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General Electric Company

Albany, New York

Phase 2 Final Design Report for 2012

Hudson River PCBs Superfund Site

Revised May 2012

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Superfund Site

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1. Introduction

This Phase 2 Final Design Report for 2012 (2012 FDR) presents the Final Design for the second year of Phase 2 dredging to be conducted in 2012 (referred to herein as Phase 2, Year 2), as part of the remedy selected by the United States Environmental Protection Agency (EPA) to address polychlorinated biphenyls (PCBs) in sediments of the Upper Hudson River (the river) located in New York State. This report includes the design for dredging associated with Certification Unit (CU) 26 through CU49, located in the main stem of the river. The final design for the remainder of Phase 2 will be submitted to EPA in separate design reports or design addenda.

This 2012 FDR has been prepared on behalf of the General Electric Company (GE) pursuant to an Administrative Order on Consent for Hudson River Remedial Design and Cost Recovery (RD AOC), effective August 18, 2003 (Index No. CERCLA-02-2003-2027; EPA/GE 2003). It has been prepared in accordance with the Remedial Design Work Plan (RD Work Plan; Blasland, Bouck & Lee, Inc. [BBL] 2003a), which is an attachment to the RD AOC, and builds upon GE's Preliminary Design Report (PDR; BBL 2004a), the Phase 2 Intermediate Design Report (Phase 2 IDR; ARCADIS 2008), and the Phase 2 Final Design Report for 2011 (2011 FDR; ARCADIS 2011).

This report has also been developed to be consistent with the Remedial Action Consent Decree between GE and the United States (Civil Action No. 1:05-CV-1270) for the Hudson River PCBs Superfund Site (RA CD; EPA/GE 2005), entered into on November 2, 2006 and modified on March 20, 2009 and August 15, 2011. The CD includes, as Appendix B, a Statement of Work for Remedial Action and Operations, Maintenance, and Monitoring (SOW), which sets forth general requirements for the remedial action and includes several attachments specifying requirements for various aspects of the remedial action. In December 2010, EPA issued revised versions of the SOW (EPA 2010c) and its attachments for Phase 2. The revised attachments to the SOW include the following:

- Attachment A: Critical Phase 2 Design Elements (Phase 2 CDE)
- Attachment B: Phase 2 Remedial Action Monitoring Scope (Phase 2 RAM Scope)
- Attachment C: Phase 2 Performance Standards Compliance Plan Scope (Phase 2 PSCP Scope)

- Attachment D: Phase 2 Remedial Action Community Health and Safety Program Scope (Phase 2 CHASP Scope)

- Attachment E: Operation, Maintenance, and Monitoring Scope for Phase 2 of the Remedial Action (Phase 2 OMM Scope)

- Attachment F: Certification Unit Completion Approval/Certification Forms for Phase 2 (Phase 2 CU Certification Forms)

This 2012 FDR constitutes a revised version of the 2012 FDR initially submitted on February 14, 2012 and reflects comments from and discussions with EPA regarding that initial version. Like that prior version, this 2012 FDR also addresses EPA's January 2012 comments on draft drawings and technical specifications (Divisions 2 through 13) for Phase 2, Year 2 dredging operations that were submitted by GE to EPA on November 28, 2011.

1.1 Project Setting

The Hudson River is located in eastern New York State and flows approximately 300 miles in a generally southerly direction from its source, Lake Tear-of-the-Clouds in the Adirondack Mountains, to the Battery located in New York City at the tip of Manhattan Island. The Superfund Record of Decision (ROD) issued by EPA for this site (EPA 2002) calls for a remedial action to remove and dispose of PCB-containing sediments meeting certain criteria for mass per unit area (MPA) of PCBs and surface PCB concentrations or characteristics from the Upper Hudson River (i.e., the section of river upstream of the Federal Dam at Troy, New York).

EPA defined three sections of the Upper Hudson River for the sediment remediation activities outlined in the ROD. The location of each river section is identified on Figure 1-1 and described below.

- *River Section 1*: Former location of the Fort Edward Dam to the Thompson Island Dam (TID; from river mile [RM] 194.8 to RM 188.5; approximately 6.3 river miles)

- *River Section 2*: TID to the Northumberland Dam (from RM 188.5 to RM 183.4; approximately 5.1 river miles)

- *River Section 3*: Northumberland Dam to the Federal Dam at Troy (from RM 183.4 to RM 153.9; approximately 29.5 river miles)

The environmental history of the Hudson River PCBs Site has been well documented in previous reports and was used in developing certain aspects of this 2012 FDR. While this information is not repeated here, information sources are referenced throughout the Phase 2 IDR, the 2011 FDR, and this 2012 FDR.

1.2 Remedial Action Summary

The remedy selected by EPA is described in the ROD. The remedial action components are described in further detail in the RD Work Plan, PDR, and RA CD, including their attachments.

The ROD calls for the removal of sediment from the Upper Hudson River based on criteria that vary by river section. In particular, the ROD specifies the following criteria:

- In River Section 1, removal of sediments based primarily on an MPA of 3 grams per square meter (g/m^2) or greater of PCBs with three or more chlorine atoms (Tri+ PCBs)

- In River Section 2, removal of sediments based primarily on an MPA of 10 g/m^2 or greater Tri+ PCBs

- In River Section 3, removal of selected sediments with high concentrations of PCBs and high erosion potential (New York State Department of Environmental Conservation [NYSDEC] Hot Spots 36, 37, and the southern portion of 39)

The sediment removal criteria, including criteria based on surface sediment concentrations of Tri+ PCBs, were further specified in EPA's decision in the dispute resolution proceeding on GE's initial Phase 1 Dredge Area Delineation Report (Phase 1 DAD Report; QEA 2005), which EPA issued in July 2004 (EPA 2004c).

The ROD calls for dredging in two distinct phases – Phase 1 and Phase 2. The Final Design for Phase 1 was described in the Phase 1 Final Design Report (Phase 1 FDR; BBL 2006a), which was approved by EPA on January 25, 2008 (EPA 2008). Phase 1 dredging operations were conducted in 2009 and included dredging, processing, and disposal of approximately 286,000 cubic yards (cy) of sediment from CU01 through CU08, CU17, and CU18 in River Section 1.

Following the completion of Phase 1 dredging, EPA and GE each prepared a Phase 1 Evaluation Report, which included respective evaluations of the Phase 1 dredging operations with regard to the Hudson River Engineering Performance Standards (EPS; EPA 2004a). The Phase 1 Evaluation Reports (Anchor QEA and ARCADIS 2010; EPA 2010a) summarized the key activities completed during Phase 1, evaluated the experience gained during Phase 1 relative to the EPS, and recommended changes to the EPS. An independent Peer Review Panel reviewed and evaluated the Phase 1 Evaluation Reports and supporting information provided by GE and EPA during and subsequent to public Peer Review Panel meetings that took place in February and May 2010. In September 2010, the Peer Review Panel issued a Peer Review of the Phase 1 Dredging Final Report (Bridges et al. 2010) summarizing the independent peer review of the Phase 1 Evaluation Reports issued by EPA and GE and supporting information, and recommending changes to the EPS for Phase 2.

On December 17, 2010, EPA issued its decision regarding the requirements for Phase 2, outlined in the following documents:

- Revised Engineering Performance Standards for Phase 2 (Phase 2 EPS; EPA 2010b)

- Technical Memorandum – Quality of Life Performance Standards – Phase 2 Changes (Ecology & Environment [E&E] 2010)

- Revised SOW (Appendix B to the RA CD) and its attachments (EPA 2010c)

On December 31, 2010, GE formally notified EPA of GE's decision to implement Phase 2 of the project under the RA CD.

The Final Design for the first year of Phase 2 dredging (referred to herein as Phase 2, Year 1) was described in the 2011 FDR, which was approved by EPA on April 26, 2011 (EPA 2011). Phase 2 Year 1 dredging operations were conducted in 2011 in accordance with the 2011 FDR and the Remedial Action Work Plan for Phase 2 Dredging and Facility Operations in 2011 (2011 RAWP; Parsons 2011a) and its appendices. These operations included dredging, processing, and off-site disposal of approximately 363,000 cy of sediment from CU09 through CU16 and CU19 through CU25.

1.3 Phase 2 Performance Standards

EPA developed performance standards for both the engineering aspects of the project and quality of life considerations. The Phase 2 EPS cover resuspension during dredging and other in-river activities (Resuspension Standard), concentrations of residual PCBs in surface sediments after dredging (Residuals Standard), and productivity (Productivity Standard) (EPA 2010b). In addition, EPA modified its previously issued Substantive Water Quality Requirements (WQ Requirements; EPA 2005, 2006a) relating to in-river releases of constituents not subject to the EPS and relating to discharges from the sediment processing facility to adjacent surface waters. Those modifications for Phase 2 were set forth in Section 6 of the Phase 2 EPS document, the Phase 2 RAM Scope, and the Phase 2 PSCP Scope. The Quality of Life Performance Standards (QoLPS) address project-related impacts on air quality, odor, noise, lighting, and river navigation (EPA 2004b). Revisions to the QoLPS for Phase 2 are detailed in a technical memorandum (E&E 2010), as well as several of the scopes attached to the revised SOW. The Phase 2 EPS, WQ Requirements, and QoLPS (collectively referred to herein as the performance standards) are summarized in Section 2.1.

1.4 Adaptive Management Process

Section 7 of the revised SOW provides that EPA will apply an adaptive management approach to the review and, as appropriate, modification of the Phase 2 EPS; the QoLPS; the Phase 2 remedial design; and monitoring, operational, and other planning documents. The stated objectives of the adaptive management approach are to maintain or improve the efficiency of the project; mitigate short-term impacts as needed; and help ensure that the ROD remedy is successfully completed, that the work remains consistent with the ROD, and that the targets and objectives set forth in the ROD are met.

GE and EPA met to review potential adaptive management changes that may be appropriate for Phase 2, Year 2. On January 20, 2012, EPA provided GE with a list of Required Adaptive Responses and Design Improvements for Phase 2 Year 2 (EPA 2012; referred to hereafter as EPA's adaptive responses). Sections 2 and 3 of this 2012 FDR include references to the items from EPA's adaptive responses that are applicable to and have been incorporated into the final design presented in the report for Phase 2, Year 2. Changes listed by EPA relating to operational issues, monitoring issues, and/or the habitat construction design are or will be addressed in other documents.

1.5 Completion of Phase 2 Design

This 2012 FDR includes design information, drawings, and specifications for dredging operations associated with Phase 2, Year 2. The design presented in this 2012 FDR applies to CU26 through CU49, although dredging operations may not be completed in all of these CUs during 2012 (see Section 3.1.1). The final design for dredging associated with the remainder of Phase 2 will be submitted to EPA in separate design reports or design addenda.

During 2012, the processing facility operations and rail yard operations will be conducted under the same contracts that were issued for the work implemented during 2011. Consequently, specifications for processing facility operations and rail yard operations, which were issued with the approved 2011 FDR, are not presented with this design report.

In addition, this design report does not include design information, drawings, or specifications related to habitat construction operations associated with the Phase 2, Year 2 dredge areas. Habitat construction design will depend on the dredging operations completed in these areas, and the habitat construction work for these areas will be targeted for 2013. The habitat construction design associated with the Phase 2, Year 2 dredge areas will be provided to EPA in a separate design report or design addendum.

This 2012 FDR references, where appropriate, other documents that have been or will be submitted for Phase 2, Year 2. These documents include:

- The Remedial Action Work Plan for Phase 2 Dredging and Facility Operations in 2012 (2012 RAWP; Parsons 2012a), and several appendices thereto – namely:
    - Appendix A: Phase 2 Dredging Construction Quality Control/Quality Assurance Plan for 2012 (2012 DQAP; Parsons 2012b) (which largely incorporates by reference the provisions of the Phase 2 Dredging Construction Quality Control/Quality Assurance Plan for 2011 [2011 DQAP; Parsons 2011b]);
    - Appendix B: Phase 2 Facility Operations and Maintenance Plan for 2012 (2012 Facility O&M Plan; Parsons 2012c);

  - Appendix C: Phase 2 Transportation and Disposal Plan for 2012 (2012 TDP; Parsons 2012f) (to be provided at a later date);
  - Appendix D: Phase 2 Performance Standards Compliance Plan for 2012 (2012 PSCP; GE 2012);
  - Appendix E: Phase 2 Property Access Plan for 2012 (2012 PAP; Parsons 2012d); and
  - Appendix F: Phase 2 Community Health and Safety Plan for 2012 (2012 CHASP; Parsons 2012g).

- Phase 2 Remedial Action Monitoring Quality Assurance Project Plan (Phase 2 RAM QAPP; Anchor QEA 2012)

1.6 Report Organization

The 2012 FDR is organized into the sections shown in Table 1-1 below.

Table 1-1 2012 FDR Organization

Section	Description
1 – Introduction	Summarizes the remedial action selected by EPA, describes the project setting, discusses the purpose and scope of this 2012 FDR, and discusses completion of the Phase 2 design.
2 – Basis of Design and Supporting Information – Phase 2, Year 2	Provides the basis of design for the second year of Phase 2 (2012), and summarizes information used to support the design for Phase 2, Year 2.
3 – Design Summary – Phase 2, Year 2	Summarizes the design, including dredging, dredged material transportation, resuspension control, on-river water treatment, sediment and water processing, transportation and disposal of processed sediment, backfilling/capping, and quality of life evaluations.
4 – Contract Summary and Remedial Action Implementation – Phase 2, Year 2	Summarizes the contracts to be established for implementing the dredging operations and related activities for Phase 2, Year 2, describes the remedial action submittals for that work, and summarizes the schedule for implementation of the remedial action activities in Phase 2, Year 2.
5 – References	Provides a list of references cited in this 2012 FDR.
6 – Acronyms and Abbreviations	Provides the definitions of acronyms and abbreviations used in this 2012 FDR.
Tables	Provides the tables referenced in this 2012 FDR.
Figures	Provides the figures referenced in this 2012 FDR.
Attachments	Provides the attachments referenced in this 2012 FDR.
Appendices	Provides the drawings and specifications for the dredging operations and on-river water treatment contracts for Phase 2, Year 2 activities.

2. Basis of Design and Supporting Information – Phase 2, Year 2

This section summarizes the Phase 2 performance requirements, discusses design support activities (e.g., engineering data), and summarizes the basis of design for the dredge areas targeted for Phase 2, Year 2.

2.1 Phase 2 Performance Requirements

Performance requirements guide the design presented in this 2012 FDR and provide a foundation for the basis of design. The performance requirements listed here include elements from the ROD, Phase 2 EPS, WQ Requirements, and QoLPS.

2.1.1 Record of Decision Requirements

The following major project elements are excerpted in summary form from the ROD and provide a basis for the Phase 2 Design:

- Removal of sediments based primarily on an MPA of 3 g/m^2 Tri+ PCBs or greater from River Section 1;

- Removal of sediments based primarily on an MPA of 10 g/m^2 Tri+ PCBs or greater from River Section 2 *(not applicable to Phase 2, Year 2);*

- Removal of selected sediments with high concentrations of PCBs and high erosional potential (NYSDEC Hot Spots 36, 37, and the southern portion of 39) from River Section 3 *(not applicable to Phase 2, Year 2);*

- Dredging of the navigation channel, as necessary, to implement the remedy and to avoid hindering canal traffic during implementation;

- Removal of PCB-containing sediments within areas targeted for remediation, with anticipated residuals of approximately 1 milligram per kilogram (mg/kg) Tri+ PCBs (prior to backfilling);

- Design to achieve the EPS and QoLPS developed by EPA;

- Backfill of dredged areas with approximately 1 foot of clean material to isolate residual PCBs and to expedite habitat recovery, where appropriate;

- Use of environmental dredging techniques to minimize and control resuspension of sediments during dredging;

- Transport of dredged sediments via barge or pipeline to sediment processing/transfer facilities for dewatering and, as needed, stabilization; and

- Rail and/or barge transport of dewatered, stabilized sediments to an appropriate licensed offsite landfill for disposal.

In addition to these requirements, EPA's July 2004 decision in the dispute resolution proceeding on GE's initial Phase 1 DAD Report (EPA 2004c) specified sediment removal criteria based on surface sediment Tri+ PCB concentrations of 10 mg/kg in River Section 1 and 30 mg/kg in River Sections 2 and 3 (the latter of which does not apply to Phase 2, Year 2).

Further, in the ROD, EPA identified a number of federal and state environmental laws and regulations as Applicable or Relevant and Appropriate Requirements (ARARs) (see Tables 14-1 through 14-3 of the ROD; EPA 2002). These ARARs, which apply to onsite activities, fall into three broad categories – chemical-specific, location-specific, and action-specific requirements – based on the manner in which they are applied at a site. (These ARARs are also addressed in Paragraph 7 of the RA CD.) The Phase 1 IDR and Phase 1 FDR provided information on how the substantive requirements of the ARARs were incorporated into the Phase 1 Design. The Phase 2 IDR described how the substantive requirements would be incorporated into the Phase 2 Design. These substantive requirements have been considered in the Phase 2, Year 2 Specifications and Drawings included in Appendices 1 through 3.

2.1.2 Engineering Performance Standards

As previously noted, the Phase 2 EPS consist of a Resuspension Performance Standard, a Residuals Performance Standard, and a Productivity Performance Standard. These standards are set out in a document titled Hudson River PCBs Superfund Site – Revised Engineering Performance Standards for Phase 2, issued by EPA in December 2010 (EPA 2010b). The Phase 2 EPS, as they apply to the Phase 2 Design, are briefly summarized below.

2.1.2.1 Project-Related Resuspension

The Phase 2 Resuspension Performance Standard specifies three types of criteria:

1. An Advisory Level applicable to total suspended solids (TSS) concentrations at near-field monitoring stations;

2. A Control Level applicable to the net loads (i.e., loads above baseline) of Tri+ PCBs at designated far-field monitoring stations; and

3. A Control Level applicable to the concentrations of total PCBs (TPCBs) at far-field monitoring stations.

A detailed description of the Phase 2 Resuspension Performance Standard, as applicable to Phase 2, Year 2, is presented in the 2012 PSCP and is not repeated in this report. That description takes into account EPA's adaptive responses described in Section 1.4 (EPA 2012).

For purposes of this 2012 FDR, it should be noted that the use of the Thompson Island automated far-field station as a means of assessing achievement of both the water PCB concentration and PCB load components of the Resuspension Performance Standard will be discontinued in 2012, and will be replaced by the Lock 5 automated far-field station (at Schuylerville). Given that change, the design analysis for the resuspension control element includes resuspension modeling to predict PCB concentrations and loads at Thompson Island, followed by extrapolation of those levels to calculate PCB levels at the Lock 5 and Waterford stations using factors based on data collected in 2011, as discussed in Section 2.2.11. The PCB concentrations and net loads predicted at the latter far-field monitoring stations are then compared with the Resuspension Standard Control Levels specified in the 2012 PSCP. The elements that form the basis of design for resuspension control and the results of the resuspension design analysis are discussed further in Sections 2.3.3 and 3.3.

2.1.2.2 Dredging Residuals

The Phase 2 EPS (pp. 2-5 and 3-1) state that the primary objectives of the Phase 2 Residuals Standard are to:

- Achieve the design depth of contamination (DoC) elevation, also known as the elevation of contamination (EoC).

- Achieve an average residual concentration of no more than 1 mg/kg Tri+ PCBs, with subsequent backfilling, while minimizing the need for capping.

- Identify areas where capping or a second dredging pass is needed because the residual sediment arithmetic average Tri+ PCBs concentration is greater than 1 mg/kg in the top 6 inches.

- Identify areas where a second dredge pass is needed because PCB inventory remains at depth or Tri+ PCB concentrations of greater than or equal to 27 mg/kg are present in surface sediments after the first pass is complete.

- Identify areas where post-dredging TPCB concentrations are greater than or equal to 500 mg/kg so these can be removed in an additional dredging pass (or a third pass if necessary).

- Discern and map the extent to which the EoC has been accurately identified and interpolated as a basis to review the success of GE's application of the adjusted terrain model and other pertinent data to meet the capping limits set forth in the Phase 2 EPS.

- Provide data to evaluate the success of the remediation in attaining the true EoC and to provide a basis for adjusting the design dredge elevation in subsequent CUs or CU sub-units to minimize the number of passes and amount of non-target sediment removed.

A detailed description of the Phase 2 Residual Performance Standard, as applicable to Phase 2, Year 2, is presented in the 2012 PSCP and is not repeated in this report. That description takes into account EPA's adaptive responses described in Section 1.4 (EPA 2012). Further, GE's approach to meeting the limits on the amount of capping that will be allowed under the Phase 2 Residuals Standard is described in the 2011 FDR and the 2012 PSCP and not repeated in this report.

2.1.2.3 Dredging Productivity

The Phase 2 Productivity Performance Standard establishes seasonal production targets for Phase 2 of the dredging project and guides progress to promote its timely completion. The Phase 2 EPS states that the Productivity Standard is subordinate to the Resuspension and Residuals Performance Standards. This standard does not specify a definite timeframe for the completion of Phase 2.

Under the Phase 2 EPS, the target for productivity in Phase 2 is a volume of 350,000 cy per year, which applies to the volume of sediments dredged, processed, and shipped off site in that year. The Phase 2 Productivity Standard also states that:

- Stabilization of shorelines and backfilling or capping, as appropriate, of areas dredged during a dredging season in Phase 2 must be completed by the end of the work season.

- All dredged materials must be processed and shipped for disposal by the end of each calendar year rather than being stockpiled for disposal the following dredging season. This standard is subject to an extension in the event that delays attributable to disposal facility(ies) and/or rail carriers prevent such offsite shipments by the end of the calendar year.

In addition, based on the EPA's adaptive responses described in Section 1.4, the following criteria will apply to the sediment temporarily staged at the sediment processing facility:

- Loading of material into railcars will begin no later than 3 weeks following the start of dredging operations.

- The volume of sediment that can be staged at the processing facility at any given time will be limited to 130,000 cy unless otherwise approved by EPA.

- The height of sediment piles temporarily staged in the coarse material staging areas shall not exceed 30 feet.

2.1.3 Quality of Life Performance Standards

The Phase 2 QoLPS consist of performance standards applicable to air quality, odor, noise, lighting, and navigation. These standards are described in the Hudson River PCBs Superfund Site Quality of Life Performance Standards, issued by EPA in May 2004 (EPA 2004b), as modified by a memorandum titled Quality of Life Performance Standards – Phase 2 Changes, issued by EPA in December 2010 (E&E 2010), and the revised SOW attachments identified in Section 1. (These standards, as so modified, are collectively cited as Phase 2 QoLPS.)

2.1.3.1 Air Quality Performance Standard

The Air Quality Performance Standard includes numerical standards for PCBs in ambient air and for opacity (the reduction of visibility from air emissions), and requires an analysis of achievement of the National Ambient Air Quality Standards (NAAQS) for several other air pollutants. A description of each of these aspects of the air quality standard is presented in the 2011 FDR and the 2012 PSCP and is not repeated in this report. An evaluation of the potential impacts of PCB air emissions from the expanded coarse material staging areas at the processing facility (described below) on the PCB air quality standard is provided in Section 2.3.6. Section 3.9.2 describes an analysis performed to evaluate the achievement of the NAAQS. Preventative or contingency measures included in the design to meet the Air Quality Performance Standard are also summarized in Section 3.9.2.

2.1.3.2 Odor Performance Standard

The primary odor of concern during dredging and sediment processing activities would result from hydrogen sulfide (H_2S) released by decaying plants and other organic material found in the river sediments. PCBs are odorless. The QoLPS for odor is described in the 2011 FDR and the 2012 PSCP and is not repeated in this report.

2.1.3.3 Noise Performance Standard

EPA established the Noise Performance Standard to limit the effects of project noise on the community. EPA categorized project activities that have the potential to generate noise as either short-term or long-term. In terms of the anticipated activities for the Phase 2, Year 2 season, short-term activities include dredging, on-river water treatment, operation of the Work Support Marina, and backfilling/capping; and long-term activities include sediment processing and rail yard operations at the sediment processing facility (which will last throughout the year). Numerical noise criteria established for dredging-related activities based on type of receptor (residential and commercial) and time of day (day and night) are described in the 2011 FDR and the 2012 PSCP and are not repeated in this report. A discussion of the potential impact of new equipment that will be installed and used at the processing facility in 2012 on noise levels is provided in Section 2.3.6. Actions included in the design to meet the Noise Performance Standard are summarized in Section 3.9.4.

2.1.3.4 Lighting Performance Standard

To meet EPA's Productivity Performance Standard, in-river dredging and on-shore processing are expected to be performed 24 hours a day, 6 days a week, which will unavoidably require night-time lighting of work areas to protect worker safety and sufficiently illuminate equipment, transport routes, and operational areas. The QoLPS establish numerical standards for lighting, which vary depending on the type of area affected. As noted in the QoLPS, the Lighting Performance Standard will not supersede worker safety lighting requirements established by the Occupational Safety and Health Administration (OSHA; EPA 2004b). A description of the lighting standards is presented in the 2011 FDR and the 2012 PSCP and is not repeated in this report. A discussion of the potential impact of new equipment that will be installed and used at the processing facility in 2012 on light levels is provided in Section 2.3.6. Actions included in the design to meet the Lighting Performance Standard are summarized in Section 3.9.5.

2.1.3.5 Navigation Performance Standard

EPA developed the QoLPS for navigation, in consultation with the NYS Canal Corporation, to regulate project-related vessel movement on the river. The Navigation Performance Standard requires that project vessels comply with the applicable provisions of federal and state navigation laws, rules, and regulations. In addition, it contains a number of other requirements relating to the relationship between project-related vessel traffic and non-project vessels. These requirements are described in the 2011 FDR and the 2012 PSCP and are not repeated in this report. Actions included in the design to meet the Navigation Performance Standard are summarized in Section 3.9.6.

2.1.3.6 Monitoring and Reporting

Routine monitoring, reporting requirements, and action levels for additional monitoring under the Phase 2 QoLPS for air quality, odor, noise, and lighting are described in the Phase 2 RAM QAPP (Anchor QEA 2012). Specific actions that will be taken to address exceedance of the criteria in the Phase 2 QoLPS and associated reporting requirements are discussed in the 2012 PSCP (GE 2012).

2.1.4 Water Quality Requirements

The Phase 2 WQ Requirements consist of:

1. Requirements relating to in-river releases of constituents not subject to the EPS; and

2. Substantive requirements for discharges from the sediment processing facility to adjacent surface waters (i.e., the Champlain Canal and Bond Creek).

These WQ Requirements are set forth in the Substantive Requirements Applicable to the Release of Constituents not Subject to Performance Standards, Substantive Requirements of State Pollutant Discharge Elimination System Permit for Potential Discharges to Champlain Canal (land cut above Lock 7), and Substantive Requirements of State Pollutant Discharges to the Hudson River, all of which were provided by EPA to GE on January 7, 2005 (EPA 2005) – as well as in a set of substantive requirements provided by EPA to GE on September 14, 2006 relating to stormwater discharges to Bond Creek (EPA 2006a). Modifications to the first of the above-listed documents are set forth in Section 6 of the Phase 2 EPS and the revised SOW attachments identified in Section 1. (The above-cited documents, as so modified, are collectively cited as Phase 2 Substantive WQ Requirements.)

The WQ Requirements for in-river releases are divided into acute WQ standards, which apply to near-field monitoring stations, and health-based standards, which apply to far-field monitoring stations. These standards are described in the 2011 FDR and the 2012 PSCP and are not repeated in this report. Based on the monitoring results from Phase 1 and Phase 2, Year 1, and in accordance with EPA's adaptive responses (EPA 2012), monitoring for the metals subject to these standards has been modified for 2012. Specifically, metals monitoring will be conducted weekly at the near-field station for a 4-week period at the beginning of dredging, and if those results show concentrations substantially below the applicable standards, routine metals monitoring will be discontinued for the remainder of the 2012 season. The monitoring requirements under the standards for in-river releases of non-PCB constituents are described in the Phase 2 RAM QAPP, and the actions that will be taken in the event of an exceedance of these standards are described in the 2012 PSCP.

The substantive requirements for discharges from the sediment processing facility to adjacent surface waters (i.e., the Champlain Canal and Bond Creek) are also described in the 2011 FDR and the 2012 PSCP and are not repeated in this report. Monitoring requirements and action levels for additional monitoring for these discharges are described in the Phase 2 RAM QAPP. Specific actions that will be taken to address exceedances of the applicable discharge limitations and reporting requirements are described in the 2012 PSCP.[1]

2.1.5 Turbidity Requirements

In addition to the Phase 2 WQ Requirements described in Section 2.1.4, the New York water quality regulations contain a standard of no increase in turbidity that would "cause a substantial visible contrast to natural conditions" (6 New York Codes, Rules, and Regulations [NYCRR] § 703.2). Although this standard was not included in the WQ Requirements issued by EPA for this project, GE and EPA (after consultation with the NYSDEC) have agreed that this standard will be satisfied through application of a turbidity limit of 350 nephelometric turbidity units (NTU), as a 24-hour average measured at the near-field transect stations 300 meters (m) downstream of dredging operations. However, a turbidity measurement above that level will be considered an exceedance of the standard only if a second 24-hour turbidity measurement confirms the initial 350 NTU exceedance. This will be considered an Advisory Level, and responses to a confirmed exceedance of that level will be the same as those for the TSS Advisory Level defined in Section 2.1.2.1.

2.2 Summary of Phase 2 Design Support Activities

This section summarizes design support activities (e.g., design studies, design analyses, modeling) conducted to support the remedial design for Phase 2, Year 2. Additional details of the design support activities were presented in Section 2.2 of the Phase 2 IDR.

2.2.1 Sediment Sampling and Analysis Program and Dredge Area Delineation

The physical and chemical characteristics of the river sediment samples collected in the Sediment Sampling and Analysis Program (SSAP) and Supplemental Engineering

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[1] Monitoring requirements and associated action levels for discharges from the on-river water treatment system (if used) will be specified in an addendum to the Phase 2 RAM QAPP and/or the 2012 PSCP.

Data Collection (SEDC) Programs were used to develop the design for Phase 2, Year 2. The SSAP was initiated in October 2002, pursuant to the Administrative Order on Consent for Hudson River Sediment Sampling (Sediment Sampling AOC), effective July 26, 2002 (Index No. CERCLA-02-2002-2023; EPA/GE 2002). Additional sediment sampling for dredge area delineation was performed under the RD AOC, and was included under the SEDC program (see Section 2.2.2). The results of the sampling activities were used to develop the Phase 1 DAD Report (QEA 2005) and the Phase 2 DAD Report (QEA 2007). The DAD Reports identified the dredge areas and quantified the volume and PCB mass targeted for removal. The delineation was based on criteria set by EPA for each river section.

Sediment sampling was conducted in 2010 as part of the 2010 SEDC program. This sampling included locations within CU26 through CU30, as discussed in the 2010 Supplemental Engineering Design Collection Data Summary Report (Anchor QEA and ESI 2011a) and Attachment D of the 2011 FDR.

Between June and October 2011, supplemental sediment sampling was conducted in CU31 through CU49 to provide additional data for delineating the DoC. (Sampling in 2011 was also conducted in CU50 through CU70, which are not included in the design for Phase 2, Year 2.) The 2011 sediment sampling activities were conducted in accordance with the Supplemental Engineering Data Collection Work Plan for Sediment Sampling in Certification Units 31-70 (2011 SEDC Work Plan for Sediment Sampling; Anchor QEA and ESI 2011b), and the results from the 2011 SEDC sampling program are summarized in the 2011 Supplemental Engineering Data Collection Data Summary Report (Anchor QEA and ESI 2012). The data generated from the 2011 sediment sampling program were incorporated into the development of dredge prisms, along with previously collected data to establish the DoC and an associated EoC (described in Sections 2.3.1.4 and 3.1.5). The data generated from the 2011 sediment sampling program were also used to revise the estimate of PCB mass to be removed in CU31 through CU49.

The PCB mass used for design was developed based on methods outlined in the Phase 2 EPS, with the modifications described in the Phase 2 Performance Standards Compliance Plan for 2011 (2011 PSCP; GE 2011), as approved by EPA. These mass estimates are used as part of the simulation of resuspension during dredging (see Attachment B of this document). The same methods will be used to calculate the mass removed, for the purposes of calculating percent release and assessing attainment of the Resuspension Performance Standard load criteria in the field in 2012.

The results of the sampling activities performed under the SSAP and SEDC programs are included in a database provided to EPA.

2.2.2 Supplemental Engineering Data Collection Program

SEDC activities have been performed to support development of the remedial design. The objectives of the SEDC Program are to fill engineering data gaps identified during evaluation of the SSAP data. SEDC activities have included infrastructure documentation, debris/obstruction surveys, select geophysical studies (e.g., magnetometer, multi-beam bathymetry, acoustic Doppler [river velocity]), geotechnical studies in certain areas (e.g., test borings, cone penetrometer), and collection of sediment cores to enhance the dredge area delineation (as described in Section 2.2.1).

SEDC activities performed and the findings of these activities are summarized in the following documents:

- Year 2 SEDC Interim Data Summary Report (Year 2 IDSR; BBL 2005a)
- Supplemental Engineering Data Collection Work Plan Addendum No. 1 (SEDC Work Plan Addendum No. 1; BBL 2005b)
- Supplemental Engineering Data Collection Work Plan Addendum No. 2 (SEDC Work Plan Addendum No. 2; BBL 2005c)
- Supplemental Engineering Data Collection Work Plan (SEDC Work Plan; BBL 2004b)
- Summary of Supplemental Investigations Performed in 2003 to Address EPA Comments on the Year 1 Data Summary Report: Side-Scan Sonar Groundtruth, Processing, Additional Fine-Grained Areas and Areas Lacking Side-Scan Coverage (QEA 2003)
- Phase 2 Supplemental Engineering Data Collection Work Plan (BBL 2006b)
- Phase 2 Supplemental Engineering Data Collection Work Plan Addendum No. 1 (ARCADIS BBL 2006)
- Phase 2 Supplemental Engineering Data Collection Data Summary Report (ARCADIS BBL 2007)

- Phase 2 Supplemental Engineering Data Collection Data Summary Report Addendum (Attachment B to the Phase 2 IDR; ARCADIS 2008)

2.2.3 Baseline Monitoring Program

The Baseline Monitoring Program, as described in the Baseline Monitoring Program QAPP (QEA 2004), was conducted from 2004 through May 2009. The Baseline Monitoring Program water column monitoring data were used to establish baseline conditions for river water quality to which future remedial action monitoring results can be compared.

To estimate the PCB mass flux passing the far-field monitoring station due to project activities, it is necessary to subtract the baseline mass flux from the total flux. The Baseline Monitoring Program was designed and implemented to provide baseline mass flux estimates for each month of the dredge season.

2.2.4 Treatability Studies

Treatability studies were conducted in 2004 and 2005 as part of the design process. Results of these studies were included in the Phase 1 IDR and Phase 1 FDR. No additional treatability studies were performed to support the design for Phase 2, Year 2.

2.2.5 Sediment Processing Facility Site Selection and Construction

EPA conducted a study to select the site for construction of the sediment processing facility (EPA 2004d). An approximate 110-acre parcel just east of the Village of Fort Edward and adjacent to the Champlain Canal above Lock 7 was selected (the Energy Park/Longe/NYS Canal Corporation site). The processing facility was constructed prior to Phase 1 dredging and was used during Phase 1 and Phase 2, Year 1 to process dredged material and load the processed materials into railcars for off-site transportation and disposal. The processing facility will also be used to dewater and process dredged sediment during Phase 2, Year 2.

2.2.6 Habitat Delineation and Habitat Assessment

Habitat delineation and habitat assessment were conducted in support of the project design to document the nature and distribution of habitats potentially affected by remediation, and to identify reference habitat locations that represent the distribution of existing conditions and that are not likely to be affected by remediation. The habitat delineation and habitat assessment information relating to Phase 2 areas was presented in the Habitat Delineation Report (HD Report; BBL & Exponent 2006) and the Habitat Assessment Report for Phase 2 Areas (Phase 2 HA Report; Anchor QEA 2009).

For the Phase 2 design, the Upper Hudson River was delineated into four different habitat types – unconsolidated river bottom, aquatic vegetation bed (submerged aquatic vegetation [SAV]), shoreline, and riverine fringing wetlands (RFW), as described in the Habitat Delineation and Assessment Work Plan (HDA Work Plan; BBL 2003b), which is an attachment to the RD AOC. Data were collected in Phase 2 areas from all four habitat types and used to develop the habitat construction design. Detailed habitat maps are included in the HD Report. The results of the detailed habitat assessment of Phase 2 areas are presented and discussed in the Phase 2 HA Report, which was approved by EPA on July 24, 2009.

Subsequent to the approval of the Phase 2 HA Report, formal delineations were conducted for wetlands in Phase 2 areas. The wetland delineation sheets, figures depicting the wetland locations, and brief descriptions of each wetland were provided in the Wetland Delineation Report for Phase 2 Areas (Anchor QEA 2011b). For areas to be dredged in Phase 2, Year 2 and other RFW areas in River Section 1, those wetland boundaries will be used to identify the extent of wetland areas to be constructed following dredging. For River Sections 2 and 3, wetland boundaries will be re-checked in the year before dredging is planned for those areas.

2.2.7 Biological Assessment and Concurrence by Resource Agencies

In January 2006, E&E completed the Final Biological Assessment (BA; E&E 2006) on behalf of EPA. The primary purpose of the Final BA (developed after a review of comments received on a May 2005 draft) was to evaluate the potential direct, indirect, and cumulative impacts of the remedial action on two threatened and endangered species identified as potentially present in the project area – the bald eagle and the shortnose sturgeon – and where deemed appropriate to specify conservation measures designed to minimize impacts on those species. The overall conclusion of the Final BA was that the project “may affect, but is not likely to adversely affect,” the bald eagle or the shortnose sturgeon. A detailed description of the BA is presented in the Phase 2 IDR and is not repeated in this report. Specific components of the BA relevant to Phase 2, Year 2 are summarized below.

As summarized in the Phase 2 IDR, the relevant resource agencies (United States Fish and Wildlife Service [USFWS] and National Oceanic and Atmospheric Administration [NOAA] Fisheries) issued letters to EPA in January 2006 and December 2005, respectively, concurring with the Final BA's conclusion that the remedial action is not likely to adversely affect either species.

The bald eagle was removed from the federal list of threatened and endangered species on August 9, 2007. However, bald eagles are still protected by the Migratory Bird Treaty Act (MBTA; 16 U.S.C. 703-712, Ch. 128; July 13, 1918: 40 Stat. 755), the Bald and Golden Eagle Protection Act (BGEPA; 16 U.S.C. 668-668d), and the New York State Environmental Conservation Law. On November 10, 2009, new rules under the BGEPA (74 Fed. Reg. 46836) went into effect. The bald eagle conservation measures described in the Final BA anticipated delisting and reflect recommendations in the National Bald Eagle Management Guidelines (USFWS 2007) and substantive requirements under BGEPA. Therefore, the bald eagle conservation measures specified in the Final BA will be implemented during Phase 2, Year 2.

As discussed in the Final BA, the bald eagle population that uses the northern segment of the Phase 2 dredge areas consists primarily of wintering eagles, although two nesting pairs were identified in 2005 near Lock 1 and the Green Island area. In addition, a bald eagle pair was observed building a new nest on the western shore just north of Coveville in March 2011. However, based on the subsequent observations, the eagles abandoned the nest in July 2011. In October 2011, what was believed to be the same bald eagle pair was observed constructing a new nest on the eastern shore approximately 0.25 mile north of the Coveville location. Additional observations of these and additional locations within the Phase 2 dredge areas are planned in winter and spring 2012 and will be coordinated with EPA.

The shortnose sturgeon is not present in any of the Phase 2 dredge areas. The shortnose sturgeon was only retained in the Final BA because it was found to occur in proximity to one of the final two sites then being considered for the sediment processing facility construction (the OG Real Estate site). However, the processing facility was constructed at a different location (the Energy Park site in Fort Edward, New York), and that facility will be used for Phase 2, Year 2. Hence, there will be no impact on the shortnose sturgeon as a result of the project work.[2]

2.2.8 Phase 2 Cultural and Archaeological Resources Assessment Program

Archaeological resource assessments have been completed to document terrestrial and underwater archaeological resources that could be affected during the Phase 2, Year 2 dredging operations. These are summarized in the following documents:

- Archaeological Resources Assessment Report for Phase 2 Dredge Areas (Phase 2 ARA Report; URS 2008)

- Terrestrial Archaeological Survey and Evaluation for the Thompson Island Pool Section of the Phase 2 Dredge Areas (URS 2011a)

- Underwater Remote Sensing Report for Certification Units 19 Through 30 in Phase 2 Remediation of the Hudson River PCBs Superfund Site (URS 2011b)

- Underwater Remote Sensing Report for Certification Units 31 Through 70 in Phase 2 Remediation of the Hudson River PCBs Superfund Site (URS 2011c)

- End-of-Field Summary: Underwater Archaeological Survey - Evaluation of Remote Sensing Targets for Certification Units 31 Through 58 in Phase 2 Remediation of the Hudson River PCBs Superfund Site (URS 2011d)

In the areas targeted for dredging during Phase 2, Year 2, two areas have been designated as sensitive archaeological areas based on archaeological resource assessments that have identified riverbank areas or in-river areas containing one or more significant archaeological resources. The following sensitive archaeological areas have been identified in the area targeted for dredging during Phase 2, Year 2:

- *Belle Island (Three Sisters) Training Dike – Sensitive Archaeological River Bottom:* located in CU31 through CU33 in the vicinity of the Three Sisters Islands; and

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[2] The same is true regarding the Atlantic sturgeon, which was listed as an endangered species in February 2012.

- *Champlain Canal Pilings Complex – Sensitive Archaeological Shoreline and River Bottom*: located along the east bank of the river adjacent to most of the shoreline of CU40 through CU42.

Detailed information regarding these sensitive archaeological areas is presented in the following documents:

- Underwater Remote Sensing Report for Certification Units 31 Through 70 in Phase 2 Remediation of the Hudson River PCBs Superfund Site (URS 2011c); and

- End-of-Field Summary: Underwater Archaeological Survey – Evaluation of Remote Sensing Targets for Certification Units 31 Through 58 in Phase 2 Remediation of the Hudson River PCBs Superfund Site (URS 2011d).

These sensitive archaeological areas are identified on Figures 2-1 and 2-2. The potential effects of dredging and backfilling/capping on these resources have been evaluated during the remedial design, and measures to protect these resources are described in Sections 2.3.1.11 and 3.1.4.[3]

2.2.9 Phase 2 River Hydrodynamic Analysis

Analyses were conducted to characterize river hydrodynamics within the Phase 2 dredge areas to define the likely range of in-river conditions that would be encountered in the project area. The hydrodynamic analyses were conducted using a two-dimensional, vertically averaged hydrodynamic model, which accounts for spatial variations in bathymetry and river velocity as well as temporal changes in river flow rate. This model, its calibration, and its validation are summarized in Attachment D to the Phase 2 IDR.

The hydrodynamic model and the predicted river flow characteristics (both velocity and flow volume) were used in the evaluation and design of dredging, resuspension, and backfilling/capping. Changes to the bathymetric conditions due to dredging and backfill will not significantly affect velocities predicted by the hydrodynamic model.

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[3] In addition to these resources, another sensitive archaeological area has been identified in the vicinity of the CUs included in this 2012 FDR – namely, the Griffin Island training dike located north of Griffin Island in CU46 and CU47. However, the dredging activities to be conducted in those CUs will leave that training dike in place, and specific measures to protect this resource are not necessary.

2.2.10 Phase 2 Logistics Modeling

A logistics model was developed to simulate dredging, backfilling/capping, and dredged material transport to the sediment processing facility and ultimately to the disposal facility. The model has been used to provide insights into various design scenarios. This model is a design tool that has been, and will continue to be, updated year-to-year as appropriate. Specific attributes offered by the logistics model include:

- The model can be used to analyze various scenarios such as the effect of adding or removing project resources (e.g., dredges, barges, tugs, train sets, offloading equipment).

- The model can be used to support adjustments to the proposed design, including the evaluation and development of dredge plans and resource allocations.

- The model can be used as a tool for communications and predicting time-based logistical information, such as the movement of project vessels and the impact of recreational traffic on interactions with locks, accumulation of processed material, and rail movement to the disposal site.

- The model allows for a variety of conditions and constraints to be simulated to assess potential bottlenecks in the dredging, dredged material transport, and restoration (i.e., backfilling and capping) activities.

The Phase 2 logistics model was initially presented in the Phase 2 IDR (ARCADIS 2008). Based on lessons learned during implementation of Phase 1 in 2009, the logistics model was updated as described in Attachment A of the 2011 FDR. In conjunction with the design for Phase 2, Year 2, the logistics model presented in the 2011 FDR (ARCADIS 2011) was further modified to provide additional features intended to improve the simulation of dredging and backfilling/capping operations by the model.

Attachment A presents a summary of the additional features incorporated into the logistics model after the 2011 FDR was issued; a description of the modeling inputs/assumptions and resulting output for Phase 2, Year 2 modeling simulations; and a summary of how the model was used to support the Phase 2, Year 2 design.

2.2.11 Resuspension Modeling

For the final design for Phase 2, Year 2 operations, the effects of sediment and PCB releases during dredging operations on water column PCB concentrations and net PCB loads (i.e., loads over background) were estimated using the screening level model described in Phase 1 IDR (ARCADIS 2008), modified to parameterize dredge release rates based on the experiences and data collected from 2 years of dredging. In the screening-level model, PCB net loads (i.e., the amount of PCB released as a result of dredging) are described by two factors: a) the PCB mass removed; and b) the “effective” dredge release rate. The PCB mass removed is determined by the sediment removal rate (i.e., dredge rate) and PCB concentrations in the sediments. The effective dredge release rate specifies the fraction of dredged PCBs that enter the water column and are transported to the closest far-field monitoring station.

The model has been used to predict PCB concentrations and loads at Thompson Island. Because compliance with the PCB concentration and load criteria will be assessed during 2012 at the Lock 5 and Waterford stations (and not at Thompson Island), the predicted levels at Thompson Island were then used to calculate levels at those compliance stations, using factors based on data collected during the 2011 dredging season.

The model used to estimate resuspension is described in Attachment B. The results of the resuspension modeling and description of how results were incorporated into the remedial design are summarized in Section 3.3.

2.3 Basis of Design Summary

This section presents the technical basis of design for Phase 2, Year 2. The Critical Phase 2 Design Elements (Phase 2 CDE; Attachment A to the 2010 SOW) summarizes key decisions affecting critical elements of the design to be included in this FDR and serves as the basis of design for several significant design issues.

Specific basis of design information is summarized in the following tables:

- Table 2-1 – Basis of Design for Dredging and Dredged Material Transport
- Table 2-2 – Basis of Design for On-River Water Treatment
- Table 2-3 – Basis of Design for Resuspension Control

- Table 2-4 – Basis of Design for Backfilling/Capping
- Table 2-5 – Basis of Design for Processed Sediment Transportation and Disposal

In addition, key basis of design information for Phase 2, Year 2 is summarized below.

2.3.1 Dredging and Dredged Material Transport

Dredging is the first step of the sediment removal and disposal process. The dredging production rate and characteristics of the dredged material will affect subsequent project elements, including resuspension, the amount of solids and water requiring transport to the processing facility, sediment processing, water treatment, sediment transport and disposal throughput rates, and the rate at which dredged areas can be backfilled or capped. The basis of design for Phase 2, Year 2 dredging and dredged material transport is summarized in Table 2-1 and in the subsections below.

2.3.1.1 Dredge Area Delineation

The dredging design process begins with the delineation of dredge areas. Dredge area delineation is a multi-step process and includes the identification of both the horizontal and vertical extents of dredging. Reports that provide the details of data collection and dredge area delineation are cited in Section 2.2.1.

2.3.1.2 Certification Unit Revisions

As part of the final design, the CU boundaries presented in the Phase 2 IDR (ARCADIS 2008) were adjusted for the CUs targeted for Phase 2, Year 2 as described below:

- Section 3.1.1.1 of the Phase 2 IDR recommended that certain Phase 2 areas be excluded from dredging based on an assessment of engineering practicality. Exclusion area EGIA01B_02_A proposed in the Phase 2 IDR was removed from the limits of CU49 based on EPA approval.
- In accordance with Step 3 of the dredge prism development steps listed in the Phase 2 CDE (EPA 2010c), supplemental sediment core samples were collected outside of the limits of certain CUs to evaluate whether the lateral extent of the dredge areas would need to be adjusted. These sampling activities were conducted in accordance with the 2011 SEDC Work Plan for Sediment Sampling

(Anchor QEA and ESI 2011b). After the collection of the initial target locations, an addendum to the 2011 SEDC Work Plan was submitted on September 28, 2011. This addendum reviewed the then-available results of the sampling outside the CUs, and proposed sampling at an additional four locations, along with 11 probing transects. The results of these sampling activities are presented in the 2011 SEDC Data Summary Report (Anchor QEA and ESI 2012). Based on the results of the 2011 sampling program, the lateral limits of CU41, CU43, CU46, CU47, and CU48 were increased by a total of 0.7 acre. Figures showing where the footprints of these CUs have increased are provided in Attachments C and G.

- Internal boundaries of CU34, CU36, CU37, CU47, CU48, and CU49 were adjusted as part of the final design. These adjustments were made based on operational considerations (i.e., to improve continuity of the CUs), and did not change the overall acreage of the dredge areas.

The electronic data file of the CU boundaries for CU26 through CU49 is provided on the CD-ROM included with this report.

2.3.1.3 Dredge Areas Designed for Phase 2, Year 2

The delineated dredge areas were divided into CUs (CU01 to CU100) that were defined in accordance with guidelines presented in the Residuals Performance Standard (EPA 2004a). In general, each CU is approximately 5 acres in size.

Dredging was completed in 10 CUs (CU01 through CU08, CU17, and CU18) during 2009 as part of Phase 1. Twenty CUs (CU09 through CU16 and CU19 through CU30) were included in the approved design for Phase 2, Year 1 (ARCADIS 2011). However, as dredging operations during Phase 2, Year 1 were not completed in CU26 through CU30, these CUs have been incorporated into the design for Phase 2, Year 2.

The Phase 2 Productivity Standard targets the removal of 350,000 cy per year (EPA 2010b). The design for Phase 2, Year 2 presented in this report includes CU26 through CU49. Figure 2-3 shows the locations of dredge areas designed for Phase 2, Year 2 in relation to the Phase 1 and Phase 2, Year 1 dredge areas; Lock 7; the sediment processing facility; and other project support areas (the Work Support Marina, Moreau Barge Loading Area, and General Support Property). Figure 2-4 shows CU26 to CU49 and the acreage for each CU.

Table 2-6 summarizes the areas and design inventory volumes for CU26 to CU49. The volume of sediment defined by the "EoC surface" (described in Sections 2.3.1.4 and 3.1.5 and Attachment C) is approximately 404,700 cy for CU26 to CU49. The volume of sediment identified for removal in the design dredge prisms (described in Section 3.1.5 and Attachment D) is approximately 409,000 cy for CU26 to CU49.

The areal extent and volume of sediment that will be dredged during Phase 2, Year 2 will depend on several factors, which are discussed in Section 3.1.1.

While the design presented in this report includes CU26 through CU49, it is not anticipated that dredging will be completed in all of these CUs during 2012. The 2012 RAWP and the contract awarded for 2012 dredging operations will target 19 of those CUs (CU26 through CU44). The actual areal extent and volume of sediment that will be dredged during Phase 2, Year 2 will depend on the necessary amount of re-dredging and several other factors, which are discussed in Section 3.1.1.

2.3.1.4 Dredge Prism Development

Dredge prisms for CU26 through CU30 were presented in the approved 2011 FDR. The process for development of the dredge prisms for these CUs was presented in Attachment D of the 2011 FDR, and is not repeated in this design report.

Dredge prisms for CU31 through CU49 were developed by a process that is detailed in Section 2.4 of the Phase 2 CDE. In summary, the following analyses were conducted to develop the dredge prisms:

- Incorporation of the 2011 data into the sediment sample database, after accounting for changes in the sediment bed elevation between the 2006 bathymetric survey and sediment bed elevations measured during the core collection in 2011;

- Determining the estimated DoC to the 1 mg/kg vertical horizon based on core chemistry data using an interpolator (based on pre-2010 sediment samples);

- Manual adjustments to the interpolated 1 mg/kg surface to account for information gained during 2010 and 2011 SEDC sediment sampling;

- Delineating areas of Glacial Lake Albany Clay (GLAC) where sufficient data on the elevation of GLAC were available;

- In areas of low confidence, using chemistry data in combination with historical information and other ancillary information to develop the EoC surface;

- In areas where the 1 mg/kg interpolator could not be developed due to data coverage, setting DoC based on the available chemistry data; and

- Incorporating engineering adjustments such as slopes, shoreline, and structural offsets into the EoC surface to develop the final dredge prisms.

Consistent with EPA's adaptive responses (EPA 2012), the dredge prism development process included a comparison of the manually adjusted interpolated surface against the manually delineated GLAC surface. In areas where the GLAC surface was shallower than or within 2 inches deeper than the interpolated surface, the GLAC surface was used to set the final EoC surface.

The EoC surface was developed in accordance with Steps 1 through 3 of the dredge prism process specified in the Phase 2 CDE (as summarized in the first six bullets above). The results are more fully described in Attachment C.

Engineering considerations (the seventh bullet above) incorporated into the EoC surface to develop the final dredge prisms for Phase 2, Year 2 are described in Section 3.1.5 and Attachment D.

The dredge prisms for Phase 2, Year 2 were developed using multi-beam bathymetry surveys conducted in 2006 and 2011.

2.3.1.5 Dredge Type

Consistent with Phase 1, the first year of Phase 2, and the Phase 2 CDE, dredging in Phase 2, Year 2 will be conducted using mechanical excavator-mounted, hydraulically closing environmental clamshell bucket dredges. Use of mechanical dredge equipment is expected to be the most effective and productive dredging technique for the areas targeted for dredging during Phase 2, Year 2.

Alternate dredge types may be considered in future design submittals for Phase 2, if appropriate.

2.3.1.6 Shoreline Definition

The elevation of the shoreline in the Thompson Island Pool (TIP; Reach 8; River Section 1) was initially based on aerial photos taken in the spring of 2002 and represents a river flow of approximately 5,000 cubic feet per second (cfs) at Fort Edward, which corresponds to an elevation of about 119 feet (NAVD88). The exact river flow varies depending on the dates and times photos were taken in different parts of the river. In fall 2008, a land survey of the 119-foot shoreline elevation was conducted for River Section 1, and a revised shoreline was defined for River Section 1 areas based on the surveyed location of the 119-foot elevation. This revised 119-foot shoreline has been incorporated into the basis of the design as the horizontal limit of dredging and backfilling for River Section 1. The electronic data file of the shoreline coordinates is provided on the CD-ROM included with this report.

2.3.1.7 Near-shore Area Definition

EPA, as part of its review of the Phase 1 Design (EPA 2006b), selected the “in-river” boundary for the restoration of near-shore bathymetry. For Phase 1 areas, which were all in Reach 8, this “in-river” boundary was defined as 117.5 feet (NAVD88), which corresponds approximately to the minimum 1-day average flow that occurs once every 3 years (1Q3; flow of 1,100 cfs at the United States Geological Survey [USGS] Fort Edward gage).

The near-shore boundary is defined as the 117.5-foot elevation for all dredge areas in Phase 2, Year 2. The near-shore area is defined as the area between the shoreline (119-foot elevation) and the 117.5-foot near-shore boundary elevation. Near-shore setpoints were established at intervals of approximately 100 feet, and at points of inflection, along the 117.5-foot contour line based on the 2005/2006 bathymetry survey data. The near-shore border extends between the near-shore setpoints to approximate the 117.5-foot bathymetric contour, but is not necessarily at elevations of 117.5 feet at all locations between the setpoints. Figures showing the near-shore setpoints and near-shore border relative to the 117.5-foot contour line are provided in Attachment H.

In addition, Section 2.3.4.3 describes the basis of design for placement of near-shore backfill. The electronic data file of the near-shore boundary is provided on the CD-ROM included with this report.

2.3.1.8 Dredged Material Transport

The basis of design for dredging and dredged material transport includes the use of hopper barges for transporting dredged materials to the sediment processing facility. The dredged material will be transported to the sediment processing facility, which is located on the Champlain Canal between Lock 7 and Lock 8. It is assumed that both dredged material transport and the locks will be operating 24 hours per day, 7 days per week for approximately 28 weeks (from early May through late November).

Based on NYS Canal Corporation design records, the lock length available for vessels is 300 feet. The maximum number of daily lockages (one-way) based on the mechanical and logistical limitation of Lock 7 is assumed to be 48.

The project vessels used in material transport include both tug boats and barges. The hopper barges expected to be used for this project are approximately 195 feet long by 35 feet wide. In certain shallow water areas, the use of smaller capacity barges, which require less draft, is anticipated. Dredged material loaded onto shallow draft barges would be transferred to larger hopper barges prior to transport to the sediment processing facility.

2.3.1.9 On-River Water Treatment

To improve dredging and sediment unloading efficiencies and productivity, a barge-mounted system may be deployed to remove and treat free water in material transport barges loaded with dredged materials. The primary objectives of this on-river water treatment operation would be to maximize, to the extent possible, the amount of dredged material in each transport barge and to minimize the total number of barges that need to be transported to the processing facility for unloading.

Dredged material transport barges that would be selected for on-river water removal/treatment and the extent of free water removal for each barge would be determined based on several factors including, but not limited to: pertinent air emission Best Management Practices (BMPs) (see Section 2.3.2); ability to achieve the QoLPS; the amount of water in the barge; the amount of sediment in the barge; the number of barges available for loading in the river; the optimization of barge transport, barge loading, and barge unloading; the location of the dredging operations; available space at the sediment processing facility for staging and unloading barges; the locations where barges are loaded; and the results of PCB air monitoring.

The specifications provide minimum requirements for the treatment system, treatment system effluent concentration criteria, and minimum equipment and operating requirements in general terms. The types and sizes of equipment, materials, and processes necessary to meet the treatment performance specification, including required effluent discharge criteria, would be determined by the contractor.

As currently specified, the on-river water treatment system would be capable of removing and treating free water from dredged material transport barges at a minimum flow rate of 1,000 gallons per minute (gpm). In addition, the on-river water treatment system would be capable of removing and treating free water from approximately six dredged material transport barges or at least 600,000 gallons of water in a 24-hour period. The specification performance requirements may be revised based on contractor and/or vendor input. The volumes of free water in each barge will vary, but it is generally anticipated that dredged material transport barges will contain between 50,000 and 150,000 gallons of free water to be removed.

The effluent limitations for the on-river water treatment system are set forth in the specifications. They are the same as those specified for discharges to the Hudson River in Tables 8-2 and 8-3 of the Phase 2 PSCP Scope included as Attachment C of the SOW (EPA 2010c).

Additional information related to the basis of design for the on-river water treatment operations is summarized in Table 2-2.

2.3.1.10 Dredge Season

The duration of the dredge season has been assumed to be 120 dredge days and is constrained by the NYS Canal Corporation operating schedule (opening of the lock system in early May and closing of the locks by November 15) and the need to conduct post-removal sampling, backfilling/capping, decontamination, and demobilization before the canal system closes.

The assumed 120-day dredge season is based on dredging 6 days per week for 22 weeks from mid-May to mid-October. It assumes that dredging will not occur on Sundays, and that no dredging will occur on the three holidays during the dredge season (Memorial Day, Independence Day, and Labor Day). The 120-day dredge season assumption also includes an allowance for an additional 9 days of downtime for in-river operations due to high-flow conditions, inclement weather, or other shutdowns. The actual number of operational days may differ.

2.3.1.11 Archaeological Site Protection Measures

Areas designated as Sensitive Archaeological Shorelines and Sensitive Archaeological River Bottom are shown on the Drawings based on the findings of previous archaeological assessments (see Section 2.2.8).

The following archaeological site protection measures will be taken to confirm that the shoreline remains stable during dredging and restoration in the area designated as a Sensitive Archaeological Shoreline Area:

- The Dredging Contractor will be required to provide sufficient notice to the Construction Manager prior to conducting work in the vicinity of the Sensitive Archaeological Shoreline area.

- Prior to initiation of dredging operations, the Dredging Contractor will be required to mark the Sensitive Archaeological Shoreline area with distinctive buoys or other appropriate visual markers.

- A minimum shoreline offset of 10 feet will be applied in the Sensitive Archaeological Shoreline area. This offset has been incorporated into the design dredge prisms (as described in Attachment D).

- If necessary, trees on the bank will be removed by hand using chainsaws. The root balls will be left in place to assist with bank stabilization. The offset may be increased in the field, if approved by EPA, to eliminate the need to remove trees from sensitive shorelines.

- No backfill will be placed on the riverbank above the shoreline in the Sensitive Archaeological Shoreline area. Dredge areas that are off-shore from, but adjacent to, the Sensitive Archaeological Shoreline will be backfilled to provide stability.

- Vessel speeds will be minimized when work is being conducted adjacent to the Sensitive Archaeological Shoreline.

The following archaeological site protection measures will be taken during dredging and restoration in areas designated as Sensitive Archaeological River Bottom:

- The Dredging Contractor will be required to provide sufficient notice to the Construction Manager prior to conducting work in the vicinity of Sensitive Archaeological River Bottom areas.

- The dredge prism will include a setback and stable slope for underwater areas determined to be archaeologically sensitive and where avoidance is the applicable mitigation measure. This offset has been incorporated into the design dredge prisms (described in Attachment D).

- No intrusive work, including debris removal, dredging, or mooring or anchoring of project vessels, will be conducted in areas designated as Sensitive Archaeological River Bottom.

- Prior to initiation of dredging operations, the Dredging Contractor will be required to mark the boundaries of Sensitive Archaeological River Bottom in the river with distinctive buoys or other appropriate visual markers.

- Vessel speeds will be minimized when work is being conducted adjacent to Sensitive Archaeological River Bottom.

If, during the dredging operations, potentially significant cultural resources are identified in areas where resources were not previously identified, activities in the immediate area that may damage or alter such resources will be halted and EPA will be notified. Additionally, in the event that human remains are discovered, work that may damage or alter these remains will be halted in the immediate area, and the local law enforcement agency, medical examiner, and EPA will be notified.

In addition, the Dredging Contractor will be required to notify the Construction Manager if debris encountered during debris removal or dredging extends into the riverbank in any dredge area. The Dredging Contractor will be instructed not to remove debris that extends into the riverbank unless otherwise directed by the Construction Manager, in consultation with EPA.

2.3.2 Air Mitigation BMPs

In accordance with the Phase 2 CDE, air mitigation BMPs will be implemented in areas with potential to emit PCBs to the air at levels close to or exceeding the air quality standard based on the following criteria:

- Areas with an average total PCB concentration in the sediment of greater than 150 mg/kg over a 1-acre area;

- Areas with low water velocities (near the shore or in backwater areas); and

- Areas within 1,000 feet of a receptor.

As noted in Section 3.1.10, the approach for designating these areas (referred to as "air mitigation BMP areas") is presented in Attachment I, and the areas are shown on Drawings D-3106 through D-3114 (Appendix 1).

As required by the Phase 2 CDE, the air mitigation BMPs will include the following to reduce PCB emissions from these areas:

- Fully covering sediments contained in a barge with water;

- Alternatively, for sediments from areas with average total PCB concentrations greater than 150 mg/kg over a 1-acre area, fully covering those sediments in a barge with sediments from other areas with lower PCB concentrations (i.e., less than 150 mg/kg total PCB); and

- Maintaining 5 feet of freeboard in the barge or using a wind screen.

As in Phase 2, Year 1, as an additional BMP to reduce PCB emissions, barges filled with sediments from air mitigation BMP areas will be given priority for transport and unloading at the processing facility over other barges that are waiting to be transported to the processing facility. Further, barges containing sediments from air mitigation BMP areas will not be staged without a water cover for extended periods of time prior to unloading.

In addition, if dredged material barges that contain sediments from air mitigation BMP areas and in which those sediments are not fully covered with sediment removed from outside such areas are transported to an on-river water treatment barge (see Section 3.2.2) and then to the processing facility, a layer of water will be maintained above the majority of the sediments in the barges prior to transport to the processing facility for unloading.

As described in Section 6.5.2 of the 2012 PSCP, the following additional measures will be considered if an applicable PCB air quality standard is exceeded on 3 consecutive days:

- Prohibiting use of “bucket flaps” on dredge buckets in air mitigation BMP areas;
- If sediments from an area other than an air emission BMP area are transported to an on-river water treatment barge, covering the majority of the dredged sediments contained in the barge with a layer of water prior to transport to the processing facility for unloading or to another dredge for loading to be completed;[4]
- Evaluating the number of barges from air emission BMP areas that can be staged at the processing facility unloading wharf at any given time;
- If the exceedance of the standard occurred when sediments from an air mitigation BMP area are being directly off-loaded from a barge, considering transport of such sediments to a filter cake staging enclosure, rather than the coarse material staging area, for staging;
- Erecting wind screens around sediment processing operations;
- Covering material stockpiles that will be staged for an extended period of time before off-site shipment or controlling the shape and placement of the piles;
- Minimizing staging time for sediments containing PCBs;
- Using larger excavation equipment to adjust the surface area/volume ratio during material handling;
- Covering tanks or PCB-containing truck beds that prove to be a significant source of PCB emissions;
- Moving transloading operations farther away from receptors;
- Modifying operations to limit emissions; and/or

[4] This BMP is already listed as a routine measure for sediments from air mitigation BMP areas.

- Spraying a chemical spray-on cover product or biodegradable foam (if determined to be compatible with the treatment system) over material stockpiles that will be staged for an extended time before off-site shipment.

2.3.3 Resuspension Control

In accordance with the Phase 2 CDE, certain resuspension control BMPs are to be implemented during all in-river operations. In addition, if there is an exceedance of the Control Level for total PCB concentrations or Tri+ PCB net loads (measured as daily percent release) under the Resuspension Standard, contingent resuspension control BMPs may be required to be implemented. The resuspension control BMPs consist of operational controls to minimize the sediment resuspension and the release of PCBs. BMPs have also been developed for containing sheens of oil released from the sediment during the dredging operations.

The specific basis for the resuspension control design for Phase 2, Year 2 is presented in Table 2-3 and described below.

2.3.3.1 Resuspension Control BMPs

The following resuspension control BMPs will be implemented during all dredging operations in Phase 2, Year 2:

- Minimizing bucket bites;

- Maintaining bucket closure unless prohibited by debris;

- Maintaining expeditious movement of the closed bucket to the receiving barge after completing a cut to reduce water leakage from the clamshell bucket into the river, to the extent practicable;

- Prohibiting “re-handling” or stockpiling of material on the river bottom;

- Prohibiting dragging the bucket to level the dredge cut;

- During pre-dredge debris removal, minimizing the number of attempts to remove an object;

- Prohibiting raking for debris removal;

- Avoiding the grounding of barges and allowing water levels to rise before attempting to free grounded vessels;
- Use of equipment appropriate for the water depth of the work area;
- Deployment of oil/sheen control materials (containment booms and adsorbents) proactively (before dredging begins) in areas with average PCB concentrations greater than 200 mg/kg;
- Limiting tug propeller revolutions per minute (RPMs);
- Prohibiting barge overflow; and
- Controlling the rate of placement of backfill and capping materials to minimize downstream transport.

The Phase 2 CDE also included a requirement to promptly apply an initial 3 to 6 inches of sand or backfill cover after the final dredging pass has been completed in a CU sub-unit and post-dredging samples have been collected. Based on discussions with EPA after issuance of the Phase 2 CDE and consistent with the approved design for Phase 2, Year 1, placement of an initial cover material layer will not be required. Instead, unless there is evidence that a third dredge pass may be necessary (e.g., to address areas with total PCB concentrations greater than 500 mg/kg), the Dredging Contractor will be directed, after completion of the second dredge pass, to promptly place backfill in compliant areas of the CU as indicated by the Construction Manager. When the results of the sediment sampling associated with the second dredge pass area are obtained, the Construction Manager will instruct the Dredging Contractor to promptly place backfill or a cap isolation layer in those areas.

2.3.3.2 Supplemental Resuspension Control BMPs

Additional contingency BMPs may need to be implemented if there is an exceedance of the Control Level for total PCB concentrations or Tri+ PCB net loads (measured as daily percent release). At a minimum, the contingency resuspension control BMPs that may need to be implemented include:

- Adjusting the sequence of dredging, including dredging areas with a low potential for resuspending PCBs (i.e., areas with low PCB concentration and/or low velocity) at the same time as high-potential locations;

- Using smaller equipment (i.e., with shallower draft and less powerful engines);

- Reducing the removal rate or temporarily suspending dredging if necessary (as stated in the Phase 2 EPS, in general, a slowdown and evaluation of operations would be required before shutdown, with shutdown being the operational change of last resort); and/or

- Restricting flow in areas where practical.

2.3.3.3 Sediment Oil Sheen Response BMPs

The Phase 2 CDE requires that actions be taken to prevent, contain, and clean up oil sheens or evidence of non-aqueous phase liquid (NAPL) observed in the field. A specification (Section 13871 – Sheen Response During Dredging Operations; see Appendix 1) was developed to describe the Dredging Contractor's requirements to address sheens and NAPL, including requirements for notification and reporting, development of a Sediment Oil Sheen Response Plan, implementation of BMPs, and sheen response actions if sheens are observed. Sheen control materials consisting of containment booms and adsorbents will be deployed proactively (before dredging begins) in areas with average PCB concentrations greater than 200 mg/kg. The approach for designating the areas where sheen response BMPs will be implemented proactively is described in Section 3.3.4.

2.3.3.4 Silt Curtains and Other Resuspension Control Barriers

In accordance with the Phase 2 CDE, silt curtains are not required to control resuspension except in specific circumstances identified by either GE or EPA. The use of silt curtains or other resuspension control barriers has not been identified for Phase 2, Year 2 operations. However, silt curtains and resuspension control barriers may be considered in future design for other Phase 2 dredge areas (e.g., for potential use in low flow or backwater areas) and, if proposed, they would be described in further Phase 2 design submittals.

2.3.4 Backfill/Cap Placement

The specific basis for the backfill/capping design for Phase 2, Year 2 is presented in Table 2-4 and described below. During Phase 1, a backfill processing area was established along the western bank of the west channel of Rogers Island. This area was used during Phase 2, Year 1 and will again be used in Phase 2, Year 2 to receive, blend, stage, and deliver backfill and cap materials to barges.

2.3.4.1 Backfill/Cap Footprint

The total area of CU26 through CU49 is approximately 124 acres. Dredged areas will be covered by backfill or cap material, based on residual sample results, except where backfill will not be placed in the navigation channel (as described below). The Phase 2 EPS limit the amount of capping that will be allowed in Phase 2. The limits provide that the total area capped may not exceed 11 percent of the total area dredged during Phase 2, and that, within that limit, the total area capped due to the presence of inventory may not exceed 3 percent of the total area dredged during Phase 2. Capping in the following types of areas will not count against the Percentage Capping Limits: locations capped due to structural offsets, locations capped due to the presence of cultural resources, locations capped in shoreline areas, locations capped due to bucket refusal (i.e., where deeper dredging is prevented by bedrock or other hard-bottom or rocky conditions), and locations capped due to the presence of exposed GLAC. The capping limits are described in more detail in the 2012 PSCP (GE 2012).

Backfill will not be placed in the navigation channel if the post-dredge elevation is above 101.7 feet (NAVD88), which corresponds to a 15.5-foot water depth (the 14-foot post-backfill placement water depth required by the Phase 2 EPS plus the 12-inch thick backfill layer and the allowable backfill placement tolerance), except where there are residual compliant sampling nodes with an average Tri+ PCB concentration exceeding 1 mg/kg, as discussed below. Approximately 37 acres of dredge areas within CU26 to CU49 are within the navigation channel.

In accordance with EPA’s adaptive responses for 2012 (EPA 2012), at sampling nodes in the navigation channel where the residual Tri+ PCB concentration in the surface sediment after the first dredging pass exceeds 1 mg/kg (after rounding) but does not cause the average Tri+ PCB concentration in the CU to exceed 1 mg/kg or meet the other mandatory conditions for re-dredging as specified in the 2012 PSCP, backfill will be placed so long as there is approximately 12 feet of draft above the post-placement backfill surface at low-pool conditions. For TIP, this would equate to placing backfill within the NYS Canal Corporation navigation channel so long as the post-backfill surface elevation is anticipated to be 105.2 feet (NAVD88) or lower).

Also, the areas that are not dredged due to offsets from riprap and structures will not be covered.

2.3.4.2 Backfill Layer Thickness

As required by the ROD (EPA 2002), dredged areas will be backfilled with approximately 1 foot of material, except in certain locations within the navigation channel where no backfill material will be placed as described in Section 2.3.4.1, and except as described in Sections 2.3.4.3, 2.3.4.4, 2.3.4.5, and where isolation caps will be placed.

2.3.4.3 Near-shore Backfill

In accordance with the Phase 2 CDE, near-shore backfill shall be used in River Section 1 to restore pre-dredge bathymetry between the 119 ft and 117.5 ft elevation (NAVD88) contours with supporting 3:1 (horizontal:vertical) side slopes. In River Section 1, the post-dredge surface will be returned to pre-dredge bathymetry by placing backfill from the point where the dredge prism intersects the shoreline (elevation 119.0 ft) laterally into the river to where the pre-dredge bed elevation equals 117.5 ft at near-shore setpoints. These setpoints are located along the pre-dredge bathymetric 117.5 ft elevation contour line.

2.3.4.4 Habitat Layer Backfill

In addition to the backfill to be placed over all dredge areas to a depth of 1 foot, additional backfill (hereafter habitat layer backfill) will be used for the creation of SAV beds in dredged areas that would otherwise no longer support such beds (i.e., deeper than 8 feet). Habitat layer backfill will be placed at locations that currently support SAV beds and have an elevation lower than 111 feet (NAVD88) after dredging and placement of the backfill layer or isolation caps is completed.

Habitat layer backfill will be placed to either return the area to pre-dredging bathymetry or to an elevation of 114 feet (equivalent to a water depth of 5 feet below the 119 ft shoreline) based on the following:

- Areas with pre-dredging elevations between 111 feet and 114 feet will be returned to pre-dredging bathymetry.
- Areas with pre-dredging elevation between 114 feet and 117 feet will be returned to an elevation of 114 feet.

2.3.4.5 Riverine Fringing Wetland Construction Areas

RFW areas will be restored to pre-dredge bathymetry in areas where wetlands are disturbed during the dredging operations. A 1-foot layer of Type 3 backfill will be placed in RFW areas. If more than 12 inches of backfill is required to restore the wetland area to pre-dredge bathymetry, Type 2 material will be placed below Type 3 material. Supporting side slopes of 3:1 (horizontal:vertical) will be created with Type 2 material extending from the edge of the RFW construction area down to the adjoining backfill surface.

2.3.4.6 Backfill Material Types

The choice of backfill type will be determined as follows:

- As in the Phase 1 and Phase 2, Year 1 design, Type 1 backfill material will be used in locations with estimated surface water velocities of 1.5 feet per second (ft/s) or less during a 2-year flow event, and Type 2 backfill material will be used in areas with estimated surface water velocities greater than 1.5 ft/s during a 2-year flow event.

- Only Type 2 backfill material will be placed in the navigation channel.

- Type 2 backfill material will be used for supporting side slopes associated with the placement of near-shore backfill, habitat layer backfill, and RFW construction areas.

- Type 2 backfill will also be designated for use as a base material layer for near-shore backfill and RFW construction areas.

- Type 3 backfill material will be used in the upper 1 foot of RFW construction areas.

The backfill material specifications are described in Specification Section 02206 (Backfill and Cap Material; Appendix 1).

2.3.4.7 Isolation Caps

The criteria requiring or allowing for installation of an engineered cap based on post-dredging residuals concentrations are set forth in the 2012 PSCP, subject to the capping limits discussed above.

The Phase 2 CDE describes the requirements of the cap design, one of which is the ability to isolate the contaminated sediments chemically such that the concentration of Tri+ PCBs in the upper 6 inches of the cap (excluding the stone armor layer) is 0.25 mg/kg or less in the long term, which is defined as 100 years for purposes of the chemical isolation modeling. The Phase 2 CDE also requires that the armor layer design be able to withstand a minimum 100-year recurrence interval flow event.

Caps located within the limits of the navigation channel are specified as the high-velocity cap design. The top elevation of caps within the navigation channel shall not exceed 103.2 feet (NAVD88) in River Section 1.

As described in Section 3.4.2, the isolation cap design analysis presented in the approved 2011 FDR (Attachment F of the 2011 FDR) is applicable for the Phase 2, Year 2 design.

2.3.5 Shoreline Stabilization

For the bank areas immediately below the defined shoreline elevation (i.e., 119.0 ft elevation in River Section 1), a shoreline construction framework was applied to minimize hardening of the shoreline. The framework was initially developed for and used in Phase 1 areas and is based on:

- The presence of shoreline structures including sheet piling, retaining walls, bridge abutments, boat launches, and outfalls;

- The presence of maintained shoreline, including riprap, armor stone, and gabion baskets;

- Thickness of dredge cut along the shoreline (shoreline areas with dredge cuts equal to or greater than 9 inches and shoreline areas with dredge cuts less than 9 inches);

- Property ownership along the shoreline, including whether the property is owned by the State of New York; and

- Proximity of the shoreline to the navigation channel.

On October 20, 2008, GE and EPA conducted a field inspection to review the shoreline treatments proposed in the Phase 2 IDR for River Section 1 and attain concurrence on the appropriate shoreline treatment for each area.

Two shoreline treatment types have been retained in the final design for Phase 2, Year 2 – near-shore backfill and Type P armor stone. Based on the experience during Phase 1, biologs will not be used to stabilize shorelines in Phase 2, Year 2, so the shoreline treatments have been modified in the areas that were previously designated to receive biologs during the October 2008 field inspection. In addition, the shoreline treatment for a portion of CU47 along the eastern shoreline was revised to specify Type P armor stone based on conditions observed along the riverbank during a 2011 field inspection.

Additional information related to the shoreline stabilization design is provided in Section 3.5.

2.3.6 Sediment and Water Processing

The sediment processing facility constructed adjacent to the Champlain Canal between Lock 7 and Lock 8 is designed to offload debris and sediment from barges, separate debris and coarse material from the fine-grained sediment, and mechanically dewater the fine-grained sediment prior to shipment of the sediment off site to a disposal facility. Water from the unloading, screening, and dewatering operations, along with stormwater collected from process areas, is treated on site and discharged to the Champlain Canal.

The sediment processing facility was constructed from May 2007 to May 2009, when it was commissioned prior to Phase 1 operations. The facility design was included in the Phase 1 FDR (BBL 2006a) and upgrades to the facility after Phase 1 were summarized in the 2011 FDR (ARCADIS 2011). Although the productivity standard of 350,000 cy was surpassed in 2011, process equipment is being added and existing plant equipment is being modified to improve productivity and reliability, and provide redundancy. The following improvements to the processing facility are being implemented for the 2012 season:

- A second unloading station is being constructed at the northern end of the processing facility wharf. Free draining material in the barges will be loaded into trucks and transported to the coarse material staging area. Wet material will be fed into the size separation plant. The unloading station will have spill shields spanning the gap between the barge and the wharf deck and splash curtains at the ends of the deck to prevent material from spilling into the canal during unloading. A second station will be installed to pump free water from the barge prior to unloading the sediment. The pipeline from the station will be contained where it spans over the canal from the barge to the wharf.

- Additional size separation processing equipment will be installed to process material from the second unloading station. This equipment includes vibratory screens and de-sanding units to separate the dredged sediment into coarse and fine fractions.

- A second gravity thickener is being constructed in the dewatering area to provide additional slurry thickening capacity. Additional slurry pipelines will be constructed to convey the fines from the new size separation processing equipment to the gravity thickener.

- Additional pumping and control systems will be constructed to convey slurry and water between the size separation and dewatering areas. Tanks will be added for storage and equalization of process water.

- The coarse material staging area has been expanded to provide additional space for the handling and staging of coarse material prior to loading into railcars. Within this area, materials that are determined to require disposal at a facility authorized to receive materials subject to the Toxic Substances Control Act (TSCA) will be staged separately from materials that are determined to be appropriate for disposal in a non-TSCA landfill. (The methodology for characterizing, segregating, and managing TSCA-regulated and non-TSCA materials for the purposes of transport and disposal will be specified in the 2012 TDP.)

Figure 2-5 shows a site plan for the sediment processing facility, updated to show the modifications described above. The layout of equipment associated with the new size separation area is shown in Figure 2-6. A detailed description of the processing facility operations is given in the 2012 Facility O&M Plan, which is Appendix B to the 2012 RAWP (Parsons 2012c).

The operation of the new equipment described above has the potential to increase the noise, light, and PCB air emissions compared to those during the 2011 season. Also, the operation of the second unloading wharf will possibly increase the number of barges that will transit between the dredge areas and the processing facility and the level of activity at the waterfront adjacent to the canal. The potential impacts of the additional equipment and areas at the processing facility on achievement of the noise, lighting, and air quality QoLPS in 2012 are discussed below.

During 2011, the noise levels at the processing facility were controlled to comply with the Noise Standard criteria. The sound levels of the new equipment are expected to be similar to those of the equipment that operated at the facility in Phase 1 and Phase 2, Year 1. However, a noise survey will be conducted at locations around the processing facility during a period when processing facility operations are at or near full production in 2012 to determine the noise levels of the new equipment when it is loaded with dredged material; to confirm that those levels will not be significantly greater than those in Phase 1 and Phase 2, Year 1; and to confirm that they will not exceed the Noise Standard criteria. This survey is described in the Phase 2 RAM QAPP. Additionally, noise monitoring will be conducted as necessary during 2012 in accordance with the Phase 2 RAM QAPP.

During 2011, the light levels at the processing facility were controlled to comply with the Lighting Standard. A lighting plan for the new size separation, gravity thickening, and coarse material staging areas will be provided to EPA for review after it has been developed. Controls, such as light shielding and directing fixed lighting into work areas only, which were specified in the original lighting design, will also be implemented in the design for the new process areas. Light monitoring will be conducted as necessary during 2012 in accordance with the Phase 2 RAM QAPP.

During 2011, air mitigation BMPs such as those described in Section 2.3.2 were implemented as part of routine operations (as they will be in 2012). No substantial additional measures to mitigate PCB air emissions were required as contingency measures. During 2011, more than 150,000 cy of dredged material were staged at the processing facility. Some of this material was staged at the temporary waterfront staging area, which was much closer to the compliance point than the coarse material staging area. For 2012, the coarse material staging area has been expanded to provide more flexibility in staging and loading materials. However, as noted in Section 2.1.2.3, EPA has limited the amount of processed material that can be staged at the facility to 130,000 cy (unless otherwise approved by EPA) and limited the height of the piles to 30 feet. EPA has also prohibited staging of processed material at the waterfront. These limitations will reduce the potential for PCB emissions from the staged coarse materials to impact ambient air PCB levels at the compliance point compared to 2011. Routine monitoring will be conducted in 2012 in accordance with the Phase 2 RAM QAPP to evaluate PCB emissions at the facility perimeter; and in response to an exceedance of the PCB air quality criteria, contingency monitoring will be performed as necessary to assess the cause of the exceedance.

2.3.7 Processed Sediment Transportation and Disposal

Dewatered sediments and debris generated as part of Phase 2, Year 2 will be loaded into railcars from staging areas at the processing facility. Prior to the placement of material into the railcar, each empty railcar will be lined with a disposable liner (or "packaging" pursuant to the applicable U.S. Department of Transportation [DOT] regulatory requirements in 49 CFR 173.240 for "sift-proof packaging"). The liners will be disposed of at the destination landfill along with the processed material. Once enough railcars are loaded, they will be assembled into a unit train and transported to one or more disposal facilities, which have been approved by EPA.

GE is currently planning to segregate materials subject to TSCA regulation (e.g., sediments containing PCBs greater than or equal to 50 mg/kg) from dredged sediments containing PCBs at less than 50 mg/kg, for transport to and disposal at separate authorized facilities. The methodology for characterizing, segregating, and managing TSCA-regulated and non-TSCA materials for the purposes of transport and disposal will be specified in the 2012 TDP. Additional information related to the basis of design for transportation and disposal is summarized in Table 2-5.

3. Design Summary – Phase 2, Year 2

As described in the PDR (BBL 2004a), the remedial action can be divided into the following eight key components or project "elements":

- Dredging
- Dredged Material Transport
- Resuspension Control
- Backfilling/Capping
- Sediment and Water Processing
- Transportation for Disposal
- Disposal
- Habitat Construction

Design summaries for each of the above-mentioned elements (except habitat construction – see Section 1.5) for Phase 2, Year 2 of the project are presented below, followed by a discussion of actions included in the design to meet the Phase 2 QoLPS.

3.1 Dredging

Dredging is the first of several linked and mutually dependent project elements. As the initial project element, the rate and process of dredging affect the design of all subsequent project elements, including resuspension control, backfill/cap placement, sediment processing and water treatment, and transportation and disposal.

3.1.1 Dredge Areas and Volume

In accordance with EPA's Productivity Standard, the objective is to dredge at least 350,000 cy of sediment during Phase 2, Year 2. The average daily removal rate required to achieve the Productivity Standard of 350,000 cy is approximately 2,900 cy/day (assuming 120 dredge days). Peak daily dredge rates will exceed the average rate, and the design allows for higher levels of productivity daily and annually.

The design presented in this report includes CU26 through CU49, which occupy approximately 124 acres. However, dredging may not be completed in all of these CUs during 2012. The 2012 RAWP and the contract for 2012 dredging operations will target 19 of those CUs – CU26 through CU44. The actual number of CUs that will be dredged during Phase 2, Year 2 will depend on several factors. As summarized in Table 2-6, the volume of sediment identified for removal by the design dredge prism (Attachment D) is approximately 409,000 cy for CU26 to CU49. The actual volume of sediment removed from each CU will vary and will depend on the following:

- The pre-construction bathymetric survey elevations measured before dredging begins, which may differ from the existing bathymetry elevations used during development of the dredge prisms (see Section 2.3.1.4);

- The extent of shoreline and in-river structure offsets incorporated into the final construction dredge prism based on field surveys prior to the start of dredging operations in 2012;

- The amount of overdredging performed to achieve the required elevations within the specified tolerances;

- The extent and elevations of GLAC and bucket refusal areas encountered during the dredging operations;

- The amount of access dredging that may be necessary to provide access to certain dredge areas;

- The amount of stable side slope dredging that may be conducted by the Dredging Contractor (i.e., dredging of slopes outside the shoreline edge of the CU boundaries steeper than are shown in the dredge prism); and

- The extent of re-dredging required based on the residual sampling results compared to the Residuals Standard criteria.

The actual number of CUs that will be dredged during Phase 2, Year 2 will depend on several factors, including, but not limited to:

- The area and volume of sediment that will be subject to re-dredging based on the residual sampling results compared to the Residuals Standard criteria, as set forth in the 2012 PSCP;

- The productivity of dredging operations to be completed (as described below) in an upstream-to-downstream sequence, while limiting the work area within four concurrent CUs;

- The productivity of dredging operations in areas with shallow water and limited access (i.e., CU35, CU36, and CU37 on the eastern side of the Three Sisters Islands);

- The extent of operational adjustments (slowdowns, shutdowns, adjustments to dredging sequencing) necessary to comply with the Performance Standards;

- The operational dates for the opening and closing of the Champlain Canal, determined by the NYS Canal Corporation;

- The frequency of high river flows or other factors, such as fog, that limit safe and productive dredging;

- The ability to efficiently unload and process dredged material and water transported to the sediment processing facility;

- The ability to transport and dispose of processed material at a rate such that the volume of processed sediments staged at the sediment processing facility at any given time (including at the coarse material staging areas and filter cake staging enclosures) does not exceed 130,000 cy unless otherwise approved by EPA; and

- The rate of backfilling and capping operations and CU closure because dredging (including re-dredging) will need to be terminated in time to allow for completion of backfilling and capping, closure of CUs, and demobilization before the canal closure date in November. The actual end date for dredging in Phase 2, Year 2 will be determined based on field conditions.

Section 3.1.6 describes assumptions (i.e., the number of CUs and volume of sediment that will be dredged) that were used in the design to develop a dredge plan as required by the Phase 2 CDE.

3.1.2 Shoreline Vegetation Pruning

To allow the safe and effective operation of dredges, backfilling/capping equipment, and shoreline stabilization equipment and to minimize incidental damage to trees, shoreline vegetation that overhangs the dredge area will be pruned. Chipped material and logs generated during removal of shoreline vegetation that have not come in contact with river sediment will be transported to the General Support Property for re-use or disposal.

3.1.3 Dredging

The dredging activities are expected to commence in mid-May 2012 – weather and river flow permitting – and continue into October. Dredging is expected to occur 24 hours a day, 6 days a week. The seventh day of the week will be reserved for maintenance, make-up time for unplanned project interruptions, and as a contingency to achieve the productivity target.

The dredging will be conducted using multiple mechanical dredges equipped with hydraulically closing environmental clamshell buckets. The number and sizes of dredges and the type and size of the dredge buckets to be used will be determined by the Dredging Contractor based on the physical constraints of the river (including the location, depth, and width of the dredge areas), the sediment removal thickness, the type of sediment to be removed, the size of the barge, and resource and production plans (including the volume and rate of sediment removal throughout the season). For design purposes, it is estimated that three to five dredges will be employed during Phase 2, Year 2 (based on Phase 2, Year 1 experience and the logistics model analysis described in Attachment A). The number and size of dredges and the type and size of dredge buckets will be proposed by the Dredging Contractor and presented in the 2012 RAWP.

The dredging buckets selected by the Dredging Contractor will be designed to maintain enclosure of sediments when the bucket is raised through the water column (unless bucket closure is prevented by debris); minimize, as much as practical, the generation of suspended sediments during bucket lowering, closing, and raising in the water column; and minimize the amount of water contained in the dredge bucket as it is closed. The bucket may include features designed by the bucket’s manufacturer that allow free water overlying the sediment in the bucket to drain once the dredge bucket has been raised above the water surface. The Dredging Contractor will be required to operate an electronic bucket positioning system and indication of bucket closure.

During Phase 2, Year 2, dredging as part of the initial design cut pass will be allowed to occur concurrently in a maximum of four adjacent CUs at any given time. This will be termed “concurrent CU dredging.” Dredging in CU35, CU36, and CU37 will be exempt from the concurrent CU dredging requirement.

Dredging in the main stem of the river will begin in the northern end of the project area (CU26) and will generally proceed downstream in a way that maximizes safety. Dredging in CU35, CU36, and CU37 is also anticipated to commence early in the season to provide additional time for dredging in these areas where productivity may be reduced due to limited access and shallow water. Dredging early in the season for these areas may provide the additional benefit of high river elevations that would improve access and may reduce potential resuspension impacts. The proposed dredging sequence and schedule will be described in the 2012 RAWP based on input from the Dredging Contractor.

Each CU will be segmented into portions or sub-units (CU sub-units) to determine if dredging has met the required elevations and/or if additional dredging will be conducted. Consistent with EPA’s adaptive responses (EPA 2012), the CU sub-units will not be required to be 1 acre in size as indicated in the Phase 2 EPS (EPA 2010b). The number, sizes, and layout of the CU sub-units will be determined in the field by the Construction Manager and the Dredging Contractor prior to the start of dredging and may be adjusted based on field conditions and decisions made during the CU acceptance process. Each CU sub-unit will be no smaller than 1 acre in size, unless otherwise approved by EPA.

The dredging process will involve initial dredging to remove the volume of design inventory sediment identified in the dredge prisms (the “design cut”), and re-dredging (if necessary) in accordance with the Residuals Standard criteria, as specified in the 2012 PSCP.

During previous dredging seasons (Phase 1 and Phase 2, Year 1), debris was removed as a separate task prior to dredging in each CU. Based on experience from these previous operations, debris removal as a separate task prior to dredging is an inefficient use of resources and has the potential to negatively impact resuspension. Therefore, the project specifications have been revised for Phase 2, Year 2 to include debris removal as part of dredging. In the event that debris cannot be removed with the dredge bucket, the Dredging Contractor will be prepared to use alternate procedures and/or equipment to remove debris as necessary to facilitate dredging to the required elevations.

The extent of dredging required for each dredging pass (the design cut or re-dredging cuts) will be shown in dredge prism files, which include electronic data that specify the horizontal (X and Y) and vertical (Z) extent of material to be removed as part of the dredging pass. The dredge prism files will contain X, Y, and Z values on a 1-foot by 1-foot grid within the footprint of the CUs and the adjoining side slope areas.

The Design Dredge Prism XYZ File identifies the sediment targeted for removal as part of the initial design cut. The electronic Design Dredge Prism XYZ Files for CU26 through CU49 are provided with this report. The Design Dredge Prism XYZ File was developed by Anchor QEA and Parsons using the procedures described in Section 2.3.1.4, Section 3.1.5, Attachment C, and Attachment D.

The Design Dredge Prism XYZ File will be modified to incorporate offsets from shoreline riprap and in-river structures in accordance with Drawing D-2802 (Appendix 1) based on the results of field probing and surveys conducted prior to dredging. The Design Dredge Prism XYZ File will also be modified to incorporate setbacks proposed by the Dredging Contractor. Such setbacks may be necessary where the Dredging Contractor believes that dredging operations cannot be implemented safely or where the Dredging Contractor believes that dredging operations cannot be implemented without compromising the integrity of public or private structures or utilities located in or along the banks of the river. These proposed setbacks will be submitted to EPA for approval prior to being incorporated into the dredge prisms. The modified dredge prisms (the Construction Dredge Prism XYZ File) will be provided to the Dredging Contractor and will serve as the basis for determining whether dredging has achieved the required elevations. When necessary, separate Construction Dredge Prism XYZ Files will be issued to the Dredging Contractor for re-dredging cuts to identify the extent of additional dredging required based on the results of post-dredge residual sampling and compliance with the Residuals Standard, as described in the 2012 PSCP.

In accordance with the Phase 2 EPS and Phase 2 CDE, and as provided in the 2012 PSCP, dredging will be required to achieve the elevations shown on the Construction Dredge Prism XYZ File in 95 percent or more of the total area dredged in each CU sub-unit. In areas where GLAC and/or bucket refusal due to the presence of bedrock or other hard-bottom or rocky conditions are encountered before the required elevations shown in the Construction Dredge Prism XYZ File is achieved, the specifications require the Dredging Contractor to stop dredging and document the GLAC and bucket refusal locations. The Construction Manager will be responsible for confirming the presence of GLAC and bucket refusal based on visual observation and, as described in the 2012 PSCP, will notify and meet with EPA when these conditions are encountered.

In accordance with EPA's adaptive responses (EPA 2012), Specification Section 13803 (Dredging) in Appendix 1 has been revised to indicate that field-identified bucket refusal and GLAC areas, as accepted by the Construction Manager, will be considered to have achieved the required elevations in those areas for the purpose of determining compliance with the 95 percent requirement.

Additionally, Specification Section 13803 (Dredging) in Appendix 1 has been revised to provide the Construction Manager with discretion to approve dredging in areas where the average value of the grid cells (10-foot by 10-foot grid cells, or 1-foot by 1-foot grid cells in near-shore areas) are 0.2 foot or less above the required elevations. This will allow the Construction Manager and EPA to review the post-dredging bathymetric survey elevations after the first dredging pass and, on a case-by-case basis, determine whether additional dredging to achieve the required elevations would be inefficient. The Construction Manager will notify and meet with EPA when these conditions are encountered. In cases where additional dredging is not efficient (as determined by the Construction Manager and EPA), the Construction Manager may approve the dredging pass and initiate the residual sampling process.

Post-dredging bathymetric surveys will be conducted to verify that the dredging has achieved the required elevations. In areas where bathymetric survey methods are not feasible (e.g., shallow water area), land survey methods will be used to verify compliance with the required elevations. Survey methods are described in the 2012 DQAP (Parsons 2012b).

Following achievement of the required elevations in a CU or CU sub-unit, sediment samples will be collected and analyzed to determine PCB concentrations in residual sediment after dredging. The Phase 2 RAM QAPP specifies the sediment sampling and analysis protocols; the 2012 PSCP describes the data evaluation procedures and actions associated with the results.

3.1.4 Sensitive Archaeological Shoreline and River Bottom Areas

As described in Section 2.2.8, two sensitive archaeological areas have been designated in the areas targeted for dredging during Phase 2, Year 2, based on archaeological resource assessments. In these areas, archaeological site protection measures will be implemented as described in Section 2.3.1.11. A dredging offset will be applied in CU31 through CU33 in the area designated as Sensitive Archaeological River Bottom based on the location of the Belle Island (Three Sisters) Training Dike. A dredging offset will also be applied in CU40 through CU42 in the area designated as

Sensitive Archaeological Shoreline and Sensitive Archaeological River Bottom based on the location of the Champlain Canal Piling Complex. The dredge prism offsets that have been incorporated into the Design Dredge Prism XYZ File are described in Attachment D.

3.1.5 Dredge Prism Development

The Phase 2 CDE requires that GE develop an EoC surface that defines the elevation which captures the entire PCB inventory and meets the removal criteria within the targeted areas. The EoC surface was developed using primarily chemistry information (i.e., sediment core profiles of PCB concentrations), but sediment type, bathymetry, historical dredging information (when appropriate), probing information, and sub-bottom information (i.e., the existence of GLAC or bedrock) also influenced its development. As described in Attachment C, an initial EoC surface was developed for CU31 through CU49 to meet the requirements of the Phase 2 CDE (the EoC for CU26 through CU30 was presented in the 2011 FDR, which was previously approved by EPA). In areas dominated by incomplete cores (i.e., cores whose profiles did not reach the 1 mg/kg Total PCB horizon), historical dredging information and constant estimates of EoC in these areas were used to set the surface (as opposed to just relying on core-by-core profiles to produce a variable EoC surface). That surface was then adjusted for engineering considerations to create the final dredge prisms (described in Attachment D).

Table 2-6 summarizes the areas and design inventory volumes for CU26 to CU49 based on the EoC Surface and the Design Dredge Prism XYZ File.

The EoC, the Design Dredge Prism XYZ File, and related files (estimated GLAC elevations, existing bathymetry elevation, polygon file showing EoC method in each area of the river) are provided on a CD-ROM with this report.

3.1.6 Dredge Planning

The Phase 2 CDE requires a dredge plan that identifies the estimated dredging duration for each dredge area, sequencing of sediment removal by dredge area, estimated number of dredges to be employed, estimated hours of operation, and estimated weekly productivity.

The Phase 2 logistics model was used in development of the dredge plan. The logistics model aids in the evaluation of various dredging scenarios and resource allocations (e.g., dredges, barges, tugs, offloading equipment) to assess the simulated project schedule/sequence and consider potential bottlenecks in the dredging and dredged material transport. Attachment A includes a description of the logistics model inputs/assumptions and resulting output used to support the Phase 2, Year 2 design.

Input assumptions for the logistics model were developed for dredging, dredged material transport, backfilling/capping, and sediment processing. The required model inputs include, but are not limited to, the number of resources (e.g., dredges, barges, tugs, offloading equipment), sediment removal rates, water production rates, barge loading factors, backfill and capping fill rates, the sediment processing facility unloading rate, sediment characteristics, CU acceptance durations, lock operation parameters, and recreational boat traffic. The inputs were developed considering Phase 1 and Phase 2, Year 1 experience; the characteristics of the Phase 2, Year 2 dredge areas; and the design basis for the upcoming dredging season.

The sediment removal volumes and re-dredging assumptions are key input assumptions for the logistics model. Based on data from Phase 2, Year 1, the initial design cut (inventory) volumes used for planning purposes in the logistics model were based on the “EoC surface” (see Attachment C) plus an assumed 7 percent increase to account for additional sediment removal associated with the final construction dredge prism and overdredging to achieve the required elevation tolerance requirements. The re-dredging assumptions used in the logistics model were also established based on data from the Phase 2, Year 1 dredging operations. For planning purposes, the logistics model inputs were developed to assume that the re-dredging volume would be 30 percent of the “EoC surface” volume, which is consistent with the ratio observed during Phase 2, Year 1.

Another input for the logistics model is the assumed barge unloading rate at the sediment processing facility. As described in Section 2.3.6, improvements will be implemented to increase productivity at the sediment processing facility. For modeling purposes, the barge unloading rate was assumed to be 5,000 cy per day, which is the basis of design for the processing facility improvements that are being implemented for the 2012 season (see Section 2.3.6). The actual production rate for processing sediments will be determined during the 2012 dredging season.

Numerous model iterations were conducted to evaluate the efficiency of the predicted operations. The model output data were analyzed for project schedule, efficiency, and potential bottlenecks. The model input parameters were adjusted, and additional model simulations were run to test the model code, address bottlenecks, evaluate the model sensitivity, and improve the model efficiency and predicted project completion sequence and schedule.

Based on the assumed model input parameters, the logistics modeling predicts that dredging in CU26 through CU44 could be completed during the 2012 season. The assumed dredging volume associated with these CUs was approximately 452,000 cy, which includes an assumed design cut volume of approximately 353,000 cy and an assumed re-dredging volume of approximately 99,000 cy. As shown in Attachment A, the logistics modeling simulation is completed within the 22-week period assumed in basis of design and backfilling/capping operations are completed prior to the anticipated closing of the locks in mid-November.

Using the logistics model output data, a dredge plan was developed and is presented in Table 3-1.

This dredge plan is the basis for the resuspension analysis. Output data from the logistics model were used as input for the resuspension model described in Attachment B. The logistics model output data (including the dredge locations, durations, sequence, and rates of dredging for each area) were compiled and transmitted to Anchor QEA for use as input data for the resuspension modeling.

The actual number of CUs and volumes that will be dredged in Phase 2, Year 2 and the dredging sequence depend on the project resources and schedule determined by the Dredging Contractor and the conditions encountered in the field (see Section 3.1.1). The Dredging Contractor will develop a dredge plan based on the proposed sequence of work and the proposed number and sizes of equipment (e.g., dredges, barges, tugs) to be employed for the project. The actual number, productivity, and sequence of project resources implementing the dredging and backfill/capping operations during Phase 2, Year 2 will be determined as a part of field implementation.

3.1.7 Anchoring Restrictions

As part of dredging and dredged material transport operations, anchoring will be restricted within areas where SAV or RFW habitat is present outside of dredge areas; in areas where SAV has been planted; in backfilled areas designated as SAV planting areas or natural colonization areas; in backfilled areas designated as RFW; in areas where caps have been placed; in sensitive archaeological areas; and in areas subject to future archaeological resource assessment. In addition, no anchoring of work-related vessels will be permitted in the navigation channel without approval from EPA in consultation with NYS Canal Corporation.

The anchoring restrictions are described in Specification Section 13820 (Anchoring during Dredging Operations) and shown on Drawings D-4201 through D-4216 (Appendix 1).

3.1.8 River Access

During Phase 1, a Work Support Marina was constructed in River Section 1 along the western shoreline across from the southern tip of Rogers Island to provide an area for support vessels to dock and load or unload passengers and equipment. During Phase 2, Year 2, vessels will continue to use the Work Support Marina, including bathymetry survey boats, sediment sampling boats, water quality monitoring boats, and oversight boats. In addition, dredging crew boats will use the Work Support Marina to help with the efficient movement of crews and equipment to and from the dredges located in River Section 1. Dredged sediments will not be staged or processed at the Work Support Marina. The location of the Work Support Marina is shown on Figure 2-3 in relation to the dredge areas. A site plan showing the Work Support Marina is presented on Figure 3-1.

During Phase 1, a property known as the General Support Property, located on the east shore of the river at Route 4 (at approximate RM 192.3), was acquired and used to provide direct access to the Hudson River. During Phase 2, Year 2, the General Support Property will be used in a manner similar to that in Phase 1 and Phase 2, Year 1 (i.e., to assemble and disassemble barges, dredges, and tugs needed prior to the opening of the Champlain Canal and throughout the dredging season). Use of the General Support Property reduces the traffic through Lock 7 and reduces the work required at the sediment processing facility Work Wharf. The location of the General Support Property is shown on Figures 2-3 and 2-4. A site plan showing the General Support Property is presented on Figure 3-2.

As dredging progresses downstream during the 2012 season, additional short-term river access areas may be identified to reduce the transit time for dredge crews travelling to the dredging equipment.

3.1.9 Access to Dredge Areas

Depending on river flow conditions during the dredging season, dredging of non-target material may be necessary to provide access to a limited number of shallow-water dredge areas. For Phase 2, Year 2, it is assumed that access dredging will not be necessary. However, the need for access dredging will be determined in the field based on river flow conditions and equipment proposed by the Dredging Contractor. The Dredging Contractor may propose locations where access dredging is desirable to conduct the work. The Dredging Contractor may also propose to sequence the work so that shallow areas (i.e., CU35, CU36, and CU37) are dredged early in the season when water elevations are likely to be higher. Any access dredging proposed by the Dredging Contractor will be reviewed by the Construction Manager based on an assessment of the benefit of the proposed access dredging compared to other potential project impacts.

3.1.10 Air Mitigation BMPs

In accordance with the Phase 2 CDE and as summarized in Section 2.3.2, air mitigation BMPs will be implemented:

- in areas with potential to emit PCBs to the air at levels close to or exceeding the applicable air quality standard; and

- in dredge areas where measured PCB concentrations at a nearby receptor results in exceedance of the air quality standard on 3 consecutive days, as described in the 2012 PSCP.

The air mitigation BMPs are summarized in Section 2.3.2 and included in Specification Section 13803 (Dredging) (Appendix 1) and Section 13816 (On-River Water Treatment System) (Appendix 3).

Based on the criteria listed in the Phase 2 CDE (and summarized in Section 2.3.2), the areas with potential to emit PCBs to the air at levels close to or exceeding the air quality standard as part of the design cut dredging pass (referred to as “air mitigation BMP areas”) have been identified based on an evaluation of the average TPCB concentrations in the targeted dredging areas. The approach for designating the air mitigation BMP areas is described in Attachment I. Figures showing the mass-weighted average TPCB concentrations associated with design cut sediment are provided in Attachment I. These figures also show where air mitigation BMP areas have been identified for the design cut based on this review of the TPCB concentrations. The air mitigation BMP areas associated with the design cut are also shown on Drawings D-3106 through D-3114 (Appendix 1).

Air mitigation BMP areas associated with re-dredging operations will be identified in the field based on the results of residual sampling.

3.2 Dredged Material Transport

Dredged material will be loaded in barges for transport to the sediment processing facility for unloading. Barges with dimensions of approximately 195 feet long and 35 feet wide are expected to be used. Tugs will move the barges to deliver the material to the processing facility. The number and sizes of tugs and barges will be determined by the Dredging Contractor based on the physical constraints of the river, including the depth and width of the channel, location, size of the barge (length, width, and draft), and volume and rate of sediment removal during dredging.

3.2.1 Barge Loading

The Dredging Contractor will be required to conduct dredging and barge loading operations in a manner that will optimize the quantity of sediment in the barges while maintaining barge stability and integrity. Optimizing the quantity of sediment in the barges will minimize the number of barges transported to the processing facility for unloading. On-river water treatment operations described in Section 3.2.2 may be implemented during Phase 2, Year 2 to assist in optimizing the quantity of sediment in barges.

When loading large barges, a dredge will be required to maintain continuous movement of the bucket toward the barge once the dredge bucket has been raised above the water surface until the dredged material is loaded into the barge. Free water overlying the sediment surface in the dredge bucket will be allowed to drain once the dredge bucket has been raised above the water surface; however, the dredge operator will not be allowed to stop the movement of the bucket for the express purpose of decanting the water.

If access to the area being dredged is limited by shallow water depth, hopper barges may be light-loaded, or on-river transload operations may be necessary to optimize the quantity of material in the barges. The Dredging Contractor may propose that alternate equipment with less draft be used to receive, contain, and transfer dredged material to a hopper barge anchored in deeper water. If practical, based on the mix of on-river activities, and if overall production will be optimized, light-loaded barges may be transferred to other locations for additional loading. The need and locations for transloading will be determined in the field by the Dredging Contractor based on available water depths and equipment availability.

Requirements for barge loading and transloading are described in Specification Section 13803 (Dredging) in Appendix 1. The specific equipment to be used for sediment transport will be described in the 2012 RAWP.

3.2.2 On-River Water Treatment

As described in Section 2.3.1.9, on-river water treatment operations may be implemented during Phase 2, Year 2 to improve dredging and sediment unloading efficiencies and productivity. After free water has been removed from the barges, the barges would be transported back to a dredge for additional loading of dredged sediment or transported to the sediment processing facility for unloading. Dredged material transport barges that would be selected for water removal/treatment and the extent of free water removal for each barge would be determined based on several factors including, but not limited to: the pertinent air emission BMPs (see Section 2.3.2); ability to achieve the QoLPS; the amount of water in the barge; the amount of sediment in the barge; the number of barges available for loading in the river; the optimization of barge transport, barge loading, and barge unloading; the location of the dredging operations; available space at the sediment processing facility for staging and unloading barges; the locations where barges are loaded; and the results of PCB air monitoring.

Specification Section 13816 (On-River Water Treatment System) (Appendix 3) presents a performance-based specification for the design, construction, operation, and maintenance of the on-river water treatment system. It also sets forth the substantive effluent discharge limitations that would apply to discharges from the on-barge water treatment system to the Hudson River.

The specific equipment and plans for operating the on-river water treatment system would be determined by the On-River Water Treatment Contractor and will be described in an addendum to the 2012 RAWP, if implemented.

3.2.3 Dredged Material Transport

Filled hopper barges will be transported through Lock 7 and up the canal to the unloading wharf at the sediment processing facility. The type of material, transport operations, and frequency of delivery and unloading at the processing facility are critical to the efficiency of dredging and processing facility operations.

Prior to Phase 1 dredging operations, a turning dolphin was installed approximately 60 feet south of Lock 7 to facilitate vessel movement and ensure safe turning of vessels. Additionally, a series of mooring dolphins was installed approximately 900 feet south of Lock 7 for temporary staging of project vessels. These dolphins are still in place and available for use in Phase 2.

It is assumed that Lock 7 will be operating 24 hours per day, 7 days per week for approximately 26 to 28 weeks, weather permitting (from early May through mid-November). Barge transport operations may occur on Sunday as needed to facilitate dredging and processing facility operations.

The Dredging Contractor will be responsible for coordinating with the Processing Facility Operations Contractor prior to the transport of dredged materials. In addition, the Processing Facility Operations Contractor will be notified in advance of the delivery of a barge to the processing facility.

During Phase 2, Year 1, an internet-based barge tracking system (referred to as the Barge Electronic Reporting System [BERS]) was used to document and provide up-to-date information regarding the status of each barge loaded by the Dredging Contractor. The BERS has a barge reporting capability that combines data from draft sensors, positioning information, geofences, and data input from the Dredging Contractor and Processing Facility Operations Contractor for each barge trip to provide status information on each barge. The BERS system will be used again during Phase 2, Year 2.

Project vessel movements will be monitored, recorded, and coordinated using a vessel traffic service (VTS) center. The VTS staff will have access to a real-time vessel tracking system as well as multiple marine VHF radios. Using this system, the VTS staff will be able to coordinate project vessel movements with the NYS Canal Corporation lock operators, non-project users of the Champlain Canal, and the processing facility operators.

The requirements for barge loading, in-water transport, lock operations, and marine traffic control are described in the Specifications included in Appendix 1 (see Specification Sections 13803 [Dredging], 13810 [In-Water Material Transport], 13840 [Transport Procedures Through Canal Locks], 13845 [Aids to Navigation During Dredging Operations], and 13860 [Marine Traffic Control]).

3.3 Resuspension Control

In accordance with the Phase 2 CDE (see Section 2.3.3), certain resuspension control BMPs are to be implemented during all in-river operations, and contingent resuspension control BMPs may be required to be implemented if the Control Level for total PCB concentrations or Tri+ PCB net loads (measured as daily percent release) under the Resuspension Standard is exceeded. Section 3.3.1 presents an evaluation of the potential for resuspension of PCBs during Phase 2, Year 2 dredging.

Additionally, the Phase 2 CDE requires that the Phase 2 design describe requirements for prevention (including BMPs), containment, cleanup, and notification of spills and releases, including sheens that may be associated with PCB oils.

3.3.1 Resuspension Modeling

The potential for resuspension and transport of PCBs during Phase 2, Year 2 dredging was evaluated using the screening-level model. As discussed in Section 2.2.11, the model was used to predict PCB concentrations and loads at Thompson Island, and the predicted levels at Thompson Island were then used to calculate levels at the Lock 5 and Waterford compliance stations, using factors based on data collected during the 2011 dredging season.

The model was used to evaluate dredging and re-dredging in CU26 through CU44 under four constant flow conditions – 3,000 cfs, 6,000 cfs, 10,000 cfs, and 15,000 cfs measured at the Ft. Edward USGS gage. Dredge plans developed from the logistics model analysis described in Attachment A were used as a basis for the dredging schedule, sequence, and rate. The model results are provided on Figures 3-3 and 3-4.

The model predicts no exceedances of the TPCB concentration Control Level (500 nanograms per liter [ng/L]) at Waterford for the 3,000 cfs and 6,000 cfs simulations.

The screening model predicts that the TPCB concentrations exceed the control level of 500 ng/L at the Lock 5 far-field monitoring station four times when flows are 3,000 cfs at Fort Edward. All four exceedances were estimated to occur in June due to dredging high sediment PCB concentrations in CU27, CU28, CU30, CU35, and CU36 (see Figure 5-1a in Attachment B). However, 3,000 cfs flows are not common in June (see Figure 5-4 of Attachment B). No exceedances of a total PCB concentration of 500 ng/L were projected at Waterford for 3,000 cfs flow, and none was projected for either Lock 5 or Waterford for 6,000 cfs flows.

The total mass of Total PCB to be removed is estimated at 25,530 kg for CU26 through CU44. The mass estimate was used to simulate resuspension during dredging (see Attachment B), using the approach outlined in the Phase 2 EPS, with the modifications described in the 2011 PSCP, as approved by EPA. The model predicts that Phase 2, Year 2 dredging will not cause resuspension sufficient to exceed the seasonal Resuspension Standard net load limits of 2 percent at Lock 5 and 1 percent at Waterford. However, the flow conditions and dredging sequence and rate that occur in Phase 2, Year 2 will undoubtedly differ from what was used in the modeling, and the water column monitoring results during Phase 2, Year 2 are likely to differ from the predicted results from the modeling.

3.3.2 Resuspension Control BMPs

The Dredging Contractor will be required to implement certain resuspension control BMPs during all in-river operations, including, but not limited to, debris removal, dredging, transport of dredged material, vessel movement, and backfill/cap placement. The resuspension control BMPs consist of operational controls to minimize the sediment resuspension and the release of PCBs. Contingent resuspension control BMPs may also be required if there is an exceedance of the Control Level for total PCB concentrations or Tri+ PCB net loads (measured as daily percent release) under the Resuspension Standard. The routine and contingent resuspension control BMPs are summarized in Sections 2.3.3.1 and 2.3.3.2 and included in Specification Section 13805 (Resuspension Control; Appendix 1).

There are many factors to consider when evaluating the potential of a dredge area to contribute to the concentration of PCBs in the water column due to dredging-generated resuspension. In addition, the limitations of the modeling tools – the logistics model for constructing dredge plans and the PCB fate and transport models used to predict water column concentrations and loads – make the precise prediction of resuspension release during the project difficult, if not impossible. While these models can be used as a tool to identify potential areas of concern, several factors – such as the river flow and the actual dredge sequence and rates – that cannot be accurately predicted prior to the work will influence the actual resuspension release. Therefore, the need for and type of contingent BMPs will be determined in the field based on monitoring data obtained during operations.

3.3.3 Resuspension Containment Systems

As discussed in the Phase 2 CDE, the use of resuspension containment systems (i.e., silt curtains) during Phase 1 for containing dissolved-phase PCBs was found to be relatively ineffective in the Hudson River. In addition, the Peer Review Panel did not support the use of silt curtains or other physical barriers to control loss of PCB due to resuspension during Phase 2. As discussed in Section 2.3.3.4, the Phase 2 CDE indicates that the use of silt curtains to control resuspension will not be required in Phase 2 except in specific circumstances identified either by GE or EPA. GE has not identified any areas where silt curtains or other resuspension control barriers are recommended for Phase 2, Year 2 dredging.

3.3.4 Sediment Oil Sheen Response

The Phase 2 CDE requires that actions be taken to prevent, contain, and clean up oil sheens or evidence of NAPL observed in the field or when dredging in areas with total PCBs greater than 200 mg/kg.

Specification Section 13871 (Sheen Response During Dredging Operations; Appendix 1) describes the Dredging Contractor's requirements to address sheens and NAPL, including requirements for notification and reporting, development of a Sediment Oil Sheen Response Plan, implementation of BMPs, and sheen response actions if sheens are observed. As discussed in Section 2.3.3.3, sheen control BMPs consisting of containment booms and adsorbents will be deployed proactively, before dredging begins, in areas with average PCB concentrations greater than 200 mg/kg. In those areas, the Dredging Contractor will be responsible for deploying and maintaining oil control booms, oil absorbent booms, and oil absorbent materials downstream of operations. Debris removal and dredging operations will not begin in those areas until the booms and absorbent materials have been deployed. Where sediment oil sheens are observed to have collected behind the control boom or other stationary locations, the Dredging Contractor will sweep the sheen areas with absorbent material and actively collect sheens and other floating debris in contact with the sheens. The Dredging Contractor will be required to adjust the booms and absorbent materials to maximize control of the sediment oil sheens.

Sheen response BMP areas were designated at certain locations using the same approach described in Section 3.1.10 for the air mitigation BMP areas, except using an average TPCB concentration of more than 200 mg/kg as the basis for designating such an area. The approach for designating the sheen response BMP areas is described in Attachment I. Figures showing the mass-weighted average TPCB concentrations associated with design cut sediment are provided in Attachment I. These figures also show where sheen response BMP areas have been identified for the design cut based on this review of the TPCB concentrations. The sheen response BMP areas associated with the design cut are also shown on Drawings D-3106 through D-3114 (Appendix 1).

Sheen response BMP areas associated with re-dredging operations will be identified in the field based on the results of residual sampling.

3.4 Backfilling/Capping

After dredging is complete in each CU or CU sub-unit, the dredged areas will be backfilled or capped, as appropriate, to isolate residual sediments and support habitat construction. The total and relative acreages of areas to be capped or backfilled will depend on the results of the residuals sampling and the number of CUs dredged.

The decision to place backfill or cap will be based on the post-dredging distribution of PCB concentrations in accordance with the Phase 2 EPS and 2012 PSCP or as otherwise approved by EPA.

The backfill and cap material specifications are described in Specification Section 02206 (Backfill and Cap Material; Appendix 1). The backfill and cap material placement requirements are described in Specification Section 13720 (Backfill/Capping; Appendix 1).

3.4.1 Backfill

There are four main components of backfill in the design:

- Base backfill layer;

- Near-shore backfill;
- Habitat layer backfill; and
- Backfill in RFW construction areas.

The basis of design for each of these components is described in Section 2.3.4.

3.4.1.1 Base Backfill Layer

The base backfill layer consists of a 12-inch layer of Type 1 or Type 2 material placed on the river bottom following completion of dredging.

Except as noted below, backfill material will not be placed in the navigation channel when the post-backfill placement water depth is predicted to be less than 14 feet (103.2 ft elevation NAVD88 for River Section 1) based on the NYS Canal Corporation's Barge Canal Datum low-pool elevation (BCD low-pool elevation) of 117.2 ft NAVD88 for River Section 1. Based on the 12-inch backfill layer and an allowable construction tolerance for backfill placement (see Specification Section 13720 [Backfilling/Capping] in Appendix 1), this means that, except as noted below, no backfill material will be placed in the navigation channel where post-dredging water depth is less than 15.5 feet (101.7 ft elevation NAVD88 for River Section 1). However, backfill will be placed within the navigation channel at residual sampling node locations where the Tri+ PCB concentration in the surface sediment after the first dredging pass exceeds 1 mg/kg (after rounding) but does not cause the average Tri+ PCB concentration in the CU to exceed 1 mg/kg (or meet the other mandatory conditions for re-dredging), so long as there is approximately 12 feet of draft above the post-placement backfill surface at low-pool conditions (105.2 ft NAVD88 for River Section 1).

Type 1 backfill material will be used in locations with estimated surface water velocities of 1.5 ft/s or less during a 2-year flow event, and Type 2 backfill material will be used in areas with estimated surface water velocities above 1.5 ft/s under a 2-year flow event. Only Type 2 backfill material will be placed in the navigation channel.

Locations where Type 1 and 2 backfill materials would be applied are identified on Drawings B-2306 through B-2314 (Appendix 1).

3.4.1.2 Near-shore Backfill

Near-shore backfill will be placed to restore pre-dredge bathymetry between the 119 ft and 117.5 ft elevation (NAVD88) contours. Central to the near-shore backfill design process was development of a near-shore border defining areas above the elevation of 117.5 feet that are likely to be disturbed by dredging. While many of these areas are within CU boundaries, dredging may also impact the near-shore areas outside of CU borders due to dredging stable side slopes. Near-shore setpoints were established at intervals of approximately 100 feet, and at points of inflection, along the 117.5 ft contour line based on the 2005/2006 bathymetry survey data. The near-shore border extends between the near-shore setpoints to approximate the 117.5 ft bathymetric contour, but is not necessarily at elevations of 117.5 ft at all locations between the setpoints. Near-shore backfill will be placed to original bathymetry in areas between the near-shore border and the shoreline (i.e., 119.0 ft elevation). The upper 1 ft of near-shore backfill material will consist of Type 1 or Type 2 material, as shown on Drawings B-2306 through B-2314 (Appendix 1). Type 2 material will be used below the upper 1 ft of near-shore backfill, as needed. Supporting side slopes of 3:1 (horizontal:vertical) (i.e., the 3:1 near-shore backfill wedge) will extend from the edge of the near-shore backfill (i.e., at the near-shore border) down to the adjoining 1 ft backfill layer. The 3:1 near-shore backfill wedge will be constructed using Type 2 material. The tolerance in Specification Section 13720 (Backfilling/Capping) in Appendix 1 has been tightened compared with the tolerance applied in 2011 for the placement of near-shore backfill. The tolerance for 2012 sets backfill limits at 6 inches higher and 12 inches lower than the 117.5 ft design elevation at the near-shore setpoints.

Details and example cross-sections for near-shore backfill are shown on B-2122 (Appendix 1). The near-shore border and near-shore setpoints, along with locations where Type 1 and 2 backfill materials would be applied, are identified on Drawings B-2306 through B-2314 (Appendix 1). The coordinates for the near-shore setpoints are identified on Drawing B-2802 (Appendix 1).

3.4.1.3 Habitat Layer Backfill

The basis for the locations of the habitat layer backfill is described in Section 2.3.4.4. Habitat layer backfill will be placed in areas that supported aquatic vegetation beds where the pre-dredging water depth was less than 8 ft and post-dredging and backfill layer placement water depth is greater than 8 ft. Based on the analysis summarized in Attachment E, an estimated volume of approximately 19,680 cy of additional habitat layer backfill would be placed in CU26 through CU49, assuming dredging to an elevation 12 inches below the EoC surface. This volume does not include the backfill that would need to be placed due to dredging (including residual dredging) deeper than 12 inches below the EoC surface or placement of the supporting 3:1 side slopes. The areas receiving additional habitat backfill and the total volume placed in Phase 2, Year 2 will be determined during the CU certification process.

In areas where habitat layer backfill is required based on the criteria listed in the Phase 2 CDE and summarized in Section 2.3.4.4, backfill material will be placed to return bathymetry to an elevation of 114 ft at locations where the original bathymetry was above 114 ft and to return to original bathymetry in areas where the original bathymetry was between 111 and 114 ft.

The habitat layer backfill will consist of Type 1 or Type 2 material. Supporting side slopes of 3:1 (horizontal:vertical) will be created extending from the edge of the habitat layer backfill down to the adjoining backfill surface. The 3:1 supporting side slopes will be constructed using Type 2 material. Habitat layer backfill will be placed above caps (where caps are placed in areas to receive habitat layer backfill) and may be placed above the 3:1 supporting side slopes for near-shore backfill.

Details and example cross-sections for habitat layer backfill are identified on Drawing B-2124 (Appendix 1). Potential locations where habitat layer backfill would be applied are identified on Drawings B-2306 through B-2314 (Appendix 1). The locations shown on the Drawings represent potential placement locations for the habitat layer backfill. Prior to backfill placement, the Dredging Contractor will be provided with the locations, extents, and elevations for placement of the habitat layer backfill by the Construction Manager. The decision of whether to place habitat layer backfill will be based on the post-dredging elevations in areas with previously delineated aquatic vegetation. Small areas (i.e., less than 0.1 acre) may be excluded by the Construction Manager for habitat backfill layer placement. The habitat backfill layer designs developed after the completion of dredging will be approved by EPA as part of the CU certification process.

3.4.1.4 Riverine Fringing Wetland Construction Areas

RFW areas will be restored in areas where wetlands, as defined in the Wetland Delineation Report for Phase 2 Areas (Anchor QEA 2011b), are disturbed during the dredging operations.

A 1 ft layer of Type 3 backfill will be placed in RFW areas. Type 2 material will be placed first if more than 12 inches of backfill is required to restore the wetland area to pre-dredge bathymetry. Supporting side slopes of 3:1 (horizontal:vertical) will be created extending from the edge of the RFW area down to the adjoining backfill surface. The 3:1 supporting side slopes will be constructed using Type 2 material.

Verification that the RFW construction areas are restored to pre-dredge bathymetry will be based on land survey methods conducted along transects that will be spaced at approximately 25 ft intervals along the RFW construction area. At a minimum, elevation survey data will be collected along each transect at the outer limits of the RFW construction areas and at locations spaced approximately 20 feet along each transect. The survey data will be collected at the same locations along each transect prior to dredging and after backfill placement to verify that the restoration of the Riverine Fringing Wetland Construction Area is compliant with the specification (See Specification Section 13720 [Backfilling/Capping]; Appendix 1).

Consistent with EPA's adaptive responses (EPA 2012), Specification Section 13701 (Riverine Fringing Wetland Seeding) (Appendix 1) was developed to include requirements for the Dredging Contractor to seed the RFW construction areas prior to installation of the coir fiber fabric.

Details and example cross-sections for RFW construction areas are identified on Drawing B-2123 (Appendix 1). The RFW construction area locations are identified on Drawings B-2306 through B-2314 (Appendix 1).

3.4.2 Cap Design – Phase 2, Year 2

Engineered caps will be installed in certain dredge areas in accordance with the Residuals Standard criteria to act as a physical barrier that both isolates and stabilizes the residual sediment. Placement of the cap will sequester residual sediment from direct interaction with the overlying water column or benthos. An armor layer will provide additional protection of the isolation layer through resistance to erosion due to currents, vessel wakes and waves, propeller wash, and ice.

The specific design objectives of the engineered caps are described in Section 2.6 of the Phase 2 CDE, and the conditions and locations for placement of caps (based on the results of the residuals sampling) are set forth in the 2012 PSCP. As required by the Phase 2 CDE, a detailed cap design analysis was performed for the targeted dredge areas during development of the 2011 FDR (ARCADIS 2011). This 2011 cap analysis was based on the location-specific characteristics in the dredge areas within TIP and also applies to the targeted areas for dredging during Phase 2, Year 2. As such, the design analysis performed as part of the 2011 FDR has been used to develop the cap design for Phase 2, Year 2. This design is summarized below. Attachment F of the 2011 FDR provides details on the design objectives, basis of design, and detailed cap analysis.

3.4.2.1 Cap Isolation Layer

The 2011 FDR design analysis included transient modeling of Tri+ PCB transport through the isolation layer to meet the Phase 2 CDE requirements for the chemical isolation cap component. The anticipated post-dredge residual sediment conditions needed for modeling efforts were developed based on previous reports and data. The data used in the 2011 FDR modeling efforts are also representative of conditions anticipated following dredging during Phase 2, Year 2, and include seepage velocity, dissolved organic carbon, Tri+ PCB partitioning coefficients, residual PCB concentration, and residual sediment total organic carbon (TOC) concentration. The 2011 FDR transient modeling results showed that a TOC value of 1.8 percent would be required for a 9-inch thick isolation cap component. Therefore, consistent with the Phase 2, Year 1 cap design, a TOC value of 2 percent has been assumed for the Phase 2, Year 2 design to be conservative. The modeling shows that the cap design meets the criterion of less than an average of 0.25 mg/kg Tri+ PCBs in the upper 6 inches of the isolation layer after 100 years; however, if the isolation layer is thicker than 9 inches, a lower TOC content would still achieve the capping goals.

3.4.2.2 Cap Armor Layer

As detailed in Attachment F of the 2011 FDR, the armor layer design for the Phase 2, Year 1 activities was developed to incorporate the considerations listed below.

- In accordance with the Phase 2 CDE, the armor layer was designed to withstand the minimum 100-year recurrence interval flow event.

- The armor layer design within the navigation channel considers propeller wash.

- Design consideration was also given to vessel wake and ice forces that could be encountered in River Section 1.

Each of these considerations is also applicable for Phase 2, Year 2 and is summarized below.

Outside the Navigation Channel

Protection from a 100-year recurrence flow event was assessed in the 2011 FDR to determine the armor stone sizing requirements, and is only necessary for areas outside of the navigation channel because the design for areas within the navigation channel is controlled by greater forces associated with vessel propeller wash. Consistent with the Phase 1 design (BBL 2005d), a velocity-based armor design was used to calculate a mean stone diameter that would be stable under a given velocity. River velocities for the 100-year flow conditions were predicted using the hydrodynamic model developed for the Upper Hudson River (see Section 2.2.9).

As detailed in Attachment F of the 2011 FDR, a 2-inch stone size would be sufficient for areas outside the navigation channel with predicted velocities during a 100-year recurrence flow event less than or equal to 5 ft/s. The Type N material (coarse gravel) referenced in Specification Section 02206 (Backfill and Cap Material) (Appendix 1) would meet this requirement.

The Modified Type O material (cobble armor) referenced in the Specification Section 02206 (Backfill and Cap Material) (Appendix 1) would provide sufficient armoring for areas targeted during Phase 2, Year 2 with velocities greater than 5 ft/s. The modeled range of 100-year flow event velocities for grids in CUs associated with the Phase 2, Year 2 design (CU26 to CU49) has a maximum velocity of 6.33 ft/s (in CU49). As shown on Figure F-3 in Attachment F of the 2011 FDR (stone sizing as a function of water velocity using the Isbash equation in non-navigation channel areas), the 4-inch stone size (D_{50}) of the Modified Type O material would be sufficient for armoring.

Figures J-1 through J-7 in Attachment J show the modeled velocity distributions for CU26 through CU49 under 100-year flow conditions. These figures serve as a basis for determining armor types for the 2012 dredge areas outside the navigation channel if a cap is required.

Within the Navigation Channel

The design for the armor stone within the navigation channel is controlled by forces associated with vessel propeller wash. The 2011 FDR armor stone analysis and quasi-stationary calculations (i.e., maneuvering Tug Margot) confirmed that a 4-inch stone size would be sufficient for armoring in the navigation channel as long as the top of cap is at least 14 feet below the water surface. Therefore, this same armor stone size will be used for Phase 2, Year 2 cap design within the navigation channel along with the requirement that the top of elevation of caps after placement must provide at least 14 ft of water depth (103.2 ft elevation NAVD88 for River Section 1) based on the NYS Canal Corporation's BCD low-pool elevation of 117.2 ft NAVD88 for the TIP.

3.4.2.3 Vessel Wakes

The analysis of vessel wakes was performed as part of the Phase 1 IDR (BBL 2005d), and this analysis remains unchanged for the Phase 2 design. Additional details are provided in Attachment F of the 2011 FDR. In summary, the calculated velocity from a vessel wake is within the flow-velocity range already anticipated for the 100-year flow event criteria and below the velocities estimated for propeller wash. Thus, vessel wake effects are likely to produce velocities lower than those used as a basis of design for the medium- and high-velocity caps. In rare occurrences where a craft passes through very shallow water, some disruption to the cap surface may take place; however, there would likely be no substantial loss of the cap material (due to the short impact time, the relatively small area affected by the event, and the relatively high settling velocity of these materials).

3.4.2.4 Ice Effects

An analysis of potential ice impacts in the River Section 1 was performed in June 2005 by Dr. George Ashton (see Attachment I to the Phase 1 IDR; BBL 2005d). The results of this analysis apply to the dredging areas in Phase 2, Year 2. Findings from the ice analysis indicated that normal ice effects are likely to produce velocities lower than those used as a basis of design for both the medium- and high-velocity caps. In situations where ice impacts very shallow water, some disruption to the cap surface may take place; however, it is expected that there would likely be minimal loss of sediment from the cap due to the relatively small areas affected by the event. Additional details of the ice analysis as it related to the cap design are included in Attachment F of the 2011 FDR.

3.4.2.5 Cap Design Summary – Phase 2, Year 2

Two cap prototype designs (summarized in Table 3-2 below) have been developed to address the range of conditions expected to be encountered in the Phase 2, Year 2 dredge areas.

Table 3-2 Summary of Design for Prototype Caps – Phase 2, Year 2

Cap Type	Area	Cap Materials and Thickness
Medium-Velocity Isolation Cap Type C	Outside navigation channel, with average water velocities ≤ 5 ft/s based on a 100 yr event	A minimum 9-inch isolation layer of Type 2 material with 2% organic carbon content
		A 6-inch armor layer of Type N material (see Specification Section 02206 [Backfill/Cap Material], Appendix 1)
High-Velocity Isolation Cap Type C	Within navigation channel or outside navigation channel with average water velocities >5 ft/s based on a 100 yr event	A minimum 9-inch isolation layer of Type 2 material with 2% organic carbon content
		A 6-inch armor layer of modified Type O material (see Specification Section 02206 [Backfill/Cap Material], Appendix 1)

Details and example cross-sections for these prototype isolation caps are provided on Drawing C-2121 (Appendix 1). The potential locations for placement of the medium- and high-velocity isolation caps are identified on Drawings C-3106 through C-3114 (Appendix 1).

3.4.3 Backfill and Cap Material Placement Techniques

Based on experience during the Phase 1 and Phase 2, Year 1 activities, it is anticipated that backfill and cap materials will be placed by taking materials from a deck barge using an excavator with a clamshell bucket. Placement using this method can be achieved through either surface or subsurface discharge. This method has been proven to meet the placement accuracy and tolerance requirements for the range of materials and in-river conditions.

Final details on the methods to be used for backfill and cap placement will be determined by the Dredging Contractor and described in the 2012 RAWP. The cap isolation layer will need to be placed with care to achieve 2 percent TOC upon placement, and the cap placement techniques may require adjustment in the field. The Dredging Contractor may propose different methods for cap material placement, and these alternate methods will be considered as long as the required accuracy and efficiency of material placement are achieved.

3.4.4 Backfill and Cap Material Sources

Potential sources of backfill and cap materials, the capability of these sources to meet the required material types and quantities, and the routes of delivery are described in the 2012 RAWP.

3.5 Shorelines

Shoreline construction is separated into two components: shoreline stabilization in areas immediately below the designated shoreline elevation (e.g., 119.0 ft elevation in River Section 1) and shoreline repair in areas above the designated shoreline elevation.

3.5.1 Shoreline Stabilization

Shoreline stabilization (or shoreline treatments) will be applied in areas where dredging is performed up to the designated shoreline elevation, and will include implementation of stabilization measures below the shoreline elevation. The types of shoreline treatments include near-shore backfill and Type P armor stone.

Shoreline stabilization requirements are described in Specification Section 13898 (Shoreline Stabilization) (Appendix 1). Details for the shoreline stabilization treatments are identified on Drawing B-2221 (Appendix 1). The types and locations for each shoreline stabilization treatment are shown on Drawings B-3106 to B-3114 (Appendix 1).

3.5.2 Shoreline Repair

The Dredging Contractor will be responsible for repairing any disturbed shoreline areas above the designated shoreline elevation.

If disturbed, areas above the designated shoreline elevation will be constructed as moderate- or low-energy shorelines based on surface water velocity profiles (above and below 1.5 ft/s, respectively). Shoreline construction will consist of seeding (low-energy) or seeding and live staking (moderate-energy).

Requirements for repair of shoreline areas disturbed during the dredging operations are presented in Specification Sections 02921 (Seeding) and 13705 (Shoreline Repair and Planting) (Appendix 1), and typical shoreline repair details are shown on Drawing B-2222 (Appendix 1).

3.6 Sediment and Water Processing

Sediment and water processing involves the unloading and preparation of dredged sediments for transportation and offsite disposal. The processing facility will receive barges and unload dredged sediment from the barges at the waterfront. As described in Section 2.3.6, a second unloading station is being designed and constructed at the waterfront. Dredged material, depending on its consistency, will be unloaded at one of the two unloading stations and fed into the size separation equipment or loaded directly into trucks for transport to the coarse material staging area without processing if the dredged material is free draining. Debris and other large objects will be separated from the sediment, and the sediment will be classified according to particle size into fine and coarse fractions. The fine fraction of the sediment will be thickened, dewatered, and staged for subsequent loading into railcars. The separated coarse fraction will also be staged for subsequent loading into railcars and transportation for disposal. Water from the unloading, screening, and dewatering operations, along with stormwater collected from process areas of the site, will be treated and discharged to the Champlain Canal.

Based on the annual productivity target of 350,000 cy and an assumed 129 days of processing, the average daily rate of sediment processing is approximately 2,700 cy/day. The assumed 129 days of processing is based on processing 6 days per week for 22 weeks from mid-May to mid-October. It assumes that processing will not occur on Sundays or on the three holidays that occur during the dredge season.[5] As described in Section 2.3.6, additional construction and process modifications are being undertaken to increase the unloading and sediment processing rate at the sediment processing facility. These modifications will provide redundancy for unloading, size separation, and gravity thickening so that the productivity standard can be met or exceeded.

The processing facility was not designed to process clay. However, incidental amounts of clay mixed with sediment during the initial dredge pass are not expected to upset operations at the facility. The Dredging Contractor will coordinate with the Processing Facility Operations Contractor to help identify which barges contain clay and the estimated amount. The Processing Facility Operations Contractor will use this information to make operational decisions regarding the sequence/schedule for barge unloading and determine whether adjustments to processing operations are needed to address the quantity of clay actually arriving in barges. If the amount of clay transported to the processing facility is expected to have a significant impact on facility operations, alternative procedures for handling the clay may include:

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[5] The assumed dredge season of 120 days as referenced in Section 2.3.1.10 assumes an additional 9 days of downtime for in-river operations due to high-flow conditions, inclement weather, or other shutdowns.

- Running the process equipment at a lower rate;
- Blending the clay that is separated with drier sediment;
- Stabilizing the processed material with lime so that it will pass the paint filter test and can be managed by loading equipment;
- Directly unloading the material and blending it in the Coarse Material Staging Area if housekeeping measures are not compromised; and/or
- Processing the material on Sundays so that dredging productivity is not impeded.

The air mitigation BMPs summarized in Section 2.3.2 will be implemented during processing facility operations. Other measures to reduce PCB emissions will include wetting down haul roads to reduce dust.

3.7 Processed Sediment Transportation and Disposal

After the dredged sediments are processed, the dewatered sediment (as well as debris removed during dredging activities) will be transported to the selected disposal facilities by rail.

3.7.1 Material Segregation

As described in Section 2.3.7, GE is currently planning to segregate materials subject to TSCA regulation (e.g., sediments containing PCBs greater than or equal to 50 mg/kg) and dredged sediments containing PCBs at less than 50 mg/kg (i.e., non-TSCA materials) for transport to and disposal at separate authorized facilities. The methodology for characterizing, segregating, and managing TSCA-regulated and non-TSCA materials for the purposes of transport and disposal will be specified in the 2012 TDP.

3.7.2 Railcar Sets

Transportation of processed sediment and other project waste material will be by rail using “unit trains” (a “unit train” consists entirely of railcars traveling from an origin to a single destination, instead of small groups of railcars that are included in trains carrying other commodities to different destinations). Railcars will be equipped with a sift-proof packaging system in accordance with DOT requirements**.** Each railcar will be weighed before leaving the processing facility rail yard to verify that the load meets the weight restrictions of the commercial carriers. Once a unit train is filled with processed sediment and other project waste material, it will be picked up by the commercial rail carrier.

It is anticipated that there will be about a 3-week lag period from the start of dredging before railcar loading activities begin. The rate of loading and movement of railcars will be determined by the dredging and sediment processing productivity and will also depend on train movements controlled by the rail carriers.

Upon return to the processing facility, railcars will be kept in a secure area of the rail yard with restricted access prior to their reuse. Before being used for any other purpose (e.g., at the end of the project), railcars will be decontaminated in accordance with applicable regulations.

3.7.3 Disposal

Once a train is loaded, the processed materials will be transported by railroad to one or more authorized commercial disposal facilities. The selected disposal facilities will be identified in the 2012 TDP (Appendix C to 2012 RAWP).

Upon arrival at the landfill, the railcars will be unloaded and set for the return trip to the processing facility. The unloaded waste material will be disposed of by the landfill operator in accordance with the landfill's operating permits and authorizations.

3.8 Threatened and Endangered Species Considerations

As discussed in Section 2.2.7, the conservation measures listed for bald eagles in the Final BA will be followed to minimize disturbances to eagles. These are incorporated into Specification Section 01140 (Work Restrictions) in Appendix 2.

3.9 Evaluations of Attainment of Quality of Life Standards

The design has been developed with the objective of achieving the numerical criteria set forth in the Phase 2 QoLPS for air quality, odor, noise, lighting, and navigation, which are summarized in Section 2.1.3. The design evaluations conducted for the QoLPS parameters for Phase 2, Year 2 are summarized below along with the design requirements associated with these standards.

3.9.1 Air Quality – PCBs

In accordance with the Phase 2 CDE and as summarized in Section 2.3.2, air mitigation BMPs will be implemented in areas with a potential to emit PCBs to the air at levels close to or exceeding the applicable PCB air quality standard, based on criteria defined in the Phase 2 CDE. Such areas are shown on Drawings D-3106 through D-3114 (Appendix 1). The air mitigation BMPs to be implemented in those areas are summarized in Section 2.3.2, and are included in Specification Section 13803 (Dredging) (Appendix 1) and Section 13816 (On-River Water Treatment System) (Appendix 3).

As discussed in Section 2.3.6, given the limitations on staging of processed sediments at the processing facility, the expanded coarse material staging areas at the processing facility are not expected to result in an increase in PCB air emissions relative to those in 2011. Accordingly, no additional routine BMPs are necessary at the processing facility.

In addition to the routine BMPs to be implemented for air mitigation BMP areas, contingent BMPs will be implemented in dredge areas or areas around the processing facility where measured PCB concentrations at a nearby receptor show an exceedance of the applicable PCB air quality standard on 3 consecutive days. The contingent air mitigation BMPs to be considered in these circumstances include those listed in the 2012 PSCP and reiterated in Section 2.3.2 above.

3.9.2 Air Quality - NAAQS

An air quality modeling analysis conducted during the Phase 1 design demonstrated that the emissions of criteria pollutants from in-river activities and processing facility operations during Phase 1 were not predicted to cause exceedances of the NAAQS. The Phase 2 PSCP Scope and Phase 2 CHASP Scope require GE to evaluate the need to revise the prior analysis to reflect any anticipated operational or equipment changes in Phase 2 that could affect these pollutants. If no such change is anticipated, no additional modeling or further evaluation of criteria pollutants is needed, and no provisions for monitoring or control of those pollutants will be necessary during Phase 2.

The NAAQS analysis has been reviewed considering anticipated operational or equipment changes for Phase 2, Year 2 that could affect these criteria pollutants. The resulting evaluation, which is presented in Attachment F (and is similar to the analysis presented in the 2011 FDR), confirms that the Phase 1 analysis demonstrating compliance with the NAAQS should likewise apply to the Phase 2, Year 2 activities, and that there is no need for a more detailed revised NAAQS analysis for Phase 2, Year 2. As a result, no provisions for monitoring or contingency actions for the criteria pollutants are necessary during Phase 2, Year 2.[6]

Nevertheless, preventative or contingency measures have been included in the specifications to prevent the generation of particulates in the form of dust during Phase 2, Year 2 operations. These measures include the following:

- Site-specific Dust Prevention and Control Plans will be prepared by the contractors that detail the methods to be used to prevent and control onsite dust generation and migration from the site during operations.
- Haul roads will be wetted down, as needed, to minimize dust generation.
- The Processing Facility Operations Contractor will be required to prevent and mitigate spills of sediment on haul roads.

3.9.3 Odor

It is not anticipated that sediments dredged in Phase 2, Year 2 will generate odors that will reach the concern or exceedance levels in the QoLPS. Routine monitoring, reporting requirements, and action levels for additional monitoring under the Phase 2 QoLPS for odor are described in the Phase 2 RAM QAPP. Specific actions that will be taken to address exceedance of the criteria in the Phase 2 QoLPS and associated reporting requirements are discussed in the 2012 PSCP (GE 2012).

3.9.4 Noise

For Phase 2, Year 2, as discussed in Section 2.3.6, the new equipment to be installed and used at the processing facility is not expected to significantly increase noise levels at the processing facility compared to those in 2011. However, GE will conduct a noise survey at locations around the processing facility during a period of peak production

[6] If design changes are necessary in subsequent years of Phase 2 that could cause a substantive change to this analysis, a revised analysis will be presented in revised design submittals for those years.

rates in 2012 to confirm that expectation. That study is described in Section 7 of the Phase 2 RAM QAPP. In addition, during Phase 2, Year 2, noise monitoring will be conducted by the Dredging Contractor and Processing Facility Operations Contractor at the initial startup of any operation or equipment different from that previously used in this project and that could result in increased noise levels. This monitoring will not be considered monitoring for compliance with the Noise Standard. However, if a sound level based on the contractor monitoring is above the numerical criteria in the Noise Standard, additional monitoring will be conducted at a location closer to the nearest receptor(s) to assess attainment of those criteria; a noise level above those criteria will be considered an exceedance only if confirmed by that follow-up monitoring. Noise monitoring will also be conducted in response to noise complaints. Routine monitoring, reporting requirements, and action levels for additional monitoring under the Phase 2 QoLPS for noise are described in the Phase 2 RAM QAPP.

Specification Section 02931 (Noise Restrictions and Controls) (Appendices 1 and 2) outlines the noise standards, requirements, restrictions, and controls during the project operations. This specification identifies the routine noise monitoring that will be conducted by the contractors at the initial startup of any operation or equipment and for any changes in equipment, procedures, or conditions. If compliance noise monitoring (whether conducted as a follow-up to the contractor monitoring or in response to a complaint) shows an exceedance of an applicable noise standard, the contractor will be responsible for implementing engineering controls or other mitigation measures, as appropriate, to address such exceedance.

3.9.5 Lighting

The Phase 2 CHASP Scope requires that the Phase 2 design include an updated evaluation, based on Phase 1 light measurements, of light intensity generated by illumination of active dredge areas, processing areas, loading and staging areas, administration areas, and other work areas on and near the river, considering any equipment changes anticipated for Phase 2 that could affect lighting levels. For Phase 2, Year 2, dredging operations are not expected to cause an increase in lighting impacts over those experienced during Phase 1 and Phase 2, Year 1. For the processing facility, as noted in Section 2.3.6, a lighting plan for the new size separation, gravity thickening, and coarse material staging areas will be provided to EPA for review after it has been developed. Based on that plan, the lighting impacts from the processing facility relative to those in Phase 1 and Phase 2, Year 1 can be assessed.

During Phase 2, Year 2, light monitoring will be conducted by the Dredging Contractor and Processing Facility Operations Contractor at the initial startup of any operation or equipment different from that used previously in this project and that could result in increased light levels. This monitoring will not be considered monitoring for compliance with the Lighting Standard. However, if a light level based on contractor monitoring is above a lighting standard, additional monitoring will be conducted at a location closer to the nearest receptor(s) to assess attainment of the standard. A light level above the level of a standard will be considered an exceedance only if confirmed by follow-up monitoring. Light monitoring will also be conducted in response to lighting complaints. Routine monitoring, reporting requirements, and action levels for additional monitoring under the Phase 2 QoLPS for lighting are described in the Phase 2 RAM QAPP.

Specification Section 02936 (Lighting Restrictions and Controls) (Appendices 1 and 2) outlines the lighting standards, requirements, restrictions, and controls during the project operations. This specification identifies routine light monitoring that will be conducted by the contractors at the initial startup of any operation or equipment and for any changes in equipment, procedures, or conditions. If compliance light monitoring (whether conducted as a follow-up to the contractor monitoring or in response to a complaint) shows an exceedance of an applicable lighting standard, the contractor will be responsible for implementing engineering controls or other mitigation measures, as appropriate, to address such exceedance.

3.9.6 Navigation

To meet the Phase 2 QoLPS for navigation, this project will be implemented to maintain safety and productivity while avoiding unnecessary disruption of non-project-related navigation, allowing efficient performance of the project. The final design incorporates certain accommodations, preventative control systems, notification protocols, contingencies, and mitigation measures to maximize safety and productivity and to avoid unnecessary disruption of non-project-related navigation, while allowing efficient performance of the project. Specifically, the design includes the following general requirements relating to navigation:

- *Prohibition on obstructing navigation* – To the extent practicable and consistent with meeting other goals and performance standards, project-related vessels will not be tied or anchored in the navigation channel in a manner that would prevent or obstruct passage of other vessels.

- *Vessel lighting and signals* – Project-related vessels will comply with applicable federal and state regulations regarding proper lighting and signaling for safe and orderly navigation, day and night.

- *Piloting* – Project-related vessels will comply with applicable federal and state regulations regarding piloting by qualified and properly trained personnel.

- *Restricting access* – Non-project-related access to active work areas will be restricted in coordination with the NYS Canal Corporation.

- *Marine traffic control* – Project vessels will be tracked via radio dispatch to schedule and control traffic to optimize productivity while minimizing interference with non-project-related vessels.

- *Use of locks* – Use of Lock 7 on the Champlain Canal will be coordinated with the NYS Canal Corporation and will be reduced by staging and routing project support vessels (i.e., vessels other than barges and associated tugs) from the Work Support Marina. Use of other locks for mobilization and demobilization of equipment will also be coordinated with NYS Canal Corporation.

- *Temporary aids to navigation* – Safe and efficient navigation near active project areas will be facilitated by use of buffer zones and temporary aids to navigation, including lighting, signs, buoys, and other aids specified by the NYS Canal Corporation and the U.S. Coast Guard (USCG).

- *Routine notices* – The NYS Canal Corporation and USCG will be provided verbal and written routine notices regarding project schedules, which will allow those agencies to issue Notices to Mariners regarding anticipated access restrictions, project vessel scheduling, lock scheduling, contingencies, or other information. The general public will also be provided a schedule of anticipated project activities that may affect navigation, as discussed in more detail in the 2012 CHASP.

- *Monitoring, notifications, and reporting* – Marine traffic will be routinely monitored after dredging operations begin. This routine monitoring will involve the recording in daily logs of information about river navigation activities in the vicinity of in-river project operations, along with any resulting navigation issues.

- *Deviations from navigation requirements and complaint management* – If on-river operations deviate from applicable navigation regulations or from the design plans relating to navigation, the procedures specified in the 2012 PSCP and 2012 CHASP for reporting and taking contingency actions will be followed. Complaints from the public relating to navigation will be handled as described in the 2012 CHASP.

Specification Sections 02936 (Lighting Restrictions and Controls), 13810 (In-Water Material Transport), 13820 (Anchoring During Dredging Operations), 13840 (Transport Procedures Through Canal Locks), 13845 (Aids to Navigation During Dredging Operations), 13860 (Marine Traffic Control), and 13897 (Marine Equipment) in Appendix 1, and Specification Sections 01140 (Work Restrictions) in Appendix 3 include the requirements, restrictions, and controls during the project operations to meet the Navigation Performance Standard.

Additional information regarding the scope of navigation monitoring, notification, contingencies, mitigation, and complaint management are provided in the 2012 PSCP and the 2012 CHASP.

4. Contract Summary and Remedial Action Implementation – Phase 2, Year 2

This section summarizes the contracts that have been or are to be awarded to implement the remedial action work for Phase 2, Year 2 and provides a general description of the remedial action activities to be performed under each contract. Also included in this section is a description of the remedial action submittals for Phase 2, Year 2 and a summary of the schedule for implementation of the remedial action activities.

4.1 Remedial Action Contracts – Phase 2, Year 2

The remedial action for Phase 2, Year 2 has been organized into the following contracts, based on the nature of work to be accomplished under each.

- Contract 30 – Processing Facility Operations
- Contract 42A – Dredging Operations
- Contract 60 – Rail Yard Operations

The specifications and drawings for Contract 42A are provided in Appendix 1, and the general conditions and requirements for that contract are included in the Division 1 specifications provided in Appendix 2. Because the processing facility operations and rail yard operations in 2012 will be conducted under the same contracts issued for the work implemented during 2011, the specifications for these contracts, which were issued with the approved 2011 FDR, are not presented with this 2012 FDR. Any changes to the technical specifications for Contract 30 or Contract 60 will be provided to EPA for review under separate cover.

In addition to the main contracts, a contract for on-river water treatment operations may be awarded if the Construction Manager determines that such a system is necessary in 2012. Performance specifications for that potential work are provided in Appendix 3. The specification performance requirements may be revised based on contractor and/or vendor input.

As discussed in Section 1.5, the habitat construction design associated with dredge areas completed in Phase 2, Year 1 will be provided to EPA in a separate design report or design addendum at a later date.

The work for each of the above-listed contracts is summarized in the following subsections. These summaries are not intended to define the scope of work for the contracts, but are presented only to provide general overviews of work to be conducted under each contract.

4.1.1 Contract 30 – Processing Facility Operations

As in Phase 2, Year 1, the processing facility operations work under Contract 30 will consist of seasonal startup, commissioning, and sediment processing operations at the processing facility, including, but not limited to, the following:

- Preparing operation plans and submittals;
- Mobilizing equipment, materials, and personnel and preparing the site for sediment processing operations;
- Barge unloading, coarse material separation, sediment dewatering, material staging, and loading of dewatered sediment, coarse material, and debris into railcars;
- Managing stormwater at the facility and treating process water and stormwater prior to discharge (including management and treatment of stormwater during the off-season following the 2012 dredging season);
- Performing general operation and maintenance activities, including dust control, cleaning, lawn mowing, snow removal, and other activities;
- Winterizing the processing facility after completion of sediment processing and railcar loading; and
- Removing, decontaminating, and demobilizing equipment, materials, and personnel.

Because the processing facility operations in 2012 will be conducted under the same contract issued for the work implemented during 2011, the specifications for processing facility operations, which were issued with the approved 2011 FDR, are not presented with this 2012 FDR.

4.1.2 Contract 42A – Dredging Operations

Dredging operations under Contract 42A, as described in Appendix 1, will include, but not be limited to, the following:

- Preparing operation plans and submittals;
- Mobilizing equipment, materials, and personnel and preparing the site and support areas for dredging operations;
- Pruning shoreline vegetation to facilitate dredging;
- Dredging sediment within the targeted dredge areas and implementing BMPs as necessary to control resuspension, air emissions, and sediment oil sheens;
- If an on-river water treatment system is implemented in 2012, coordinating with the operator of the on-river water treatment barge, including determining which dredged material transport barges will be selected for on-river water treatment, transporting loaded barges to the on-river water treatment barge, and retrieving barges after on-river water removal and treatment;
- Transporting dredged sediment and debris to the processing facility;
- Installing appropriate shoreline stabilization measures and repairing and planting shoreline areas disturbed above the 119 ft shoreline;
- Backfilling and capping, including procurement of backfill and cap materials, transport of those materials to the dredge areas, and placement in accordance with the design for each CU;
- Providing marine traffic control services; and
- Removing and demobilizing equipment, materials, and personnel and performing decontamination activities.

4.1.3 On-River Water Treatment Contract

If a contract for an on-river water treatment system is awarded, operations under that contract, as described in Appendix 3, will include, but not be limited to, the following:

- Preparing operation plans and submittals, including a design and O&M plan for the on-river water treatment system;
- Mobilizing equipment, materials, and personnel and preparing the site for the on-river water treatment operations;
- Coordinating with the Dredging Contractor, who will be responsible for delivering/retrieving dredged material transport barges to/from the on-river water treatment barge;
- Removing free water from dredged material transport barges and treating the water to meet the specified effluent criteria; and
- Removing and demobilizing equipment, materials, and personnel and performing decontamination activities.

4.1.4 Contract 60 – Rail Yard Operations

As in Phase 2, Year 1, the rail yard operations work under Contract 60 will consist of activities required to set up outbound loaded trains and receive inbound empty trains. The railroad that operates the track at and near the processing facility (Canadian Pacific Railroad [CPR]) will drop a set of empty railcars on one of the receiving tracks. The Rail Yard Operations Contractor will use a yard engine dedicated to the project to break down the train set and switch the cars to the loading track. When the cars are loaded, the Rail Yard Operations Contractor will weigh the cars, move the loaded cars to a vacant track, and continue to set empty cars on the loading track. The loaded cars will be assembled into unit trains, which will be set on the departure track for pickup by CPR and transported to the selected disposal facility.

The rail yard operations work will include, but not be limited to:

- Inspecting, maintaining, and operating the rail yard and track, an onsite rail support building, drainage structures, grade crossings, equipment, and a weigh-in-motion scale;
- Moving, switching, and weighing railcars, including setting railcars for loading by the Processing Facility Operations Contractor;
- Preparing unit trains for departure; and

- Providing logistical support services to facilitate the movement of railcars within the rail yard and coordinating the movement of railcars to and from the disposal facility.

Because the rail yard operations in 2012 will be conducted under the same contract issued for the work implemented during 2011, the specifications for rail yard operations, which were issued with the approved 2011 FDR, are not presented with this design report.

4.2 Remedial Action Work Plan and Other Remedial Action Submittals – Phase 2, Year 2

For the work to be performed in each construction year of Phase 2, Section 3.1 of the revised SOW (EPA 2010c) requires GE to submit a RAWP for Phase 2 Dredging and Facility Operations for the dredging to be performed in that year. GE submitted an initial version of the 2012 RAWP in February 2012 and submitted a revised version of the 2012 RAWP (reflecting comments from EPA and input from contractors) on March 30, 2012, dated April 2012 (Parsons 2012a). The 2012 RAWP describes the dredging and facility operations to be performed as part of Phase 2, Year 2; the equipment staging for dredging operations; a construction schedule; and a dredge production schedule. As indicated in Section 1.5 above, the 2012 RAWP includes, as appendices, the following plans: 2012 DQAP, 2012 Facility O&M Plan, 2012 TDP (to be submitted at a later date), 2012 PSCP, 2012 PAP, and 2012 CHASP.

GE has also submitted the Phase 2 Remedial Action Health and Safety Plan for 2012 (2012 RA HASP; Parsons 2012e). The 2012 RA HASP addresses potential worker health and safety issues for GE and its contractors' workers, describes potential hazards and impacts to project workers, and identifies the steps that GE and its contractors will take to prevent and respond to them.

In addition, GE submitted a Phase 2 RAM QAPP (Anchor QEA 2012), which describes in detail the monitoring and sampling activities, including sample collection, analysis, and data handling activities, to be conducted by GE during the remainder of Phase 2, including Phase 2, Year 2.

In accordance with the revised SOW, the above-listed documents will be further revised and/or updated for each subsequent year of Phase 2, and will be submitted to EPA for review and approval.

4.3 Remedial Action Implementation Schedule – Phase 2, Year 2

The schedule for implementation of Phase 2, Year 2 dredging and facility operations is provided in the 2012 RAWP.

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6. Acronyms and Abbreviations

ARA	Archaeological Resources Assessment
ARAR	Applicable or Relevant and Appropriate Requirement
AOC	Administrative Order on Consent
BA	Biological Assessment
BBL	Blasland, Bouck & Lee
BCD	Barge Canal Datum
BERS	Barge Electronic Reporting System
BGEPA	Bald and Golden Eagle Protection Act
BMP	Best Management Practice
CD	Consent Decree
CDE	Critical Design Elements
CFR	Code of Federal Regulations
cfs	cubic feet per second
CHASP	Community Health and Safety Plan
CPR	Canadian Pacific Railroad
CU	Certification Unit
cy	cubic yards
cy/day	cubic yards per day
DAD	Dredge Area Delineation

DoC	Depth of Contamination
DOT	U.S. Department of Transportation
DQAP	Dredging Construction Quality Control/Quality Assurance Plan
E&E	Ecology & Environment
EoC	Elevation of Contamination
EPA	U.S. Environmental Protection Agency
EPS	Engineering Performance Standards
FDR	Final Design Report
ft/s	feet per second
g/m^2	grams per square meter
GE	General Electric Company
GLAC	Glacial Lake Albany Clay
gpm	gallons per minute
HA	Habitat Assessment
HASP	Health and Safety Plan
HD	Habitat Delineation
HDA	Habitat Delineation and Assessment
H_2S	hydrogen sulfide
IDR	Intermediate Design Report
IDSR	Interim Data Summary Report

m	meters
mg/kg	milligrams per kilogram
MPA	mass per unit area
MTBA	Migratory Bird Treaty Act
NAAQS	National Ambient Air Quality Standards
NAPL	non-aqueous phase liquid
NAVD88	North American Vertical Datum of 1988
ng/L	nanograms per liter
NOAA	National Oceanic and Atmospheric Administration
NTU	nephelometric turbidity units
NYCRR	New York Codes, Rules, and Regulations
NYS Canal Corporation	New York State Canal Corporation
NYSDEC	New York State Department of Environmental Conservation
O&M	Operations and Maintenance
OMM	Operations, Maintenance, and Monitoring
OSHA	Occupational Safety and Health Administration
PAP	Property Access Plan
PCB	polychlorinated biphenyl
PDR	Preliminary Design Report
ppm	parts per million

PSCP	Performance Standards Compliance Plan
QAPP	Quality Assurance Project Plan
QoLPS	Quality of Life Performance Standard
RA CD	Remedial Action Consent Decree
RAM	Remedial Action Monitoring
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
RD AOC	Administrative Order on Consent for Hudson River Remedial Design and Cost Recovery
RFW	riverine fringing wetland
RM	River Mile
ROD	Record of Decision
RPM	revolutions per minute
SAV	submerged aquatic vegetation
SEDC	Supplemental Engineering Data Collection
SOW	Statement of Work
SSAP	Sediment Sampling and Analysis Program
TDP	Transportation and Disposal Plan
TID	Thompson Island Dam
TIP	Thompson Island Pool

TOC	total organic carbon
TPCB	total polychlorinated biphenyls
Tri+ PCBs	PCBs with three or more chlorine atoms
TSCA	Toxic Substances Control Act
TSS	Total Suspended Solids
U.S.C.	United States Code
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VTS	vessel traffic service
WQ	Water Quality

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Tables

Table 2-1
Basis of Design for Dredging and Dredged Material Transport – Phase 2, Year 2

Phase 2 Final Design Report for 2012
General Electric Company – Hudson River PCBs Superfund Site

Item	Basis	Source/Notes
PCB MPA threshold for sediment removal in River Section 1	3 g/m^2 Tri+ PCBs	• Record of Decision (EPA 2002)
Surface sediment threshold for sediment removal in River Section 1	10 mg/kg Tri+ PCBs	• Specified in Phase 2 DAD Report (QEA 2007) • EPA's Final Decision Regarding GE's Disputes on Draft Phase 1 DAD Report and Draft Target Area Identification Report (EPA 2004a)
Location and depth of dredging	Design inventory dredge depths are based on removal to 1 mg/kg Total PCBs	• EoC surface was developed by Anchor QEA based on the Dredge Prism Development Steps included in the Phase 2 CDE and sediment PCB data (see Attachment C) • Dredge prisms provided with this 2012 FDR were developed by Parsons based on the Dredge Prism Development Steps included in the Phase 2 CDE and the EoC surface developed by Anchor QEA (see Attachment D) • Location and depth of 2012 dredging based on the planned removal of a minimum 350,000 cy of sediment (Phase 2 EPS)
Post-dredge sediment PCB concentration target	1 mg/kg Tri+ PCBs	• From Phase 2 EPS, additional criteria of 6 and 27 mg/kg Tri+ PCBs and 500 mg/kg total PCBs require various response actions
Target sediment removal volume	350,000 cy	• Phase 2 EPS
CUs designed for Phase 2, Year 2	CU26 to CU49	• The design inventory volume for CU26 through CU49 is approximately 409,000 cy based on the dredge prism (see Attachments C and D) • The dredge plan (Table 3-1) developed based on logistics modeling (Attachment A) assumes that Phase 2, Year 2 dredging will be completed in CU26 through CU44 (see Section 3.1.6) • The actual number of CUs completed and volume of sediment dredged during Phase 2, Year 2 will be dependent on the extent of re-dredging required, among other factors (see Section 3.1.1)
Re-dredge volume	To be determined	• Based on data from 2011, the estimated volume of re-dredging is assumed to be 30 percent of the EoC volume • The extent of re-dredging required may reduce the number of CUs completed and the volume of sediment removed during Phase 2, Year 2
Dredge elevation tolerance requirement	Achievement of required dredge elevation in at least 95% of the dredge area	• Phase 2 EPS and Phase 2 CDE • Compliance based on 1-ft by 1-ft grid cells in the near-shore area and 10-ft by 10-ft grid cells in areas outside of the near-shore area • Field identified bucket refusal or clay areas, as accepted by the Construction Manager, will be considered to have achieved the required elevations in those areas (EPA 2012)

Table 2-1
Basis of Design for Dredging and Dredged Material Transport – Phase 2, Year 2

Phase 2 Final Design Report for 2012
General Electric Company – Hudson River PCBs Superfund Site

Item	Basis	Source/Notes
Canal season	Approximately 28 weeks	• Assumed length of the navigational season (i.e., early May to mid-November) based on NYS Canal Corporation operational data • Actual length of navigational season is controlled by the NYS Canal Corporation, and the actual opening and closing dates may differ from the assumed early May to mid-November season • Assumes that sufficient water flows will be available for uninterrupted lock operations • Assumes that the locks will be operational during the canal season
Dredge season (both the design cut and re-dredge passes)	Approximately 22 weeks (120 dredging days)	• Design assumption based on dredging between May 14, 2012 and October 15, 2012 including dredging 6 days per week, observation of 3 non-working holidays (Memorial Day, Independence Day, and Labor Day), and 9 days of downtime assumed for conditions such as inclement weather (fog, lightning, heavy rain), or high river flows, slowdown or shutdown per the Performance Standards, and unexpected conditions • Actual number days available for dredging will depend on field conditions and other factors and could be more or less than 120 • Design assumption of 120 dredge days provides approximately 1 month for completion of backfilling/capping operations, equipment decontamination, and demobilization prior to the NYS Canal Corporation closing the lock system (assumed to be mid-November)
Dredging hours of operation	24 hours/day; 6 days/week (with contingent seventh day)	• Design assumption – based on Phase 1 and Phase 2, Year 1 experience
Dredge type	Mechanical dredge with clamshell bucket	• Phase 2 CDE • Based on the design evaluation for Phase 1 and Phase 2 areas (see Phase 1 IDR; BBL 2005a) and based on Phase 1 and Phase 2, Year 1 experience
Design Inventory Volume for each CU	See Table 2-6	• Volumes based on the design dredge prism developed in accordance with the Phase 2 CDE • Volumes do not account for overdredging to achieve the required elevation tolerances or the application of shoreline or structural offsets that will be incorporated into the final construction dredge prism based on field survey and contractor input prior to dredging

Table 2-1
Basis of Design for Dredging and Dredged Material Transport – Phase 2, Year 2

Phase 2 Final Design Report for 2012
General Electric Company – Hudson River PCBs Superfund Site

Item	Basis	Source/Notes
Minimum average dredge rate	2,900 cy/day (average over 120 dredge days)	• Average daily removal rate needed to remove 350,000 cy of sediment over an assumed period of 120 dredge days • Peak daily dredge rates will exceed average rate • The actual number and size of dredges necessary to meet the project requirements will be identified in the RAWP based on Dredging Contractor input • Dredge rates may vary based on several factors, including, but not limited to: o Startup coordination with the Processing Facility Operations Contractor o Operational adjustments (slowdowns, shutdowns, adjustments to dredging sequencing) necessary based on compliance with the Performance Standards o High river flows or other conditions (e.g., fog) that limit safe and productive dredging o Processing facility unloading/processing rates
Dredge bucket size	5 cy clamshell	• Design assumption for dredge buckets expected to be used during Phase 2, Year 2 • The actual number and size of dredges necessary to meet the project requirements will be identified in the RAWP based on Dredging Contractor input
Shoreline definition	119.0 ft elevation NAVD88 for River Section 1	• Shoreline is based on river flow during conditions in spring 2002 when aerial photography was taken (approximate flow rate of 5,000 cfs at the Fort Edward USGS Gauge Station). In fall 2008, a land survey of the 119-foot shoreline elevation was conducted for River Section 1 and a revised shoreline was defined for River Section 1 areas.
Near-shore area	Area between the 119 ft shoreline and the 117.5 ft in-river pre-dredge elevation	• Phase 2 EPS
Existing conditions – river bottom contours	Multi-beam bathymetry surveys by OSI – electronic files	• OSI bathymetric surveys conducted in 2005 and 2006
Geotechnical properties of subsurface materials	Key parameters identified in the Phase 2 SEDC Work Plan (BBL 2006b). Data summarized in SEDC summary reports (see Section 2.2.2).	• Data collected during the SEDC Program
Water depths	Depth varies	• Varies based on river flow • Pre-dredge water depths based on OSI bathymetric surveys conducted in 2005 and 2006 • Post-dredge water depths (before backfill/cap material placement) based on the Dredge Prism XYZ File
Navigation channel	As shown on the Drawings	• Location provided by Anchor QEA based on information from NYSCC, USACE, and field measurements by Anchor QEA
Sediment chemistry	<u>Key Parameter</u> • PCBs	• SSAP and SEDC database (see Section 2.2.1)

Table 2-1
Basis of Design for Dredging and Dredged Material Transport – Phase 2, Year 2

Phase 2 Final Design Report for 2012
General Electric Company – Hudson River PCBs Superfund Site

Item	Basis	Source/Notes
Geotechnical properties of shoreline	Key parameters identified in the Phase 2 SEDC Work Plan (BBL 2006b). Data summarized in SEDC summary reports (see Section 2.2.2).	• Data collected during the SEDC Program
In-river debris	As shown on the G-Series Existing Condition Reference Drawings and figures in the appendices of the Phase 2 Supplemental SEDC Summary Report Addendum (ARCADIS 2008b) (Attachment B to the Phase 2 IDR)	• Data collected during SEDC Program. OSI surveys conducted in 2002 and 2005. Nature and location could change prior to implementation.
Presence of shoreline structures	As shown on the G-Series Existing Condition Reference Drawings	• Data collected during SEDC Program. Nature and location could change prior to dredging. • Updated to incorporate findings from a shoreline survey conducted by Parsons during 2010 • To be verified by contractor prior to dredging
Presence of in-water structures	As shown on the G-Series Existing Condition Reference Drawings	• Data collected during SEDC Program. Nature and location could change prior to dredging. • Updated to incorporate findings from a field reconnaissance conducted by Parsons during 2010 • To be verified by contractor prior to dredging
Sediment type	Varies	• Based on side scan sonar and probing data collected during the SEDC Program
Presence of bedrock or hardpan	Data summarized in Year 2 SEDC Interim DSR (BBL 2005b) and Phase 2 SEDC DSR (ARCADIS BBL 2007)	• Data collected during SEDC Program and SSAP
Presence of clay	Location and elevation varies. See Attachment C.	• Approximate locations and elevation of clay delineated by Anchor QEA based on data collected during the SSAP and SEDC Program • The approximate limits of where clay controls the EoC elevations are shown on Section 6 figures in Attachment C. These limits represent areas where sufficient core data was available to map the elevation of the top of GLAC and GLAC is shallower than or within 2 inches deeper than the chemistry-based EoC.
Presence and type of vegetation	Data summarized in habitat delineation and assessment reports	• See Section 2.2.6
Presence of archaeological resources	Data summarized in archaeological assessment reports	• See Section 2.2.8
Dredged material transport hours of operation (including lock operations)	24 hours/day, 7 days/week	• Design assumption based on Phase 1 and Phase 2, Year 1 experience
Lock dimensions	Length – 328 feet Width – 45 feet <u>Area Available for Vessels:</u> Length – 300 feet Width – 43.5 feet	• NYS Canal Corporation design records

Table 2-1
Basis of Design for Dredging and Dredged Material Transport – Phase 2, Year 2

Phase 2 Final Design Report for 2012
General Electric Company – Hudson River PCBs Superfund Site

Item	Basis	Source/Notes
One-way lockage time	30 minutes for Lock 7	• Design assumption to stage and position vessel in the lock, drain or fill the lock, and exit the lock, based on operational data collected during Phase 1. Actual duration will vary and depends on the stage of lock upon vessel arrival and vessel traffic.
Distance between Lock 7 and Processing Facility	1.8 miles	• Aerial mapping by Chas H. Sells 2002
Tugboat sizes	25-foot length 14-foot beam 400 hp and 600 hp	• Size of tugs procured for use on the project • The actual number and size of tugs necessary to meet the project requirements will be specified in the 2012 RAWP based on Dredging Contractor input
Dredged material transport barge dimensions and capacity	195-foot by 35-foot barges 1,650 tons (includes dredged material and water)	• Size of barges procured for use on the project • Barge capacity based on an assumed average barge draft of 7.75 ft and ullage tables for barges used during Phase 2, Year 1 • The actual number and size of barges necessary to meet the project requirements will be specified in the 2012 RAWP based on Dredging Contractor input
Small barge capacity (for shallow water, restricted draft areas)	100 cy	• Design assumption for the capacity of shallow draft barges for use in shallow water areas with limited access • The actual number and size of barges necessary to meet the project requirements will be specified in the 2012 RAWP based on Dredging Contractor input
Barge staging areas	Sta. 61+00 to 65+00	• Barges can be staged at staging dolphins south of Lock 7 or outside the navigation channel where there is sufficient water depth and where there are no restrictions on anchoring • Barge staging areas will be subject to approval by the Construction Manager
Average speed of tug and barge (loaded, upstream)	6 mph	• Design assumption based on weight of barge, material in barge, horsepower of tug and vessel maneuvering characteristics for safe operations
Average speed of tug and barge (empty, downstream)	7 mph	• Design assumption based on weight of barge, material in barge, horsepower of tug and vessel maneuvering characteristics for safe operations
Anchoring restrictions	See D-series Drawings	• Anchoring will be restricted within areas where wetlands and SAV have been delineated outside of dredge areas, where backfill has been placed and accepted by the Construction Manager in delineated SAV and wetland areas, where SAV has been planted, where natural colonization areas have been designated, where caps have been placed, in sensitive archaeological areas, and in areas subject to future archaeological resource assessment • No anchoring of work-related vessels will be permitted in the navigation channel without approval from EPA in consultation with NYS Canal Corporation
Air quality, odor, noise, lighting, and navigation performance standards	See Section 2.1.3	• Hudson QoLPS (EPA 2004) • Memorandum titled “Quality of Life Performance Standards – Phase 2 Changes” (E&E 2010) • Requirements specified in the Phase 2 PSCP Scope (Attachment C to the SOW for the Hudson River RA CD; EPA/GE 2010) • 2012 PSCP (GE 2012)

Table 2-1
Basis of Design for Dredging and Dredged Material Transport – Phase 2, Year 2

Phase 2 Final Design Report for 2012
General Electric Company – Hudson River PCBs Superfund Site

Item	Basis	Source/Notes
Air emission BMPs	See Section 2.3.2	• Phase 2 CDE • Required Adaptive Responses and Design Improvements for Phase 2, Year 2 (EPA 2012)

Notes:
1. References are defined in Section 5 of the 2012 FDR.
2. Acronyms and abbreviations are defined in Section 6 of the 2012 FDR.

Table 2-2
Basis of Design for On-River Water Treatment

Phase 2 Final Design Report for 2012
General Electric Company – Hudson River PCBs Superfund Site

Item	Basis	Source/Notes
Selection of barges for free water removal and water treatment	Varies – to be determined in the field	• Decisions regarding the dredged material transport barges that will be selected for the removal of free water and water treatment and the extent of free water removal for each barge will be determined in the field based on the conditions encountered and as appropriate to improve project efficiencies. The primary goal of the on-river water treatment operation will be to maximize, to the extent possible, the amount of dredged material in each dredged material transport barge and to minimize the total number of barges that need to be transported to the processing facility for unloading. • Dredged material transport barges that will be selected for free water removal/water treatment and the extent of free water removal for each barge will be determined based on several factors including, but not limited to: the pertinent air emission BMPs (see Section 2.3.2); ability to achieve the Quality of Life Performance Standards (QoLPS); the amount of water in the barge; the amount of sediment in the barge; the number of barges available for loading in the river; the optimization of barge transport, barge loading, and barge unloading; the location of the dredging operations; available space at the sediment processing facility for staging and unloading barges; the locations where barges are loaded; and the results of PCB air monitoring.
Minimum water treatment system flowrate	1,000 gpm	• Design assumption based on the estimated flowrate necessary to remove and treat free water from a minimum of six barges or at least 600,000 gallons of water in a 24-hour period • Assumes 1.5 hours to wait and change each barge, 1 hour of maintenance/repair per day, and a peaking factor of 1.4
Minimum capacity of the on-river water treatment system	Capable of removing and treating free water from a minimum of six barges or at least 600,000 gallons of water in a 24-hour period	• Design assumption based on an average of approximately 100,000 gallons of free per barge
Volume of free water in barges	Varies based on field conditions - estimated between 50,000 and 150,000 gallons per barge	• During Phase 2, Year 1 (2011), the average volume of water decanted from barges at the sediment processing facility was approximately 98,600 gallons/barge
Minimum water treatment system processes	Pre-Carbon Solids Removal System and GAC Adsorbers (minimum of two)	• Specification Section 13816 (On-River Water Treatment System) (Appendix 3) provides minimum requirements for the water treatment system, treatment system effluent concentration criteria, and minimum equipment and operating requirements in general terms. The types and sizes of equipment, processes, and materials necessary to meet the performance specification, including the required effluent limits, will be determined by the contractor.
Water treatment system effluent limits	Varies – See Tables 13816-1 and 13816-2 in Specification Section 13816 (On-River Water Treatment System) (Appendix 3)	• Effluent limits based Tables 8-2 and 8-3 of the Phase 2 Performance Standards Compliance Plan Scope (Phase 2 PSCP Scope) included as Attachment C of the SOW (EPA 2010C)

Table 2-2
Basis of Design for On-River Water Treatment

Phase 2 Final Design Report for 2012
General Electric Company – Hudson River PCBs Superfund Site

Item	Basis	Source/Notes
Air emission BMPs	See Section 2.3.2	• Phase 2 CDE • Required Adaptive Responses and Design Improvements for Phase 2, Year 2 (EPA 2012)

Notes:
1. References are defined in Section 5 of the 2012 FDR.
2. Acronyms and abbreviations are defined in Section 6 of the 2012 FDR.

Table 2-3
Basis of Design for Resuspension Control – Phase 2, Year 2

Phase 2 Final Design Report for 2012
General Electric Company – Hudson River PCBs Superfund Site

Item	Basis	Source/Notes
Control Level (Tri+ PCB Net Loads)	The Resuspension Standard is summarized in Section 2.1.2.1	• Phase 2 EPS • 2012 PSCP
Control Level (Total PCB Concentration)	The Resuspension Standard is summarized in Section 2.1.2.1	• Phase 2 EPS • 2012 PSCP
Advisory Level (TSS Concentrations)	The Resuspension Standard is summarized in Section 2.1.2.1	• Phase 2 EPS • 2012 PSCP
Resuspension Control BMPs	See Section 2.3.3.1	• Phase 2 CDE
Supplemental Resuspension Control BMPs	See Section 2.3.3.2	• Phase 2 CDE
Sheen Response BMPs	See Section 2.3.3.3	• Phase 2 CDE
Silt Curtains and other Resuspension Control Barriers	See Section 2.3.3.4	• Phase 2 CDE
Far-field monitoring stations	Schuylerville, Lock 5, Stillwater, and Waterford	• Locations of the far-field stations shown in the Phase 2 RAM QAPP (Anchor QEA 2012)
Mass of PCBs targeted for removal (kg)	Total PCBs: 25,530 kg (CU26 to CU44) Tri+ PCBs: 8,090 kg (CU26 to CU44)	• See Table 4-1 in Attachment B • The resuspension modeling (Attachment B) is based on logistics modeling (Attachment A) and assumes that Phase 2, Year 2 dredging will be completed in CU26 through CU44 (see Section 3.1.6) • The mass used in resuspension modeling is based on the EoC surface (Attachment C) and differs from that in the final dredge prisms (Attachment D)
River flow	Varies – See Attachment B	• Resuspension modeling (Attachment B) was performed based on river flows of 3,000 cfs, 6,000 cfs, 10,000 cfs, and 15,000 cfs
Sediment bed initial conditions, including the bed composition and PCB concentrations	Varies	• See Attachment B
Dredge rate, volume, duration, and number of dredges	Based on output (dredge plan) from the Phase 2 Logistics Model. See Attachment A.	• These are assumed model input conditions; the actual number and sequence of dredges and their associated removal rates during operations will vary from these model inputs

Notes:
1. References are defined in Section 5 of the 2012 FDR.
2. Acronyms and abbreviations are defined in Section 6 of the 2012 FDR.

Table 2-4
Basis of Design for Backfilling/Capping – Phase 2, Year 2

Phase 2 Final Design Report for 2012
General Electric Company – Hudson River PCBs Superfund Site

Item	Basis	Source/Notes
Backfill/cap footprint	Approximately 124.2 acres would be considered for backfill and/or cap placement within CU26 to CU49	• The Near-shore Area within CU26 to CU49 occupies approximately 9.3 acres • There is approximately 0.4 acre of RFW in CU26 to CU49 • The estimated area where habitat layer backfill will be applied in CU26 to CU49 is 4.3 acres (based on the analysis provided in Attachment E). Actual areas of placement are dependent on the post-dredging elevations in the delineated SAV areas. • The Phase 2 EPS limits the amount of capping that will be allowed in Phase 2 (see Section 2.1.2.2 and the 2012 PSCP)
Top elevation of caps within the navigation channel	103.2 ft (NAVD88)	• 14 feet of water depth above the cap based on the NYSCC's Barge Canal Datum low-pool elevation (BCD low-pool elevation) of 117.2 ft NAVD88 for TIP • Phase 2 EPS, Phase 2 CDE
The top elevation of backfill within the navigation channel	103.2 ft (NAVD88), unless compliant residual sampling node locations exceed 1 mg/kg Tri+ PCBs (after rounding) within the first core segment after the first dredging pass	• 14 feet of water depth above the backfill material based on the NYSCC's BCD low-pool elevation of 117.2 ft NAVD88 for TIP (Phase 2 EPS, Phase 2 CDE) • Backfill will not be placed in the navigation channel unless the post-dredge elevation is below 101.7 ft (NAVD88). This elevation corresponds to a 15.5-foot water depth (the 14-foot post-backfill placement water depth required by the Phase 2 EPS plus the 12-inch thick backfill layer and the allowable backfill placement tolerance). • In accordance with EPA's adaptive responses for 2012 (EPA 2012), at sampling nodes in the navigation channel where the residual Tri+ PCB concentration in the surface sediment after the first dredging pass exceeds 1 mg/kg (after rounding) but does not cause the average Tri+ PCB concentration in the CU to exceed 1 mg/kg or meet the other mandatory conditions for re-dredging as specified in the 2012 PSCP, backfill will be placed so long as there is approximately 12 feet of draft above the post-placement backfill surface at low-pool conditions (105.2 ft NAVD88 for TIP).
Backfill thickness	Varies	• The backfill layer will be 12 inches (1 foot) (ROD; EPA 2002) • Near-shore backfill will be restored to original bathymetry between the 119.0 and 117.5 ft elevation (NAVD88) in locations where dredging extends to the defined shoreline (Phase 2 CDE) • Where placed, habitat layer backfill will be placed to either return the area to pre-dredging bathymetry or to an elevation of 114 ft (NAVD88) (equivalent to a water depth of 5 feet below the 119 ft shoreline) (Phase 2 CDE). Habitat layer backfill may also be required above isolation caps where determined appropriate by EPA (Phase 2 CDE). • RFW areas will be restored to original bathymetry
Near-shore area	Area between the 119 ft shoreline and the 117.5 ft in-river pre-dredge elevation	• Near-shore backfill will be restored to original bathymetry in the near-shore area (Phase 2 CDE) • Pre-dredge bed elevation equals 117.5 ft (NAVD88) at near-shore setpoints, which are located along the pre-dredge bathymetric 117.5 ft elevation contour line based on OSI bathymetric surveys conducted in 2005 and 2006

Table 2-4
Basis of Design for Backfilling/Capping – Phase 2, Year 2

Phase 2 Final Design Report for 2012
General Electric Company – Hudson River PCBs Superfund Site

Item	Basis	Source/Notes
Flow velocities and flow return frequency – backfill design	≤ 1.5 ft/s – Type 1 backfill > 1.5 ft/s – Type 2 backfill 2-year flow return frequency	• These flow regimes are used as the basis for the backfill design • Flow velocities based on the Phase 2 Hydrodynamic Model (Attachment H of the Phase 2 IDR)
Backfill Material Types	Type 1, Type 2, Type 3	• Type 1 backfill material will be used in locations with estimated surface water velocities of 1.5 ft/s or less during a 2-year flow event • Type 2 backfill material will be used in areas with estimated surface water velocities above 1.5 ft/s during a 2-year flow event • Only Type 2 backfill material will placed in the navigation channel • Supporting side slopes for near-shore backfill, habitat layer backfill, and RFW construction areas will be constructed using Type 2 material • Base materials (depths of greater than 1 foot below the final backfill surface) for near-shore backfill and RFW construction areas will be constructed using Type 2 material • Type 3 backfill material will be used to provide a planting surface in restored RFW construction areas
Residuals sediment concentration triggers following dredging	1 mg/kg Tri+ PCBs 27 mg/kg Tri+ PCBs 500 mg/kg Total PCBs	• Phase 2 EPS • See Section 2.1.2.2 and the 2012 PSCP
Water depth after dredging	Varies	• Function of location in the river and dredging depths (range based on bathymetric data)
Flow velocities and flow return frequency – cap design	≤ 5 ft/s – Medium-velocity isolation cap > 5 ft/s – High-velocity isolation cap 100-year flow return frequency	• These flow regimes were used as the basis for the cap design (Attachment F of the 2011 FDR) • Flow velocities based on the Phase 2 Hydrodynamic Model (Attachment H of the Phase 2 IDR) • The basis for the flow return frequency related to the isolation cap design was set forth in the Phase 2 CDE
Caps in the navigation channel	High-velocity isolation caps with the top elevation of caps at or below 103.2 ft (NAVD88)	• Phase 2 CDE
Maximum residual sediment concentration subject to capping	500 mg/kg Total PCBs	• Areas with residual total PCB concentrations greater than 500 mg/kg (which is approximately equivalent to 200 mg/kg Tri+ PCBs) will be subject to re-dredging (Phase 2 EPS) • See Attachment F of the 2011 FDR
Tri+ PCB concentration in the top 6 inches of the cap isolation layer after 100 years	≤ 0.25 mg/kg	• Phase 2 CDE
Isolation cap design parameters	Varies	• See Attachment F of the 2011 FDR
Thickness of cap isolation layer	9 inches	• See Attachment F of the 2011 FDR
Ice conditions	Varies	• Basis for isolation cap design • See Attachment F of the 2011 FDR
Vessel effects	Varies	• Basis for isolation cap design • See Attachment F of the 2011 FDR

Notes:
1. References are defined in Section 5 of the 2012 FDR.
2. Acronyms and abbreviations are defined in Section 6 of the 2012 FDR.

Table 2-5

Basis of Design for Processed Sediment Transportation and Disposal – Phase 2, Year 2

Phase 2 Final Design Report for 2012

General Electric Company – Hudson River PCBs Superfund Site

Item	Basis	Source/Notes
Tonnage of material to be transported and disposed during Phase 2, Year 2	448,000 tons – Target Productivity	• Based on the minimum target production of 350,000 cy – Phase 2 EPS (EPA 2010) • Assumes average processing facility output density of approximately 1.28 tons per *in situ* cy dredged (based on Phase 2, Year 1 data)
PCB concentration for waste disposal characterization	Variable	• Actual PCB concentrations will vary depending on dredge area and processing • Processed sediment and debris may be segregated as TSCA and Non-TSCA material for disposal at separate commercial disposal facilities permitted to accept the materials. The methodology for characterizing, segregating, and managing TSCA-regulated and non-TSCA materials for the purposes of transport and disposal will be specified in the 2012 TDP.
Processed sediment shipping season	Early June to December 31 (~30 weeks)	• Initial shipments are assumed to begin 3 weeks after dredging is initiated to allow adequate volume to accumulate for load out and shipment • Based on the plan that all material will be shipped from processing facility by end of calendar year • Shipment of all staged sediment and debris by the end of the calendar year may be subject to an extension in the event that delays attributable to actions of the disposal facility operator or rail carriers prevent such removal by the end of the calendar year (Phase 2 EPS)
Available staging area capacity for processed material	<u>Coarse Material:</u> 116,000 cy <u>Fine Material:</u> 41,000 cy	• Constructed at the Processing Facility during Phase 1 and upgraded during 2011 and 2012 • Total material staged shall not exceed 130,000 cy (EPA 2012) (unless otherwise approved by EPA)
Landfill destination	To be determined.	• The processed materials will be transported by railroad to one or more authorized commercial disposal facilities • The selected disposal facility(ies) will be identified in the 2012 TDP
Delivery mode	Rail, using gondola rail cars	• Rail delivery in unit trains directly to selected disposal facility(ies) • Material will be packaged in rail cars by a method meeting DOT performance standards
Debris	Size limited and segregated from filter cake	• Debris is defined as any single piece of material greater than 4 feet in any length, or any single piece of material weighing more than 1 ton and less than 6 tons • Railcars loaded with debris will be designated so that they can be easily identified at the landfill
Moisture content of processed material	Pass paint filter test	• TSCA regulations (40 CFR 761) • Disposal facility requirements
RCRA designation of sediment	Non-Hazardous	• SSAP data

<u>Notes:</u>
1. References are defined in Section 5 of the 2012 FDR.
2. Acronyms and abbreviations are defined in Section 6 of the 2012 FDR.
3. TDP = Transport and Disposal Plan (Parsons 2012d; Appendix C to the 2012 RAWP; to be provided at a later date).

Table 2-6
Certification Unit Areas and Design Volumes

Phase 2 Final Design Report for 2012
General Electric Company - Hudson River PCBs Superfund Site

Certification Unit (CU)	CU Area (acres) [1]	EoC Surface Volume (cy) [2,4]	Design Dredge Prism Volume (cy) [3,4]
CU26	4.24	17,000	17,400
CU27	4.18	14,700	14,900
CU28	4.72	19,000	19,200
CU29	4.95	14,300	14,600
CU30	4.95	14,800	14,900
CU31	4.81	8,300	8,200
CU32	4.94	11,200	10,800
CU33	5.49	15,800	15,300
CU34	3.97	10,300	10,800
CU35	5.38	18,900	19,100
CU36	5.74	19,000	19,000
CU37	6.69	26,200	25,300
CU38	5.57	19,300	19,300
CU39	5.56	18,300	18,400
CU40	5.55	20,900	20,700
CU41	5.61	25,600	26,000
CU42	5.32	21,000	21,300
CU43	5.42	19,400	20,800
CU44	5.00	15,800	15,900
CU45	4.98	13,800	13,700
CU46	5.16	16,700	16,900
CU47	3.95	15,100	14,900
CU48	5.52	15,200	15,800
CU49	6.48	14,100	15,800
TOTAL - CU26 to CU49	**124.2**	**404,700**	**409,000**

Notes:

1. Certification Unit (CU) Area based on the area within the CU boundary limits and does not include adjustments associated with offsets/setbacks within the CU limits or engineering sideslopes outside the CU boundaries.

2. The Elevation of Contamination (EoC) surface was developed by Anchor QEA based on the Dredge Prism Development Steps included in the Phase 2 CDE and sediment PCB data (see Attachment C).

3. Design dredge prisms were developed by Parsons based on the Dredge Prism Development Steps included in the Phase 2 CDE and the EoC surface developed by Anchor QEA (see Attachment D).

4. Volumes for the EoC surface and the design dredge prisms are based on comparison with the existing bathymetry data, which is based on bathymetric surveys conducted in 2005 and 2006. The Design Dredge Prism Volumes include engineering sideslopes that are outside of the CU boundaries.

Table 3-1
Dredge Plan - Phase 2, Year 2

Phase 2 Final Design Report for 2012
General Electric Company - Hudson River PCBs Superfund Site

Week	Day	CU26	CU27	CU28	CU29	CU30	CU31	CU32	CU33	CU34	CU35	CU36	CU36	CU38	CU39	CU40	CU41	CU42	CU43	CU44	Total Design Inventory Volume (cy)	Total Re-Dredge Volume (cy)	Total Volume by Day (cy)	Total Volume by Week (cy)
		DAILY REMOVAL VOLUMES BY CU																						
	1																				-	-	-	
	2																				-	-	-	
	3																				-	-	-	
1	4																				-	-	-	**0**
	5																				-	-	-	
	6																				-	-	-	
	7										*No dredging assumed during the first 2 weeks.*										-	-	-	
	8																				-	-	-	
	9																				-	-	-	
	10																				-	-	-	
2	11																				-	-	-	**0**
	12																				-	-	-	
	13																				-	-	-	
	14																				-	-	-	
	15											1124									1,124.42	-	**1,124.42**	
	16											1182									1,181.70	-	**1,181.70**	
	17											1182									1,181.70	-	**1,181.70**	
3	18											1182									1,181.70	-	**1,181.70**	**6,793**
	19											1055									1,054.54	-	**1,054.54**	
	20											1069									1,069.37	-	**1,069.37**	
	21										*Sunday*										-	-	-	
	22	1410										1025									2,434.82	-	**2,434.82**	
	23	1442										1026									2,467.51	-	**2,467.51**	
	24	1442										1067									2,508.33	-	**2,508.33**	
4	25	1442										906									2,347.66	-	**2,347.66**	**13,707**
	26	1442										580									2,022.04	-	**2,022.04**	
	27	1357										570									1,926.98	-	**1,926.98**	
	28										*Sunday*										-	-	-	
	29										*Memorial Day Holiday*										-	-	-	
	30	2183	1419									580									4,181.78	-	**4,181.78**	
	31	2233	1363									528									4,124.16	-	**4,124.16**	
5	32	1794	1481									660									3,935.23	-	**3,935.23**	**19,738**
	33	1698	1424									690									3,811.66	-	**3,811.66**	
	34	1655	1340									690									3,685.45	-	**3,685.45**	
	35										*Sunday*										-	-	-	
	36	425	2254	725								690									4,093.85	-	**4,093.85**	
	37		2170	1358							450	211									4,188.93	-	**4,188.93**	
	38		2279	1219							690										4,187.38	-	**4,187.38**	
6	39		1695	1733							690										4,118.81	-	**4,118.81**	**25,092**
	40		258	2590	833						690										4,370.72	-	**4,370.72**	
	41			2461	1011						660										4,132.56	-	**4,132.56**	
	42										*Sunday*										-	-	-	
	43			2864	1143						720										4,726.43	-	**4,726.43**	
	44	1400		1662	536						660										2,858.63	1,400.05	**4,258.68**	
	45	1965		1181							660										1,841.33	1,965.29	**3,806.62**	
7	46	1423		1080	789						690										2,559.35	1,422.89	**3,982.24**	**25,171**
	47	29		1028	2436						690										4,153.62	29.34	**4,182.96**	
	48			867	2656						690										4,213.67	-	**4,213.67**	
	49										*Sunday*										-	-	-	
	50		2035	113	1555						690										2,358.08	2,034.89	**4,392.97**	
	51		1802		1415						655										2,070.03	1,802.18	**3,872.21**	
	52		404		1957	738					570										3,264.03	403.88	**3,667.91**	
8	53				957	2143					580										3,679.97	-	**3,679.97**	**23,238**
	54				1001	2036					570										3,606.64	-	**3,606.64**	
	55				540	2363	565				550										4,018.18	-	**4,018.18**	
	56										*Sunday*										-	-	-	
	57			626		1492	1166				585										3,242.38	625.86	**3,868.23**	
	58			1874		445	942				480										1,867.46	1,873.83	**3,741.30**	
	59			2270		1100					660										1,759.52	2,270.31	**4,029.83**	
9	60			1132		1751					690										2,440.67	1,132.00	**3,572.67**	**21,829**
	61			872		1669	17				690										2,376.31	871.60	**3,247.91**	
	62				127	1479	1133				630										3,241.29	127.49	**3,368.79**	
	63										*Sunday*										-	-	-	

Table 3-1
Dredge Plan - Phase 2, Year 2

Phase 2 Final Design Report for 2012
General Electric Company - Hudson River PCBs Superfund Site

Week	Day	DAILY REMOVAL VOLUMES BY CU																			Total Design Inventory Volume (cy)	Total Re-Dredge Volume (cy)	Total Volume by Day (cy)	Total Volume by Week (cy)
		CU26	CU27	CU28	CU29	CU30	CU31	CU32	CU33	CU34	CU35	CU36	CU36	CU38	CU39	CU40	CU41	CU42	CU43	CU44				
	64				1142	118	2006				690										2,814.13	1,142.21	**3,956.34**	
	65				1123		2149				650										2,798.89	1,122.94	**3,921.83**	
	66										*Independence Day Holiday*										-	-	**-**	
10	67				398		1196	1565			690										3,450.73	398.24	**3,848.97**	19,571
	68						253	2262	778		660										3,952.90	-	**3,952.90**	
	69							1366	1151	715	660										3,891.25	-	**3,891.25**	
	70										*Sunday*										-	-	**-**	
	71							1060	1101	1131	660										3,951.92	-	**3,951.92**	
	72					1555		992	73	320	690										2,074.55	1,554.93	**3,629.48**	
	73					1859		1065			690										1,755.11	1,858.62	**3,613.73**	
11	74					1657		1075	229		239	660									2,203.44	1,656.80	**3,860.24**	23,471
	75					575		1053	1324			1035									3,411.79	575.08	**3,986.87**	
	76					852		1090	1476			1011									3,577.15	851.60	**4,428.75**	
	77										*Sunday*										-	-	**-**	
	78						76	81	1577	1084		866									3,607.95	75.74	**3,683.69**	
	79						1417		1265	929		757									2,950.43	1,417.22	**4,367.65**	
	80						1910		2136												2,135.62	1,910.02	**4,045.65**	
12	81						967		1821				1412								3,232.99	967.10	**4,200.10**	24,098
	82						106		1683		600		1327								3,010.88	705.97	**3,716.85**	
	83								1030	1054	690		1310								3,393.47	690.37	**4,083.84**	
	84										*Sunday*										-	-	**-**	
	85								993	1162	690		1428								3,583.04	689.62	**4,272.67**	
	86							990	135	1142	630		1232								2,508.56	1,620.41	**4,128.97**	
	87							1739		247	578		1412								1,659.50	2,317.20	**3,976.70**	
13	88							2209			690		1204								1,203.68	2,898.33	**4,102.01**	24,748
	89							1590		195	690		1690								1,884.71	2,280.28	**4,164.98**	
	90									1066	690		2347								3,413.32	689.63	**4,102.94**	
	91										*Sunday*										-	-	**-**	
	92									1094	415		2174	557							3,824.44	415.26	**4,239.70**	
	93								210	902			1991	1319							4,212.12	210.34	**4,422.46**	
	94								1045				1826	1312							3,137.59	1,044.68	**4,182.28**	
14	95								1020				1930	1333							3,262.64	1,020.39	**4,283.03**	25,218
	96											891	1904	1310							3,214.55	891.44	**4,105.99**	
	97											958	1947	1080							3,027.01	957.69	**3,984.70**	
	98										*Sunday*										-	-	**-**	
	99											1018	175	2219	897						3,290.99	1,018.06	**4,309.05**	
	100											1004		2258	1112						3,370.50	1,004.00	**4,374.50**	
	101											871		1995	855						2,849.81	871.28	**3,721.08**	
15	102									1187				2104	1015						3,119.11	1,186.72	**4,305.84**	25,214
	103									998				2099	1254						3,353.14	998.38	**4,351.52**	
	104									177		480		2038	1457						3,495.12	657.17	**4,152.28**	
	105										*Sunday*										-	-	**-**	
	106											550	45	2248	1271						3,519.24	594.69	**4,113.93**	
	107											570	2235	968							967.64	2,804.68	**3,772.33**	
	108											251	2293	848	508						1,355.63	2,543.72	**3,899.35**	
16	109												2184	918	1249						2,166.84	2,184.00	**4,350.83**	24,250
	110												690		2207	1190					3,396.54	690.38	**4,086.92**	
	111												660		1626	1740					3,366.21	660.00	**4,026.21**	
	112										*Sunday*										-	-	**-**	
	113												177		955	2620	1095				4,669.74	176.95	**4,846.69**	
	114														1121	2472	1358				4,951.29	-	**4,951.29**	
	115														1003	2545	1487				5,034.43	-	**5,034.43**	
17	116															2631	2543				5,174.09	-	**5,174.09**	29,452
	117													1137		1079	2611				3,689.64	1,136.70	**4,826.34**	
	118													1110		1563	1945				3,508.47	1,110.29	**4,618.76**	
	119										*Sunday*										-	-	**-**	
	120													949		2092	1315				3,406.46	949.33	**4,355.79**	
	121															1762	2005				3,767.55	-	**3,767.55**	
	122															2056	1965				4,021.13	-	**4,021.13**	
18	123															1860	2001				3,860.96	-	**3,860.96**	23,640
	124															595	1461	1375			3,431.86	-	**3,431.86**	
	125																1784	2419			4,202.65	-	**4,202.65**	
	126										*Sunday*										-	-	**-**	

Table 3-1
Dredge Plan - Phase 2, Year 2

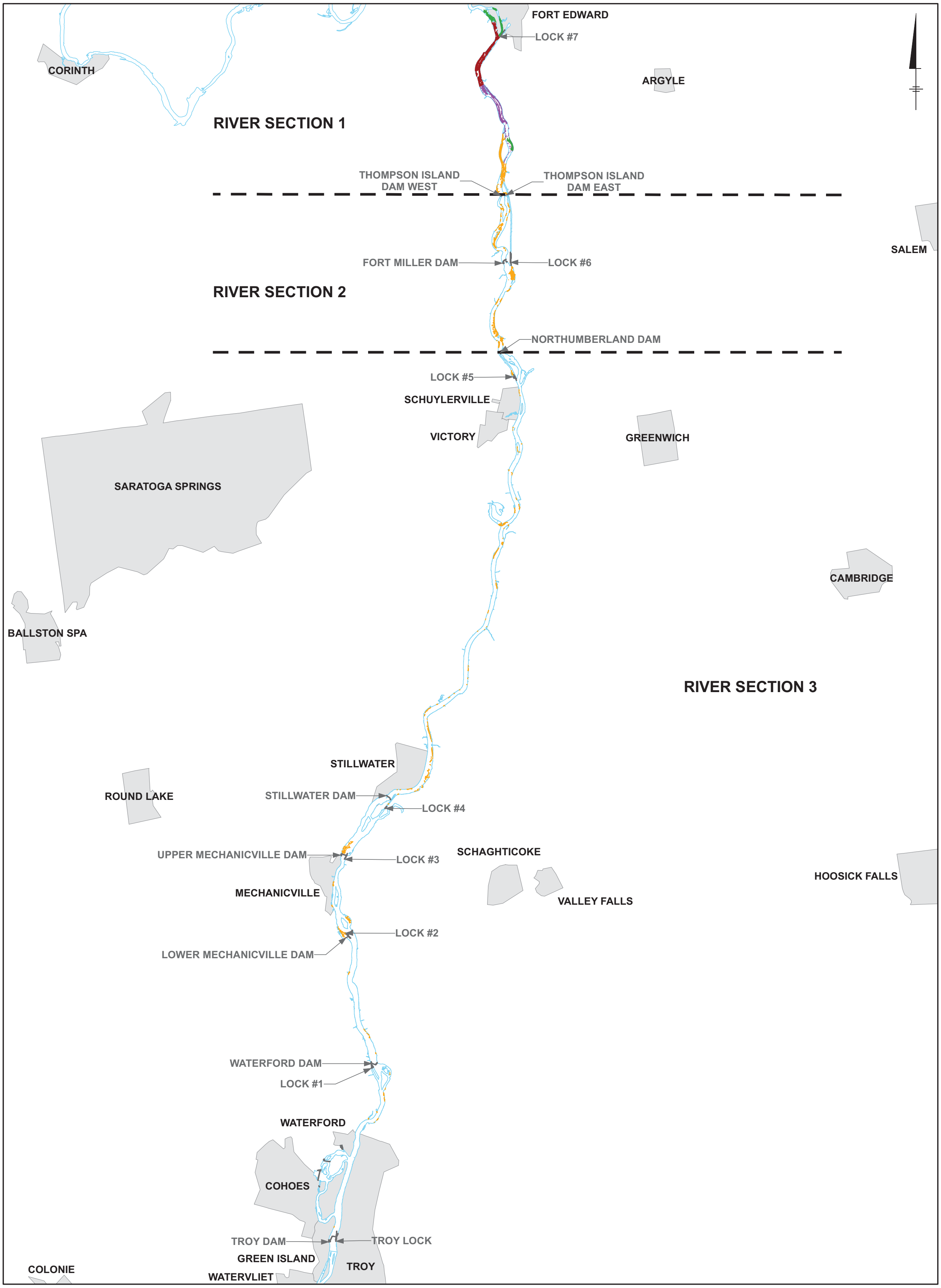
Phase 2 Final Design Report for 2012
General Electric Company - Hudson River PCBs Superfund Site

Week	Day	DAILY REMOVAL VOLUMES BY CU																			Total Design Inventory Volume (cy)	Total Re-Dredge Volume (cy)	Total Volume by Day (cy)	Total Volume by Week (cy)
		CU26	CU27	CU28	CU29	CU30	CU31	CU32	CU33	CU34	CU35	CU36	CU36	CU38	CU39	CU40	CU41	CU42	CU43	CU44				
	127										*Labor Day Holiday*										-	-	**-**	
	128														309		1912	1880			3,791.92	308.66	**4,100.58**	
	129														1258		1706	1368			3,074.28	1,258.28	**4,332.56**	
19	130														1904		891	1416			2,306.74	1,904.00	**4,210.74**	21,875
	131														2016	9	455	2040			2,495.35	2,025.38	**4,520.72**	
	132														1047	1139		2525			2,524.99	2,185.49	**4,710.48**	
	133										*Sunday*										-	-	**-**	
	134														130	1971		2689			2,688.64	2,100.35	**4,788.99**	
	135															2117		2710			2,709.57	2,117.05	**4,826.62**	
	136															1376		1394	1617		3,011.02	1,376.01	**4,387.03**	
20	137															195		783	2814	622	4,219.11	195.39	**4,414.50**	27,318
	138																	808	2822	883	4,513.08	-	**4,513.08**	
	139																	929	2596	863	4,388.04	-	**4,388.04**	
	140										*Sunday*										-	-	**-**	
	141																356	917	1995	926	3,838.53	355.71	**4,194.24**	
	142																2040	856		914	1,770.30	2,039.87	**3,810.17**	
	143																1561	596	1067	536	2,198.86	1,560.94	**3,759.81**	
21	144																864		1889	1160	3,048.78	863.65	**3,912.42**	20,379
	145																678		872	1091	1,962.87	678.37	**2,641.24**	
	146																		907	1154	2,060.88	-	**2,060.88**	
	147										*Sunday*										-	-	**-**	
	148																		919	1151	2,070.55	-	**2,070.55**	
	149																		919	597	1,515.75	-	**1,515.75**	
	150																	246	41	1328	1,369.63	245.60	**1,615.22**	
22	151																	1052		1378	1,378.31	1,052.18	**2,430.49**	12,575
	152																	1196		1378	1,378.31	1,195.76	**2,574.07**	
	153																	1046		1323	1,323.33	1,045.79	**2,369.12**	
	154										*Sunday*										-	-	**-**	
	155																	1163		1370	1,370.34	1,162.59	**2,532.93**	
	156																	984	438	1031	1,031.40	1,421.98	**2,453.38**	
	157																		2327		-	2,326.83	**2,326.83**	
23	158																		1573		-	1,572.58	**1,572.58**	9,181
	159																		295		-	294.92	**294.92**	
	160																				-	-	**-**	
	161										*Sunday*										-	-	**-**	
	162																			1030	-	1,029.80	**1,029.80**	
	163																			1153	-	1,152.77	**1,152.77**	
	164																			1200	-	1,199.51	**1,199.51**	
24	165																			1071	-	1,071.22	**1,071.22**	5,291
	166																			838	-	838.00	**838.00**	
	167																				-	-	**-**	
	168										*Sunday*										-	-	**-**	
Total Inventory Volume (cy)		**18,521**	**15,684**	**18,881**	**16,830**	**15,332**	**9,426**	**11,608**	**16,771**	**11,042**	**20,269**	**20,344**	**25,309**	**24,606**	**16,528**	**24,206**	**26,533**	**24,706**	**18,458**	**17,708**	--	--	--	--
Total Redredge Volume (cy)		**4,818**	**4,241**	**6,774**	**2,791**	**6,497**	**4,476**	**6,528**	**2,275**	**2,362**	**5,673**	**6,593**	**8,284**	**3,196**	**6,664**	**6,807**	**5,499**	**5,686**	**4,632**	**5,291**	--	--	--	--
Total Volume (cy)		**23,339**	**19,925**	**25,655**	**19,621**	**21,830**	**13,903**	**18,135**	**19,046**	**13,404**	**25,942**	**26,937**	**33,593**	**27,802**	**23,192**	**31,013**	**32,032**	**30,392**	**23,090**	**22,999**	**352,763**	**99,087**	**451,850**	**451,850**

Notes:
1. Dredge plan developed based on output data from the Phase 2 logistics model (Run #2012FDR-124) for planning purposes only. See Attachment A for additional details.
2. The initial design cut (inventory) dredge volumes are based on the EoC volume plus an assumed 7 percent increase to account for additional volume associated with the final dredge prism and overdredging associated with achieving the specified dredging tolerance. The re-dredging volume assumes a single re-dredge pass would be conducted to removal approximately 30% of the EoC volume over 42% of the CU area.
3. Shaded cells indicate volumes associated with the re-dredge pass.
4. The Dredging Contractor will be responsible for developing a dredge plan in accordance with the requirements of Specification Section 13803 (Dredging; Appendix 1).
5. Dredge plan assumes that dredging will be completed in CU26 through CU44 during Phase 2, Year 2. The actual number of CUs and volumes that will be dredged depends on several factors including, but not limited to:
   - The area and volume of sediment that will be subject to re-dredging based on the residual sampling results compared to the Residuals Standard.
   - The productivity of dredging operations to be completed in an upstream to downstream sequence, while limiting the work area in accordance with the concurrent CU dredging requirement.
   - The productivity of dredging operations in areas with shallow water and limited access (e.g., CU35, CU36, and CU37 on the eastern side of the Three Sisters Islands).
   - The degree of operational adjustments (slowdowns, shutdowns, adjustments to dredging sequencing) necessary based on compliance with the Performance Standards.
   - The operational dates for the Champlain Canal. Equipment will be mobilized after the Champlain Canal is opened in May and demobilization will occur in advance of canal closure in November. The actual dates for canal operation will be determined by the NYS Canal Corporation.
   - The frequency of high-river flows that limit safe and productive dredging.
   - The ability to efficiently unload and process dredged material and water transported to the sediment processing facility.
   - The ability to transport and dispose of processed material at a rate that prevents completely filling the coarse material staging areas, which have been limited by EPA to 130,000 cy at any one time, and filter cake staging enclosures.
   - The rate of backfilling and capping operations and CU closure. Dredging (including re-dredging) will need to be terminated in time to allow for closure of CUs and demobilization before the canal closure date. The actual end date for dredging in 2012 will be determined based on field conditions.

Figures

City: SYR Div/Group: 90 Created By: mkohberger Last Saved By: MKOHBERGER
GE Hudson River (B0031087.2009.02100)
R:\GE_GIS\GE_HudsonRiver\Phase2_FDR\DredgeAreaDelineation\mxd\Phase 1 and Phase 2 DAs with River Sections_v2.mxd 1/23/2012 3:41:28 PM



LEGEND:

- DAM/LOCK
- PHASE 1 DREDGE AREAS
- PHASE 2, YEAR 1 DREDGE AREAS
- PHASE 2, YEAR 2 DREDGE AREAS
- REMAINDER OF PHASE 2 DREDGE AREAS
- INCORPORATED AREA
- SHORELINE

NOTE:

1. BASEMAPPING PROVIDED BY ANCHOR QEA, LLC.

0 2.7 5.4 Miles

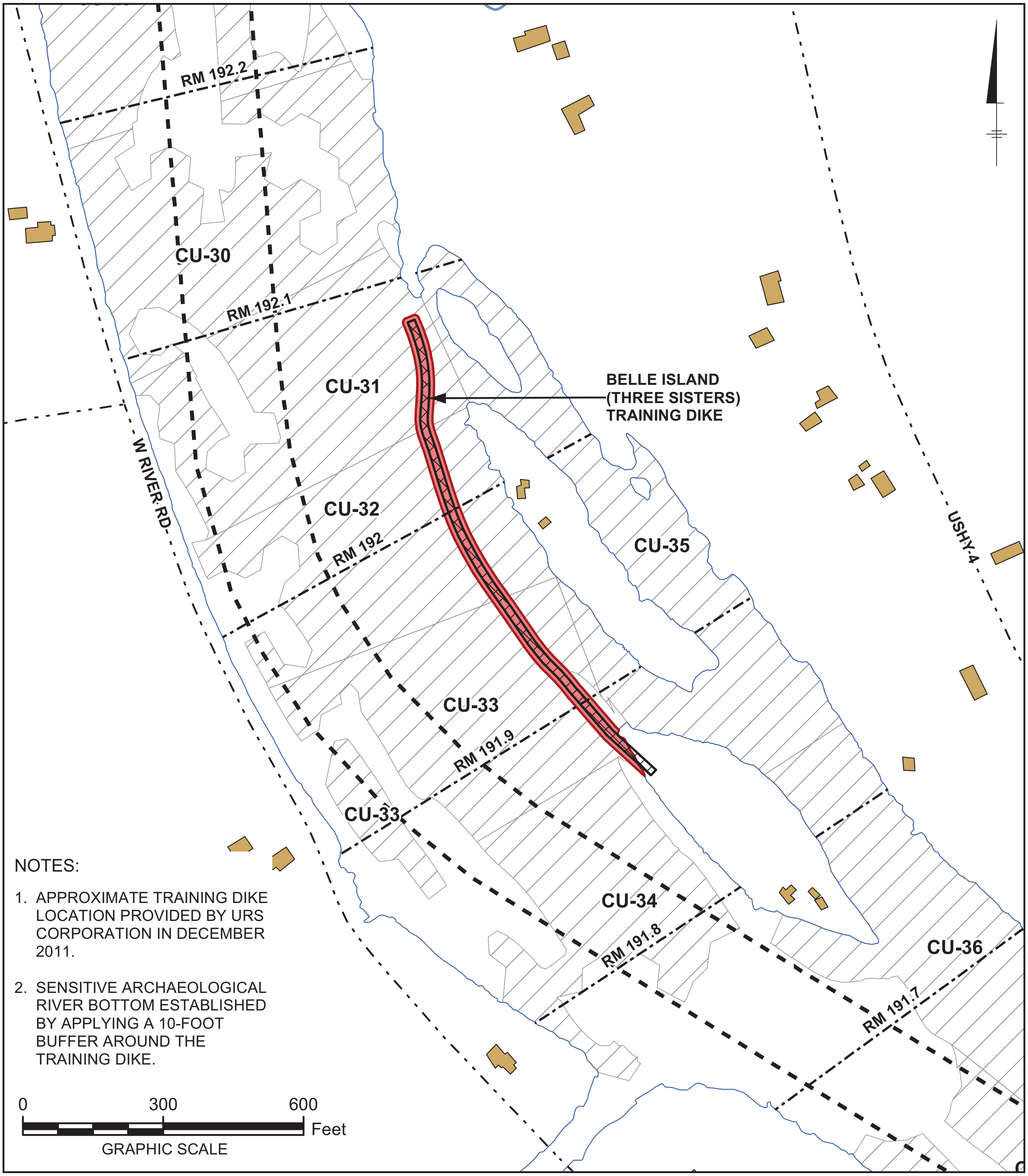
GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
HUDSON RIVER PCBs SUPERFUND SITE
PHASE 2 FINAL DESIGN REPORT FOR 2012

UPPER HUDSON RIVER

ARCADIS

FIGURE **1-1**



NOTES:

1. APPROXIMATE TRAINING DIKE LOCATION PROVIDED BY URS CORPORATION IN DECEMBER 2011.
2. SENSITIVE ARCHAEOLOGICAL RIVER BOTTOM ESTABLISHED BY APPLYING A 10-FOOT BUFFER AROUND THE TRAINING DIKE.

LEGEND:

- RIVER MILE MARKER
- STREET CENTERLINE
- STRUCTURE
- SHORELINE (APPROXIMATE)
- NAVIGATION CHANNEL
- CERTIFICATION UNIT
- SENSITIVE ARCHAEOLOGICAL RIVER BOTTOM
- APPROXIMATE HISTORIC TRAINING DIKE LOCATION

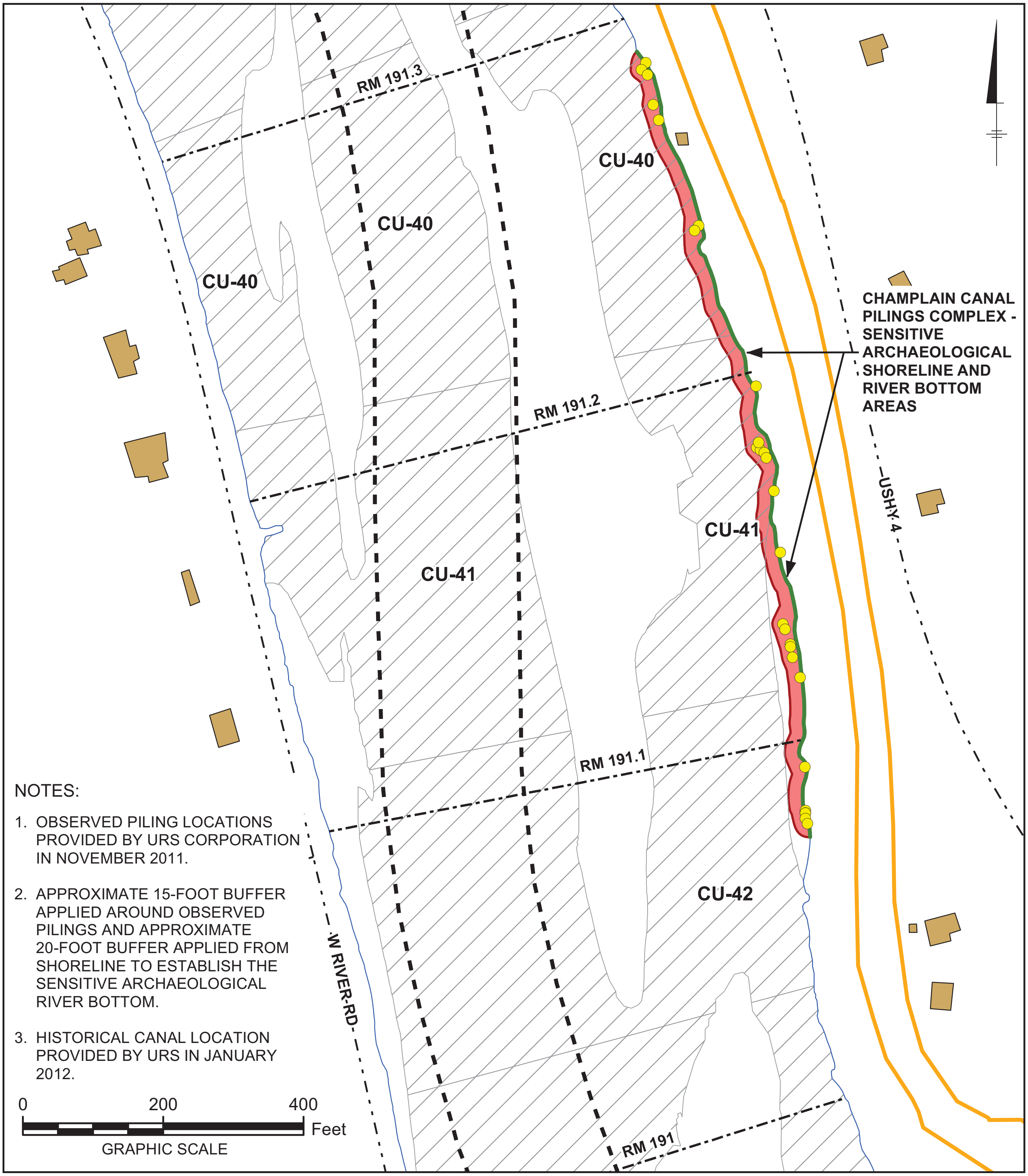
GENERAL ELECTRIC COMPANY
HUDSON RIVER PCBs SUPERFUND SITE

PHASE 2 FINAL DESIGN REPORT FOR 2012

SENSITIVE ARCHAEOLOGICAL RIVER BOTTOM - CU31 TO CU33

ARCADIS

FIGURE
2-1



NOTES:

1. OBSERVED PILING LOCATIONS PROVIDED BY URS CORPORATION IN NOVEMBER 2011.
2. APPROXIMATE 15-FOOT BUFFER APPLIED AROUND OBSERVED PILINGS AND APPROXIMATE 20-FOOT BUFFER APPLIED FROM SHORELINE TO ESTABLISH THE SENSITIVE ARCHAEOLOGICAL RIVER BOTTOM.
3. HISTORICAL CANAL LOCATION PROVIDED BY URS IN JANUARY 2012.

LEGEND:

- OBSERVED PILING
- RIVER MILE MARKER
- STREET CENTERLINE
- HISTORIC CANAL LOCATION
- STRUCTURE
- SHORELINE (APPROXIMATE)
- NAVIGATION CHANNEL
- CERTIFICATION UNIT
- SENSITIVE ARCHAEOLOGICAL SHORELINE
- SENSITIVE ARCHAEOLOGICAL RIVER BOTTOM

GENERAL ELECTRIC COMPANY
HUDSON RIVER PCBs SUPERFUND SITE

PHASE 2 FINAL DESIGN REPORT FOR 2012

SENSITIVE ARCHAEOLOGICAL SHORELINE AND RIVER BOTTOM - CU40 TO CU42

ARCADIS

FIGURE **2-2**

City: SYR Div/Group: 90 Created By: Sruti Pulugurtha Last Saved By: MKOHBERGER
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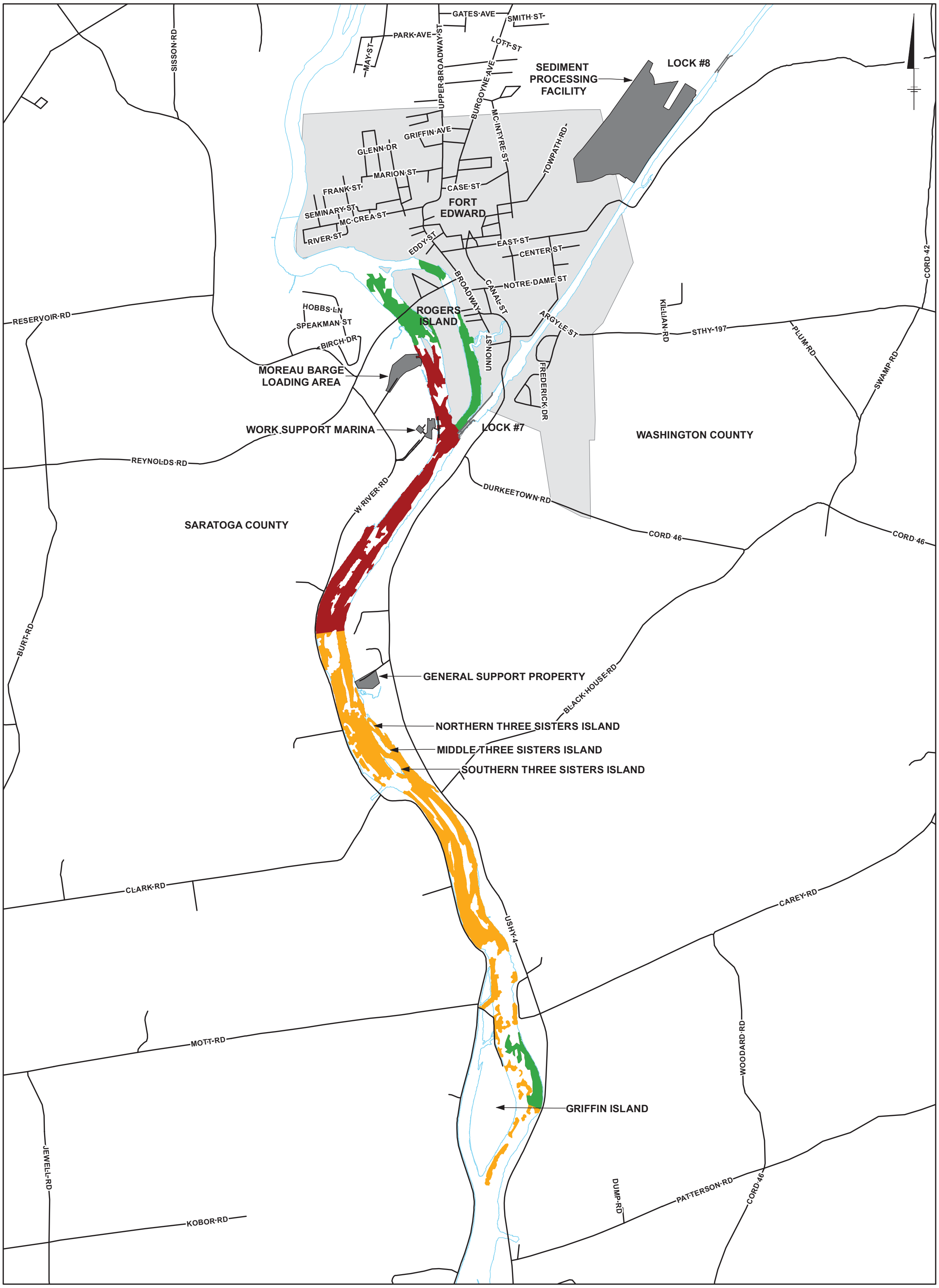


LEGEND:

- STREET CENTERLINE (APPROXIMATE)
- PHASE 1 DREDGE AREAS
- PHASE 2, YEAR 1 DREDGE AREAS
- PHASE 2, YEAR 2 DREDGE AREAS
- INCORPORATED AREA
- SHORELINE

NOTE:

1. BASE MAPPING PROVIDED BY ANCHOR QEA, LLC.

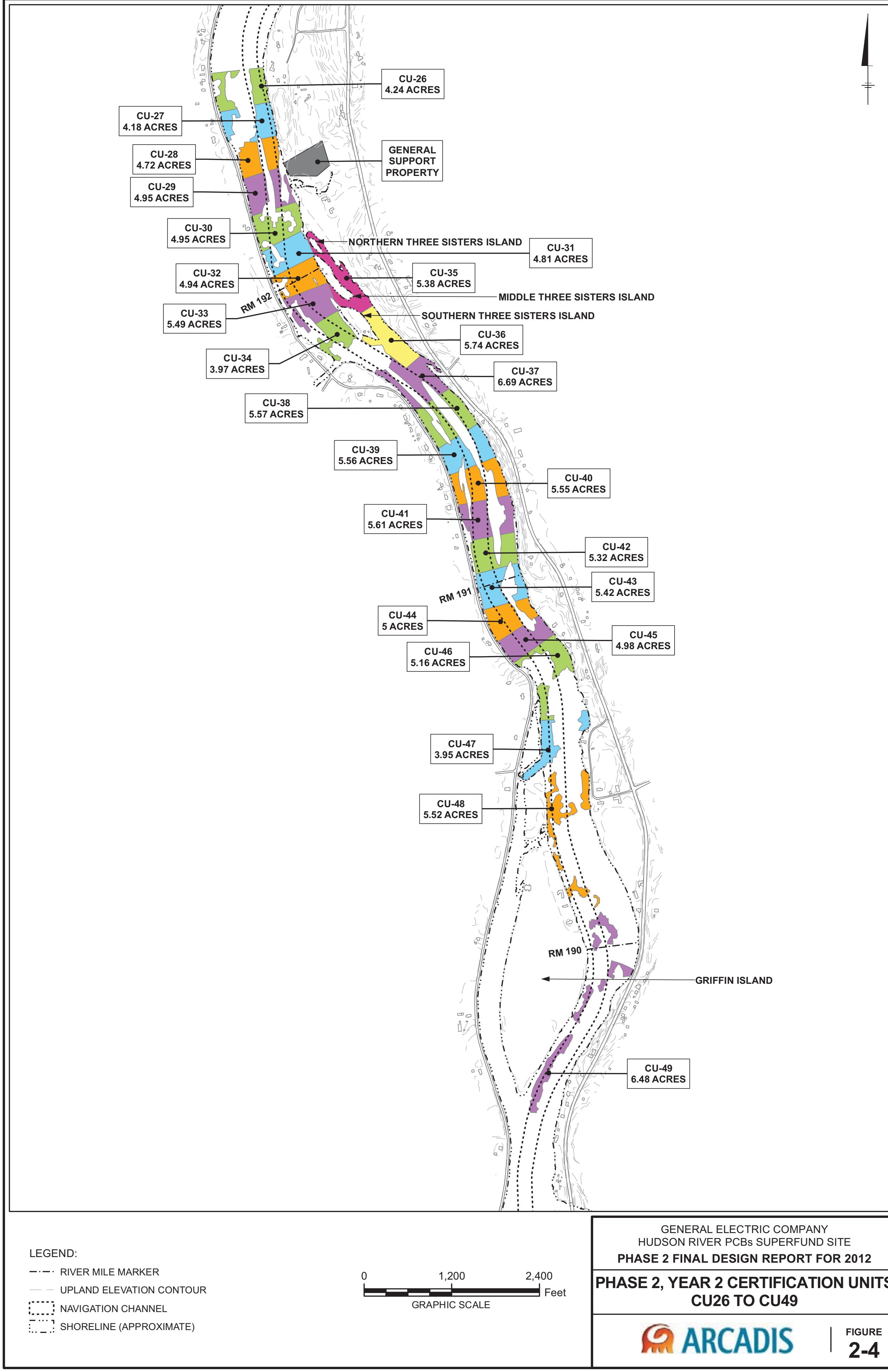
0 2,400 4,800 Feet
GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
HUDSON RIVER PCBs SUPERFUND SITE
PHASE 2 FINAL DESIGN REPORT FOR 2012

PHASE 2, YEAR 2 DREDGE AREAS

ARCADIS

FIGURE
2-3

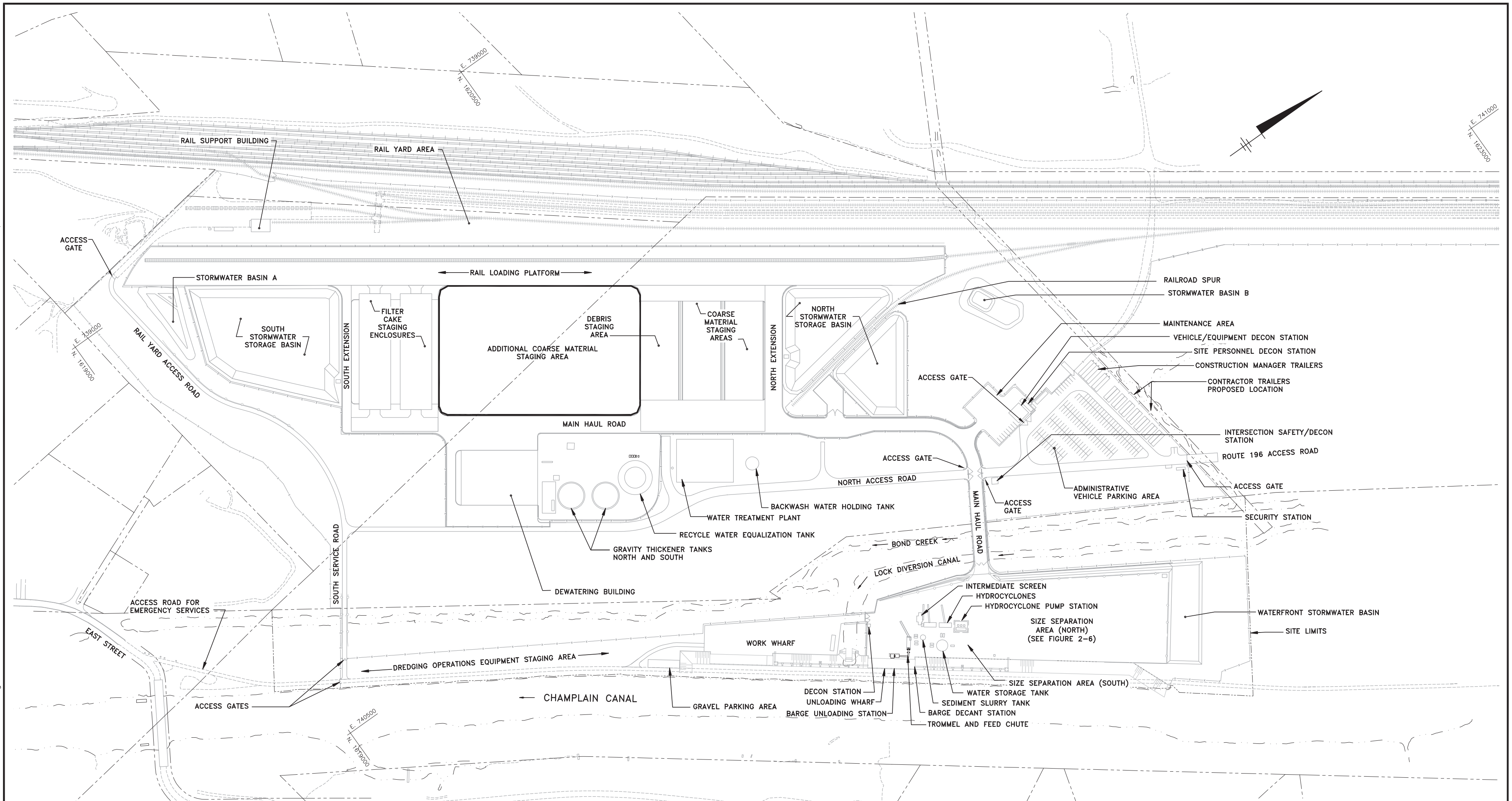


GENERAL ELECTRIC COMPANY
HUDSON RIVER PCBs SUPERFUND SITE
PHASE 2 FINAL DESIGN REPORT FOR 2012

PHASE 2, YEAR 2 CERTIFICATION UNITS CU26 TO CU49

ARCADIS

FIGURE
2-4



NOTES:

1. ALL LOCATIONS ARE APPROXIMATE.
2. THE ADDITIONAL COARSE MATERIAL STAGING AREA AND THE SECOND GRAVITY THICKENER TANK WERE CONSTRUCTED IN 2011. THE SIZE SEPARATION AREA (NORTH) WILL BE CONSTRUCTED IN 2012.

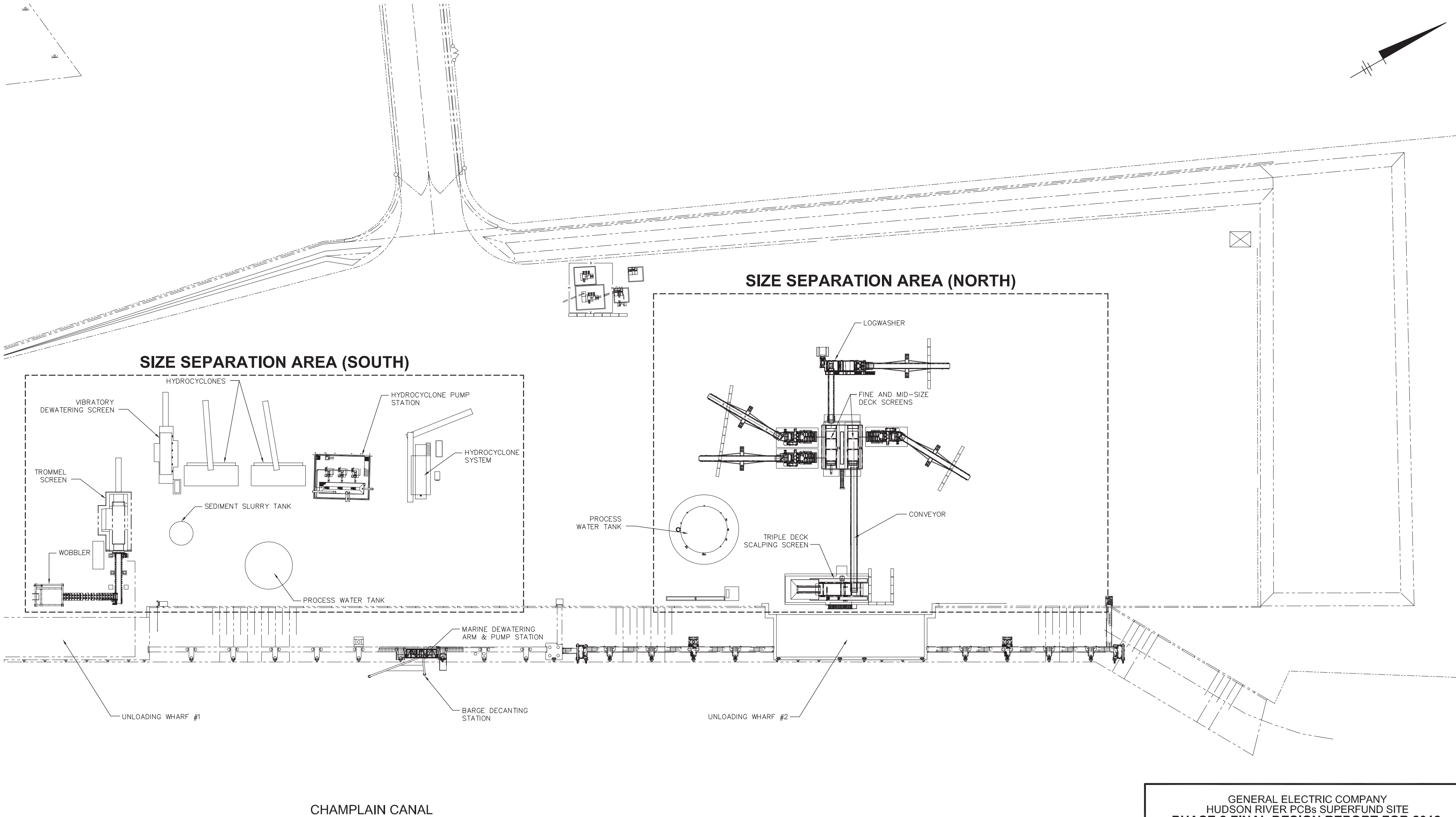
0 150' 300'
GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
HUDSON RIVER PCBs SUPERFUND SITE
PHASE 2 FINAL DESIGN REPORT FOR 2012

SEDIMENT PROCESSING FACILITY - SITE PLAN

ARCADIS

FIGURE
2-5



NOTES:

1. ALL LOCATIONS ARE APPROXIMATE
2. SIZE SEPARATION AREA LAYOUT PROVIDED BY SHAW IN FEBRUARY 2012.

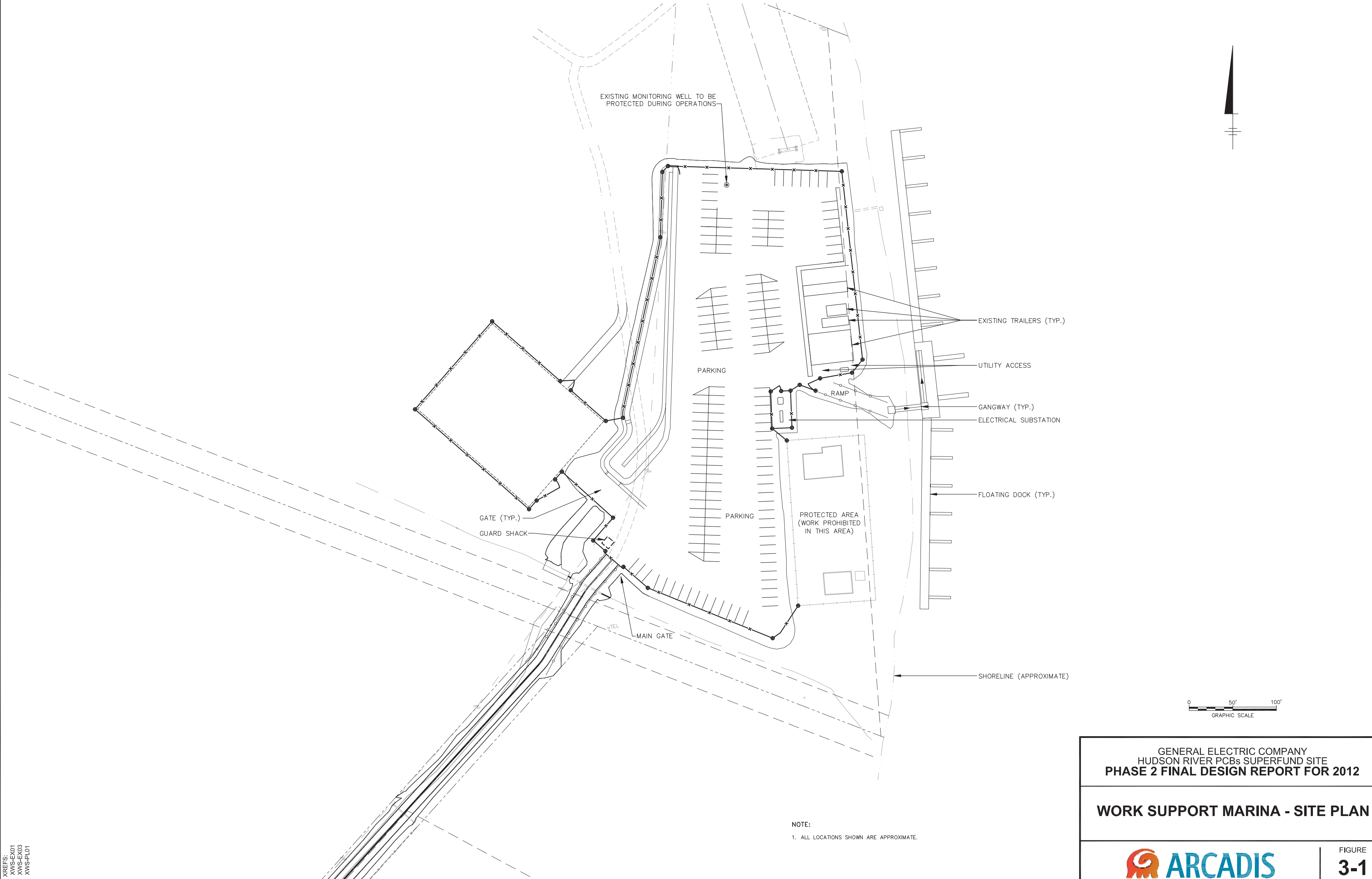
0 400' 800'
GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
HUDSON RIVER PCBs SUPERFUND SITE
PHASE 2 FINAL DESIGN REPORT FOR 2012

SIZE SEPARATION AREA (NORTH)

ARCADIS

FIGURE
2-6



NOTE:

1. ALL LOCATIONS SHOWN ARE APPROXIMATE.

GENERAL ELECTRIC COMPANY
HUDSON RIVER PCBs SUPERFUND SITE
PHASE 2 FINAL DESIGN REPORT FOR 2012

WORK SUPPORT MARINA - SITE PLAN

ARCADIS

FIGURE
3-1

LEGEND:

- TRUCK ROUTE
- DISTURBED AREA
- LIMIT OF WORK

NOTES:

1. ALL SITE LAYOUT FEATURES AND LOCATIONS ARE APPROXIMATE.
2. BASE MAP DRAWING SUPPLIED BY CASHMAN DREDGING AND MARINE CONTRACTING.

0 60' 120'
GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
HUDSON RIVER PCBs SUPERFUND SITE
PHASE 2 FINAL DESIGN REPORT FOR 2012

GENERAL SUPPORT PROPERTY - SITE PLAN

ARCADIS

FIGURE
3-2

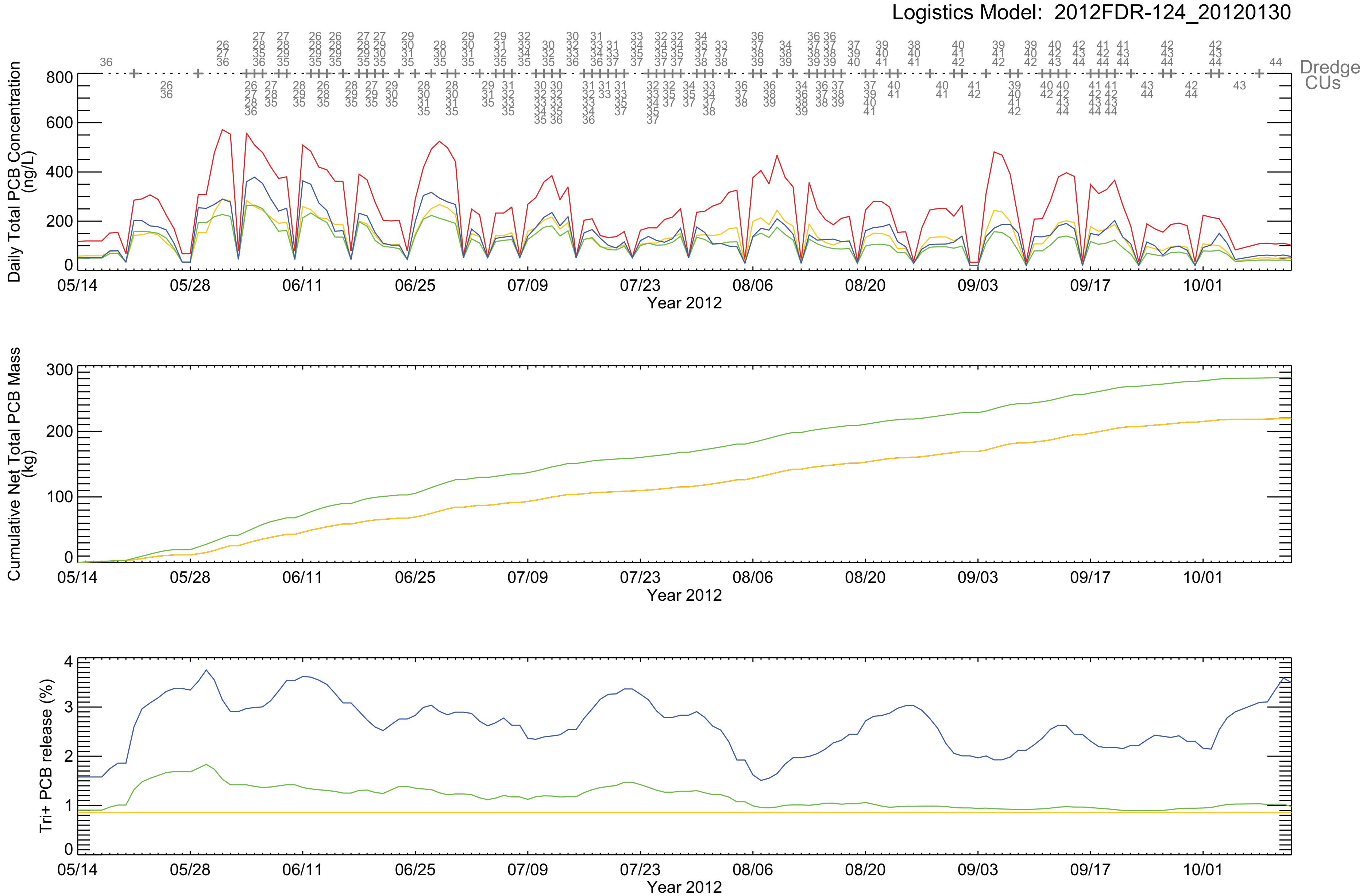


Figure 3-3

Estimated PCB Concentrations and Loads at Thompson Island in Year 2012

Notes: Dredging progress is shown on the top panel. Percent release is calculated as a function of river velocity for the 10,000 cfs and 15,000 cfs flows, and as a constant (0.86%) for the 3,000 cfs and 6,000 cfs flows. Residual PCB concentrations are assumed to be the same as the design PCBs for each site. Thompson Island flow is set to be 1.04 times the Fort Edward flow. Baseline PCB concentrations vary by month and flow at Fort Edward.

Resuspension Modeling
General Electric Company

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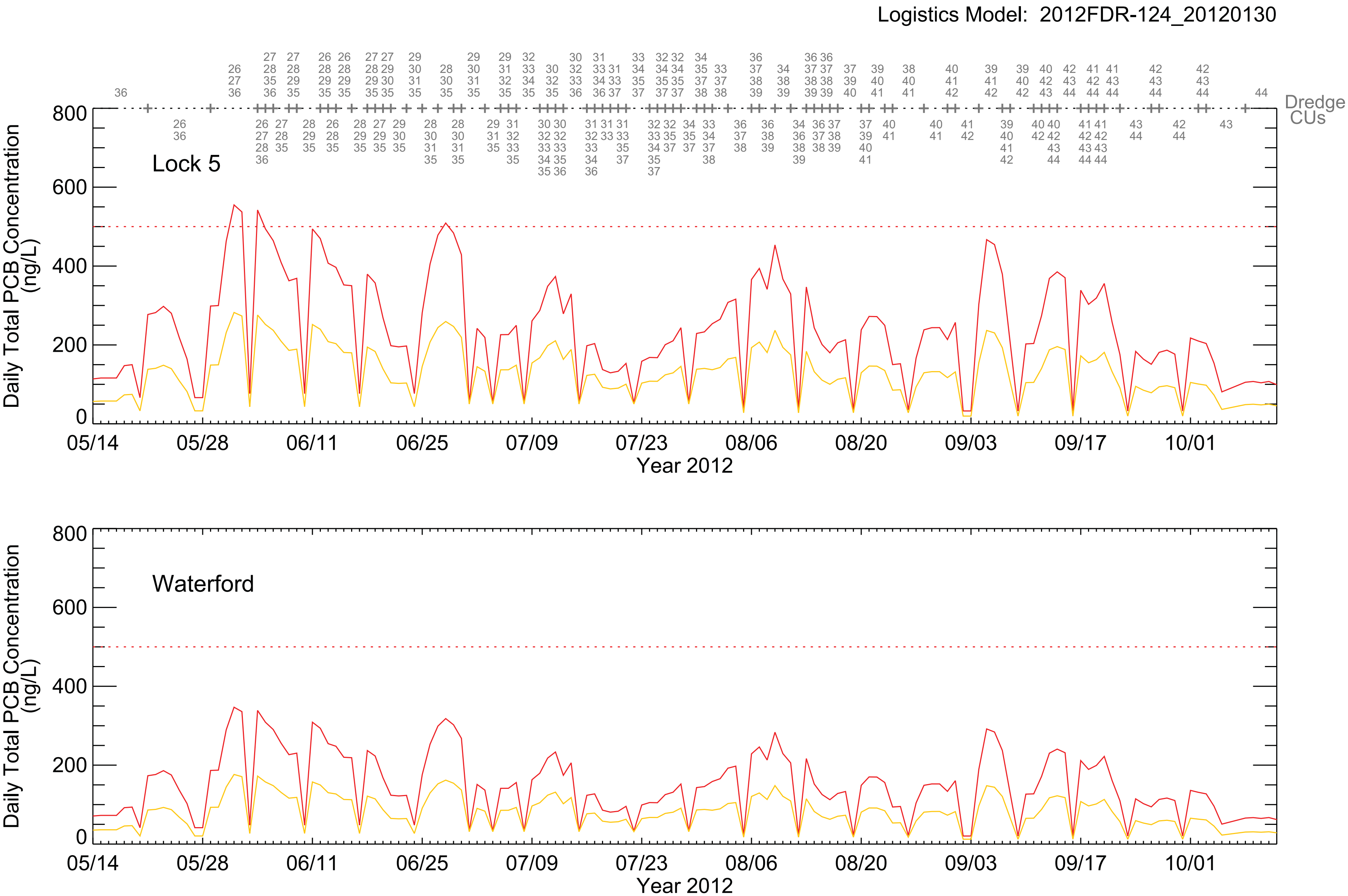

Fort Edward Flow = 3,000 cfs
Fort Edward Flow = 6,000 cfs
Control Level

Figure 3-4

Estimated PCB Concentrations at Lock 5 and Waterford in Year 2012

Notes: Dredging progress is shown on the top panel. Residual PCB concentrations are assumed to be the same as the design PCB concentrations for each site. Lock 5 or Waterford flow is assumed to be 1.05 or 1.56 times the Fort Edward flow.

Resuspension Modeling
General Electric Company

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