FEASIBILITY STUDY

FINAL
FIELD SAMPLING PLAN

for

Stratford Army Engine Plant
Stratford, Connecticut

Contract No.: W912WJ-15-D-0003
Task Order No.: 003

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Prepared for:

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This is to certify that Amec Foster Wheeler has performed a peer technical review of this deliverable under USACE NAE Contract No. W912WJ-15-D-0003 consistent with Amec Foster Wheeler's Quality Management Program Procedure-PJM-PRO-002, Technical Review.

United States Army Corps of Engineers, New England District
Stratford Army Engine Plant, Stratford, CT
Final Field Sampling Plan

QUALITY ASSURANCE STATEMENT

Delivery Order Title: Stratford Army Engine Plant Feasibility Study

Task Order No.: 0003

Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler) has prepared this Field Sampling Plan for the Feasibility Study Work Plan for the Stratford Army Engine Plant, Stratford, CT project. The Program Manager and Project Manager have completed a technical and quality assurance review of this document for technical accuracy and completeness, in accordance with the objectives of the revised Performance Work Statement, dated January 13, 2017 and Amec Foster Wheeler's Final Proposal, dated March 2, 2017.

Rod Pendleton, P.G.
Project Manager

January 5, 2018
Date

Jeffrey S. Pickett, C.G.
Program Manager

January 5, 2018
Date

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GLOSSARY OF ABBREVIATIONS AND ACRONYMS

Amec Foster Wheeler	Amec Foster Wheeler Environment & Infrastructure
AOI	Area of Investigation
ASTM	American Society for Testing and Materials
bgs	below ground surface
BL	Blank
CENAE	United States Army Corps of Engineers New England District
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Chain-of-Custody
CTDEEP	Connecticut Department of Energy and Environmental Protection
DP	Duplicate
EB	Equipment Blank
ERM-Q	Effects Range Medium Quotient
FDR	Field Data Record
FOL	Field Operations Leader
FS	Feasibility Study
FSP	Field Sampling Plan
ID	Identification
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NPDES	National Pollutant Discharge Elimination System
PCB	Polychlorinated Biphenyls
P-GDT	Pressure Gravity Drainage Testing
ppm	parts per million
Project	Stratford Army Engine Plant Feasibility Study
QC	Quality Control
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act

RDT	rapid drainage test
RI	Remedial Investigation
SAEP	Stratford Army Engine Plant
SB	Source Blank
SD	Sediment
SOP	Standard Operating Procedure
SPLP	Synthetic Precipitation Leaching Procedure
SSHP	Site-Specific Safety and Health Plan
SW	Surface Water
TB	Trip Blank
TCLP	Toxicity Characteristic Leaching Procedure
TSCA	Toxic Substances Control Act
VOC	Volatile Organic Compound
SSHP	Site-Specific Safety and Health Plan
U.S.	United States
USACE	United States Army Corps of Engineers
U.S. Army	United States Department of the Army
USEPA	United States Environmental Protection Agency

1.0 INTRODUCTION

This Field Sampling Plan (FSP) has been prepared by Amec Foster Wheeler Environment & Infrastructure (Amec Foster Wheeler) for the Stratford Army Engine Plant (SAEP) Feasibility Study (FS) (Project), in Stratford, Connecticut (**Figure 1-1**) on behalf of United States Army Corps of Engineers (USACE), New England District (CENAE). The purpose of the FSP is to collect data that can be used in combination with data from previous investigations to prepare a Feasibility Study (FS) for remedial alternatives evaluation at the Site.

The FSP provides guidance for field work to be conducted including the sampling and data-gathering methods Amec Foster Wheeler and its subcontractors will use to collect Project data during the FS. The work proposed within this FSP, as well as preparation of the FS Report, will be conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980.

1.1 Background

The former SAEP is located at 550 Main Street, Stratford, Connecticut. The Site Areas of Investigation (AOIs) for this project are the Tidal Flats area between the SAEP and the Housatonic River channel, and the Outfall 008 drainage ditch. The locations of these AOIs, along with the background reference area, are presented in **Figure 1-2**. This FSP contains proposed investigative activities for the Tidal Flats only; no additional investigations are planned at the Outfall 008 Drainage Ditch.

The property was developed in 1927 for Sikorsky Aircraft. Aircraft and engines have been manufactured at the facility since 1929. Wastes generated included waste oils, fuels, solvents, and paints. An on-site chemical waste treatment plant operated to treat waste generated at the facility, and released effluent to the Housatonic River under a National Pollutant Discharge Elimination System (NPDES) permit. Lagoons on the Site were regulated under the Resource Conservation and Recovery Act (RCRA), and were closed under RCRA in the 1980s. The facility was cited in 1983 for violating the Toxic Substances Control Act (TSCA) regarding reporting of polychlorinated biphenyl (PCB)-containing transformers. The Site was owned by the United States (U.S.) Air Force until 1976, when ownership was transferred to the U.S. Army (USEPA, 2016).

All manufacturing operations at the facility have ceased, and some office space is currently utilized for site security and building maintenance. The Connecticut Department of Energy and Environmental Protection (CT DEEP) is the lead regulatory agency in remedial oversight at the Site (USEPA, 2016).

1.2 FSP Organization

The FSP provides the sampling objectives and describes the sediment sampling program for the Tidal Flats area, as well as descriptions of the treatability testing to be conducted. This FSP complements the Site-Specific Safety and Health Plan (SSHP) (Amec Foster Wheeler, 2017a) and the Quality Assurance Project Plan (QAPP) (Amec Foster Wheeler, 2017b), which are provided under separate cover. The FSP addresses the following topics:

- Section 1.0 – Introduction
- Section 2.0 – Project Background
- Section 3.0 – Project Organization and Responsibilities
- Section 4.0 – Objectives and Scope
- Section 5.0 – Field Procedures
- Section 6.0 – Field Operations Documentation
- Section 7.0 – Sample Designation, Packaging, and Shipping
- Section 8.0 – Investigation Derived Waste
- Section 9.0 – Non-Conformance/Corrective Actions
- Section 10.0 – Reporting
- Section 11.0 - References

2.0 PROJECT BACKGROUND

2.1 Investigation History

There have been numerous investigations of the sediments in the Tidal Flats area prior to 2014, as summarized below:

- Sampling of the Tidal Flats and Outfall 008 drainage ditch sediments was conducted by the U.S. Army in 1992, 1994, and 1999 as part of a Remedial Investigation (RI).
- Background/reference sediment sampling was conducted in 1994, 1999, 2009, and 2012.
- In April 2014, the U.S. Department of the Army issued the Final Work Plan for Determination of Sediment Remediation Endpoints, Tidal Flats and Outfall 008, Stratford Army Engine Plant, Stratford, Connecticut (AMEC, 2014a). The Final Work Plan was reviewed by CT DEEP. The Final Work Plan proposed sediment toxicity testing as a means to assist in developing the remediation endpoint goals for the sediments in question, and laid out the steps for development of the remediation endpoints. The Final Work Plan also presented some of the historical sediment data referenced above. In April and May 2014, additional sediment sampling and toxicity testing were conducted, and in September 2014 the Army issued the Draft Sediment Remediation Endpoints Report for the Tidal Flats and Outfall 008 (AMEC, 2014b). The report presented the results of sediment chemical characterization, toxicity testing results, and proposed sediment remediation endpoints for the Tidal Flats and Outfall 008 areas. The results of the toxicity testing were that toxicity was not definitively linked with a specific chemical present in the sediment. As an alternative to using toxicity test results alone for development of remediation endpoints, the report presented statistical analyses of the data and proposed using and Effects Range Medium Quotient (ERM-Q) of 1.0 for the metals cadmium, chromium, and copper.
- On December 2, 2014, the CT DEEP submitted comments on the Draft Sediment Remediation Endpoints Report (AMEC, 2014b). CT DEEP concluded from their review of the report that toxicity was not definitively linked with a specific chemical, and recommended setting the remedial goal based on multiple chemicals to more accurately describe the chemical quality associated with the non-toxic samples. CT DEEP's recommendations for determining the sediment remediation endpoint goals were as follows:
    - Use an ERM-Q of 0.5 for the eight metals arsenic, cadmium, chromium, copper, lead, nickel, silver, and zinc; an ERM-Q greater than 0.5 would require remediation.
    - Concentrations of mercury and PCBs should generally not be present in post-remedial conditions.

    - Additional site characterization was needed to refine the area of sediment contamination both at depth within the Tidal Flat and Outfall 008 areas, as well as within surficial and deeper sediments between the eastern edge of the intertidal flats and the Housatonic River.

- On February 17, 2015, the U.S. Department of the Army responded to CT DEEP's comments indicating that they agreed to removal of contaminated sediments with ERM-Qs greater than 0.5 from the 0-2 foot below ground surface (bgs) interval in both the Tidal Flats and Outfall 008 areas, as well as replacement with CT DEEP-approved backfill. Following further discussions with CT DEEP, the U.S. Department of the Army issued a memorandum to CT DEEP on March 24, 2015 indicating that they were committed to proceeding with the additional sampling in a timely manner to ensure re-development of the SAEP site without further delay.
- In April 2015, additional sediment sampling was conducted in the Tidal Flats and Outfall 008 areas, as follows:
    - between the Tidal Flats and the margin of the dredged Housatonic River channel
    - at depths greater than 2 feet (ft) bgs in the Tidal Flats
    - at depths greater than 2 ft bgs in the Outfall 008 drainage ditch.
- Results of the sediment chemical characterization, proposed sediment remediation endpoints, and preliminary remediation footprints for the Tidal Flats and Outfall 008, are presented in the Draft Sediment Remediation Endpoints Report (Amec Foster Wheeler, 2017c).

2.2 Physical Project Description

The Tidal Flats area is approximately 5,000 ft upstream of the mouth of the Housatonic River, where the river enters Long Island Sound. The Tidal Flats are classified as estuarine and marine wetlands. The Tidal Flats consist of fine-grained sediments exposed twice daily during low tide. The sediment is soft and deep, and walking more than a few feet out onto the Tidal Flats is not possible without sinking to depths above the knee. Maximum water depth in the Tidal Flats area is approximately five feet at high tide, but only two to three feet deep near the Dike boundary adjacent to the Tidal Flats.

The sediments are un-vegetated, except for the northwest portion supporting limited emergent vegetation. A Causeway extends from the upland SAEP facility toward the river channel and divides the Tidal Flats into two areas (see **Figure 1-2**). The Causeway was constructed over the Tidal Flats in 1929 to provide access to the river channel. A stone jetty borders the Tidal Flats on the northeast, separating the Tidal Flats from the river. The jetty was built in 1932 to divert effluent from the Stratford Wastewater Treatment Plant, which is located immediately upstream from the Tidal Flats. Numerous outfalls formerly released liquid waste streams from SAEP industrial operations to the Tidal Flats. Several of the outfalls currently function to pump storm water and groundwater infiltration from the SAEP facility.

2.3 Summary of Existing Project Data

Data from previous Tidal Flats area investigations indicate a general decrease in metals and PCB concentrations with depth, with the exception being the area around the tip of the Causeway, as well as the outer fringes of the Tidal Flats adjacent to the stone jetty and toward the Housatonic River channel. The additional data collected in 2015 at the outer limits of the Tidal Flats support prior interpretations that there may be source(s) of contamination that are not associated with the SAEP facility, transported to the Tidal Flats by the Housatonic River. This interpretation is supported by ERM-Q, total PCB, and mercury distributions in the 2-3 and 3-4 foot bgs sample intervals.

Total PCBs exceeding 1.0 parts per million (ppm), and mercury concentrations greater than the ERM value of 0.71 ppm, are generally co-located with samples having an ERM-Q greater than 0.5. The 5-6 and 7-8 foot bgs data indicate no criteria were exceeded, except for a 7-8 foot bgs total PCBs concentration greater than 1.0 ppm along the Dike near outfalls OF-002 & OF-003.

3.0 ORGANIZATION AND RESPONSIBILITIES

The proposed project team, shown in the attached Project Organizational Chart (**Figure 3-1**), consists of staff from our Portland, Maine, office. The project team is familiar with many of USACE's requirements, which will enable the work to be performed efficiently, safely, and in accordance with USACE's policies and procedures.

The project will be managed out of our Portland, Maine office by Rod Pendleton. In addition to Rod Pendleton, the following presents a list of key personnel that will work on the project:

Name	Title
Jeff Pickett, CG	Program Manager
Rod Pendleton, PG	Project Manager
Ann Bernhardt, CQM	Quality Control Assurance Manager
Cindy Sundquist, CIS, CSP	Certified Industrial Hygienist/Safety Professional
Tony Delano, PE	FS Technical Leader
Rebecca Brosnan	Investigation Technical Lead
Mike Lounsbury	Field Operations Leader
Wolfgang Calicchio	Project Chemist

The qualifications of key Amec Foster Wheeler personnel and their organizational responsibilities are summarized below.

Jeffrey Pickett, CG, is the **Program Manager**, responsible for the overall quality of the project, as well as ensuring that the necessary resources are made available to the Amec Foster Wheeler PM for execution of the work. He also provides a critical outlet for CENAE outside the core project team and is in a position to coordinate with other Amec Foster Wheeler executives to implement corrective actions.

Rod Pendleton, PG, is Amec Foster Wheeler's **Project Manager**. He will be the primary day-to-day contact with CENAE personnel and will be ultimately responsible for the technical and relational success of the effort. He is an Amec Foster Wheeler-certified project manager with 29 years of experience performing and managing environmental investigations.

Ann Bernhardt, CQM, is the **Quality Control Assurance Manager** and will function independently from the Amec Foster Wheeler PM to verify that Amec Foster Wheeler QA/QC policy is implemented.

Cindy Sundquist is a **Certified Industrial Hygienist and Certified Safety Professional** responsible for Northeast Region Health and Safety for Amec Foster Wheeler. She is responsible for maintaining health and safety training of the personnel involved on the project, as well as review of the Site Safety and Health Plan.

Tony Delano, PE, has over 25 years of environmental consulting experience, and as the **FS Technical Lead** will be responsible for the development of the FS and cost estimating, and provide technical oversight of project deliverables during their preparation.

Rebecca Brosnan will act as the **Investigation Technical Lead**, responsible for development of the Field Sampling Plan and guiding the field team to fulfill the objectives of the FSP. She will be the communication link to the FS Technical Lead during the field investigations and subsequent reporting.

Michael Lounsbury is Amec Foster Wheeler's Project **Field Operations Leader** for the FS tasks. As a field lead, Mr. Lounsbury is responsible for leading the field activities in accordance with the FSP and QAPP to meet the objectives of the FS tasks, and is the communication link between the field team, subcontractors, Amec Foster Wheeler FS Technical Lead, and Amec Foster Wheeler PM. He will be the primary point of contact with the sediment coring subcontractor during the field investigation, as well as ensuring that the samples collected are collected, handled, and shipped to the analytical laboratory and treatability test laboratory in accordance with the FSP and QAPP.

Wolfgang Calicchio will act as the **Project Chemist**, responsible for development of the QAPP, as well as need for corrective action for field and analytical issues. He is responsible for notifying the PM of any QA/QC issues with project field samples or analytical results as soon as discrepancy is identified. He will be the primary point of contact with the analytical laboratory responsible for the analysis of sediment samples collected during the project.

Worksheet #s 5 through 7 in the QAPP specify organization and responsibilities, communications pathways, and personnel responsibilities and qualifications, respectively (Amec Foster Wheeler, 2017b).

The following subcontractors will be involved in this project:

Sediment Coring Subcontractor:
TG&B Marine Services, Inc.
Monument Beach, MA
Mark Avakian
Tel. # 508-326-5686

Analytical Laboratory:
Envirosystems, Inc.
1 Lafayette Rd
Hampton, NH 03842

Kirk Cram
Tel. # 603-926-3345

Treatability Testing Subcontractor:
Kemron Environmental Services, Inc.
1359-A Ellsworth Industrial Blvd.
Atlanta, GA 30318
Tommy Jordan
Tel. # 404-636-0928

Engineering Consultant:
John Lally, PE
Lally Consulting LLC
2811 Fairview Avenue East, Suite 1004
Seattle, Washington 98102
Tel. # 206-325-0274

4.0 OBJECTIVES AND SCOPE

This section identifies the objectives and scope of the project activities planned, as well as the project schedule.

4.1 Objectives

The general objective of the work to be conducted in this FSP is to supplement the usable, existing Project data collected to date to support development of the FS. In particular, the sampling and analyses specified in this FSP will fill data gaps and allow for remedial footprints of contaminated sediment in the Tidal Flats Area to be refined, both horizontally and vertically. The FSP includes proposed sample collection, analyses, and testing of contaminated sediments from the Tidal Flats to evaluate treatability of dredged sediments for land-side re-use, as well as to characterize properties of the sediments relevant to dredging, disposal and treatment evaluations.

The objectives of the delineation and treatability testing components of the work proposed in this FSP are as follows:

1. Perform sediment sampling and analyses in the Tidal Flats to further delineate:
   a. concentrations of PCBs from 0-2 feet below ground surface (bgs) at locations where total PCBs have been detected at concentrations exceeding 50 ppm; and
   b. concentrations of PCBs and mercury at depths between 4 and 8 feet bgs near the historic wastewater outfalls which discharged to the Tidal Flats west of the Causeway.
2. Collect samples from the Tidal Flats to conduct bench-scale treatability studies to:
   a. evaluate sediment dewatering, flocculation, stabilization, disposal characteristics, elutriate characteristics, and geotechnical properties; and
   b. evaluate water generated by dewatering sediments for treatability with various technologies aimed at reducing PCBs and metals concentrations.

Section 4.2 presents the scope of work proposed to meet the objectives outlined above.

4.2 Scope of Work

The scope of work detailed in the subsections below presents the major elements of the investigation proposed for the Tidal Flats Area sediments.

4.2.1 Sediment Sampling for Delineation

Sediment samples will be collected to delineate PCB concentrations greater than or equal to 50 ppm. The USEPA Region 1 has requested that additional data is needed to delineate the areas of PCBs greater than or equal to 50 ppm, as the impacted areas do not appear to have been fully delineated. There are general locations in the Tidal Flats sediments in the 0-2 foot depth interval where PCBs have been detected at concentrations exceeding 50 ppm, as depicted in **Figure 4-1**. Amec Foster Wheeler proposes sampling in the 0-1 and 1-2 foot depth intervals around each of these locations using a 50-foot sampling grid. A total of 23 sediment cores are proposed around the three locations, with samples collected from each sediment core from the 0-1 and 1-2 foot depth intervals. Sediment samples will be collected using Piston-Vibracore® techniques, and each sampled depth interval (46 total samples) will be homogenized prior to containerization and submittal to the analytical laboratory for analysis of total PCB Homologs. **Table 4-1** provides a list of core location IDs, coordinates, and sample intervals, and analyses for the 0-2 foot cores.

Figure 4-1 and **Table 4-1** also present locations of 18 additional contingency cores that will be collected over the 0-2' depth interval and processed in the same manner as the first 23cores. However, the samples will be held frozen at the laboratory pending analytical results from the first 35 cores. If there are detections of total PCBs greater than 50 ppm in the samples from the original 23 cores, then the adjacent contingency core sample(s) will be analyzed to further delineate the extent of total PCBs at concentrations greater than 50 ppm.

Additional sediment cores will be collected from the depth interval between 4 and 8 feet near the facility outfalls at locations specified in **Figure 4-2**. There has been one instance of total PCBs detected over this depth interval to the north of Outfall OF-002 at a depth of 7-8 feet (see **Figure 4-2**). CT DEEP has requested that the depth interval between 4 and 8 feet be evaluated for total PCB Homologs, as well as mercury, near Outfalls OF-001, -002, -003, -004, and -007 (**Figure 4-2**). A total of 12 sediment cores are proposed around these outfalls, with samples collected from each sediment core from the 4-5, 5-6, 6-7, and 7-8 foot depth intervals. Sediment samples will be collected using Piston-Vibracore® techniques, and each sampled depth interval (48 total samples) will be homogenized prior to containerization and submittal to the analytical laboratory for analysis of total PCB Homologs and mercury. **Table 4-2** provides a list of core location IDs, coordinates, sample intervals, and analyses for the 4-8 foot cores.

4.2.2 Sediment Sampling for Treatability Testing and Engineering Parameters

Sediment sample collection is proposed with the purpose of evaluating the required treatment for sediment for on-site consolidation, off-site disposal and for dewatering fluids generated during sediment processing. The sediment sample locations were selected from areas with higher concentrations of PCBs, metals, and mercury, and from hydrodynamically diverse areas of the site (shallow vs. deep water, near shore vs. near river, near outfalls, and opposites sides of the causeway) to ensure collection of sediments from potentially differing depositional environments (e.g., representation of variability in sediment grain size). These areas have been selected to ensure that sediments that are potentially more difficult to dewater are tested, so that water treatment performance can be adequately assessed. In addition, areas were selected to provide vertical representation of sediment characteristics for proposed dredging depths. **Figure 4-3** presents the proposed locations of sediment samples to be collected for treatability studies and other engineering evaluations. These proposed treatability and engineering parameter sample locations are shown on **Figure 4-3** in purple as Areas 1, 4, 6, and 8. For each Area, the proposed number of cores, depths, and analyses are presented in a call-out box on the figure. Specific sampling locations within each Area will be determined in the field.

A sample collection matrix for sediment treatability sampling and other engineering parameters is presented in **Table 4-3**. The sampling will include approximately 81 sediment cores, with 57 0-2 ft bgs cores and 24 0-4 ft bgs cores. Depending on the volume of sediment recovered at each core, the number of cores may need to be increased to supply adequate volume for the proposed samples. Samples will be analyzed for treatability, off-site disposal characterization, Synthetic Precipitation Leaching Procedure (SPLP) PCBs and metals, effluent characteristics for dredged material (effluent elutriate test), and geotechnical analyses (see **Table 4-3**). Sediment sampling will be conducted using Piston-Vibracore® drilling/sampling methods.

4.2.3 Surface Water Sampling for Treatability Testing

Surface water samples will be collected to support the bench-scale treatability testing. The locations for surface water sampling are Areas 1, 6, and 8 depicted on **Figure 4-3**. Surface water samples will be collected from a boat during the time when water is present on the Tidal Flats. Samples will be collected using a submersible pump (whale pump, or equivalent), and containerized in clean, decontaminated 5-gallon plastic pails with lids. Surface water sampling will be conducted prior to any coring activities during the same tidal cycle. **Table 4-4** presents the proposed surface water sample location IDs, sample IDs, and volume required for each sample. One 55-gallon sample will be collected as make-up water for treatability studies (Area 1), and three 5-gallon samples will be collected as makeup water for corresponding sediment for elutriate analysis (Areas 1, 6, and 8). The surface water samples will be provided to the treatability testing laboratory.

4.2.4 Treatability Testing

Treatability tests to be conducted as part of this work order are described in the paragraph below. The treatability tests will be conducted by Kemron Environmental Services, Inc.

4.2.4.1 Sediment Dewatering Tests and Disposal Characteristics

Sediment dewatering treatability testing is proposed to help determine selection of the hydraulic or mechanical dredging, and to identify the likely sediment processing (remedial) options for dewatering, whether hydraulic or mechanical dredging is selected.

Several options for dewatering of sediments will be evaluated, discussed in a separate report, and used in the FS evaluations:

- Option 1: Separation/Dewatering using a Settling Pond
- Option 2: Pressure Geotube® Dewatering Test (P-GDT)

- Option 3: Mechanical Dewatering Utilizing the Derrick® HI-G® Dewatering Machine and Fines Recovery System Technology and Clarification Thickeners

Table 4-5 presents the quantities of sediment and surface water required to perform the treatability testing under Options 1 through 3.

Option 1: Evaluation of Chemical Coagulants and Flocculants to Increase Water Solids Separation within a Settling Pond

These tests are appropriate for hydraulically dredged sediments pumped to a settling pond. The following will be estimated:

a. Perform settling rate [feet per minute] of untreated sample;

b. Perform settling rate [feet per minute] using up to four chemical coagulant and flocculent combinations;

c. Evaluate settling rates and settled solids for density and percent dry solids;

d. Evaluate free water phase of various chemical coagulants and flocculent combinations for total suspended solids and Nephelometric Turbidity Units; and

e. Establish an estimated ft^2 area for a settling pond to contain and settle sediment using settling rate data.

Option 2: Pressure Geotube® Dewatering Test (P-GDT)

These tests are designed to simulate the dewatering of hydraulically dredged sediment pumped into a Geotube®. The following will be implemented:

<u>Filtration Tests</u>

a. Filtration testing shall consist of sediment dewatering using P-GDT protocol (see http://www.smartfeedsystem.com/media/pdf/smartfeed_pgdt_procedures.pdf), having a filtration volume design of 1 ft^3.

b. Filtration evaluation will test sediment using no chemical conditioning additives to evaluate if filtrate capture rate and sediment compaction rate meet project goals.

c. Filtration evaluation using chemical conditioning additives will be tested and correlation of filtration capture rates and sediment compaction rates evaluated for best treatment methods for the project goals.

d. Tabulation of data will utilize P-GDT test log.

e. Filtrate will be collected and analyzed for metals and PCBs to determine pre-treatment water concentrations.

Chemical Conditioning (Flocculents) Program Evaluation using Geotube® Rapid Drainage Test (RDT)

a. Flocculent selection and performance evaluation using RDT test method (see http://www.tencate.com/amer/Images/nb_geotube_3tests_tcm29-12838.pdf).

b. Chemical conditioning selection shall be tabulated using RDT test log.

c. Chemical conditioning program evaluated for filtrate solids capture rate and solids compaction rates.

Geotube® Project Estimator

a. Resulting test data will be entered into the Geotube® Estimator (software provided by TenCade Geotube®, see also: http://www.tencate.com/amer/geosynthetics/design/tencate-geotube-estimator/default.aspx) which will provide project parameters for dredge rates, dredge dilution percent, project processing days.

b. The estimator will provide, based on P-GDT test data, estimated yards and wet tons for disposal.

c. Filtration area required to process project in-situ yd^3 of sediment reported as linear feet of Geotube® containment at a specified design circumference.

d. The resulting Geotube® filtration area required will be plotted to scale on a lay-down plan near bulkhead or barges.

Technology Scale-Up to Full-scale Application

a. Testing will provide sufficient data (i.e., to develop estimates of lbs of dry polymer per dry ton of solids) for filtration parameters for programming SmartFeed™ chemical conditioning and data management (see http://www.smartfeedsystem.com/).

b. SmartFeed™ technology is a Geotube® supporting technology which maintains chemical conditioning dosage exactly as was tested during lab testing.

c. The data management of SmartFeed™ will provide daily reports of project parameter goals and water treatment standards for project compliance oversight.

Option 3: Mechanical Dewatering Utilizing the Derrick® HI-G® Dewatering Machine and Fines Recovery System Technology and Clarification Thickeners

The purposes of these tests are to determine size separation parameters using screening, hydrocyclone, and thickening technologies:

a. Conduct screening methods evaluation to remove course fraction of sediment 2” to 200≥ mesh;

b. Conduct screening and hydro cyclone evaluation to remove and dewater fines fraction 200 to 380 mesh;

c. Conduct clarification and dewatering methods for fines fraction 380 to 600 mesh; and

d. Provide project mass-balance showing volume and weight resulting from Option 3 - Processing.

Technology developed by Derrick Corporation will be used to evaluate mechanical dewatering (see http://derrick.com/Products/fines-recovery-system/).

4.2.4.2 Water Treatment Testing

Water generated by dewatering sediments in each of Options 1, 2, and 3 above in subsection 4.2.4.1 will be tested for treatment with several technologies aimed at reducing metals and PCBs to achieve potential permit limits. For each of the 3 options described above, water generated from the dewatering tests will be subjected to further testing. Each sample will be analyzed for target metals and PCBs pre-treatment. Water from each option will be treated using chemically impregnated zeolites, activated carbon, and ion exchange resin media for dissolved metals removal. Dissolved metals removal media will be selected based upon the results of the other technologies tested, and the required permit discharge limits. Following treatment, effluent will be analyzed for PCBs and target metals to determine the effectiveness of treatment.

4.2.4.3 Sediment Stabilization and Consolidation Testing

Similar to the water treatment tests, sediment generated during the testing for Options 1, 2, and 3 above in subsection 4.2.4.1 will be subjected to stabilization agent tests. Each sediment sample will be mixed with three different amendments (currently lime kiln dust, hydrated lime, and sodium silicate Metzo beads) at ratios of 1 percent, 3 percent, and 5 percent wet mass ratio each to determine the optimal percentage and amendment to meet the paint filter test (no free liquids) and geotechnical characters for off- or on-site disposal. The final selected additives will be determined through additional discussion with the treatability vendor and the Army. Each sample with each additive will be tested at the treatability laboratory for strength using a pocket penetrometer, torvane, and unconfined compressive strength for each weight ratio.

4.2.4.4 Sediment Sample Testing for Off-Site Disposal Characterization

Sediment sampling is proposed for the purpose of evaluating characteristics for off-site disposal. Data will be used to evaluate if the material can be disposed of as RCRA Subtitle D (non-hazardous solid waste), as RCRA Subtitle C (hazardous waste), as Toxic Substances Control Act of 1975 remediation waste (based upon PCB concentrations), or if sediment will require treatment prior to disposal (e.g., stabilization to eliminate RCRA toxicity characteristic). Cost assumptions for disposal of sediments will be based upon these data. A single composite sample (the same 40-gallon sample generated for the treatability sampling) will be used for the off-site disposal characterization suite. A subsample will be collected from the single 40-gallon sample composited from Areas 1, 4, and 8 (as shown in **Table 4-3**) for treatability analyses, and submitted for off-site waste disposal characterization. The locations for this sample have been selected to provide a composite that represents typical conditions across areas of the site and contaminants anticipated at relatively higher concentrations.

4.2.4.5 Sediment Sample Testing for On-Site Re-use and Dredged Materials Characterization

In addition to off-site disposal, on-site re-use/consolidation will be evaluated as part of the FS. A total of 14 samples will be collected to characterize the sediment to be removed and potentially placed on-site as fill (see **Table 4-3**, Geotechnical column). Ten of these samples will be discrete samples analyzed for geotechnical parameters, and five will be composite samples analyzed for SPLP PCB Homologs and metals. Geotechnical data will be used to support FS level evaluations for dredging (hydraulic and mechanical dredging) and placement of sediments on site. Data from SPLP analyses will be used to assess the potential for release of site contaminants to groundwater should processed sediments be placed on site as fill. Geotechnical data will also be used to support the analysis of the placement on site of sediments. The proposed sampling locations for on-site re-use and dredged material characterization are shown in purple as Areas 1, 4, 6, and 8 on **Figure 4-3**. Locations for the geotechnical samples have been selected as discrete one foot intervals from areas across the site to represent differing hydrodynamic conditions which can affect sediment characteristics. Locations for SPLP have been selected to ensure adequate depth averaging for the proposed dredging footprint, the full suite of site contaminants, and differing hydrodynamic conditions across the site. **Table 4-3** provides more detail on sampling locations, depth intervals, and analyses. Sample locations are shown on **Figure 4-3**.

4.2.4.6 Sediment Sample Elutriate Testing

Elutriate tests will be run on three composite samples to estimate the dissolved concentrations of site chemical constituents in effluent generated from upland sediment processing and dewatering. Results will be compared against water quality standards to determine the need for water treatment and verify the results from the treatability testing as described above. The “modified elutriate” or “effluent elutriate test” is proposed for these purposes.

The proposed sampling locations for elutriate testing are shown in purple as Areas 1, 6, and 8 on **Figure 4-3**. These areas have been selected to represent various groupings of contaminants and to cover different areas of the site which are subject to differing hydrodynamic conditions. Two cores will be composited over the 0-4 ft interval from locations identified for 4 ft of removal; a third core will be composited over the 0-2 ft interval from a location identified for 2 ft of removal.

4.3 Schedule

The project schedule is presented as **Figure 4-4.** The table below presents the major milestone events through the completion of the FS.

Event	Date
Complete Treatability Sample sediment coring in the Tidal Flats	8/4/2017
Completion of Treatability Testing	1/2/2018
Complete PCB/mercury Sediment Characterization Sampling	10/20/2017
Analyses of Sediment Characterization Samples completed	12/22/2017
Data Validation of Sediment Characterization Samples completed	1/12/2018
Draft FS Report due to CENAE	1/30/2018
Draft Final FS Report due to CENAE, CT DEEP, and USEPA	3/21/2018
Final FS Report due to CENAE, CT DEEP, and USEPA	4/26/2018

5.0 FIELD PROCEDURES

This section of the FSP presents the major elements of the investigation proposed for the Tidal Flats area sediments. Standard Operating Procedures (SOPs) are include in the QAPP (Amec Foster Wheeler, 2017b), and are listed below:

- S-1 Sediment Sampling
- S-2 Surface Water Sampling
- S-3 Calibration of Field Instruments for Water Quality Parameters
- S-4 Decontamination of Field Equipment
- S-5 Sample Chain of Custody Procedure
- S-6 Field Sample Tracking System
- S-7 Sample Packaging and Shipment
- S-8 Use of Field Logbooks

5.1 Rationale/Design

The rationale for the additional sediment PCB delineation, as well as the selection of locations for treatability testing samples and the types of treatability tests to be conducted, are presented in Section 4.2.

5.2 Utility Clearance

Call Before You Dig will be contacted at least one week in advance of investigation activities in the Tidal Flats. Note that prior investigations on the Tidal Flats have not determined that there are any overhead or buried utilities in the Tidal Flats area.

5.3 Field Equipment Calibration

Field instruments requiring calibration include water quality meters for turbidity, pH, specific conductivity, temperature, and salinity. Field monitoring instruments used during the collection of surface water samples will be calibrated in accordance with manufacturer specifications as described in SOP S-3 in the QAPP (Amec Foster Wheeler, 2017b). Instrument numbers, calibration procedures, and instrument performance data will be recorded on a Field Instrument Calibration Record (example included in **Appendix A**).

5.4 Decontamination Procedures for Field Equipment

Decontamination is performed as a QC measure and a safety precaution. It prevents cross-contamination between samples and also helps to maintain a clean working environment for the safety of field personnel.

Decontamination of sediment sampling equipment will be performed between coring locations. Decontamination of sediment coring devices will be conducted via scrubbing surfaces with a phosphate free detergent (LiquiNox), and rinsing with available surface water. Decontamination of field equipment used for sample collection and processing (i.e., stainless steel spoons and bowls for homogenization) will be performed in the same manner, except that the final rinse will be with DI water. The decontamination procedures are described in SOP S-4 in the QAPP (Amec Foster Wheeler, 2017b). Polycarbonate sleeves for collection of Piston-Vibracore® samples will only be used once; therefore, no decontamination is required. The effectiveness of decontamination procedures will be assessed by collection of one equipment rinse blank per type of sample collection equipment per week during the program for samples collected without dedicated equipment/tubing, as discussed in Section 5.10. During the investigation program, a QC blank sample of the source water used for decontamination will be collected (see Section 5.10).

5.5 Sediment Sample Collection

Sediment samples will be collected as outlined below. Sampling equipment must be decontaminated prior to sample collection, as described in Section 5.4.

TG&B Marine Services will use a Trimble® *Ag*GPS 124/132 differential GPS receiver with sub-meter accuracy to maneuver their boat to the coordinates provided in **Tables 4-1** and **4-2** for the PCB delineation samples. For the treatability sample testing samples, the boat will be maneuvered to the areas portrayed in **Figure 4-3**. The boat will be anchored approximately 80 feet up wind of the designated sample location, and maneuvered back to the sampling coordinates, where a spud will be set, thus allowing the boat to remain stationary over the desired location. The user manual for the Trimble® *Ag*GPS 124/132 can be found here: http://trl.trimble.com/docushare/dsweb/Get/Document-9665/Ag124_132%20Rev%20C1.pdf. If a water sample is required for treatability sampling from the area to be cored, then the water sample will be collected prior to any coring activities. The depth of water from surface to the top of the sediment will be measured and recorded, as well as the time of collection of the measurement.

TG&B Marine Services will use a heavy duty pneumatic Piston-Vibracore® sampler (BH-5) for the work in the Tidal Flats. A rigid polycarbonate tube (2-5/8" inner diameter and 1/16" wall thickness) will be used for sediment core collection and placed inside a 3" stainless steel core barrel. A vibrating hammer drives the core barrel into the sediments. To decrease the amount of compaction caused by the vibration, a fixed piston will be utilized inside the core tube, creating a negative pressure directly above the sediments inside the tube. As the tube is advanced, the negative pressure facilitates the sediments to move upwards relative to the core tube, reducing the amount of sediment compaction due to vibration and surface friction. For collection of the Piston-Vibracore® samples, the following steps will be taken:

- After arriving at each core location and anchoring the boat, prepare a sediment core log (**Appendix A**).
- Measure water height above the surface of the sediment using a weighted tape, and record on sediment core log, along with the exact time of measurement.

- Cut a four or eight-foot core of polycarbonate tube, insert the piston, and feed the tube into the core assembly.
- Lower the assembly to the bottom (mudline) and secure the piston wire.
- Using the mechanical Piston-Vibracore®, advance core to the appropriate depth, record depth of penetration on the sediment core log.
- Retrieve the core assembly and remove the core tube.
- Decant water from the top of the core tube if present.
- Using a tape measure with 0.1-foot increments, measure and record the total length of the retrieved sediment core.
- Calculate percent recovery, defined as the length of sediment retrieved divided by the length of the core penetration. The criteria for core acceptance is a percent recovery of at least 75%. If recovery is less than 75%, the core will be rejected and another core attempted. A maximum of three cores will be attempted at any one location.
- Cap and tape both ends and label the core tube with the Location ID and top/bottom.
- Record coordinates for the core location from the GPS onto the sediment core log.
- Transport sediment cores in a vertical position to the field office at the SAEP facility.
- Mark the depth from sediment surface corresponding with sample interval on the polycarbonate tubes with indelible marker.
- Cut the polycarbonate tube and sediment core lengthwise using a knife designed for the purpose.
- Record description of sediment core by depth interval on sediment core log, and take digital photograph(s), with scale, core location ID and up direction noted in the photograph.
- Cut the core into sections specified in **Tables 4-1 through 4-3** using a decontaminated stainless steel knife.
- Place each sample interval from the core into separate, decontaminated stainless steel bowls for homogenization.
- For any VOC sampling (disposal characterization, see **Table 4-3**), the selected core interval will first be sampled for the VOC aliquot and containerized prior to compositing to avoid loss of volatiles.
- Containerize samples for analysis at the analytical per the QAPP (Amec Foster Wheeler, 2017b).

For delineation samples, one core per sample location will provide adequate volume for chemical analyses. For treatability testing, one 4-foot core provides approximately one gallon of sediment. Treatability testing is estimated to require 30 gallons of sediment, equivalent to 30 4-foot cores. Treatability testing samples will be shipped or transported to the treatability laboratory.

5.6 Surface Water Sample Collection

TG&B Marine Services will use a Trimble® *Ag*GPS 124/132 differential GPS receiver with sub-meter accuracy to maneuver their boat to the approximate center of Areas 1, 6, and 8 (see **Figure 4-3**) for surface water sampling. Quantities of surface water required for the treatability and elutriate testing are presented in **Table 4-4**. The boat will be anchored approximately 80 feet up wind of the designated sample location, and maneuvered back to the sampling location, where a spud will be set, thus allowing the boat to remain stationary over the desired location.

Surface water for treatability testing will be collected using a peristaltic pump, or equivalent, with weighted tubing placed approximately one foot above the mudline. Surface water will be collected from single locations coinciding with locations where sediment samples for treatability testing will be collected; however, surface water will be collected prior to any disturbance related to sediment sampling activities. Collected water will be pumped directly into five-gallon sealable pails for transport or shipment to the treatability laboratory. Surface water sample collection is described in more detail in SOP S-2 in the QAPP (Amec Foster Wheeler, 2017b). For collection of the surface water samples, the following steps will be taken:

- After arriving at each core location and anchoring the boat, prepare a surface water sampling log (**Appendix A**).
- Measure water height above the surface of the sediment using a weighted tape, and record on surface water sampling log.
- Lower weighted tubing connected to the pump to a point one foot above the sediment/surface water interface.
- Turn on the pump and evacuate approximately 1 gallon of water through the tubing and discharge overboard.
- Begin collection of the surface water in the 5-gallon pails.
- Monitor the water temperature, pH, and salinity of the water in the pail with a multimeter, and record on the surface water sampling log.
- Record coordinates for the sampling location from the GPS onto the surface water sampling log.
- As 5-gallon pails are filled, seal the pails and record the sample identification and sample date/time on the outside of the 5-gallon pail(s) with indelible marker.
- Pails containing surface water will be transported or shipped to the treatability testing laboratory.

5.7 Analytical Laboratory Testing Program

The analytical laboratory testing program for sediments in the Tidal Flats consists of PCB delineation and treatability testing, as follows:

- PCB Delineation
- Treatability Testing
- Off-Site Disposal Characterization
- On-Site Re-use/Dredged Materials Characterization
- Dredging Resuspension Testing (Elutriate)

The proposed analyses for each of these programs is presented in **Table 5-1**. Field samples collected during the investigation will be analyzed by a certified laboratory using SW 846 analytical methods published by the United States Environmental Protection Agency (USEPA), as listed in QAPP Worksheet #19A (sediment) and Worksheet #19B (surface water) Analytical SOP Requirements (Amec Foster Wheeler, 2017b). Project-specific measurement performance criteria are established for analytical methods presented in Worksheet 12 of the QAPP (Amec Foster Wheeler, 2017b) for each analytical method and media planned for the investigation. Additional information on analytical method sensitivity, target analytes, and detection limits is provided on Worksheet 15 of the QAPP (Amec Foster Wheeler, 2017b).

Analytical chemistry methods will be completed by Envirosystems of Hampton, NH using USEPA SW-846 methods (USEPA, 2014) for the majority of chemical parameters as listed in Worksheet #23 of the QAPP (Amec Foster Wheeler, 2017b). Other data types (e.g., geotechnical or treatability) will be generated using ASTM and other methods as appropriate, including vendor-specific methods.

5.8 Sample Containers and Preservation Techniques

Specifications for sample collection processes and the containers and preservative used to store samples prior to analysis were determined based on requirements in the published analytical methods or USEPA Region I data validation guidelines (USEPA, 1996). Required sample volumes, containers, and preservation requirements for each method and matrix is presented in **Table 5-2**, and the QAPP Worksheets 19A and 19B (Amec Foster Wheeler, 2017b).

5.9 Sample Chain of Custody (COC) and Shipping

Procedures are established to document the custody of samples that are collected during investigations and to identify and track samples delivered or shipped to the analytical laboratory for analysis. Tracking procedures are also established to verify that data for samples are obtained from the laboratory. The sample custody process is illustrated in Worksheet #26 and SOP S-5 of the QAPP (Amec Foster Wheeler, 2017b).

A computerized sample tracking program will be used to ensure that relevant sample information is recorded accurately and completely at each stage of the sample handling process. The field sample tracking system is described in SOP S-6 in the QAPP (Amec Foster Wheeler, 2017b).

The sample tracking program will be the primary method used to record sample collection information and print individual bottle labels as described in the QAPP. COC forms may be handwritten or computer generated. Examples of the handwritten and computer generated COC are presented in Appendix D of the QAPP (Amec Foster Wheeler, 2017b).

The primary chemical analyses include PCBs and metals and waste disposal characterization. Geotechnical parameters will also be performed on some samples. The collection of QC samples (blanks, spikes, and duplicates) and formal data quality reviews will be included in investigation programs as outlined in detail in the QAPP (Amec Foster Wheeler, 2017b).

5.10 Field Quality Control Sampling Procedures

The field quality control samples will consist of the following:

- Rinsate (or equipment) blanks from decontaminated equipment
- Decontamination source water (Source blank)
- Field duplicate and matrix spike/matrix spike duplicate (MS/MSD) samples

5.10.1 Rinsate Field Equipment Blank

Following equipment decontamination procedures, a rinsate blank (also referred to as an equipment blank) will be collected and submitted for analyses to confirm that the decontamination water is not introducing low-level impacts to Project samples. The parameters to be analyzed will depend on, and include, the same parameters as analyzed during the affected investigation program. The rinsate blank will be collected as follows.

- Thoroughly decontaminate the sampling device from which the blank will be collected (see Section 5.4).
- Assign sample ID for rinsate sample and attach bottle labels.
- Pour source water over the equipment surfaces that have contacted the sample.
- Run source water through the entire sampling apparatus that was used to collect samples.
- Collect or “catch” the rinsate water directly into the appropriate sample bottles.
- Record the collection time and sample ID in the field logbook.
- Store, pack, and ship samples in accordance with Section 7.0.
- Document the sampling activities and general identifying information on an FDR.
- Document sample collection requirements for each analytical fraction including the container types/volumes, time collected, sample bottle IDs, analyses to be performed etc., on the FDR.

5.10.2 Decontamination Water Source

A sample of the potable tap water (also known as a Source blank) from the SAEP facility, to be used for decontamination of sampling equipment, will be collected for analysis of PCB Homologs and metals. The Source blank will be collected as follows.

- Assign sample ID for source sample and attach bottle labels.
- Turn on potable water tap and allow to run for one minute before collecting the water directly into the appropriate sample bottles.
- Record the collection time and sample ID in the field logbook.
- Store, pack, and ship samples in accordance with Section 7.0.
- Document the sampling activities and general identifying information on an FDR.
- Document sample collection requirements for each analytical fraction including the container types/volumes, time collected, sample bottle IDs, analyses to be performed etc., on the FDR.

5.10.3 Field Duplicates and Matrix Spike/Matrix Spike Duplicates

Field duplicate samples will be collected following sediment sample homogenization, then apportioning into two sets of containers. Both sets of containers will be submitted for analyses with one set designated as an "original sample," the other designated as a "duplicate sample". Field duplicate samples will be collected at a rate of one per 10 field samples.

Matrix spike and matrix spike duplicate (MS/MSD) samples will be collected following sediment sample homogenization, then apportioned into three sets of containers. The three sets of containers will be submitted for analyses with one set designated as an "original sample," the second designated as a "matrix spike", and the third designated as a “matrix spike duplicate”. MS/MSD samples will be collected at a rate of one per 20 field samples, and submitted to the laboratory for analysis of PCB Homologs.

5.11 Sample Location Survey

The sediment and surface water sample horizontal coordinates for PCB delineation and treatability testing samples will be collected via differential GPS with sub-meter accuracy by TG&B Marine Services as sediment cores are collected. Coordinates will be collected and recorded in the Connecticut State Plane coordinate system on FDRs, and provided by TG&B Marine Services in their data report.

6.0 FIELD OPERATIONS DOCUMENTATION

Records of field data will be made throughout the project as described in Worksheet #29 of the QAPP (Amec Foster Wheeler, 2017b) to capture information that might be needed later, such as during preparation of the report or for use by other investigators who were not present when the data were collected. The field activities and the collection of field samples will be documented using Project and field logbooks, FDR forms, and COC forms. **Appendix A** contains the field forms to be utilized in the documentation of field efforts. Photography will also be used to document field activities.

The Amec Foster Wheeler FOL has the responsibility to maintain files containing logbooks, forms, and notebooks that document daily field activities. Individual responsibilities may be delegated to other field staff, as appropriate. Special emphasis will be placed on the completeness and accuracy of information recorded in the field logbooks, forms, and notebooks. Documentation will contain statements that are legible, accurate, and inclusive of required documentation for project activities. Because the logbooks, FDR forms, and COC forms provide the basis for future reports, they must contain accurate facts and observations.

Examples of the project record types for this project include:

- Chain-of-Custody (COC) Records
- Project and field logbooks
- Sample FDRs
- Field Instrument Calibration Records; etc.

Original records will be scanned at Amec Foster Wheeler's Portland, Maine office and uploaded to the electronic Project file. CENAE will also be provided with electronic Project files, including the native format files for work plans and reports. Hardcopy originals will be maintained in the Project paper file in the Portland, Maine office.

6.1 Chain of Custody Forms

COC forms are used to document the custody of samples that are collected during investigations, and to identify and track samples delivered or shipped to the analytical laboratory for analysis. Use of COC forms is described in Section 5.9 and in the QAPP (Amec Foster Wheeler, 2017b).

6.2 Logbooks

The Amec Foster Wheeler field team will follow the procedures described in the QAPP and SOP S-8 to complete field logbook entries. Project and field logbooks will be newly procured, and provide the means of recording the chronology of data collection activities performed during the investigation in detail. As such, entries will be described in as much detail as possible so that a field activity could be reconstructed without reliance on memory.

Logbooks will be hardcover permanently bound field survey books or notebooks and be project-specific. Logbooks will be stored in the project files when not in use. Each logbook will be identified by the Amec Foster Wheeler project number and logbook number. Logbooks will be water resistant and have sequentially numbered pages.

The title page of each logbook will contain the following:

- Logbook number
- CENAE Contract Number
- CENAE
- Amec Foster Wheeler project number
- Project name
- Logbook start date

The Project and field logbooks provide a daily hand written account of field activities. Entries will be written in a clear, logical and legible manner, and made in permanent black or blue ink. Any correction to an entry will be made with a single line with the author initials and date. Each page of the logbook will be dated and signed by the person completing the logbook. Partially completed pages will have a line drawn through the unused portion at the end of each day, and signed and dated by the person making the entry.

Field and Project logbooks are the property of CENAE and will be given to CENAE (if requested) at the end of this project. These documents will also be scanned and saved to the electronic Project file.

6.2.1.1 Project Logbook

The Project logbook is a record of major tasks completed for each day or operation. Entries are made each day. The FOL responsible for on-Project field operations will complete the Project logbook and will include at a minimum the following information:

- A list of field logbooks created for the project;
- Names and titles of project related personnel present at the Project during each day of operation;
- A summary of activities completed for each day of operation;
- A listing of changes made to established program procedures; and
- A summary of problems encountered during the day including a description of corrective actions and impacts on the project.

Due to the short duration of the proposed field work (approximately 5 days), the Field Logbook may substitute for the Project Logbook for this Project.

6.2.1.2 Field Logbook

Field logbooks are daily records of field task activities that are entered in real time by the on-Project field technicians and scientists. The following information will be entered into the field logbooks:

- The date and time of each entry. The daily log will begin with weather conditions and the names and organizations of personnel performing the documented task;
- A summary of important tasks or subtasks completed during the day;
- A description of any field tests completed in association with the daily task;
- A description of any samples collected including documentation of any quality control samples that were prepared (equipment blanks, field duplicates, MS/MSDs, trip blanks, etc.);
- Documentation of equipment maintenance and decontamination activities; and
- A summary of any problems encountered during the day including a description of corrective actions and impacts on the daily task; and.
- Other pertinent information as appropriate.

6.3 Sample Collection and Exploration Records

FDRs document details of explorations and sample collection activities. A sample collection record is completed each time a field sample is collected. The goal of the FDR is to document exploration and sample collection methods, materials, dates and times, sample locations, and identifiers. Field measurements and observations associated with a given exploration or sample collection task are recorded on the sample collection record. Sample collection records are maintained throughout the field program by the FOL in files that become a permanent record of field program activities. A listing of investigation and sample collection records is included on Worksheet #29 of the QAPP (Amec Foster Wheeler, 2017b) including:

- Daily Project Safety and Health Inspection Checklist
- Daily Tailgate Safety Meeting Checklist
- Summary of Daily Activities
- Field Instrument Calibration Record
- Equipment Blank Sampling Record
- Sediment Core and Discrete Sample Log

- Surface Water Sampling Record

6.4 Photographic Records

Photographs of field activities will be taken to supplement other field documentation. Information about each photograph's location and subject matter will be recorded in the field. Photographs will be saved to the electronic Project file and used in reporting as appropriate.

7.0 SAMPLE DESIGNATION, PACKAGING, AND SHIPPING

Samples collected during the investigations will be designated and identified consistently as described in **Section 7.1**, and each location will be surveyed for incorporation into the Project database as described in **Section 7.2**.

7.1 Sample Designation

Samples collected during Project activities will be assigned unique sample identifications (IDs) as described in **Section 7.2** below that will be used to identify and track each sample collected for analysis during completion of the Project scope of work. In addition, the sample IDs will be used to identify and retrieve the analytical results received from the laboratory, as well as other data related to the sample.

The contracted laboratories will provide appropriate containers for the collection of the Project samples as described in the QAPP (Amec Foster Wheeler, 2017b). Each sample bottle will be identified with a separate ID label. Labeling will be pre-printed and/or augmented by notations completed in indelible/waterproof ink. Entry errors will be crossed out with a single line, dated, and initialed. Each securely-affixed label will include the following information:

- Project ID
- Location ID
- Field sample ID
- Preservatives present and/or added
- Date and time of collection
- Analytical fraction and method
- Sampler(s) initials

Prior to each sampling event, the Amec Foster Wheeler FOL will check that labels are applied to each sample container including containers intended for QC sample aliquots (e.g., field duplicate, matrix spike, etc.).

7.2 Sample Numbering System

7.2.1 Assigning Location IDs

A unique location ID will be assigned to each sampling location with unique horizontal coordinates. Examples are provided below and have been assigned to sampling locations in **Tables 4-1** through **4-3**:

- Sediment cores:
  - For delineation sample cores, the location IDs will be in the form "SD-PCB-001", and are given sequential three digit numbers in the last three characters of the location ID. SD = sediment, PCB = PCB delineation core, and 001 is the core number.
  - For treatability testing cores, the location IDs will be in the form "SDT-01-001", and are given sequential three digit numbers in the last three characters of the location ID. SDT = sediment for treatability testing, next two digits = treatability testing area, and 001 is the core number.
- Surface water samples:
  - For treatability study surface water samples, the location IDs will be in the form "SW-01-001", and are given sequential three digit numbers in the last three characters of the location ID. SW = surface water, next two digits = treatability testing area, and 001 is the unique surface water location number.
- QC Samples:
  - Equipment blanks will be given unique location IDs in the form "EB-001", and are given sequential three digit numbers in the last three characters of the location ID.
  - The source water blank will be given the unique location ID "SB-001"
  - Trip blanks, if necessary, will be given unique location IDs in the form "TB-001", and are given sequential three digit numbers in the last three characters of the location ID.

7.2.2 Sample IDs

A unique sample ID will be assigned to each sample collected during the investigation, and will be identified by the character naming system, as follows:

<u>Sample Type (2 to 3 digits)</u>

SD – sediment sample

SDT – sediment sample for treatability testing

SW – surface water sample

SB – source water blank

EB – equipment rinsate blank

TB – QC Blank

Sample Program (2 to 3 digits)

PCB – sample for delineation of PCBs

01 – area designation of treatability testing samples (01 through 07)

Horizontal Sample Locator from Location ID (3 digits)

Examples: 001, 003, etc.

For sediment treatability composite samples where sediment from multiple cores from the same area are composited, the number of the first core is used. For the 30-gallon composite sample collected from multiple cores in multiple areas, the sample ID is listed as SD-COMP-001.

For surface water treatability samples, the horizontal sample locator is the three-digit location ID number.

Sample Depth Interval in feet

Examples 0001 = 0' to 1' bgs

0812 = 8' to 12' bgs

Sample Modifiers (2 to 3 digits)

DUP – Duplicate Sample

MS – Matrix Spike

MSD – Matrix Spike Duplicate

EB – Equipment Blank

TB – Trip Blank

SB – Source Blank

Example Field Sample IDs

- A sediment sample collected for PCB delineation from sample location 037, from the depth interval 7-8' bgs would be identified as "SDPCB0370708".
- A duplicate sediment sample collected for PCB delineation from sample location 015, from the depth interval 1-2' bgs would be identified as "SDPCB0150102DUP".

- An MS sample for a treatability study sediment core from area 03 with a location ID number of 029 collected from a depth interval of 3-4' bgs would be identified as "SDT030290304MS".

Depth information for samples will be noted in field notes and on Field Data Records (FDRs) (**Appendix A**). The Amec Foster Wheeler FOL is responsible for checking that labels are affixed to the sample containers prior to each sampling task, and that labels are completed correctly prior to the sample being submitted to the laboratory.

Future samples collected at previously sampled locations will be identified using the previously identified location ID.

7.3 Sample Packaging and Shipment

Sample packaging and shipment procedures are presented in QAPP SOP S-7 (Amec Foster Wheeler, 2017b), and are provided in the following bullets:

- Be certain that containers are sufficiently tight, preserved, and labeled correctly.
- Sediment samples will be allowed to settle for a minimum of 2 hrs prior to shipping to the laboratory.
- The sample manger will look closely at sediment samples to see if a clear water layer forms above the sediment. Any water layer will be decanted from the sample jar prior to shipping to the laboratory.
- Clean the exterior of each sample container such that no gross contamination remains.
- Complete the Chain of Custody (COC) as described QAPP SOP S-9. When the COC form is completed, verify that bottle labels, analytical fractions, and bottle numbers match what is written on the COC form.
- Wrap sample containers in bubble wrap. Zip-type plastic baggies may be used as additional containment.
- Line the cooler with the trash bag and add a layer of packing material. If the cooler has a drain, close and seal to prevent leakage of water from melting ice.
- Place sample containers into the cooler, and pack them sufficiently to prevent them from shifting during shipment.
- Place ice-filled zip-type bags on samples such that samples are contacted by the ice.
- Place sufficient ice to retain the sample temperature between 2 and 6 degrees C. Place a temperature blank in with the samples.
- Fill the remaining space in the cooler with packing material and close and secure the top of the trash bag.
- On the chain of custody, sign in the relinquished by box and add in the subsequent received by box the name of the courier/carrier and the air bill number (if applicable).

- Place the COC into a plastic bag and tape it to the inside top of the cooler.
- Close the cooler and tape the cooler shut with strapping tape or similar high-strength shipping tape.
- If more than one cooler is being shipped under the same COC, copies of the COC should be placed into each additional cooler in the same manner as the original COC.
- If shipped through FEDEX or other shipping vendor, apply custody seals to the cooler such that the seals must be broken in order to open the cooler.
- Apply “UP Arrows” in the appropriate direction on at least opposing sides of the cooler exterior, or indicate on top “this side up”.
- Add the appropriate shipping address labels to the cooler along with a return address to the cooler. If more than one cooler is being shipped, add “one of X” to the label so that the recipient is aware that more than one cooler should be received.

8.0 INVESTIGATION DERIVED WASTE

As part of the field activities, a certain amount of waste material will be generated in association with personal protection, sample handling, and decontamination. Effort will be taken to minimize the waste generated. Personal protective equipment will be bagged and disposed of as municipal waste. Consistent with previous investigative activities, if there is sediment Investigation Derived Waste (IDW) produced, it will be containerized in 55-gallon DOT-approved steel drums. Disposition of IDW will be determined when analytical results of the investigation sampling are available.

9.0 NON-CONFORMANCE/CORRECTIVE ACTIONS

Worksheet # 31 - Planned Project Assessments Table, and Worksheet #32 - Assessment Findings and Corrective Action Responses in the QAPP (Amec Foster Wheeler, 2017b), present the proposed project assessments and corrective action Reponses for the project. Corrective action procedures will be taken in the event a discrepancy is discovered by field personnel or during a desk or field audit, or the laboratory discovers discrepancies or problems. Typical discrepancies or problems include but are not limited to: improper sampling procedures, improper instrument calibration procedures, incomplete or improper sample preservation, and problems with samples upon receipt at the laboratory.

10.0 REPORTING

The following subsections discuss the electronic data deliverable requirements for the project, as well as the content of the Sediment Investigations Report. Files and records associated with the deliverables will be maintained on the Amec Foster Wheeler Portland, Maine office server. CENAE will be provided with electronic Project files, including the native format files for work plans and reports. Report deliverables will be submitted to regulatory agencies for review in electronic PDF format, and native format files will be supplied upon request.

10.1 Electronic Data Deliverables

Both the analytical laboratory and Amec Foster Wheeler will obtain the most recent version (ADR.NET) of the USACE ADR software. Amec Foster Wheeler will develop comprehensive ADR library files (i.e., Electronic Quality Assurance Project Plan or EQAPP) for analytical methods to be used on the project. The library files will be submitted to CENAE for approval prior to field sampling. Approved library files will be used by the subcontract laboratory and Amec Foster Wheeler to check the laboratory electronic data deliverables (EDDs) for compliance, and the ADR module will be used to perform applicable data validation reviews. ADR validation actions will be reviewed/verified by the Amec Foster Wheeler project chemist. Final results will be provided to CENAE and be entered into EDMS. Final results will also be entered into the Amec Foster Wheeler TED data management system for use in preparing the FS report and subsequent documents.

Data from field activities and the analytical laboratory will be entered into the Amec Foster Wheeler's TED environmental database. The contract laboratory will submit Stage 2a EDDs to Amec Foster Wheeler using the Staged Electronic Data Deliverables (SEDD) format (i.e., xml format files) by Sample Delivery Group (SDG). The contract laboratory will ensure that SEDD files are checked using the Contract Compliance Screening (CSS) tool contained in the laboratory version of the ADR software. The laboratory shall prepare a separate non-conformance report addressing and explaining any items identified by the CSS tool. SEDD files will be submitted on CD along with the hardcopy data package and will also include a transmittal letter ensuring that the SEDD files are error free and in agreement with hard copy data packages.

10.2 Sediment Investigations Report

Amec Foster Wheeler will prepare a Sediment Investigations Report to summarize the field sampling efforts, which will include data summary tables and figures. Figures will be "D" size and depict newly collected sample results overlaid with historic sampling results. Each sample location will have a specific symbol based on the year the sample was collected. Average ERM-Q Indices greater than 0.5 will be depicted in red, while average ERM-Q Indices less than 0.5 will be depicted in green. An overall shading of red will be used for each depth interval (0-1, 1-2, 2-3, 3-4 etc.) to depict the area of Tidal Flats that need to be remediated based on metals and average ERM-Q Index results. Similarly, separate figures will be completed for PCBs with newly collected samples overlaid with historic sampling results. Each PCB sample location will have a specific symbol based on the year the sample was collected. PCB results greater than 1 ppm will be depicted in red, while PCB results less than 0.5 will be depicted in green. An overall shading of red will be used for each depth interval (0-1, 1-2, 2-3, 3-4 etc.) to depict the area of Tidal Flats that need to be remediated based on PCB results.

The Sediment Investigations Report will have a section specific to sediment re-use and sampling/testing results (chemical analyses, grain size, TOC, water content, % solids, moisture content, Atterberg limits, SPLP, TCLP, elutriate, flocculent agents, and stabilization tests). The results of these tests will be summarized and integrated into a discussion of sediment re-use for construction and redevelopment purposes. This will include a geotechnical evaluation of the stabilization tests for comparison to uses of the material identified by the developer, and/or to identify suitable, safe uses of the stabilized sediments. Limitations and uncertainties will be identified as part of the evaluation, including a discussion of bias (low/high) in analytical data, and the implications of this on the recommendations for sediment reuse for construction and redevelopment purposes.

The Draft Sediment Investigations Report will be submitted to CENAE for review in electronic PDF format, and the text of the report will be submitted in MS-Word format. The Draft Final Report will be submitted to both CENAE and regulatory agencies in electronic PDF format, with native format files available upon request. The Final Report will be submitted in both electronic native format and hardcopy format to CENAE and the regulatory agencies.

11.0 REFERENCES

AMEC, 2014a. Final Work Plan for Determination of Sediment Remediation Endpoints, Tidal Flats and Outfall 008, Stratford Army Engine Plant, Stratford, Connecticut. April 16, 2014.

AMEC, 2014b. Draft Sediment Remediation Endpoints Report, Tidal Flats and Outfall 008, Stratford Army Engine Plant, Stratford, Connecticut. September 26, 2014.

Amec Foster Wheeler, 2017a. Draft Site Safety and Health Plan (SSHP), Stratford Army Engine Plant, Stratford, Connecticut. June 9, 2017.

Amec Foster Wheeler, 2017b. Draft Quality Assurance Project Plan (QAPP), Stratford Army Engine Plant, Stratford, Connecticut. June 28, 2017.

Amec Foster Wheeler, 2017c. Draft Sediment Remediation Endpoints Report, Stratford Army Engine Plant, Stratford, Connecticut. June 14, 2017.

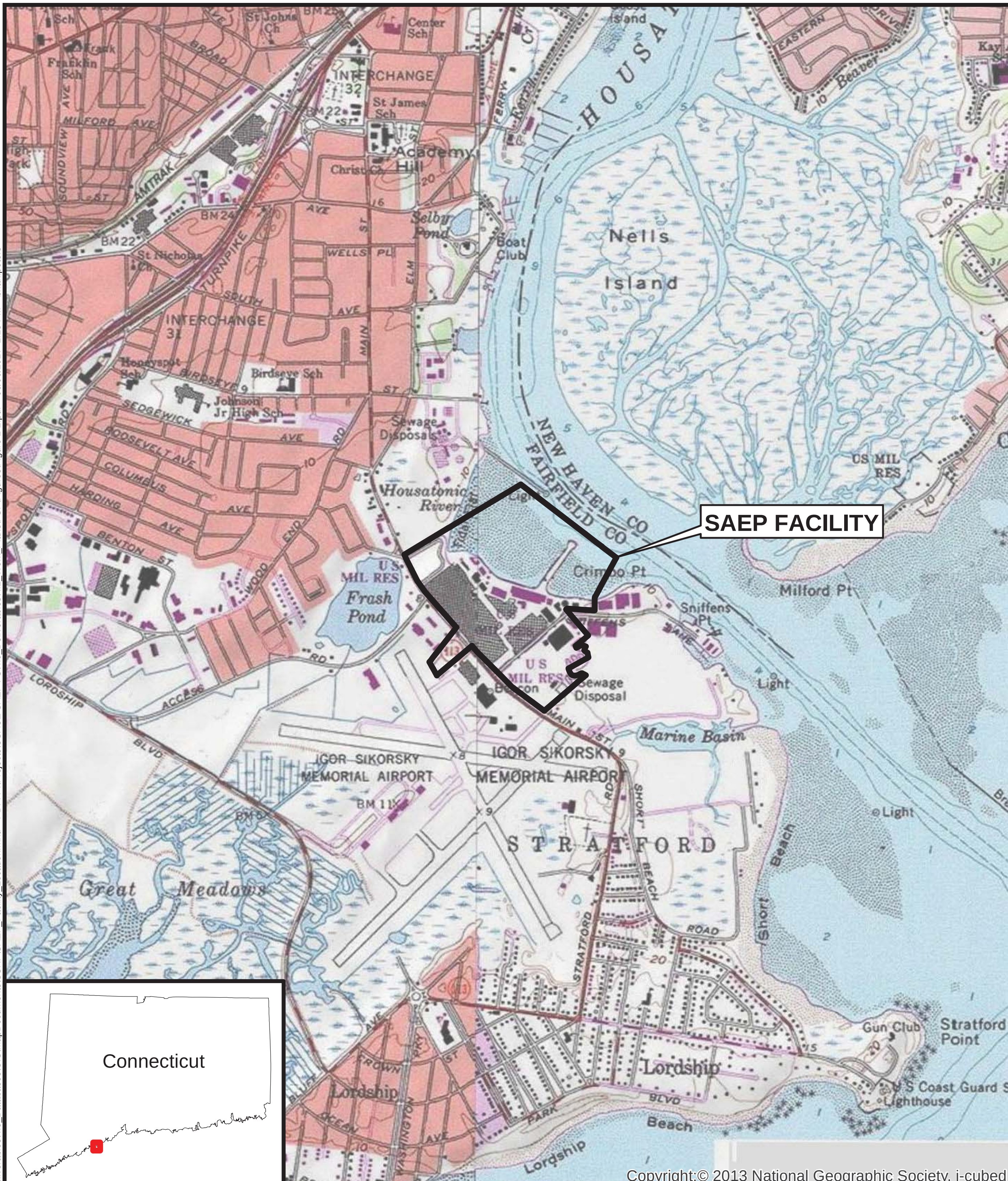
United States Army Corps of Engineers, Engineer Research and Development Center (USACE) 2003. Evaluation of Dredged Material Proposed for Disposal at Island, Nearshore, or Upland Confined Disposal Facilities – Testing Manual. January 2003.

United States Environmental Protection Agency (USEPA), 2016. Waste Site Cleanup & Reuse in New England - Stratford Army Engine Plant. Updated May 31, 2016. https://yosemite.epa.gov/r1/npl_pad.nsf/8b160ae5c647980585256bba0066f907/535708bdb8e8342085256b4200606200!OpenDocument

USEPA, 2014. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods Compendium. SW-846 Update V. July 2014.

USEPA, 1996. Region I, EPA-New England Data Validation Functional Guidelines for Evaluating Environmental Analyses. July 1996. Revised December 1996.

FIGURES



amec foster wheeler

N

0 1,000 2,000 Feet

Figure 1-1
Facility Location

Stratford Army Engine Plant
Stratford, Connecticut

Prepared/Date: BRP 06/06/17 | Checked/Date: RB 06/06/17

Document: P:\Projects\USACE SAEP FS\4.0_Deliverables\4.5_Databases\GIS\MapDocuments\SSHP\SAEP_Facility_Location.mxd PDF: P:\Projects\USACE SAEP FS\4.0_Deliverables\4.2_Work_Plans\FSP\Figures\Figure 1-1.pdf 06/06/2017 2:13 PM brian.peters

amec foster wheeler

N

0 300 600 Feet

Figure 1-2
Location of Areas of Interest

Stratford Army Engine Plant
Stratford, Connecticut

Prepared/Date: BRP 06/06/17	Checked/Date: RB 06/06/17

Document: \\PLD2-FS1\Project\Projects\USACE SAEP FS\4.0_Deliverables\4.5_Databases\GIS\MapDocuments\SSHP\SSHP_11x17LS.mxd PDF: P:\Projects\USACE SAEP FS\4.0_Deliverables\4.2_Work_Plans\SSHP\Figures\Figure 1-2.pdf 06/06/2017 2:15 PM brian.peters

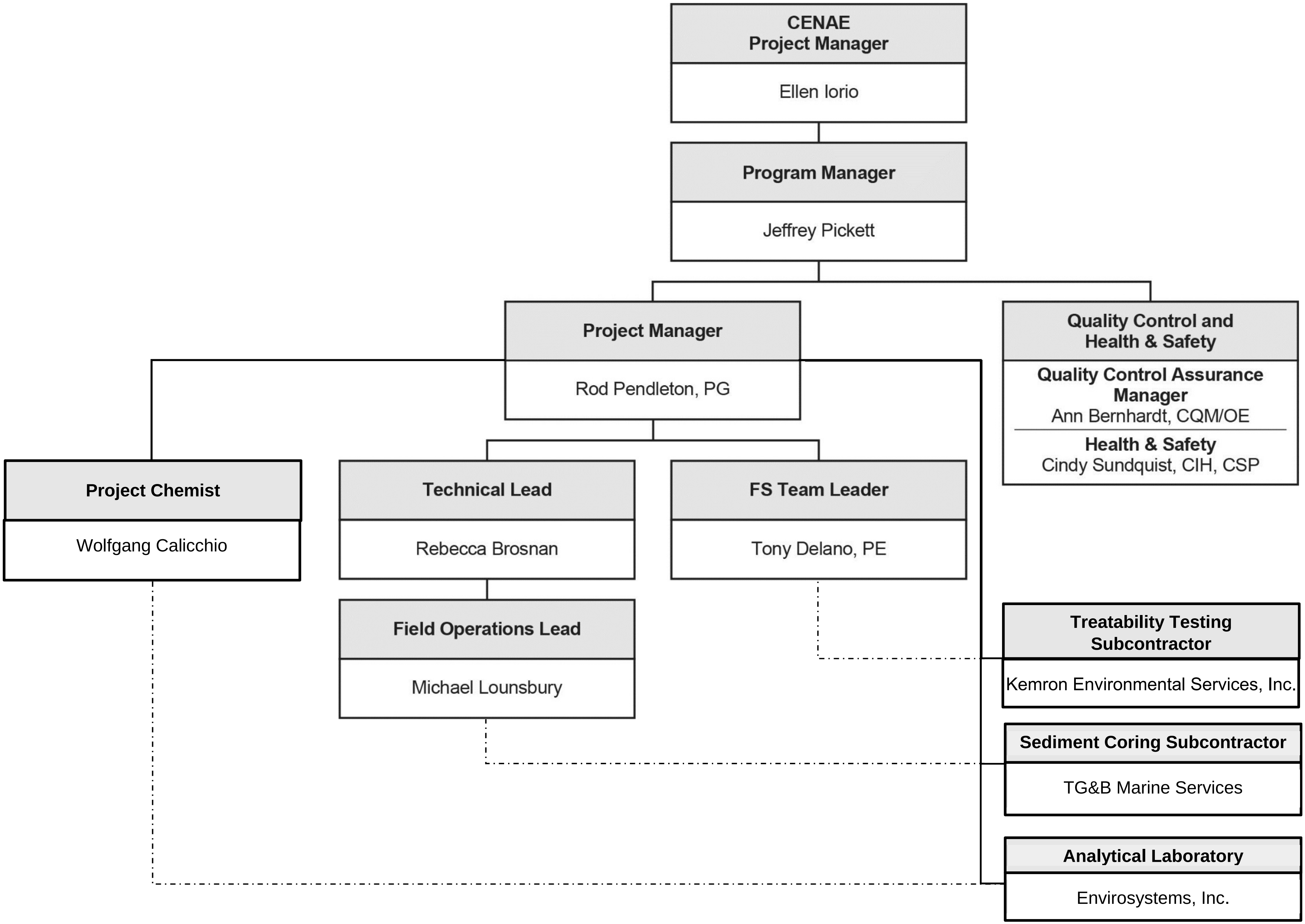
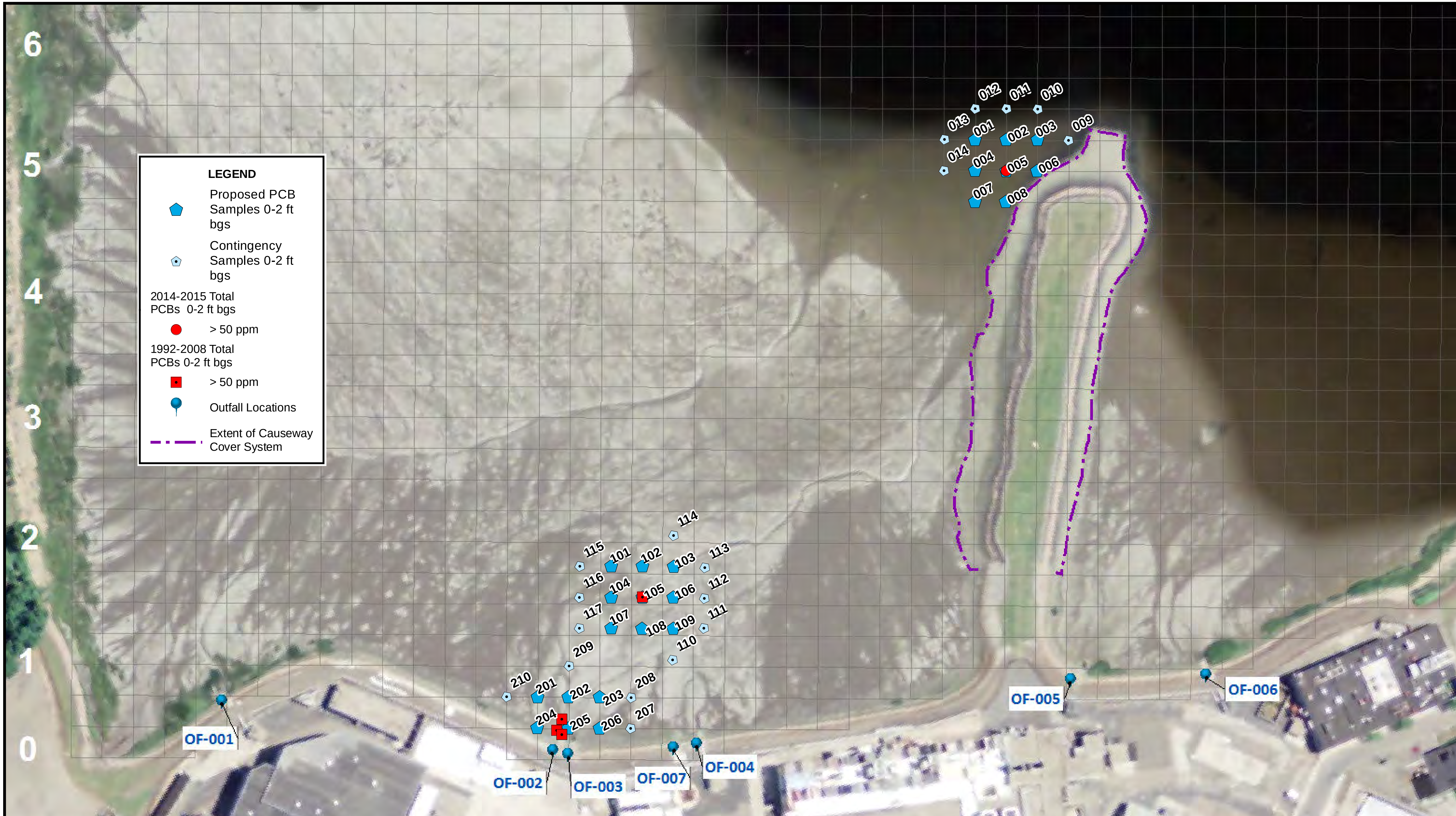


FIGURE 3-1
PROJECT ORGANIZATIONAL CHART



2014 Aerial Imagery
USDA National Agriculture
Imagery Program

N

0 75 150
Feet

Notes:
1) Historical concentrations of total PCBs are in parts per million (ppm)
2) Proposed samples will be collected with VibraCore and divided into 0-1 and 1-2 ft intervals for laboratory analysis of PCB Homologs

Figure 4-1
Proposed PCB Delineation Samples 0-2 ft, bgs
Tidal Flats

Stratford Army Engine Plant
Stratford, Connecticut

amec foster wheeler

Prepared/Date: BRP 07/18/17 | Checked/Date: TD 07/18/17

Document: P:\Projects\USACE SAEP FS\4.0_Deliverables\4.5_Databases\GIS\MapDocuments\FSP_SAEP_FS_11x17LS_Index_14Jul2017.mxd PDF: P:\Projects\USACE SAEP FS\4.0_Deliverables\4.2_Work_Plans\FSP\Figures\Figure 4-2 with Proposed Excavations.pdf 07/18/2017 12:44 PM brian.peters

2014 Aerial Imagery
USDA National Agriculture
Imagery Program

N

0 75 150 Feet

Notes:
1) Historical concentrations of total PCBs are in parts per million (ppm)
2) Proposed samples will be collected with VibraCore and divided into 4-5, 5-6, 6-7, and 7-8 ft intervals for laboratory analysis of PCBI Homologs

Figure 4-2
Proposed PCB Delineation Samples 4-8 ft, bgs
Tidal Flats

Stratford Army Engine Plant
Stratford, Connecticut

Prepared/Date: BRP 07/18/17 | Checked/Date: TD 07/18/17

Document: P:\Projects\USACE SAEP FS\4.0_Deliverables\4.5_Databases\GIS\MapDocuments\FSP_SAEP_FS_11x17LS_Index_14Jul2017.mxd PDF: P:\Projects\USACE SAEP FS\4.0_Deliverables\4.2_Work_Plans\FSP\Figures\Figure 4-2 with Proposed Excavations.pdf 07/18/2017 12:44 PM brian.peters

Area 1

Cores	Depth (ft)	Intervals	Analysis
15	4	0-4'	Treatability/Off-site Disposal
2	4	0-4'	Elutriate
1	4	0-2', 2-4'	SPLP
1	4	0-1',1-2', 2-4'	Geotechnical Parameters

Area 6

Cores	Depth (ft)	Intervals	Analysis
2	4	0-4'	Elutriate
1	4	0-4'	SPLP
1	4	0-1',1-2', 2-4'	Geotechnical Parameters

Area 8

Cores	Depth (ft)	Intervals	Analysis
20	2	0-2'	Treatability/Off-site Disposal
4	2	0-2'	Elutriate
1	2	0-2'	SPLP
1	2	0-1',1-2'	Geotechnical Parameters

Area 4

Cores	Depth (ft)	Intervals	Analysis
30	2	0-2'	Treatability/Off-site Disposal
1	2	0-2'	SPLP
1	2	0-1',1-2'	Geotechnical Parameters

amec foster wheeler

2014 Aerial Imagery
USDA National Agriculture
Imagery Program

N
0 75 150 Feet

Notes:
1) Historical concentrations of total PCBs are in parts per million (ppm)
2) Proposed samples will be collected with VibraCore and divided into
0-1 and 1-2 ft intervals for laboratory analysis of total Aroclors and total Homologs

Figure 4-3
Proposed Treatability Testing Sample Locations Tidal Flats

Stratford Army Engine Plant
Stratford, Connecticut

Prepared/Date: BRP 07/24/17 | Checked/Date: TD 07/24/17

ID		Task Name	Duration	Start	Finish	Predecessors	Successors
1		Project Award	0 days	Fri 3/10/17	Fri 3/10/17		3,4,5,7,8,58,2
2		**Notice to Proceed**	0 days	Fri 3/10/17	Fri 3/10/17	1	
3		**Task 1 - Project Management**	**400 days**	**Fri 3/10/17**	**Mon 10/8/18**	**1**	
6	✓	**Task 2 - Sediment Remediation Endpoints Report**	**106 days**	**Fri 3/10/17**	**Wed 8/9/17**		
13		**Task 4 - Work Plans**	**89 days**	**Wed 4/5/17**	**Thu 8/10/17**		
39		**Task 5 - Characterization and Treatability Testing - Tidal Flats Sediment**	**139 days**	**Thu 6/22/17**	**Wed 1/17/18**		
40	✓	Subcontractor Procurement (Sediment Coring, Analytical Laboratory, Treatability Lab)	25 days	Thu 6/22/17	Fri 7/28/17	18	41
41	✓	Mobilization	1 day	Mon 7/31/17	Mon 7/31/17	40	42
42	✓	Conduct Treatability Tests Sediment Sampling (AmecFW)	3 days	Wed 8/2/17	Fri 8/4/17	41	48FS+40 days
43		**Conduct Treatability Testing & Reporting**	**58 days**	**Tue 10/3/17**	**Tue 1/2/18**	**42**	
44		Report Summary Table of Task I Untreated Characterization Testing (raw testing and hydraulic dredge testing)	11 days	Tue 10/3/17	Tue 10/17/17	42FS+40 days	49
45		Report Polymer/Flocculant Testing (Task II)	16 days	Tue 10/3/17	Tue 10/24/17	42FS+40 days	49
46		Report results of Task III Mechanical Dewatering Simulation Results (except HiG/Hydrocyclone results)	34 days	Tue 10/3/17	Fri 11/17/17	42FS+40 days	49
47		Report results of Task IIIa, IIIb, IIIc Paste evaluation and Solidification/Moisture reduction evaluation	41 days	Tue 10/3/17	Thu 11/30/17	42FS+40 days	49
48		Report results of HiG/Hydrocyclone Results and Task IV -Gravity drain testing and solidification evaluation	52 days	Tue 10/3/17	Fri 12/15/17	42FS+40 days	49
49		Submit Draft Treatability Testing Report to Amec FW	6 days	Mon 12/18/17	Tue 1/2/18	44,45,46,47,48	65FF+10 days
50		Amec FW reviews Draft Treatability Testing Report	10 days	Wed 1/3/18	Tue 1/16/18	49	51,66FF
51		Amec FW submits Draft Treatability Testing Report to USACE	0 days	Tue 1/16/18	Tue 1/16/18	50	
52		Conduct Sediment Coring for Additional Characterization (Sub/AmecFW)	5 days	Mon 10/16/17	Fri 10/20/17	42FS+49 days	53
53		Characterization Sediment Sample Laboratory Analyses (Lab)	20 days	Mon 10/23/17	Fri 11/17/17	52	54
54		Characterization Sediment Sample Data Validation (AmecFW)	15 days	Mon 11/20/17	Tue 12/12/17	53	55
55		Prepare Report of Characterization Results (Text, Tables, Figs)	20 days	Wed 12/13/17	Wed 1/17/18	54	56
56		Submit Draft Report of Characterization Results to USACE	0 days	Wed 1/17/18	Wed 1/17/18	55	
57		**Task 3A - Feasibility Study thru Alternatives Screening**	**216 days**	**Fri 3/10/17**	**Tue 1/23/18**		
58	✓	Background Information Review	15 days	Fri 3/10/17	Thu 3/30/17	1	61FS+20 days
59	✓	Finalize Preliminary Remediation Goals (PRGs)	10 days	Thu 6/1/17	Wed 6/14/17	10FF+5 days	60
60	✓	Preliminary Estimates of Volume of Media	5 days	Thu 6/15/17	Wed 6/21/17	59	
61	✓	Identify and Screen Technologies	30 days	Fri 4/28/17	Fri 6/9/17	58FS+20 days	62
62		Develop and Screen Alternatives	92 days	Mon 6/12/17	Fri 10/20/17	61	64SS+40 days
63		Amec FW Receives Dredge Feasibility Analysis from Lally Consulting	30 days	Fri 10/6/17	Thu 11/16/17		65FF+20 days
64		Detailed Evaluation of Alternatives	90 days	Thu 8/31/17	Tue 1/16/18	62SS+40 days,65FF	66
65		Develop Cost Estimates of Alternatives	72 days	Wed 9/27/17	Tue 1/16/18	0 days,63FF+20 days	68,64FF
66		Selection of Preferred Alternative	5 days	Wed 1/17/18	Tue 1/23/18	64,50FF	68FS-10 days
67		**Task 3B - Preapare Feasibility Study Report**	**72 days**	**Wed 1/17/18**	**Thu 4/26/18**		
68		Prepare Draft FS Report	10 days	Wed 1/17/18	Tue 1/30/18	66FS-10 days,65	69
69		USACE Review Draft FS Report	15 days	Wed 1/31/18	Tue 2/20/18	68	70
70		Meeting with USACE (Concord, MA) to Discuss Draft FS Report	1 day	Wed 2/21/18	Wed 2/21/18	69	71
71		Prepare Draft Final FS Report based on USACE Comments	15 days	Thu 2/22/18	Wed 3/14/18	70	72,80

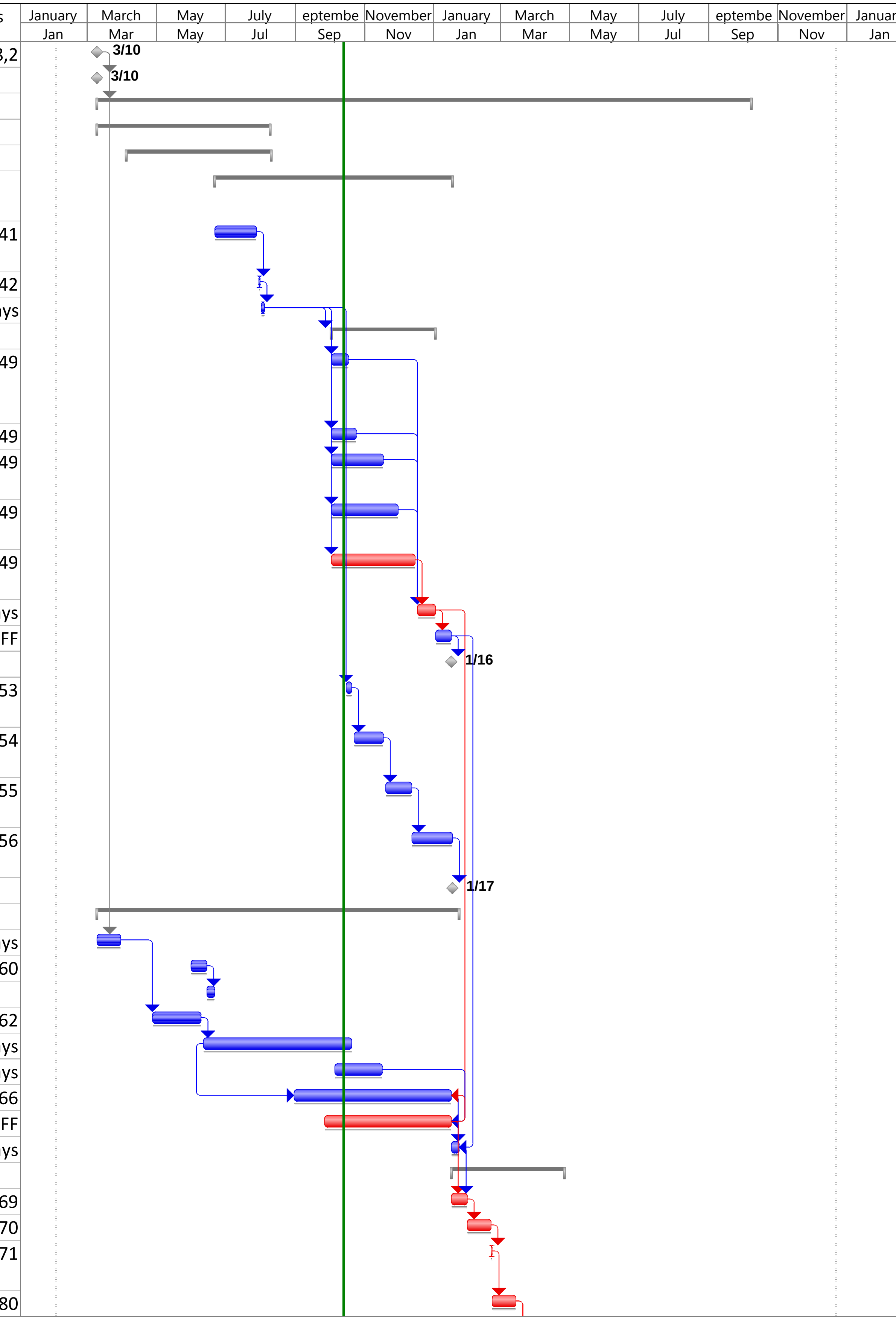


Figure 4-4
Project Schedule
Final Field Sampling

Task		Milestone	◆	Project Summary		External Milestone	◆	Critical	
Split		Summary		External Tasks		Deadline	⇩	Critical Split	
								Progress	

ID		Task Name	Duration	Start	Finish	Predecessors	Successors
72		USACE Review of Draft Final FS Report	5 days	Thu 3/15/18	Wed 3/21/18	71	73
73		Issue Draft Final FS Report to CT DEEP	0 days	Wed 3/21/18	Wed 3/21/18	72	FS+5 days,74
74		CT DEEP Review of Draft Final FS Report	15 days	Thu 3/22/18	Wed 4/11/18	73	
75		Meeting with CT DEEP to present/review Draft Final FS Report	1 day	Thu 3/29/18	Thu 3/29/18	73FS+5 days	76
76		Revise Draft Final FS Based on CT DEEP Comments	15 days	Fri 3/30/18	Thu 4/19/18	75	77
77		USACE Review of Final FS Report	5 days	Fri 4/20/18	Thu 4/26/18	76	78
78		Issue Final FS Report to USACE and CT DEEP	0 days	Thu 4/26/18	Thu 4/26/18	77	
79		**Task 6 - Proposed Plan**	**112 days**	**Thu 3/15/18**	**Sun 8/19/18**		
80		Prepare Draft Proposed Plan	20 days	Thu 3/15/18	Wed 4/11/18	71	81
81		Submit Draft Proposed Plan to USACE for review	0 days	Wed 4/11/18	Wed 4/11/18	80	82
82		USACE Review of Draft Proposed Plan	15 days	Thu 4/12/18	Wed 5/2/18	81	83
83		Revise Proposed Plan based on USACE Comments	10 days	Thu 5/3/18	Wed 5/16/18	82	84
84		Submit Draft Proposed Plan to CT DEEP for review	0 days	Wed 5/16/18	Wed 5/16/18	83	85
85		CT DEEP Review of Draft Proposed Plan	15 days	Thu 5/17/18	Wed 6/6/18	84	86
86		Revise Proposed Plan based on CT DEEP Comments	5 days	Thu 6/7/18	Wed 6/13/18	85	87
87		USACE review of Proposed Plan	5 days	Thu 6/14/18	Wed 6/20/18	86	88
88		Submit Draft Final Proposed Plan for Public Comment	0 days	Wed 6/20/18	Wed 6/20/18	87	89
89		Public Comment Period	30 edays	Wed 6/20/18	Fri 7/20/18	88	91,90
90		Public Meeting	1 day	Mon 7/23/18	Mon 7/23/18	89	
91		Collect and Respond to CT DEEP and Public Comments	30 edays	Fri 7/20/18	Sun 8/19/18	89	93
92		**Task 7 - Decision Document**	**90 days**	**Mon 8/20/18**	**Fri 12/21/18**		
93		Prepare Draft Record of Decision	25 days	Mon 8/20/18	Fri 9/21/18	91	94
94		Submit Draft Record of Decision to USACE for review	0 days	Fri 9/21/18	Fri 9/21/18	93	95
95		USACE Review of Draft Record of Decision	15 days	Mon 9/24/18	Fri 10/12/18	94	96
96		Revise Record of Decision based on USACE Comments	10 days	Mon 10/15/18	Fri 10/26/18	95	97
97		Submit Draft Record of Decision to CT DEEP for review	0 days	Fri 10/26/18	Fri 10/26/18	96	98
98		CT DEEP Review of Draft Record of Decision	15 days	Mon 10/29/18	Fri 11/16/18	97	99
99		Revise Record of Decision based on CT DEEP Comments	5 days	Mon 11/19/18	Fri 11/23/18	98	100
100		USACE review of Final Record of Decision	10 days	Mon 11/26/18	Fri 12/7/18	99	101
101		Revise Final Record of Decision	10 days	Mon 12/10/18	Fri 12/21/18	100	102
102		Issue Final Record of Decision	0 days	Fri 12/21/18	Fri 12/21/18	101	

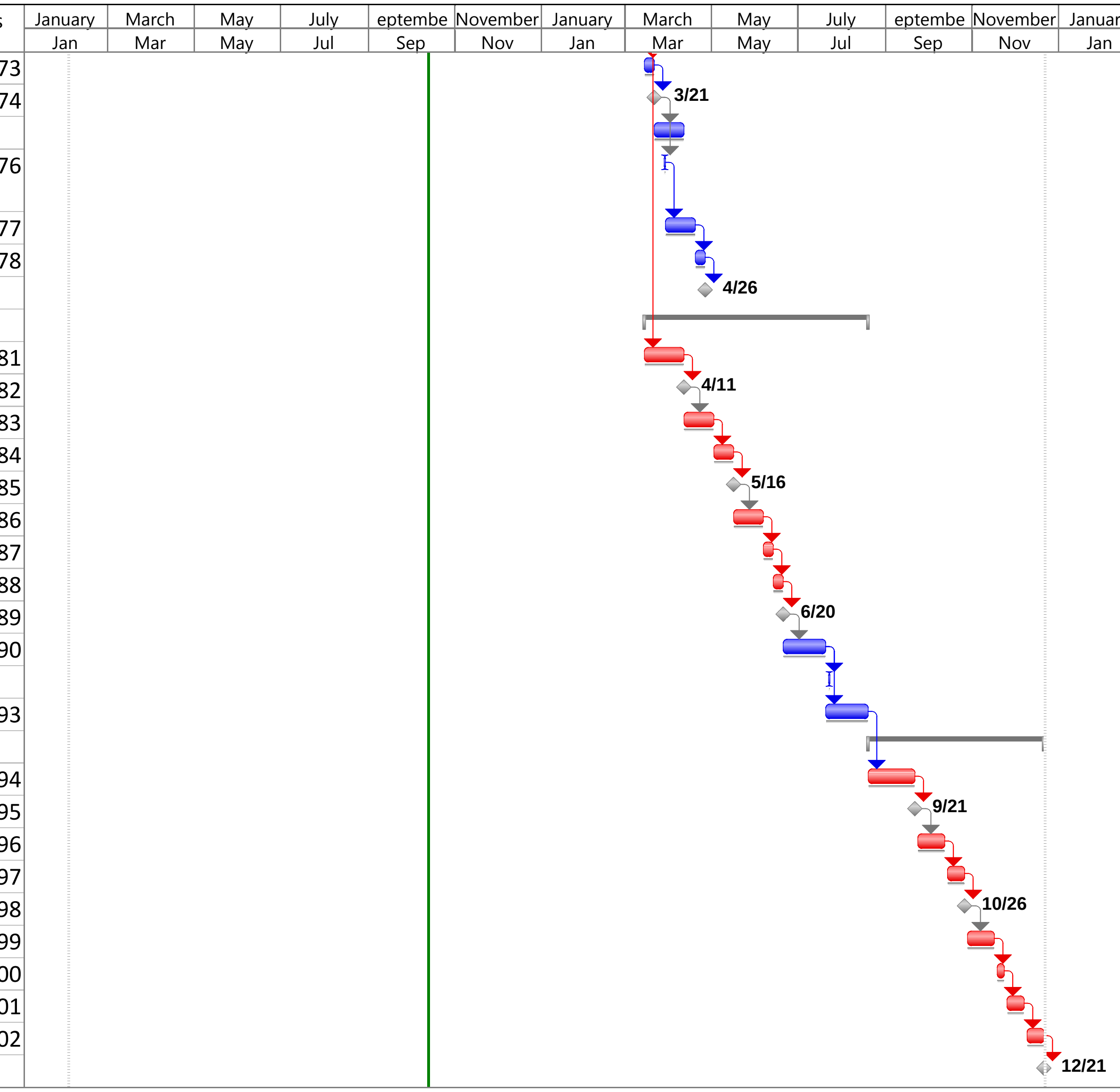


Figure 4-4
Project Schedule
Final Field Sampling Plan

Task		Milestone		Project Summary		External Milestone		Critical		Progress	
Split		Summary		External Tasks		Deadline		Critical Split			

TABLES

TABLE 4-1
SEDIMENT PCB DELINEATION 0-2' SAMPLE MATRIX

FINAL FIELD SAMPLING PLAN
STRATFORD ARMY ENGINE PLAN
STRATFORD, CONNECTICUT

Proposed Location ID	Contingency Boring	Easting	Northing	Sample Depth Intervals (ft)	Proposed Sample IDs	Analytical Sample Quantitites Total PCB Homologs (Method 680)
SD-PCB-001		898122	624350	0-1 1-2	SDPCB0010001 SDPCB0010102	1 1
SD-PCB-002		898167	624327	0-1 1-2	SDPCB0020001 SDPCB0020102	1 1
SD-PCB-003		898212	624305	0-1 1-2	SDPCB0030001 SDPCB0030102	1 1
SD-PCB-004		898100	624305	0-1 1-2	SDPCB0040001 SDPCB0040102	1 1
SD-PCB-005		898145	624283	0-1 1-2	SDPCB0050001 SDPCB0050102	1 1
SD-PCB-006		898189	624261	0-1 1-2	SDPCB0060001 SDPCB0060102	1 1
SD-PCB-007		898078	624260	0-1 1-2	SDPCB0070001 SDPCB0070102	1 1
SD-PCB-008		898122	624238	0-1 1-2	SDPCB0080001 SDPCB0080102	1 1
SD-PCB-009	x	898256	624283	0-1 1-2	SDPCB0090001 SDPCB0090102	0 0
SD-PCB-010	x	898234	624350	0-1 1-2	SDPCB0100001 SDPCB0100102	0 0
SD-PCB-011	x	898189	624372	0-1 1-2	SDPCB0110001 SDPCB0110112	0 0
SD-PCB-012	x	898144	624395	0-1 1-2	SDPCB0120001 SDPCB0120102	0 0
SD-PCB-013	x	898077	624372	0-1 1-2	SDPCB0130001 SDPCB0130102	0 0
SD-PCB-014	x	898055	624327	0-1 1-2	SDPCB0140001 SDPCB0140102	0 0
SD-PCB-101		897295	623989	0-1 1-2	SDPCB1010001 SDPCB1010102	1 1
SD-PCB-102		897340	623967	0-1 1-2	SDPCB1020001 SDPCB1020102	1 1
SD-PCB-103		897385	623945	0-1 1-2	SDPCB1030001 SDPCB1030102	1 1
SD-PCB-104		897273	623944	0-1 1-2	SDPCB1040001 SDPCB1040102	1 1
SD-PCB-105		897318	623922	0-1 1-2	SDPCB1050001 SDPCB1050102	1 1
SD-PCB-106		897363	623900	0-1 1-2	SDPCB1060001 SDPCB1060102	1 1
SD-PCB-107		897251	623899	0-1 1-2	SDPCB1070001 SDPCB1070102	1 1
SD-PCB-108		897296	623877	0-1 1-2	SDPCB1080001 SDPCB1080102	1 1
SD-PCB-109		897341	623855	0-1 1-2	SDPCB1090001 SDPCB1090102	1 1
SD-PCB-110	x	897317	623810	0-1 1-2	SDPCB1100001 SDPCB1100102	0 0
SD-PCB-111	x	897385	623834	0-1 1-2	SDPCB1110001 SDPCB1110102	0 0
SD-PCB-112	x	897407	623877	0-1 1-2	SDPCB1120001 SDPCB1120102	0 0
SD-PCB-113	x	897429	623921	0-1 1-2	SDPCB1130001 SDPCB1130102	0 0
SD-PCB-114	x	897406	623990	0-1 1-2	SDPCB1140001 SDPCB01140102	0 0
SD-PCB-115	x	897249	624012	0-1 1-2	SDPCB1150001 SDPCB1150102	0 0
SD-PCB-116	x	897226	623967	0-1 1-2	SDPCB1160001 SDPCB1160102	0 0
SD-PCB-117	x	897204	623922	0-1 1-2	SDPCB1170001 SDPCB1170102	0 0

TABLE 4-1
SEDIMENT PCB DELINEATION 0-2' SAMPLE MATRIX

FINAL FIELD SAMPLING PLAN
STRATFORD ARMY ENGINE PLAN
STRATFORD, CONNECTICUT

Proposed Location ID	Contingency Boring	Easting	Northing	Sample Depth Intervals (ft)	Proposed Sample IDs	Analytical Sample Quantitites Total PCB Homologs (Method 680)
SD-PCB-201		897096	623852	0-1	SDPCB2010001	1
				1-2	SDPCB2010102	1
SD-PCB-202		897141	623830	0-1	SDPCB2020001	1
				1-2	SDPCB2020102	1
SD-PCB-203		897186	623808	0-1	SDPCB2030001	1
				1-2	SDPCB2030102	1
SD-PCB-204		897074	623807	0-1	SDPCB2040001	1
				1-2	SDPCB2040102	1
SD-PCB-205		897119	623785	0-1	SDPCB2050001	1
				1-2	SDPCB2050102	1
SD-PCB-206		897164	623763	0-1	SDPCB2060001	1
				1-2	SDPCB2060102	1
SD-PCB-207	x	897208	623741	0-1	SDPCB2070001	0
				1-2	SDPCB2070102	0
SD-PCB-208	x	897231	623786	0-1	SDPCB2080001	0
				1-2	SDPCB2080102	0
SD-PCB-209	x	897163	623875	0-1	SDPCB2090001	0
				1-2	SDPCB2090102	0
SD-PCB-210	x	897051	623874	0-1	SDPCB2100001	0
				1-2	SDPCB2100102	0
					Subtotal Field Sample Analyses:	46
					Field Duplicate Analyses (10%):	5
					MS/MSD Analyses (5%):	3
					Total Analytical Samples:	54

Note:
1) Coordinates are North American Datum 1983 Connecticut State Plane
2) 18 Contingency cores will be completed in the same manner as the first 23 cores from 0-2'; however samples will be held frozen at the laboratory pending analytical results from the first 23 cores.

TABLE 4-2
SEDIMENT PCB/MERCURY DELINEATION 4-8'
SAMPLE MATRIX

FINAL FIELD SAMPLING PLAN
STRATFORD ARMY ENGINE PLAN

					Analytical Sample Quantitites	
Proposed Location ID	**Easting**	**Northing**	**Sample Depth Intervals (ft)**	**Proposed Sample IDs**	**Total PCB Homologs (Method 680)**	**Mercury (Method 7474)**
SD-PCB-201	897096	623852	4-5	SDPCB2010405	1	1
			5-6	SDPCB2010506	1	1
			6-7	SDPCB2010607	1	1
			7-8	SDPCB2010708	1	1
SD-PCB-205	897119	623785	4-5	SDPCB2050405	1	1
			5-6	SDPCB2050506	1	1
			6-7	SDPCB2050607	1	1
			7-8	SDPCB2050708	1	1
SD-PCB-206	897164	623763	4-5	SDPCB2060405	1	1
			5-6	SDPCB2060506	1	1
			6-7	SDPCB2060607	1	1
			7-8	SDPCB2060708	1	1
SD-PCB-210	897051	623874	4-5	SDPCB2100405	1	1
			5-6	SDPCB2100506	1	1
			6-7	SDPCB2100607	1	1
			7-8	SDPCB2100708	1	1
SD-PCB-300	897253	623719	4-5	SDPCB3000405	1	1
			5-6	SDPCB3000506	1	1
			6-7	SDPCB3000607	1	1
			7-8	SDPCB3000708	1	1
SD-PCB-301	897275	623764	4-5	SDPCB3010405	1	1
			5-6	SDPCB3010506	1	1
			6-7	SDPCB3010607	1	1
			7-8	SDPCB3010708	1	1
SD-PCB-302	897320	623741	4-5	SDPCB3020405	1	1
			5-6	SDPCB3020506	1	1
			6-7	SDPCB3020607	1	1
			7-8	SDPCB3020708	1	1
SD-PCB-303	897365	623719	4-5	SDPCB3030405	1	1
			5-6	SDPCB3030506	1	1
			6-7	SDPCB3030607	1	1
			7-8	SDPCB3030708	1	1
SD-PCB-304	897343	623674	4-5	SDPCB3043045	1	1
			5-6	SDPCB3040506	1	1
			6-7	SDPCB3040607	1	1
			7-8	SDPCB3040708	1	1
SD-PCB-400	896603	624095	4-5	SDPCB4000405	1	1
			5-6	SDPCB4000506	1	1
			6-7	SDPCB4000607	1	1
			7-8	SDPCB4000708	1	1
SD-PCB-401	896625	624140	4-5	SDPCB4010405	1	1
			5-6	SDPCB4010506	1	1
			6-7	SDPCB4010607	1	1
			7-8	SDPCB4010708	1	1

TABLE 4-2
SEDIMENT PCB/MERCURY DELINEATION 4-8'
SAMPLE MATRIX

FINAL FIELD SAMPLING PLAN
STRATFORD ARMY ENGINE PLAN

					Analytical Sample Quantitites	
Proposed Location ID	**Easting**	**Northing**	**Sample Depth Intervals (ft)**	**Proposed Sample IDs**	**Total PCB Homologs (Method 680)**	**Mercury (Method 7474)**
SD-PCB-402	896670	624118	4-5	SDPCB4020405	1	1
			5-6	SDPCB4020506	1	1
			6-7	SDPCB4020607	1	1
			7-8	SDPCB4020708	1	1
				Subtotal Field Sample Analyses:	48	48
				Field Duplicate Analyses (10%):	5	5
				MS/MSD Analyses (5%):	3	3
				Total Analytical Samples:	56	56

Notes:
1) Coordinates are North American Datum 1983 Connecticut State Plane

TABLE 4-3
SEDIMENT TREATABILITY SAMPLE MATRIX

FINAL FIELD SAMPLING PLAN
STRATFORD ARMY ENGINE PLAN
STRATFORD, CONNECTICUT

								Number of Samples Per Analysis							Rationale for Selection of Sampling Location			
Area	**Proposed Location ID**	**Proposed Sample ID**	**Discrete/ Composite**	**Number of Cores to Composite**	**Core Number**	**Depth Interval (ft)**	**Notes**	**Treat-ability[2]**	**Off-Site Waste Disposal[3]**	**PCBs/ Metals/Hg**	**Elutriate[5]**	**% Solids**	**SPLP[4]**	**Geo-technical[6]**	**Elevated PCB Conc.**	**Elevated Metals Conc.**	**Elevated Hg Conc.**	**Representative Area/Hydrodynamic conditions**
01	SDT-01-001 through SDT-01-015	SDT01COMP001	Treatability Composite[1]	15	1 through 15	0-4	15 gal of 45 gal total. Surface water to be collected. See Note 7.							1	X	X	X	West side of Causeway; deeper water
	SDT-01-016,017	SDT01COMP002	Composite	2	16 and 17	0-4	3-gallon sediment volume needed, 10 gal SW needed			1	1							
	SDT-01-018	SDT010180002	Discrete	NA	18	0-2						1	1					
		SDT010180204	Discrete	NA		2-4						1	1					
	SDT-01-019	SDT010190001	Discrete	NA	19	0-1								1				
		SDT010190001	Discrete	NA		1-2								1				
		SDT010190001	Discrete	NA		2-4								1				
04	SDT-04-020 through SDT-04-049	SDT04COMP001	Treatability Composite[1]	30	20-49	0-2	20 gal of 45 gal total							1	X	X		Near outfalls; shallow water
	SDT-04-050	SDT040500002	Discrete	NA	50	0-2						1	1					
	SDT-04-051	SDT040510001	Discrete	NA	51	0-1								1				
		SDT040510102	Discrete	NA		1-2								1				
06	SDT-06-052,053	SDT06COMP003	Composite	2	52-53	0-4	3-gallon sediment volume needed, 10 gal SW needed			1	1			1		X		East side of Causeway, shallow water
	SDT-06-054	SDT060540004	Discrete	NA	54	0-4						1	1					
	SDT-06-055	SDT060550001	Discrete	NA	55	0-1								1				
		SDT060550102	Discrete	NA		1-2								1				
		SDT060550204	Discrete	NA		2-4								1				
08	SDT-08-056 through SDT-08-075	SDT08COMP001	Treatability Composite[1]	20	56-75	0-2	10 gal of 45 gal total							1	X	X		Near outfalls; shallow water
	SDT-08-076 through SDT-08-079	SDT08COMP004	Composite	4	76-79	0-2	3-gallon sediment volume needed, 10 gal SW needed			1	1							
	SDT-08-80	SDT080800004	Discrete	NA	80	0-2						1	1					
	SDT-08-081	SDT080810001	Discrete	NA	81	0-1								1				
		SDT080810102	Discrete	NA		1-2								1				
06	SDT-06-044 thru SDT-06-049	SDT-XX-COMP-001	Treatability Composite[1]	40 gallons	NA	NA	Composite Area 1, Area 4, and Area 8 into one composite	1	1	1		1		1	X	X	X	East side of Causeway, shallow water
							Total Samples:	1	1	4	3	6	5	15				

Notes:

Refer to Figure 4-3 for treatability testing areas 1, 4, 6, and 8.

1. All treatability cores will be composited together to create a single sample volume of 45 gallons to be submitted for treatability analyses and off-site waste disposal characterization parameters. Prior to combining cores from different areas, samples the area composite for geotechnical parameters to assess variability across the site. Sample volume may be collected via shovel where this can be done safely.

2. Analyses and procedures are specified in text.

3. Parameters include Volatile Organic Compounds (VOCs), Semi-VOCs, Polychlorinated Biphenyls (PCBs) [Aroclors], metals, Total Petroleum Hydrocarbons, Toxicity Characteristic Leaching Procedure (VOCs, SVOCs, Pesticides, herbicides, metals), ignitability, corrosivity, reactivity. VOC samples to be collected prior to compositing.
4. Synthetic Precipitation Leaching Procedure parametes include PCBs (homologs) and metals (arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), nickel (Ni), silver (Ag), zinc (Zn), mercury (Hg) only)
5. Elutriate analysis is aqueous and includes PCBs (Homologs) and metals (As, Cd, Cr, Cu, Pb, Ni, Ag, Zn, Hg only). In addition, analysis to be performed on sediment and surface water pre-elutriate prep.
6. Geotechnical parameters include Atterberg limits, TOC, grain size, percent solids/moisture content, water content, bulk and dry density, specific gravity of solids.
7. 55 gallons of surface water to be collected at this location prior to coring, to be used for performing bench tests. Expressed water from dewatering tests to be used for water treatment tests.

TABLE 4-4
SURFACE WATER TREATABILITY SAMPLE MATRIX

FINAL FIELD SAMPLING PLAN
STRATFORD ARMY ENGINE PLAN
STRATFORD, CONNECTICUT

						Number of Samples Per Analysis	
Area	**Proposed Location ID**	**Proposed Sample ID**	**Discrete/ Composite**	**Depth Interval (ft)**	**Volume**	**Treatability[1]**	**Elutriate[2]**
01	SW-01-001	SW010010001	Discrete	1 ft above sediment surface	Collect 55 gallons surface water, one foot above sediment surface , place in 5 gallon pails	1	
	SW-01-002	SW010020001	Discrete	1 ft above sediment surface	5 gallons		1
06	SW-06-001	SW060010001	Discrete	1 ft above sediment surface	5 gallons		1
08	SW-08-001	SW080010001	Discrete	1 ft above sediment surface	5 gallons		1
					Total Samples:	**1**	**3**

Notes:

1. Collect full 55-gallons of surface water needed for treatability studies from Area 1 prior to any coring.
2. Collect 5 gallons of surface water at Areas 1, 6, and 8 prior to any coring. Sample to be used as makeup water for corresponding sediment for elutriate analysis.

TABLE 4-5
SEDIMENT DEWATERING TEST QUANTITIES

FINAL FIELD SAMPLING PLAN
STRATFORD ARMY ENGINE PLAN
STRATFORD, CONNECTICUT

Sample Type	Volume/Container	Option 1 Separation/Dewatering - Settling Pond	Option 2 Pressure Geotube® Dewatering Test (P-GDT)	Option 3 Mechanical Dewatering	Total Containers/Volume
Sediment Composite	5-Gallon Bucket	1	3	2	6 (30 gal)
Surface Water	5-Gallon Bucket	2	5	4	11 (55 gal)

TABLE 5-1
ANALYTICAL LABORATORY TESTING PROGRAM

FINAL FIELD SAMPLING PLAN
STRATFORD ARMY ENGINE PLAN
STRATFORD, CONNECTICUT

Sampling Objective	Solid/Aqueous	Analysis	Laboratory Analytical Method	Estimated Number of Samples
PCB and Mercury Delineation	Solid	PCB Homologs	EPA Method 680 Mod	110
	Solid	Mercury	EPA Method 245.7	56
Treatability Testing (includes total number of analyses proposed for the five options/phases of treatability testing)	Solid	PCB Homologs	EPA Method 680 Mod	11
	Solid	Metals + mercury[1]	EPA Method 6020/245.7	11
	Solid	SPLP PCB Homologs	SW 846 1312/680 Mod	20
	Solid	SPLP Metals + mercury[1]	SW 846 1312/6020/245.7	20
	Aqueous	Metals + mercury[1]	EPA Method 6020/7471	23
	Aqueous	PCB Homologs	EPA Method 680 Mod	23
Off-Site Disposal Characterization	Solid	TCLP VOCs, SVOCs, pesticides, herbicides, metals[2]	SW-846 1311 leachate prep, followed by aqueous analysis by 8260, 8270, 8081, 6020, 245.7, 8151A	1
	Solid	Total Petroleum Hydrocarbons, PCB Aroclors and Homologs	Method 8015, 8082, and 680 Mod	1
	Solid	Hazardous Waste Parameters, Ignitability, Corrosivity, Reactivity	SW-846 1030, 9045, 9010, 9038	1
On-site Re-use/Dredged Materials Characterization	Solid	SPLP PCB Homologs	SW-846 1312 leachate prep, followed by aqueous analysis by EPA Method 680	6
	Solid	SPLP Metals+ mercury[1]	SW 846 1312/6020/245.7	6
	Solid	Atterberg Limits	American Society for Testing and Materials (ASTM) D4318	15
	Solid	Total Organic Carbon	Lloyd Kahn	15
	Solid	Grain Size	ASTM D6913 (ASTM D422 withdrawn) w/ hydrometer (ASTM D7928)	15
	Solid	Percent Solids	EPA Method 160.3	21
	Solid	Water Content	ASTM 2216	15
	Solid	Specific Gravity of Solids	ASTM D854	15
	Solid	Bulk and Dry Density	ASTM D653	15
Dredging Resuspension Testing (Elutriate)	Aqueous	Surface Water Eluant Metals+mercury[1]	Inland Testing Manual/EPA Method 6020/245.7	3
	Aqueous	Surface Water Eluant PCB Homologs	Inland Testing Manual/EPA Method 680 Mod	3
	Aqueous	Surface Water Elutriate Metals+mercury[1]	Inland Testing Manual/EPA Method 6020/245.7	3
	Aqueous	Surface Water Elutriate PCB Homologs	Inland Testing Manual/EPA Method 680 Mod	3
	Solid	Metals+mercury[1], raw sediment	Inland Testing Manual/EPA Method 6020/245.7	3
	Solid	PCB Homologs, raw sediment	Inland Testing Manual/EPA Method 680 Mod	3

PCB = Polychlorinated Biphenyl
SPLP = Synthetic Precipitation Leaching Procedure
VOCs = Volatile Organic Compounds
SVOCs = Semi-volatile Organic Compounds
1. Metals analysis by method 6020 includes As, Cd, Cr, Cu, Pb, Ni, Ag, and Zn only, plus mercury by method 245.7.
2. Metals for TCLP analyses are RCRA 8 metals only.

TABLE 5-2
SAMPLE CONTAINERS, PRESERVATIVES, AND HOLD TIMES

FINAL FIELD SAMPLING PLAN
STRATFORD ARMY ENGINE PLAN
STRATFORD, CONNECTICUT

Matrix	Analytical Group	Analytical and Preparation Method/SOP Reference (1)	Sample Volume Required	Containers (number, size, and type)	Shipping	Holding Time To Preservation	Preservative	Storage	Maximum Holding Time To Prep And Analysis
SED	PCB Homologs	SW-846 680 modified/L-1, L-7,L-9, L-10	8 ounces (oz.)	One Amber Glass Teflon Lined	Cool, ≤ 6ºC	immediate	Cool, ≤ 6ºC	In a cooler on ice	14 Days to extraction; 40 days to analysis
SED	Total TAL Metals	SW-846 6020/L-3, L-11	8 oz.	One Amber Glass Teflon Lined	Cool, ≤ 6ºC	immediate	Cool, ≤ 6ºC	In a cooler on ice	180 days to analysis
SED	Total Mercury	SW-846 7474/L-4, L-13	8 oz.	One Amber Glass Teflon Lined	Cool, ≤ 6ºC	immediate	Cool, ≤ 6ºC	In a cooler on ice	28 days to analysis
SED	Total Organic Carbon	Lloyd Kahn/L-6	4 oz.	One Amber Glass Teflon Lined	Cool, ≤ 6ºC	immediate	Cool, ≤ 6ºC	In a cooler on ice	28 days to analysis
SED	Grain Size	ASTM D422 w/Hydrometer/L-15	4 oz., combined [1]	One plastic bucket	Cool, ≤ 6ºC	immediate	Cool, ≤ 6ºC	In a cooler on ice	180 days to analysis
SED	Water Content	ASTM 2216/L-17	4 oz., combined [1]	One Amber Glass Teflon Lined	Cool, ≤ 6ºC	immediate	Cool, ≤ 6ºC	In a cooler on ice	As soon as possible
SED	Percent Solids	EAP 160.3/L-18	4 oz., combined [1]	One Amber Glass Teflon Lined	Cool, ≤ 6ºC	immediate	Cool, ≤ 6ºC	In a cooler on ice	As soon as possible
SED	Atterberg Limits	ASTM D4318/L-19	4 oz., combined [1]	One plastic bucket	Cool, ≤ 6ºC	immediate	Cool, ≤ 6ºC	In a cooler on ice	180 days to analysis
SED	Bulk and Dry Density	ASTM D653/L-20	4 oz., combined [1]	One plastic bucket	Cool, ≤ 6ºC	immediate	Cool, ≤ 6ºC	In a cooler on ice	180 days to analysis
SED	Specific Gravity of Solids	ASTM D854/L-21	8 oz.	One Amber Glass Teflon Lined	Cool, ≤ 6ºC	immediate	Cool, ≤ 6ºC	In a cooler on ice	14 days
SED	Elutriate Prep	Inland Testing Manual/L-22	5 gallons	One plastic bucket	Cool, ≤ 6ºC	immediate	Cool, ≤ 6ºC	In a cooler on ice	7 days
SED	Toxic Characteristic Leaching Procedure	SW-846 1311/L-23	16 oz.	One Amber Glass Teflon Lined	Cool, ≤ 6ºC	immediate	Cool, ≤ 6ºC	In a cooler on ice	14 days
SED	Synthetic Precipitate Leaching Procedure	SW-846 1312/L-24	16 oz.	One Amber Glass Teflon Lined	Cool, ≤ 6ºC	immediate	Cool, ≤ 6ºC	In a cooler on ice	14 days
SW, EL	PCB Homologs	SW-846 680 modified/L-1, L-8, L-9, L-10, L-22	2 x 1 liter	Two Amber Glass Teflon Lined	Cool, ≤ 6ºC	immediate	Cool, ≤ 6ºC	In a cooler on ice	7 Days to extraction; 40 days to analysis
SW, EL	Total TAL Metals	SW-846 6020/L-3, L-12	5 gallons, combined [2]	One plastic bucket	Cool, ≤ 6ºC	immediate	Cool, ≤ 6ºC	In a cooler on ice	180 days to analysis
SW, EL	Total Mercury	SW-846 7471B/L-5, L-4	5 gallons, combined [2]	One plastic bucket	Cool, ≤ 6ºC	immediate	Cool, ≤ 6ºC	In a cooler on ice	28 days to analysis

Notes:
C - celsius
EL - elutriate
PCB - polychlorinated biphenyls
SED - sediment
SW - surface water

1: Grain size, water content, percent solids, Atterberg Limits, Bulk and Dry Density analyses combined in one 4 oz. jar

2: Total TAL metals and mercury analyses combined in one 5 gallon bucket

APPENDIX A

FIELD DATA RECORDS

DAILY PROJECT SAFETY AND HEALTH INSPECTION CHECKLIST

Project: Stratford Army Engine Plant, Stratford, Connecticut

Project Number: 3616176064 **Project Manager:** Rod Pendleton

Prepared by: ____________________

Names of Amec Foster Wheeler employees on project: ____________________

Amec Foster Wheeler Subcontractors and their employees' Names on project:

____

Y	N	N/A		Comments
			Inspect Initial Start up of the project, when tasks change or new workers come to the project.	
☐	☐	☐	1) Are emergency phone numbers posted?	
☐	☐	☐	2) Are directions to the nearest emergency medical care posted?	
☐	☐	☐	3) Is there a SSHP at the Project?	
☐	☐	☐	a. Is it current?	
☐	☐	☐	b. Does it address all know/suspected hazards?	
☐	☐	☐	c. Is it approved?	
☐	☐	☐	4) Have applicable workers received 40-hour initial training? (24-hours training for contractors is acceptable)	
☐	☐	☐	5) Have all applicable workers received refresher training within the past year?	
☐	☐	☐	6) Are all applicable workers in the medical monitoring program?	
☐	☐	☐	a. Are they current in their physicals?	
☐	☐	☐	7) Is there a charged fire extinguisher on Project?	
☐	☐	☐	8) Is there an eyewash on Project?	
☐	☐	☐	a. Solution not expired?	
☐	☐	☐	9) Is there a first aid kit on project?	
☐	☐	☐	a. Adequately stocked?	

AMEC FOSTER WHEELER DAILY TAILGATE SAFETY MEETING CHECKLIST

I have participated in the daily safety meeting discussing the topics indicated on the reverse and fully understand my responsibility for complying with all health and safety requirements. I have had the opportunity to have my questions on project health and safety issues and procedures answered.

Employee Name	Employee Signature	Date

Name and Signature of person conducting training Date:

SUMMARY OF DAILY ACTIVITIES

Site Name:	Stratford Army Engine Plant	**Project Number:**	3616176064
Technician Name:		**Date and Time:**	
Personnel Onsite:			
Weather Conditions:			

Description of Daily Activities and Events:

List Samples Collected:

Deviation from Plans:

Visitors on Site:	**Important Telephone Calls / Photos Taken:**	**Technician Signature:**
		Technician Name (print)**:**

QA/QC'd by: **QA/QC Date:**

FIELD INSTRUMENTATION CALIBRATION RECORD

PROJECT: Stratford Army Engine Plant DATE ______ TIME ______

CREW ID OR TASK ID ______ JOB NUMBER 3616176064

SAMPLER SIGNATURE ____CHECKED BY___________________

EQUIPMENT CALIBRATION

MANF & MODEL NO.______________

UNIT ID NO._________________

		INITIAL CALIBRATION STANDARD VALUE	INITIAL CALIBRATION METER VALUE	SECONDARY CALIBRATION (see note 3) STANDARD VALUE	SECONDARY CALIBRATION (see note 3) METER VALUE	ACCEPTANCE CRITERIA **
pH	units	_________	_________	_________	_________	+/- 10% of standard
Redox	+/- mV	_________	_________	_________	_________	see note 1
Conductivity	mS/cm	_________	_________	_________	_________	+/- 10% of standard
DO	mg/L *	_________	_________	_________	_________	+/- 10% of standard
Thermometer Temperature	deg. C	_________	_________	_________	_________	+/- 2.0 deg. C
TURBIDITY METER TYPE_________________ MODEL NO._______________	NTU (low)	_________	_________	_________	_________	within 0.5 NTU of the standard
UNIT ID NO._______________	NTU (high)	_________	_________	_________	_________	+/- 10% of standard
PHOTOIONIZATION METER TYPE_______________	Background ppmv	_________	_________	_________	_________	within 5 ppmv of Zero
MODEL NO._______________ UNIT ID NO._______________	Span Gas ppmv	_________	_________	_________	_________	+/- 10% of standard
OTHER METER TYPE_____________ MODEL NO._______________ UNIT ID NO._______________		_________	_________	_________	_________	see note 2

Check One

☐ Equipment calibrated within the Acceptance Criteria specified for each of the parameters listed above.

☐ Equipment (not) calibrated within the Acceptance Criteria specified for each of the parameters listed above (see notes below).

MATERIALS RECORD

Deionized Water Source: ______________________

PID SPAN Gas: Lot __________________________

PID Zero Gas: Lot ___________________________

Other : ___________________________________

Source and Lot Number

pH ____________________________

ORP ____________________________

Conductivity ____________________________

Turbidity ____________________________

Other ____________________________

NOTES:

* = Indicate in notes section what was used as the DO standard (i.e., based on saturation at room temperature)

** = If the meter reading is not within acceptance criteria, clean or replace probe and re-calibrate, or use a different meter if available. If project requirements necessitate use of the instrument, clearly document on all data sheets and log book entries that the parameter was not calibrated to the acceptance criteria.

1 = meter must read within specified range of the Zobell solution.

2 = specify acceptance criteria in the Notes section

3 = secondary calibration to be completed should instrument drift be suspected during field day

EQUIPMENT BLANK SAMPLING RECORD

PROJECT NAME	SAMPLE LOCATION	PROJECT NO
Stratford Army Engine Plant		3616176064

Rinsate Blank Sample I.D.:	
Date/Time:	
DI Water Source:	
Equipment Used:	

Sample I.D.s associated with above Rinsate Blank	Comment

Created By: BPW
Checked By:

Stratford Army Engine Plant - Feasibility Study

SEDIMENT CORE and DISCRETE SAMPLE LOG

Site: Stratford Army Engine Plant **Project No.:** 3616176064 **Logger:**

Sub: **WO:** **Crew:**

Date: **Time :** **Vessel:**

Coordinates: **Easting** **Northing**

Sampling Station:

Weather/Conditions: Traffic: Water Temp:

Measured Water Depth (ft):

Core Liner tube length (ft):

Core Penetration (ft) Core Recovery (ft):

Calculated Percent Recovery:

Coring Notes:

Interval	Sample ID	Description (Odor, Color, Type, etc.)	Notes
0-1'			
1-2'			
3-4'			
4-5'			
5-6'			
6-7'			
7-8'			

Number of containers:					Equipment
					Sampler Type
Type of container:	40 ml VOA	Amber Jar	Plastic bag	other	Capacity

Live Organisms present	Y	N
Oil-Like Present	Y	N
Odor Present	Y	N
Debris Present	Y	N

Photo Numbers

Comments

SURFACE WATER SAMPLING RECORD

Amec Foster Wheeler
511 Congress Street
Suite 200
Portland, Maine 04101

PROJECT NAME	SAMPLE LOCATION	DATE
Stratford Army Engine Plant		
PROJECT NUMBER 3616176064	**START TIME**	**END TIME**
SAMPLE ID	**SAMPLE TIME**	**PAGE** of
Lat.	**Long.**	

SURFACE WATER DATA

WATER DEPTH AT SAMPLE LOCATION ______ FT.

DEPTH OF SAMPLE BELOW WATER SURFACE ______ FT.

SAMPLING FLOW RATE ______ ML/MIN

TIDE DIRECTION ☐ INCOMING ☐ OUTGOING

FIELD SKETCH ☐ YES ☐ NO

TOTAL PURGE VOLUME ______ ML

WATER QUALITY PARAMETERS:

TEMPERATURE ______ ^{o}C
SPEC. COND. ______ mS/cm
PH ______ pH Units
ORP ______ mV
TURBIDITY ______ NTUs
DO ______ mg/L
SALINITY ______ ppt

EQUIPMENT USED:

☐ BEAKER
☐ BOTTLE
☐ PACS BOMB
X PUMP Peristaltic Pump (Geopump)
☐ FILTER ______
☐ 5 ft of lab precleaned 1/4 " Teflon Tubing
☐ 3 ft of lab precleaned Masterflex Tubing

TYPE OF SURFACE WATER:

☐ STREAM
☐ RIVER
☐ LAKE
☐ POND
☐ SEEP
X TIDAL FLATS
☐ ______

☐ FIELD DUPLICATE COLLECTED
DUP. ID ______
TIME ______

☐ MATRIX SPIKE COLLECTED
MS ID ______
TIME ______

☐ MATRIX SPIKE DUPLICATE COLLECTED
MSD ID ______
TIME ______

DECON FLUIDS USED

☐ ALL USED
☐ LIQUINOX/DI H_2O SOLUTION
☐ DEIONIZED WATER
☐ POTABLE WATER
☐ NITRIC ACID
☐ HEXANE
☐ ETHYL ALCOHOL
☐ N/A

SAMPLING EQUIPMENT

WATER QUALITY METER MODEL NO. ______ UNIT ID NO. ______
TURBIDITY METER MODEL NO. ______ UNIT ID NO. ______

ANALYTICAL PARAMETERS

	PARAMETER	METHOD NUMBER	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED
☐					
☐					
☐					
☐					
☐					
☐					
☐					

NOTES/SKETCH

Note:

Sampler Signature: Print Name:

Checked By: Date:

APPENDIX B

RESPONSE TO CT DEEP COMMENTS ON DRAFT FINAL FIELD SAMPLING PLAN

US Army Corps
of Engineers ®

New England District
Engineering Planning Division
696 Virginia Road
Concord, Massachusetts
01742-2751

REVIEW COMMENTS

Project Name: Stratford Army Engine Plant
Location: Stratford, Connecticut
Document Name: (Draft Final) Feasibility Study Work Plan - Field Sampling Plan
Prepared By: Amec Foster Wheeler

Date: September 22, 2017
Reviewer: Connecticut DEEP
Dated: July 25, 2017

No.	COMMENTS	USACE Response
1.	The FSP proposes collecting sediment samples at depth in certain areas of the Tidal Flats to improve delineation of elevated PCBs below 4 feet that may remain after the proposed dredging, or be candidates for spot removal. Given the limited data on mercury concentrations at depth, these proposed samples should also include mercury analyses.	Analysis of mercury will be included for the samples collected between 4 and 8 feet bgs.
2.	Some FSP proposed at-depth sampling is in areas where earlier investigations were not able to acquire samples, please describe any contingent approaches for how the data gap will be filled if sampling again is difficult.	In April 2015, fourteen Vibracore explorations were attempted in the Tidal Flats sediments adjacent to the Dike west of the Causeway. At four out of the 14 explorations, a 7-8 ft bgs sample was not collected due to poor recovery. These explorations were primarily located within 10-15 feet of the toe of slope of the Dike. The poor recovery was attributable to refusal at hard-packed material, which was evidenced by rocks in several cores. The likely cause of the refusal is the presence of the Dike rip-rap material which slopes outward from the Dike beneath the Tidal Flats. Of the 12 proposed deep cores presented on Figure 4-2 of the FSP, four of the cores are proposed in areas where recovery of a 7-8 foot bgs sample was not obtained in April 2015. Amec Foster Wheeler proposes that if refusal is met at depths less than 7 feet in any of the 12 twelve proposed cores after two attempts, the proposed exploration be re-located 15 feet riverward of the proposed location and re-attempted.
3.	FSP section 7.3 indicates that any clear water above sediment will be decanted prior to shipping. Please note that this clear water may reflect the interstitial pore water quality and should be separately evaluated as part of the evaluation of dewatering effluent quality.	Assessment of partitioning to dewatering fluids will be performed by analyzing the following water samples: decant from the modified elutriate procedure, which includes vigorous mixing to simulate water quality in dewatering fluids following settling of hydraulically dredged sediments; decant fluids from a gravity dewatering process; decant/filtrate from several mechanical dewatering methods (filter press, recessed chamber, centrifuge, screening/hydrocylone); decant/filtrate from a Geotube dewatering simulation.

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No.	COMMENTS	Contractor Disposition
4.	The FSP proposes treatability testing for dewatering and disposal of the contaminated sediment. Whole Effluent Toxicity (WET) testing, including the effects of proposed treatment chemistry, is appropriate for evaluating the dewatering effluent relative to Connecticut's Water Quality Standards. Given the need to study the sediment dewatering, WET testing should be conducted to determine the environmentally best alternatives for discharge of dewatering fluids, and may be a factor in selection of treatment chemicals.	As indicated above in response to comment 2, a series of decant/filtrate/elutriate samples will be evaluated for site contaminants as part of treatability testing. While WET testing also evaluates the effect of chemical additives used to enhance settling and filtration, the additives selected for the treatability testing will very likely not be the same as those ultimately selected by the contractor who eventually performs the work; therefore, we believe that WET testing at this point will provide little or no useful data.
5.	DEEP requests that FSP section 10.2 indicate that data will be presented for PCBs (and the added mercury data) in green only for concentrations that are ND or less than reference location/background rather than using, for PCBs, 0.5 mg/kg.	CT DEEP's request will be considered during development of the data report.
6.	DEEP requests that the native format electronic files be provided, rather than made available on request as described in FSP section 10.2	Section 10.2 of the FSP will be revised to indicate the native format electronic files will be provided.