harmful to plant growth or be a hindrance to grading, planting and maintenance operations.

3. The pH of the material is recommended to be between 6.0 and 7.5 as guidance.

B. Manufactured Topsoil: Manufactured topsoil shall consist of a mixture of Erosion Control Mix (ECM) and Common Borrow mineral soil (approximately 20% ECM to mineral soil) such that the final mixture consists of good quality organic friable soil consisting of a sandy loam, loam or silty loam that is free of stones over 3 inches and meeting the following requirements:

1. The pH of the material is recommended to be between 6.0 and 7.5 as guidance.
2. Topsoil shall have at least 6 percent by weight of fine textured stable organic material, and no greater than 20 percent. Muck soil shall not be considered topsoil.
3. Topsoil containing soluble salts greater than 500 parts per million shall not be used.
4. Topsoil manufactured from mineral soil and organic compost material to these specified requirements is acceptable.

C. Manufactured soils shall be tested and conform to the requirements listed below. Provide topsoil source testing at 1 test per source per material.

1. Texture: sandy loam, fine sandy loam, silt loam, or loam: ASTM D 2487.
2. Organic matter (loss on ignition): 6 – 20 %
3. pH: 6.0 – 7.5: ASTM D 4972
4. Soluble salts: < 75 mg/kg

D. Erosion Control Mix: Erosion Control Mix shall contain a well-graded mixture of particle sizes with bark fragments less than 6-inch and stones 3 inches or less in diameter. Mulch must be free of refuse, physical contaminants and material toxic to plant growth. The mix composition shall meet the following standards:

1. The organic matter content shall be between 60 and 100%, dry weight basis.
2. Particle size by weight shall be 100% passing a 6 inch screen and a minimum 70%, maximum of 85%, passing a .75 inch screen.
3. The organic portion needs to be fibrous and elongated.
4. Large portions of silts, clays or fine sands are not acceptable in the mix.
5. Soluble salts content shall be <4.0 mmhos/cm.
6. The pH should fall between 5.0 and 8.0.
7. The CONTRACTOR shall certify that the Mulch is clean (free of contamination) and meets all Maine Erosion and Sediment Control BMP requirements.

PART 3 EXECUTION

3.01 APPLICATION

A. 18 inches of Common Borrow will be spread in an even uniform layer over the geotextile.

B. 6 inches of Manufactured Topsoil will be spread evenly over the 18 inches of Common Borrow.

C. Deposit Common Borrow and Manufactured Topsoil on prepared areas to obtain a reasonable uniform depth as shown on the Drawings. Manufactured Topsoil may be created by spreading and mixing Erosion Control Mix into the top final 6-inch layer of Common Borrow placed in a total thickness of 24 inches. Spread and till, raking out pieces of sod, roots, and grass if they are in abundance. Spread into an even uniform layer by rolling to prepare for liming, fertilizing, and seeding.

D. Compaction and traffic on the installed manufactured topsoil layer shall be minimized.

3.02 INSPECTION

A. The ENGINEER may randomly inspect the Manufactured Topsoil before, during and after placement.

B. The CONTRACTOR shall inspect the completed top soiled area weekly and prior to during and after storm events to check for erosion and movement of the mulch. Any failures shall be repaired immediately with the addition of mulch or other stabilization methods, as necessary.

C. The CONTRACTOR shall certify that the Common Borrow and Erosion Control Mix is clean (free of contamination) and meets all Maine Erosion and Sediment Control BMP requirements.

Seed Mixture

PART 1 GENERAL

1.01 SUMMARY

A. This specification includes the seed mix to be used to re-vegetate the area. The seed will be placed on top.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Pilot Study Work Plan

B. The Contract Topsoil Specification

1.03 REFERENCES

A. Maine Erosion and Sediment Control BMP's

B. New England Wet-Mix Seed (see attached)

1.04 SUBMITTALS

A. Grass Seed Vendor's Certificate: CONTRACTOR shall submit for approval by the ENGINEER the seed vendor's certified statement for the grass seed mixture required, showing common name, percentage of seed mix by weight, percentages of purity and germination, year of production, date of packaging, and location of packaging.

PART 2 PRODUCTS

2.01 PRODUCTS

A. New England Wet-mix seed mix will be used to re-vegetate the area. It contains a wide variety on native seeds which are suitable for most wetland areas in Maine.

B. Mulch:
1. Straw, hay, or wood cellulose fiber mulch mulches shall meet the requirements of the Maine Erosion Control Standards.
2. Straw or hay mulch shall consist of late cut, matured, and cured hay or straw that is free from primary noxious weed seeds.
3. Mulch anchoring - Provide peg and twine, mulch netting, wood cellulose fiber, or tackifiers in accordance with Maine Erosion Control Standards.
4. Nettings shall be 100% degradable.

5. Tackifier shall consist of commercially developed products for tacking of hay or straw. Binder shall be free of refuse, physical contaminants, and materials toxic to plant growth.

PART 3 - EXECUTION

3.01 PREPARATION

A. All Areas to be Seeded:
1. Shall be worked with a disk, harrow, dragged with a chain, mat or blade, machine-raked, or hand-worked as necessary to provide a reasonably firm but friable seedbed.
2. Shall meet the specified grades or blend and match existing grades and are free of growth and debris.
3. Take care to prevent the formation of low places and pockets where water will stand.

B. Depth of Tillage: 2 inches or as directed by the ENGINEER

3.02 APPLICATION

A. Seeding:
1. Perform seeding and mulching upon completion for final restoration of a unit or portion of the project.
2. Apply seed at rate recommended by seed vendor. Seed shall be applied by hand-operated mechanical equipment with the materials in a dry form. The use of hand shovels to spread the materials will not be allowed.
3. The ENGINEER reserves the right to prohibit the use of any equipment that is unsuitable or inadequate for the proper performance of the work; immediately remove all rejected equipment from the Project.

B. Mulch:
1. Undertake immediately after each area has been properly prepared.
2. Apply Straw or hay mulch shall at 2 ton/acre (90 lbs/1000sq.ft.) or such that over 90% surface coverage is provided.
3. Blowing chopped mulch will be permitted when authorized.
4. Authorization will be given when it can be determined that the mulch fibers will be of such length and applied in such a manner that there will be a minimum amount of matting that would retard the growth of plants.
5. Straw or hay mulch should cover the ground enough to shade it, but the mulch should not be so thick that a person standing cannot see ground through the mulch.
6. Remove matted mulch or bunches.
7. When specified, anchor mulch in accordance with the approved Erosion Prevention and Sediment Control Plan and Section 31 25 00, "Erosion and Sedimentation Control."
8. Properly dispose of all baling wire or rope offsite.

3.03 SEEDING SEASONS

A. Conduct permanent seeding between August 15 and September 1, or as directed or permitted by the ENGINEER.

B. Do not seed during windy weather or when the ground is frozen, excessively wet, or otherwise untillable.

3.04 CARE AFTER SEEDING

A. Protect and care for seeded areas until final acceptance of the work, and repair any damage to seeded areas caused by pedestrian or vehicular traffic or other causes, at the Contractor's expense.

B. If necessary, place barricades and suitable signs to protect the seeded areas.

C. Apply water to maintain proper moisture to promote growth. Use approved water wagons or tanks or other approved devices to apply water in the form of a spray or sprinkle without erosive force. Apply water prior to 10:00 a.m. and after 4:00 p.m. to minimize losses due to evaporation.

D. Cut back weeds growing in seeded areas to prevent them from dominating the desired grass plants.

E. Hay mulch to be provided as described on the Drawings.

F. To be acceptable, a stand of grass shall show a reasonably thick, uniform stand, free from sizable areas of thin or bare spots, with a uniform coverage of at least 90

G. Reseed any parts of seeded areas which fail to show a uniform stand until all areas are covered with grass, at the CONTRACTOR's expense.

H. Maintenance Period:
   1. This period shall extend for 60 days or until the turf has been has been completed and accepted on all areas.
   2. Acceptable grass areas shall have coverage of not less than 90 percent of permanent grasses at the termination of the maintenance period.

Plant Mix

NEW ENGLAND WETLAND PLANTS, INC

820 WEST STREET, AMHERST, MA 01002
PHONE: 413-548-8000 FAX 413-549-4000
EMAIL: INFO@NEWP.COM WEB ADDRESS: WWW.NEWP.COM

New England Wetmix (Wetland Seed Mix)

Botanical Name	Common Name	Indicator
Carex lurida	Lurid Sedge	OBL
Carex scoparia	Blunt Broom Sedge	FACW
Verbena hastata	Blue Vervain	FACW
Carex lupulina	Hop Sedge	OBL
Scirpus atrovirens	Green Bulrush	OBL
Panicum rigidulum	Redtop Panic Grass	FACW+
Deschampsia cespitosa	Tufted Hairgrass	FACW
Bidens aristosa	Tickseed Sunflower/Bur Marigold	FACW
Eleocharis palustris	Creeping Spike Rush	OBL
Juncus effusus	Soft Rush	FACW+
Carex crinita	Fringed Sedge	OBL
Mimulus ringens	Square Stemmed Monkey Flower	OBL
Aster puniceus	Swamp Aster	OBL
Eupatorium perfoliatum	Boneset	FACW
Glyceria canadensis	Rattlesnake Grass	OBL
Asclepias incarnata	Swamp Milkweed	OBL
Helenium autumnale	Common Sneezeweed	FACW+
Penthorum sedoides	Ditch Stonecrop	OBL

PRICE PER LB. $135.00
REQ. QUANTITY: 1 LBS.
TOTAL $135.00
APPLY: 18 LBS/ACRE
1 LB/2500 SQ FT
MINIMUM QUANTITY: 1 LBS

The New England Wetmix (Wetland seed mix) contains a wide variety of native seeds which are suitable for most wetland restoration sites that are not permanently inundated. All species are best suited to moist disturbed ground as found in most wet meadows, scrub shrub, or forested wetland restoration areas. This mix is well suited for detention basin borders, and the bottom of detention basins not generally under standing water. The seeds will not germinate under inundated conditions. If planted during the fall months, the seed mix will germinate the following spring. During the first season of growth, several species will produce seeds, while other species will produce seeds after the second growing season. Not all species will grow in all wetland situations. This mix is composed of the wetland species most likely to grow in created/restored wetlands and should produce more than 75% ground cover in two full growing seasons. Always apply on clean bare soil. The mix may be applied by hydro-seeding, by mechanical spreader, or on small sites it can be spread by hand. Lightly rake, or roll to ensure proper soil-seed contact. Best results are obtained with a Spring seeding. Late Spring and Summer seeding will benefit with a light mulching of clean weed-free straw to conserve moisture. If conditions are drier than usual, watering may be required. Late Fall and Winter dormant seeding require an increase in the seeding rate. Fertilization is not recommended. Preparation of a clean weed free soil surface is necessary for optimal results.

New England Wetland Plants, Inc. may modify seed mixes at any time depending upon seed availability. The design criteria and ecological function of the mix will remain unchanged. Price is $/bulk pound, FOB warehouse, plus S&H and applicable taxes.