FINAL 2016 MOBILE SEDIMENT CHARACTERIZATION REPORT

Penobscot River Phase III Engineering Study
Penobscot River Estuary, Maine

Prepared for:

United States District Court

District of Maine

Prepared by:

Amec Foster Wheeler
Environment & Infrastructure, Inc.

511 Congress Street
Portland, ME 04101

November 2017

Project No. 3616166052

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LIST OF ACRONYMS AND ABBREVIATIONS

Amec Foster Wheeler	Amec Foster Wheeler Environment & Infrastructure, Inc.
cm	centimeters
the Court	US District Court for the District of Maine
EGAD	Environmental and Groundwater Analysis Database
Estuary	Penobscot River Estuary
GPS	global positioning system
kg/m^3	kilograms per cubic meter
mm	millimeters
m/s	meters per second
MLLW	mean low low water
ng/g	nanograms per gram
NOAA	National Oceanic and Atmospheric Administration
NOHRSC	NOAA National Operational Hydrologic Remote Sensing Center
PRMS	Penobscot River Mercury Study
PRMSP	Penobscot River Mercury Study Panel
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RTK	real-time kinematic
SOP	Standard Operating Procedure
TOC	total organic carbon
US	United States
yd^3	cubic yards
%	percent
#	number
~	approximately

EXECUTIVE SUMMARY

This report describes the results of a sediment characterization study of the Penobscot River Estuary (the Estuary) conducted by Amec Foster Wheeler between May 2016 and March 2017. This study was undertaken to better understand the size, location, seasonal movement and composition of the 'mobile pool', a term employed by the Phase II Study Group to identify a potentially recurring source of mercury contamination to the Estuary via the recycling of mercury-impacted sediment. This report is intended as a data summary report that presents the results of field and laboratory analyses focused on characterizing both the mineral and wood waste components of the mobile pool. As detailed in this report, characterization of the mobile sediment pool incorporated chemical and physical analyses and included total mercury and ancillary chemistry in sediment, sediment physical and geophysical properties, and an evaluation of the chemistry and distribution of wood waste in Estuary sediment. Wood waste, as defined in this report, describes a range of materials including wood fines, wood chips, and wood mulch to differentiate these materials from typical organic detritus such as leaves, twigs and bark. The presence of significant wood waste in the Estuary would have implications for remedial design, including potentially impacting sediment bed stability, sediment bearing capacity (such as for cap placement), and the potential for re-contaminating areas as the result of resuspension and transport.

The purpose of the characterization and analysis presented in this study is to evaluate patterns of mercury distribution within the Estuary with the overall objective of assessing the spatial extent and volume of mercury-impacted sediment in the Estuary that may require remedy. As such, this report represents an Interim Data Summary detailing work that is being carried out concurrently with the development of an Alternatives Evaluation Report to assess potential options for Estuary remediation. This study's efforts built upon the Phase II observations of the mobile sediments. The study used geophysical mapping tools with ground-truthing, ASTM, USEPA and MEDEP analytical methods, and multi-season observations to make spatial and temporal comparisons to improve the characterization of the mobile sediments. Observations of the mobility of the wood waste fraction of the mobile sediments through the spring, summer, and fall along with laboratory characterization of the wood waste and inorganic sediment partitions improved the understanding of these partitions.

The sediment characterization study discussed in this report began with a review of existing site data. Existing site data were reviewed with a focus on identifying data gaps with potential impact on remedial investigations. Sources of background information relevant to this review included the Phase II Study Report, the Maine Department of Environmental Protection Environmental and Groundwater Analysis Database, information regarding past *in-water* physical work that may have impacts on sediment distribution in the Estuary (including recent dam removal, and historic activities including the construction of groins and channel dredging), and academic publications focused on either the Estuary or topics relevant to contaminant chemistry or industrial history of estuaries. Taken together, review of the historical data identified data gaps further supporting investigation of sediment transport dynamics (including deposition and re-mobilization). Relatedly, sediment transport within the Estuary may be influenced by the presence of structures like groins and by the maintenance dredging history of the Estuary. Dredging history in the Estuary includes both the maintenance of navigation channels, anchorages, and the apparent *in-Estuary* disposal of dredged materials.

With the goal of identifying areas in the river where data gaps may exist, the Phase III Engineering Study team has classified the Estuary in terms of reaches and zones. Classification in terms of reach is based on a combination of the results and recommendations of the Phase II Study Group and current Amec Foster Wheeler investigations. Classification in terms of reach is focused on characterizing sections of the Estuary that may be distinct in terms of river flow, tidal influence, and/or the transport and deposition of mercury-impacted sediment. Classification in terms of zones is based on bathymetry as defined in digitized NOAA navigation chart 13309. The zone designation is intended to allow for assessment of remedial technologies by practicality.

The work detailed in this report was conducted under Work Orders 3, 3A and 4A-020 and is being carried out concurrently with the development of an Alternatives Evaluation Report to assess options for potential Estuary remediation. A brief summary of results by Work Order is presented in the following paragraphs.

Spring 2016 Sediment Characterization Field Work

An understanding of river bottom conditions is critical for evaluating remedial alternatives such as dredging, capping and the construction or placement of sediment traps. Geophysical and remote sensing tools were used to characterize the river bed in the Estuary. Geophysical profiling advances the Phase III Engineering Study by facilitating:

- Characterization of river bottom (subtidal) conditions including sediment types, sub-bottom characteristics, bottom elevation data, and presence of debris or obstructions;
- Identification of natural sediment deposits and/or sediment deposits resulting from past channel dredging activities;
- Characterization of nearshore and intertidal elevations, including mudflats and the presence of intertidal groins, debris and obstructions; and
- Evaluation of the areal extent, location, and volume of contaminated sediments requiring remediation.

Field efforts also included sediment sampling. Sediment sampling was conducted principally to ground truth geophysical survey findings, with the secondary goal of determining sediment mercury and organic carbon chemistry.

Geophysical survey results suggest the presence of a lower density mobile phase within the Estuary channel, as well as in the vicinity of Bucksport. Sub-Bottom Profiling in the vicinity of Bucksport identified the Mill Pile, a deposit approximately 8 feet thick. Geophysical survey results suggest that sediment mobility may be a concern both in the river channels and in the vicinity of the Bucksport Mill Pile. With respect to the composition of the mobile phase, there appears to be an abundance of wood waste detected within river channels as compared to within shallow coves or on tidal flats. Visual inspection while sampling suggested that for the majority of Estuary reaches, wood waste was present in varying amounts within either/both the intertidal and subtidal zones.

Fall 2016 Sediment Characterization Field Work

In support of improved characterization of the mobile phase, the objective of the fall 2016 sediment characterization work was to trap and retrieve the mix of material that is tidally transported in the Frankfort Flats, Bucksport, East Channel, Orland River and South Verona reaches of the Estuary. Modified eel traps were used to capture and analyze the mix of wood waste and sediment that appears to be transported in suspension in the Estuary. Samples collected from these traps within Frankfort Flats and Verona East appeared to be enriched with wood waste.

Samples of the mobile sediment pool bulk material collected during fall 2016 field work were prepared and analyzed with a focus on evaluating sediment heterogeneity. Heterogeneity refers here to variability in sediment grain size as well as the presence of legacy wood waste and wood degradation products. Thus, this work focused on two main objectives: (1) to reduce analytical uncertainty associated with employing multiple laboratories with varying sample preparation protocols and analytical methods; and (2) to assess inherent heterogeneity of samples characterized by varying contents of mineral sediment and wood waste.

Overall Findings

Organic material in the form of wood waste may be an important component of the mobile sediment pool. Spatial characterization of wood waste suggests sediment deposits enriched in wood waste may reach 8 feet thick in some locations and that the mobile sediment pool may be thicker in some locations and during some seasons than previously estimated. Chemical analysis of wood waste suggests that total mercury and methylmercury concentrations in this material may be elevated relative to concentrations in either bulk sediment or sediment that is sieved to exclude visible wood waste. The combination of the spatial characterization and chemical analysis suggest that this widely distributed and lighter density component of the Estuary (both in the stable bed and the mobile sediment pool) may require consideration in evaluating remedial alternatives.

Estuary reaches in which sediment samples appeared to be visibly enriched with wood waste included Orrington, Frankfort Flats, Bucksport, Verona Northeast, Verona East and Orland River. Overall, sediment chemistry results show total mercury concentrations in Estuary surface sediment ranged from 0.024 milligrams per kilogram (mg/kg) to 3.59 mg/kg, with the highest concentrations by reach located in Bucksport (3.59 mg/kg), Verona East (1.59 mg/kg), and Verona Northeast (1.50 mg/kg). Further sediment characterization efforts planned for 2017 is aimed at refining the Conceptual Site Model and development of potential remedial options for the estuary.

1.0 INTRODUCTION

1.1 Purpose, Scope, and Objectives

This report describes the results of a sediment characterization study of the Penobscot River Estuary (the Estuary) conducted between May 2016 and March 2017. This study was undertaken to better understand the size, location, seasonal mobility and composition of the 'mobile pool', a term employed by the Phase II Study Group to identify a potentially recurring source of mercury contamination to the Estuary via the recycling of mercury-impacted sediment. This report is intended as a data summary report that presents the results of field and laboratory analyses focused on characterizing both the mineral and wood waste components of the mobile pool.

Characterization of the mobile pool incorporated chemical and physical analyses and included total mercury and ancillary chemistry in sediment, sediment physical and geophysical properties, and an evaluation of the chemistry and distribution of wood waste in Estuary sediment. Wood waste, as defined in this report, describes a range of materials including wood fines, wood chips, and organic detritus such as leaves, twigs and bark. The presence of significant wood waste in the Estuary would have implications for remedial design, including potentially impacting sediment bed stability, sediment bearing capacity (such as for cap placement), and the potential for re-contaminating areas as the result of resuspension and transport.

The purpose of the characterization and analysis presented in this study is to evaluate patterns of mercury distribution within the Estuary with the overall objective of assessing the spatial extent and volume of mercury-impacted sediment in the Estuary that may require remedy. As such, this report represents an Interim Data Summary detailing work that is being carried out concurrently with the development of an Alternatives Evaluation Report to assess potential options for Estuary remediation.

As background, beginning in 1967, a chlor-alkali facility located in Orrington, Maine began releasing mercury into the Penobscot River Estuary. Releases of mercury at varying (and decreasing) concentrations continued throughout facility operation and ceased with facility closure in 2000.

In November 2003, the US District Court ordered a study of the mercury in the Penobscot River. The Court-ordered Penobscot River Mercury Study (PRMS) monitored the concentration and distribution of mercury in estuary sediment, surface water, and biota (Penobscot River Mercury Study Panel [PRMSP], 2013a), with the most recent data from that study presented in 2013 (PRMSP, 2013b).

In January 2016, the United States (US) District Court for the District of Maine (the Court) selected Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler) to conduct the Phase III Engineering Study. The purpose of this study is to identify and evaluate potential remedial options for mercury impacts to the Estuary. The area under remedial evaluation includes the main stem of the lower river from the site of the former Veazie Dam (upstream) to Upper

Penobscot Bay (at the mouth of the estuary), as well as Mendall Marsh and the Orland River (Figure 1).

1.2 Report Organization

- Section 1.0 - Introduction presents the purpose and organization of this report.
- Section 2.0 - Background summarizes historical data with relevance to 2016 sediment characterization.
- Section 3.0 – Spring 2016 Field Work presents the scope and methods relevant to Work Orders 3 and 3A and summarizes geophysical and analytical results, and presents additional information that was evaluated to refine project understanding.
- Section 4.0 – Fall 2016 Field Work presents visual observations and methods of bulk material collection used to evaluate the distribution of mobile pool sediments (Work Order 4A-020).
- Section 5.0 – Field 2016 Laboratory presents methods for sample processing, preparation and analytical results.
- Section 6.0 – Findings presents current understanding of the mobile sediment pool classification and the spatial distribution of wood waste in the Estuary.
- Section 7.0 – References provides references for documents cited within this report.

2.0 BACKGROUND STUDIES AND PRELIMINARY SITE ASSESSMENTS

Section 2.0 and Appendix A summarizes background studies and preliminary site assessments relevant to this sediment characterization report. Sources of background information relevant to sediment characterization and summarized in this section include the Phase II Study Report, Maine Department of Environmental Protection Environmental and Groundwater Analysis Database, information regarding *in-water* work (including recent dam removal, and historic activities including the construction of groins and channel dredging) with bearing on the Estuary, and academic publications, discussions with university faculty and relevant news items focused on either the Estuary or topics relevant to contaminant chemistry or industrial history of estuaries. Appendix A includes summaries of background studies as well as literature that was reviewed as part of development of an initial conceptual site understanding.

2.1 Background Studies

2.1.1 Phase II Penobscot River Mercury Study

A summary of Phase II Study chapters with relevance to the identification and characterization of the 'mobile pool' is included in Appendix A. In brief, The Phase II Study Report (PRMSP, 2013b) identified the 'mobile pool' as a potentially recurring source of mercury (and methylmercury) contamination to the Estuary through the recycling of mercury-impacted sediment. Because tidal action slows the rate at which sediment moves from the Estuary to Penobscot Bay and results in sediment moving up-gradient seasonally under the influence of the tide, this sediment movement may result in the redistribution of mercury within the Estuary.

In the Phase II Study Report, the mobile pool was described as concentrating near Bucksport in the spring, and near Frankfort Flats (as well as near the Eastern Channel and Orland River) in the late summer and fall. The mobile pool has been generally described as unconsolidated river bed sediments that accumulate, disperse and re-accumulate seasonally. Movement of this unconsolidated sediment is initiated and maintained by a combination of factors including seasonal changes in river flow, the extent of scour or erosion of the river bed, and the effect of salinity (the tide) on the density of water in the Estuary. The authors of the Phase II Study Report described the mobile pool as being 3+ feet (approximately 1 meter) thick in the vicinity of Bucksport and generally thinner in other areas of the Estuary. Regarding the size of the mobile pool, discussions in 2016 with selected authors of the Phase II Study Report (PRMSP, 2013b) clarified that estimates regarding the size of the mobile pool provided in the Phase II Study Report were approximated based on their current understanding of the Estuary, and that there was uncertainty in the total volume of the mobile sediments.

2.1.2 Maine Department of Environmental Protection Environmental and Groundwater Analysis Database

The Maine Department of Environmental Protection Environmental and Groundwater Analysis Database (EGAD) provided additional Estuary-specific data beyond what were available from the

Phase II Study Report. Data accessed through EGAD included sediment classification and mercury chemistry from Bangor to Fort Point Cove. Data were provided on April 14, 2016 by Tracy Krueger, an EGAD Data Manager from the Maine Department of Environmental Protection Bureau of Remediation and Waste Management. EGAD data were used in the process of identifying and evaluating locations in the Estuary where there is potential for sediment deposition and mercury accumulation.

2.1.3 Physical Structures and Construction

This section summarizes the significant physical structures and construction that may have impacted sediment movement and/or deposition in the Estuary. Information summarized in this section includes the removal of the Veazie Dam (2013-2014), historic information on the construction of groins within the Estuary, and historic information on navigational dredging activities within the Estuary.

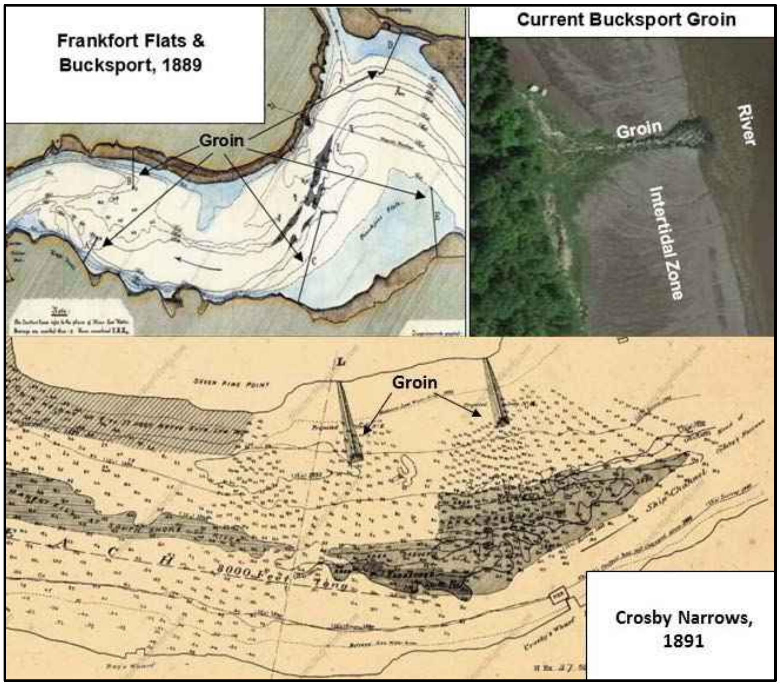
2.1.3.1 Removal of the Veazie Dam

The former Veazie Dam was located at the head-of-tide in Veazie and Eddington, Maine and was removed in 2013-2014. The dam was removed as a component of Penobscot River Restoration Project with the goal of restoring habitat for Atlantic sturgeon, shortnose sturgeon, and herring in the Penobscot River. While the Veazie Dam was a run-of-river dam and, in general, run-of-river dams are not typically associated with significant sediment retention, the removal of this structure has changed Site condition between the Phase II and Phase III Studies and so warrants evaluation. Of specific relevance for the Phase III Engineering Study is that dam removal may influence system hydrodynamics in terms of both the upgradient extent of tidal influence and the altered potential for downgradient bedload sediment transport. Because both these hydrodynamic impacts may influence sediment transport within the Estuary, dam removal may have been (and may continue to be) associated with some degree of contaminant redistribution.

2.1.3.2 Groins

The location of current and historic groins in the Estuary was evaluated to improve understanding of *in-water* and near-shore structures that could affect sediment transport, sediment deposition and implementation of remedial alternatives. A groin is a rigid structure built out from the river bank. Because groins affect river flow, they may create conditions that result in sediment deposition, as well as serving as underwater excavation hazards. Groins were identified from historic National Oceanic and Atmospheric Administration (NOAA) navigational charts. INSET 2-1 shows navigational charts from 1889 and 1891, as well as contemporary satellite imagery that highlight the location of groins in Crosby Narrows, Frankfort Flats, and the Bucksport area.

INSET 2-1: Locations of Groins in the Penobscot River Estuary



2.1.3.3 Dredging History

Dredging activities are relevant to the objectives of this study because based on the eras when maintenance dredging occurred, common industry practice would have generally disposed of dredged sediments *in-water* rather than at a confined upland disposal facility (CDF). With regard to the Estuary, the review of historic dredging activities aids in identifying potential locations in which disposal of dredged materials may influence the observed distribution of mercury in surface sediment. This section briefly summarizes what is known of the timing and scale of maintenance dredging in the Estuary and the potential locations of *in-water* dredged material disposal.

There are federally-authorized channels and an anchorage within the Project Limits. These include the 22-foot Lawrence Cove Channel, the 22-foot Frankfort Flats Channel, the 14-foot Bangor Harbor Channel, and the 16-foot Middle Ground Area (an anchorage). It appears that of these federally-authorized channels and anchorages, the USACE records indicate that only the Lawrence Cove Channel underwent dredging between 1960 and 1985 with no recorded dredging since 1985. United States Army Corps of Engineers records indicate that Lawrence Cove Channel was dredged five times between 1961 – 1984, for a total dredge volume of ~ 300,000 cubic yards (yd^3) (Appendix A). Bathymetric analysis of Lawrence Cove in 2010 suggested that the Cove accumulated approximately 7 feet of sediment within the dredge area since the most recent dredge activity (1984). Because the Lawrence Cove Channel is in the vicinity of the Phase

II-hypothesized mobile sediment pool, it is possible that the Channel is serving as a sediment trap that accumulates mercury-enriched sediment.

The USACE's self-reported records of dredged material placement are limited. While a USEPA designated open water disposal site, the Rockland Disposal Site in Penobscot Bay, was first used in 1973 and has received dredged material from a range of coastal Maine locations; no records were found indicating that the Rockland Disposal Site has received dredged material from the Penobscot River. Likewise, NOAA navigational charts of the Penobscot River do not indicate the presence of any disposal sites north of Fort Point Cove. Potentially relevant United States Army Corps of Engineers records concerning dredging material disposal and survey history for the Penobscot River are included in Appendix A.

A discussion with a representative of the Great Lakes Dredge & Dock Company, LLC who served as the project engineer for the maintenance dredging of the Lawrence Cove Channel in or about 1984revealed that mechanically dredged silts and wood waste were disposed of by open scow dump north of the Verona Island Bridge (Stan Ekren; interviewed March 24, 2017). Mr. Ekren stated anecdotally that the area north of the Verona Island Bridge was a historic dump site commonly used for disposal of dredged material.

2.1.4 Additional Relevant Studies Summary

Other additional studies with relevance to the mobile sediment pool characterization were reviewed as part of the project background research (INSET 2-2). Studies included in this section address hydrodynamics, sediment transport, mercury biogeochemistry, industrial history and historic or contemporary biota studies. A brief summary of the contents of each study are included in Appendix A.

INSET 2-2. Additional Studies with Relevance to Mobile Sediment Pool

Title	**Year**
Hydrography of the Penobscot River (Maine) Estuary	1967
1972 Penobscot River Study	1972
Macrobenthic Ecology of a Sawdust-Bearing Substrate in the Penobscot River Estuary (Maine)	1973
Heavy Metal Levels in Suspended Particulates, Biota, and Sediments of the St. Croix Estuary in Maine	1976
Mercury Dynamics in Sulfide-Rich Sediments: Geochemical Influence on Contaminant Mobilization and Methylation within the Penobscot River Estuary, Maine	2007
Effects of Pulp and Paper Mill Discharges on Fish Populations in Three Maine Rivers	2009
Fine Sediment Trapping in the Penobscot River (Maine) Estuary	2011

Title	Year
Wintering Shortnose Sturgeon and Their Habitat in the Penobscot River, Maine	2013
Sweden River Fiber Study/ The Fiber Bank Project	2014

2.2 Estimating Spring Freshet Conditions (2016)

To assist the scheduling of field work to locate and identify the mobile sediment pool, it was important to estimate the timing/size of seasonal meltwater input from the Penobscot River (i.e., the spring freshet) to the Estuary. A better understanding of the freshet is important because freshwater (river) input to the Estuary influences the location and the size of the mobile sediment pool.

In brief, with the goal of sampling the mobile sediment pool near Bucksport, a range of data were employed to evaluate the timing of the 2016 spring freshet. Data used in this evaluation included 2015 snowfall data for Millinocket, Maine (a municipality on the upper west branch of the Penobscot River), historic snowpack data for Millinocket, historic data linking early spring temperatures near Millinocket and upgradient river gauge data on the river, historic turbidity data from the Eddington gauge, and sediment bedload data from the Phase II Study Report. Evidence of the freshet was recorded upstream in late March 2016. The Phase II Study Report suggested that settlement of the sediment bedload may have a three-week lag after the river crest has passed Bucksport. Therefore, the field work under Work Order 3 was not started until May 2016.

The magnitude of the spring 2016 freshet flow was estimated based on snowpack depth data. According to the NOAA National Operational Hydrologic Remote Sensing Center (NOHRSC) Interactive Snow Information, the snowpack in Millinocket as of March 31, 2016, measured approximately 10 inches or 0.83 feet. The snowpack data suggested that the snowpack depth of 10 inches toward the end of March was on pace with historical averages and was likely in the process of melting, which would continue into April. The snowpack data also indicated that melting of the snowpack was usually completed by late April. Even though the total snowfall from October 2015 to March 2016 was less than average, the 2016 snowpack depth suggested that a noticeable and recordable freshet river flow/crest comparable to previous years occurred in the spring 2016 season.

2.3 Evaluation of Study Areas

The Penobscot River Estuary has multiple reaches, each with different hydraulic, hydrologic and sediment dynamics. Six study areas were selected to represent the areas within the Estuary where the mobile sediments would likely be located at different seasons based on past observations of the Phase II Study and review of other existing data sources. These study areas did not include full coverage of project limits, but were intended to provide information at areas within the Estuary. Discussions with the Phase II Study participants indicated that the mobile sediments pool was concentrated near the Bucksport during spring freshet flow and dispersed to

Frankfort Flats during other seasons. To accompany an understanding of the Bucksport and Frankfort Flats areas seasonally, additional locations further upstream and downstream were identified to map the presence or absence of the mobile sediment pool soon after the spring freshet. In addition to providing a spring freshet mapping, these areas were selected with the intention of repeating the mapping in the fall to identify the seasonal changes to the bed sediments. The six study areas assessed in the spring 2016 were:

- Bucksport;
- Frankfort Flats;
- Hampden;
- Gross Point;
- Fort Point Cove; and
- Odom Ledge.

The study area boundaries are presented in Figure **1**. Appendix B details the background information and the Phase III Engineering Report team's notes and justification for the selection of these initial study areas.

During the field data collection program, other areas were added to the data collection program based on early findings during the investigations. These areas included Mendall Marsh, Orland River and the eastern channel adjacent to Verona Island (East Channel).

3.0 SPRING 2016 FIELD INVESTIGATION

Field work executed as part of the spring 2016 mobile sediment characterization included geophysical and remote sensing tools that were used to characterize the study area river bed conditions in the Estuary in combination with a limited number of sediment samples. Four on-water geophysical surveys were completed using sub-bottom profiling, side scan sonar, dual frequency bathymetry and multibeam bathymetry. The accuracy of the geophysical findings was verified by comparison to the collected surficial sediments. The results of the mobile sediment evaluation work contributes to the evaluation of remedial alternatives:

- Characterization of the river bottom (i.e., riverbed sediment types and density, sub-bottom conditions, bottom elevation data, debris, obstructions) contributes to the evaluation of the constructability of remedial alternatives including sediment trapping, capping, and dredging. The collected data facilitated our identification of natural or man-made[1] depressions that may be functioning as existing sediment traps or locations where, with some alteration, could function as sediment traps.
- Identification of locations of natural sediment deposits or sediment deposits resulting from past channel dredging activities can focus future efforts to characterize in-water sediment accumulations that potentially function as a source to the mobile sediment pool.
- Characterization of the near-shore and inter-tidal coastal landform elevations (groins, mudflats, river bottom bathymetry and sub-bottom conditions), sediment types, debris and obstructions, which can greatly affect the constructability of remedial alternatives including in-situ admixtures, thin-layer capping, excavation, and construction (vessel) access.
- Assist in the evaluation of the areal extent, distribution, and volume of mobile sediments and contaminated sediments.

Field efforts included geophysical surveys and sediment sampling. Sediment sampling was conducted principally to ground truth geophysical survey findings, with the secondary goal of determining sediment mercury and organic carbon chemistry. The following figures are associated with the spring 2016 sampling effort:

- Figure 1 presents the Estuary study areas investigated.
- Figures 2 – 7 present side scan sonar results.
- Figures 8 – 13 present dual frequency survey results.
- Figures 14 – 20 present sub-bottom profiling results.

[1] The federally-authorized navigation channels of Lawrence Cove and Frankfort Flats historical reports and surveys are examples of in-water man-made depressions.

- Figure 21 shows multibeam bathymetry results.

3.1 Field Effort Summary and Additional Efforts

On-water field work focused on geophysical surveys and sediment sampling was undertaken and completed during three intervals:

- May 22 - May 26, 2016 (Week 1);
- June 6 - June 10, 2016 (Week 2); and
- June 20 - June 23, 2016 (Week 3).

Sediment sampling was conducted principally to ground truth geophysical survey findings, with the secondary goal of evaluating sediment mercury and organic carbon chemistry. The study areas for the geophysical surveys are presented in Figure 1. Geophysical survey results are presented in Figures 2 – 21 and are discussed in greater detail in Section 3.2 (Geophysical Surveys). Sediment chemistry data are discussed in Section 3.4 (Sediment Analytical Results). The Standard Operating Procedures (SOPs) used to perform geophysical surveys and associated sediment sampling are appended to the project Quality Assurance Project Plan (QAPP).

The geophysical technology data retrieval was completed during the first two On-Water work week periods. Data collection using each of the four geophysical methods was accomplished during these weeks. Because the tidal currents, sea conditions (chop), winds and variable/abrupt changes in the bottom conditions impeded the ability to run multiple geophysical survey technologies concurrently, adjustments to timing and schedules were made in the field (e.g., deploying the side scan sonar at slack high water when it was possible to access the near shore area and have sufficient water depth for tow-fish maneuvering; deploying the sub-bottom profiler at slack low water when surface chop was less so as to reduce return signal loss and improve signal resolution).

Due to site conditions and the desire to achieve time (and cost) efficient results, a “zig-zag” pattern of transects was run rather than full coverage using equally-spaced transects. The zig-zag alignments were selected to maximize existing information (e.g., pre-existing sediment samples, historical navigation features and publicly-available bathymetry) as well as to capture locations not previously characterized. Individual geophysical methods were deployed along the same zig-zag pattern during the appropriate tidal phase. Based on these modifications to the work plan: (1) the zig-zag pattern replaced the proposed 100% coverage by all four geophysical survey methods; and b) daily production of survey data was reduced because each study area had to be surveyed multiple times (i.e., once each with each survey technology) during the appropriate tidal stage for that technology. A limited number of grab and mudline samples were also collected for the purposes of verifying geophysical observations; some of the samples collected for this purpose were also submitted for chemical analysis. “Mudline’ is defined as the predominantly liquid phase captured at the sediment-water interface. Grab and mudline sample collections were successful, as expected for bottom conditions. Manual push core collection was attempted but resulted in low sample recovery.

Overall, of the four geophysical survey techniques employed (discussed further in Section 3.2), multibeam bathymetry was the least successful in mapping soft and potentially mobile sediments and did not aid in the interpretation of the zig-zag pattern findings beyond what was provided by side scan sonar, dual frequency sonar, and sub-bottom profiling. Due to weather-induced time-constraints, multibeam bathymetry coverage was reserved for the final on-water day and was used to assess site conditions within only a portion of the Bucksport Study Area.

A second vessel and crew was employed during On-Water Week 2 to perform ponar grab and mudline retrieval. This crew used a 19-foot flat bottom skiff, a petite ponar, a Kemmerer sampler outfitted with 10 pounds of weight, sub-meter global positioning system (GPS)[2], and a tablet-based navigation and data recording system. The Kemmerer sampler was used to collect mudline samples. Sampling stations were pre-determined based on the results of the Week 1 findings. Sampling was designed to ground-truth the geophysical technology as well as to assess the presence and abundance of wood chips in the mudline. In most instances, ponar and mudline samplers were deployed at each of the sampling stations. Following sample recovery, field experiments were completed to separate wood chips from mudline and mixed sediments using a kitchen strainer and coffee filters. The field experiments were focused on questions regarding potential contaminant adsorption to organic material (e.g., wood chips). Toward the end of Week 2, sample preparation for laboratory analysis began, but was not completed during that week of field activity. Sample preparation during Week 2 included 22 sediment samples for chemical analyses, 13 liquid samples for chemical analyses, 57 sediment samples for physical analyses, and four sediment plus five liquid quality assurance/quality control (QA/QC) samples for chemical analyses.

During Week 3 (a partial week), the remaining individual sediment samples were prepared for laboratory analysis. Sample preparation during Week 3 included 32 sediment samples for chemical analyses and two sediment plus one liquid QA/QC samples for chemical analyses.

3.2 Geophysical Surveys

Geophysical and remote sensing tools were used to characterize selected segments of the Estuary bottom, sub-bottom, and the depositional sediments along the shoreline, in coves, and other depositional areas, as well as assess conditions where the mobile sediment pool was forecasted to be seasonally located. Validation of geophysical findings were also performed through the collection of surface sediments.

The spring 2016 survey event was intended to be conducted soon after the spring freshet flows subsided in early May 2016. Scheduling the on-water work considered tidal conditions, daylight, currents, vessel traffic and the timing of the spring freshet. With a tidal range of 10 to 14 feet, and the intention to characterize near shore and in-channel segments of the Estuary, the proposed

[2] Trimble R1 GNSS Receiver which provides sub meter accuracy. All GPS corrections were done in real time by Satellite-based augmentation systems.

field measurements were mainly conducted during rising high tide. Generally, the optimal high tide and daylight conditions matched on alternating weeks. Conducting the on-water work during daylight is required for vessel and passenger safety as well as obstruction avoidance.

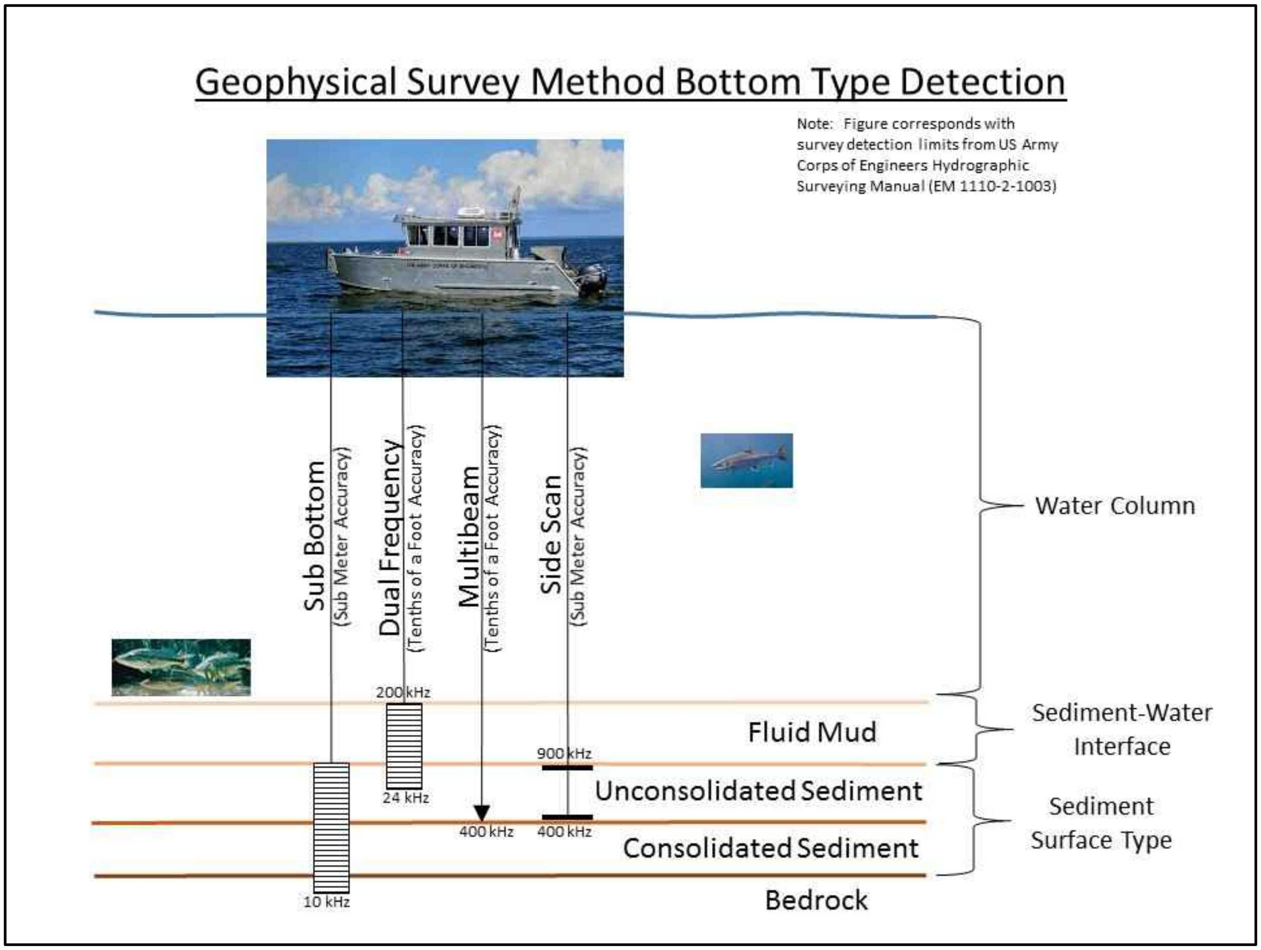
[redacted] Survey Global Positioning System and Accuracy

Tracking of survey data was completed using real-time kinematic (RTK) GPS and differential GPS. The geophysical remote sensing surveys were conducted by Aqua Survey, Inc., covering the specified project area along the Estuary from Hampden to Fort Point Cove, Maine. The study area stretched approximately 30 miles along the river and included locations at Hampden, Frankfort Flats, Bucksport, Odom Ledge, Gross Point and Fort Point Cove.

Project control was provided by a Hemisphere RTK GPS unit with centimeter accuracy. RTK corrections were supplied through KeyNET service. Prior to commencing the survey, the RTK system was checked against a local National Geodetic Survey benchmark for positioning accuracy. The RTK antenna was mounted directly over the fathometers and sub-bottom profiler. The side scan sonar was towed off the side of the vessel and antenna offsets were corrected in post-processing. All results are produced in Maine East State Plane North American Datum of 1983 (NAD83) coordinate system with units in US survey feet and North American Vertical Datum of 1988 (NAVD88) with depths produced in US survey feet.

The illustration below (INSET 3-1) depicts the river bottom detection limits of each geophysical survey method and how they compare relative to each other. The illustration corresponds with the survey detection limits from the United States Army Corps of Engineers (United States Army Corps of Engineers, 2013). It is important to note how each survey method may detect a different river bottom surface based on the method's signal frequency. Each survey method was used to detect and evaluate the differences between sediment layers. Dual frequency (one-tenth of a foot accuracy) mostly detects the surface of fluid mud layers and can penetrate the surface of unconsolidated sediments. Side scan sonar (sub-meter accuracy) can detect the surfaces of unconsolidated and consolidated sediments while multibeam bathymetry (tenths of a foot accuracy) only images the surface of consolidated sediment. Lastly, sub-bottom profiling (sub-meter accuracy) penetrates the mudline and records the upper layers of sediment to help assess unconsolidated versus consolidated sediments, the presence of buried boulders, and depth to bedrock.

INSET 3-1: Image depicting the detection capabilities of each geophysical method



[redacted] Side Scan Sonar

Side scan sonar captures images of the riverbed providing images of the river bottom to identify variations in sediment materials as well as identify debris and obstructions. An Edgetech 4125-FS dual frequency 400kHz/900kHz side scan sonar system was used for the side scan sonar survey. Preliminary survey lines were run from shoreline to shoreline in a zig zag pattern during On-Water Week 1 (May 22 to May 26, 2016) to locate any abrupt changes in sediment type and to detect any large objects or man-made targets that might be present. After locating areas of interest, select survey lines were run 150 feet apart parallel to the shoreline. The sonar records were mosaicked using Chesapeake Technologies Sonar Wiz Map 6.0 software to provide a better overall view of the survey area and produce geo-referenced images of the survey area.

The side scan data identified the distribution of different sediment types along the river bottom and were used to produce bottom type characterization figures (Figures 2 – 7). Regarding interpretation of field survey data presented in Figures 2 – 7, a side scan sonar signal with low reflection represents soft bottom composed of silt/wood waste; a signal with grainy or high reflection represents hard bottom composed of sands/gravel/rock. Areas of low versus high reflection were recorded on field maps during data collection to distinguish between areas of soft bottom versus sand or rocky bottom. Post-survey data processing allowed for further distinction between areas where the bottom was dominated by silt (mineral) versus wood chips. Data interpretations were validated by Aqua Survey, Inc. and used to revise the field maps records. Ripples and scouring of the sediment surface that were observed (labeled on each figure) are suggestive of higher velocity flow rate in the overlying water. Objects such as large boulders and timber were visible along the shorelines of all survey areas, as well as the outcrop in Odom Ledge. Bottom types (i.e., silt, wood chips, and sands/rock) were ground-truthed with grab sampling.

[redacted] Dual Frequency

Dual Frequency separation was used to assess sediment type (e.g., cobble, sands, fines, organics, etc.) and thickness of near-surface sediments. An Odom Echotrac CVM dual frequency fathometer with 24 kHz (20-degree) and 200 kHz (4-degree) transducers was used for the dual frequency survey. Prior to the commencement of survey operations, a bar check was conducted to adjust for draft and speed of sound for both frequencies to insure accurate sounding data. A bar check was also conducted at the end of the day to be sure the settings continued to be correct. Survey lines were run perpendicular to shore at varied spacing throughout each survey area. Processing included removing erroneous data points and correcting the data to NAVD88 based on RTK GPS corrections. Each frequency was processed separately and the difference between the two layers was calculated providing a layer showing areas of separation. Location and elevation records of high frequency depths, low frequency depths, and the separation between were provided for each study area.

Significant separation occurred throughout most of the study areas. Dual frequency figures show separation gradients for each study area (Figures 8 – 13). Dual frequency separation is most significant in the Bucksport (0-12 feet), Frankfort Flats (0-22 feet), and Odom Ledge (0-18 feet) study areas and appears to be greatest within river channels. Less separation is observed in the Hampden (0-4 feet), and Gross Point (0-4 feet) study areas, but is also identified in areas of deeper channels compared to the shallower tidal flats. Dual frequency separation is least significant in the Fort Point Cove (0-0.7 feet) study area and, when apparent, is generally located either within or on the edge of the cove versus the deeper channel.

[redacted] Sub-Bottom Profiling

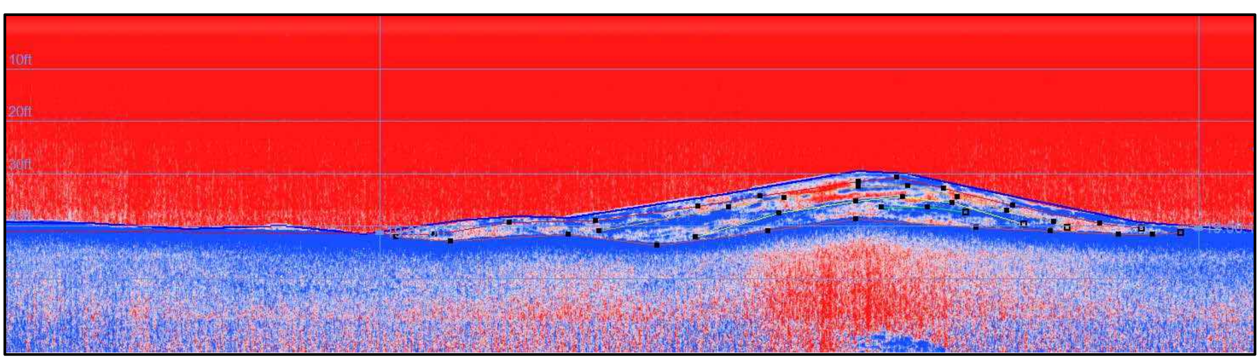
A SyQwest Stratabox sonar system was used to collect the sub-bottom profiling data during the survey. The transducer was hard-mounted to the side of the survey vessel with the navigational antenna mounted directly over the transducer, eliminating offset errors. The sensor was deployed at a depth of at least two feet to minimize interference from the vessel. The navigational data was logged at one-second intervals by the Stratabox digital recording system and electronically paired with the sub-bottom data to allow geo-referencing of all data collected.

Sub-bottom profilers use acoustic methods to generate high-resolution (on the order of 0.5-1 feet) cross-sectional images of the marine sub-bottom to depths of up to 100 feet beneath the seafloor. The transmitted sound pulses travel through the water column and sub-bottom and are reflected when changes in acoustic impedance (equivalent to a material's sonic velocity times its density) are encountered. Acoustic impedance changes commonly occur at boundaries between materials (e.g., interfaces between water and sediments, sediments and gas, different types of sediments, and sediments and buried objects). The reflected sound pulses travel back to the profiler where their amplitudes, as a function of travel-time, are digitally recorded.

All profiles were manually bottom tracked to create a surface for the bottom elevation as seen in the sub-bottom data. An additional reflector (reflector 1) was seen in most of the sub-bottom profiles which was also manually digitized. Location and elevation files for each study area of reflector 1 were provided, which shows the separation between the river bed and the first reflector. Occasional additional reflectors were seen in some areas of the study areas. The nature of the material generating the reflectors cannot be determined from the data alone, however, ground-truthing data can be consulted to identify the composition of the layered materials. The composition of first reflectors is most likely bedrock, however further ground-truthing would be required to confirm. Figures were created using the sub-bottom data to evaluate the depth to bedrock within each study area (Figures 14 – 19).

A significant feature was detected near the Bucksport Mill. This area is referred to as the Bucksport Mill Pile. Figure 20 shows the contours of the sub-bottom profile within this area with a thickness up to eight feet. For the six study areas investigated during the Spring 2016, the greatest amount of multiple layering was seen in the in the Bucksport Mill Pile (8-feet thick) and in the deeper river channels (1-3 feet thick) on the east (i.e., Lawrence Cove Navigation Channel) and west sides of the study area. Additional features were identified within the main channel at Gross Point (1-1.5 feet thick), within the approximate area of the Frankfort Flats Navigation Channel (1-foot thick), and within the deep channels (1-foot thick) to the east and west sides of the Odom Ledge study area. Ground-truthing upon these areas confirmed deposits of wood waste. INSET 3-2 provides an example of a cross-section of the sub-bottom survey data from the Bucksport Mill Pile.

INSET 3-2: Sub-Bottom Image of Bucksport Mill Pile



[redacted] Multibeam Bathymetry

An R2 Sonic multibeam sonar was used to collect bathymetry data at the interest location of the Bucksport Mill Pile. System components included the multibeam projector, an SMC IMU-108 motion reference unit, Hemisphere VS-110 satellite compass, Castaway CTD, and an AML Micro-X sound velocity probe. A multibeam calibration was conducted following data acquisition. This is also known as a patch test and is used to solve for the alignment values between the motion sensor reference frame and the multibeam reference frame. Standard patch test calibration lines were run to resolve the latency, pitch, roll and yaw alignments. A satisfactory bar check was conducted to verify the depths reported by the sounding equipment and subsequent data processing routines.

Multibeam data was collected at variable line spacing based on water depth to produce approximately 100% bottom coverage of the Bucksport survey area. Survey speeds were between three to four knots. The average sounding density throughout the project exceeded one sounding per square foot. Sound velocity of the water was monitored at the sonar head during the entire survey and sound velocity profiles of the water column were taken at the beginning and end of the survey. The water column was well mixed due to the river currents.

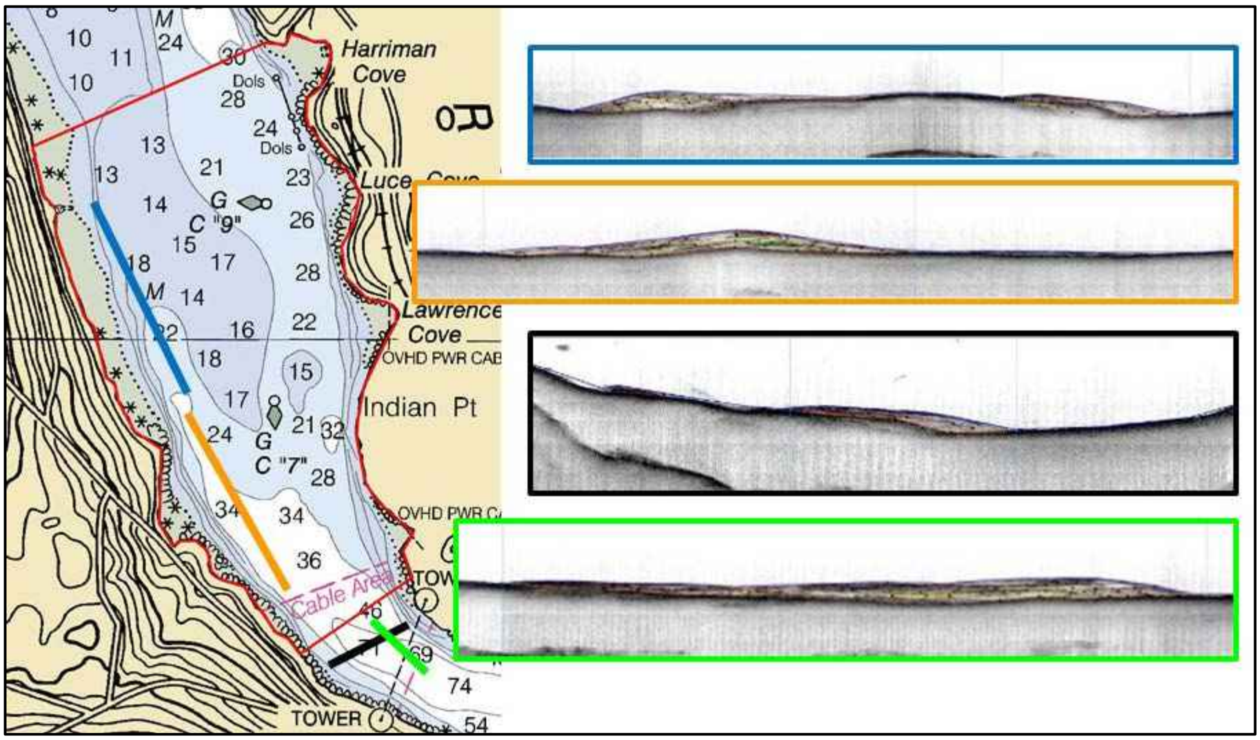
All multibeam sonar raw data were logged in Hypack 2016 and processed using HySweep multibeam editor. Data were reviewed for any potential issues, outliers or data drop-outs with erroneous data points removed. Soundings were corrected for the heave, pitch, roll and heading of the vessel in real time during acquisition and correlated with position data. Sound velocity profiles measured in the field were applied to the sonar data on a nearest in time basis to correct each sonar beam's path through the water column. Real time sound velocity at the sonar head was measured and applied to the data using sound velocity sensor. To maintain data quality, the soundings were manually filtered. The sonar system used can record an 80-degree swath to each side of the sonar, but the data was often filtered at a lesser angle for improved accuracy of the dataset.

Water level height was generated by correcting the raw RTK height for vessel heave, pitch, roll and draft. These corrections were then applied to reduce the sounding data to the project vertical datum (NAVD88). Data quality was excellent and in addition to the bathymetry generated from the data, the high data resolution and density allowed for detection of sediment characteristics within the survey area, including two scouring locations in the center of the channel. Multibeam data depths ranged from 12-feet to 86-feet deep with multibeam depth contours displayed in Figure 21. The high resolution multibeam data shows evidence of channel scouring and the deep basin to the south of the Bucksport study area.

[redacted] Key Geophysical Survey Interpretations

Combining all survey results, the areas of concern for a mobile or shifting sediment type is the Bucksport Mill Pile and river channels. INSET 3-3 illustrates the abundance of wood waste detected within river channels compared to shallow coves or tidal flats. The border color of each sub-bottom image corresponds to the matching transect path within the Bucksport study area. The pattern of wood waste deposition within river channels following the freshet flow conditions is observed and supported by the results of each survey method. And due to the high velocity currents and complex mixing throughout the river, it is likely that any sediment type that contains wood waste, is highly aqueous, or any other low density materials would be the most vulnerable to movement.

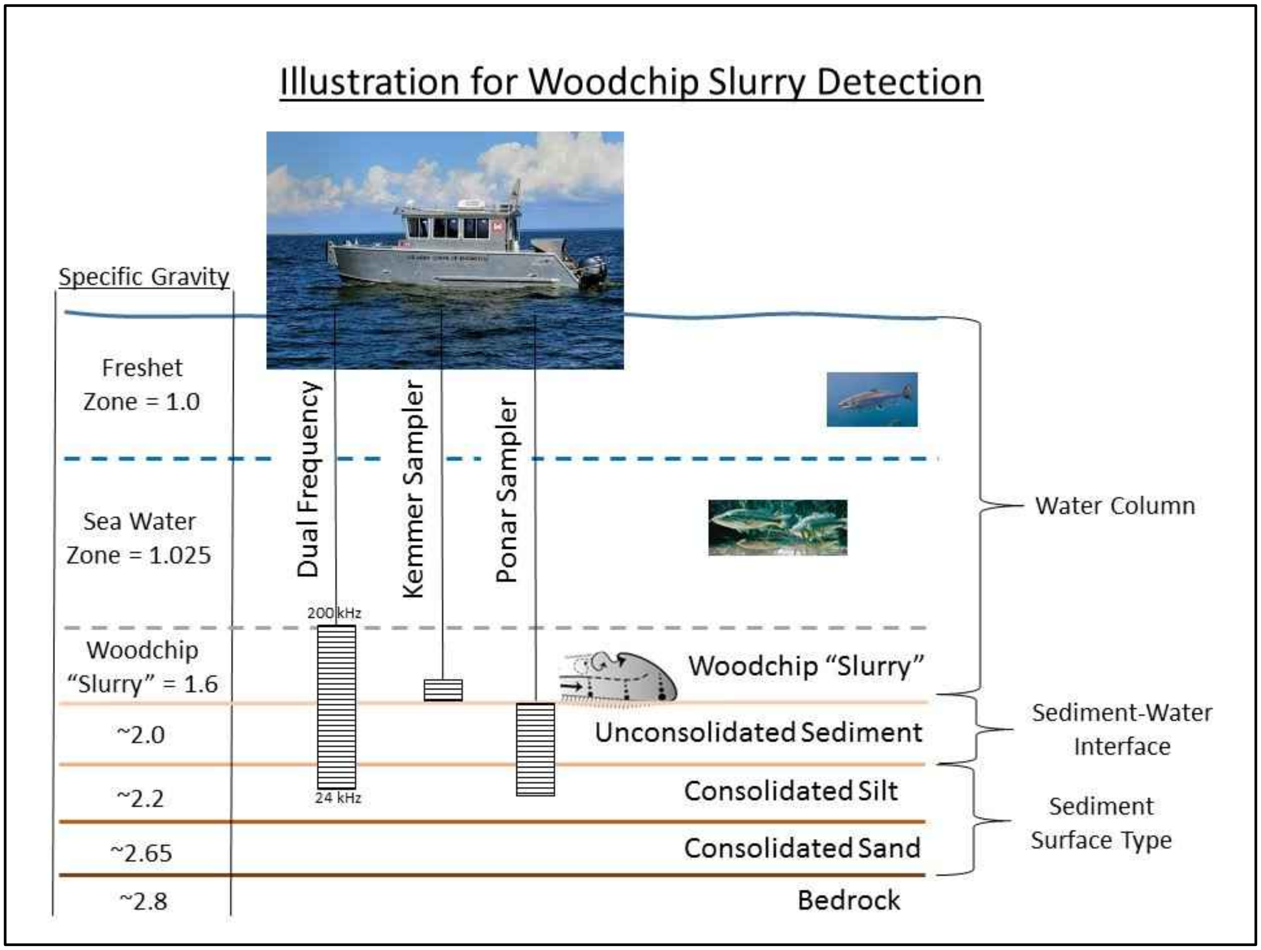
INSET 3-3: Abundant wood waste detected within river channels



3.2.6.1 Wood Chip "Slurry" Identification

In some areas the dual frequency separation appears to be greater than the sub-bottom depth to bedrock. One possible explanation for this inconsistency between geophysical survey method results is that the greater dual frequency separation is created from the detection of a "wood chip slurry" still in suspension and being transported above the riverbed. The illustration below (INSET 3 -4) shows how the dual frequency could detect the top of this layer and be misinterpreted as the riverbed surface. Due to the aqueous and unconsolidated nature of the wood chip slurry, it would not be detected by the sub-bottom profiler. Therefore, this slurry traveling above the riverbed results in some areas of having a greater dual frequency thickness compared to the sub-bottom depth to bedrock. The wood chip slurry adds another element to the overall method of wood waste deposition and transport within deeper Estuary channels during freshet flow.

INSET 3-4: Image showing the detection of the wood chip slurry and vertical density gradient within the water column and sediments



3.3 Sediment Collection & Analysis (Ponar Grabs & Kemmerer Mudline Samples)

Within the Spring 2016 study areas, surface sediment was collected to ground truth the pertinent geophysical survey findings. The sediment collection was not intended to be a comprehensive sediment characterization effort, rather a means to supplement the geophysical survey. The sampling stations were refined during the real-time recorded geophysical survey findings. Sediment samples were collected using a ponar grab sampler. The ponar grab sampler was expected to recover the upper six inches of sediment and supply samples for laboratory analysis. A Kemmerer sampler was also used to retrieve mudline samples to compare against previously collected data on the mobile sediment pool. The mudline is defined as the predominantly liquid phase captured at the sediment-water interface and may therefore be most similar to material described as mobile sediment in the Phase II Study.

The sediment retrieval and sample collection was performed to further characterize sediment type, near-surface strata thickness, and near-surface physical characteristics of the river bottom and included the following tasks:

- Sample collection at different river depths and depositional conditions to characterize the river bottom, providing verification of the geophysical survey data.
- Provide physical characterization including Unified Soils Classification System, ASTM D422 grain size distributions with an additional sieve to 0.063 millimeters (mm) (#230 sieve) to provide coarse and fine fraction with hydrometer to further subdivide fines (the ASTM D422 "Standard Test Method for Particle Size Analysis of Soils" was followed with the addition of the #230 sieve [0.063mm] to quantify the percent fines under the Wentworth classification system). On a portion of the samples, the ASTM D422 with hydrometer was used to subdivide the fines into silts and clays consistent with US Environmental Protection Agency and United States Army Corps of Engineers manuals. Samples were prepared using ASTM D421 method "Dry Preparation of Soil Samples for Particle Size Analysis and Determination of Soil Constants".
- Analyze samples for organic content, total mercury and total organic carbon (TOC).

[redacted] Sediment Classification

Sediments were logged after collection following the descriptions and procedures outlined in the Unified Soil Classification System per ASTM D 2487. The grab-collected sediments were documented on sediment logs and a photograph of the recovered sediment was collected when possible. Sediment photographs are included in Appendix C, and completed sediment logs are included in Appendix D.

[redacted] Wood Chip Field Partitioning & Mudline Sample Preparation

The field collection of sediment and water samples occurred during field Weeks 1 and 2. The sediments and mudline samples collected from Fort Point Cove, Odom Ledge, Hampden, Gross Point, East Channel and Orland River were processed in the field to generate samples submitted for chemical and physical analyses. The Fort Point Cove, Odom Ledge and Hampden samples were individually homogenized to prepare laboratory-submitted samples. Homogenization was conducted using a drill-mounted stainless steel mixing rod for a minimum of five minutes. Mixing speed was controlled to minimize spilling of sampled material.

The field crew investigated the East Channel and further upriver in the Orland River than the limits of the Gross Point study area based on the observation of wood waste in the sediments and mudline waters. The Gross Point, East Channel and Orland River sediment and wood waste samples were composited based on right bank, channel center, left bank collection and homogenized as described above prior to preparing laboratory samples. A portion of the Gross Point, East Channel and Orland River composited samples were strained using a kitchen strainer to separate the wood chips which were individually submitted for laboratory analysis.

The mudline samples from Bucksport and Frankfort Flats were composited based on the visual presence (or absence) of wood waste. These composites were settled for a period of 24 hours in a 10-gallon aquarium at the field station. Post-settlement, the components were individually sampled to generate four fractions: 1) overlying water; 2) wood chips strained using a stainless-steel kitchen strainer; 3) fines remaining after strained wood waste was separated using a coffee filter; and 4) the liquid remaining after the wood chips and fines were removed. The liquid remaining in fraction #4 above was filtered using a Nalgene 0.45 µm filter. Two sets of these mudline component samples were prepared (one with visual wood chips and one without visual wood chips) and submitted for chemical analysis. In the settlement aquarium containing wood chips, many isopods were observed swimming, whereas in the settlement aquarium without wood chips no isopods were observed.

Samples from the southern portion of Bucksport Study Area that were visually observed to contain an abundance of wood waste were submitted for chemical and physical analyses. Additionally, handfuls of the wood waste mix were manually squeezed and the resulting waters were collected. These collected "squeeze waters" were submitted for total and filtered (0.45 µm Nalgene filter) analysis. The remaining sediments in Bucksport and Frankfort Flats included black silts, brown silts, brown sands, gray sands, black sands, and samples with and without wood waste. INSET 3-5 includes images of wood waste collected from a ponar grab sample and a typical silty sand and wood waste mixture.

INSET 3-5: Images of wood waste and sediment mixture

[redacted]

[redacted]

Sediment samples designated for chemical analysis were sent to Alpha Analytical Laboratories, and analyzed for total mercury by EPA method 7474, total organic carbon by Lloyd Kahn method, and total solids by ASTM 2540G. Unfiltered and field-filtered water samples were also sent to Alpha Analytical Laboratories and analyzed for total and dissolved mercury by EPA method 7470.

Samples analyzed for physical characteristics were sent to the Amec Foster Wheeler Durham, NC Sediment Laboratory and analyzed for the following: organic content by ASTM D2974-C, and grain size distribution by ASTM D422. Laboratory data sheets are included in Appendix E. Due to the addition of highly organic wood waste within samples, the Amec Foster Wheeler Sediment Laboratory adjusted the analysis procedures to account for this matrix. The adjusted standard operating procedures conducted for the organic content and grain size distribution analyses will be included in a future QAPP addendum.

3.4 Sediment Analytical Results

Chemical and physical results for the Spring 2016 sampling effort are summarized in Table 1 with photographs, field data records, and sediment laboratory data sheets provided in Appendix C, D and E, respectively, and are described by study area below.

[redacted] Bucksport

In the Bucksport study area, 21 sediment samples and 10 water samples were submitted for chemical analysis. Due to limited sediment available at certain sampling locations, 15 of the 21 sediment samples were submitted for physical analysis. The sediment samples collected in this area, listed in descending order by prevalence, were classified as wood waste, gray fine sand, coarse sand, gray silt, black coarse sand, brown silt, black silt and brown find sand.

Total mercury concentrations in sediment ranged from 82 nanograms per gram (ng/g) to 3,590 ng/g, with an average concentration of 837 ng/g. The only water sample to detect total mercury above laboratory reporting limits (12.17 ng/L) was the “squeeze water” sample collected from a handful of wood waste. All other water samples in the Bucksport study area had total mercury concentrations less than 0.2 ng/g.

Total organic carbon in sediment ranged from 0.526 percent (%) to 44.30%, with an average of 18.73%. Organic content in sediment ranged from 2.1% to 45.9%, with an average of 17.9%. Total mercury concentrations were observed to be generally greatest in samples with more total organic carbon and/or organic content.

Grain size analysis determined the distribution of gravel (0% - 17.3%), sand (15.8% - 88.2%), and fine sediment (i.e., passing #200 sieve) (10.9% - 84.1%). The average grain size distribution for sediment in the Bucksport study area is characteristic of 3.8% gravel, 48.1% sand, and 48.4% fine sediment (i.e., passing #200 sieve). Some samples contained bark and wood waste, which is reflected as gravel and sand in grain size distributions.

Additional analysis was completed for wood waste collected in the Bucksport study area. For wood waste greater than 0.420 millimeters (mm) (e.g., retained on #40 sieve), the following physical parameters were determined: specific gravity 0.37 (Dry) and 1.746 (Wet), bulk density 370 kilograms per square meter (kg/m^3)(Dry) and 1,746 kg/m^3 (Wet), and absorption potential of 211.5%. For wood waste less than 0.420 mm (e.g., passing #40 sieve), specific gravity was determined to be 2.248 (Dry) and bulk density to be 2,248 kg/m^3 (Dry).

[redacted] Frankfort Flats

In the Frankfort Flats study area, 14 sediment samples were submitted for chemical analysis. Due to limited sediment available at certain sampling locations, 12 of the 14 sediment samples were submitted for physical analysis. The sediment samples collected in this area, listed in descending order by prevalence, were classified as coarse sand, brown silt, brown fine sand, brown coarse sand, wood waste, gray silt, black silt and gray fine sand.

Total mercury concentrations in sediment ranged from 47 ng/g to 770 ng/g, with an average concentration of 214 ng/g. No water samples were collected in the Frankfort Flats study area.

Total organic carbon in sediment ranged from 0.314% to 5.65%, with an average of 1.55%. Organic content in sediment ranged from 0.5% to 16.8%, with an average of 6.1%. Total mercury concentrations were observed to be generally greatest in samples with more total organic carbon and/or organic content.

Grain size analysis determined the distribution of gravel (0% - 72.2%), sand (14.9% - 94.7%), and fine sediment (i.e., passing #200 sieve) (3.8% - 84.9%). The average grain size distribution for sediment in the Frankfort Flats study area is characteristic of 20.8% gravel, 49.4% sand, and 29.8% fine sediment (i.e., passing #200 sieve).

[redacted] Hampden

In the Hampden study area, two sediment samples were submitted for chemical and physical analysis. The sediment samples collected in this area, no order assigned due to equal distribution through the samples, were classified as gray silt, gray fine sand and gravel.

Total mercury concentrations in sediment ranged from 24 ng/g to 438 ng/g, with an average concentration of 231 ng/g. No water samples were collected in the Hampden study area.

Total organic carbon in sediment ranged from 1.40% to 8.91%, with an average of 5.16%. Organic content in sediment ranged from 6.5% to 16.6%, with an average of 11.6%. Total mercury concentrations were observed to be generally greatest in samples with more total organic carbon and/or organic content.

Grain size analysis determined the distribution of gravel (0% - 0.4%), sand (3% - 92.2%), and fine sediment (i.e., passing #200 sieve) (7.4% - 97%). The average grain size distribution for sediment in the Hampden study area is characteristic of 0.2% gravel, 47.6% sand, and 52.2% fine sediment (i.e., passing #200 sieve).

[redacted] Gross Point

In the Gross Point study area, six sediment samples and six water samples were submitted for chemical analysis. Due to limited sediment available at certain sampling locations, three of the six sediment samples were submitted for physical analysis. The sediment samples collected in this area, listed in descending order by prevalence, were classified as wood waste, gray silt, brown silt, black silt and gray fine sand.

Total mercury concentrations in sediment ranged from 75 ng/g to 1,150 ng/g, with an average concentration of 551 ng/g. There was only one water sample (GP36ABC_060816_ML_C) where total mercury was detected above laboratory reporting limits (0.32 ng/g). All other water samples in the Gross Point study area had total mercury concentrations less than 0.2 ng/g.

Total organic carbon in sediment ranged from 3.07% to 7.01%, with an average of 4.99%. Organic content in sediment ranged from 3.9% to 10.3%, with an average of 7.8%. Total mercury concentrations were observed to be generally greatest in samples with more total organic carbon and/or organic content.

Grain size analysis determined the distribution of gravel (0% - 6%), sand (2.3% - 58.4%), and fine sediment (i.e., passing #200 sieve) (36.9% - 97.7%). The average grain size distribution for sediment in the Gross Point study area is characteristic of 3.6% gravel, 30.4% sand, and 66.0% fine sediment (i.e., passing #200 sieve). Some samples contained bark and wood chips, which is reflected as gravel and sand in grain size distributions.

[redacted] East Channel

In the East Channel study area, 11 sediment samples and 10 water samples were submitted for chemical analysis. Due to limited sediment available at certain sampling locations, four of the 11 sediment samples were submitted for physical analysis. The sediment samples collected in this area, listed in descending order by prevalence, were classified as wood waste, gray silt and gray fine sand.

Total mercury concentrations in sediment ranged from 578 ng/g to 1,530 ng/g, with an average concentration of 910 ng/g. There were no detections of total mercury above laboratory reporting limits from the water samples collected in the East Channel study area.

Total organic carbon in sediment ranged from 4.62% to 25.40%, with an average of 6.75%. Organic content in sediment ranged from 11.3% to 12%, with an average of 11.7%. Total mercury concentrations were observed to be generally greatest in samples with more total organic carbon and/or organic content.

Grain size analysis determined the distribution of gravel (0%), sand (6.1% - 12.2%), and fine sediment (i.e., passing #200 sieve) (87.8% - 93.9%). The average grain size distribution for sediment in the East Channel study area is characteristic of 0% gravel, 7.9% sand, and 92.1% fine sediment (i.e., passing #200 sieve). Some samples contained wood waste, which is reflected as sand in grain size distributions.

[redacted] Fort Point Cove

In the Fort Point Cove study area, four sediment samples were collected and submitted for chemical and physical analysis. The sediment samples collected in this area, listed in descending order by prevalence, were classified as gray silt and gray fine sand.

Total mercury concentrations in sediment ranged from 389 ng/g to 694 ng/g, with an average concentration of 588 ng/g. No water samples were collected in the Fort Point Cove study area.

Total organic carbon in sediment ranged from 2.40% to 4.12%, with an average of 3.07%. Organic content in sediment ranged from 5.3% to 72.2%, with an average of 23.9%. Total mercury concentrations were observed to be generally greatest in samples with more total organic carbon and/or organic content.

Grain size analysis determined the distribution of gravel (0%), sand (0.7% - 26.8%), and fine sediment (i.e., passing #200 sieve) (73.2% - 99.3%). The average grain size distribution for sediment in the Fort Point Cove study area is characteristic of 0% gravel, 8.3% sand, and 91.7% fine sediment (i.e., passing #200 sieve).

[redacted] Odom Ledge

In the Odom Ledge study area, three sediment samples were submitted for chemical and physical analysis. The sediment samples collected in this area, listed in descending order by prevalence, were classified as gray fine sand, gray silt, black silt and gravel.

Total mercury concentrations in sediment ranged from 454 ng/g to 634 ng/g, with an average concentration of 552 ng/g. No water samples were collected in the Odom Ledge study area.

Total organic carbon in sediment ranged from 1.64% to 4.76%, with an average of 2.97%. Organic content in sediment ranged from 3.3% to 12.1%, with an average of 7.3%. Total mercury concentrations were observed to be generally greatest in samples with more total organic carbon and/or organic content.

Grain size analysis determined the distribution of gravel (0%), sand (2.9% - 55.8%), and fine sediment (i.e., passing #200 sieve) (44.2% - 97.1%). The average grain size distribution for sediment in the Odom Ledge study area is characteristic of 0% gravel, 24.0% sand, and 76.0% fine sediment (i.e., passing #200 sieve).

3.5 Reach & Zone Determination

To characterize sections of the Estuary that may be distinct in terms of river flow, tidal influence, and/or the transport and deposition of mercury-impacted sediment, river reaches were defined to identify like-area conditions. The reach boundaries were designed using physical features as clear markers so that field personnel could easily recognize each reach (INSET 3-6). River reaches are presented in Figure 22.

INSET 3-6: River Reach Boundaries

Study Reach Name	Up River Extent	Down River Extent
Bangor	Former Veazie Dam	Souadabscook Stream
Orrington	Souadabscook Stream	Overhead Power Lines at Bucks Ledge
Winterport	Overhead Power Lines at Bucks Ledge	Northern Limit of Cable area at Drachm Point
Frankfort Flats	Northern Limit of Cable area at Drachm Point	Green Can #11
Bucksport	Green Can #11	Cable Crossing
Bucksport Harbor	East Side of Thalweg	Bucksport Verona Bridge
Bucksport Thalweg	Cable Crossing	Penobscot Narrows Bridge
Verona West	Penobscot Narrows Bridge	Sandy Point - Verona Island
Upper Penobscot Bay	Sandy Point - Verona Island	Fort Point - Wilson Point
Fort Point Cove	*Fort Point - Sandy Point	*Fort Point - Sandy Point
Cape Jellison	Fort Point - Wilson Point	Red Can #4 - Perkins Point
Verona Northeast	Bucksport Verona Bridge	Gross Point
Verona East	Gross Point	Confluence with Bay
Orland River	Orland River Dam	Gross Point
Mendall Marsh	Bowden Point	

* Due to the shape of Fort Point Cove, only an eastern boundary is associated with it, all other boundaries are land.

River reaches were further subdivided into a zone-consistent approach with added definition for environment type and equipment access. The zones were classified to include the following: mobile pool, vegetated marsh, intertidal and subtidal.

- Mobile pool zone represents material that travels throughout other zones.

- Vegetated marsh was defined to include 1) the marsh platform (e.g., Mendall Marsh and Orland River), 2) the low, middle and high marsh using the high annual tide elevation as the boundary between high marsh and upland environments, and 3) the riverine bench.

- Intertidal zone was classified as the area between the mean low water and mean high water elevations. This zone was observed to be predominately mudflats with vegetation closer to the mean high water boundary.

- Subtidal zone was characterized as shallow water depths ranging from the mean low water elevation to the (-)20-feet MLLW elevation, river channels and trenches, and river shelves, bedrock, and deep pockets.

4.0 FALL 2016 FIELD INVESTIGATION

During the fall 2016 field event, the mobile sediment mix and the mudline (i.e., the predominantly liquid phase captured at the sediment-water interface) samples were observed to contain a variable, but significant, wood waste component. Moreover, during August 2016 eel monitoring in the Estuary, Amec Foster Wheeler observed that wood chips accumulated in the eel traps. In talking with local lobstermen, Amec Foster Wheeler field personnel learned that this accumulation has also been observed in lobster traps in the South Verona area.

Based on these observations, to better characterize the wood waste component and evaluate its potential contribution to the mobile sediment pool, the objective of fall 2016 field work was to trap and retrieve the mix of wood waste and sediment that is tidally transported in the Frankfort Flats, Bucksport, East Channel, Orland River and South Verona reaches of the Estuary. To meet this objective, modified eel traps were deployed to capture and analyze the mix of wood waste and sediment that is transported in suspension by the tide. Characterization of the mobile sediment mix, and principally the wood components of that mix, is important for evaluating potential remedial alternatives and assessing their effectiveness.

The SOPs used to visually characterize field sediment and identify stations of wood waste enrichment will be appended to the project QAPP. Field Activity Photographs are included in Appendix C. Field Data Records are included in Appendix D.

4.1 Wire Traps

Amec Foster Wheeler deployed modified eel traps to capture and analyze the mix of wood waste and sediment that is transported in suspension by the tide.

For eel traps, material captured in the traps was classified as mobile subtidal fluid wood waste. To evaluate both finer-grained sediment and larger sized woody particles, traps were altered to either allow passage of a wood waste/sediment mixture or to exclude all but fine grained sediment. Traps designed to capture a mix of wood waste and sediment were altered so that only material able to pass through a #40 sieve-sized screen (i.e., a fine window screen) would be retained in the trap. Traps designed to capture only fine grain sediment were altered so that only material able to pass through a simulated #200 sieve size screen would be retained in the trap.

Traps were deployed in pairs and monitored daily for ~1 week. Following trap recovery, materials collected within the traps was recovered, described, and photographed (Appendix C). Overall, when wood waste was visually present, individual samples recovered in modified traps could be described as medium brown in color, consistent in appearance, blocky in shape and approximately 1/8” – 1/16” in size. All sediment/wood waste samples were stored in an on-site freezer until determination by the Special Master/Litigants regarding further analytical assessment. Biota captured in the traps were recorded on the field log and released.

A descriptive summary of results for the 2016 study areas is provided below. Tables 2 and 3 summarize the assessment/characterization of samples.

4.2 Sediment Sampling and Visual Assessment

Bulk samples were collected using sediment probes with a target depth of 1 foot below mudline. Where probes were unsuccessful or had low recovery, ponar grab samples were collected. The presence and relative abundance of wood waste within Estuary reaches was evaluated by a qualitative visual - manual assessment (ASTM, 2000). The goal of the qualitative visual – manual assessment is to broadly evaluate the distribution and abundance of wood waste throughout the Estuary, as well as between specific Reaches. For this qualitative survey, the terms used and the relative percentages that they include are as follows: (1) no (0%); (2) trace (1 – 5%); (3) some (5 – 20%); (4) scattered (20 – 50%); (5) occasional (50 – 80%); and (6) abundant (80 – 100%). Results of this visual - manual assessment are presented in Tables 2 and 3 and an overview of results by Reach is provided below. As consistent with the method, where possible, grab samples were collected to supplement the visual assessment. In addition, select samples were retained and frozen for chemical and/or physical analysis. Visual assessment findings are shown on Figure 23 (a – e).

[redacted] Orrington Reach

The Orrington Reach was visually observed to contain scattered (20-50%) to occasional (50-80%) amounts of wood waste. Visual Assessment FDRs in the Orrington Reach reflect that station locations were collected in small silty intertidal coves near Snub Point with four locations on the left bank and one on the right bank just before Bald Hill Cove. Trace leaves and grass and occasional particle (grain) wood fines were observed on the surf line and intermingled in the base sediment at all of the locations. At Station Location "SP103-INT" in Bartlett Cove (Figure 23e), wood waste was also observed in the surf line and where suspended by the boat propeller.

Core and grab samples from the Orrington Reach in both subtidal and intertidal locations contained occasional to scattered particle (grain) wood fines and trace wood chips.

[redacted] Winterport Reach

The Winterport Reach was visually observed to contain occasional (50-80%) to abundant (80-100%) amounts of wood waste. Only a supplementary visual assessment was performed in the Winterport Reach that extended into Frankfort Flats on October 10, 2016. Abundant wood waste was observed on the intertidal flats and the extent of that wood waste was investigated by assessing each spot checked with a GPS point and tested via different tools to obtain samples of this material. Wood waste was observed in exploratory cores (GPS points "WP-1" and "WP-2") (Figure 23c) approximately a quarter mile upstream of the Winterport dock. The mobile pool was tracked down the right bank toward Treat Hill to GPS point "Vis 7" (Figure 23c) where trace (0-5%) to some (5%- 20%) wood waste was observed in the embayment, as well as on the left bank along Frankfort Flats (GPS points "Vis-5" to "Vis-8") (Figure 23c) where wood waste was observed. On October 14, 2016, rebar and wood markers were used in combination with GPS points to track the movement of a rivulet in Winterport marina.

[redacted] Frankfort Flats Reach

The Frankfort Flats Reach was visually observed to contain scattered (20-50%) to abundant (80-100%) amounts of wood waste within the subtidal and intertidal zones. Visual Assessment FDRs in the Frankfort Flats Reach reflect that both locations were sited on a large sloping intertidal flat near Drachm Point. At location "FF200-INT" (Figure 23c) near the surf line, the base sediment was visually characterized as silt with intermingled abundant wood waste along with trace leaves, grass and shredded mulch with some particle sized inorganic material. More than 20 amphipods where retained on a #40 Sieve. At location "FF100 INT" (Figure 23c) near the surf line, there was no base sediment observed. Abundant wood chips and trace particle (grain) wood fines estimated to be greater than 6 inches thick were present. The estimated thickness of this material was based on the core penetration depth.

Core and grab samples in the Frankfort Flats Reach were collected on or near a large sloping intertidal flat near Drachm Point and all contained wood waste. At the intertidal sampling locations, samples were characterized with occasional particle sized and scattered to abundant wood chips in silty sediments. The subtidal sampling locations were characterized with scattered to occasional wood fines, trace to scattered wood chips, and occasional shredded mulch in silty fine sand sediments.

Three traps were set in the Franklin Flats Reach from October 6-19, 2016 at various sub-tidal locations. Each recovered trap contained wood waste.

[redacted] Mendall Marsh Reach

The Mendall Marsh Reach was visually observed to contain no (0%) to trace (1-5%) amounts of wood waste. Core and grab samples in the Mendall Marsh Reach provided no visual evidence of wood waste. Intertidal visual characteristics contained silt with varying amounts of roots, leaves and twigs. Subtidal visual characteristics contained silt to medium sand with trace roots, leaves and twigs.

Two traps ("FF-AMEC-10" and "FF-AMEC-18") were set in the Mendall Marsh Reach on October 5, 2016, at a subtidal location near the mouth of the Marsh River (Figure 23c). Neither trap contained wood chips. "FF-AMEC-18" contained one crab that was returned to the Penobscot River.

[redacted] Bucksport Reach

The Bucksport Reach was visually observed to contain scattered (20-50%) to abundant (80-100%) amounts of wood waste within the intertidal zone, and trace (0-5%) to abundant (80-100%) amounts of wood waste within the subtidal zone. Visual Assessment FDRs in the Bucksport Reach were obtained mostly in the subtidal portion of the river. Four station locations were located in the Thalweg zone near the left bank. Samples were collected at these locations via ponar grab and were primarily characterized as gray silty sand with trace wood chips. Some subtidal grab locations had abundant wood chips with fine sand and trace silt. One station location was near the right bank edge of an intertidal sloping mudflat where abundant shredded mulch and wood chips were observed near the surf line with an estimated thickness of 1-2 inches.

Intertidal samples were collected with a shovel and were visually characterized as containing silt with scattered twigs and scattered to occasional wood chips. Subtidal core and grab samples were visual characterized as varying from silt with trace fine sand and trace wood chips to coarse gravel.

Eight traps were set in the Bucksport Reach from October 14-20, 2016 at various subtidal locations. Seven of the traps contained wood waste in various amounts. One of the traps, BU-Amec-10, was abandoned due to river structures preventing retrieval.

[redacted] Bucksport Harbor and Thalweg Reaches

There were two supplementary visual assessment locations, "Mill pile 1" and "Mill pile 2", recorded in the Bucksport Thalweg Reach on October 6, 2016 (Figures 23b,c). However, due to very limited recovery it is unclear if wood waste was present.

[redacted] Verona Northeast Reach (East Channel)

The Verona Northeast Reach was visually observed to contain occasional (50-80%) to abundant (80-100%) amounts of wood waste in the intertidal zone and some (5-20%) amounts in the subtidal zone. One station location "EC112-INT" (Figure 23b), was in a subtidal location on the edge of an intertidal mudflat bounded by boulder outcrops. At this station location, the surf line intermingled with silty base sediment and was characterized by abundant wood waste to an estimated thickness of ¼ inch. Three station locations were on the left bank of intertidal sloping mudflats with boulder outcrops near Gross Point. These station locations were generally characterized by silt intermingled with abundant wood chips and trace to scattered leaves and grass to about ¼ inch thickness. Supplementary visual assessments indicated that the spatial extent of wood waste is highly variable.

Core and grab sample observations indicated that wood waste was present periodically on intertidal mudflats and near the edge of the subtidal river channel. Observations of wood waste on intertidal mudflats appeared to increase along the narrower southern section of the Reach, especially near Gross Point.

Six traps were set from October 12-15, 2016 at a subtidal location. Samples "VN-Amec-4" and "VN-Amec-6" were observed to contain varying amounts of wood waste.

[redacted] Orland River Reach

The Orland River Reach was visually observed to contain some (5-20%) to scattered (20-50%) amounts of wood waste in the intertidal zone and subtidal zone. Wood waste near the surf line was noted at location “OR106-INT” to have an estimated thickness of 4 inches. Generally at the surf line, the silty base sediment was intermingled with scattered wood chips, and trace shredded mulch on intertidal sloping mudflats. Three station locations ("OR105-INT", "OR107-INT", and "OR108-INT") were in intertidal sloping mudflats near the Orland Dam (Figure 23b). Two of the three stations were not observed to contain wood waste. The third location, "OR108-INT", was located on the edge of a raised intertidal sloping mudflat west of a large rivulet that emptied into a cove. For this location, there was approximately 1 foot of scattered wood chips intermingled into the silt base sediment. Four locations indicated varying amounts of wood waste located on the edge of the shallow subtidal surf line in silty base sediment. One station, "OR-102-INT" (Figure 23b), was located in an intertidal cove in the lower Orland River and contained abundant wood waste intermingled into silty base sediment to a depth of 6 inches.

A supplementary visual assessment location, "Orland River east" (Figure 23b), was collected with a hand push corer to approximately 2.5 feet and contained polychaetes and organic material characterized as green algae.

Four traps were set in the Orland River Reach from October 12-15, 2016 at various subtidal locations. While three of the four trap samples collected various amounts of wood waste and crabs these collected materials were not processed for analyses. The collected materials were not processed for analyses because an unexpected algal bloom occurred while the traps were deployed. A field decision was made to not process these collected materials due to the unknown influence of the algal bloom upon the collected materials. The fourth trap, "OR_TRAP-48" (Figure 23b), did not contain sediment or wood waste.

[redacted] Verona East Reach (South Verona)

The Verona East Reach was visually observed to contain occasional (50-80%) to abundant (80-100%) amounts of wood waste in the intertidal zone and trace (1-5%) to scattered (20-50%) amounts in the subtidal zone. The visual assessment in the Verona East Reach included three locations on the left bank, along Verona Island near the edge of the subtidal and intertidal zones, that all contained wood wastes to varying thicknesses and sizes. There also were four locations on the right bank near the edge of subtidal and intertidal zones, and one location near sloping mudflats contained wood waste.

Ten of the twelve manual push core and grab samples contained trace to occasional wood chips typically in silt with trace fine sand. Bulk grab log "VE61" (Figure 23a) had low recovery with gravel descriptions. Bulk grab log "VE51" (Figure 23b) did not have recovery due to boulder terrain. For analytical samples "VE60", "VE59", "VE58", and "VE53" (Figures 23a,b), sample descriptions indicated occasional wood chips with trace to scattered twigs. The highest relative abundance of wood waste was recorded on the right bank across from the mouth of the Orland River and appears to decrease downstream on both banks until the South Orland Cove where coarser inorganic sediment increases.

There were nine bulk traps retrieved from the subtidal zone from October 6-19, 2016, but only three were processed for analytical testing. "EC-Amec-04 / VE_TRAP1" (Figure 23a), was processed as a limited composite sample for analytical testing. "EC-Amec-10 / VE_TRAP2" and "VE_TRAP3" (Figure 23a) had abundant wood chips and were processed as a composite sample and sent for analytical testing as "VE_TRAP2+3" during Work Order 4A-020. Near the left bank of the South Orland shore "VE_TRAP_08" (Figure 23a) was deployed for two complete tidal cycles and captured trace wood chips. "VE-TRAP-04" (Figure 23a) retained trace silts and wood chips. "VE-TRAP-06" (Figure 23a) initially retained primarily crabs and some tomcod, however upon retrieval on October 19, 2016, it contained abundant wood chips.

[redacted] Upper Penobscot Bay

The Upper Penobscot Bay Reach was visually observed to contain trace (1-5%) amounts of wood waste. Seven grab samples were obtained on October 8, 2016, with two of the seven locations containing wood waste near the confluence of Verona West and Verona East channels. With the exception of Morse Cove that did not visually contain any wood waste, the amount of observable wood waste appears to decrease with water depth and is lower for coarser bed sediments.

[redacted] Cape Jellison Reach

The Cape Jellison Reach was visually observed to contain no (0%) to trace (1-5%) amounts of wood waste. There were 13 grab samples obtained in this reach located primarily in subtidal locations. Four of the locations contained wood waste. These locations were located near the east bank of Cape Jellison near the Thalweg zone.

[redacted] Penobscot Bay

The Penobscot Bay Reach was visually observed to contain no (0%) to trace (1-5%) amounts of wood waste. Six grab samples where obtained south of the Cape Jellison Reach that contained predominately dark gray silts with shells and did not contain visual observations of wood waste. Sampling in the Bay was complicated by the water depth and the ponar sampler did not always close properly during sampling and recovery.

4.3 Preparation and Analysis of Fall 2016 Sediment Samples

In the winter of 2017 (i.e., February 2017) (Work Order 4A-020), the distribution of mercury and methylmercury in Estuary sediment was evaluated, and the role of wood waste (wood chips) in the transport and redistribution of mercury within the Estuary was investigated. This work included the preparation and laboratory analyses of mobile pool bulk materials [collected under Work Order 3A; October 2016], and focused on evaluating sediment heterogeneity. Heterogeneity refers here to variability in sediment grain size as well as the presence of legacy wood waste and wood degradation products; therefore, the work focused on two main objectives: (1) to reduce analytical uncertainty associated with employing multiple laboratories with varying sample preparation protocols and analytical methods; and (2) to assess inherent heterogeneity of samples characterized by varying contents of mineral sediment and wood waste. Results from Work Order 4A-010 (Analytical Comparisons) are not included in this Report, and will be provided under separate cover.

SOPs for the preparation, processing, and physical analysis (grain size distribution, sediment organic content and sediment bulk density) testing of mobile pool bulk materials were prepared and appended to the project QAPP. Laboratory data sheets for the physical analyses are provided in Appendix E.

[redacted] Discrete & Partitioned Sample Processing

Bulk material collected in the fall 2016 were prepared in the winter 2017 into multiple samples submitted for laboratory analyses. The primary purpose of the multiple samples was to characterize the as-recovered and sieve-partitioned fractions. Discrete samples represented the as-recovered condition. The sieve-partitioned fractions represented the portion retained on the #40 (420 micron) sieve and the portion that passed. The fraction that was retained was visually observed to predominantly contain medium and coarse sands and wood chip-sized wood waste.

The discrete and partitioned samples were shipped to Eurofins and Alpha for chemical analyses and to the Amec Foster Wheeler Durham, NC soil laboratory for physical analyses.

[redacted] Chemical & Physical Analytical Results

Chemical and physical results of the fall 2016-collected sediments are presented in Table 5. Photographs, field data records, and sediment laboratory data sheets are provided in Appendix C, D and E, respectively.

Sediment total mercury concentrations for bulk sediment samples collected during both the Spring and Fall 2016 sampling events were combined and are presented on Figure 23 (a – e).

4.3.2.1 Orrington Reach

The river geomorphology of the Orrington Reach influences the transport and deposition of mobile pool sediments and forms different environmental zones, such as vegetated marsh, intertidal and shallow subtidal zones. During ebb tide, rivulets form within the intertidal zone that indicate an erosional process with each tidal cycle that can facilitate continued movement of sediment after initial settlement. Wood waste was observed in marsh surface sediments, partially suspended at the surf line, and embedded with river bed sediments. Total mercury concentrations within the Orrington Reach had a maximum concentration of 2,410 ng/g. Methyl mercury was also recorded to be highest in samples collected in October 2016, with a maximum of 28.90 ng/g. Total mercury concentrations were observed to be generally greatest in samples with more total organic carbon and/or organic content. Total organic carbon ranged from 7.60% to 20.20% while organic content ranged from 18.15% to 45.00%. The sediment submitted for sample analysis was characterized as predominantly silts and clays.

4.3.2.2 Winterport Reach

The upper portion of the Winterport Reach is characteristic of shoaling, but no samples were submitted for laboratory analyses. The lower portion of the reach is primarily influenced by tidal interaction with the Frankfort Flats Reach. Limited samples analyzed for total mercury were collected as part of the Phase II Study. Total mercury concentrations were observed to be highest within the lower portion and closest to the Frankfort Flats Reach. The Winterport Reach is representative of vegetated marsh, intertidal and shallow subtidal zones. Shifting rivulets are commonly observed in the intertidal zone during ebb tide. Wood waste was observed in intertidal surface sediments, partially suspended at the surf line and embedded in river bed sediments.

4.3.2.3 Frankfort Flats Reach

Historical groins within Frankfort Flats appear to have influenced areas where sediment accumulates and may potentially lead to stockpiling of mobile pool sediments. This reach is affected by tidal interactions with the Winterport and Bucksport Reaches that ultimately influences sediment transport and deposition. Intertidal and subtidal zones were dominant environments with shifting rivulets commonly observed within the intertidal zone during ebb tide. Large amounts of wood waste were observed in intertidal surface sediments and as partially suspended fluid material about 15 feet thick in subtidal river channels. Total mercury concentrations were greatest in samples collected in wire traps.

Total mercury concentrations ranged from 776 ng/g to 1,940 ng/g. Methyl mercury ranged from 6.32 ng/g to 17.40 ng/g. Total mercury concentrations were observed to be generally greatest in samples with more total organic carbon and/or organic content. Total organic carbon ranged from 5.20% to 27.00%. Organic content ranged from 9.00% to 58.15%. Grain size analysis determined the distribution of gravel (0%), sand (9.00% - 72.10%), and fine sediment (i.e., passing #200 sieve) (27.90% - 82.40%).

4.3.2.4 Bucksport Reach

Historical groins within the Bucksport Reach appears to have influenced areas where sediment has accumulated in the near shore and may potentially result with stockpiling of mobile pool sediments. The Lawrence Cove Navigation Channel has a recorded history of dredging wood waste-laden sediment for maintaining the authorized depth. An abundance of wood waste and mobile pool material in the Bucksport Reach was observed in the late spring and early summer, likely influenced by freshet flow conditions. The wood waste was mainly located in subtidal river channels and included up to about eight feet thick of fluid material. Total mercury concentrations were greatest in samples collected near historic and current groin locations and from sediment traps.

Total mercury concentrations ranged from 235 ng/g to 1,820 ng/g. Methyl mercury ranged from 3.22 ng/g to 22.70 ng/g. Total mercury concentrations were observed to be generally greatest in samples with more total organic carbon and/or organic content. Total organic carbon ranged from 3.26% to 25.80%. Organic content ranged from 3.47% to 46.63%. Grain size analysis determined the distribution of gravel (0% - 0.10%), sand (16.80% - 86.90%), and fine sediment (i.e., passing #200 sieve) (13.10% - 83.20%).

4.3.2.5 Bucksport Harbor and Thalweg Reaches

Substantial differences in bathymetry, hydrodynamics, and geomorphology coupled with a developed harbor, limited samples, a history of dredging and in-water dredged material disposal activities complicates the mercury distribution in these reaches. Additionally, a large wood waste pile about 8 to 10 feet thick was identified adjacent to a historical mill location and was is suspected to have been created from mill discharge and additional deposition from mobile pool sediments. Near the southern portion of the Bucksport Thalweg reach, an additional suspected 20-foot accumulation of sediment was identified and is located proximal to the disposal location from dredging activities conducted in or about 1985. The source of this material is likely wood waste-laden sediments that was removed from the Lawrence Cove Navigation Channel. The Bucksport Harbor and Thalweg Reaches have not largely been assessed.

4.3.2.6 Verona West Reach (the Narrows and Odom's Ledge)

The deepest water depths and highest river current velocities were observed in the Verona West Reach. Previous records documented observations of wood waste in the subtidal and intertidal zones. In the southern portion of the reach near Odom's Ledge, many ripple and scour features on the river bed were observed indicating depositional and erosional sediment transport. Sediment deposits were identified within the deep river channels. No samples were collected from the Verona West Reach during the 2016 sediment characterization program, but there are a few previous samples that have been collected. The Verona West Reach has not largely been assessed.

4.3.2.7 Verona Northeast Reach (East Channel)

A large tidal flat was identified near Porcupine Island that contains ample wood waste-laden mercury affected sediments. Fluid wood waste was also identified within the main river channel. Elevated methyl mercury concentrations were observed throughout the reach and total mercury concentrations for samples retained on the #40 sieve were highly variable.

Total mercury concentrations ranged from 111 ng/g to 1,630 ng/g. Methyl mercury ranged from 0.73 ng/g to 15.60 ng/g. Total mercury concentrations were observed to be generally greatest in samples with more total organic carbon and/or organic content. Total organic carbon ranged from 3.74% to 11.50%. Organic content ranged from 8.69% to 49.79%. Grain size analysis determined the distribution of gravel (0% - 22.50%), sand (3.80% - 61.00%), and fine sediment (i.e., passing #200 sieve) (34.40% - 96.20%).

4.3.2.8 Verona East Reach (South Verona)

A broad distribution of wood waste-laden sediments was identified across each environmental zone (e.g., vegetated marsh, intertidal, subtidal). Wood waste-laden sediments have been historically observed in intertidal sediments, especially in a cove located near the southern part of Verona Island. Near the southern portion of the reach, a natural depression was identified and would be an adequate location for a sediment trap. Captured fluid wood waste was characteristic of elevated total mercury and methyl mercury concentrations.

Total mercury concentrations ranged from 88.70 ng/g to 2,210 ng/g. Methyl mercury ranged from 1.11 ng/g to 17.30 ng/g. Total mercury concentrations were observed to be generally greatest in samples with more total organic carbon and/or organic content. Total organic carbon ranged from 0.98% to 37.20%. Organic content ranged from 1.84% to 71.56%. Grain size analysis determined the distribution of gravel (0% - 4.30%), sand (8.10% - 98.30%), and fine sediment (i.e., passing #200 sieve) (1.70% - 91.90%).

4.3.2.9 Orland River Reach

The Orland River Reach was classified as primarily intertidal with a much smaller shallow subtidal zone. The high majority of areas where wood waste-laden sediment was observed appeared to be located near the east bank. Fluid wood waste was captured in sediment traps during algal bloom conditions, which increases uncertainty if the algal bloom was a contributor to causing lower total mercury concentrations compared to previous sampling results.

Sediment trap samples were characteristic of total mercury concentrations that ranged from 189 ng/g to 713 ng/g. Methyl mercury ranged from 1.79 ng/g to 7.30 ng/g. Total mercury concentrations were observed to be generally greatest in samples with more total organic carbon and/or organic content. Total organic carbon ranged from 2.49% to 7.61%. Organic content ranged from 5.54% to 10.50%. Grain size analysis determined the distribution of gravel (0% - 0.20%), sand (52.20% - 63.70%), and fine sediment (i.e., passing #200 sieve) (36.10% - 47.80%).

4.3.2.10 Mendall Marsh Reach

The Mendall Marsh Reach was characterized as intertidal and shallow subtidal zones with a steep intertidal bank. Wood waste was not uniformly visible in sediment retained in the #40 sieve, which was dominantly sand.

Total mercury concentrations ranged from 40.40 ng/g to 1,260 ng/g. Methyl mercury ranged from 0.20 ng/g to 12.50 ng/g. Total mercury concentrations were observed to be generally greatest in samples with more total organic carbon and/or organic content. Total organic carbon ranged from 0.37% to 14.20%. Organic content ranged from 2.36% to 28.66%. Grain size analysis determined the distribution of gravel (0%), sand (2.20% - 38.90%), and fine sediment (i.e., passing #200 sieve) (61.10% - 97.80%).

4.3.2.11 Cape Jellison Reach

The Cape Jellison Reach has not largely been assessed. However, sediment grab samples were collected for analysis. Wood waste was not visible in grab samples yet trace amounts were observed on sieved sediment retained in the #40 sieve, which was dominantly sand. Wood fines (sand grain sized wood waste) were observed during the field collection but were too small to be retained on the #40 sieve.

Total mercury concentrations ranged from 27.70 ng/g to 721 ng/g. Methyl mercury ranged from 0.24 ng/g to 6.09 ng/g. Total mercury concentrations were observed to be generally greatest in samples with more total organic carbon and/or organic content. Total organic carbon ranged from 0.32 % to 3.49%. Organic content ranged from 1.79% to 19.38%. Grain size analysis determined the distribution of gravel (0% - 2.80%), sand (1.20% - 88.50%), and fine sediment (i.e., passing #200 sieve) (11.50% - 98.80%).

5.0 FINDINGS AND RECOMMENDATIONS

Findings and recommendations for the spring and fall 2016 sediment characterization efforts are summarized below.

5.1 Spring 2016 Sediment Characterization

The objective of spring 2016 sediment characterization work was to expand on the identification of the mobile sediment pool observed by the Phase II Study group. During 2016 field activities, highly organic wood waste was encountered in addition to expected inorganic (mineral) sediments. Evaluating the wood waste suggested that there are several different size classes or transport phases of this component of the Estuary system. Grab sampling and sub-bottom profiling results confirmed one component of wood waste to be wood chips mixed with inorganic sediment as a part of consolidated riverbed sediments. Dual frequency results suggest a second component of wood waste that is partially-suspended and actively transported above the river bed as a wood chip slurry. The data from the spring 2016 program suggest that highly organic material in the form of wood waste may be a significant component of the mobile pool, and adds another element to the overall understanding of wood waste deposition and transport within deeper Estuary river channels during freshet flow.

5.2 Fall 2016 Sediment Characterization

With this improved identification of the content of the mobile pool, the fall 2016 sediment characterization work was designed to evaluate the distribution of wood waste throughout the Estuary and to compare distribution of wood waste to the distribution of inorganic (mineral) sediment in the mobile pool. Coupling the geophysical results from spring 2016 program with the wire trap recovered material, visual assessment, grab samples, and exploratory manual push cores in the fall 2016 improved observations of mobile pool sediments thickness and distribution, including distribution of a mobile sediment slurry-like phase. Of note, in limited areas of the Estuary, the combined information suggested that in some locations the mobile sediments slurry may reach 22 feet in thickness.

Analysis of the fall 2016 samples indicated that the wood waste retained on a #40 sieve were enriched in total mercury and methylmercury relative to either unsieved (bulk) sediment samples or the fraction of sediment samples that passed through a #40 sieve. Overall for all reaches, the concentrations of total mercury and methylmercury in unsieved (bulk) sediment and in the fraction of bulk sediment passing through the #40 sieve were generally similar to each other. Estuary reaches in which sediment samples appeared to be enriched in wood waste retained on a #40 sieve included Orrington, Frankfort Flats, Bucksport, Verona Northeast and Verona East. Samples collected from eel traps, lobster traps, or wire traps within Frankfort Flats and Verona East also appeared to be substantially enriched in wood waste. Analytical results also indicate mobile pool sediments to be characteristic of dry bulk densities ranging from approximately 400 kg/m^3 to approximately 2,500 kg/m^3.

Understanding how the mobile sediment pool component impacts mercury distribution is important as any sediment type that contains lower density materials such as wood waste would be more vulnerable to erosion and transport. The difference in density between mineral sediment and wood wastes suggests that the organic and inorganic portions of the mobile sediment pool may not be distributed in the same manner throughout the Estuary, a factor that may be increasing the overall variability of surface sediment mercury concentrations in the Estuary.

5.3 2017 Data Collection

During the 2017 season, characterization efforts are focused upon improving the understanding of the vertical distribution and composition of the apparent mobile sediments in suspension. Expanding the geophysical data collection (i.e., dual frequency and sub-bottom profiling) from the spring 2016 Study Areas to a broader expanse of the project limits will refine the site understanding and focus on assessing the spatial extent of the mobile sediment and its components. Results gathered in 2017 will be combined with efforts undertaken by the Phase II Study group and 2016 Sediment Characterization work to refine the Conceptual Site Model and provide volume and mass estimates for potential remedial alternatives.

6.0 REFERENCES

American Society for Testing and Materials (ASTM), 2017. Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis (ASTM Designation: D6913 / D6913M-17), ASTM International, West Conshohocken, Pennsylvania.

American Society for Testing and Materials (ASTM), 2014. Standard Test Methods for Specific Gravity of Soil Solids by Water Pycnometer (ASTM Designation: D854-14), ASTM International, West Conshohocken, Pennsylvania.

American Society for Testing and Materials (ASTM), 2013. Standard Test Methods for Moisture, Ash, and Organic matter of Peat and Other Organic Soils (ASTM Designation: D2974-13), ASTM International, West Conshohocken, Pennsylvania.

American Society for Testing and Materials (ASTM), 2011. Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) (ASTM Designation: D2487-11), ASTM International, West Conshohocken, Pennsylvania.

American Society for Testing and Materials (ASTM), 2007. Standard Practice for Dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants (ASTM Designation: D421-85), ASTM International, West Conshohocken, Pennsylvania.

American Society for Testing and Materials (ASTM), 2007. Standard Test Method for Particle-Size Analysis of Soils (ASTM Designation: D422-63), ASTM International, West Conshohocken, Pennsylvania.

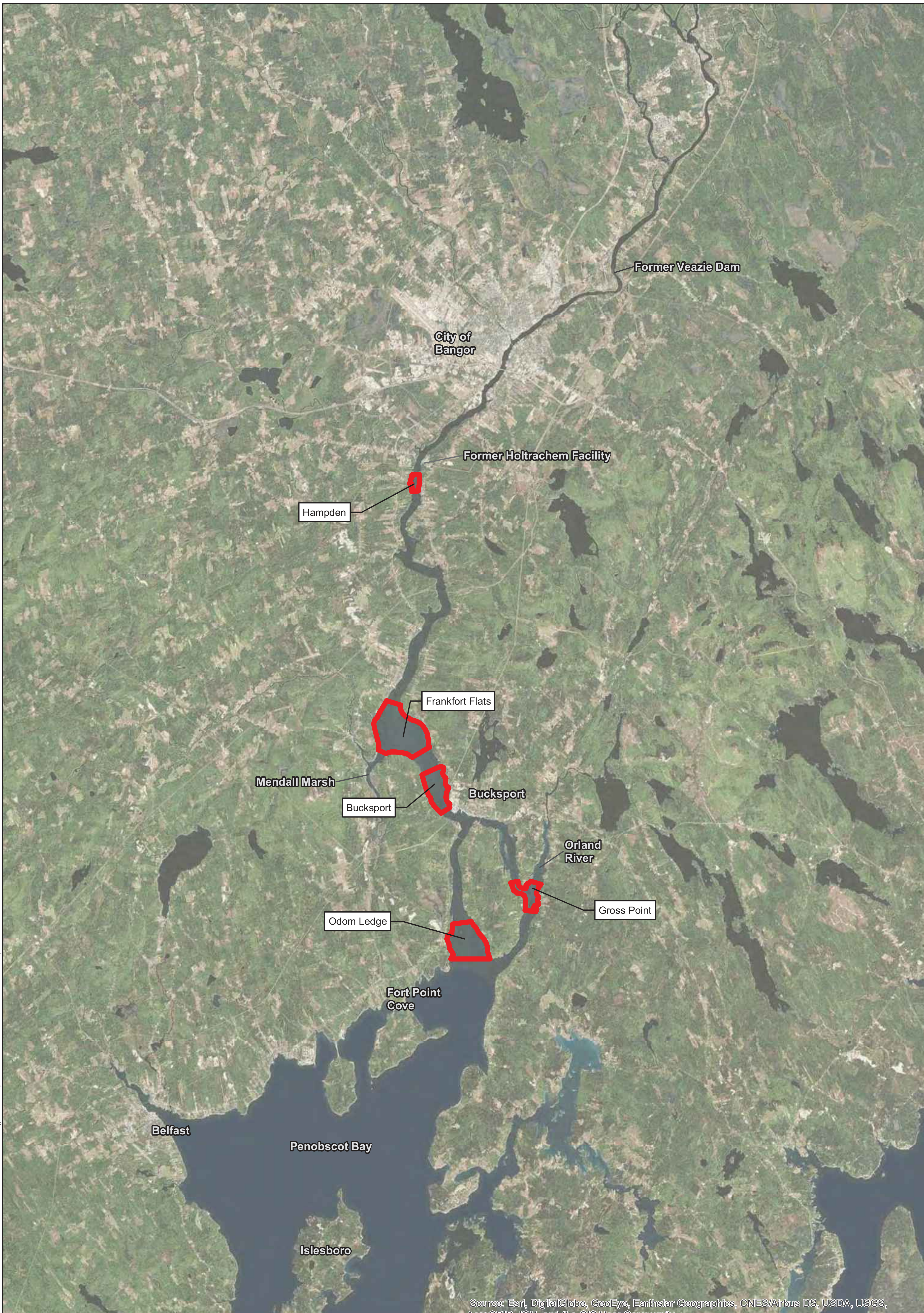
American Society for Testing and Materials (ASTM), 2000. Standard Practice for Description and Identification of Soils (Visual-Manual Procedures) (ASTM Designation: D2488), ASTM International, West Conshohocken, Pennsylvania.

Penobscot River Mercury Study Panel (PRMSP), 2013a. Results of 2012 Monitoring of Mercury in the Penobscot River and Bay with Comparisons to Previous Years. Penobscot River Mercury Study. December 2013.

Penobscot River Mercury Study Panel (PRMSP), 2013b. Final Report: Mercury Contamination of the Penobscot River Estuary: Current Situation, Remediation Targets, and Possible Remediation Procedures. Penobscot River Mercury Study. April 2013.

U.S. Army Corps of Engineers. 2016. EM 1110-2-5025 Dredging and Dredged Material Management. Engineer Manual EM 1110-2-5025. Washington, DC: Department of the Army.

FIGURES



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Symbol Key

Study Area Boundary

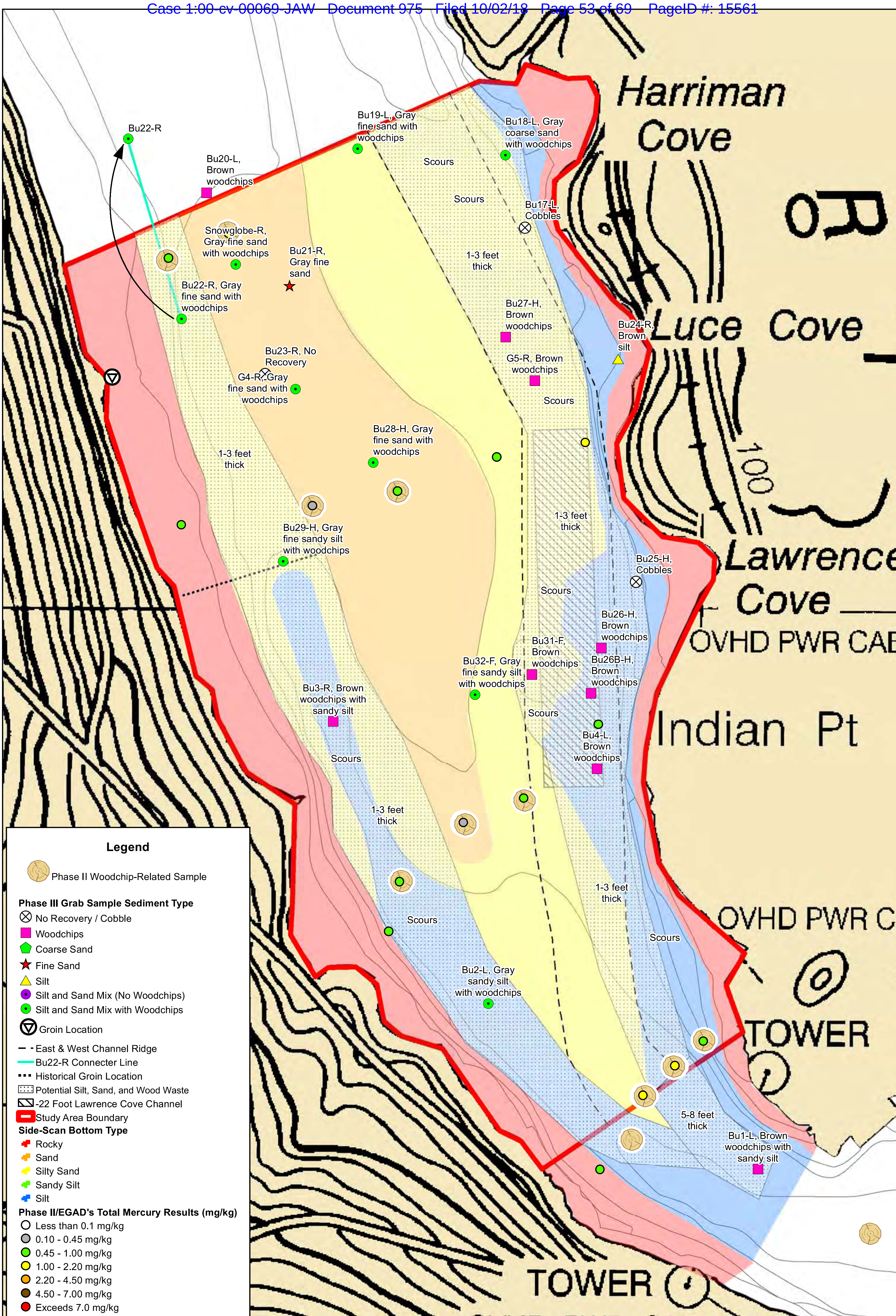
0 1.5 3 6 Miles

Figure 1
Penobscot River Estuary
Spring 2016 Study Areas

2016 Mobile Sediment Characterization Report
Penobscot River Phase III Engineering Study

Project: 3616166052	Prepared/Date: ICD 7/11/2017	Checked/Date:XXX 7/11/2017	NAD83 State Plane Maine East, US Survey Feet

Document:P:\Projects\USDC - Penobscot River\4.0_Deliverables\4.5_Databases\GIS\Shared\MXD\New Folder\Raleigh\WO3 Study Areas1.mxd 7/11/2017 12:37:15 PM ian.desjarlais



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Notes:
G4-R = Sample ID collected at rising tide.
Bu20-L = Bucksport sample ID collected at low tide.
Bu27-H = Bucksport sample ID collected at high tide.
Bu31-F = Bucksport sample ID collected at falling tide.
EGAD = MEDEP Environmental and Geographic Analysis Database

N

0 650 1,300 Feet

Figure 2
Bucksport Side Scan Sonar

2016 Mobile Sediment Characterization Report
Penobscot River Phase III Engineering Study

Project: 3616166052	Prepared/Date: 8/23/2017	Checked/Date: 8/23/2017	NAD83 State Plane Maine East, US Survey Feet

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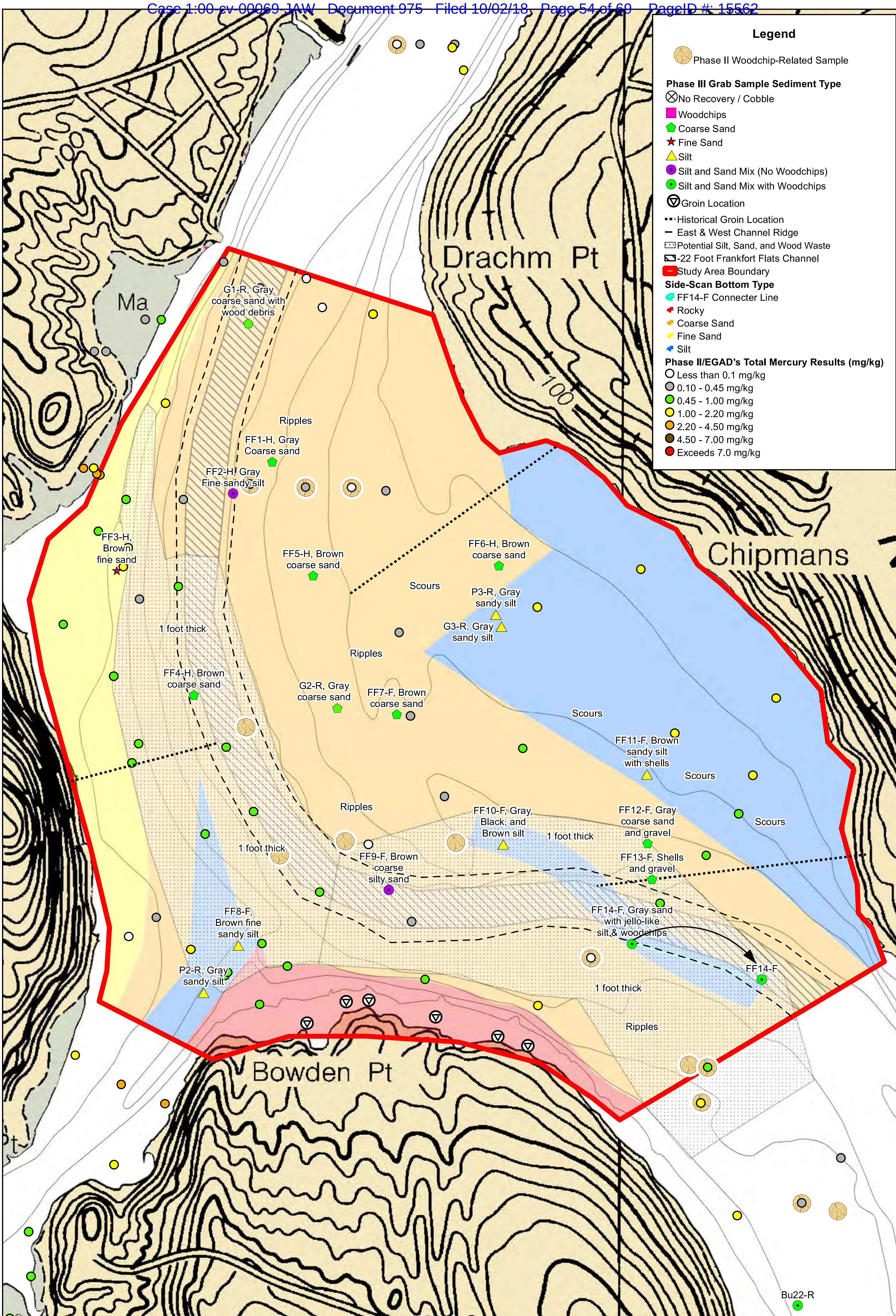

Notes:
G1-R = Sample ID collected at rising tide.
FF1-H = Frankfort Flats sample ID collected at high tide.
FF8-F = Frankfort Flats sample ID collected at falling tide.
EGAD = MEDEP Environmental and Geographic Analysis Database

N

0 1,000 2,000 Feet

amec foster wheeler

Figure 3
Frankfort Flats Side Scan Sonar

2016 Mobile Sediment Characterization Report
Penobscot River Phase III Engineering Study

Project: 3616166052	Prepared/Date: 8/23/2017	Checked/Date: 8/23/2017	NAD83 State Plane Maine East, US Survey Feet

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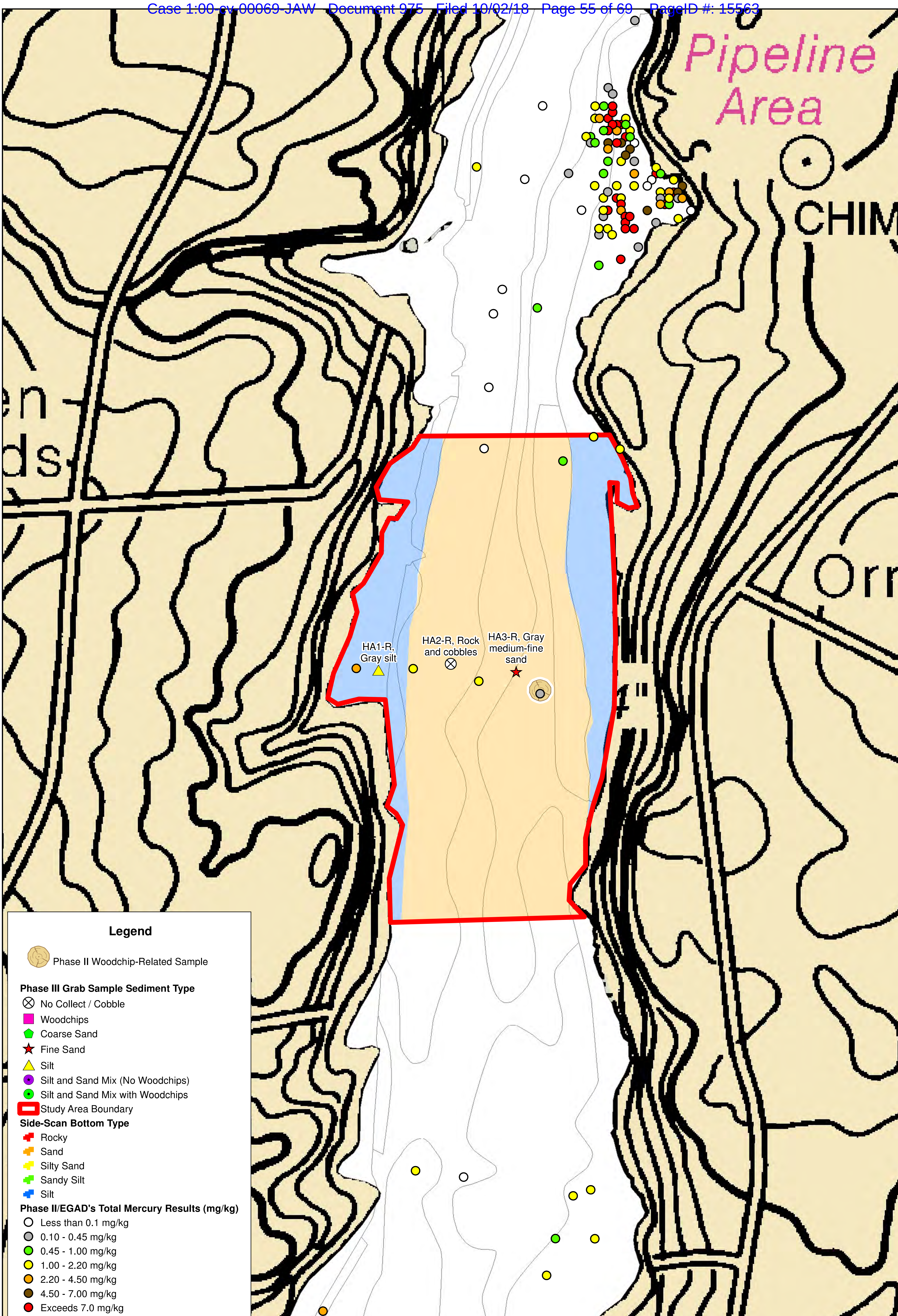

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amec foster wheeler

Notes:
HA1-R = Hampden sample ID collected at rising tide.
EGAD = MEDEP Environmental and Geographic Analysis Database

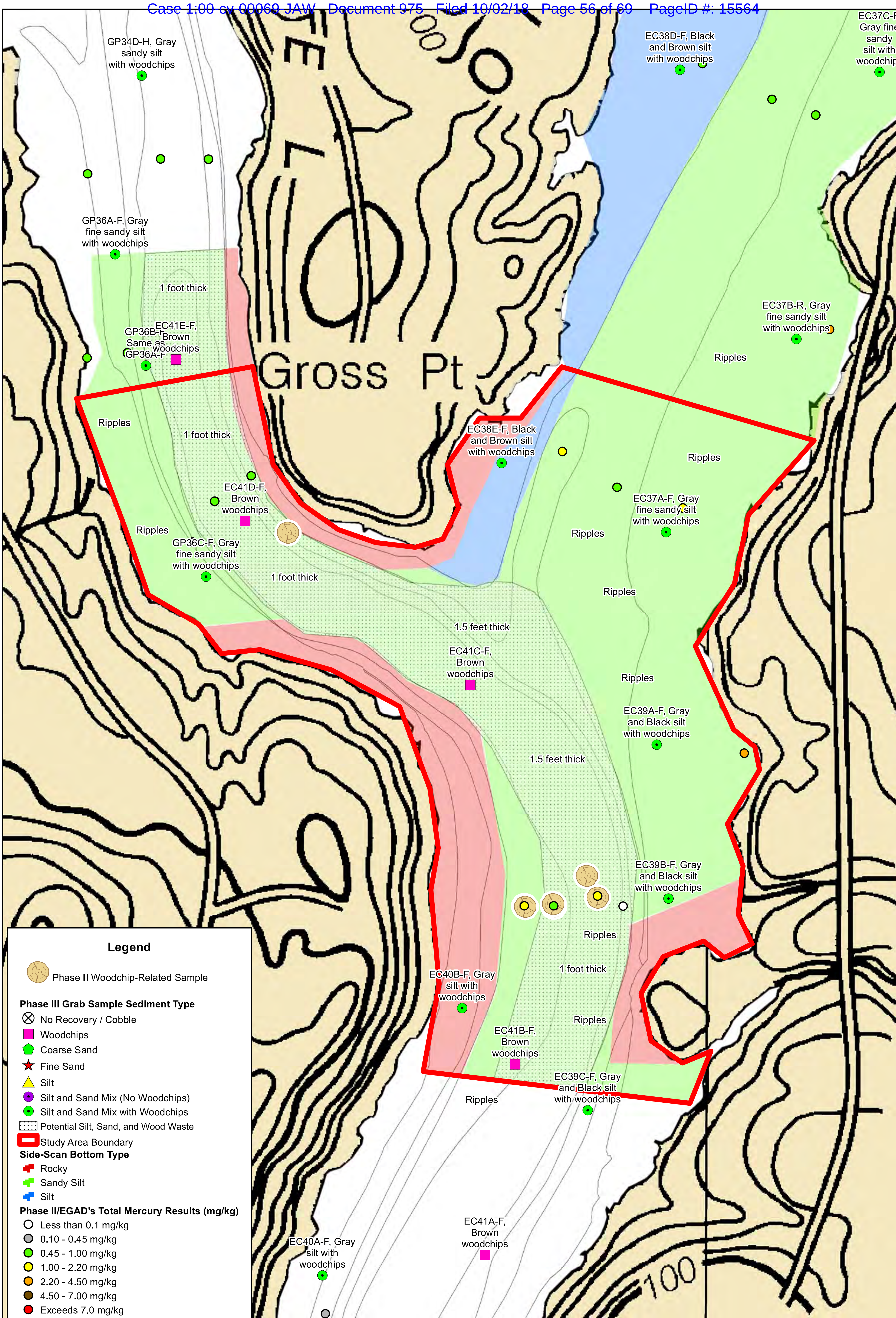
N

0 500 1,000 Feet

Figure 4
Hampden Side Scan Sonar

2016 Mobile Sediment Characterization Report
Penobscot River Phase III Engineering Study

Project: 3616166052	Prepared/Date: 7/10/2017	Checked/Date: 7/10/2017	NAD83 State Plane Maine East, US Survey Feet



Notes:
GP34-H = Gross Point sample ID collected at high tide.
GP36C-F = Gross Point sample ID collected at falling tide.
EGAD = MEDEP Environmental and Geographic Analysis Database.

N

0 625 1,250 Feet

Figure 5
Gross Point Side Scan Sonar

2016 Mobile Sediment Characterization Report
Penobscot River Phase III Engineering Study

amec foster wheeler

Project: 3616166052 | Prepared/Date: 8/23/2017 | Checked/Date: 8/23/2017 | NAD83 State Plane Maine East, US Survey Feet

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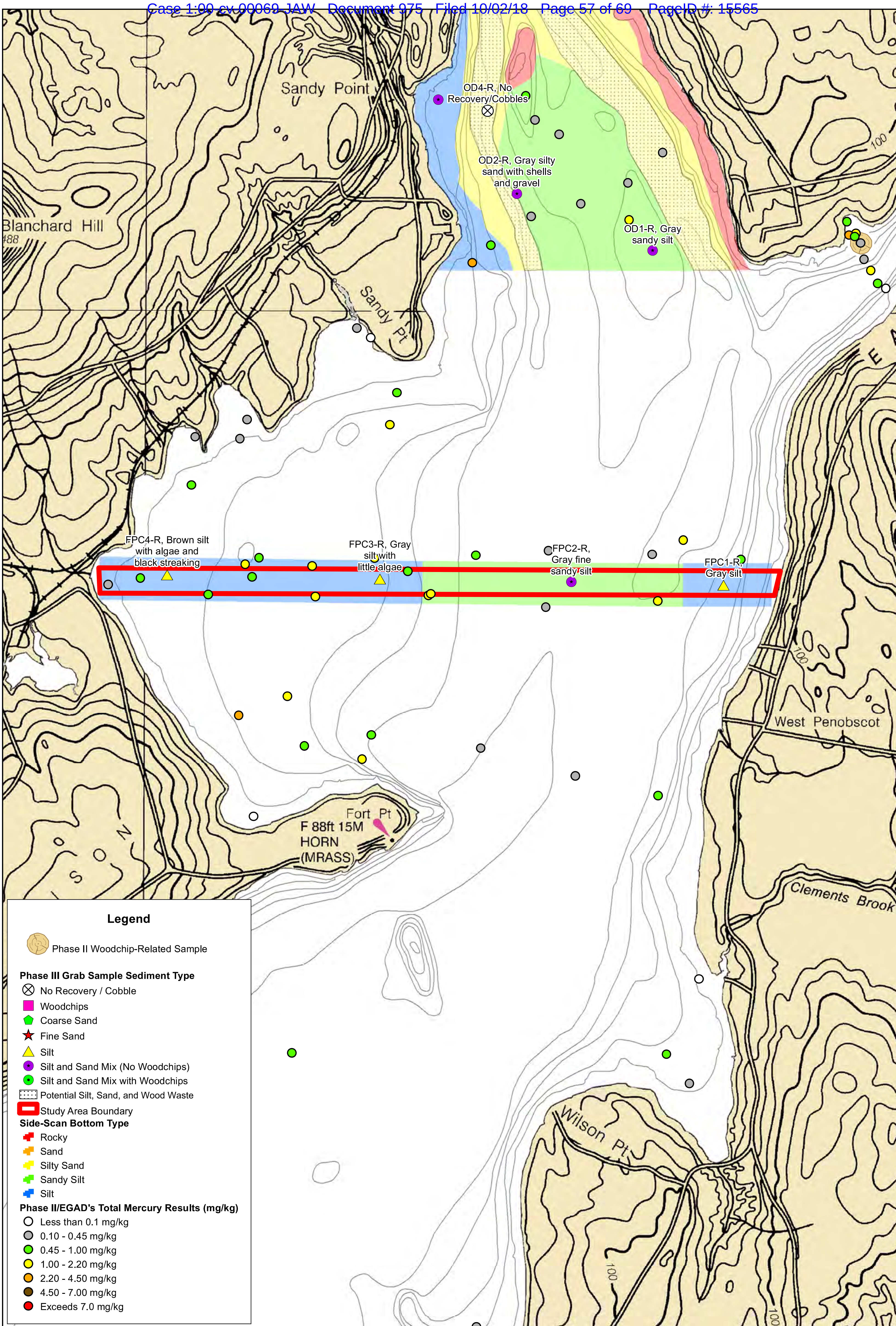

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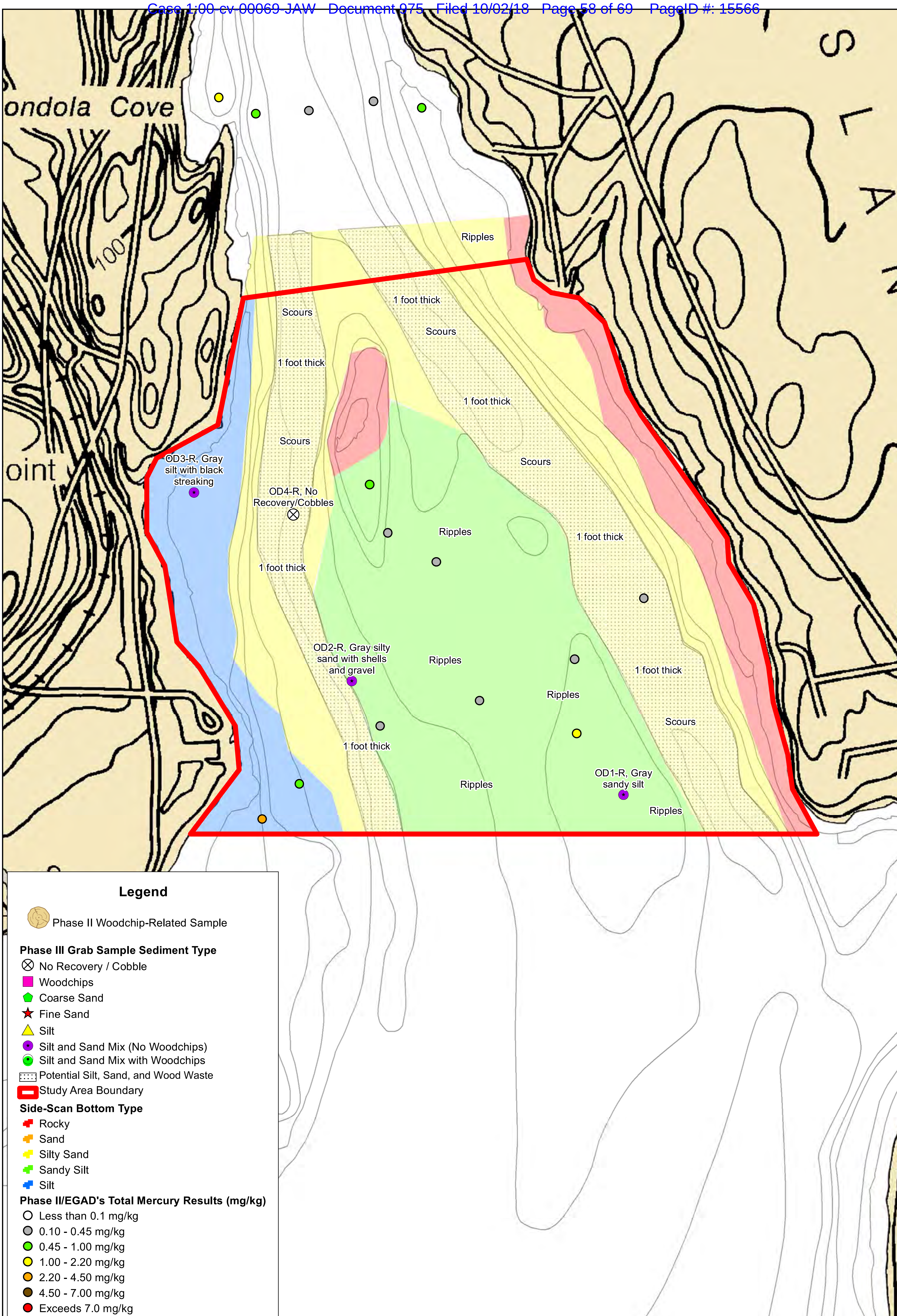
amec foster wheeler

Notes:
FPC1-R = Fort Point Cove sample ID collected at rising tide.
EGAD = MEDEP Environmental and Geographic Analysis Database.

Figure 6
Fort Point Cove Side Scan Sonar

2016 Mobile Sediment Characterization Report
Penobscot River Phase III Engineering Study

Project: 3616166052	Prepared/Date: 8/23/2017	Checked/Date: 8/23/2017	NAD83 State Plane Maine East, US Survey Feet



Notes:
During rising tide, scour marks oriented pointing upriver.
OD1-R = Odom Ledge sample ID collected at rising tide.
EGAD = MEDEP Environmental and Geographic Analysis Database.

Figure 7
Odom Ledge Side Scan Sonar

2016 Mobile Sediment Characterization Report
Penobscot River Phase III Engineering Study

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Project: 3616166052	Prepared/Date: 8/23/2017	Checked/Date: 8/23/2017	NAD83 State Plane Maine East, US Survey Feet

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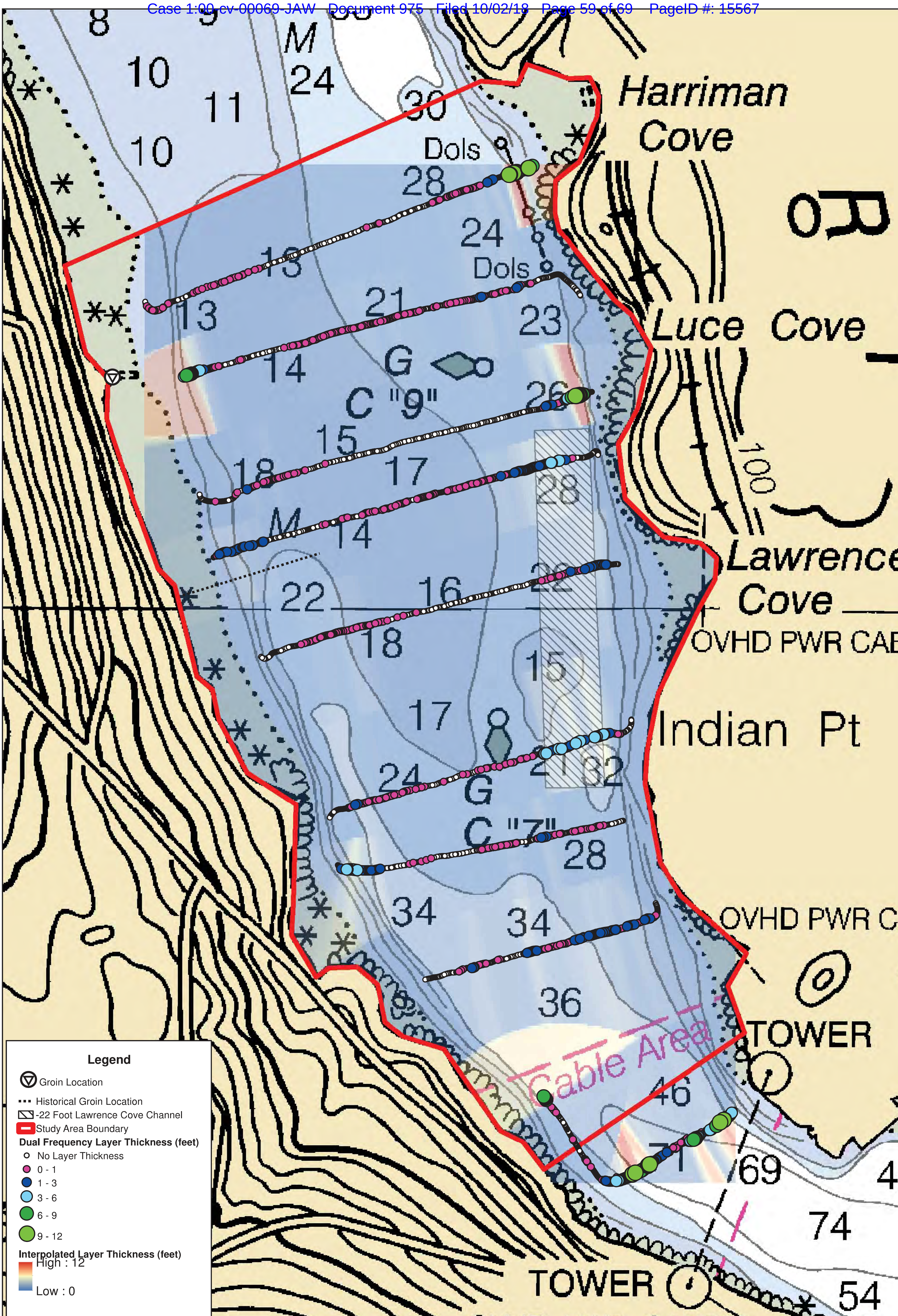

Figure 8
Bucksport-Dual Frequency

N
0 650 1,300 Feet

2016 Mobile Sediment Characterization Report
Penobscot River Phase III Engineering Study

Project: 3616166052	Prepared/Date: 6/30/2017	Checked/Date: 6/30/2017	NAD83 State Plane Maine East, US Survey Feet

Document: P:\Comm-Ind\Projects\Clients M to S\Penobscot\(GIS)\Work Order 3\David_Working\Dual Frequency\Figure 1 - Bucksport_Dual Frequency.mxd 6/30/2017 10:47:09 AM david.young2

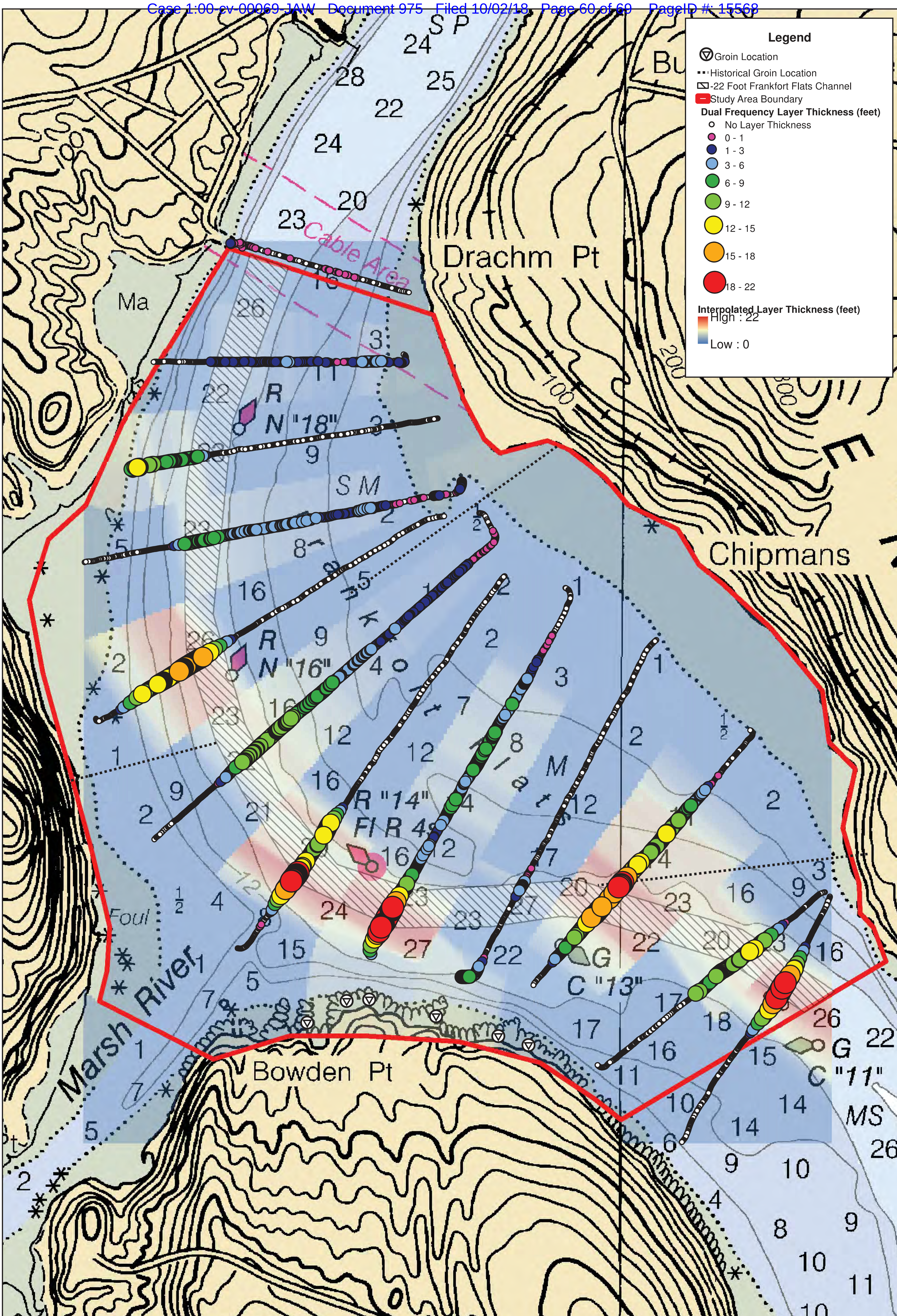

Figure 9
Frankfort Flats-Dual Frequency

amec foster wheeler

N

0 1,000 2,000 Feet

2016 Mobile Sediment Characterization Report
Penobscot River Phase III Engineering Study

Project: 3616166052	Prepared/Date: 6/30/2017	Checked/Date: 6/30/2017	NAD83 State Plane Maine East, US Survey Feet

Document: P:\Comm-Ind\Projects\Clients M to S\Penobscot\(GIS)\Work Order 3\David_Working\Dual Frequency\Figure 2 - Frankfort Flats_Dual Frequency.mxd 6/30/2017 10:48:49 AM david.young2

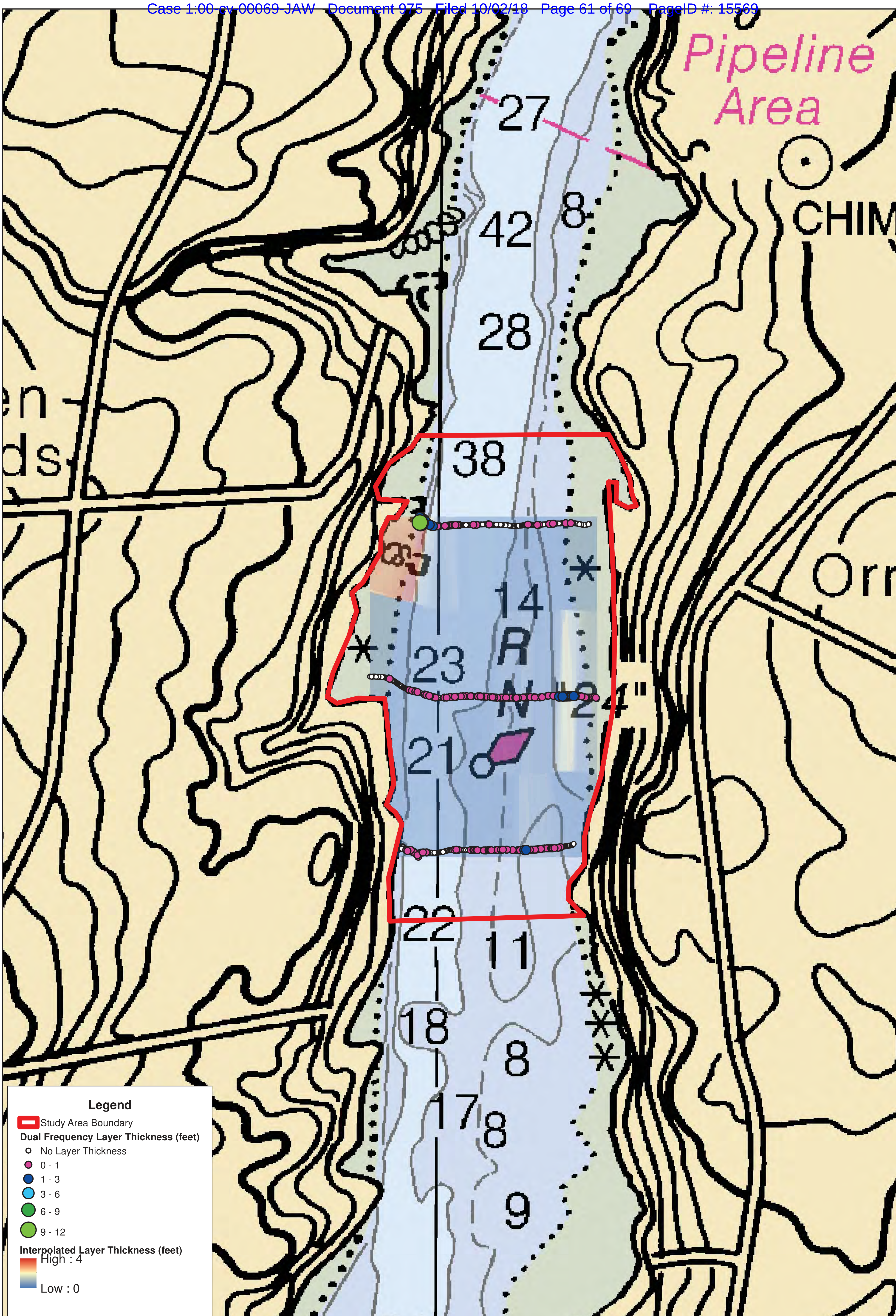

Figure 10
Hampden-Dual Frequency

N
0 500 1,000 Feet

2016 Mobile Sediment Characterization Report
Penobscot River Phase III Engineering Study

Project: 3616166052	Prepared/Date: 6/30/2017	Checked/Date: 6/30/2017	NAD83 State Plane Maine East, US Survey Feet

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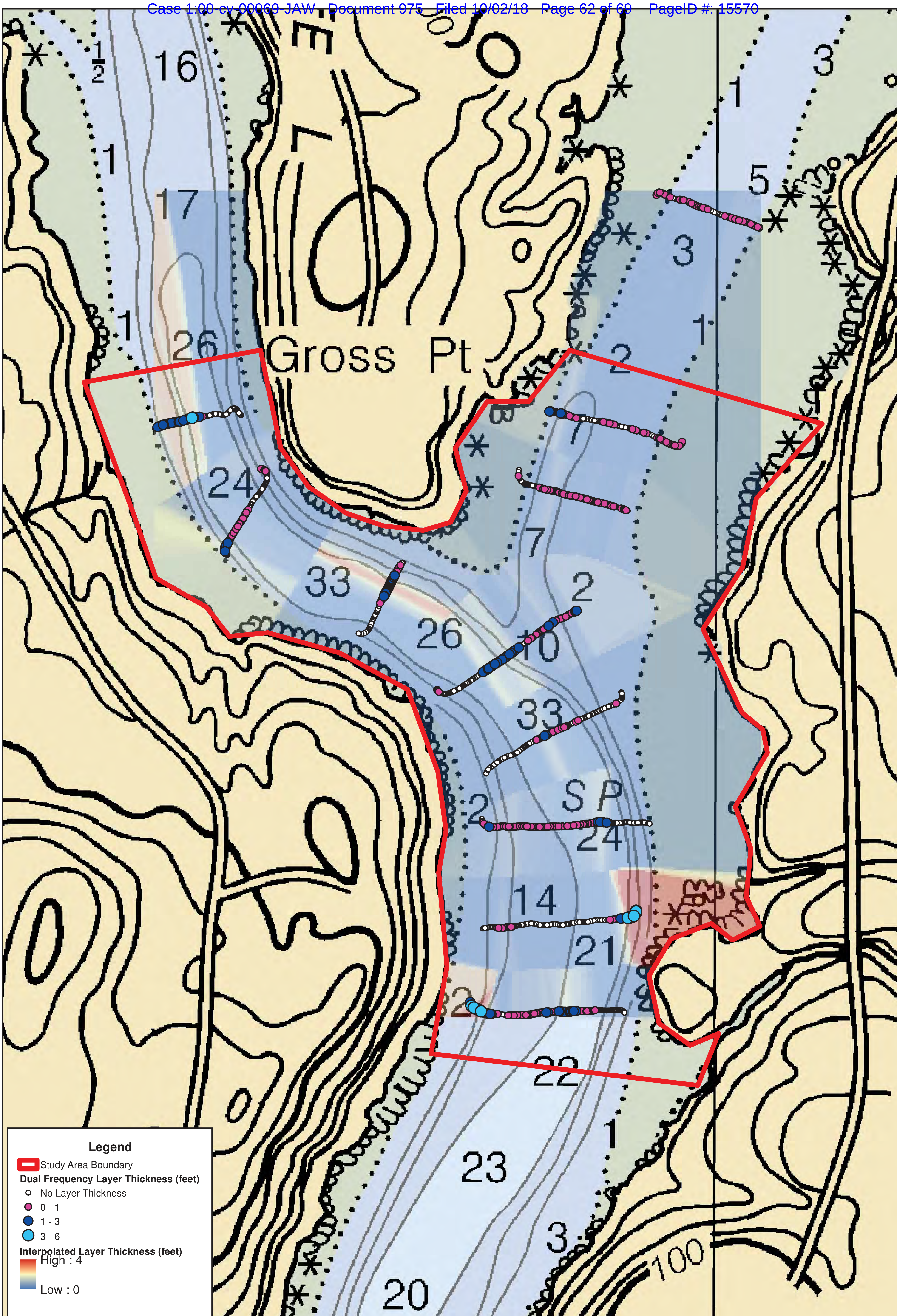

Figure 11
Gross Point-Dual Frequency

amec foster wheeler

N

0 625 1,250 Feet

2016 Mobile Sediment Characterization Report
Penobscot River Phase III Engineering Study

Project: 3616166052	Prepared/Date: 6/30/2017	Checked/Date: 6/30/2017	NAD83 State Plane Maine East, US Survey Feet

Document: P:\Comm-Ind\Projects\Clients M to S\Penobscot\(GIS)\Work Order 3\David_Working\Dual Frequency\Figure 4 - Gross Point_Dual Frequency.mxd 6/30/2017 10:51:54 AM david.young2

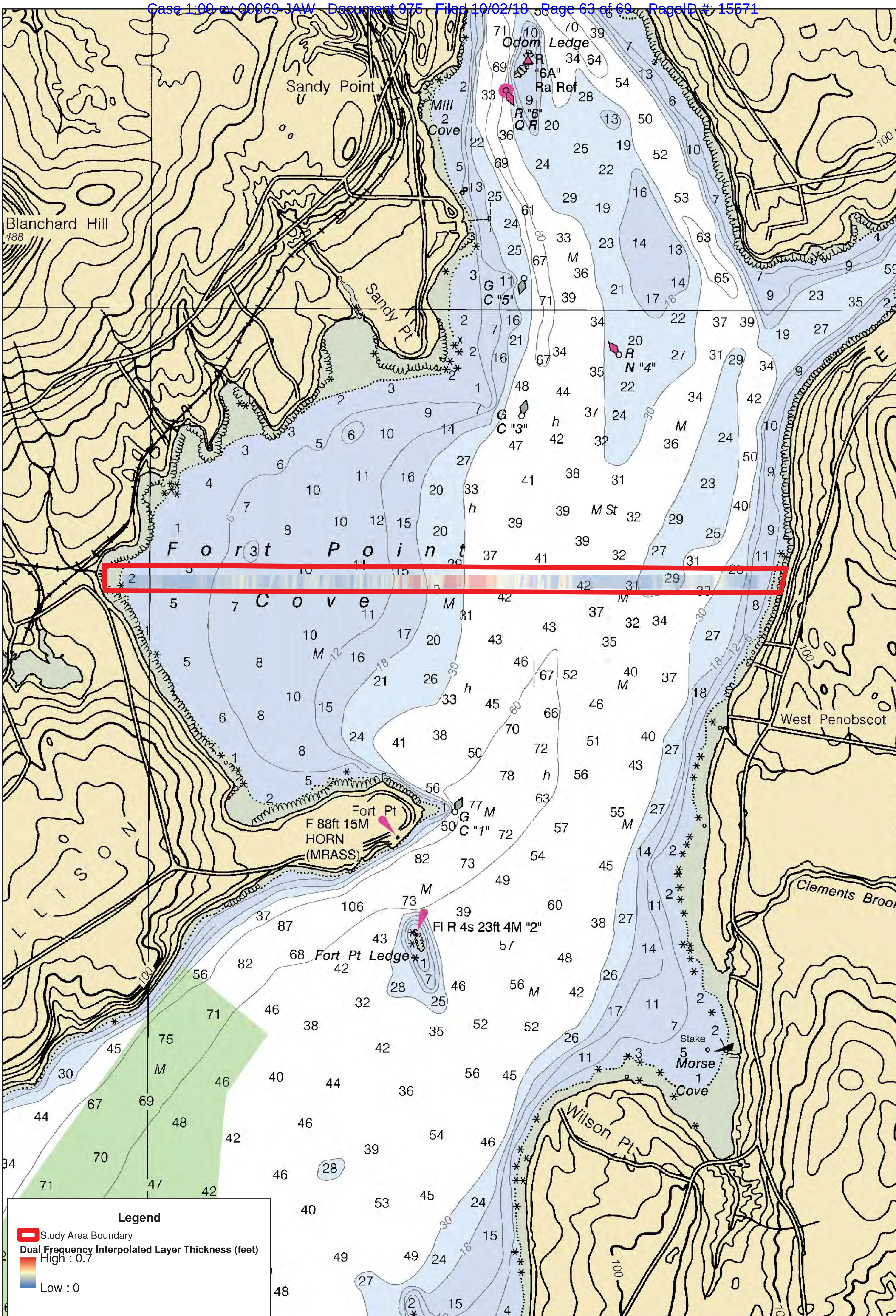

Figure 12
Fort Point Cove-Dual Frequency

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N

0 2,000 4,000 Feet

2016 Mobile Sediment Characterization Report
Penobscot River Phase III Engineering Study

Project: 3616166052 | Prepared/Date: 6/30/2017 | Checked/Date: 6/30/2017 | NAD83 State Plane Maine East, US Survey Feet

Document: P:\Comm-Ind\Projects\Clients M to S\Penobscot\(GIS)\Work Order 3\David_Working\Dual Frequency\Figure 5 - Fort Point Cove_Dual Frequency.mxd 6/30/2017 10:53:59 AM david.young2

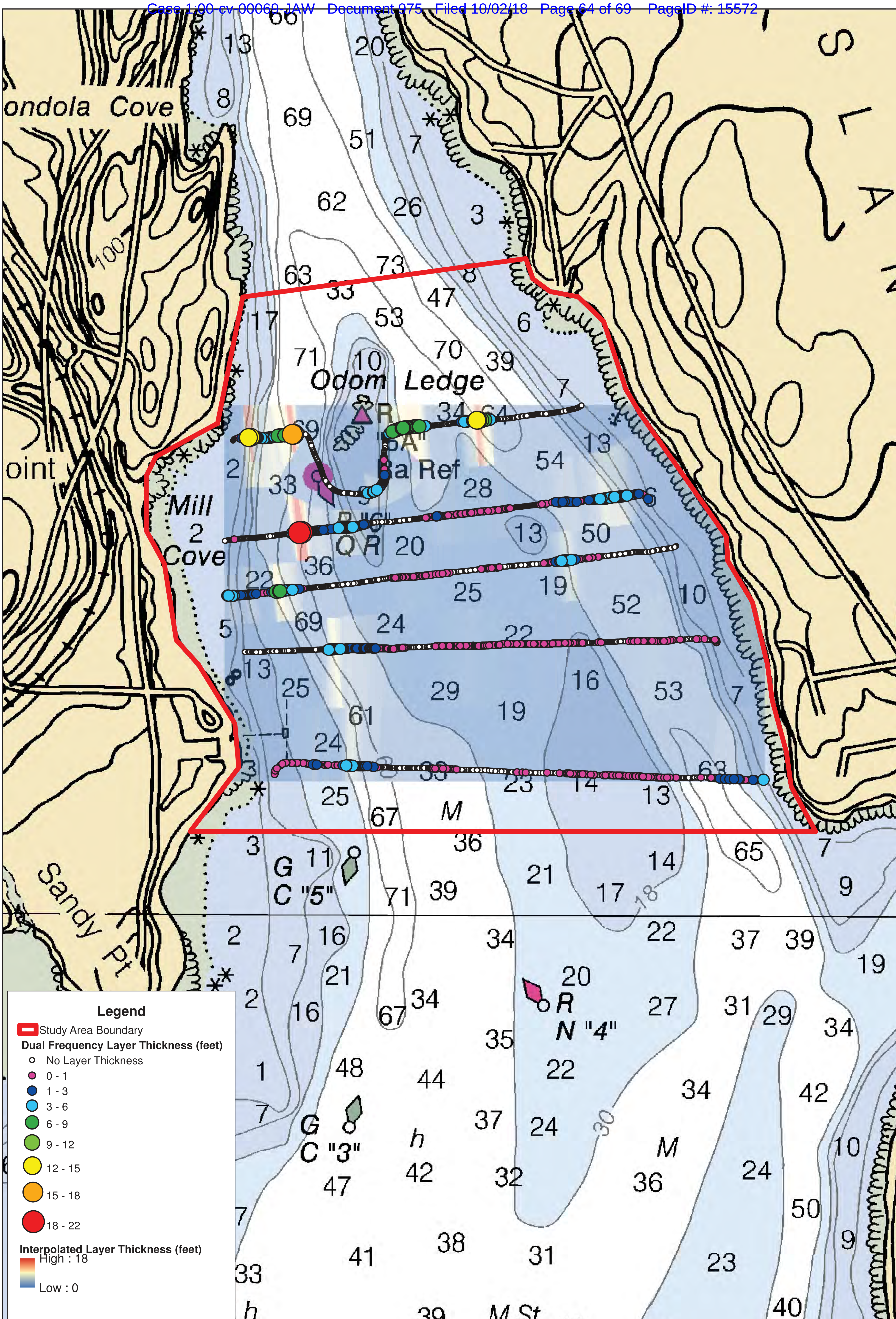

Figure 13
Odom Ledge-Dual Frequency

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2016 Mobile Sediment Characterization Report
Penobscot River Phase III Engineering Study

Project: 3616166052 | Prepared/Date: 6/30/2017 | Checked/Date: 6/30/2017 | NAD83 State Plane Maine East, US Survey Feet

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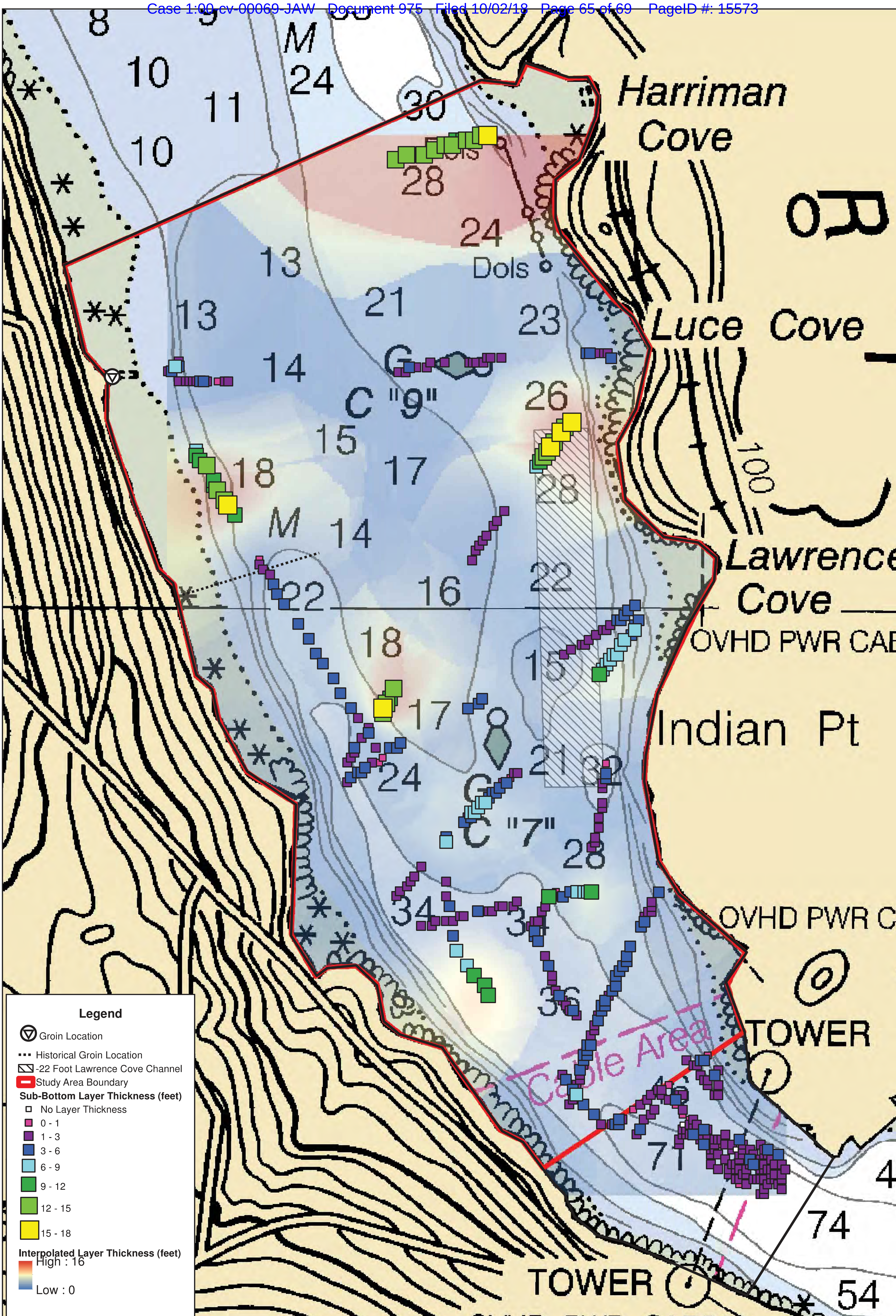

Figure 14
Bucksport-Sub-Bottom Profiling

2016 Mobile Sediment Characterization Report
Penobscot River Phase III Engineering Study

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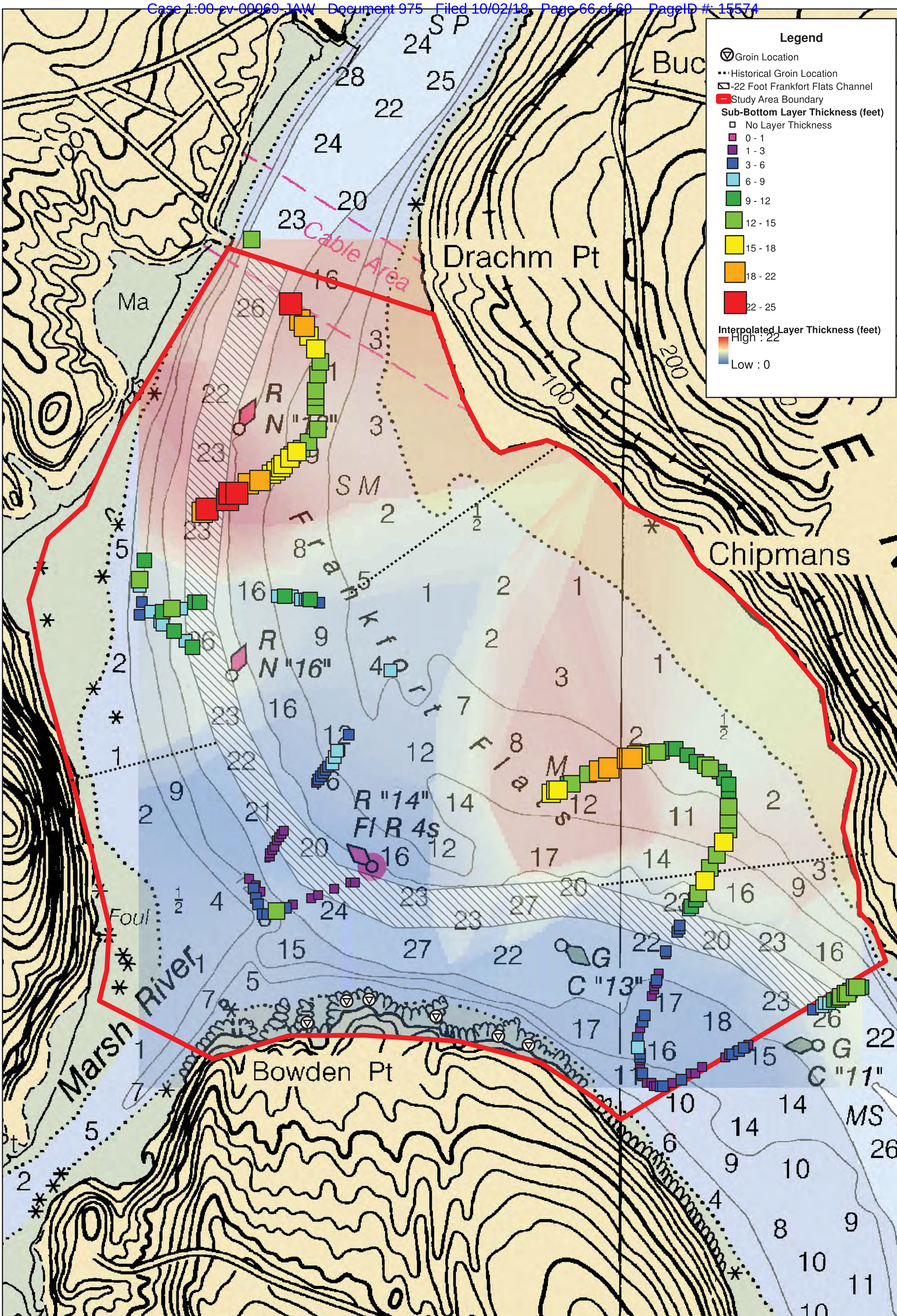
Project: 3616166052	Prepared/Date: 6/30/2017	Checked/Date: 6/30/2017	NAD83 State Plane Maine East, US Survey Feet

Document:P:\Comm-Ind\Projects\Clients M to S\Penobscot\(GIS)\Work Order 3\David_Working\Sub-Bottom\Figure 1 - Bucksport_Sub Bottom.mxd 6/30/2017 10:28:12 AM david.young2



amec foster wheeler			Figure 15 Frankfort Flats-Sub-Bottom Profiling 2016 Mobile Sediment Characterization Report Penobscot River Phase III Engineering Study
Project: 3616166052	Prepared/Date: 6/30/2017	Checked/Date: 6/30/2017	NAD83 State Plane Maine East, US Survey Feet

N

0 1,000 2,000 Feet

Document: P:\Comm-Ind\Projects\Clients M to S\Penobscot\(GIS)\Work Order 3\David_Working\Sub-Bottom\Figure 2 - Frankfort Flats_Sub Bottom.mxd 6/30/2017 10:29:54 AM david.young2

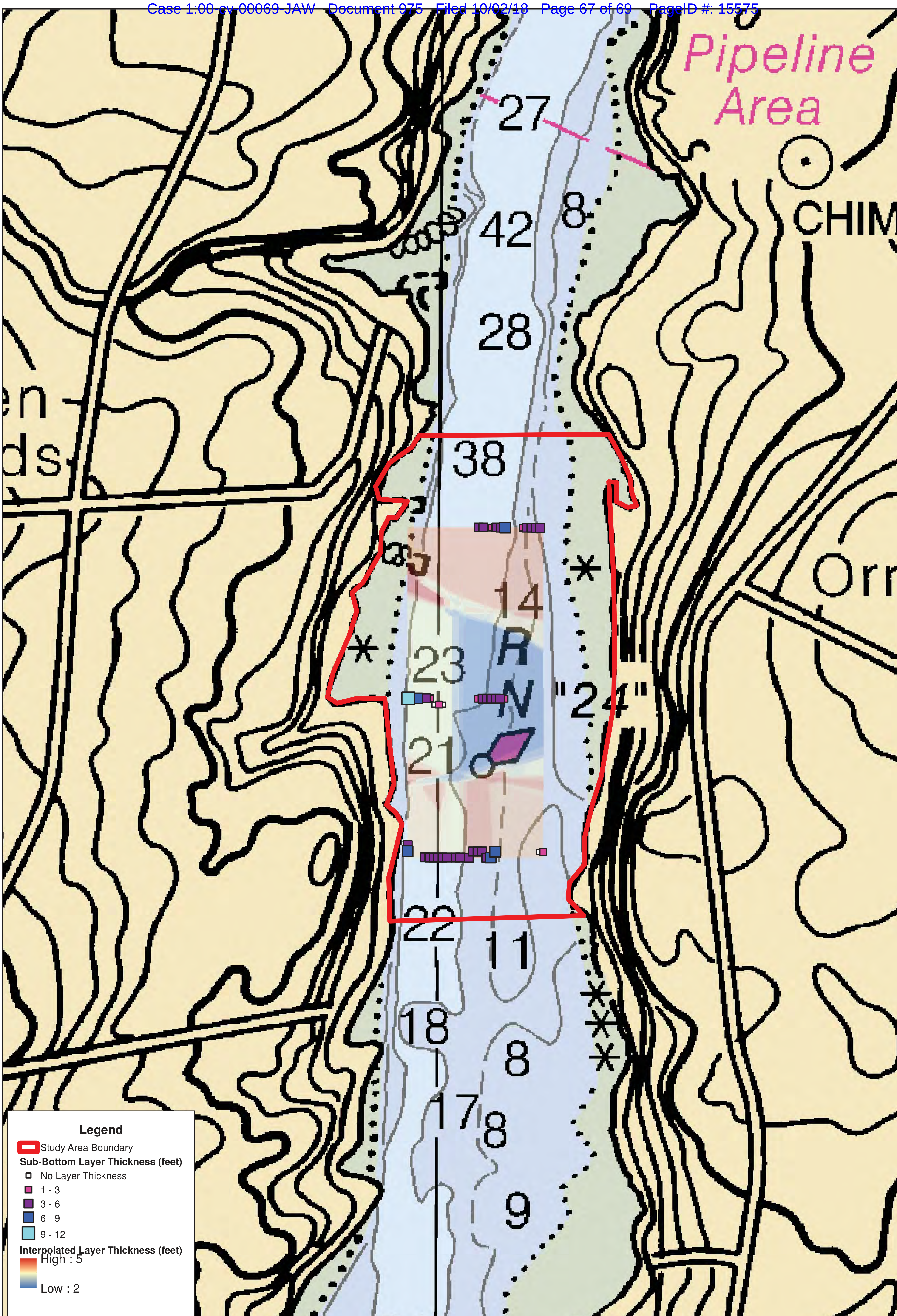


Figure 16
Hampden-Sub-Bottom Profiling

amec foster wheeler

N

0 500 1,000 Feet

2016 Mobile Sediment Characterization Report
Penobscot River Phase III Engineering Study

Project: 3616166052	Prepared/Date: 6/30/2017	Checked/Date: 6/30/2017	NAD83 State Plane Maine East, US Survey Feet

Document: P:\Comm-Ind\Projects\Clients M to S\Penobscot\(GIS)\Work Order 3\David_Working\Sub-Bottom\Figure 3 - Hampden_Sub Bottom.mxd 6/30/2017 10:31:40 AM david.young2

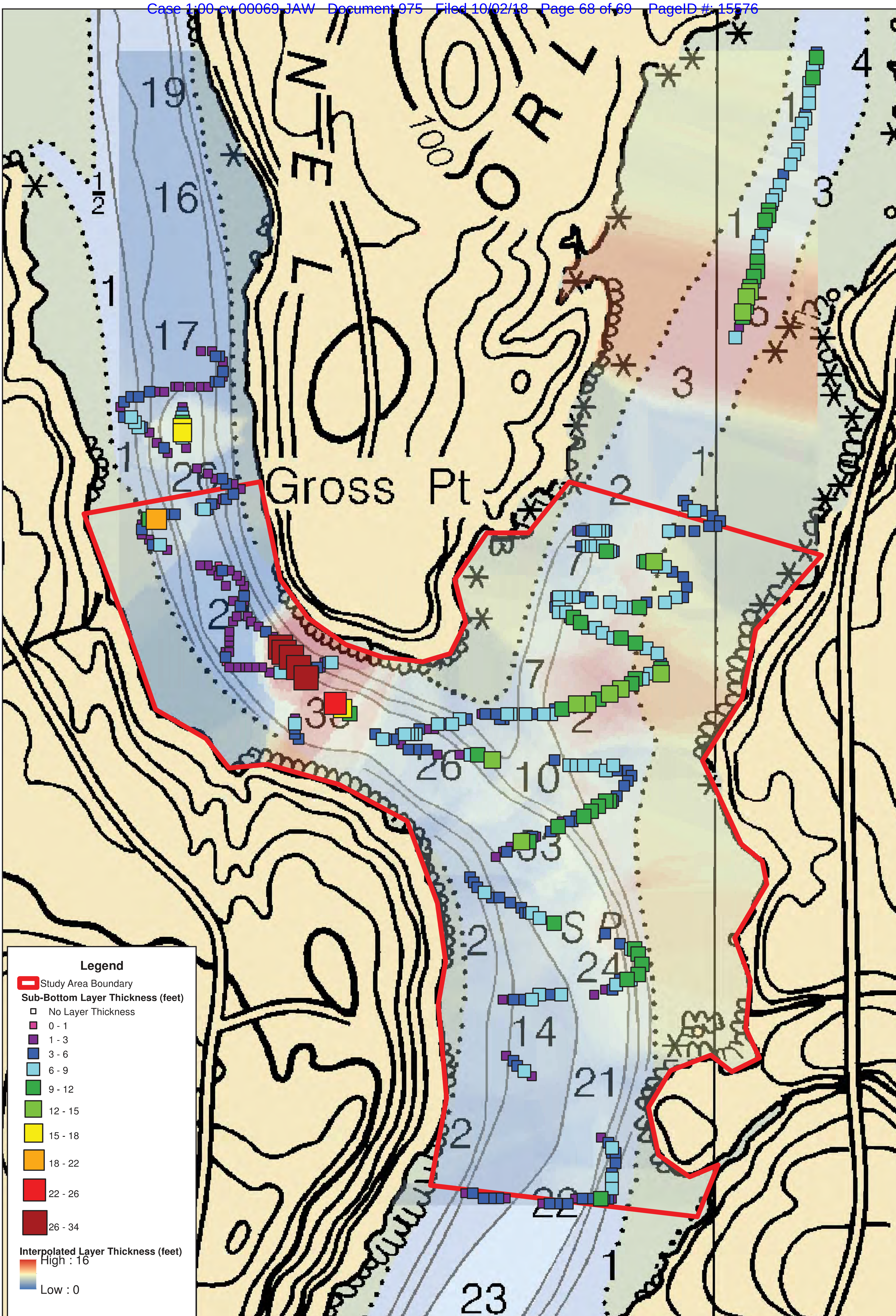


Figure 17
Gross Point-Sub-Bottom Profiling

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N
0 625 1,250 Feet

2016 Mobile Sediment Characterization Report
Penobscot River Phase III Engineering Study

Project: 3616166052	Prepared/Date: 6/30/2017	Checked/Date: 6/30/2017	NAD83 State Plane Maine East, US Survey Feet

Document: P:\Comm-Ind\Projects\Clients M to S\Penobscot\(GIS)\Work Order 3\David_Working\Sub-Bottom\Figure 4 - Gross Point_Sub Bottom.mxd 6/30/2017 10:33:35 AM david.young2

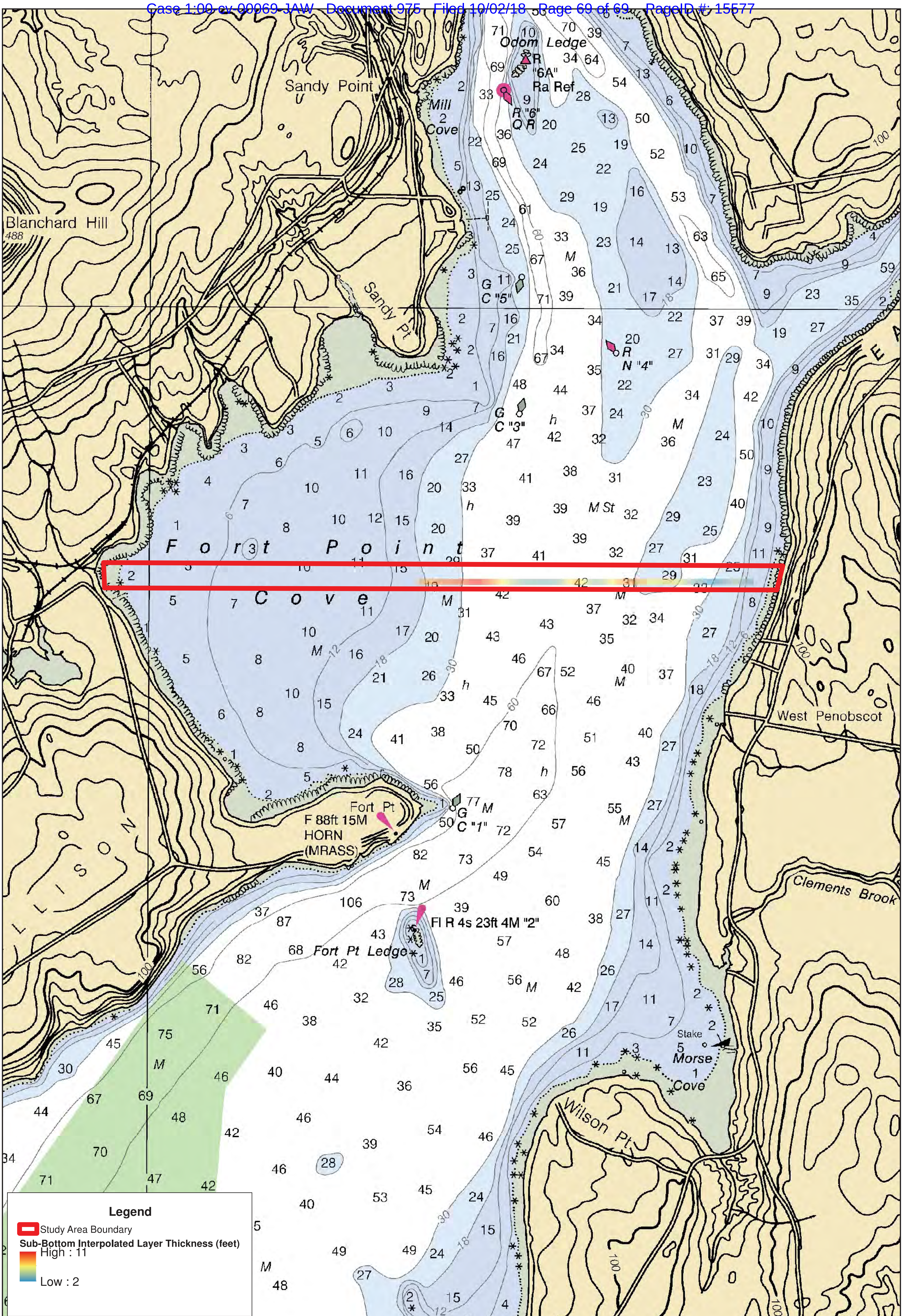

Figure 18
Fort Point Cove-Sub-Bottom Profiling

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2016 Mobile Sediment Characterization Report
Penobscot River Phase III Engineering Study

Project: 3616166052 | Prepared/Date: 6/30/2017 | Checked/Date: 6/30/2017 | NAD83 State Plane Maine East, US Survey Feet

Document: P:\Comm-Ind\Projects\Clients M to S\Penobscot\(GIS)\Work Order 3\David_Working\Sub-Bottom\Figure 5 - Fort Point Cove_Sub Bottom.mxd 6/30/2017 10:10:47 AM david.young2

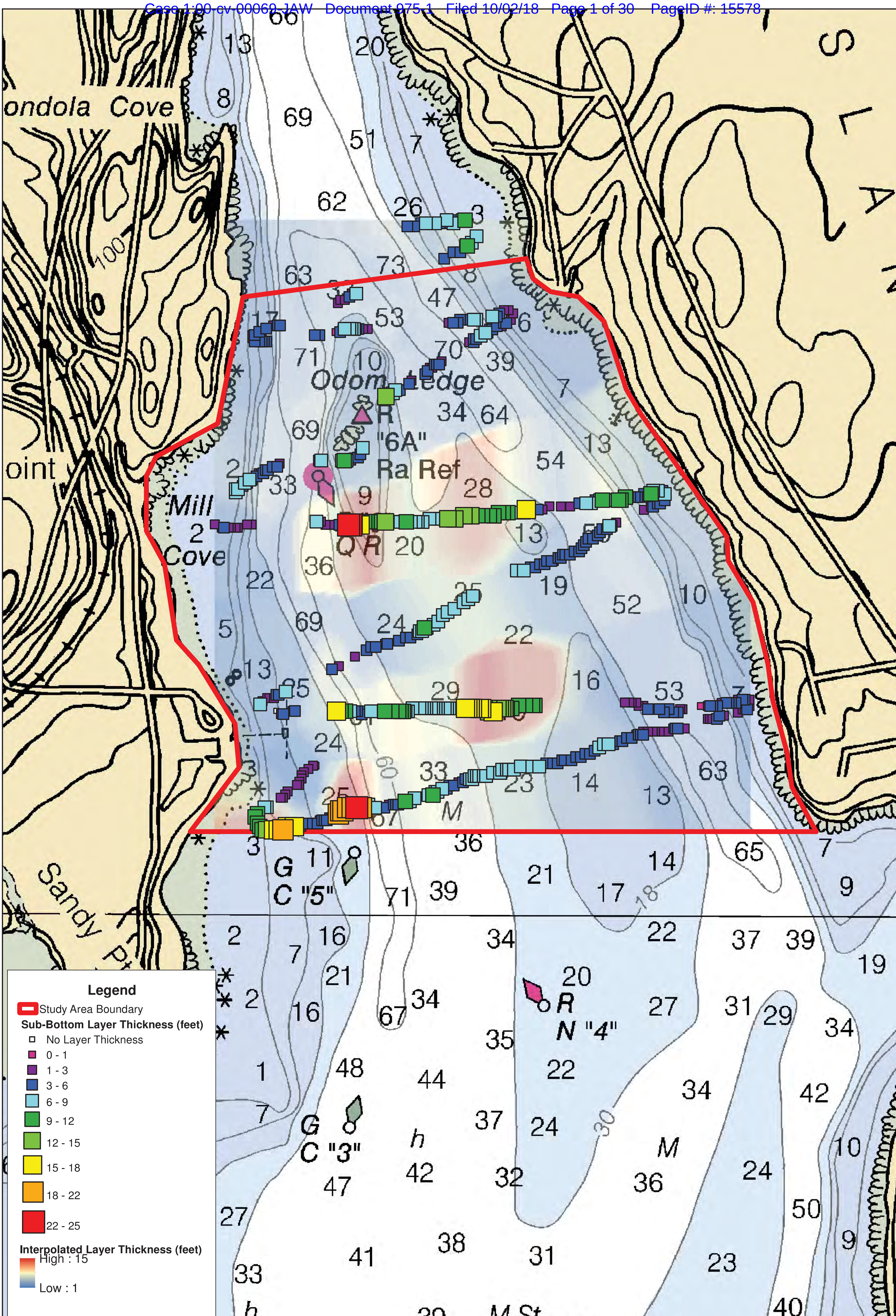

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Figure 19
Odom Ledge-Sub-Bottom Profiling

2016 Mobile Sediment Characterization Report
Penobscot River Phase III Engineering Study

Project: 3616166052	Prepared/Date: 6/30/2017	Checked/Date: 6/30/2017	NAD83 State Plane Maine East, US Survey Feet

Document: P:\Comm-Ind\Projects\Clients M to S\Penobscot\(GIS)\Work Order 3\David_Working\Sub-Bottom\Figure 6 - Odom Ledge_Sub Bottom.mxd 6/30/2017 10:15:06 AM david.young2

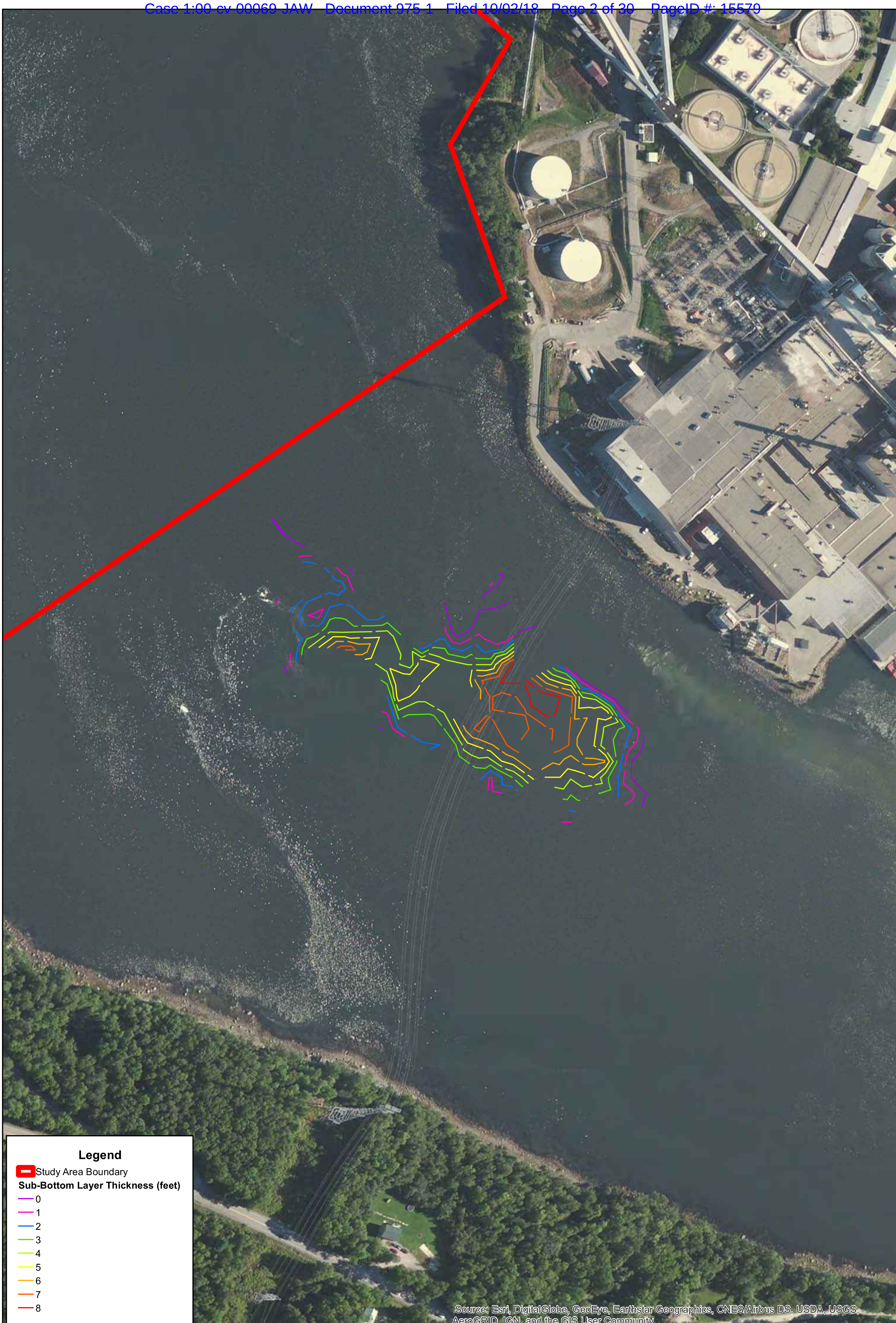

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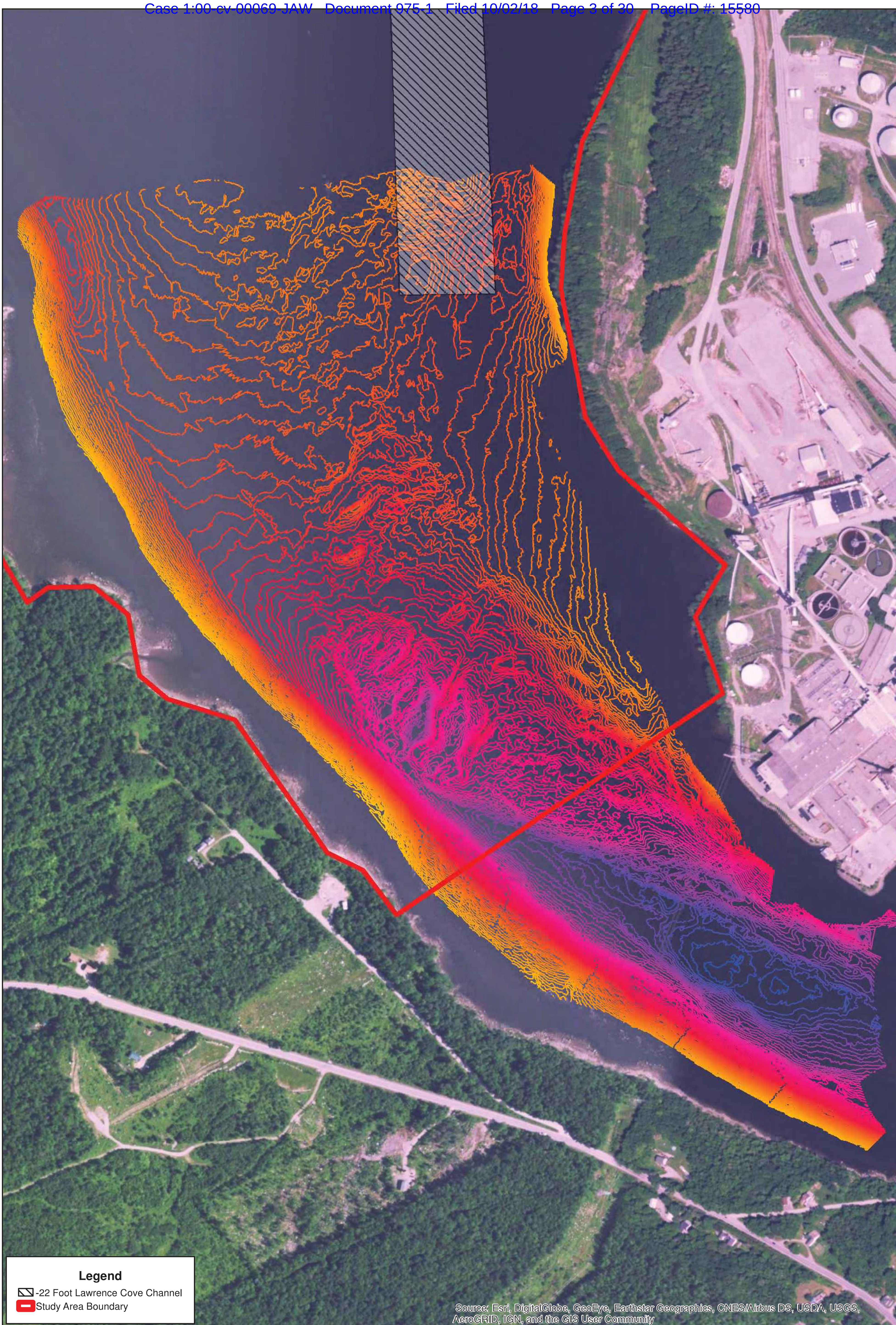
Figure 20
Bucksport Mill Pile
Sub-Bottom Profile Thickness

2016 Mobile Sediment Characterization Report
Penobscot River Phase III Engineering Study

Project: 3616166052	Prepared/Date: 10/20/2017	Checked/Date: 10/20/2017	NAD83 State Plane Maine East, US Survey Feet



Notes:
Contour interval = 1 foot
Multibeam bathymetry water depths range from 12 feet to 86 feet.
The yellow to blue color gradient represents the transition from shallow to deeper water depths, respectively.

N

0 400 800 Feet

Figure 21
Buckport-Multibeam Bathymetry

2016 Mobile Sediment Characterization Report
Penobscot River Phase III Engineering Study

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Project: 3616166052	Prepared/Date: 7/6/2017	Checked/Date: 7/6/2017	NAD83 State Plane Maine East, US Survey Feet

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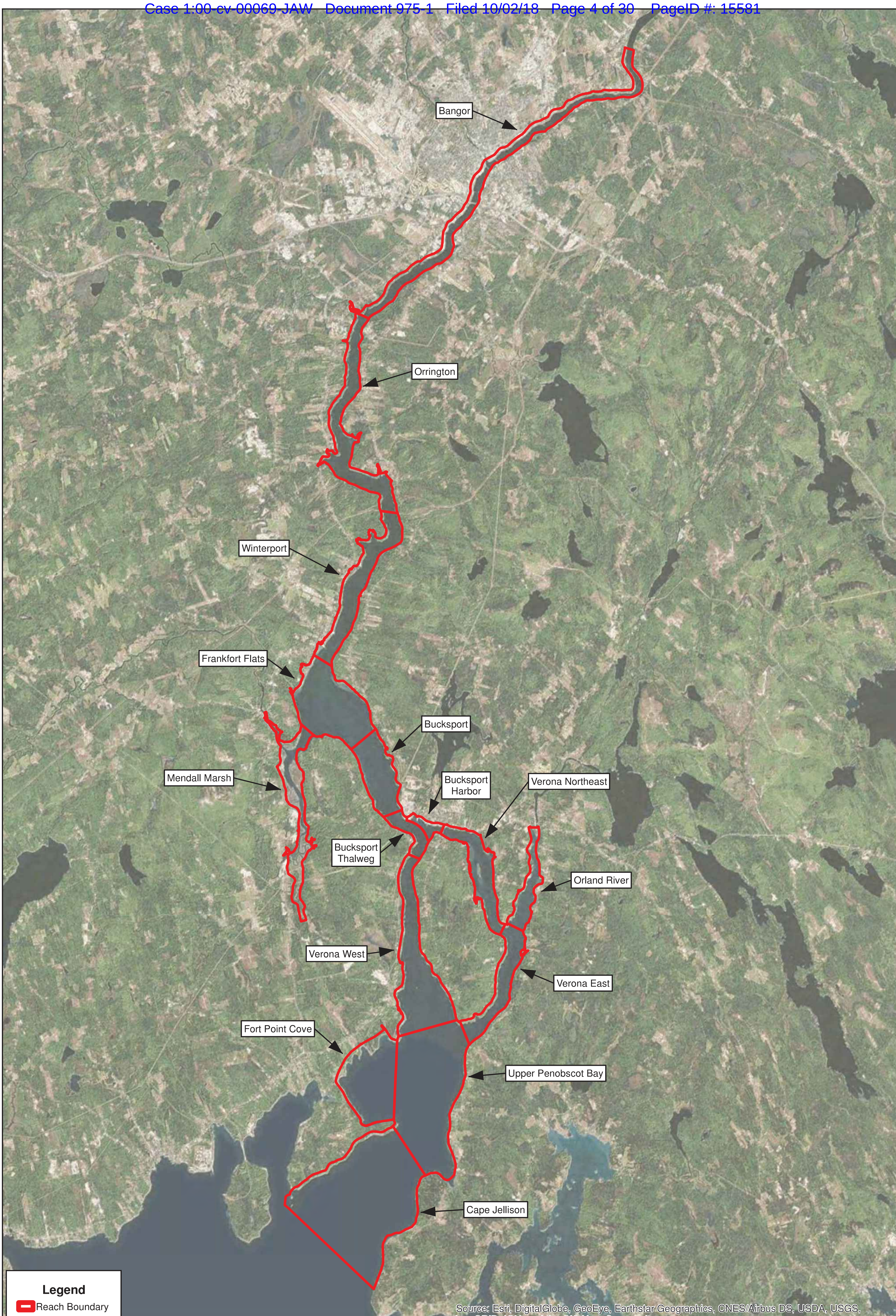

Figure 22
Phase III Reach Designation

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2016 Mobile Sediment Characterization Report
Penobscot River Phase III Engineering Study

Project: 3616166052	Prepared/Date: 6/30/2017	Checked/Date: 6/30/2017	NAD83 State Plane Maine East, US Survey Feet

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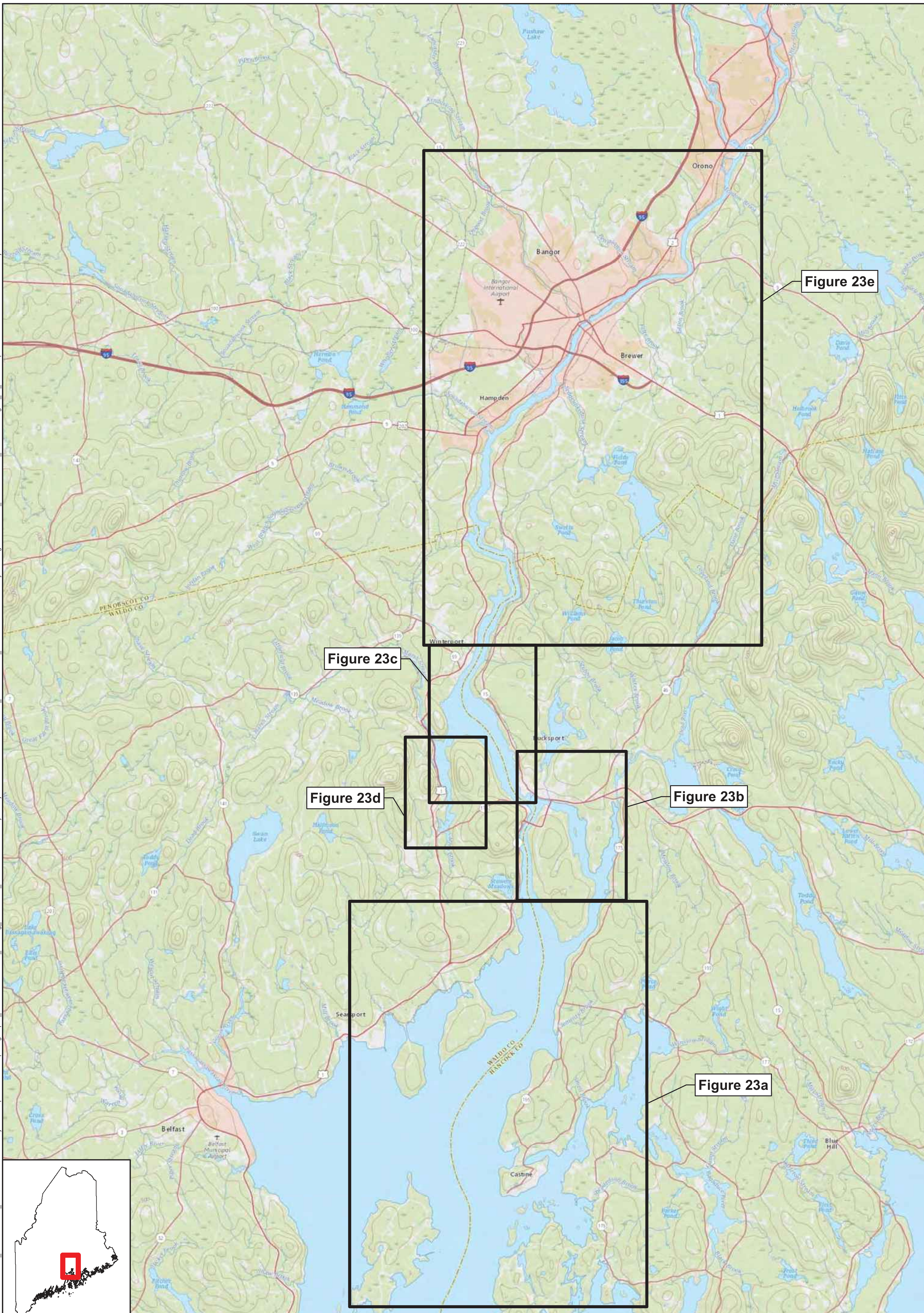

Figure 23
2016 Sediment Sampling Locations
Overview

2016 Mobile Sediment Characterization Report
Penobscot River Phase III Engineering Study

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Project: 3616166052 | Prepared/Date: ICD 07/7/17 | Checked/Date: KM 07/7/17

NAD83 State Plane Maine East, US Survey Feet

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Symbol Key

- Wood Waste Observed
- Sediment Physical/Visible Properties Evaluated

MM-71|20-Oct-16/0'-0.5' : Analytical Sample Location|Sample Date/Sample Depth Interval

MM-Core01C : Physical/Visible Sample Location

0 2,500 5,000 10,000 Feet

NAD83 State Plane Maine East, US Survey Feet

amec foster wheeler

Figure 23a
2016 Sediment Sampling Results
Penobscot Bay

2016 Mobile Sediment Characterization Report
Penobscot River Phase III Engineering Study

Project: 3616166052	Prepared/Date: ICD 07/7/17	Checked/Date: KM 07/7/17

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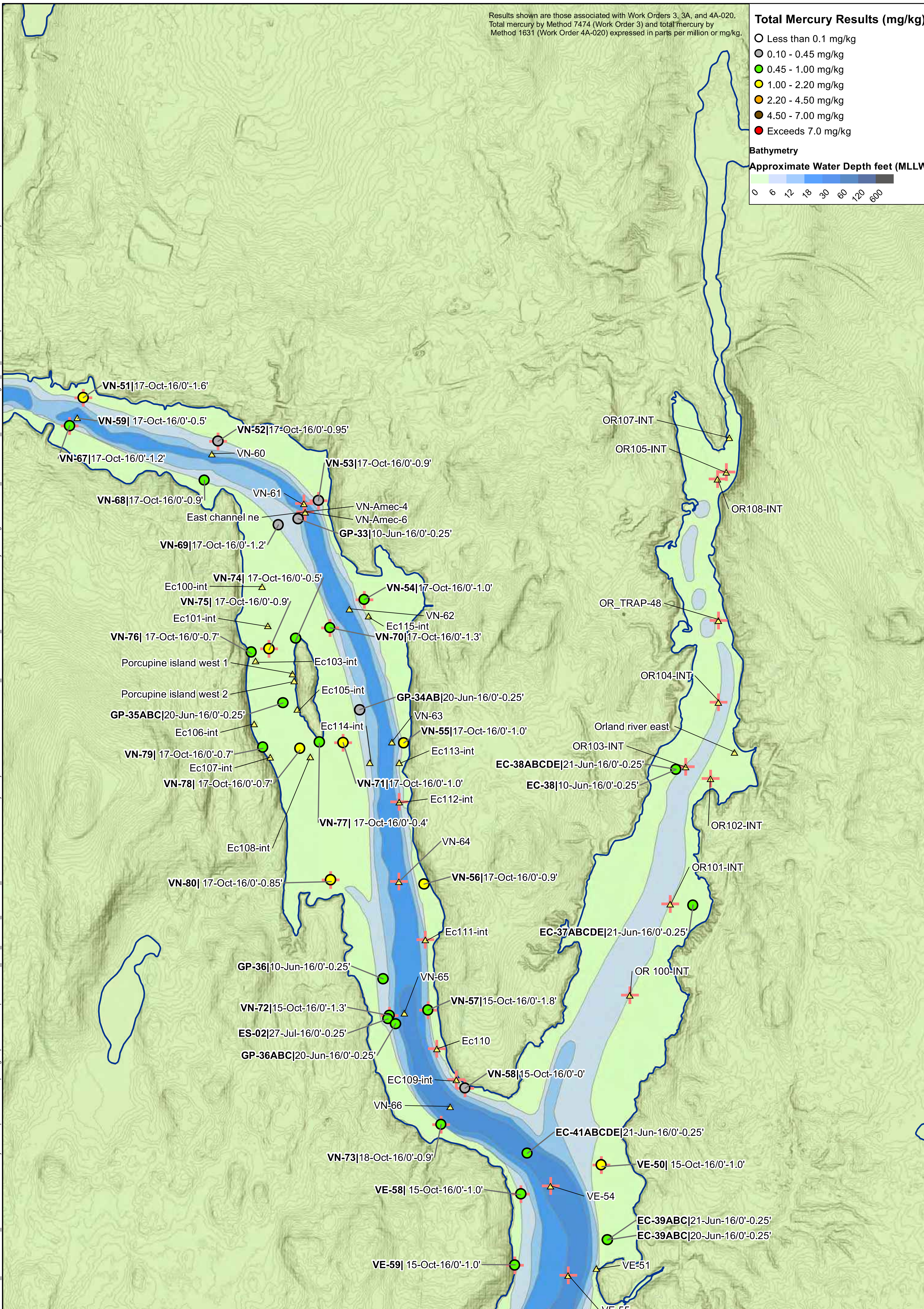


Symbol Key

- Wood Waste Observed
- Sediment Physical/Visible Properties Evaluated

MM-71|20-Oct-16/0'-0.5' : Analytical Sample Location|Sample Date/Sample Depth Interval

MM-Core01C : Physical/Visible Sample Location

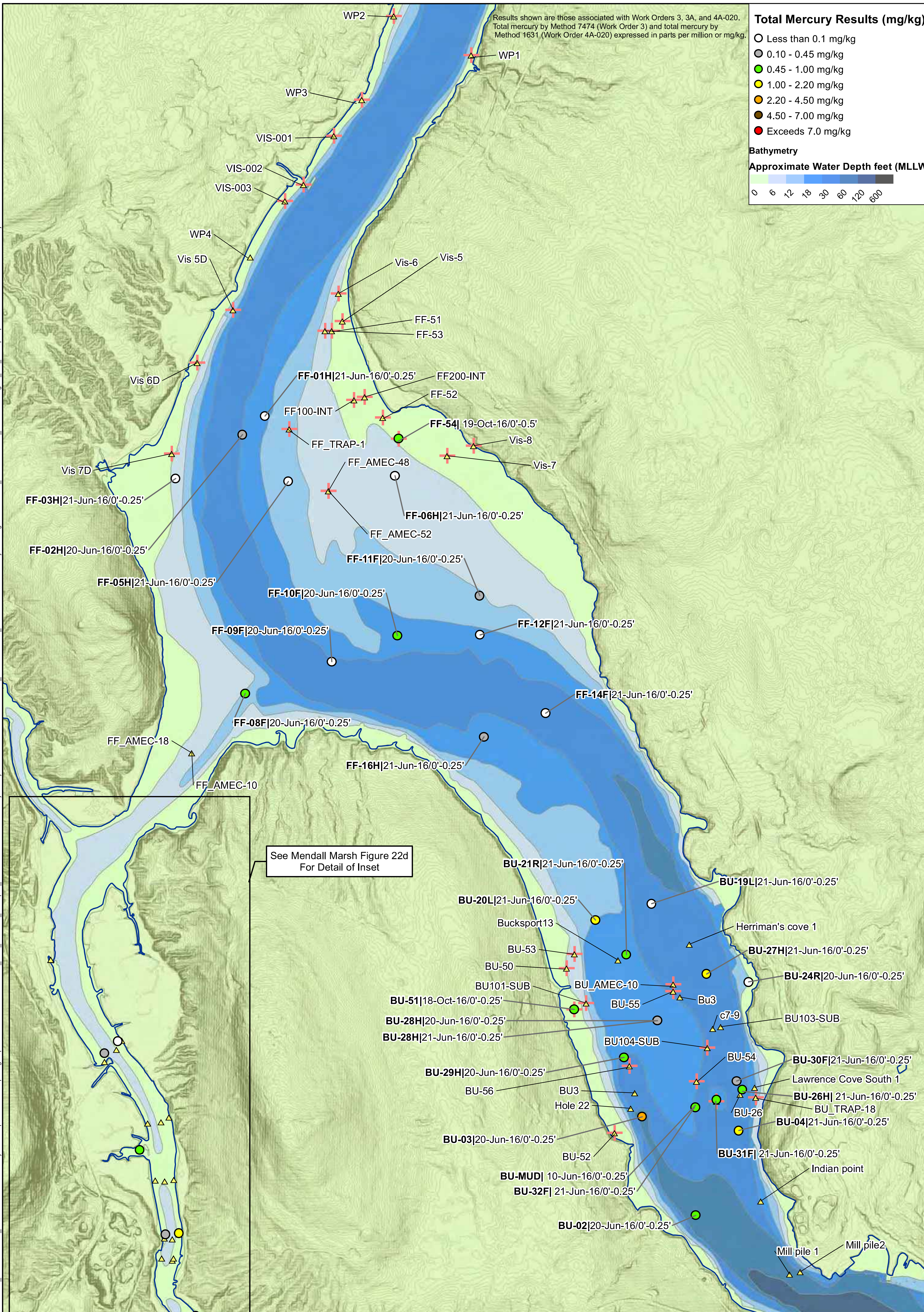
N 0 450 900 1,800 2,700 3,600 Feet

amec foster wheeler

Figure 23b
2016 Sediment Sampling Results
Eastern Channel

2016 Mobile Sediment Characterization Report
Penobscot River Phase III Engineering Study

Project: 3616166052	Prepared/Date: ICD 07/12/17	Checked/Date: KM 07/07/17	NAD83 State Plane Maine East, US Survey Feet



Symbol Key

- Wood Waste Observed
- Sediment Physical/Visible Properties Evaluated

MM-71|20-Oct-16/0'-0.5' : Analytical Sample Location|Sample Date/Sample Depth Interval

MM-Core01C : Physical/Visible Sample Location

0 450 900 1,800 2,700 3,600 Feet

Figure 23c
2016 Sediment Sampling Results
Bucksport

2016 Mobile Sediment Characterization Report
Penobscot River Phase III Engineering Study

Project: 3616166052	Prepared/Date: ICD 07/12/17	Checked/Date: KM 07/12/17	NAD83 State Plane Maine East, US Survey Feet

amec foster wheeler

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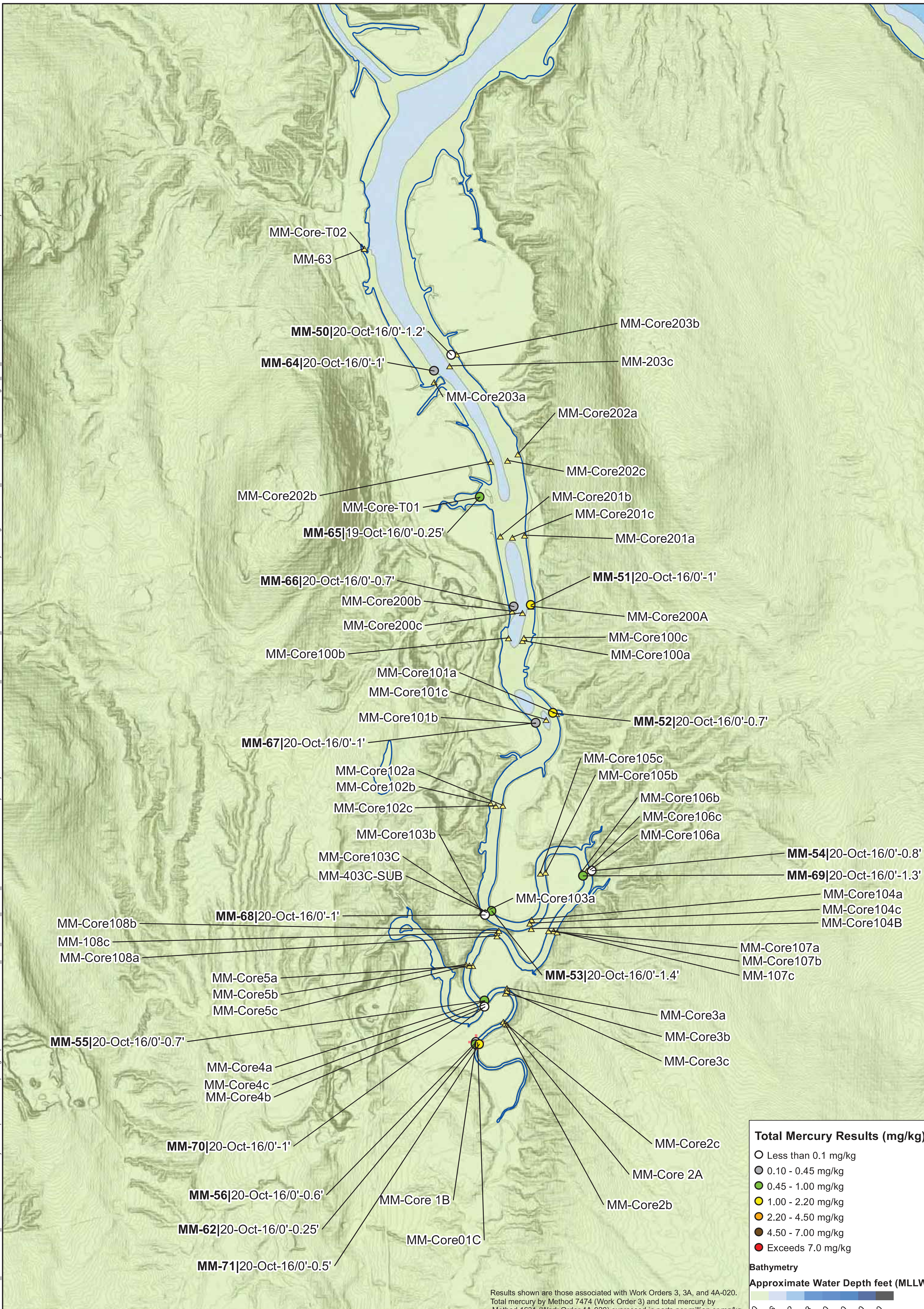

amec foster wheeler

Symbol Key

- Wood Waste Observed
- Sediment Physical/Visible Properties Evaluated

MM-71|20-Oct-16/0'-0.5' : Analytical Sample Location|Sample Date/Sample Depth Interval

MM-Core01C : Physical/Visible Sample Location

N 0 1,380 2,760 Feet

Figure 23d
2016 Sediment Sampling Results
Mendall Marsh

2016 Mobile Sediment Characterization Report
Penobscot River Phase III Engineering Study

Project: 3616166052	Prepared/Date: ICD 07/07/17	Checked/Date: KM 07/07/17	NAD83 State Plane Maine East, US Survey Feet

amec foster wheeler

Symbol Key

- Wood Waste Observed
- Sediment Physical/Visible Properties Evaluated

MM-71|20-Oct-16/0'-0.5' : Analytical Sample Location|Sample Date/Sample Depth Interval

MM-Core01C : Physical/Visible Sample Location

N 0 11,600 Feet

Figure 23e
2016 Sediment Sampling Results
Bangor

2016 Mobile Sediment Characterization Report
Penobscot River Phase III Engineering Study

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TABLES

TABLE 1
SPRING 2016 SAMPLING RESULTS - CHEMICAL AND PHYSICAL ANALYSIS

Penobscot River Phase III Engineering Study
Penobscot River Estuary, Maine

amec foster wheeler

Location ID	Field Sample ID	Study Area	Sub-Area	Tidal Phase	General Description	Sample Matrix	Collection Method	Chemical Results: Total Mercury (mg/kg or mg/L) EPA Method 7474[6]	Chemical Results: Qualifier[3]	Chemical Results: Total Organic Carbon[2] (%) Lloyd Kahn Method[5]	Chemical Results: Total Solids (%) ASTM 2540G	Physical Results: Sample Type	Atterberg Limits LL/PL	Sediment Classification (USCS)	Sieve Number	Organic Content (% of Total) ASTM D2974-C	Organic Content (% of Ind. Sieve) ASTM D2974-C	% Passing (Cum) ASTM D422[4]	% Retained (Cum) ASTM D422[4]	% Retained (Ind) ASTM D422[4]	% Gravel ASTM D422[4]	% Sand ASTM D422[4]	% Fines (passing #200 sieve) ASTM D422[4]	% Silt ASTM D422[4]	% Clay ASTM D422[4]	% Fines (passing #230 sieve) ASTM D422[4]
												Bulk	NA	ML	All	16.6	NA	NA	NA	NA	0	3	97	82.9	14.1	95
															Sum	6.1	NA	NA	NA	NA						
															3/8	0	0.0	100	0.0	0.0						
															4	0	0.0	100	0.0	0.0						
															10	0	0.0	100	0.0	0.0						
															20	0.19	21.4	99.2	0.8	0.8						
															40	0.35	47.1	98.5	1.5	0.7						
															60	1.12	56.3	98.0	2.0	0.5						
															200	1.06	34.0	97.0	3.0	1.0						
															230	0.35	17.2	95.0	5.0	2.0						
															270	1.27	NA	93.7	6.3	1.3						
HA-01	HA1_060916_SED_G	Hampden	West Bank	Rising	Gray Silt	Sediment	Grab	0.438	None	8.91	28.8	Partition	NA	ML	pan	1.76	NA	NA	NA	NA				NA		
												Bulk	NA	SP	All	6.5	NA	NA	NA	NA	0.4	92.2	7.4	NA	NA	6.3
															Sum	1.97	NA	NA	NA	NA						
															3/8	0.63	37.7	99.8	0.2	0.2						
															4	0.26	51.0	99.6	0.4	0.2						
															10	0.42	17.7	99.3	0.7	0.3						
															20	0.02	1.1	96.6	3.4	2.7						
															40	0.18	0.3	57.9	42.1	38.7						
															60	0.18	0.4	15.8	84.2	42.1						
															200	0.07	0.6	7.4	92.6	8.4						
															230	0.09	5.3	6.3	93.7	1.1						
															270	0.07	14.7	5.9	94.1	0.4						
HA-03	HA3_060916_SED_G	Hampden	Center Channel	Rising	Gray Medium-Fine Sand	Sediment	Grab	0.024	None	1.40	75.3	Partition	NA	SP	pan	0.06	19.0	NA	NA	NA				NA		
FF-01H	FF1H_060616_SED_G	Frankfort Flats	North Center Channel	High	Gray Coarse Sand	Sediment	Grab	0.078	None	2.10	71.3	Bulk	NA	SP	All	16.8	NA	NA	NA	NA	17.6	78.6	3.8	NA	NA	2.9
FF-02H	FF2H_060616_SED_G	Frankfort Flats	North Center Channel	High	Gray Fine Sandy Silt	Sediment	Grab	0.177	None	0.796	67.3	Bulk	46/37	ML	All	9.8	NA	NA	NA	NA	0.2	38.1	61.7	55.4	6.3	60.4
FF-03H	FF3H_060616_SED_G	Frankfort Flats	West Bank	High	Brown Fine Sand with Gravel	Sediment	Grab	0.083	None	0.927	66.9	Bulk	NA	SM	All	1.4	NA	NA	NA	NA	72.2	18.8	9	8.6	0.4	8.4
FF-05H	FF5H_060616_SED_G	Frankfort Flats	Center Channel	High	Brown Coarse Sand	Sediment	Grab	0.079	None	0.314	80.1	Bulk	NA	SP	All	0.5	NA	NA	NA	NA	0	94.7	5.3	NA	NA	4.2
FF-05H	FF5H_060616_SED_G_DUP	Frankfort Flats	Center Channel	High	Brown Coarse Sand	Sediment	Grab	0.09	None	0.326	75.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
FF-06H	FF6H_060616_SED_G	Frankfort Flats	East Bank	High	Brown Coarse Sand with Gravel	Sediment	Grab	0.093	None	0.386	85.1	Bulk	NA	SM	All	2.1	NA	NA	NA	NA	12.1	58.7	29.2	28.3	0.9	24.8
FF-08F	FF8F_060616_SED_G	Frankfort Flats	Mendall Marsh Mouth	Falling	Brown Fine Sandy Silt with Gravel	Sediment	Grab	0.745	None	3.44	34.0	Bulk	NA	ML	All	3.8	NA	NA	NA	NA	2.1	35.9	62	59	3	56.7
FF-09F	FF9F_060616_SED_G	Frankfort Flats	South Center Channel	Falling	Brown Coarse Silty Sand with Gravel	Sediment	Grab	0.062	None	0.460	74.3	Bulk	NA	SM	All	6.4	NA	NA	NA	NA	5.1	72.9	22	NA	NA	18.2
FF-10F	FF10F_060616_SED_G	Frankfort Flats	Southeast Center Channel	Falling	Gray, Black, and Brown Silt	Sediment	Grab	0.770	None	5.65	31.6	Bulk	NA	ML	All	13.3	NA	NA	NA	NA	0	15.1	84.9	76.6	8.3	82.6
FF-11F	FF11F_060616_SED_G	Frankfort Flats	East Bank	Falling	Brown Sandy Silt with Shells	Sediment	Grab	0.339	None	1.80	53.7	Bulk	NA	ML	All	6.3	NA	NA	NA	NA	67.4	14.9	17.7	16.6	1.1	15.4
FF-12F	FF12F_060616_SED_G	Frankfort Flats	Southeast Center Channel	Falling	Gray Coarse Sand and Gravel	Sediment	Grab	0.074	None	1.22	65.7	Bulk	NA	SM	All	3	NA	NA	NA	NA	71.4	20.4	8.2	NA	NA	7
												Bulk	40/33	SM	All	7.4	NA	NA	NA	NA	0.8	59.1	40.1	34.6	5.5	36
															Sum	4.43	NA	NA	NA	NA						
															3/8	0	0.0	100	0.0	0.0						
															4	0.32	10.6	99.2	0.8	0.8						
															10	0.42	3.3	96.2	3.8	3.0						
															20	0.73	7.0	85.3	14.7	10.9						
															40	0.75	5.3	70.9	29.1	14.4						
															60	0.53	3.6	58.3	41.7	12.6						
															200	0.81	3.4	40.1	59.9	18.2						
															230	0.34	3.4	36	64.0	4.1						
															270	0.24	3.6	33.2	66.8	2.8						
FF-14F	FF14F_060616_SED_G_1	Frankfort Flats	Southeast Center Channel	Falling	Gray Sand with Woodchips	Sediment	Grab	0.047	None	0.330	76.0	Partition	NA	SM	pan	0.30	3.4	NA	NA	NA				NA		

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Location ID	Field Sample ID	Study Area	Sub-Area	Tidal Phase	General Description	Sample Matrix	Collection Method	Chemical Results: Total Mercury (mg/kg or mg/L) EPA Method 7474(6)	Qualifier(3)	Total Organic Carbon(2) (%) Lloyd Kahn Method(5)	Total Solids (%) ASTM 2540G	Physical Results: Sample Type	Atterberg Limits LL/PL	Sediment Classification (USCS)	Sieve Number	Organic Content (% of Total) ASTM D2974-C	Organic Content (% of Ind. Sieve) ASTM D2974-C	% Passing (Cum) ASTM D422(4)	% Retained (Cum) ASTM D422(4)	% Retained (Ind) ASTM D422(4)	% Gravel ASTM D422(4)	% Sand ASTM D422(4)	% Fines (passing #200 sieve) ASTM D422(4)	% Silt ASTM D422(4)	% Clay ASTM D422(4)	% Fines (passing #230 sieve) ASTM D422(4)
FF-14F	FF14F_060616_SED_G_2	Frankfort Flats	Southeast Center Channel	Falling	Jello-like Silt	Sediment	Grab	0.222	None	2.97	49.6	NA	NA	ML	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
FF-16H	FF16F_060616_SED_G	Frankfort Flats	None	High	Gray Coarse Sand with Woodchips	Sediment	Grab	0.139	None	0.93	71.2	Bulk	NV/NP	SM	All	1.9	NA	NA	NA	NA	0.3	85.6	14.1	11.4	2.7	9.4
												Bulk	NA	SM	All	44.1	NA	NA	NA	NA	13.1*	69.2*	17.7	NA	NA	16.6
															Sum	54.88	NA	NA	NA	NA						
															3/8	3.38	74.6	94.9	5.1	5.1						
															4	10.92	72.5	86.9	13.1	8.0						
															10	21.26	39.9	66.5	33.5	20.4						
															20	14.59	38.3	28.1	71.9	38.4						
															40	3.46	40.8	19	81.0	9.1						
															60	0.74	70.4	17.9	82.1	1.1						
															200	0.12	60.0	17.7	82.3	0.2						
															230	0.21	18.5	16.6	83.4	1.1						
															270	0.21	83.3	16.4	83.6	0.2						
															pan	0	0.0	NA	NA	NA				NA		
															≥40	Specific Gravity (Dry) = 0.37										
																Specific Gravity (Wet) = 1.746										
																Dry Bulk Density = 370 kg/m^3										
																Wet Bulk Density = 1,746 kg/m^3										
																Absorption = 211.5%										
															≤40	Specific Gravity (Dry) = 2.248										
																Dry Bulk Density = 2,248 kg/m^3										
BU-01	Bu1_061016_SED_G_WC	Bucksport	Southeast Center Channel	Low	Brown Woodchips with Silty Sand	Woodchips	Grab	0.576	None	23.00	20.8	Partition	NA	SM		Adsorption = ND										
BU-01	Bu1_061016_SED_G_WC_DUP	Bucksport	Southeast Center Channel	Low	Brown Woodchips with Silty Sand	Woodchips	Grab	0.596	None	39.10	21.2	Bulk	NA	ML	All	45.9	NA	NA	NA	NA	5.6*	19.8*	74.6	NA	NA	74.5
BU-01	Bu1_061016_Squeeze_G_WC	Bucksport	Southeast Center Channel	Low	Brown Woodchips	Liquid	Grab	0.01217	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BU-01	Bu1_061016_Squeeze_G_WC_Filtered	Bucksport	Southeast Center Channel	Low	Brown Woodchips	Liquid	Grab	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BU-01	Bu1_061016_Squeeze_G_WC_Filtered_DUP	Bucksport	Southeast Center Channel	Low	Brown Woodchips	Liquid	Grab	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
												Bulk	78/65	MH	All	26.9	NA	NA	NA	NA	1.6*	40.6*	57.8	42.8	15	51.5
															Sum	37.64	NA	NA	NA	NA						
															3/8	0	0.0	100	0.0	0.0						
															4	0.91	40.1	98.4	1.6	1.6						
															10	5.08	35.4	94.6	5.4	3.8						
															20	6.29	77.9	87	13.0	7.6						
															40	7.85	55.2	74.1	25.9	12.9						
															60	3.57	60.8	68.4	31.6	5.7						
															200	2.62	23.3	57.8	42.2	10.6						
															230	0.20	2.3	51.5	48.5	6.3						
															270	0.35	22.2	50.1	49.9	1.4						
BU-02	Bu2_060916_SED_G	Bucksport	Southwest Channel	Low	Gray Sandy Silt with Woodchips	Sediment	Grab	0.856	None	7.86	32.9	Partition	NA	MH	pan	10.77	42.7	NA	NA	NA				NA		

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BU-03	Bu3_060916_SED_G	Bucksport	West Channel	Rising	Brown Woodchips with Sandy Silt	Sediment	Grab	3.59	None	8.68	32.9	Bulk	NA	ML	All	12	NA	NA	NA	NA	0	30.4*	69.6	63.2	6.4	63.4
												Bulk	NA	ML	All	13.3	NA	NA	NA	NA	0.1*	19.4*	80.5	NA	NA	36.2
															Sum	20.19	NA	NA	NA	NA						
															3/8	0.00	NA	96.3	3.7	3.7						
															4	0.00	NA	92.4	7.6	3.9						
															10	0.00	NA	82.1	17.9	10.3						
															20	3.61	NA	59.6	40.4	22.5						
															40	5.70	NA	48.2	51.8	11.4						
															60	2.70	NA	44.5	55.5	3.7						
															200	4.44	NA	38	62.0	6.5						
															230	1.11	NA	36.2	63.8	1.8						
															270	0.61	NA	34.7	65.3	1.5						
BU-03	Bu3_060916_SED_G_DUP	Bucksport	West Channel	Rising	Brown Woodchips with Sandy Silt	Sediment	Grab	0.987	None	9.38	28.9	Partition	NA	ML	pan	2.03	NA	NA	NA	NA	NA					
BU-04	Bu4_060916_SED_G	Bucksport	East Channel	Low	Brown Woodchips	Sediment	Grab	1.10	None	25.90	10.1	Bulk	72/58	MH	All	15.5	NA	NA	NA	NA	0	19*	81	67.9	13.1	78.5
BU-19L	Bu19L_060716_SED_G	Bucksport	Northeast Channel	Low	Gray Fine Sand with Woodchips	Sediment	Grab	0.083	None	0.718	69.9	Bulk	NA	SM	All	2.1	NA	NA	NA	NA	0.9	88.2	10.9	9.9	1	9.4
BU-19L	Bu19L_060716_SED_G_DUP	Bucksport	Northeast Channel	Low	Gray Fine Sand with Woodchips	Sediment	Grab	0.111	None	0.619	70.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BU-20L	Bu20L_060716_SED_G	Bucksport	Northwest Channel	Low	Brown Woodchips	Sediment	Grab	1.15	None	44.30	15.4	Bulk	NA	OL	All	4.5	NA	NA	NA	NA	17.3*	71.6*	11.1	NA	NA	10
BU-21R	Bu21R_060716_SED_G	Bucksport	North Center Channel	Rising	Gray Fine Sand	Sediment	Grab	0.926	None	19.20	26.8	Bulk	NV/NP	SM	All	8.9	NA	NA	NA	NA	1.4*	81.1*	17.5	13	4.5	13.8
BU-24R	Bu24R_060716_SED_G	Bucksport	East Bank	Rising	Brown Silt	Sediment	Grab	0.082	None	0.526	81.5	Bulk	43/33	ML	All	4.8	NA	NA	NA	NA	6.6	43.4	50	42.6	7.4	46.5
												Bulk	NA	OH	All	45.6	NA	NA	NA	NA	7.6*	54.4*	38	NA	NA	36.2
															Sum	27.55	NA	NA	NA	NA						
															3/8	1.99	51.4	96.3	3.7	3.7						
															4	2.05	48.1	92.4	7.6	3.9						
															10	5.07	45.3	82.1	17.9	10.3						
															20	9.89	40.5	59.6	40.4	22.5						
BU-26H	Bu26H_060716_SED_G	Bucksport	East Channel	High	Brown Woodchips	Sediment	Grab	0.994	None	38.40	20.2	Partition	NA	OH	40	4.72	40.8	48.2	51.8	11.4	NA					
															60	1.70	44.0	44.5	55.5	3.7						
															200	1.43	21.8	38	62.0	6.5						
															230	0.27	11.1	36.2	63.8	1.8						
															270	0.19	9.1	34.7	65.3	1.5						
															pan	0.23	25.0	NA	NA	NA						
BU-27H	Bu27H_060716_SED_G	Bucksport	East Channel	High	Brown Woodchips	Sediment	Grab	1.22	None	39.90	12.4	Bulk	NA	OL	All	5.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BU-28H	Bu28H_060716_SED_G	Bucksport	Center Channel	High	Gray Fine Sandy Silt With Woodchips	Sediment	Grab	NA	NA	29.80	28.1	Bulk	NA	ML	All	3.9	NA	NA	NA	NA	0.1*	15.8*	84.1	NA	NA	83.3
BU-28H	Bu28H_060716_ML_G	Bucksport	Center Channel	High	Gray Fine Sand	Sediment	Grab	0.162	None	2.03	64.7	NA	NA	SM	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BU-28H	Bu28H_060716_ML_G	Bucksport	Center Channel	High	Gray Fine Sand	Liquid	Grab	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BU-28H	Bu28H_060716_ML_G_Filtered	Bucksport	Center Channel	High	Gray Fine Sand	Liquid	Grab	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BU-29H	Bu29F_060716_SED_G	Bucksport	West Channel	High	Gray Fine Sandy Silt with Woodchips	Sediment	Grab	0.809	None	4.72	35.5	Bulk	50/37	MH	All	13.6	NA	NA	NA	NA	0	36.4*	63.6	51.7	11.9	51.5
BU-30F	Bu30F_060716_SED_G	Bucksport	None	Falling	Brown Fine Sandy Silt with Woodchips	Sediment	Grab	0.407	None	4.02	44.9	Bulk	39/34	ML	All	8.7	NA	NA	NA	NA	0.1*	41.9*	58	48.8	9.2	47.8
BU-31F	Bu31F_060716_SED_G	Bucksport	East Channel	Falling	Brown Woodchips	Sediment	Grab	0.734	None	38.60	22.4	Bulk	NA	OL	All	30.2	NA	NA	NA	NA	3.1*	86*	10.9	NA	NA	10.8
BU-32F	Bu32F_060716_SED_G	Bucksport	Center Channel	Falling	Gray Fine Sand with Woodchips	Sediment	Grab	0.682	None	11.00	12.9	Bulk	NA	ML	All	19.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

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BU-RW	Bu-RW_061016_SW_G	Bucksport	None	NA	NA	Liquid	Grab	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BU-RW	Bu-RW_061016_SW_G_Filtered	Bucksport	None	NA	NA	Liquid	Grab	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BU_MUD	Bu_mud+WC_060716_SED_C	Bucksport	None	NA	NA	Liquid	Composite	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MUDLINE_BU+FF	Mudline_Bu+FF_Solids	Bucksport & Frankfort Flats	None	NA	NA	Sediment	Composite	0.628	None	4.04	37.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MUDLINE_BU+FF	Mudline_Bu+FF_WC	Bucksport & Frankfort Flats	None	NA	Brown Woodchips	Woodchips	Composite	1.2	None	19.80	19.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MUDLINE_BU+FF	Mudline_Bu+FF	Bucksport & Frankfort Flats	None	NA	NA	Liquid	Composite	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MUDLINE_BU+FF	Mudline_Bu+FF_Filtered	Bucksport & Frankfort Flats	None	NA	NA	Liquid	Composite	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GP-35ABC	EC35ABC_060916_SED_C	East Channel	West Bank	High	Gray Silt with Woodchips	Sediment	Composite	0.822	None	5.85	41.6	Bulk	70/48	MH	All	12	NA	NA	NA	NA	0	6.5*	93.5	79.7	13.8	91.7
												Partition	NA	MH	Sum	3.37	NA	NA	NA	NA	NA					
															3/8	0	0.0	100	0.0	0.0						
															4	0	0.0	100	0.0	0.0						
															10	0	0.0	100	0.0	0.0						
															20	0.61	48.0	98.7	1.3	1.3						
															40	0.53	39.0	97.5	2.5	1.2						
															60	0.44	50.0	96.5	3.5	1.0						
															200	1.35	33.0	93.5	6.5	3.0						
															230	0.19	8.2	91.7	8.3	1.8						
															270	0.03	2.6	89.9	10.1	1.8						
															pan	0.22	13.8	NA	NA	NA						
GP-35ABC	EC35ABC_060916_SED_C	East Channel	West Bank	High	Gray Silt with Woodchips	Liquid	Composite	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GP-35ABC	EC35ABC_060916_SED_C_Filtered	East Channel	West Bank	High	Gray Silt with Woodchips	Liquid	Composite	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
EC-WEST35	ECWest35_060916_ML_C_WC	East Channel	West Bank	High	Gray Silt with Woodchips	Woodchips	Composite	1.18	None	NA	25.2	NA	NA	ML	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
EC-WEST35	ECWest35_060916_ML_C	East Channel	West Bank	High	Gray Silt with Woodchips	Liquid	Composite	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
EC-WEST35	ECWest35_060916_ML_C_Filtered	East Channel	West Bank	High	Gray Silt with Woodchips	Liquid	Composite	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
EC-37ABCDE	EC37ABCDE_060916_SED_C	East Channel	East Bank Orland River	Falling	Black and Brown Silt with Woodchips	Sediment	Composite	0.777	None	4.62	38.5	Bulk	NA	ML	All	11.3	NA	NA	NA	NA	0	6.1*	93.9	84.3	9.6	91.8
												Partition	NA	ML	Sum	3.96	NA	NA	NA	NA	NA					
															3/8	0	0.0	100	0.0	0.0						
															4	0	0.0	100	0.0	0.0						
															10	0.22	33.3	99.8	0.2	0.2						
															20	0.17	28.6	99.2	0.8	0.6						
															40	0.52	51.4	98.2	1.8	1.0						
															60	1.02	72.5	96.8	3.2	1.4						
															200	1.46	46.5	93.9	6.1	2.9						
															230	0.36	16.7	91.8	8.2	2.1						
															270	0.22	88.9	91.5	8.5	0.3						
															pan	0	0.0	NA	NA	NA						
EC-37ABCDE	EC37ABCDE_060916_ML_C_WC	East Channel	East Bank Orland River	Falling	Gray Fine Sandy Silt with Woodchips	Woodchips	Composite	0.695	None	NA	29.2	NA	NA	OL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
EC-37ABCDE	EC37ABCDE_060916_ML_C	East Channel	East Bank Orland River	Falling	Gray Fine Sandy Silt with Woodchips	Liquid	Composite	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
EC-37ABCDE	EC37ABCDE_060916_ML_C_Filtered	East Channel	East Bank Orland River	Falling	Gray Fine Sandy Silt with Woodchips	Liquid	Composite	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 1
SPRING 2016 SAMPLING RESULTS - CHEMICAL AND PHYSICAL ANALYSIS

Penobscot River Phase III Engineering Study
Penobscot River Estuary, Maine

								Chemical Results				Physical Results														
Location ID	Field Sample ID	Study Area	Sub-Area	Tidal Phase	General Description	Sample Matrix	Collection Method	Total Mercury (mg/kg or mg/L) EPA Method 7474[6]	Qualifier[3]	Total Organic Carbon[2] (%) Lloyd Kahn Method[5]	Total Solids (%) ASTM 2540G	Sample Type	Atterberg Limits LL/PL	Sediment Classification (USCS)	Sieve Number	Organic Content (% of Total) ASTM D2974-C	Organic Content (% of Ind. Sieve) ASTM D2974-C	% Passing (Cum) ASTM D422[4]	% Retained (Cum) ASTM D422[4]	% Retained (Ind) ASTM D422[4]	% Gravel ASTM D422[4]	% Sand ASTM D422[4]	% Fines (passing #200 sieve) ASTM D422[4]	% Silt ASTM D422[4]	% Clay ASTM D422[4]	% Fines (passing #230 sieve) ASTM D422[4]
EC-38	EC38ABCDE_060916_SED_C_WC	East Channel	West Bank Orland River	Falling	Black and Brown Silt with Woodchips	Woodchips	Composite	1.02	None	12.60	17.5	NA	NA	OL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
EC-38	EC38ABCDE_060916_SED_C	East Channel	West Bank Orland River	Falling	Black and Brown Silt with Woodchips	Sediment	Composite	0.973	None	7.79	34.0	Bulk	NA	ML	All	11.3	NA	NA	NA	NA	0	12.2*	87.8	81	6.8	86.3
EC-38ABCDE	EC38ABCDE_060916_ML_C	East Channel	West Bank Orland River	Falling	Black and Brown Silt with Woodchips	Liquid	Composite	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
EC-38ABCDE	EC38ABCDE_060916_ML_C_Filtered	East Channel	West Bank Orland River	Falling	Black and Brown Silt with Woodchips	Liquid	Composite	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
EC-39ABC	EC39ABC_060916_SED_C	East Channel	East Bank	Falling	Gray and Black Silt with Woodchips	Sediment	Composite	0.578	None	5.98	32.8	Bulk	78/57	MH	All	12	NA	NA	NA	NA	0	6.8*	93.2	74.5	18.7	90.6
												Partition	NA	MH	Sum	5.37	NA	NA	NA	NA	NA					
															3/8	0	0.0	100	0.0	0.0						
															4	0	0.0	100	0.0	0.0						
															10	0.79	34.3	99.5	0.5	0.5						
															20	1.66	59.6	96.9	3.1	2.6						
															40	0.50	46.2	95.9	4.1	1.0						
															60	0.79	73.1	94.7	5.3	1.2						
															200	0.87	56.8	93.2	6.8	1.5						
															230	0.21	5.0	90.6	9.4	2.6						
															270	0.25	11.4	88.8	11.2	1.8						
															pan	0.29	20.7	NA	NA	NA						
EC-39ABC	EC39ABC_060916_ML_C	East Channel	East Bank	Falling	Gray and Black Silt with Woodchips	Sediment	Composite	0.896	None	7.38	31.9	NA	NA	ML	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
EC-39ABC	EC39ABC_060916_ML_C	East Channel	East Bank	Falling	Gray and Black Silt with Woodchips	Liquid	Composite	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
EC-39ABC	EC39ABC_060916_ML_C_Filtered	East Channel	East Bank	Falling	Gray and Black Silt with Woodchips	Liquid	Composite	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
EC-40AB	EC40AB_060916_SED_C	East Channel	West Bank	Falling	Gray Silt with Woodchips	Sediment	Composite	0.65	None	4.68	41.3	NA	NA	ML	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
EC-40AB	EC40AB_060916_SED_C_WC	East Channel	West Bank	Falling	Gray Silt with Woodchips	Woodchips	Composite	1.53	None	NA	10.2	NA	NA	OL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
EC-41ABCDE	EC41ABCDE_060916_SED_C	East Channel	Center Channel	Falling	Brown Woodchips	Sediment	Composite	0.885	None	25.40	14.3	NA	NA	OL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GP-33	GP33H_060916_SED_C	Gross Point	Center Channel	High	Gray Fine Silty Sand	Sediment	Composite	0.283	None	3.13	60.6	Bulk	NA	SM	All	3.9	NA	NA	NA	NA	4.7	58.4	36.9	35.2	1.7	33.8
												Partition	NA	SM	Sum	2.00	NA	NA	NA	NA	NA					
															3/8	0.02	0.3	98.7	1.3	1.3						
															4	0.09	0.2	95.3	4.7	3.4						
															10	0.24	0.5	91.8	8.2	3.5						
															20	0.13	13.0	82.7	17.3	9.1						
															40	0.37	1.5	74.7	25.3	8.0						
															60	0.34	3.5	65.8	34.2	8.9						
															200	0.52	1.4	36.9	63.1	28.9						
															230	0.11	2.3	33.8	66.2	3.1						
															270	0.09	21.4	24.9	75.1	8.9						
															pan	0.07	20.0	NA	NA	NA						
GP-33	GP33H_060916_SED_C_WC	Gross Point	Center Channel	High	Gray Fine Silty Sand	Woodchips	Composite	0.075	None	7.01	75.1	NA	NA	OL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 1
SPRING 2016 SAMPLING RESULTS CHEMICAL AND PHYSICAL ANALYSIS

Penobscot River Phase III Engineering Study
Penobscot River Estuary, Maine

Location ID	Field Sample ID	Study Area	Sub-Area	Tidal Phase	General Description	Sample Matrix	Collection Method	Chemical Results				Physical Results														
								Total Mercury (mg/kg or mg/L) EPA Method 7474(6)	Qualifier(3)	Total Organic Carbon(2) (%) Lloyd Kahn Method(5)	Total Solids (%) ASTM 2540G	Sample Type	Atterberg Limits LL/PL	Sediment Classification (USCS)	Sieve Number	Organic Content (% of Total) ASTM D2974-C	Organic Content (% of Ind. Sieve) ASTM D2974-C	% Passing (Cum) ASTM D422(4)	% Retained (Cum) ASTM D422(4)	% Retained (Ind) ASTM D422(4)	% Gravel ASTM D422(4)	% Sand ASTM D422(4)	% Fines (passing #200 sieve) ASTM D422(4)	% Silt ASTM D422(4)	% Clay ASTM D422(4)	% Fines (passing #230 sieve) ASTM D422(4)
GP-34AB	GP34AB_060916_SED_C	Gross Point	Center Channel	High	Gray Sandy Silt with Woodchips	Sediment	Composite	0.397	None	3.07	49.9	Bulk	46/37	ML	All	10.3	NA	NA	NA	NA	6*	30.5*	63.5	52	11.5	56.6
												Partition	NA	ML	Sum	3.88	NA	NA	NA	NA	NA					
															3/8	0.04	0.2	97.7	2.3	2.3						
															4	0.30	2.5	94	6.0	3.7						
															10	0.00	0.3	90.2	9.8	3.8						
															20	0.74	16.7	86.2	13.8	4.0						
															40	0.41	11.8	83.1	16.9	3.1						
															60	0.52	22.5	80.9	19.1	2.2						
															200	1.37	3.5	63.5	36.5	17.4						
															230	0	3.0	56.6	43.4	6.9						
															270	0.17	4.9	53.4	46.6	3.2						
															pan	0.30	8.2	NA	NA	NA						
GP-34AB	GP34AB_060916_SED_C	Gross Point	Center Channel	High	Gray Sandy Silt with Woodchips	Liquid	Composite	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GP-34AB	GP34AB_060916_SED_C_Filtered	Gross Point	Center Channel	High	Gray Sandy Silt with Woodchips	Liquid	Composite	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GP-36ABC	GP36ABC_060916_SED_C	Gross Point	West Bank	Falling	Gray Fine Sandy Silt with Woodchips	Sediment	Composite	0.518	None	5.37	38.1	Bulk	NA	ML	All	9.1	NA	NA	NA	NA	0	2.3*	97.7	81.6	16.1	95.8
GP-36	GP36ABC_060816_SED_C_WC	Gross Point	West Bank	Falling	Gray Fine Sandy Silt with Woodchips	Woodchips	Composite	1.15	None	NA	10.0	NA	NA	OL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GP-36ABC	GP36ABC_060916_ML_C	Gross Point	West Bank	Falling	Gray Fine Sandy Silt with Woodchips	Sediment	Composite	0.883	None	6.38	35.9	NA	NA	ML	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GP-36ABC	GP36ABC_060916_ML_C	Gross Point	West Bank	Falling	Gray Fine Sandy Silt with Woodchips	Liquid	Composite	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GP-36ABC	GP36ABC_060916_ML_C_Filtered	Gross Point	West Bank	Falling	Gray Fine Sandy Silt with Woodchips	Liquid	Composite	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GP-36ABC	GP36ABC_060816_ML_C	Gross Point	West Bank	Falling	Gray Fine Sandy Silt with Woodchips	Liquid	Composite	0.00032	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GP-36ABC	GP36ABC_060816_ML_C_Filtered	Gross Point	West Bank	Falling	Gray Fine Sandy Silt with Woodchips	Liquid	Composite	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
OD-01	OD1_060916_SED_G	Odom Ledge	South Center Channel	Rising	Gray Sandy Silt	Sediment	Grab	0.454	None	2.52	45.4	Bulk	NA	ML	All	6.4	NA	NA	NA	NA	0	13.2	86.8	79.5	7.3	74.7
												Partition	NA	ML	Sum	1.83	NA	NA	NA	NA	NA					
															3/8	0	0.0	100	0.0	0.0						
															4	0	0.0	100	0.0	0.0						
															10	0.20	26.4	99.7	0.3	0.3						
															20	0.40	44.3	98.7	1.3	1.0						
															40	0.28	55.0	98.2	1.8	0.5						
															60	0.15	53.8	97.9	2.1	0.3						
															200	0.35	2.7	86.8	13.2	11.1						
															230	0.10	0.6	74.7	25.3	12.1						
															270	0.08	0.7	67.3	32.7	7.4						
															pan	0.28	6.5	NA	NA	NA						
OD-02	OD2_060916_SED_G	Odom Ledge	West Channel	Rising	Gray Silty Sand with Shells and Gravel	Sediment	Grab	0.568	None	1.64	51.5	Bulk	NA	SC-SM	All	3.3	NA	NA	NA	NA	0	55.8	44.2	35.6	8.6	37.1
												Partition	NA	SC-SM	Sum	1.65	NA	NA	NA	NA	NA					
															3/8	0	0.0	100	0.0	0.0						
															4	0	0.0	100	0.0	0.0						
															10	0.04	0.2	97.3	2.7	2.7						
															20	0.10	1.4	84.9	15.1	12.4						
															40	0.24	2.6	76.8	23.2	8.1						
															60	0.38	6.8	71.4	28.6	5.4						
															200	0.58	2.0	44.2	55.8	27.2						
															230	0.00	6.2	37.1	62.9	7.1						
															270	0.18	18.0	34	66.0	3.1						
															pan	0.14	2.7	NA	NA	NA						

TABLE 1
SPRING 2016 SAMPLING RESULTS - CHEMICAL AND PHYSICAL ANALYSIS

Penobscot River Phase III Engineering Study
Penobscot River Estuary, Maine

amec foster wheeler

Location ID	Field Sample ID	Study Area	Sub-Area	Tidal Phase	General Description	Sample Matrix	Collection Method	Chemical Results: Total Mercury (mg/kg or mg/L) EPA Method 7474(6)	Qualifier(3)	Total Organic Carbon(2) (%) Lloyd Kahn Method(5)	Total Solids (%) ASTM 2540G	Physical Results: Sample Type	Atterberg Limits LL/PL	Sediment Classification (USCS)	Sieve Number	Organic Content (% of Total) ASTM D2974-C	Organic Content (% of Ind. Sieve) ASTM D2974-C	% Passing (Cum) ASTM D422(4)	% Retained (Cum) ASTM D422(4)	% Retained (Ind) ASTM D422(4)	% Gravel ASTM D422(4)	% Sand ASTM D422(4)	% Fines (passing #200 sieve) ASTM D422(4)	% Silt ASTM D422(4)	% Clay ASTM D422(4)	% Fines (passing #230 sieve) ASTM D422(4)
OD-03	OD3_060916_SED_G	Odom Ledge	West Bank	Rising	Gray Silt with Black Streaking	Sediment	Grab	0.634	None	4.76	35.4	Bulk	NA	ML	All	12.1	NA	NA	NA	NA	0	2.9	97.1	79	18.1	94
OD-03	OD3_060916_SED_G_DUP	Odom Ledge	West Bank	Rising	Gray Silt with Black Streaking	Sediment	Grab	0.520	None	4.72	35.0	NA	NA	ML	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
FPC-01	FPC1_060816_SED_G	Fort Point Cove	East Bank	Rising	Gray Silt	Sediment	Grab	0.389	None	2.42	50.8	Bulk	NA	ML	All	5.3	NA	NA	NA	NA	0	4.8	95.2	78.3	16.9	87.6
FPC-02	FPC2_060816_SED_G	Fort Point Cove	East-Center Channel	Rising	Gray Fine Sandy Silt	Sediment	Grab	0.588	None	2.40	46.1	Bulk	NA	ML	All	6.4	NA	NA	NA	NA	0	26.8	73.2	58.6	14.6	68.5
FPC-03	FPC3_060816_SED_G	Fort Point Cove	West-Center Channel	Rising	Gray Silt with Little Algae	Sediment	Grab	0.694	None	4.12	35.2	Bulk	NA	ML	All	11.8	NA	NA	NA	NA	0	0.7	99.3	70.7	28.6	97.6
FPC-04	FPC4_060816_SED_G	Fort Point Cove	West Bank	Rising	Brown Silt with Algae and Black Streaking	Sediment	Grab	0.681	None	3.33	28.1	Bulk	NA	ML	All	72.2	NA	NA	NA	NA	0	0.9	99.1	72.8	26.3	97.8
BR-SILT_OL_C	BrSilt_OL_C	None	None	None	Overlying water in sample bucket	Liquid	Composite	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BR-SILT_OL_C	BrSilt_OL_C_Filtered	None	None	None	Overlying water in sample bucket	Liquid	Composite	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GRSILT_OL_C	GrSilt_OL_C	None	None	None	Overlying water in sample bucket	Liquid	Composite	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GRSILT_OL_C	GrSilt_OL_C_Filtered	None	None	None	Overlying water in sample bucket	Liquid	Composite	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BRFI-SAND_OL_C	BrFiSand_OL_C	None	None	None	Overlying water in sample bucket	Liquid	Composite	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BRFI-SAND_OL_C	BrFiSand_OL_C_Filtered	None	None	None	Overlying water in sample bucket	Liquid	Composite	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GRSAND_OL_C	GrSand_OL_C	None	None	None	Overlying water in sample bucket	Liquid	Composite	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
GRSAND_OL_C	GrSand_OL_C_Filtered	None	None	None	Overlying water in sample bucket	Liquid	Composite	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BR-06SAND_OL_C	BrCoSand_OL_C	None	None	None	Overlying water in sample bucket	Liquid	Composite	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BR-06SAND_OL_C	BrCoSand_OL_C_Filtered	None	None	None	Overlying water in sample bucket	Liquid	Composite	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
QC	AFW1_061016_DI_QC	None	None	None	Quality Control	Liquid	Grab	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
QC	FSSink_061016_SW_QC	None	None	None	Quality Control	Liquid	Grab	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
QC	Ponar_061016_SED_QC	None	None	None	Quality Control	Liquid	Grab	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
QC	Mixer_061016_SED_QC	None	None	None	Quality Control	Liquid	Grab	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
QC	Mixer_062116_SED_QC	None	None	None	Quality Control	Liquid	Grab	0.0002	None	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BU-02	Bu2_060916_SED_G_MS	Bucksport	Southwest Channel	Low	Quality Control	Sediment	Grab	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BU-02	Bu2_060916_SED_G_MSD	Bucksport	Southwest Channel	Low	Quality Control	Sediment	Grab	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
FPC-02	FPC2_060816_SED_G_MS	Fort Point Cove	East-Center Channel	Rising	Quality Control	Sediment	Grab	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
FPC-02	FPC2_060816_SED_G_MSD	Fort Point Cove	East-Center Channel	Rising	Quality Control	Sediment	Grab	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 1
SPRING 2016 SAMPLING RESULTS CHEMICAL AND PHYSICAL ANALYSIS

Penobscot River Phase III Engineering Study
Penobscot River Estuary, Maine

									Chemical Results					Physical Results														
Location ID	Field Sample ID	Study Area	Sub-Area	Tidal Phase	General Description	Sample Matrix	Collection Method		Total Mercury (mg/kg or mg/L) EPA Method 7474(6)	Qualifier(3)	Total Organic Carbon(2) (%) Lloyd Kahn Method(5)	Total Solids (%) ASTM 2540G		Sample Type	Atterberg Limits LL/PL	Sediment Classification (USCS)	Sieve Number	Organic Content (% of Total) ASTM D2974-C	Organic Content (% of Ind. Sieve) ASTM D2974-C	% Passing (Cum) ASTM D422(4)	% Retained (Cum) ASTM D422(4)	% Retained (Ind) ASTM D422(4)	% Gravel ASTM D422(4)	% Sand ASTM D422(4)	% Fines (passing #200 sieve) ASTM D422(4)	% Silt ASTM D422(4)	% Clay ASTM D422(4)	% Fines (passing #230 sieve) ASTM D422(4)
BU-RW	Bu-RW_061016_SW_GMS	Bucksport	None	None	Quality Control	Liquid	Grab		NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BU-RW	Bu-RW_061016_SW_GMSD	Bucksport	None	None	Quality Control	Liquid	Grab		NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NOTES:

(1) = Laboratory method included extraction procedure that may have potentially resulted in lower concentrations compared to CDM 2001, Ph2-Geyer, and Ph2-Yeager values.

(2) = Higher TOC is observed for woodchip-related samples compared to locations without woodchips.
(4) = Sodium hexametaphosphate used as a deflocculant during sample preparation.
(5) = Phosphoric acid used to inorganic carbon during sample preparation.
(6) = Nitric and hydrochloric acid used for sample digestion during sample preparation.

*** Yellow Highlight** = The sample is mainly bark and woodchips which is reflected as gravel and sand. The sand fraction percentage is not just sand and may not be comparable to other grain size data by others.

Green Highlight = The organic content is lower than expected due to interference by woodchip-generated ash affecting method calculations. The post-heating observations showed woodchip ash in crucible which increased the sample weight and skewed the weight-based organic content calculation.

Reach ID Definitions:
BU = Bucksport
EC = East Channel
FF = Frankfurt Flats
FPC = Fort Point Cove
GP = Gross Point
HA = Hampden
OD = Odem Ledge

Orange Highlight = A deflocculant additive (sodium hexametaphosphate) and subsequent washing was completed as part of the partition organic content procedure and all D422 analyses, which resulted with the loss of sample material. Therefore, the sum of the partition organic content samples is less than the bulk organic content value. The partition organic content results are relative compared to each other.

NA = Not Analyzed
NV = No Value
NP = Non Plastic

Prepared b KC/MM/BCG 6/29/2017

Checked b KM 6/29/2017

TABLE 2
SPRING 2016 SAMPLING RESULTS VISUAL ASSESSMENT SUMMARY

Penobscot River Phase III Engineering Study
Penobscot River Estuary, Maine

Reach	Location ID	Surf Line			Wood Waste at Mudline		Edge Conditions	Bank Conditions
		Wood Waste Description	Base Sediment	Intermingled Wood Waste?	Exposed Above Mudline	Below Mudline		
Orrington	SP100-INT	Trace Leaves and Grass; Occassional Particle Grain	Silt with fine sand	Yes	Yes	Yes	Vegetated	Sloping Mudflats
	SP101-INT	Trace Leaves and Grass; Occassional Particle Grain	Silt	Yes	Yes	Yes	Vegetated	Sloping Mudflats
	SP102-INT	Trace Leaves and Grass; Occassional Particle Grain	Silt	Yes	Yes	Yes	Vegetated	Sloping Mudflats
	SP103-INT	Trace Leaves and Grass; Trace Wood Chips; Occassional Particle Grain	Silt	Maybe	Yes	Yes	Vegetated	Sloping Mudflats
	SP104-INT	Trace Leaves and Grass; Occassional Particle Grain	Silt	Yes	Yes	Yes	Vegetated	Sloping Mudflats
Frankfort Flats	FF100	Abundant Wood Chips; Trace Particle Grain	Sand and Silt	Yes	Yes	Yes	Vegetated	Sloping Mudflats
	FF200_INT	Trace Leaves and Grass; Trace Shredded Mulch; Abundant Wood Chips; Maybe Particle Grain	Silt	Yes	Yes	No	Vegetated	Sloping Mudflats
Bucksport	BU31	Scattered Wood Chips	Sand and Silt	No	N/A	N/A	N/A	N/A
	BU101-SUB	Abundant Shredded Mulch	Silt	N/A	Yes	No	Vegetated	Sloping Mudflats
	BU103	None observed	Silt	No	Yes	No	Vegetated	Boulder Outcrops; Sloping Mudflats
	BU104	Trace Wood Chips	Sand and Silt	No	N/A	N/A	N/A	N/A
	BU105	Trace Wood Chips	Sand and Silt	No	N/A	N/A	N/A	N/A
Verona Northeast	EC109-INT	Scattered Leaves and Grass; Abundant Particle Grain	N/A	Yes	Yes	Yes	Vegetated	Boulder Outcrops; Sloping Mudflats
	EC110-INT	Trace to Scattered Leaves and Grass; Abundant Particle Grain	N/A	Yes	Yes	Yes	Vegetated	Boulder Outcrops; Sloping Mudflats
	EC111-INT	Trace Leaves and Grass; Abundant Particle Grain	Silt	Yes	Yes	Yes	Vegetated	Boulder Outcrops; Sloping Mudflats
	EC112-INT	Abundant Particle Grain	Silt	Yes	Yes	Yes	Vegetated	Boulder Outcrops; Sloping Mudflats

TABLE 2
SPRING 2016 SAMPLING RESULTS VISUAL ASSESSMENT SUMMARY

Penobscot River Phase III Engineering Study
Penobscot River Estuary, Maine

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Reach	Location ID	Surf Line			Wood Waste at Mudline		Edge Conditions	Bank Conditions
		Wood Waste Description	Base Sediment	Intermingled Wood Waste?	Exposed Above Mudline	Below Mudline		
Orland River	OR100-INT	Trace Wood Chips; Occassional Particle Grain	Silt	Yes	Yes	Yes	Vegetated with Boulder	Boulder Outcrops; Sloping Mudflats
	OR101-INT	None observed	Silt	No	Yes	No	Vegetated with Boulder	Boulder Outcrops; Sloping Mudflats
	OR102-INT	Abundant Wood Chips	Silt	Yes	Yes	Yes	Vegetated with Boulder	Boulder Outcrops; Sloping Mudflats
	OR103-INT	Occassional Wood Chips; Trace Particle Grain	Silt	Yes	Yes	Yes	Vegetated	Boulder Outcrops; Sloping Mudflats
	OR104-INT	Abundant Wood Chips; Scattered Particle Grain	Silt	Yes	Yes	Yes	Vegetated	Sloping Mudflats
	OR105-INT	None observed	Silt	No	Yes	No	Vegetated	Sloping Mudflats
	OR106-INT	Trace Shredded Mulch; Trace Wood Chips; Scattered Particle Grain	Silt	Yes	Yes	Yes	Vegetated	Sloping Mudflats
	OR107-INT	None observed	Silt	N/A	No	No	Vegetated	Slumped Mudflats
	OR108-INT	Scattered Wood Chips; Scattered Particle Grain	Silt	Yes	Yes	Yes	Vegetated	Sloping Mudflats
Verona East	SV001-INT	None observed	N/A	N/A	Yes	N/A	Boulder Outcrops	Boulder Outcrops
	SV002-INT	None observed	N/A	N/A	No	N/A	Boulder Outcrops	Boulder Outcrops
	SV003-INT	Trace Wood Chips; Scattered Particle Grain	Silt	N/A	No	No	Boulder	Boulder Outcrops
	SV005-INT	Scattered Wood Chips	Silt	Yes	No	Yes	N/A	Boulder Outcrops; Sloping Mudflats
	SV006-INT	None observed	N/A	N/A	N/A	N/A	Boulder	Sloping Mudflats
	SV007-INT	Scattered Wood Chips; Scattered Particle Grain	Silt	Yes	Yes	Yes	Vegetated	Boulder Outcrops
	SV008-INT	Trace Wood Chips	Silt	Yes	Yes	No	Boulder Outcrops	Sloping Mudflats

NOTES:
N/A = not applicable

Prepared by: KC/MM 6/29/2017
Checked by: KM 6/29/2017

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TABLE 3

SPRING 2016 SAMPLING RESULTS - WOOD WASTE OBSERVATIONS

Penobscot River Phase III Engineering Study
Penobscot River Estuary, Maine

Reach	Location ID	Wood Waste Present		
		Wood Waste Observed	X[1]	Y[1]
Orrington	SP104-INT	Y	896031.4027	377007.37
	SP103-INT	Y	896894.3258	378195.8898
	SP102-INT	Y	896171.7912	379503.9924
	SP101-INT	Y	896175.5518	380408.0755
	SP100-INT	Y	896334.0563	381016.2255
Winterport	Vis-6	Y	894954.7083	349757.8804
	VIS-003	Y	893895.1031	351588.7639
	VIS-002	Y	894260.9331	351915.3063
	VIS-001	Y	894863.7131	352878.821
	WP3	Y	895413.3441	353594.68
	WP1	Y	897577.3753	354475.238
	WP2	Y	896044.916	355247.1096
Frankfort Flats	Vis-7	Y	897102.364	346548.2057
	Vis 7D	Y	891660.5993	346589.4582
	Vis-8	Y	897623.9323	346746.5747
	FF100 int	Y	895258.2969	347653.1487
	FF200-INT	Y	895466.8303	347710.604
	Vis 6D	Y	892163.1364	348391.7999
	Vis-5	Y	895030.5111	349210.7355
	Vis 5D	Y	892870.5919	349435.0056
Mendall Marsh	MM-108c	N	891285.0444	326194.5794
	MM-107c	N	892145.233	326220.0029
	MM-403C-SUB	N	891129.9931	326497.8312
	MM-203c	N	890567.1271	334801.0629
Bucksport	BU-31	Y	902417.0102	333775.1713
	BU104-SUB	Y	902238.7293	334836.69
	BU103 SUB	N	902500.8457	335251.2645
	BU101 sub	Y	899845.4169	335717.3239
Verona Northeast	EC109-int	Y	916120.6652	317347.897
	Ec110	Y	915783.4596	317892.1467
	Ec111-int	Y	915581.0622	319810.2932
	Ec112-int	Y	915119.6702	322235.9984
	Ec114-int	N	914600.5915	322930.3227
	Ec113-int	N	915121.9191	322928.6234

TABLE 3
SPRING 2016 SAMPLING RESULTS - WOOD WASTE OBSERVATIONS

Penobscot River Phase III Engineering Study
Penobscot River Estuary, Maine

Reach	Location ID	Wood Waste Present		
		Wood Waste Observed	X[1]	Y[1]
Verona Northeast (Cont'd)	Ec107-int	N	912854.4492	323027.2436
	Ec108-int	N	913558.2628	323032.1853
	Ec106-int	N	912569.6967	323615.1159
	Ec105-int	N	913326.4602	323871.4076
	Es104-int	N	913275.9952	324371.0007
	Es103-int	N	912599.4927	324723.2297
	Ec101-int	N	912810.0865	325342.2466
	Ec115-int	N	914582.973	325511.3506
	Ec100-int	N	912708.1366	326027.9328
Orland River	OR100-INT	Y	919175.8094	318836.6123
	OR101-INT	Y	919884.596	320442.0903
	OR102-INT	Y	920595.0754	322649.0832
	OR103- INT	Y	920152.5669	322858.2005
	OR104-INT	Y	920729.4227	323993.8454
	OR108-INT	Y	920715.0909	327923.6666
	OR105-INT	Y	920871.8213	328047.1441
	OR107-INT	N	920925.7537	328655.7719
Verona East	SV002-INT	N	912630.6205	302956.3096
	SV003-INT	N	913965.2778	304173.0794
	SV001-INT	Y	911488.867	304790.1678
	SV004-INT	Y	913447.6182	305417.8748
	SV006-INT	N	916139.66	306972.9847
	SV005-INT	Y	915201.0158	307114.5294
	SV007-INT	Y	916768.8606	307962.5342
	SV008-INT	Y	915856.9136	308282.591

Y = Yes
N = No
[1]XY = Coordinates provided in NAD83 Maine State Plane East US Survey Feet

TABLE 4
MULTI-TEMPERATURE ORGANIC CONTENT SUMMARY

Penobscot River Phase III Engineering Study
Penobscot River Estuary, Maine

Multi-Temp Organic Content (D2974) Data

D2974 OC	At 440°C [%]	At 550°C [%]	At 750°C [%]	550 vs 440	550 vs 750	750 vs 440
BU50THRU52						
C-PRE	8.26	8.81	9.34	106.57%	94.28%	113.04%
C-WCH	39.83	46.63	47.83	117.07%	97.48%	120.09%
C-SED	3.2	3.47	3.95	108.74%	87.88%	123.74%
D	13.48	14.38	14.65	106.71%	98.15%	108.72%
CJ01THRU22						
C-PRE	5.79	7.78	9.38	134.48%	82.96%	162.10%
C-WCH	7.99	9.33	10.53	116.67%	88.61%	131.67%
C-SED	7.71	9.12	9.86	118.30%	92.52%	127.86%
FF_TRAP1+3						
C-PRE	57.26	58.15	59.85	101.55%	97.16%	104.52%
C-WCH	60.2	67.14	67.91	111.53%	98.85%	112.82%
MM57THRU62						
C-PRE	6.72	7.41	8.13	110.26%	91.16%	120.95%
C-WCH	1.84	2.36	2.7	128.07%	87.53%	146.31%
C-SED	10.02	11.05	11.85	110.27%	93.30%	118.19%
MM68THRU71						
C-SED	8.39	8.1	8.37	96.58%	96.79%	99.78%
ON1						
C-PRE	20.7	19.33	19.58	93.35%	98.69%	94.59%
VE_TRAP2+3						
C-PRE	43.76	57.88	62.36	132.26%	92.82%	142.50%
C-WCH	77.7	71.56	72.44	92.10%	98.78%	93.23%
C-SED	35.09	18.04	39.31	51.40%	45.89%	112.02%
VE58THRU60						
C-WCH	18.81	18.93	26.35	100.67%	71.86%	140.10%
C-SED	3.89	11.63	11.73	299.16%	99.19%	301.61%
VN51THRU58						
C-SED	12.96	14.88	15.42	114.78%	96.49%	118.96%
VN67THRU73						
C-PRE	10.07	11.2	11.2	111.22%	100.03%	111.19%
C-WCH	13.75	28.1	27.7	204.38%	101.44%	201.48%
C-SED	10.52	10.65	10.84	101.23%	98.25%	103.03%
Average	20.78	22.43	24.4	120.32%	91.74%	130.80%
Average without max and min	18.97	21.05	23.15	121.30%	91.61%	131.85%
Average without VE_TRAP2+3 WCH	18.19	20.2	22.22	121.60%	91.42%	132.51%

TABLE 4
MULTI-TEMPERATURE ORGANIC CONTENT SUMMARY

Penobscot River Phase III Engineering Study
Penobscot River Estuary, Maine

Descriptive Statistics of Partition Multi-Temp Organic Content Data

D2974 OC	At 440°C [%]			At 550°C [%]			At 750°C [%]		
Partition	C-PRE	C-WCH	C-SED	C-PRE	C-WCH	C-SED	C-PRE	C-WCH	C-SED
Average	21.8	31.45	11.47	24.37	34.86	10.87	25.69	36.49	13.92
Standard Error	7.79	10.84	3.57	8.82	10.39	1.54	9.26	10.24	3.81
Median	10.07	18.81	9.21	11.2	28.1	10.85	11.2	27.7	11.28
Standard Deviation	20.6	28.68	10.09	23.34	27.49	4.37	24.5	27.09	10.77
Sample Variance	424.25	822.55	101.82	544.59	755.74	19.07	600.01	734.1	116.01
Kurtosis	-0.25	-0.95	5.66	-0.98	-1.7	0.71	-0.93	-1.56	5.98
Skewness	1.16	0.76	2.24	1.11	0.33	0.01	1.14	0.25	2.3
Range	51.48	75.85	31.9	50.74	69.2	14.56	54.23	69.74	35.36
Minimum	5.79	1.84	3.2	7.41	2.36	3.47	8.13	2.7	3.95
Maximum	57.26	77.7	35.09	58.15	71.56	18.04	62.36	72.44	39.31
Sum	152.57	220.12	91.79	170.56	244.04	86.96	179.84	255.46	111.33
Count	7	7	8	7	7	8	7	7	8

NOTES:
%= percent
°= degrees Celcius

TABLE 4
MULTI-TEMPERATURE ORGANIC CONTENT SUMMARY (GRAPHED DATA)

Penobscot River Phase III Engineering Study
Penobscot River Estuary, Maine

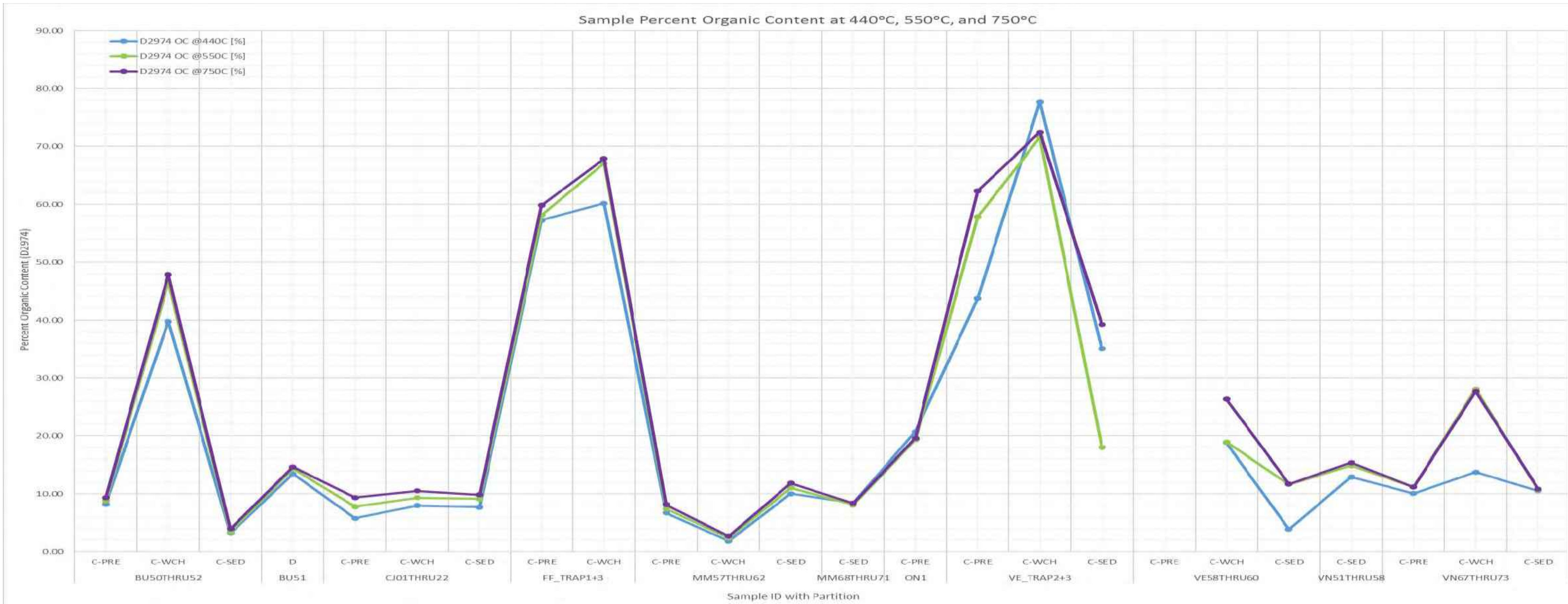

TABLE 5
FALL 2016 SAMPLING RESULTS - CHEMICAL & PHYSICAL ANALYSIS

Penobscot River Phase III Engineering Study
Penobscot River Estuary, Maine

			Eurofins Solids			Eurofins Liquids		Flett	Alpha				Amec Foster Wheeler - Durham											
Reach ID	Location ID	Field Sample ID	Eurofins Solids Total Hg 1631 [ng/g]	Eurofins Solids MeHg 1630 [ng/g]	Eurofins Percent Solids [%]	Eurofins Liquids Total Hg 1631 [ng/L]	Eurofins Liquids MeHg 1630 [ng/L]	Flett Total Hg [ng/g]	Alpha TOC Lloyd-Kahn [%]	Alpha Total Solids 2540G [%]	Alpha Total Hg 7474 [mg/kg]	Alpha Total Hg 7474 Converted [ng/g]	Visual Classifications (USCS)	AmecFW ASTM D422 Grain Size % Gravel	AmecFW ASTM D422 Grain Size % Sand	AmecFW ASTM D422 Grain Size %Fines (passing #200 sieve)	AmecFW ASTM D422 Grain Size %Fines Passing #230	AmecFW ASTM D422 Grain Size with Hydrometer %Silt	AmecFW ASTM D422 Grain Size with Hydrometer %Clay	AmecFW ASTM D854 Density	AmecFW ASTM D2974 OC @TBD	AmecFW ASTM D2974 OC @440C [%]	AmecFW ASTM D2974 OC @550C [%]	AmecFW ASTM D2974 OC @750C [%]
BU	BU_TRAP1+3	BU_TRAP1+3_SIEVE_03112017_FLIQ				13.10																		
BU	BU_TRAP1+3	BU_TRAP1+3_SIEVE_03112017_FLIQ_DUP				12.80																		
BU	BU_TRAP1+3	BU_TRAP1+3_SIEVE_03112017_SED_PRE	314.00	5.18	45.30			404.00	6.03	46.90	0.39	392.00	SC	0.00%	86.90%	13.10%	11.90%	NP	NP	2.535	SHIPPED	NP	34.67%	NP
BU	BU_TRAP1+3	BU_TRAP1+3_SIEVE_03112017_SED_PRE_R2							6.78															
BU	BU_TRAP1+3	BU_TRAP1+3_SIEVE_03112017_SED_PRE_DUP	321.00	4.17	48.20			429.00	3.83	46.10	0.36	361.00												
BU	BU_TRAP1+3	BU_TRAP1+3_SIEVE_03112017_SED_PRE_DUP_R1							4.16															
BU	BU_TRAP1+3	BU_TRAP1+3_SIEVE_03112017_SED_PRE_DUP_R2							3.49															
BU	BU_TRAP1+3	BU_TRAP1+3_SIEVE_03112017_SED_PRE_DUP_R3							3.29															
BU	BU_TRAP1+3	BU_TRAP1+3_SIEVE_03112017_ULIQ				476.00	2.99																	
BU	BU_TRAP1+3	BU_TRAP1+3_SIEVE_03112017_ULIQ_DUP				494.00	7.46																	
BU	BU_TRAP1+3	BU_TRAP1+3_SIEVE_03112017_WCH_R1	270.00	5.06	53.70			347.00	4.09	48.30	0.33	327.00	MH	0.00%	21.80%	78.20%	71.30%	NP	NP	2.471	SHIPPED	NP	19.48%	NP
BU	BU_TRAP1+3	BU_TRAP1+3_SIEVE_03112017_WCH_R2	235.00	5.20	54.70				3.36	48.70	0.34	335.00												
BU	BU_TRAP1+3	BU_TRAP1+3_SIEVE_03112017_WCH_R3	246.00	3.22	55.70				3.26	46.60	0.31	314.00												
BU	BU_TRAP1+3	BU_TRAP1+3_SIEVE_03112017_WCH_R4							4.37		0.34	340.00												
BU	BU_TRAP1+3	BU_TRAP1+3_SIEVE_03122017_SED	384.00	3.76	49.60			427.00	13.80	26.00	1.09	1090.00	SC	0.00%	73.30%	26.70%	24.90%	NP	NP	NP	SHIPPED	NP	16.74%	NP
BU	BU_TRAP1+3	BU_TRAP1+3_SIEVE_03122017_SED_R2							16.60															
BU	BU-50THRU52	BU50THRU52_SIEVE_02102017_SED_PRE	460.00	5.10	48.90				4.28	47.00			ML	0.00%	31.50%	31.50%	60.20%	54.50%	14.00%	NP	SHIPPED	8.26%	8.81%	9.34%
BU	BU-50THRU52	BU50THRU52_SIEVE_02102017_SED_PRE_R2							4.07															
BU	BU-50THRU52	BU50THRU52_SIEVE_02102017_WCH_R1	1710.00	16.60	19.50				25.80	36.10	1.15	1150.00	OL	0.00%	18.30%	81.70%	80.70%	NP	NP	NP	SHIPPED	39.83%	46.63%	47.83%
BU	BU-50THRU52	BU50THRU52_SIEVE_02102017_WCH_R2	1740.00	17.30	17.70				25.60	18.40	2.39	2390.00												
BU	BU-50THRU52	BU50THRU52_SIEVE_02102017_WCH_R3	1820.00	22.70	18.30					18.30	2.32	2320.00												
BU	BU-50THRU52	BU50THRU52_SIEVE_02112017_FLIQ				7.22																		
BU	BU-50THRU52	BU50THRU52_SIEVE_02102017_SED	503.00	5.53	51.40				4.07	49.30			ML	0.00%	37.70%	62.30%	49.90%	56.20%	6.10%	NP	SHIPPED	3.20%	3.47%	3.95%
BU	BU-50THRU52	BU50THRU52_SIEVE_02102017_SED_R2							4.12															
BU	BU-50THRU52	BU50THRU52_SIEVE_02112017_ULIQ				31.60	0.63																	
BU	BU-51	BU51_10182016_SED	704.00	5.46	36.90			845.00	6.39	35.60	1.00	999.00	ML	0.00%	16.80%	83.20%	76.90%	62.50%	20.70%	NP	SHIPPED	13.48%	14.38%	14.65%
BU	BU-51	BU51_10182016_SED_R2							6.05															
BU	BU-51	BU51_10182016_SED_DUP						875.00																
CJ	CJ-01	CJ01_10082016_SED	132.00	1.13	65.40								CL	0.00%	70.30%	27.60%	26.80%	NP	NP	NP	SHIPPED	NP	5.03%	NP
CJ	CJ-01THRU22	CJ01THRU22_SIEVE_02092017_SED_PRE	409.00	3.35	42.10			409.00	2.58	40.60	0.51	511.00	CL	0.10%	16.30%	83.60%	82.60%	36.60%	47.00%	NP	SHIPPED	5.79%	7.78%	9.38%
CJ	CJ-01THRU22	CJ01THRU22_SIEVE_02092017_SED_PRE_R2							2.98															
CJ	CJ-01THRU22	CJ01THRU22_SIEVE_02092017_WCH_R1	118.00	0.96	69.10			114.00	3.37	66.70	0.16	162.00	SM	0.00%	88.00%	12.00%	11.60%	6.30%	5.70%	NP	SHIPPED	7.99%	9.33%	10.53%
CJ	CJ-01THRU22	CJ01THRU22_SIEVE_02092017_WCH_R2	127.00	0.94	69.90				2.72	69.10	0.16	156.00												
CJ	CJ-01THRU22	CJ01THRU22_SIEVE_02092017_WCH_R3	113.00	0.95	69.30					69.40	0.14	144.00												
CJ	CJ-01THRU22	CJ01THRU22_SIEVE_02102017_ULIQ				63.60	1.18																	
CJ	CJ-01THRU22	CJ01THRU22_SIEVE_02112017_FLIQ				5.99																		
CJ	CJ-01THRU22	CJ01THRU22_SIEVE_02112017_SED	461.00	3.28	38.70				3.38	39.70	0.57	570.00	CL	0.00%	3.10%	96.90%	96.00%	36.70%	60.20%	NP		7.71%	9.12%	9.86%
CJ	CJ-01THRU22	CJ01THRU22_SIEVE_02112017_SED_R2							3.38															
CJ	CJ-03	CJ03_10082016_SED	413.00	4.11	39.30								ML	0.00%	2.70%	97.30%	96.70%	NP	NP	NP	SHIPPED	NP	11.22%	NP
CJ	CJ-04	CJ04_10082016_SED	440.00	2.65	42.00								CL	0.00%	21.00%	79.00%	76.10%	NP	NP	NP	SHIPPED	NP	8.92%	NP
CJ	CJ-05	CJ05_10082016_SED	442.00	2.97	39.80								CL	0.00%	19.60%	80.40%	77.80%	NP	NP	NP	SHIPPED	NP	8.63%	NP
CJ	CJ-06	CJ06_10082016_SED	551.00	2.76	37.80								ML	0.00%	1.80%	98.20%	97.50%	NP	NP	NP	SHIPPED	NP	12.29%	NP
CJ	CJ-07	CJ07_10072016_SED	273.00	1.42	39.10								CL	0.50%	11.40%	88.10%	87.40%	NP	NP	NP	SHIPPED	NP	7.45%	NP
CJ	CJ-08	CJ08_10072016_SED	169.00	1.24	32.10								ML	0.00%	10.50%	89.50%	87.50%	NP	NP	NP	SHIPPED	NP	8.78%	NP
CJ	CJ-09	CJ09_10072016_SED	302.00	1.53	34.00				2.77	33.20			CL	0.00%	21.50%	78.50%	76.80%	NP	NP	NP	SHIPPED	NP	8.95%	NP
CJ	CJ-09	CJ09_10072016_SED_R2							2.77															
CJ	CJ-10	CJ10_10072016_SED	456.00	2.82	37.30				3.25	38.00			CL	0.20%	17.20%	82.60%	81.10%	NP	NP	NP	SHIPPED	NP	9.34%	NP
CJ	CJ-10	CJ10_10072016_SED_R2							3.31															
CJ	CJ-11	CJ11_10072016_SED	721.00	4.66	38.20								CL	0.00%	3.00%	97.00%	95.80%	NP	NP	NP	SHIPPED	NP	11.33%	NP
CJ	CJ-12	CJ12_10072016_SED	478.00	2.80	49.90				2.69	50.60			CL	2.80%	30.70%	66.50%	65.20%	NP	NP	NP	SHIPPED	NP	10.12%	NP
CJ	CJ-12	CJ12_10072016_SED_R2							3.21															
CJ	CJ-13	CJ13_10072016_SED	523.00	6.09	36.50				3.44	35.90			CL	0.00%	34.10%	65.90%	61.80%	NP	NP	NP	SHIPPED	NP	15.84%	NP
CJ	CJ-13	CJ13_10072016_SED_R2							3.49															
CJ	CJ-14THRU16	CJ141516_10072016_SED	27.70	0.24	86.10				0.36	81.50			SM	0.00%	88.50%	11.50%	9.30%	NP	NP	NP	SHIPPED	NP	1.79%	NP
CJ	CJ-14THRU16	CJ141516_10072016_SED_R2							0.32															
CJ	CJ-17	CJ17_10082016_SED	416.00	2.72	30.90								CL	0.00%	17.30%	82.70%	77.50%	NP	NP	NP	SHIPPED	NP	11.73%	NP
CJ	CJ-18	CJ18_10082016_SED	472.00	3.48	45.10								CL	0.00%	26.20%	73.80%	70.60%	NP	NP	NP	SHIPPED	NP	10.07%	NP
CJ	CJ-19	CJ19_10072016_SED	316.00	2.33	44.90								CL	0.00%	19.70%	80.30%	78.70%	NP	NP	NP	SHIPPED	NP	8.60%	NP
CJ	CJ-20	CJ20_10072016_SED	465.00	2.65	36.00				3.30	36.80			CL	0.00%	1.20%	98.80%	98.40%	NP	NP	NP	SHIPPED	NP	11.32%	NP
CJ	CJ-20	CJ20_10072016_SED_R2							3.26															

TABLE 5
FALL 2016 SAMPLING RESULTS - CHEMICAL & PHYSICAL ANALYSIS

Penobscot River Phase III Engineering Study
Penobscot River Estuary, Maine

amec foster wheeler

			Eurofins Solids			Eurofins Liquids		Flett	Alpha				Amec Foster Wheeler - Durham											
Reach ID	Location ID	Field Sample ID	Eurofins Solids Total Hg 1631 [ng/g]	Eurofins Solids MeHg 1630 [ng/g]	Eurofins Percent Solids [%]	Eurofins Liquids Total Hg 1631 [ng/L]	Eurofins Liquids MeHg 1630 [ng/L]	Flett Total Hg [ng/g]	Alpha TOC Lloyd-Kahn [%]	Alpha Total Solids 2540G [%]	Alpha Total Hg 7474 [mg/kg]	Alpha Total Hg 7474 Converted [ng/g]	Visual Classifications (USCS)	AmecFW ASTM D422 Grain Size % Gravel	AmecFW ASTM D422 Grain Size % Sand	AmecFW ASTM D422 Grain Size %Fines (passing #200 sieve)	AmecFW ASTM D422 Grain Size %Fines Passing #230	AmecFW ASTM D422 Grain Size with Hydrometer %Silt	AmecFW ASTM D422 Grain Size with Hydrometer %Clay	AmecFW ASTM D854 Density	AmecFW ASTM D2974 OC @TBD	AmecFW ASTM D2974 OC @440C [%]	AmecFW ASTM D2974 OC @550C [%]	AmecFW ASTM D2974 OC @750C [%]
CJ	CJ-21	CJ21_10072016_SED	278.00	1.47	32.40				2.57	33.30			ML	0.00%	1.30%	98.70%	98.30%	NP	NP	NP	SHIPPED	NP	19.38%	NP
CJ	CJ-21	CJ21_10072016_SED_R2							2.62															
CJ	CJ-22	CJ22_10072016_SED	194.00	1.15	56.10				1.90	56.60			SC	0.00%	59.30%	40.70%	39.20%	NP	NP	NP	SHIPPED	NP	8.65%	NP
CJ	CJ-22	CJ22_10072016_SED_R2							2.01															
FF	FF_TRAP1+3	FF_TRAP1+3_SIEVE_03112017_SED_PRE	1330.00	17.40	13.60				25.70	14.30			SM	0.00%	72.10%	27.90%	27.30%	20.40%	7.50%	2.589		57.26%	58.15%	59.85%
FF	FF_TRAP1+3	FF_TRAP1+3_SIEVE_03112017_SED_PRE_R2							23.10															
FF	FF_TRAP1+3	FF_TRAP1+3_SIEVE_03112017_WCH_R1	1530.00	16.60	10.40				25.50	9.73			OL	NP	NP	NP	NP	NP	NP	NP		60.20%	67.14%	67.91%
FF	FF_TRAP1+3	FF_TRAP1+3_SIEVE_03112017_WCH_R2	1280.00	15.80	10.30				27.00															
FF	FF_TRAP1+3	FF_TRAP1+3_SIEVE_03112017_WCH_R3	1240.00	14.40	10.50																			
FF	FF_TRAP1+3	FF_TRAP1+3_SIEVE_03122017_SED	1420.00	14.60	17.80				26.10	17.80			OL	NP	NP	NP	NP	NP	NP	NP	SHIPPED	NP	51.49%	NP
FF	FF_TRAP1+3	FF_TRAP1+3_SIEVE_03122017_SED_R2							26.50	18.20														
FF	FF-51THRU52	FF5152_SIEVE_03082017_SED_PRE	870.00	6.32	36.50			1080.00	6.34	34.70	1.07	1070.00	ML	0.00%	27.40%	72.60%	65.40%	NP	NP	NP	SHIPPED	NP	17.16%	NP
FF	FF-51THRU52	FF5152_SIEVE_03082017_SED_PRE_R2							5.20															
FF	FF-51THRU52	FF5152_SIEVE_03082017_WCH_R1	1070.00	9.29	30.20			1420.00	14.50	31.60	1.55	1550.00	OL	0.00%	43.20%	56.80%	44.90%	NP	NP	NP	SHIPPED	NP	20.46%	NP
FF	FF-51THRU52	FF5152_SIEVE_03082017_WCH_R2	1060.00	9.46	30.20			1310.00	11.00	29.90	1.44	1440.00												
FF	FF-51THRU52	FF5152_SIEVE_03082017_WCH_R3	1300.00	9.60	29.90			1330.00		30.10	1.49	1490.00												
FF	FF-51THRU52	FF5152_SIEVE_03092017_FLIQ				8.62																		
FF	FF-51THRU52	FF5152_SIEVE_03092017_FLIQ_DUP				8.73																		
FF	FF-51THRU52	FF5152_SIEVE_03092017_SED	1220.00	7.28	40.60			1310.00	6.01	40.80	1.13	1130.00	OL	0.00%	22.50%	77.50%	72.10%	NP	NP	2.508	SHIPPED	NP	9.97%	NP
FF	FF-51THRU52	FF5152_SIEVE_03092017_SED_R2							6.03															
FF	FF-51THRU52	FF5152_SIEVE_03092017_SED_DUP	650.00	3.89	53.90			665.00																
FF	FF-51THRU52	FF5152_SIEVE_03092017_ULIQ				452.00	2.19																	
FF	FF-51THRU52	FF5152_SIEVE_03092017_ULIQ_DUP				644.00	2.62																	
FF	FF-53THRU54	FF5354_SIEVE_03122017_SED	776.00	11.40	51.70				5.57	50.30			OL	0.00%	18.20%	81.80%	78.30%	NP	NP	NP	SHIPPED	NP	10.85%	NP
FF	FF-53THRU54	FF5354_SIEVE_03122017_SED_R2							5.35															
FF	FF-53THRU54	FF5354_SIEVE_03122017_WCH_R1	1940.00	13.30	25.60				13.00	46.60			OL	0.00%	47.00%	53.00%	49.20%	NP	NP	NP	SHIPPED	NP	34.67%	NP
FF	FF-53THRU54	FF5354_SIEVE_03122017_WCH_R2	1730.00	17.60	24.50				11.90															
FF	FF-53THRU54	FF5354_SIEVE_03122017_WCH_R3	1740.00	17.80	24.40																			
FF	FF-54	FF54_10192016_SED	929.00	7.26	39.90				4.93	33.60			OL	0.00%	17.60%	82.40%	78.40%	NP	NP	NP	SHIPPED	NP	9.00%	NP
FF	FF-54	FF54_10192016_SED_R2							4.78															
MM	MM-50	MM50_10202016_SED	50.20	0.39	62.10				1.99	63.40			ML	0.00%	5.20%	94.80%	91.20%	NP	NP	NP	SHIPPED	NP	4.68%	NP
MM	MM-50	MM50_10202016_SED_R2							1.91															
MM	MM-50THRU56	MM50THRU56_SIEVE_03092017_SED_PRE	459.00	1.70	48.20			476.00	4.10	47.10	0.50	501.00	OL	0.00%	11.30%	88.70%	86.60%	NP	NP	NP	SHIPPED	NP	9.30%	NP
MM	MM-50THRU56	MM50THRU56_SIEVE_03092017_SED_PRE_R2						447.00	4.07	48.10														
MM	MM-50THRU56	MM50THRU56_SIEVE_03092017_WCH_R1	467.00	2.62	35.40			578.00	5.91	34.50	0.50	504.00	MH	0.00%	34.90%	65.10%	60.60%	NP	NP	NP	SHIPPED	NP	15.44%	NP
MM	MM-50THRU56	MM50THRU56_SIEVE_03092017_WCH_R2	480.00	2.37	35.10				5.97	34.60	0.51	508.00												
MM	MM-50THRU56	MM50THRU56_SIEVE_03092017_WCH_R3	487.00	1.82	35.00				33.80		0.50	501.00												
MM	MM-50THRU56	MM50THRU56_SIEVE_03102017_FLIQ				3.40																		
MM	MM-50THRU56	MM50THRU56_SIEVE_03102017_SED	498.00	1.23	45.00			550.00	4.66	46.90	0.55	552.00	CL	0.00%	8.80%	91.20%	88.80%	NP	NP	NP	SHIPPED	NP	10.28%	NP
MM	MM-50THRU56	MM50THRU56_SIEVE_03102017_SED_R2							4.63															
MM	MM-50THRU56	MM50THRU56_SIEVE_03102017_SED_DUP	366.00	1.65	53.20				2.79	57.40	0.33	332.00												
MM	MM-50THRU56	MM50THRU56_SIEVE_03102017_SED_DUP_R2							2.68															
MM	MM-50THRU56	MM50THRU56_SIEVE_03102017_ULIQ				229.00	0.89																	
MM	MM-51	MM51_10202016_SED	1150.00	2.30	42.60				6.97	43.30			CL	0.00%	13.10%	86.90%	84.20%	NP	NP	NP	SHIPPED	NP	NP	NP
MM	MM-51	MM51_10202016_SED_R2							7.12															
MM	MM-52	MM52_10202016_SED	1260.00	1.46	36.40				6.88	38.90			CL	0.00%	3.80%	96.20%	94.30%	NP	NP	NP	SHIPPED	NP	14.46%	NP
MM	MM-52	MM52_10202016_SED_R2							7.00															
MM	MM-53	MM53_10202016_SED	791.00	5.17	37.10				7.28	37.30			CL	0.00%	33.20%	66.80%	63.30%	NP	NP	NP	SHIPPED	NP	17.43%	NP
MM	MM-53	MM53_10202016_SED_R2							7.10															
MM	MM-54	MM54_10202016_SED	44.60	0.43	70.90				0.37	75.00			CL	0.00%	2.40%	97.60%	94.30%	NP	NP	NP	SHIPPED	NP	2.43%	NP
MM	MM-54	MM54_10202016_SED_R2							0.37															
MM	MM-55	MM55_10202016_SED	873.00	6.71	35.70				6.96	34.60			CL	0.00%	3.10%	96.90%	95.50%	NP	NP	NP	SHIPPED	NP	15.66%	NP
MM	MM-55	MM55_10202016_SED_R2							7.03															
MM	MM-56	MM56_10202012_SED	44.70	0.39	44.60				5.23	46.80			CL	0.00%	3.50%	96.50%	96.10%	NP	NP	NP	SHIPPED	NP	12.02%	NP
MM	MM-56	MM56_10202012_SED_R2							5.02															
MM	MM-57THRU62	MM57THRU62_OL_02112017_ULIQ				145.00	SHIPPED																	
MM	MM-57THRU62	MM57THRU62_SIEVE_02112017_SED_PRE	365.00	5.20	52.60				2.02	53.80	0.47	468.00	ML	0.00%	18.90%	81.10%	78.60%	62.20%	18.90%	NP	SHIPPED	6.72%	7.41%	8.13%
MM	MM-57THRU62	MM57THRU62_SIEVE_02112017_SED_PRE_R2							2.74															
MM	MM-57THRU62	MM57THRU62_SIEVE_02112017_SED_PRE_NEW	698.00	8.11	36.60				5.81	47.00			NP	NP	NP	NP	NP	NP	NP	NP	SHIPPED	NP	16.67%	NP
MM	MM-57THRU62	MM57THRU62_SIEVE_02112017_SED_PRE_NEW_R2							5.64															

TABLE 5
FALL 2016 SAMPLING RESULTS - CHEMICAL & PHYSICAL ANALYSIS

Penobscot River Phase III Engineering Study
Penobscot River Estuary, Maine

			Eurofins Solids			Eurofins Liquids		Flett	Alpha				Amec Foster Wheeler - Durham											
Reach ID	Location ID	Field Sample ID	Eurofins Solids Total Hg 1631 [ng/g]	Eurofins Solids MeHg 1630 [ng/g]	Eurofins Percent Solids [%]	Eurofins Liquids Total Hg 1631 [ng/L]	Eurofins Liquids MeHg 1630 [ng/L]	Flett Total Hg [ng/g]	Alpha TOC Lloyd-Kahn [%]	Alpha Total Solids 2540G [%]	Alpha Total Hg 7474 [mg/kg]	Alpha Total Hg 7474 Converted [ng/g]	Visual Classifications (USCS)	AmecFW ASTM D422 Grain Size % Gravel	AmecFW ASTM D422 Grain Size % Sand	AmecFW ASTM D422 Grain Size %Fines (passing #200 sieve)	AmecFW ASTM D422 Grain Size %Fines Passing #230	AmecFW ASTM D422 Grain Size with Hydrometer %Silt	AmecFW ASTM D422 Grain Size with Hydrometer %Clay	AmecFW ASTM D854 Density	AmecFW ASTM D2974 OC @TBD	AmecFW ASTM D2974 OC @440C [%]	AmecFW ASTM D2974 OC @550C [%]	AmecFW ASTM D2974 OC @750C [%]
MM	MM-57THRU62	MM57THRU62_SIEVE_02122017_WCH_R1	80.30	1.06	72.20				0.98	74.90	0.09	88.00	ML	0.00%	17.20%	82.80%	80.80%	NP	NP	NP		1.84%	2.36%	2.70%
MM	MM-57THRU62	MM57THRU62_SIEVE_02122017_WCH_R2	77.70	0.89	72.80				0.90	74.40	0.08	81.00												
MM	MM-57THRU62	MM57THRU62_SIEVE_02122017_WCH_R3	78.10	1.01	72.50					75.00	0.08	76.00												
MM	MM-57THRU62	MM57THRU62_SIEVE_02142017_FLIQ				3.18																		
MM	MM-57THRU62	MM57THRU62_SIEVE_02142017_ULIQ				65.70	0.62																	
MM	MM-57THRU62	MM57THRU62_SIEVE_02152017_SED	664.00	7.56	41.50				5.74	44.60			ML	0.00%	38.90%	61.10%	58.50%	34.90%	26.20%	NP		10.02%	11.05%	11.85%
MM	MM-57THRU62	MM57THRU62_SIEVE_02152017_SED_R2							5.63															
MM	MM-62	MM62_10202016_SED	685.00	8.69	37.40				5.84	37.80			ML	0.00%	5.80%	94.20%	92.50%	72.90%	21.30%	NP	SHIPPED	NP	11.00%	NP
MM	MM-62	MM62_10202016_SED_R2							5.86															
MM	MM-64	MM64_10202016_SED	424.00	2.17	42.40				5.10	41.90			CL	0.00%	17.30%	82.70%	78.70%	NP	NP	NP	SHIPPED	NP	14.69%	NP
MM	MM-64	MM64_10202016_SED_R2							5.00															
MM	MM-64THRU67	MM64THRU67_SIEVE_03092017_SED_PRE	396.00	3.48	44.60				4.97	45.00			CL	0.00%	14.80%	85.20%	83.20%	NP	NP	NP	SHIPPED	NP	10.92%	NP
MM	MM-64THRU67	MM64THRU67_SIEVE_03092017_SED_PRE_R2							4.97															
MM	MM-64THRU67	MM64THRU67_SIEVE_03092017_WCH_R1	512.00	3.46	27.60				9.63	26.80			OL	NP	NP	NP	NP	NP	NP	NP	SHIPPED	NP	15.69%	NP
MM	MM-64THRU67	MM64THRU67_SIEVE_03092017_WCH_R2	511.00	3.01	27.50				8.77															
MM	MM-64THRU67	MM64THRU67_SIEVE_03092017_WCH_R3	496.00	3.63	27.40																			
MM	MM-64THRU67	MM64THRU67_SIEVE_03102017_FLIQ				4.12																		
MM	MM-64THRU67	MM64THRU67_SIEVE_03102017_SED	357.00	3.51	45.80				4.76	43.90			CL	0.00%	17.40%	82.60%	80.90%	NP	NP	NP	SHIPPED	NP	14.29%	NP
MM	MM-64THRU67	MM64THRU67_SIEVE_03102017_SED_R2							4.86															
MM	MM-64THRU67	MM64THRU67_SIEVE_03102017_ULIQ				330.00	4.28																	
MM	MM-65	MM65_10192016_SED	853.00	12.50	37.40				6.74	38.10			CL	0.00%	9.60%	90.40%	88.00%	NP	NP	NP	SHIPPED	NP	14.91%	NP
MM	MM-65	MM65_10192016_SED_R2							6.80															
MM	MM-66	MM66_10202016_SED	147.00	0.51	59.00				3.40	3.49			CL	0.00%	7.70%	92.30%	89.00%	NP	NP	NP	SHIPPED	NP	24.91%	NP
MM	MM-66	MM66_10202016_SED_R2							3.49															
MM	MM-67	MM67_10202016_SED	235.00	0.52	44.10				6.52	45.10			CL	0.00%	5.30%	94.70%	93.00%	NP	NP	NP	SHIPPED	NP	14.59%	NP
MM	MM-67	MM67_10202016_SED_R2							6.49															
MM	MM-68	MM68_10202016_SED	40.40	0.20	69.70				0.41	71.20			CL	0.00%	5.20%	94.80%	93.80%	NP	NP	NP	SHIPPED	NP	3.27%	NP
MM	MM-68	MM68_10202016_SED_R2							0.45															
MM	MM-68THRU71	MM68THRU71_SIEVE_03092017_WCH_R1	456.00	2.79	20.10			441.00	12.80	20.10	0.41	411.00	OL	NP	NP	NP	NP	NP	NP	NP	SHIPPED	NP	28.66%	NP
MM	MM-68THRU71	MM68THRU71_SIEVE_03092017_WCH_R2	444.00	2.10	21.50				13.20	19.80	0.38	380.00												
MM	MM-68THRU71	MM68THRU71_SIEVE_03092017_WCH_R3	439.00	1.95	21.20					18.80	0.43	431.00												
MM	MM-68THRU71	MM68THRU71_SIEVE_03102017_FLIQ				1.16																		
MM	MM-68THRU71	MM68THRU71_SIEVE_03102017_SED	313.00	0.96	49.30			328.00	3.31	58.50	0.26	255.00	OL	0.00%	2.20%	97.80%	97.50%	41.10%	56.70%	NP		8.39%	8.10%	8.37%
MM	MM-68THRU71	MM68THRU71_SIEVE_03102017_SED_R2							3.30		0.25	248.00												
MM	MM-68THRU71	MM68THRU71_SIEVE_03102017_SED_R3							3.35															
MM	MM-68THRU71	MM68THRU71_SIEVE_03102017_SED_R4							3.38															
MM	MM-68THRU71	MM68THRU71_SIEVE_03102017_SED_DUP	312.00	1.66	47.20				3.50	45.80	0.31	311.00												
MM	MM-68THRU71	MM68THRU71_SIEVE_03102017_SED_DUP_R2							3.56															
MM	MM-68THRU71	MM68THRU71_SIEVE_03102017_ULIQ				47.90	1.27																	
MM	MM-69	MM69_10202016_SED	899.00	4.41	38.30				6.82	38.40			CL	0.00%	20.50%	79.50%	76.80%	NP	NP	NP	SHIPPED	NP	14.94%	NP
MM	MM-69	MM69_10202016_SED_R2							6.88															
MM	MM-70	MM70_10202016_SED	66.40	0.82	27.60				14.20	27.50			CL	0.00%	38.10%	61.90%	60.40%	NP	NP	NP	SHIPPED	NP	26.96%	NP
MM	MM-70	MM70_10202016_SED_R2							13.20															
MM	MM-71	MM71_10202016_SED	1090.00	4.52	39.90				6.48	39.80			CL	0.00%	11.30%	88.70%	87.60%	NP	NP	NP	SHIPPED	NP	13.43%	NP
MM	MM-71	MM71_10202016_SED_R2							7.04															
ON	ON-01	ON1_SIEVE_03102017_SED_PRE	1330.00	16.90	21.60				9.17	21.90			OL	0.00%	7.30%	92.70%	91.80%	57.30%	35.40%	NP		20.70%	19.33%	19.58%
ON	ON-01	ON1_SIEVE_03102017_SED_PRE_R2							8.46															
ON	ON-01	ON1_SIEVE_03102017_SED_PRE_DUP	1150.00	18.90	22.10				9.21	23.20														
ON	ON-01	ON1_SIEVE_03102017_SED_PRE_DUP_R2							8.95															
ON	ON-01	ON1_SIEVE_03102017_WCH_DUP							18.80	16.70														
ON	ON-01	ON1_SIEVE_03102017_WCH_DUP_R2							18.00															
ON	ON-01	ON1_SIEVE_03102017_WCH_R1	2410.00	28.90	17.20				20.20	17.10			OL	0.00%	42.60%	57.40%	54.90%	NP	NP	2.106	SHIPPED	NP	45.00%	NP
ON	ON-01	ON1_SIEVE_03102017_WCH_R2	2210.00	29.50	17.30				19.30															
ON	ON-01	ON1_SIEVE_03102017_WCH_R3	2200.00	28.80	17.40																			
ON	ON-01	ON1_SIEVE_03112017_SED	1030.00	11.80	37.50				7.60	34.20			ML	0.00%	13.90%	86.10%	85.10%	NP	NP	NP	SHIPPED	NP	18.15%	NP
ON	ON-01	ON1_SIEVE_03112017_SED_R2							7.70															
ON	ON-01	ON1_SIEVE_03112017_SED_DUP	1110.00	12.80	37.70				7.67	36.10														
ON	ON-01	ON1_SIEVE_03112017_SED_DUP_R2							7.90															
OR	OR_TRAP1+2	OR_TRAP1+2_SIEVE_03092017_SED_PRE	337.00	3.77	58.90				2.87	50.80			SM	0.20%	63.70%	36.10%	34.40%	NP	NP	NP	SHIPPED	NP	7.53%	NP
OR	OR_TRAP1+2	OR_TRAP1+2_SIEVE_03092017_SED_PRE_R2							2.49															

TABLE 5
FALL 2016 SAMPLING RESULTS - CHEMICAL & PHYSICAL ANALYSIS

Penobscot River Phase III Engineering Study
Penobscot River Estuary, Maine

			Eurofins Solids			Eurofins Liquids		Flett	Alpha				Amec Foster Wheeler - Durham											
Reach ID	Location ID	Field Sample ID	Eurofins Solids Total Hg 1631 [ng/g]	Eurofins Solids MeHg 1630 [ng/g]	Eurofins Percent Solids [%]	Eurofins Liquids Total Hg 1631 [ng/L]	Eurofins Liquids MeHg 1630 [ng/L]	Flett Total Hg [ng/g]	Alpha TOC Lloyd-Kahn [%]	Alpha Total Solids 2540G [%]	Alpha Total Hg 7474 [mg/kg]	Alpha Total Hg 7474 Converted [ng/g]	Visual Classifications (USCS)	AmecFW ASTM D422 Grain Size % Gravel	AmecFW ASTM D422 Grain Size % Sand	AmecFW ASTM D422 Grain Size %Fines (passing #200 sieve)	AmecFW ASTM D422 Grain Size %Fines Passing #230	AmecFW ASTM D422 Grain Size with Hydrometer %Silt	AmecFW ASTM D422 Grain Size with Hydrometer %Clay	AmecFW ASTM D854 Density	AmecFW ASTM D2974 OC @TBD	AmecFW ASTM D2974 OC @440C [%]	AmecFW ASTM D2974 OC @550C [%]	AmecFW ASTM D2974 OC @750C [%]
OR	OR_TRAP1+2	OR_TRAP1+2_SIEVE_03092017_WCH_R1	194.00	1.79	55.00				7.61	28.80			SM	NP	NP	NP	NP	NP	NP	NP	SHIPPED	NP	5.54%	NP
OR	OR_TRAP1+2	OR_TRAP1+2_SIEVE_03092017_WCH_R2	189.00	2.24	56.90				7.51															
OR	OR_TRAP1+2	OR_TRAP1+2_SIEVE_03092017_WCH_R3	212.00	2.42	50.60																			
OR	OR_TRAP1+2	OR_TRAP1+2_SIEVE_03102017_SED	713.00	7.30	47.50				3.90	58.80			SC	0.00%	52.20%	47.80%	44.70%	NP	NP	NP	SHIPPED	NP	10.50%	NP
OR	OR_TRAP1+2	OR_TRAP1+2_SIEVE_03102017_SED_R2							3.42	57.30														
VE	VE_TRAP-01	VE_TRAP1_SIEVE_03112017_SED_PRE	1940.00	15.10	13.00				27.10	11.80			OL	0.00%	60.70%	39.30%	38.80%	NP	NP	NP	SHIPPED	NP	21.75%	NP
VE	VE_TRAP-01	VE_TRAP1_SIEVE_03112017_SED_PRE							26.40															
VE	VE_TRAP2+3	VE_TRAP2+3_SIEVE_03112017_FLIQ				18.80																		
VE	VE_TRAP2+3	VE_TRAP2+3_SIEVE_03112017_SED_PRE	1730.00	13.80	14.30			2070.00	26.80	15.20	1.86	1860.00	SM	0.00%	51.10%	48.90%	48.50%	34.60%	14.30%	NP		43.76%	57.88%	62.36%
VE	VE_TRAP2+3	VE_TRAP2+3_SIEVE_03112017_SED_PRE_R2							29.00															
VE	VE_TRAP2+3	VE_TRAP2+3_SIEVE_03112017_SED_PRE_DUP	1920.00	10.70	14.50			2110.00	23.20	14.30	1.75	1750.00												
VE	VE_TRAP2+3	VE_TRAP2+3_SIEVE_03112017_SED_PRE_DUP_R2							24.50															
VE	VE_TRAP2+3	VE_TRAP2+3_SIEVE_03112017_ULIQ				569.00	1.11																	
VE	VE_TRAP2+3	VE_TRAP2+3_SIEVE_03112017_WCH_R1	2050.00	11.70	10.30			2330.00	37.20	11.60	2.61	2610.00	OL	0.00%	81.70%	18.30%	16.80%	NP	NP	NP		77.70%	71.56%	72.44%
VE	VE_TRAP2+3	VE_TRAP2+3_SIEVE_03112017_WCH_R2	2210.00	17.30	10.20				36.90	10.50	2.66	2660.00												
VE	VE_TRAP2+3	VE_TRAP2+3_SIEVE_03112017_WCH_R3	2100.00	13.10	10.10					10.10	2.64	2640.00												
VE	VE_TRAP2+3	VE_TRAP2+3_SIEVE_03122017_SED	1720.00	10.50	21.40			1710.00	19.40	21.40	2.01	2010.00	ML	0.00%	8.10%	91.90%	91.00%	63.10%	28.80%	NP		35.09%	18.04%	39.31%
VE	VE_TRAP2+3	VE_TRAP2+3_SIEVE_03122017_SED_R2							19.50															
VE	VE-50	VE50_10152016_SED	1590.00	7.00	41.00				6.72	40.50			CL	0.00%	30.90%	69.10%	66.00%	NP	NP	NP	SHIPPED	NP	17.57%	NP
VE	VE-50	VE50_10152016_SED_R2							7.22															
VE	VE-505253	VE505253_SIEVE_03072017_SED_PRE	478.00	4.24	61.30				2.62	60.20														
VE	VE-505253	VE505253_SIEVE_03072017_SED_PRE_R2							3.53															
VE	VE-505253	VE505253_SIEVE_03072017_WCH_R1	267.00	2.47	60.30				3.05	59.30			SP	0.00%	98.30%	1.70%	1.40%	NP	NP	NP	SHIPPED	NP	6.58%	NP
VE	VE-505253	VE505253_SIEVE_03072017_WCH_R2	286.00	2.28	58.10				3.06															
VE	VE-505253	VE505253_SIEVE_03072017_WCH_R3	269.00	2.57	57.80																			
VE	VE-505253	VE505253_SIEVE_03082017_SED	971.00	7.65	46.20				7.83	37.50			OL	0.00%	28.40%	71.60%	67.20%	NP	NP	NP	SHIPPED	NP	7.44%	NP
VE	VE-505253	VE505253_SIEVE_03082017_SED_R2							8.26															
VE	VE-52	VE52_10152016_SED	88.70	1.11	78.80				1.03	79.20			SC	4.30%	88.50%	7.20%	6.40%	NP	NP	NP	SHIPPED	NP	1.84%	NP
VE	VE-52	VE52_10152016_SED_R2							0.98															
VE	VE-53	VE53_10152016_SED	893.00	13.60	41.40				4.75	43.40			CL	0.00%	26.30%	73.70%	70.50%	NP	NP	NP	SHIPPED	NP	17.83%	NP
VE	VE-53	VE53_10152016_SED_R2							5.20															
VE	VE-58	VE58_10152016_SED	467.00	3.10	54.20				3.96	50.70			OL	0.00%	11.90%	88.10%	85.40%	64.20%	23.90%	NP	SHIPPED	NP	10.39%	NP
VE	VE-58	VE58_10152016_SED_R2							5.26															
VE	VE-58THRU60	VE58THRU60_SIEVE_03072017_SED_PRE	803.00	5.40	45.80				5.90	43.80														
VE	VE-58THRU60	VE58THRU60_SIEVE_03072017_SED_PRE_R2							6.38															
VE	VE-58THRU60	VE58THRU60_SIEVE_03072017_WCH_R1	1250.00	9.92	24.70				8.15	28.70			OL	0.00%	40.50%	59.50%	56.70%	NP	NP	2.502		18.81%	18.93%	26.35%
VE	VE-58THRU60	VE58THRU60_SIEVE_03072017_WCH_R2	1190.00	9.15	25.00				8.84															
VE	VE-58THRU60	VE58THRU60_SIEVE_03072017_WCH_R3	1240.00	9.97	24.40																			
VE	VE-58THRU60	VE58THRU60_SIEVE_03082017_FLIQ				7.19																		
VE	VE-58THRU60	VE58THRU60_SIEVE_03082017_SED	704.00	2.81	46.00				5.82	44.70			OL	0.00%	30.00%	70.00%	66.00%	43.20%	26.80%	NP		3.89%	11.63%	11.73%
VE	VE-58THRU60	VE58THRU60_SIEVE_03082017_SED_R2							6.13															
VE	VE-58THRU60	VE58THRU60_SIEVE_03082017_ULIQ				586.00	4.26																	
VE	VE-59	VE59_10152016_SED	852.00	9.93	41.30				9.79	48.90			MH	0.00%	35.10%	64.90%	62.10%	NP	NP	NP	SHIPPED	NP	16.45%	NP
VE	VE-59	VE59_10152016_SED_R2							9.85															
VE	VE-60	VE60_10152016_SED	1230.00	14.60	29.90				13.00	29.10			CL	0.00%	35.10%	64.90%	64.20%	NP	NP	NP	SHIPPED	NP	27.32%	NP
VE	VE-60	VE60_10152016_SED_R2							13.50															
VN	VN-51	VN51_10172016_SED	1130.00	10.80	35.30								CL	0.70%	29.20%	70.10%	66.80%	NP	NP	NP	SHIPPED	NP	15.64%	NP
VN	VN-51THRU58	VN51THRU58_SIEVE_02082017_SED_PRE	790.00	5.21	43.70								ML	0.00%	16.80%	83.20%	76.90%	62.50%	20.70%	NP	SHIPPED	NP	NP	NP
VN	VN-51THRU58	VN51THRU58_SIEVE_02082017_WCH_R1	1370.00	6.26	25.20				16.70	21.00	2.12	2120.00	OL	NP	NP	NP	NP	NP	NP	NP	SHIPPED	NP	37.07%	NP
VN	VN-51THRU58	VN51THRU58_SIEVE_02082017_WCH_R2	1350.00	6.24	24.90				17.40	19.40	2.34	2340.00												
VN	VN-51THRU58	VN51THRU58_SIEVE_02082017_WCH_R3	1340.00	7.29	25.30					21.40	2.17	2170.00												
VN	VN-51THRU58	VN51THRU58_SIEVE_02092017_SED	832.00	4.97	39.10				5.46	35.70	1.03	1030.00	CL	0.00%	3.10%	96.90%	96.00%	NP	NP	NP	SHIPPED	12.96%	14.88%	15.42%
VN	VN-51THRU58	VN51THRU58_SIEVE_02092017_SED_R2							5.48															
VN	VN-51THRU58	VN51THRU58_SIEVE_02092017_ULIQ				117.00	0.28																	
VN	VN-51THRU58	VN51THRU58_SIEVE_02102017_FLIQ				3.98																		
VN	VN-52	VN52_10172016_SED	230.00	1.20	41.80								CL	2.40%	26.90%	70.70%	66.10%	NP	NP	NP	SHIPPED	NP	14.91%	NP
VN	VN-53	VN53_10172016_SED	111.00	0.73	50.90								CL	0.00%	10.70%	89.30%	85.70%	NP	NP	NP	SHIPPED	NP	9.03%	NP
VN	VN-54	VN54_10172016_SED	844.00	9.53	41.70								CL	0.00%	21.20%	78.80%	74.90%	NP	NP	NP	SHIPPED	NP	11.73%	NP
VN	VN-55	VN55_10172016_SED	1150.00	8.59	37.60								CL	0.00%	12.40%	87.60%	84.80%	NP	NP	NP	SHIPPED	NP	16.44%	NP
VN	VN-56	VN56_10172016_SED	1170.00	7.81	40.40								CL	0.00%	8.10%	91.90%	90.30%	NP	NP	NP	SHIPPED	NP	14.46%	NP

TABLE 5
FALL 2016 SAMPLING RESULTS - CHEMICAL & PHYSICAL ANALYSIS

Penobscot River Phase III Engineering Study
Penobscot River Estuary, Maine

			Eurofins Solids			Eurofins Liquids		Flett	Alpha				Amec Foster Wheeler - Durham											
Reach ID	Location ID	Field Sample ID	Eurofins Solids Total Hg 1631 [ng/g]	Eurofins Solids MeHg 1630 [ng/g]	Eurofins Percent Solids [%]	Eurofins Liquids Total Hg 1631 [ng/L]	Eurofins Liquids MeHg 1630 [ng/L]	Flett Total Hg [ng/g]	Alpha TOC Lloyd-Kahn [%]	Alpha Total Soilds 2540G [%]	Alpha Total Hg 7474 [mg/kg]	Alpha Total Hg 7474 Converted [ng/g]	Visual Classifications (USCS)	AmecFW ASTM D422 Grain Size % Gravel	AmecFW ASTM D422 Grain Size % Sand	AmecFW ASTM D422 Grain Size %Fines (passing #200 sieve)	AmecFW ASTM D422 Grain Size %Fines Passing #230	AmecFW ASTM D422 Grain Size with Hydrometer %Silt	AmecFW ASTM D422 Grain Size with Hydrometer %Clay	AmecFW ASTM D854 Density	AmecFW ASTM D2974 OC @TBD	AmecFW ASTM D2974 OC @440C [%]	AmecFW ASTM D2974 OC @550C [%]	AmecFW ASTM D2974 OC @750C [%]
VN	VN-57	VN57_10152016_SED	479.00	3.37	44.00								CL	0.00%	3.80%	96.20%	83.10%	NP	NP	NP	SHIPPED	NP	12.27%	NP
VN	VN-58	VN58_10152016_SED	415.00	5.38	43.70								CL	22.50%	43.10%	34.40%	32.00%	NP	NP	NP	SHIPPED	NP	13.55%	NP
VN	VN-67	VN67_10172016_SED	738.00	11.40	50.00								CL	0.00%	40.70%	59.30%	50.80%	NP	NP	NP	SHIPPED	NP	10.88%	NP
VN	VN-67THRU73	VN67THRU73_SIEVE_03072017_SED_PRE	723.00	4.46	43.10				4.61	42.40			OL	0.00%	17.00%	83.00%	79.80%	56.10%	26.90%	2.571		10.07%	11.20%	11.20%
VN	VN-67THRU73	VN67THRU73_SIEVE_03072017_SED_PRE_R2							4.93															
VN	VN-67THRU73	VN67THRU73_SIEVE_03072017_WCH_R1	1130.00	12.80	30.70				11.40	31.80			OL	0.00%	40.70%	59.30%	55.00%	NP	NP	2.467		13.75%	28.10%	27.70%
VN	VN-67THRU73	VN67THRU73_SIEVE_03072017_WCH_R2	1090.00	13.60	30.40				10.60															
VN	VN-67THRU73	VN67THRU73_SIEVE_03072017_WCH_R3	1130.00	15.60	30.00																			
VN	VN-67THRU73	VN67THRU73_SIEVE_03082017_FLIQ				4.73																		
VN	VN-67THRU73	VN67THRU73_SIEVE_03082017_FLIQ_DUP				4.78																		
VN	VN-67THRU73	VN67THRU73_SIEVE_03082017_SED	826.00	4.17	43.40				5.58	43.80			OL	0.00%	6.10%	93.90%	91.90%	63.20%	30.70%	2.566		10.52%	10.65%	10.84%
VN	VN-67THRU73	VN67THRU73_SIEVE_03082017_SED_R2							5.63															
VN	VN-67THRU73	VN67THRU73_SIEVE_03082017_ULIQ				236.00	4.32																	
VN	VN-67THRU73	VN67THRU73_SIEVE_03082017_ULIQ_DUP				548.00	2.38																	
VN	VN-68	VN68_10172016_SED	760.00	8.95	30.60								CL	0.00%	23.70%	76.30%	72.70%	NP	NP	NP	SHIPPED	NP	17.20%	NP
VN	VN-69	VN69_10172016_SED	376.00	0.83	52.10								CL	1.00%	21.30%	77.70%	73.60%	NP	NP	NP	SHIPPED	NP	9.02%	NP
VN	VN-70	VN70_10172016_SED	667.00	10.30	42.50								CL	0.00%	25.00%	75.00%	71.00%	NP	NP	NP	SHIPPED	NP	11.56%	NP
VN	VN-71	VN71_10172016_SED	1140.00	9.65	36.30								CL	0.00%	16.60%	83.40%	79.60%	NP	NP	NP	SHIPPED	NP	13.78%	NP
VN	VN-72	VN72_10152016_SED	964.00	10.60	42.00								CL	0.00%	17.90%	82.10%	78.40%	NP	NP	NP	SHIPPED	NP	16.07%	NP
VN	VN-73	VN73_10182016_SED	735.00	8.52	38.90								CL	0.00%	16.00%	83.90%	79.80%	NP	NP	NP	SHIPPED	NP	12.12%	NP
VN	VN-74	VN74_10172016_SED	594.00	4.24	51.60				4.42	53.00														
VN	VN-74	VN74_10172016_SED_R2							5.27															
VN	VN-74THRU80	VN74THRU80_SIEVE_03072017_SED_PRE	1150.00	4.71	42.90				6.27	40.70	1.12	1120.00	ML	0.00%	8.30%	91.70%	90.50%	61.60%	30.10%	NP	SHIPPED	NP	10.51%	NP
VN	VN-74THRU80	VN74THRU80_SIEVE_03072017_SED_PRE_R2							6.15															
VN	VN-74THRU80	VN74THRU80_SIEVE_03072017_WCH_R1	1630.00	7.19	26.80				11.50	23.20	2.19	2190.00	OL	0.00%	61.00%	39.00%	35.70%	NP	NP	NP	SHIPPED	NP	49.79%	NP
VN	VN-74THRU80	VN74THRU80_SIEVE_03072017_WCH_R2	1370.00	7.06	26.80				10.30	23.30	2.10	2100.00												
VN	VN-74THRU80	VN74THRU80_SIEVE_03072017_WCH_R3	1400.00	6.32	26.30					24.80	2.04	2040.00												
VN	VN-74THRU80	VN74THRU80_SIEVE_03082017_FLIQ				6.74																		
VN	VN-74THRU80	VN74THRU80_SIEVE_03082017_SED	962.00	4.56	46.60			1120.00	5.60	49.00	1.09	1090.00	CL	0.00%	4.30%	95.70%	94.80%	NP	NP	NP	SHIPPED	NP	8.69%	NP
VN	VN-74THRU80	VN74THRU80_SIEVE_03082017_SED_R2							5.71															
VN	VN-74THRU80	VN74THRU80_SIEVE_03082017_ULIQ				969.00																		
VN	VN-75	VN75_10172016_SED	1240.00	6.24	41.80				7.24	40.40														
VN	VN-75	VN75_10172016_SED_R2							7.01															
VN	VN-76	VN76_10172016_SED	616.00	5.62	36.00				7.05	34.20														
VN	VN-76	VN76_10172016_SED_R2							7.08															
VN	VN-77	VN77_10172016_SED	590.00	4.70	46.20				3.81	62.70														
VN	VN-77	VN77_10172016_SED_R2							3.74															
VN	VN-78	VN78_10172016_SED	1100.00	4.32	46.10				5.86	44.50														
VN	VN-78	VN78_10172016_SED_R2							5.74															
VN	VN-79	VN79_10172016_SED	897.00	3.77	41.40				6.49	40.10														
VN	VN-79	VN79_10172016_SED_R2							6.52															
VN	VN-80	VN80_10172016_SED	1500.00	5.95	38.90				6.90	37.90			CL	0.00%	33.20%	66.80%	64.40%	NP	NP	NP	SHIPPED	NP	17.49%	NP
VN	VN-80	VN80_10172016_SED_R2							7.27															
NOTES:			0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	96.00	0.00	0.00	0.00

Sum of ULIQs: 0.00
Sum of FLIQs: 0.00

Sum of 440, 550, 750, TBD, and density: 96.00

NP=not performed
mg/kg= milligrams per kilogram
ng/g=nanograms per gram
ng/L=nanograms per liter
%=percent

Reach ID Definitions:

BU = Bucksport	MM = Mendall Marsh
CJ = Cape Jellison	ON = Orrington
FF = Frankfurt Flats	OR = Orland River
	VE = Verona East
	VN = Verona North

Prepared by: KC/MM 6/29/2017
Checked by: KM 6/29/2017