REPORT

Phase 1 Intermediate Design Report Hudson River PCBs Superfund Site

Report Text, Tables, and Figures

General Electric Company
Albany, New York

August 22, 2005

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

John G. Haggard
Manager, Hudson River Program

GE
320 Great Oaks Office Park, Ste: 319
Albany, NY 12203

T 518 862 2739
F 518 862 2731
John.Haggard@ge.com

Via Courier and Federal Express

August 22, 2005

Team Leader, Hudson River Team
Emergency and Remedial Response Division
United States Environmental Protection Agency, Region 2
290 Broadway, 19th Floor
New York, New York 10007-1866
Attn: Douglas Garbarini, Hudson River PCBs Superfund Site (3 copies)

Chief, New York/Caribbean Superfund Branch
Office of Regional Counsel
United States Environmental Protection Agency, Region 2
290 Broadway, 17th Floor
New York, New York 10007-1866
Attn: Hudson River PCBs Superfund Site Attorney (1 copy)

Director, Division of Environmental Remediation
New York State Department of Environmental Conservation
625 Broadway, 12th Floor
Albany, New York 12233-7011
Attn: Hudson River PCBs Superfund Site (7 copies – 1 unbound)

Director, Bureau of Environmental Exposure Investigation
New York State Department of Health
547 River Street
Troy, New York 12180
Attn: Hudson River PCBs Superfund Site (2 copies)

Re: Hudson River – Phase 1 Intermediate Design Report

Dear Sir or Madam:

Pursuant to the Remedial Design Administrative Order on Consent (RD AOC-Index Number CERCLA-02-2003-2027) enclosed is the Phase I Intermediate Design Report for your review and comment. The document has been prepared consistent with the requirements of the Remedial Design Work Plan attached to the RD AOC.

Each report contains a compact disc (CD) containing an electronic version of the report. Due to the size (12 inches thick) of the Treatability Studies Report, we have only provided 1 hard copy of this report to Doug Garbarini. However, the CD does contain an electronic version of the full report. Also, based on my discussion with Dave King, we will send the unbound copy of the report to the EPA Hudson Falls field office.

Please let me know if you have any questions. I will be on vacation until after Labor Day. In my absence, please direct any questions to Bob Gibson at (518) 862-2736.

Sincerely,

John G. Haggard
Manager, Hudson River Program

JGH/bg
Enclosure

cc: David King, U.S. EPA Hudson Falls Field Office (1 copy unbound)
John Mulligan, Malcolm Pirnie Inc., Albany, New York (1 copy)
Gary Klawinski, Ecology & Environment (1 copy)
Steve Sweeney, New York State Canal Corporation (1 copy)
Bob Pender, U.S. Army Corps of Engineers (1 copy)
Mark Otis, U.S. Army Corps of Engineers (1 copy)
Paul Doody, Blasland, Bouck & Lee

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Executive Summary

This *Phase 1 Intermediate Design Report* presents the current state of design of the first year of the Hudson River dredging project. This design document was prepared pursuant to the Administrative Order on Consent for Hudson River Remedial Design and Cost Recovery (RD AOC) – a formal agreement between the General Electric Company (GE) and the United States Environmental Protection Agency (EPA) that was effective August 18, 2003 (Index No. CERCLA-02-2003-2027) (EPA/GE, 2003). The RD AOC lays out project requirements related to sampling, design, and documentation. In addition, this report was prepared in accordance with the *Remedial Design Work Plan* (Blasland, Bouck & Lee, Inc. [BBL], 2003a), and builds upon the design presented in the EPA-approved *Preliminary Design Report* (BBL, 2004a).

EPA issued a Superfund Record of Decision (ROD) on February 1, 2002 (EPA, 2002a) calling for, among other things, the dredging and disposal of certain sediments from the Upper Hudson River containing polychlorinated biphenyls, or PCBs. The ROD states that dredging will occur in two distinct phases. In Phase 1, defined as the first year of dredging, at least 1 month of dredging will be conducted at the full-scale production rate necessary to complete Phase 2. The areas in the river targeted for sediment removal in Phase 1 stretch from the northern end of Rogers Island to the mouth of Snook Kill, and an area in the vicinity of Griffin Island. Phase 2 is defined as the dredging needed to remove targeted sediment that remains in the project area after completion of Phase 1. As described in the RD AOC, separate designs for Phase 1 and Phase 2 are being prepared.

The ROD provided an estimate of the amount of material to be dredged, but recognized that additional data were required to determine locations where sediments met the criteria for dredging. Since 2002, GE has conducted a major sediment sampling program to gather data for use in developing the remedy. As a result of this work – carried out in accordance with the Administrative Order on Consent for Hudson River Sediment Sampling, effective July 26, 2002 (Index No. CERCLA-02-2002-2023) (EPA/GE, 2002) – more than 48,000 sediment samples have been collected from the Upper Hudson River. The data generated to date from this ongoing effort, along with criteria specified in the ROD, have been used to delineate the specific areas and volumes to be dredged and evaluate engineering options for sediment removal and processing. The delineation of dredge areas has been completed for Phase 1 and is documented in the *Phase 1 Dredge Area Delineation Report* (QEA, 2005a), approved by the EPA in February 2005. The delineation of sediment areas and volumes targeted in Phase 2 is under development.

Basis of the Design

GE is designing the remedy to address a number of regulations and specific requirements developed by the EPA for this project. In addition to the specifications in the ROD, there are three other key sets of standards that guide the overall basis of design of the remedy. The *Hudson River Engineering Performance Standards* (EPA, 2004a) specify the amounts of sediments to be dredged and processed in each year of the project (productivity), limits for resuspension of PCBs and sediments during dredging (resuspension), and the targets for the concentration of PCBs remaining on the river bottom after dredging (residuals). The *Hudson River Quality of Life Performance Standards* (EPA, 2004b) address potential community impacts caused by the remedy, including air quality, odor, noise, lighting, and navigation. Water quality monitoring activities, limitations on releases of treated water from the sediment processing facility to the Hudson River and Champlain Canal, and limits on concentrations of metals and other parameters allowed in the river during dredging are outlined in a document developed by New York State and issued by the EPA that presents a range of substantive water quality requirements (EPA, 2005a). Details for each of these standards and descriptions of how the design is being developed to achieve the various requirements are provided throughout this report.

In addition to the requirements summarized above, the project is being developed based on findings generated from a variety of design support activities undertaken to document site conditions and physical constraints that will impact implementation of the remedy. These activities included, but were not limited to, identifying areas and volumes of sediment to be dredged in Phase 1; selecting a site for the sediment processing facility; sampling, analyzing, and testing to characterize sediments and evaluate engineering options; assessing habitat and cultural and archaeological resources; and evaluating the range of water velocity, river depths, and shoreline conditions in the project area.

Monitoring Activities

Throughout the project, monitoring will be conducted to assess compliance with EPA's Engineering Performance Standards, Quality of Life Performance Standards, and water quality requirements. A variety of activities will be carried out, including water column and fish monitoring, sediment residuals monitoring, air quality and odor monitoring, noise monitoring, lighting monitoring, water discharge monitoring, and resuspension monitoring. One objective of Phase 1 in general and the monitoring efforts in particular is to test the effectiveness of the remedial activities relative to the performance standards. At the end of Phase 1 and prior to the initiation of Phase 2, EPA and GE will each evaluate the Phase 1 experience, and EPA will conduct an independent peer review. Based on the results of these Phase 1 reviews, changes to the project, the engineering design, and/or performance standards may be necessary.

Summary of the Remedy at Intermediate Design

Although the design of Phase 1 of the remedy is ongoing, GE has developed a comprehensive conceptual framework for the project, and a number of critical decisions have been made that are described in detail in this *Phase 1 Intermediate Design Report*. Those critical decisions and elements of the project are summarized below. This summary is not, however, an exhaustive review of all of the information and analyses either conducted to date or included in the report. Additional details are provided in the text, tables, figures, appendices, and attachments that follow this executive summary.

Phase 1 Dredging Activities

- Approximately 265,000 cubic yards of sediment will be removed from the northern end of Rogers Island to the mouth of Snook Kill and on the eastern shore of Griffin Island. Approximately 80 acres of the river will be dredged.
- Dredging will begin in May and continue into October. Backfilling and habitat replacement/reconstruction activities will continue through mid-November.
- To achieve EPA's Productivity Performance Standard, dredging will occur 24 hours a day, 6 days a week. The seventh day will be reserved for maintenance, make up time for unplanned outages, or as a contingency to satisfy EPA's Productivity Performance Standard.
- For a minimum of 1 month, dredging will be conducted at the rate necessary to complete Phase 2, resulting in the removal of an estimated 89,000 cubic yards of sediment during the 1-month period.
- Mechanical dredges will be used for all dredging activities. Up to seven dredges may be operating at any one time to complete the initial dredging and any re-dredging necessary in areas where PCB targets are not met on the initial dredge pass.
- A fleet of 12 or more barges, moved by tug boats, will be needed to transport dredged sediment and debris to the processing facility at the Energy Park/Longe/New York State Canal Corporation site (referred to as the Energy Park site) and to carry backfill and capping materials to river areas after dredging.
- To maintain productivity targets during peak operations, as many as 26 barge trips through Lock 7 will be necessary each day.

- To limit other project-related traffic through Lock 7, a support facility will be needed at the West River Road Boat Launch in Moreau. This facility will have approximately 500 feet of floating docks to accommodate 26 support vessels. Dredged sediments will not be transported to or processed at this facility.
- Between 134,000 and 186,000 cubic yards of backfill and capping materials will be placed in the river once dredging is completed. Sources for these materials have been identified, and one or more sources will be selected during Phase 1 Final Design.
- To limit resuspension during dredging, sheet piling will be used in two areas: the eastern channel of Rogers Island and an area east of Griffin Island. The placement of sheet piling across the northern end of the eastern channel of Rogers Island will divert water flow from this area. The eastern channel of Rogers Island is a very narrow area where a significant amount of sediment will be removed. Sheet piling at the northern end of this channel, along with the amount of equipment necessary to conduct dredging here, will close this channel (including the Fort Edward Yacht Basin) to non-project-related vessels during dredging of this area.

Construction of Processing Facility

- EPA selected a 100-acre site in Fort Edward (the Energy Park site) for the location of a sediment processing and dewatering facility. Given the location of this site, all dredged materials will be transported through Lock 7 into the land-cut portion of the Champlain Canal for offloading at the processing site.
- Trucks delivering construction materials to the processing site will enter the site via Towpath Road, using an existing railroad crossing.
- Utilities will be developed, a network of roads will be built, and upwards of 100,000 cubic yards of imported backfill may be needed to grade the property. Site security fencing will be placed around the entire perimeter.
- Heavy brush and small trees along the existing railroad tracks and along the west side of Bond Creek will be removed. Areas on the property that are not needed to support the project will be left undisturbed wherever possible.
- A waterfront unloading facility for the Energy Park site will be constructed on property at the site owned by the New York State Canal Corporation. The waterfront area will encompass approximately 1,450 feet of shoreline and will provide enough space for up to three barges, where they will be unloaded. Approximately 35,000 cubic yards of material will be excavated to construct the facility.
- The existing Lock 8 access road will be relocated to the west, closer to Bond Creek, to accommodate the waterfront facility. A security guard will be present during operating hours to ensure safe access for New York State Canal Corporation employees along the relocated road.

- During operations, employee and delivery traffic will access the site from a road to be constructed off East Street, across from the Fort Edward rail station. The road will run along the railroad right-of-way to the southwest end of the site.

Processing Facility Operations During Phase 1

- Like dredging, operations at the processing facility will occur 24 hours a day, 6 days a week. The seventh day will be reserved for maintenance, make up time for unplanned outages, or as a contingency to satisfy EPA's Productivity Performance Standard.
- Dredged material will be unloaded from barges by either a hydraulic or mechanical offloader. Large debris will be segregated, and the remaining sediment will be sent to one of two hydrocyclone systems.
- Coarse materials separated out in the hydrocyclone systems will be placed on a screen to remove excess water. Fine materials will be mixed with chemicals to enhance dewatering, then sent through filter presses for additional water removal. Approximately 12 filter presses will be used.
- Once dewatered, processed fine material will resemble a dry "cake" and coarse material will be a sand and gravel mixture. Trucks will move the material to one of five structures, each approximately 100 feet wide by 400 feet long and situated on concrete slab foundations.
- Water generated during sediment processing, along with rain that falls on material handling areas, will be collected for treatment. The onsite water treatment plant will be designed to treat approximately 2 million gallons of water a day.
- Once treated, water will be discharged to the Champlain Canal. Monitoring will verify compliance with requirements established by EPA and New York State.

Rail Transportation and Disposal

- Front-end loaders will load processed materials from the storage areas to rail cars for transport to one or more landfills outside of the Hudson River Valley. An extensive review of existing facilities authorized to dispose of material containing PCBs has been completed, and a "short list" of facilities that meet project criteria has been developed. Final selection of the landfill(s) from this "short list" will occur during Phase 1 Final Design.
- The rail yard will consist of two, 2,400-foot-long tracks on which rail cars will be loaded. Additional tracks will be constructed to enable maneuvering, repair, and inspection of rail cars, and delivery of materials to the processing facility. Approximately 38,000 feet (more than 7 miles) of rail will be installed to support the Phase 1 project.

- During Phase 1, approximately 390,000 tons of processed material will be transported offsite. To move out this much material, two to four trains, each 81 rail cars long, will be loaded each week.
- A fleet of 350 to 650 gondola-type rail cars will be fabricated and dedicated for the project. Either sealed cars with watertight, hard lids or individually-lined cars will be used.
- The rail line adjacent to the Energy Park site is owned and operated by Canadian Pacific Railway, which does not serve any landfills that are under consideration. This will necessitate the use of one or more additional railroad carriers to transport the material to the final disposal location.
- It is difficult to secure commitments from railroad carriers. In addition, industry-wide infrastructure problems could delay the transport of processed materials offsite. Discussions with rail carriers are ongoing, and necessary agreement and logistical arrangements will be made prior to project implementation.

Next Steps

The design of this complex environmental remediation project is not complete; this *Phase 1 Intermediate Design Report* describes the progress made to date, but more work remains. This includes more sample collection and analysis, information gathering, negotiations with land owners and municipalities for access, discussions with various federal/state/local agencies on details of the design, additional design work, and discussions with the railroads and landfills. After EPA gathers public input and approves this stage of the design, GE will proceed to Phase 1 Final Design. During Phase 1 Final Design, the remaining Phase 1 details, including a schedule for construction, will be determined. The final design will form the basis of Bid and Contract Documents. At this point, the project will move from design to remedial action.

When an agreement to perform the remedy is reached, a contracting strategy will be developed and contractors will be pre-qualified. Bidding will be initiated upon submittal of the *Phase 1 Final Design Report* to EPA. After contractors are chosen, *Remedial Action Work Plan*s will be developed for each of the major components of the project – constructing the processing facility, installing the processing equipment, conducting dredging and operating the processing facility, and transporting and disposing the processed sediment. Those work plans will guide the implementation of the first year of the Hudson River dredging project.

1. Introduction

This *Phase 1 Intermediate Design Report* (Phase 1 IDR) has been prepared on behalf of the General Electric Company (GE) and presents the Intermediate Design for Phase 1 of the remedy selected by the United States Environmental Protection Agency (EPA) to address polychlorinated biphenyls (PCBs) in sediments of the Hudson River PCBs Superfund Site, located in New York State. This Phase 1 IDR was prepared 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). In addition, this Phase 1 IDR has been prepared in accordance with the *Remedial Design Work Plan* (RD Work Plan) (Blasland, Bouck & Lee, Inc. [BBL], 2003a), and builds upon the *Preliminary Design Report* (PDR) (BBL, 2004a).

This Phase 1 IDR was developed in a manner consistent with the following EPA guidance documents:

- *Guidance for Scoping the Remedial Design* (EPA, 1995a);
- *Remedial Design/Remedial Action Handbook* (EPA, 1995b); and
- *Guidance on EPA Oversight of Remedial Designs and Remedial Actions Performed by Potentially Responsible Parties* (EPA, 1990).

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 EPA issued a Superfund Record of Decision (ROD) on February 1, 2002 calling for, among other things, the removal and disposal of PCB-contaminated sediments meeting certain mass per unit area (MPA) and surface concentration or characteristic criteria from the Upper Hudson River (EPA, 2002a), i.e., the section of river upstream of the Federal Dam at Troy, New York. The remedial action is to be conducted in two distinct phases. The focus of this report is design for Phase 1, which is the first dredging season of the project.

The EPA defined three sections of the Upper Hudson River for the sediment remediation activities outlined in the 2002 ROD. The location of each river section is illustrated on Figure 1-1 and described below.

- **River Section 1:** Former location of Fort Edward Dam to Thompson Island Dam (from river mile [RM] 194.8 to RM 188.5; approximately 6.3 river miles);
- **River Section 2:** Thompson Island Dam to Northumberland Dam (from RM 188.5 to RM 183.4; approximately 5.1 river miles); and
- **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 this site has been well documented in previous reports and is not repeated in this introduction. This information, however, has been used in developing certain aspects of this Phase 1 design, and the reports will be referenced in the corresponding sections of this Phase 1 IDR.

1.2 Remedial Action Summary

The ROD calls for the removal of sediment from the Upper Hudson River based on criteria that vary by river section:

- In River Section 1, sediment is to be removed based primarily on an MPA of 3 grams per square meter (g/m^2) Tri+ PCBs or greater;
- In River Section 2, sediment is to be removed based primarily on an MPA of 10 g/m^2 Tri+ PCBs or greater; and
- In River Section 3, sediments with concentrations of PCBs deemed high and potential for erosion deemed high (New York State Department of Environmental Conservation [NYSDEC] *Hot Spots* 36, 37, and the southern portion of 39) are to be removed.

In the Feasibility Study (FS) (EPA, 2000), using data available at the time and using criteria discussed in the FS, the EPA estimated that a total volume of 2.65 million cubic yards (cy) of sediments would be removed from the Upper Hudson River. The ROD recognized that the actual volume to be removed would be developed using data to be collected during remedial design.

Since the ROD was issued in 2002, additional data and information have been collected and assessed, and the volume of sediment targeted for removal has been refined during the remedial design process. The additional data collection activities, conducted 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), have been performed in all three river sections, including areas of the river to be addressed during Phase 1. The data have been used to delineate dredge areas and volumes for Phase 1 dredging described in the *Phase 1 Dredge Area Delineation Report* (Phase 1 DAD Report) (QEA, 2005a) and the *Phase 1 Target Area Identification Report* (Phase 1 TAI Report) (QEA, 2004a). Phase 1 dredging will occur in the following areas:

- The northern portion of the Thompson Island Pool from the north end of Rogers Island to the mouth of the Snook Kill, i.e. the area of the river between the northing parallel at 1,605,034 and the northing parallel at 1,617,246; NYS Plane East, North American Datum (NAD) 83; and
- The area of the river in the vicinity of Griffin Island, between the northing parallel at 1,592,438 and the northing parallel at 1,598,220 (NYS Plane East, NAD 83).

These dredge areas are discussed in more detail in Sections 2.3.1, 2.3.3, and 3.3.

The ROD calls for the dredging to be undertaken in two distinct phases. Phase 1 is defined as the first year of the project, in which sediment removal will be conducted at a reduced rate (with at least one month at full-scale production). The target removal volume for Phase 1 is defined as 265,000 cy of sediment, with a minimum required removal volume of 200,000 cy. The relationship between Phase 1 and Phase 2 of the remedial action and the three steps of design (Preliminary, Intermediate, and Final), as described in the RD Work Plan (BBL, 2003a), are illustrated on Figure 1-2, below.

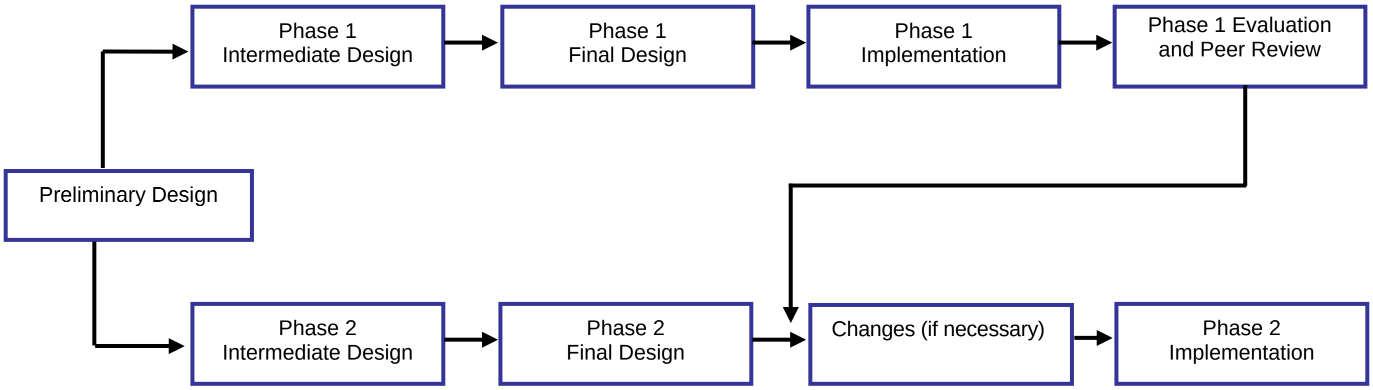


Figure 1-2 – Sequence of Design for Phase 1 and Phase 2 of the Hudson River Project

This Phase 1 IDR presents the Phase 1 design at the intermediate stage, and includes provisions for redundant or contingent equipment and operations measures that are currently known to be required. As part of the development of the *Phase 1 Final Design Report* (Phase 1 FDR), a Failure Mode Effects Analysis (FMEA) will be conducted to guide the specification of redundant and/or contingent equipment and operations; these additional measures will be included, as appropriate, in the Phase 1 Final Design. Additionally, following submittal of this Phase 1 IDR, GE will conduct a constructability review of the Phase 1 Intermediate Design to evaluate alternatives for construction of the project that may improve efficiencies or reduce cost. Changes to the design resulting from the constructability review will be included in the Phase 1 FDR.

The ROD also specifies that sediment will be removed from the river using environmental dredging techniques and transported by barge or pipeline to the land-based sediment processing/transfer facilities (processing facilities) for dewatering and, as needed, stabilization. It further specifies that the dewatered sediments will be transported via rail and/or barge to licensed landfills outside the Hudson River Valley for final disposal. Using trucks to transport processed material to the final disposal facility is precluded; however, the ROD permits materials destined for beneficial use to be transported out of the project area via rail, barge, or truck. In addition, the ROD states that dredged areas are to be backfilled with approximately 1 foot of clean backfill material to isolate residual PCB contamination and to expedite habitat recovery, where appropriate. Backfill materials are to be transported within the "Upper Hudson River area" via rail and/or barge.

The EPA has developed performance standards for both the engineering aspects of the project and quality of life considerations. The *Hudson River Engineering Performance Standards* (Hudson EPS) cover productivity, PCB resuspension during dredging and other in-river activities, and concentrations of residual PCBs in surface sediments after dredging for Phase 1 (EPA, 2004a). The *Hudson River Quality of Life Performance Standards* (Hudson QoLPS) address project-related issues/impacts associated with air quality, odor, noise, lighting, and navigation for Phase 1 (EPA, 2004b).

One objective of the Phase 1 work is to test the effectiveness of the remedial design relative to the performance standards. At the end of Phase 1 and prior to the initiation of Phase 2 dredging, the EPA and GE will each evaluate the Phase 1 experience. An independent peer review will be conducted to evaluate whether the EPS can be met or should be changed and to evaluate the associated monitoring. Based on the results of the Phase 1 review, changes to the project, design, and/or performance standards may be necessary. The Hudson EPS and QoLPS are discussed as elements of the basis of design presented in Section 2.

A more detailed description of the EPA-selected remedy can be found in the PDR (BBL, 2004a), RD Work Plan (BBL, 2003a), and ROD (EPA, 2002a).

1.3 Remedial Design Objectives

As stated in the PDR (BBL, 2004a), the primary objective of the remedial design for the Upper Hudson River is to develop plans and specifications for implementing the EPA-selected remedy, consistent with the ROD and the goal of achieving the performance standards. The design is to be developed so that the remedy is implemented in a safe and efficient manner.

Activities to accomplish the remedial design objectives are described in the PDR (BBL, 2004a) and RD Work Plan (BBL, 2003a), and include the following:

- Develop remedial design deliverables to allow timely execution of the Phase 1 and Phase 2 dredging programs (this Phase 1 IDR is a component of this ongoing activity);
- Collect and analyze data necessary to support the remedial design for the Upper Hudson River. This activity has included sediment sampling, geophysical investigations, bathymetric surveys, and other tasks (this is an ongoing effort – see Sections 2.3.2 and 2.3.6);

- Develop engineering and design specifications to support EPA efforts in identifying and evaluating land-based sites necessary for project implementation, including the processing facilities (this activity is complete for Phase 1 – see Section 2.3.4);
- Design facilities to handle and process dredged sediment and prepare the sediment for transport and disposal (this Phase 1 IDR is a report on the status of this ongoing activity);
- Design a dredging program with a total target project duration of 6 years (1 year for Phase 1 and 5 years for Phase 2), consistent with the Productivity Performance Standard (this Phase 1 IDR is a report on the status of this ongoing activity);
- Develop engineering and design information to support the identification and selection of the sediment areas to be removed during the Phase 1 dredging program (this activity is complete – see Sections 2.3.1 and 2.3.3);
- Delineate sediment to be removed from the Upper Hudson River consistent with the criteria in the ROD (EPA, 2002a) and RD Work Plan (BBL, 2003a) (this activity is complete for Phase 1 – see Sections 2.3.1 and 2.3.3);
- Develop design documents for the Phase 1 and Phase 2 dredging programs with the goal of achieving the performance standards established by the EPA (this Phase 1 IDR is a report on the status of this ongoing activity – see appended Phase 1 Contract Drawings and Specifications);
- Develop an effective monitoring program, starting with implementation of a baseline monitoring program, to allow an assessment of the results of remedy implementation relative to the performance standards and remedial goals established by the EPA (baseline monitoring is underway in accordance with the *Baseline Monitoring Program – Quality Assurance Project Plan* (BMP- QAPP [QEA, 2003a]; Attachment A provides the *Phase 1 Intermediate Design Remedial Action Monitoring Scope* [Phase 1 ID RAM Scope]; and
- Design the system by which: 1) the dredged and processed sediment will be efficiently and safely transported by rail and/or barge from the processing facilities to disposal facilities; and 2) the backfill/cap material will be transported by rail and/or barge to the Upper Hudson River area prior to placement in the river (this Phase 1 IDR is a report on the status of this ongoing activity).

1.4 Phase 1 Intermediate Design Report Organization

The Phase 1 IDR is organized into the sections shown in Table 1-1, below.

Table 1-1 – Phase 1 IDR Organization

Section	Description
1 – Introduction	Provides an overview of the proposed remedial action, the project setting, and the purpose and scope of this Phase 1 IDR.
2 – General Basis of Design	Provides summary information from design support activities to document the project conditions and physical constraints under which the remedial action will occur.
3 – Phase 1 Design Analysis	Describes how the general basis of design (discussed in Section 2) has been used in the design of Phase 1 of the remedial action.
4 – Phase 1 Scope of Work and Schedule	Presents the scope of work and schedule for Phase 1 of the remedial action.
5 – Environmental Monitoring During Phase 1 of the Remedial Action	Describes the anticipated monitoring and reporting requirements for all media, to satisfy the EPS and QoLPS.
6 – Permit Equivalency Analysis	Provides the permit equivalency analysis.
7 – References	Presents references cited in this Phase 1 IDR.
8 – Acronyms	Provides definitions of key acronyms that are used in this Phase 1 IDR.
Tables	Provides tables referenced in this Phase 1 IDR.
Figures	Provides figures referenced in this Phase 1 IDR.
Attachments	Provides a number of attachments referenced in this Phase 1 IDR.
Appendices	Provided in three bound volumes: the *Treatability Studies Report* (TS Report), the Phase 1 Intermediate Design Contract Drawings, and the Phase 1 Intermediate Design Specifications.

2. General Basis of Design

2.1 Introduction

This section summarizes the general basis for the design presented in this Phase 1 IDR – the project performance requirements, engineering data, and basic assumptions that guide the overall development of Phase 1 of the project. The general basis of design incorporates information from the various design support activities that were implemented to document site conditions and physical constraints under which the remedial action will occur. Findings of the individual design support activities are summarized in Section 2.3; detailed results were presented in a variety of reports that are incorporated by reference into the general basis of design.

More specific information used as the basis of design for each of the various project elements is discussed within each section of the Phase 1 design analysis (Section 3).

2.2 Phase 1 Performance Requirements

Performance requirements guide the design presented in this Phase 1 IDR. These requirements are derived from five sources; the sources are listed below and the performance requirements are summarized in the following subsections:

- ROD (EPA, 2002a);
- Hudson EPS (EPA, 2004a);
- Hudson QoLPS (EPA, 2004b);
- Water quality requirements (WQ requirements) (EPA, 2005a), which include the following: *Substantive Requirements Applicable to Releases 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 Discharge Elimination System Permit for Potential Discharge to the Hudson River*; and
- Other regulatory requirements.

The requirements of the Hudson EPS, the Hudson QoLPS, and the WQ requirements and the actions that GE will perform to implement those performance standards and requirements will be set forth in a number of documents to be developed as part of future Phase 1 activities. Scopes of these documents were used in the general basis of design for Phase 1 and are attached to this Phase 1 IDR. Specifically:

- The environmental monitoring to be conducted during Phase 1 will be performed under a Phase 1 Remedial Action Monitoring Program (RAMP). The Phase 1 RAMP is described in a *Phase 1 Intermediate Design Remedial Action Monitoring Scope* (Phase 1 ID RA Monitoring Scope), which is attached to this Phase 1 IDR as Attachment A. The requirements of the Phase 1 RAMP will be further specified in a *Phase 1 Environmental Monitoring Plan* (Phase 1 EMP), which will accompany the Phase 1 FDR, and in a *Phase 1 Remedial Action Quality Assurance Project Plan* (Phase 1 RAM QAPP), which will be developed and submitted as part of the remedial action work plans. The Phase 1 ID RA Monitoring Scope included in Attachment A serves as an outline of the Phase 1 EMP for purposes of this Phase 1 IDR.
- The community health and safety program to be implemented during Phase 1 will be described in a *Phase 1 Remedial Action Community Health and Safety Plan* (Phase 1 RA CHASP), to be submitted with the Phase 1 FDR. A general scope of that document is provided in the *Phase 1 Intermediate Design Remedial Action Community Health and Safety Program Scope* (Phase 1 ID RA CHASP Scope), which is provided as Attachment B hereto. (This scope is a slightly modified version of a similar document that was previously been provided by EPA to the public for comment.) The Phase 1 RA CHASP will be consistent with the Phase 1 ID RA CHASP Scope, but will provide considerably more detail on the community health and safety program.
- The actions that GE will undertake to address the EPS, the QoLPS, and the WQ requirements during Phase 1 of the remedial action will be set forth in a *Phase 1 Performance Standards Compliance Plan* (PSCP), to be developed as part of the *Remedial Action Work Plan for Phase 1 Dredging and Facility Operations* (Phase 1 RA Work Plan – refer to Section 4). A scope of that document is presented in Attachment C, the *Phase 1 Intermediate Design Performance Standards Compliance Plan Scope* (Phase 1 ID PSCP Scope).

2.2.1 ROD Requirements

The ROD specified several requirements for the project that affect the Phase 1 Design. The following list is taken from the ROD, and includes requirements that apply to Phase 2 of the remedy:

- Removal of sediments based primarily on a mass per unit area (MPA) of 3 grams per meter squared (g/m^2) Tri+ PCBs or greater from River Section 1 (all Phase 1 areas are in River Section 1);
- Removal of sediments based primarily on an MPA of 10 g/m^2 Tri+ PCBs or greater from River Section 2 (this ROD requirement does not apply to Phase 1; there are no Phase 1 dredge areas in River Section 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 (this ROD requirement does not apply to Phase 1; there are no Phase 1 dredge areas in River Section 3);
- Dredging of the navigation channel, as necessary, to implement the remedy and to avoid hindering canal traffic during implementation;
- Removal of all PCB-contaminated sediments within areas targeted for remediation, with an anticipated residual of approximately 1 milligram per kilogram (mg/kg) Tri+ PCBs (prior to backfilling);
- Engineering and Quality of Life Performance Standards are to be developed during design (see below).
- Performance of the dredging in two phases whereby remedial dredging will occur at a reduced rate during the first year of dredging. This will allow comparison of operations with pre-established performance standards and evaluation of necessary adjustments to dredging operations in the succeeding phase or to the standards. Beginning in Phase 1 and continuing throughout the life of the project, the EPA will conduct an extensive monitoring program. The data that the EPA gathers, as well as the Agency's ongoing evaluation of the work with respect to the performance standards, will be made available to the public in a timely manner and will be used to evaluate the project to determine whether it is achieving its human health and environmental protection objectives;
- Backfill of dredged areas with approximately 1 foot of clean material to isolate residual PCB contamination and to expedite habitat recovery, where appropriate;
- Use of rail and/or barge for transportation of clean backfill materials within the Upper Hudson River area;
- Monitored natural attenuation (MNA) of PCB contamination that remains in the river after dredging;
- 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;

- Rail and/or barge transport of dewatered, stabilized sediments to an appropriate licensed offsite landfill(s) for disposal. If a beneficial use of some portion of the dredged material is arranged, then an appropriate transportation method will be determined (rail, truck, or barge);
- Monitoring of fish, water and sediment to determine when Remediation Goals are reached, and also monitoring the restoration of aquatic vegetation; and
- Implementation (or modification) of appropriate institutional controls such as fish consumption advisories and fishing restrictions by the responsible authorities, until relevant Remediation Goals are met.

2.2.2 Engineering Performance Standards

In 2003, the EPA issued draft EPS for resuspension, residuals, and productivity (collectively referred to as the Hudson EPS) for the remedy. A peer-review panel evaluated the draft standards, and the final Hudson EPS for Phase 1 of the remedial action, was issued in a five-volumes in 2004 (EPA, 2004a).

Specific activities that will be undertaken to address the Hudson EPS during Phase 1 will be set forth in the Phase 1 EMP/Phase 1 RAM QAPP and in the Phase 1 PSCP. Scopes of these documents are included as Attachments A and C, respectively. Summaries of the EPS, as they apply to the Phase 1 design, are discussed in the following sections.

2.2.2.1 Project-Related Resuspension

The Resuspension Performance Standard forms the basis of design primarily for dredging and resuspension controls. This standard specifies three action levels – Evaluation, Control, and Standard. These action levels apply to PCBs and/or total suspended solids (TSS) in surface water at either near-field stations (located within 300 meters [m] of the dredging activities) or far-field stations (located more than 1 mile downstream of dredging activities). The Phase 1 ID RA Monitoring Scope provided in Attachment A sets out the scope of the routine monitoring, reporting requirements, and action levels used to trigger additional monitoring or contingency actions during the remedial action; and the Phase 1 ID PSCP Scope in Attachment C describes the actions that GE will take when the resuspension action levels are exceeded.

The near-field and far-field solids concentration due to dredging operations were predicted as part of the development of this design. Also, the flux and concentration of total and Tri+ PCBs were predicted at the far-field station (compliance point) for Phase 1, which is at Thompson Island Dam, located approximately 29 and 32 miles upstream of the intakes for the public water supply facilities at Halfmoon and Waterford, respectively. In the design analysis for the resuspension control element presented in Section 3.5, the concentration and flux predicted at the far-field station are compared with the Evaluation, Control, and Standard levels. Since exceedance of the Control Level requires the consideration and implementation of engineering controls, it was selected as the basis of design. Note that the control level for allowable 7-day flux has been updated to reflect the current dredging plan; additional discussion of the results of the resuspension design analysis is presented in Section 3.5.

2.2.2.2 Dredging Residuals

The Residuals Performance Standard forms the basis of design primarily for dredging, backfilling, and capping. This standard describes action levels for Tri+ PCBs in surface sediment that remains after dredging. The action levels will be applied on a Certification Unit (CU) basis, which is described in Section 3.3 of this Phase 1 IDR. The Phase 1 ID RA Monitoring Scope in Attachment A provides an overview of the routine monitoring, reporting requirements, and requirements for sediment sampling and analysis under this performance standard; and the Phase 1 ID PSCP Scope in Attachment C describes the other actions that GE will take to implement the Residuals Performance Standard. The process for evaluating data, defining response actions, certifying closure of CUs, and reporting is set out in Section 3.3.

2.2.2.3 Dredging Productivity

The Productivity Performance Standard forms the basis of design primarily for the dredging, dredge material transport, sediment processing, and transportation and disposal elements of the remedial action. This standard specifies the annual minimum and target volumes of sediment (*insitu* volumes, excluding re-dredging volumes) to be removed, processed, and shipped offsite during Phase 1 (Hudson EPS, Volume 4, p. 27). The productivity schedule for Phase 1 dredging is provided in Section 3.3 of this Phase 1 IDR. Certain contingency actions will be implemented if specific productivity monitoring thresholds are exceeded; these monitoring thresholds and contingency actions will be developed in the Phase 1 PSCP, a scope of which is included as Attachment C.

2.2.3 Quality of Life Performance Standards

In May 2004, the EPA issued the Hudson QoLPS (EPA, 2004b). The Hudson QoLPS address air quality, odor, noise, lighting, and river navigation. These standards apply to Phase 1 of the remedy and may be modified following completion of Phase 1. The Hudson QoLPS form the basis of design for all design elements except offsite transportation and disposal. The design analysis to assess the quality of life impacts of the project is presented in Section 3.11.

The Phase 1 ID RA Monitoring Scope in Attachment A provides an overview of the routine monitoring, reporting requirements, and action levels which trigger additional monitoring or contingency actions during the remedial action. Specific actions to be taken to address the Hudson QoLPS will be discussed in the Phase 1 RA CHASP and Phase 1 PSCP; scopes of these documents are provided as Attachments B and C, respectively.

2.2.4 Water Quality Requirements

The WQ requirements contain numerical standards/limitations and monitoring requirements both for: 1) in-water releases of constituents not subject to the Hudson EPS (notably, metals and physical parameters); and 2) discharges of pollutants from the land-based facilities to the river. These requirements form the basis of design primarily for dredging, resuspension controls, and sediment and water processing. The monitoring requirements for releases during dredging activities and discharges from the sediment and water processing operations, including the sample and analytical methods, contingency monitoring, and reporting requirements are provided in the Phase 1 RA ID Monitoring Scope, included as Attachment A. Specific actions to be taken to address the WQ requirements are discussed in the Phase 1 ID PSCP Scope (Attachment C). The analysis to assess the design of the water treatment facilities with respect to these requirements is presented in Section 3.6.4, and the Design Analysis: Processing Facilities (Attachment G).

2.2.5 Other Regulatory Requirements

In the ROD, the EPA identified as Applicable or Relevant and Appropriate Requirements (ARARs), a number of federal and state environmental laws and regulations (see Tables 14-1 through 14-3 of the ROD). ARARs fall into three broad categories, based on the manner in which they are applied at a site: chemical-specific, location-specific, and action-specific requirements. The specific ARARs that have formed the basis of design are listed in the detailed basis of design section for each design element.

As provided for in the ROD and further specified in the PDR (BBL, 2004a), processed materials will be sampled and analyzed for PCB content after processing to determine appropriate disposal locations. In the event that GE seeks to utilize a non-Toxic Substances Control Act (TSCA) landfill for the disposal of sediments having post-processed PCB concentrations less than 50 mg/kg, GE will request that EPA Region 2 and the EPA Region in which the non-TSCA landfill is located provide a risk-based approval of such disposal under 40 CFR 761.61(c).

2.3 Summary of Design Support Activities

In addition to the Phase 1 performance requirements, engineering data and information collected through design support activities are incorporated into the basis of design. The design support activities include:

- Phase 1 Target Area Identification (TAI);
- Sediment Sampling and Analysis Program (SSAP);
- Phase 1 Dredge Area Delineation (DAD);
- Phase 1 Processing Facility Site Selection;
- Treatability Studies;
- Phase 1 Supplemental Engineering Data Collection (SEDC) Program;
- Habitat Delineation and Habitat Assessment of Phase 1 Areas;
- Phase 1 Cultural and Archaeological Resources Assessment (CARA) Program;
- River Hydrodynamic Analyses; and
- Baseline Monitoring Program (BMP).

The scope, findings, and uses of the data and information generated during implementation of these activities as they relate to the basis of design are discussed in the following sections.

2.3.1 Phase 1 Target Area Identification

The Productivity Performance Standard identifies a final Phase 1 target removal volume of 265,000 cy and a minimum required removal volume of 200,000 cy. To select specific areas to be dredged during Phase 1, a number of candidate Phase 1 dredge areas were evaluated in the Phase 1 TAI Report (QEA, 2004a), which is incorporated into this Phase 1 IDR by reference.

The EPA and GE evaluated three areas of the river as candidates for the Phase 1 dredging. These candidate Phase 1 areas, in upstream to downstream order, are the Northern Thompson Island Pool (NTIP), East Griffin Island Area (EGIA), and Northumberland Dam area. The Phase 1 TAI Report, which was approved by the EPA in January 2005, recommended the EGIA and NTIP as the target areas for Phase 1 dredging, including dredge areas NTIP01 through NTIP03. These areas encompass the following locations:

- NTIP – The northern portion of the Thompson Island Pool from the north end of Rogers Island to the mouth of the Snook Kill (the area of the river between the northing parallel at 1,605,034 and the northing parallel at 1,617,246; NYS Plane East, NAD 83); and
- EGIA – The area of the river in the vicinity of Griffin Island, between the northing parallel at 1,592,438 and the northing parallel at 1,598,220 (NYS Plane East, NAD 83).

Based on the February 2005 Phase 1 DAD Report (QEA, 2005a), the sediment volume in these areas is more than the Phase 1 target volume of 265,000 cy specified in the Productivity Performance Standard. The sediment volumes in the specific Phase 1 have been refined in this Phase 1 IDR, and the areas for Phase 1 dredging have been selected during the design process using the target volume of 265,000 cy (see Section 3.3 for more detail).

2.3.2 Sediment Sampling and Analysis Program

The SSAP was initiated in October 2002, pursuant to the Sediment Sampling AOC (EPA/GE, 2002). The objective of the SSAP was to provide sediment data for the design of the site remedy set forth in the ROD. Additional sediment sampling has also been performed under the RD AOC as a supplemental delineation sampling component of the SEDC Program; because the sediment sampling activities were performed for similar purposes, the data are collectively referred to in this Phase 1 IDR as derived from the SSAP.

These data were used to delineate the areal extent and depth of sediments to be removed and provide measurements of certain chemical and physical properties in those sediments. In addition, the SSAP results and related geophysical survey data have been used to develop information useful for determining the potential presence of cultural resources.

2.3.2.1 Scope of the SSAP

The Phase 1 SSAP included the three candidate Phase 1 dredge areas. The program included the collection of sediment samples for analysis of PCBs and other parameters, as well as and geophysical investigations, including bathymetric, side-scan sonar, and sub-bottom profiling surveys.

2.3.2.2 Summary of Findings

The results of the SSAP activities are presented in a series of *Data Summary Reports* (DSRs), as follows:

- The *Phase 1 Data Summary Report* (Phase 1 DSR) covering the 2002 SSAP (QEA, 2004c), approved by the EPA on September 21, 2004.
- The *Supplemental Delineation Sampling Program Data Summary Report* (2004 DSR), approved by the EPA in March, 2005 (QEA, 2005b). The 2004 DSR presented the results of the supplemental delineation sampling program conducted in 2004, which included collecting samples to address Phase 1 data gaps.

The DSRs, which are incorporated into this Phase 1 IDR by reference, present raw data in the form of field observations, laboratory analytical results for the sediment sample analysis, and geophysical survey results, and include assessments as to the reliability of the data to be used in interpretation. The SSAP data were used to determine the areal extent and depth of targeted sediment in the areas to be dredged, as presented in the approved Phase 1 DAD Report (QEA, 2005a) (described in Section 2.3.3). The data were subsequently used to develop water depth drawings and determine the range of anticipated sediment characteristics.

2.3.2.3 Data Uses and Limitations

The SSAP data were used primarily to determine PCB concentrations and PCB mass on an MPA-basis, and delineate the areas where sediment would be targeted for removal as determined in the Phase 1 DAD Report (QEA, 2005a). The results of this dredge area delineation process are described in Section 2.3.3.

The SSAP data were also directly used to develop the Phase 1 Intermediate Design. For example, the PCB and other chemistry data, as well as geotechnical data such as grain size and physical descriptions, were used in developing the sediment processing and disposal design elements. Concentrations of metals and organic constituents in sediment samples were used to evaluate waste disposal characteristics and sub-bottom chemistry.

While the geotechnical and geophysical data have also been used to develop the Phase 1 Intermediate Design for various elements such as dredging, resuspension control, and backfilling/capping, additional data were necessary to complete the design. Collection of these data was addressed in the Phase 1 SEDC Program, described in Section 2.3.6. The specific uses of the data collected under the SSAP are addressed in the basis of design discussions in each of the design task discussions in Section 3.

2.3.3 Phase 1 Dredge Area Delineation

The basis of 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 extent of dredging. The horizontal extent of dredging in Phase 1 is presented in the Phase 1 DAD Report (QEA, 2005a), which was approved by the EPA on March 30, 2005. The depth of contamination (DoC) analysis included in the Phase 1 DAD Report has been refined and finalized in this Phase 1 IDR. The process of developing dredge prisms for Phase 1 of the dredging, uses the Phase 1 DAD as a starting point and is described in Section 3.3 and Attachment D.

2.3.3.1 Scope of the Phase 1 Dredge Area Delineation

The first step of the DAD consisted of comparing: 1) PCB concentrations in the sediment relative to the removal criteria; and 2) physical attributes (sediment type, bathymetry) of the potential dredge areas against the requirements as set forth in the Phase 1 DAD Report (QEA, 2005a). Horizontal boundaries were defined primarily based on sediment chemistry, although the boundary between soft sediment and rocky or cobbly sediments was also used, where justified. Based on these parameters and interpolated Tri+ MPA and surface sediment Tri+ PCB concentrations, the horizontal delineation boundaries of the dredge areas were established and presented in the Phase 1 DAD Report which is incorporated into this Phase 1 IDR by reference.

The DoC was also evaluated in the Phase 1 DAD Report (QEA, 2005a) to identify depths in the sediment of the proposed dredging area where the total PCB concentration was less than 1 mg/kg. Kriging, a statistical tool, was used to interpolate a continuous bottom surface of the targeted removal area at the DoC. A final continuous DoC surface for the bottom of each targeted dredge area was developed using the median or 50^{th} percentile kriging prediction. This was used to calculate the volume of sediment in each dredge area. Kriging results for a range of other percentiles were also included in the Phase 1 DAD Report, including the 5^{th}, 16^{th}, 84^{th}, and 95^{th} percentiles. While the median value of the kriging results was considered to be the best estimate of DoC in the Phase 1 DAD Report, EPA's approval of the report acknowledged that the process for establishing DoC would be developed in the Phase 1 Intermediate Design (see Section 3.3 and Attachment D for additional discussion on DoC).

2.3.3.2 Summary of Findings

The process for evaluating the sediment data, the rationale used to delineate dredge area boundaries and depths, and the identification of dredge areas within the candidate Phase 1 dredge areas are presented in the Phase 1 DAD Report (QEA, 2005a). The delineation process included consideration of the Tri+ PCB MPA, surface sediment Tri+ PCB concentrations, and ancillary information, including side-scan sonar sediment type and bathymetry for each of the areas.

Using the 50^{th} percentile of the kriging results to establish the removal boundaries, the depth of sediment estimated to contain PCBs varies from dredge area to dredge area and is less than 3 feet in most cases. The most notable exceptions are in the southern portion of the east channel at Rogers Island, and the area just south of Lock 7, where the depth of PCB-containing sediment extends to 5 feet or more.

The horizontal footprint of the dredge areas delineated in the Phase 1 DAD Report (QEA, 2005a) is approximately 122 acres, and using the 50^{th} percentile of the kriging results, the volume is approximately 400,000 cy. Only that portion of this volume necessary to meet the productivity standard for Phase 1 is planned to be removed during Phase 1. This volume estimate does not include the additional sediment removal associated with engineering considerations for dredge prism development (e.g., side slopes). The majority of the delineated volume and area is in the NTIP (378,500 cy in 90 acres). Approximately 32 acres and 32,100 cy of material were identified in the EGIA.

The Phase 1 DAD Report includes a summary table that presents average grain-size distribution, specific gravity, percent solids, PCB concentration, and TOC for sediments, based on the SSAP results. The report also includes figures that show average water depths over the delineated Phase 1 areas based on a water flow of 3,000 cubic feet per second (cfs), measured at the United States Geological Survey (USGS) gauge at Fort Edward (corresponding to a stage height of 120.6 feet [NAVD88]). Point water depths represent the average estimated depth at the center of a 40-foot grid. A flow of 3,000 cfs was chosen because it represents low water conditions typically occurring during the summer at the site; thus the figures depict low draft conditions for project vessel movement. Average water depths are predicted to increase by 0.5, 1.0, and 1.5 feet at flows of 4,500, 6,000, and 9,000 cfs, respectively.

2.3.3.3 Data Uses and Limitations

The use of kriging to contour the DoC as applied in the Phase 1 DAD Report (QEA, 2005a) has a “smoothing” effect on the data, and, as a generalization, predicts higher DoC in thin sediment deposits and a lower DoC in thicker sediment deposits.. This smoothing effect is evidenced by the inclusion of multiple cores within some dredge areas that do not exceed the MPA or surface concentration criteria, and other places where cores that exceed those criteria are found outside the area defined by the DoC surface. As a result, the approach for developing the dredge prisms described in Section 3.3 provides an approach other than kriging for developing the DoC, and includes an evaluation of both the DoC development process and uncertainty associated with the DoC. Additional bathymetric data collected in 2005 provide a better baseline from which to measure sediment volumes, and were used to develop the dredge prisms presented in Section 3.3.

2.3.4 Phase 1 Processing Facility Site Selection

A key basis of design component is the selection of the processing facility site. The EPA and its contractors conducted this effort.

2.3.4.1 Scope of Processing Facility Site Selection

The scope of the EPA site selection process is presented in the *Hudson River PCBs Superfund Site Facility Siting Concept Document* (Facility Siting Concept Document) (EPA, 2002b). The site selection process involved eight milestones that encompassed the identification and investigation of candidate areas. The EPA has completed all eight milestones. The scope and results of the effort are reported in the *Hudson River PCBs Superfund Site Final Facility Siting Report* (Final Facility Siting Report) (EPA, 2004c); results are summarized below.

2.3.4.2 Summary of Findings

After defining the critical siting criteria, the EPA identified 24 Preliminary Candidate Sites (PCSs) in June 2003. The EPA noted the benefits, potential limitations, and design considerations for each site. These sites were narrowed down to seven Final Candidate Sites (FCSs) in September 2003. After completing site-specific field investigations, five FCSs were identified as suitable sites. The EPA addressed comments received during the public review process, and selected two Recommended Sites in December 2004: the Energy Park/Longe/New York State Canal Corporation (EP/L/NYSCC or "Energy Park") site and the OG Real Estate site. The primary factors used by the EPA to select the Recommended Sites included the size of useable area, rail yard suitability, waterfront suitability, environmental conditions, road access, proximity to dredge areas, and other site considerations (e.g., presence of wetlands, cultural resources, and floodplains).

In June 2005, the EPA announced that a single processing facility located at the Energy Park site would be suitable for Phase 1. Use of this site is subject to a number of conditions, including the successful completion of agreements with the landowner(s) and the railroad carrier(s) serving the site, as well as obtaining access to the site from public roads. GE is currently negotiating with the landowners to obtain use agreements for the sites. In the event that such agreements cannot be reached, GE will notify the EPA who will then have to obtain the necessary use rights. GE is also actively pursuing agreements with the railroad carriers. Because the site is located on the shore of the Champlain Canal land cut above Lock 7, it presents a number of limitations for barging and land access, as discussed in the dredged material transport and sediment processing sections. The site does not currently have access to a public highway. GE will work with the EPA to obtain the necessary approvals for obtaining access to a public highway.

2.3.4.3 Data Uses and Limitations

The location of the processing facility both affects and is affected by major design elements, including dredge selection, dredged material transport, river access, processed material storage and loading, and the dewatering and water treatment facilities. The interrelationships between site selection and these design elements have been considered during the development of the Phase 1 Intermediate Design, including the selection of dredges and the mode of transport of dredged and processed material.

2.3.5 Treatability Studies

The objective of the treatability studies was to provide data needed to:

- Assess the impact of dredging on river water quality;
- Design the sediment dewatering system so that processed sediment will meet anticipated landfill acceptance requirements or beneficial use requirements;
- Design the water treatment system so that treated water will meet water discharge requirements; and
- Determine the effects of transport on the characteristics of processed sediment relative to anticipated landfill acceptance requirements.

The treatability study activities are described in the *Treatability Studies Work Plan* (TS Work Plan) (BBL, 2004b), and additional work is described in a series of Treatability Studies Correction Action Memoranda (TS CAMs). Treatability studies were conducted during 2004 and 2005, and results are presented in the appended *Treatability Studies Report*. More specific discussion on how the treatability studies are used as a basis of design is provided in the design analysis discussions in Section 3.6. Additional treatability studies are being performed concurrently with the development of the Phase 1 Final Design; these studies will not impact the schedule for submission of the Phase 1 FDR.

2.3.5.1 Scope of Treatability Studies

As described in the TS Work Plan (BBL, 2004b), the treatability studies generally consisted of collecting representative sediment and water samples from the river and characterizing the samples using chemical and geotechnical analytical methods. As discussed in the design analysis for the processing facility (Section 3.6), the studies provided data used to assess the performance of treatment system unit processes and the characteristics of dredged sediment and water subjected to these operations.

Two key variables, sediment grain size distribution and sediment PCB concentration, were determined to be important in achieving representative treatability study results. This determination of sediments to be tested was based on SSAP data, which indicate that higher PCB concentrations are associated with fine-grained sediments, while lower PCB concentrations are associated with coarse-grained sediments. Accordingly, four categories of sediments were identified and sampled to represent the anticipated range of sediments present in the dredge areas. Descriptions of these four sediment categories are presented in Table 2-1, below.

Table 2-1 – Sediment Categories for Treatability Testing

Sediment Category Designation	Physical Characteristics	Chemical Characteristics
S1	Coarse-grained sediment	Relatively low PCB concentrations
S2	Mixture of coarse- and fine-grained sediment	Moderate PCB concentrations
S3	Fine-grained sediment	Relatively high PCB concentrations
S4	Fine-grained sediment with organic fraction and/or lower bulk density	Highest PCB concentrations

Surface water was also collected for use in the treatability studies. A total of 2,400 gallons of water was collected from approximately 1 foot below the water surface during sampling events in May 2004 (900 gallons), August 2004 (600 gallons), and November 2004 (900 gallons). Representative water samples were analyzed for chemical properties; the results were used to provide pre-processing data for the treatability tests.

Following sample collection and baseline analytical testing, sediment slurries were prepared for use in the treatability studies. Sediment slurries were prepared to simulate both hydraulic and mechanical dredging methods, as well as to simulate mechanically dredged material that is hydraulically processed. Dredged material slurry simulations for these three dredging and transport/offloading scenarios were prepared by mixing sediment samples with varying quantities of river water.

The treatability studies included a series of process-specific tests. Many of the tests were interrelated, with the residuals from one test used as the feed materials for a subsequent test. Individual treatability studies, organized by the purpose of the data they generated, are summarized below.

- *Assess the impact of dredging on river water quality* – this study involved the use of the dredge elutriate test (DRET) procedure to determine PCB and non-PCB release to the water column from the dredge head.
- *Design the sediment dewatering system so that processed sediment will meet anticipated landfill acceptance requirements or beneficial use requirements* – this study involved assessing the performance of the following treatment components: stabilization/solidification; size separation; gravity drainage; primary sedimentation; plate and frame filter press; centrifuge separation; belt press; and hydrocyclone separation. Other studies in this group evaluated dewatering polymer dosages, mixing techniques, cake release screening, formation of cake solids versus time, and required mixing energy. These studies were carried out to determine if free liquids would be present in dewatered material, and if processed materials would be classified as hazardous waste as defined in the Resource Conservation and Recovery Act (RCRA).
- *Design the water treatment system so that treated water will meet water discharge requirements* – this study involved the use of precipitation/flocculation filtrate settling tests, filtrate column settling tests, multimedia filtration tests, rapid small-scale column tests, and carbon column tests.
- *Determine the effects of transport on the characteristics of processed sediment relative to anticipated landfill acceptance requirements* – this study involved the use of storage/transportation stability shaker tests.

2.3.5.2 Summary of Findings

The appended *Treatability Studies Report* gives details on how the treatability tests were executed and provides treatability data tables, other analytical laboratory data tables, and data validation reports. Key findings from the treatability studies were used in the design of elements of the dewatering and water treatment processes, and are described within the design analysis (Section 3) for the various design elements.

2.3.5.3 Data Uses and Limitations

The treatability studies were conducted to collect data across a range of sediment types and slurry simulations. The range of sediment types was selected based on the range of expected PCB and grain size characteristics in sediment that may be removed. Care must be taken when interpreting results, as the characteristics of some sediment removed during dredging activities must be classified into one of the four categories (S1, S2, S3, or S4) that represent the range of conditions examined in the study.

The information obtained from the treatability studies guided equipment selection and sizing of the processing facilities, as described in the specific basis of design sections within the design analysis (Section 3.6) for the various design elements. The specific design elements that incorporate the results of the treatability studies are summarized in Table 2-2, below.

Table 2-2 – Use of Treatability Studies Results in the Remedial Design

Treatability Study	Element of Design
Dredge Elutriate Tests	Dredging and resuspension controls
Mixing Energy Tests	Sediment slurry tanks
Size Separation Tests	Screening and desanding
Hydrocyclone Tests	Hydrocyclone (desanding)
Primary Sedimentation Tests	Gravity thickener tanks
Dewatering Polymer Tests	Dewatering conditioning tanks
Mixing Sub-Studies Tests	Dewatering conditioning tanks
Cake Release Screening Tests	Filter press (dewatering)
Plate and Frame Filter Press Tests	Filter press (dewatering)
Cake Solids vs. Time Tests	Filter press (dewatering)
High-Volume Plate and Frame Filter Press Tests	Filter press (dewatering)
Precipitation/Flocculation Filtrate Settling Tests	Flocculation and clarification tanks
Filtrate Column Settling Tests	Clarification tanks
Multimedia Filtration (MMF) Tests	Multimedia filter systems
Rapid Small-Scale Column Tests (RSSCTs)	Granular-activated carbon (GAC) systems
Carbon Column Tests	GAC systems
Drainage Tests	Sediment product storage area
Stabilization/Solidification Tests	Filter cake rework area
Storage/Transportation Stability Shaker Tests	Offsite sediment transportation and disposal
Centrifuge Tests	Not proposed to be included as part of the processing facility
Belt Filter Press Tests	Not proposed to be included as part of the processing facility

The treatability studies were conducted to obtain data for an expected range of equipment operating conditions and for an expected range of sediment type. Nevertheless, inherent uncertainties are associated with the representativeness of the sediment samples and water samples used in these studies, and with the scale at which the studies were conducted.

A limited amount of additional testing to address data gaps is still in progress. Results from additional testing will be incorporated into the Phase 1 FDR.

2.3.6 Phase 1 SEDC Program

The SEDC Program was developed to gather the engineering field data to support the development of the remedial design. As described in the *Supplemental Engineering Data Collection Work Plan* (SEDC Work Plan) (BBL, 2004c), the specific objectives of the SEDC Program were to:

- Identify the presence and determine the characteristics of structures, boulders, obstructions, and debris in sediments targeted for removal;
- Identify potential issues associated with access of barges, dredging equipment, and other vessels during dredging;
- Determine the availability of suitable backfill materials in the vicinity of the project area; and
- Collect additional data regarding engineering properties of sediments and underlying strata to support the remedial design, including:
    - Geotechnical properties of in-river sediments and underlying strata;
    - Dredgeability of sediments to be removed;
    - Slope stability adjacent to dredge areas during and following dredging; and
    - River characteristics (velocity and discharge, stage, waves).

Results from the SEDC activities have been reported in stages, and Addenda to the SEDC Work Plan (BBL, 2005a) have been developed to address newly identified data needs. The scope of the SEDC Program, summary of findings from the program, and associated data uses and limitations are briefly discussed below. More detail on these topics is available in the work plan, addenda, and DSRs which are incorporated into this Phase 1 IDR by reference.

2.3.6.1 Scope of the SEDC Program

The SEDC data needs included information regarding the physical characteristics of the riverbed (including sub-strata) in the areas targeted for dredging during Phase 1. To meet the objectives described above, the Phase 1 SEDC Program included several tasks:

- *Infrastructure Documentation* – the documentation of infrastructure in the candidate Phase 1 dredge areas provided information on man-made obstructions that may affect the logistics of the dredging program and/or present possible equipment access issues, and included meetings and reconnaissance with various state agencies, local governments/municipalities, utility companies, and private companies within Phase 1 areas.
- *Debris and Obstruction Survey* – the SEDC debris and obstruction survey focused on identifying boulders and other debris that could also affect dredging operations, and consisted of a review of the available data from side-scan sonar performed by Ocean Surveys, Inc. (OSI). An addendum to the Phase 1 SEDC Program included performance of a multi-beam bathymetry survey, sub-bottom profiling surveys, and magnetometer surveys in portions of the candidate Phase 1 dredge areas north of the Snook Kill (NTIP and on the east side of Griffin Island as identified in the Phase 1 TAI Report [QEA, 2004a]).
- *Backfill Source Material Identification and Characterization* **–** potential sources of backfill material for the project were identified, and the quantity and grain-size distribution of available material was determined. This effort was conducted to develop of the backfill design, which is associated with both dredging design and the habitat replacement and reconstruction program.
- *Geotechnical Drilling Program* – the geotechnical drilling activities included collecting additional sediment and sub-bottom samples and submitting the samples for analysis of geotechnical parameters (i.e., grain size, Atterberg limits, specific gravity, water content, and Unified Soil Classification System [USCS]). The activities also included Standard Penetration Testing (SPT), Cone Penetrometer Testing (CPT), and Vane Shear Strength Testing.
- *River Hydrodynamics and Hydrography* – as discussed in the RD Work Plan (BBL, 2003a), a hydrodynamic model was used to predict velocities in the river for a range of flow conditions to support the remedial design. Current velocity measurements collected during the Phase 1 SEDC Program provided an additional data set for validation of the hydrodynamic model.

2.3.6.2 Summary of Findings

Infrastructure Documentation

The location of various structures within the river and along the shore, as well as descriptions of shoreline types and estimations of shoreline tree overhangs within the candidate Phase 1 dredge areas are displayed on Figures 1 through 136 of the *Year 2 SEDC Interim Data Summary Report* (Year 2 SEDC IDSR) (BBL, 2005b). Field record logs, including sketches, photographs, field measurements, and overhead clearance of various in-river and shoreline structures were presented in Appendices D and E of that document, and are shown on the Contract Drawings of existing conditions (G-0001 to G-0022).

Debris and Obstruction Survey

Appendix F of the Year 2 SEDC IDSR (BBL, 2005b) contains a report that includes the review methods, tabular results, and figures depicting the various classes of debris and obstructions that were mapped. 1,683 sonar targets (indicating the presence of debris and/or obstructions at the river bottom) were identified from the sonar data for this phase of the investigation. The targets detected within the Phase 1 dredge areas are shown on the draft Contract Drawings of existing conditions (G-0001 to G-0022).

Backfill Source Material Identification and Characterization

Thirty-five potential backfill sources in the vicinity of the project area were identified and contacted to obtain information on the quantity and type of material available. Owners of a number of backfill sources have provided information, including verbal descriptions and/or grain-size analyses of available material. A summary of the information obtained and the characterization data (grain-size analyses) obtained were presented in Appendix J of the Year 2 SEDC IDSR (BBL, 2005b). Backfill sources that can only deliver material to the processing facility location by means of trucks will be excluded from further consideration (except for fill materials needed for site construction), in accordance with the ROD requirement that backfill for the river can only be delivered by rail or barge within the Upper Hudson Area. Results from this investigation are discussed in Section 3.9.

Geotechnical Drilling Program

A summary of all geotechnical laboratory test results was presented as Appendix H of the Year 2 SEDC IDSR, and a summary of vane shear test results is provided in Appendix I of the Year 2 SEDC IDSR (BBL, 2005b). Subsurface investigations were conducted in candidate Phase 1 dredge areas from Rogers Island to Northumberland Dam. In general, similar conditions were encountered in broad areas, with some localized distinct features. SPT blow counts were presented on the borings logs in Appendix G of the Year 2 SEDC IDSR (BBL, 2005b). Boring locations are shown on the draft Contract Drawings of existing conditions (G-0001 to G-0022).

River Hydrodynamics and Hydrograph Data Collection

The Phase 1 SEDC Program included an investigation of river hydrodynamics to provide additional data for model calibration/validation, and a review of hydrographic data (i.e., bathymetry and stage at a particular flow) for the purposes of assessing available water depths for dredging operations and navigation. The findings from these activities are described below and in Section 2.3.9.

River Hydrodynamics Investigation

The data on river velocity were used to validate the hydrodynamic model, which simulates the flow conditions at the transect locations where the data were collected. Predicted and measured velocities are compared to validate the model. Appendix L of the Year 2 SEDC IDSR (BBL, 2005b) contains tabulated results, figures showing current velocity vectors, and bathymetric cross-sections for each measurement event.

River Bottom Surface

Areas where physical conditions of the river bottom surface may affect dredging operations, dredged material transportation, equipment access, and installation and operation of resuspension control systems were identified using the available bathymetry data in the Upper Hudson River and the QEA 1-D hydrodynamic model for water stage elevations (QEA, 1999), and Arc Geographical Information System (GIS) for water depths. Complete results of the modeling activities are included in the Year 2 SEDC IDSR (BBL, 2005b). A full discussion of the single beam bathymetry surveys conducted in the Upper Hudson River and the associated results are included in the Phase 1 DSR (QEA, 2004b) and Phase 2 DSR (QEA, 2004c).

2.3.6.3 Data Uses and Limitations

The Phase 1 SEDC Program was limited to candidate Phase 1 dredge areas. SEDC borings were installed in a limited number of locations, but provide a good general depiction of site conditions. Key findings from the Phase 1 SEDC Program were used to prepare the Phase 1 Intermediate Design and are described in the specific basis of design sections within the design analysis (Section 3) for the various design elements.

After review of the single-beam survey data, a multi-beam survey was completed to improve on the accuracy of the bathymetry contours developed under the SSAP. The multi-beam data were used for the development of dredge prisms and design documents.

2.3.7 Habitat Delineation and Assessment of Phase 1 Areas

As described in the *Habitat Delineation and Assessment Work Plan* (HDA Work Plan) (BBL, 2003b), the goals of the habitat delineation and Phase 1 area habitat assessment activities are to:

- Document the nature and distribution of habitats potentially affected by remediation;
- Identify reference habitat locations representing the distribution of existing conditions and which are not likely to be affected by remediation; and
- Identify measures of habitat structure and function to use in the determination of when post-remediation habitat conditions fall within the ranges of reference conditions.

Habitat-specific physical and biological measurements are being collected to develop habitat replacement and reconstruction designs for those in-river habitats affected by dredging.

2.3.7.1 Scope of Habitat Delineation and Assessment of Phase 1 Areas and Reference Areas

As part of the habitat delineation process, data were compiled from existing habitat maps, aerial photography, and field verification efforts to classify and identify the distribution of habitats in the project area. The delineation process was used in identifying representative areas at which to complete habitat assessments.

The habitat assessment process included the collection of habitat-specific data following protocols for assessing the four habitat types being evaluated as part of this program: unconsolidated river bottom, aquatic vegetation bed, shoreline, and riverine fringing wetland habitats. Field work was focused on collecting information on habitat-specific physical and biological variables (as described in the HDA Work Plan [BBL, 2003b]) that are related to the ecological functions provided by habitats in reference areas and candidate Phase 1 dredge areas (BBL and Exponent, 2005b). For example, information on physical and biological variables collected in aquatic vegetation bed habitats included plant species composition, light availability, water depth, shoot biomass and density, percent cover, and sediment nutrient availability. The habitat-specific data were used to develop conceptual habitat replacement and reconstruction designs. Reference areas include both onsite (i.e., within the project area) and offsite reference stations. Offsite reference areas will be assessed in upstream portions of the Upper Hudson River and in the Lower Mohawk River.

For purposes of monitoring the success of the habitat replacement and reconstruction program, preliminary Functional Capacity Indices (FCIs) were developed for each of the habitat types using the field data as preliminary input parameters to test the FCI models. FCIs calculated for habitats affected by dredging will be compared to FCIs developed for reference (non-dredged) stations. The results will be used to evaluate whether and when the functions of the habitats directly impacted by dredging are within the range of functions found in similar habitats in the Upper Hudson River that have not been impacted by dredging.

In addition, observations of fish and wildlife were recorded, and Habitat Suitability Indices (HSIs) for common species in the Upper Hudson River were identified for potential use. While FCIs are used to assess the functionality of a habitat, HSIs are specific to wildlife, and are used to measure the features or elements of a habitat that are necessary to support a particular species. HSI models will be used to supplement site-specific FCI models to quantify the wildlife habitat functions for representative indicator species and/or validate FCI models for wildlife function.

2.3.7.2 Summary of Findings to Date

The results of the HDA work completed to date are documented in the Habitat Delineation Report (HD Report) (BBL and Exponent, 2005a), and the Habitat Assessment Report for Candidate Phase 1 Areas (Phase 1 HA Report) (BBL and Exponent, 2005b) submitted to the EPA in June 2005. The HD Report documents the distribution and classification of unconsolidated river bottom, aquatic vegetation bed, shoreline, and riverine fringing wetland habitats in the project area. The Phase 1 HA Report documents the results of habitat assessments that have been completed to date, i.e., those completed in 2003 and 2004 for a subset of areas. Habitat assessment results for the remaining Phase 1 areas will be incorporated into the Phase 1 Final Design and all assessment results and will be included in a Phase 2 HA Report. For each habitat type, the “reference condition” will be established from data collected at unimpacted reference areas following remediation, along with data from both target and reference areas prior to remediation. In addition, data collected from offsite reference areas may be considered to represent watershed-wide conditions. Collectively, reference data will be considered in the evaluation of the success of the habitat replacement/reconstruction program. As noted above, these data will be used as a component of the basis for habitat replacement and reconstruction designs and to develop the FCI and HSI models. The application of the reference condition to Phase 1 dredge areas after habitat replacement and reconstruction is complete will be described in the *Adaptive Management Plan*. The *Adaptive Management Plan* will be provided in the Phase 1 FDR.

2.3.7.3 Data Uses and Limitations

The HD and Phase 1 HA Reports provide some of the information that will be used to determine when post-dredging habitat conditions fall within the ranges of reference conditions for specific locations of each habitat type. Habitat delineation maps presented in the HD Report have been used as base maps to overlay EPA-approved dredge locations to initially determine the areal extent of habitats that would be removed by Phase 1 dredging. However, the extent of impacts will not be fully quantified until the final dredge prisms are developed and implemented.

Habitat assessment data have been completed at only a subset of the Phase 1 stations to be sampled. Therefore, the habitat data set currently being used for design will be modified as additional data from the remaining Phase 1 habitat assessment stations are collected. The modified data set will be used for habitat replacement and reconstruction design presented in the Phase 1 FDR.

2.3.8 Phase 1 Cultural and Archaeological Resources Assessment (CARA)

The purpose of the CARA Program was to document the existence of cultural and archaeological resources in the Upper Hudson River that could be affected by implementing the site remedy. The *Cultural and Archaeological Resources Assessment Work Plan* (CARA Work Plan) (URS, 2003) outlines the specific activities that comprise the CARA Program. A brief overview of the scope of the CARA Program, a summary of the findings from the program, and data uses and limitations are provided below.

2.3.8.1 Scope of the CARA

The primary goal of the CARA Program was to evaluate the potential effects of the in-river portion of the remedy (i.e., dredging, backfilling/capping, and habitat reconstruction and restoration) on cultural and historical resources along the Upper Hudson River. The assessment included an evaluation of potential impacts to archaeological or historical architectural resources (if any) in those shoreline areas which, as a result of in-river activities, may become unstable. CARA activities to assess potential effects from the siting of the land-based processing facility(ies) were not included in this assessment, but were conducted by the EPA consistent with the Facility Siting Concept Document (EPA, 2002b) and associated facility siting work plans (Ecology and Environment, Inc. (E&E), 2003a, b). Accordingly, the in-river Archaeological Area of Potential Effects for this project includes the candidate Phase 1 dredge areas and the immediate shorelines, which could potentially be dredged or disturbed and rendered unstable during implementation of in-river Phase 1 remedial action activities.

As the Phase 1 design progresses from Intermediate to Final Design, the in-river aspects of the design will be carefully reviewed to verify that the plans adequately incorporate approaches to avoid physical impacts to cultural areas or historical properties. Since dredging has taken place historically in the Upper Hudson River (for navigational and maintenance purposes) and the remedial action is temporary, the remedy is not expected to result in any further changes in the character or use of standing historical or architectural resources listed in or eligible for listing in the National Register of Historic Places (or as-yet-unidentified, potentially eligible historic resources visible from the river). Therefore, these resources will not be subject to further investigations under the CARA Program unless they are shown to be in shoreline locations that could potentially be rendered unstable by dredging.

2.3.8.2 Summary of Findings

Findings of the CARA Program are presented in the *Archeological Resources Assessment Report for Phase 1 Dredge Areas* (Phase 1 ARA Report) (URS, 2005). The report, which was submitted to the EPA, NYSDEC, and State Historic Preservation Office (SHPO) on April 29, 2005 and approved on July 6, 2005, follows the *Standards for Cultural Resource Investigations and the Curation of Archaeological Collections in New York State* (New York Archeological Council, 1994).

The following conclusions were presented in the Phase 1 ARA Report (URS, 2005):

NTIP:

- Characteristics of the landforms along the river (soil types, drainage, and slope) indicate that there are extensive stretches of riverbank that have the potential to contain archaeological sites.
- National Oceanic and Atmospheric Administration (NOAA) charts indicate two submerged wreck locations just off the southwest end of Rogers Island. The side-scan sonar survey identified what appears to be a relic barge at the position of one of the NOAA wreck locations. Remnants of the second NOAA wreck were not identified in the sonar data, which may indicate that the wreck is gone or that the rocky bottom in the area masks any wreck remnants. Shallow water conditions were encountered during the sonar survey near Rogers Island, so the resolution of near-shore images is somewhat obscured.

- The area near Rogers Island and Fort Edward should be considered particularly sensitive for a wide range of archaeological resources. The eastern river bank of the Hudson in Fort Edward should be considered to have high potential to contain archaeological sites pending more detailed investigations. The river channel on the east side of Rogers Island is also classified as a high potential area, indicating that there may be significant historical artifacts and/or sites submerged in the river, and additional study may be necessary to identify and delineate them. Additional high potential areas within the river channel include the suspected shipwrecks off the southwest corner of Rogers Island and the 18th century Albany road crossing south of the island. Further downstream from Rogers Island, there are long stretches of riverbank with high potential to contain archaeological sites.

EGIA:

- Characteristics of the landforms along the river (soil types, drainage, and slope) indicate that there are extensive stretches of riverbank along the west side of the Hudson River with a high potential to contain archaeological sites. On the east side of the river (where the currently identified Phase 1 dredge areas are located), lower landforms and more poorly drained soils result in larger areas of low potential. Only the northern third of the eastern riverbank is classified as high potential.
- No potential submerged cultural targets were identified during the side-scan sonar survey in the EGIA.
- Portions of the riverbank of the Griffin Island Area, particularly on the west side of the river, have a high potential for prehistoric archaeological sites resources, and the northeastern shore of Griffin Island has a high potential for historic archaeological deposits.

In the Phase 1 ARA Report (URS, 2005), the sensitivity maps showing the archaeological potential were compared with the areas targeted for dredging, as defined in the approved Phase 1 DAD Report (QEA, 2005a) (note that the information from the sensitivity maps showing the archaeological potential is also shown on the separately bound Drawings G-0001 to G-0022 that depict existing conditions). The objective of this comparison was to determine whether any areas identified as having a high potential to contain archaeological sites are situated within the areas and depths to be dredged. Nine high potential areas have been identified within the Phase 1 dredge areas. Refer to the Phase 1 ARA Report (URS, 2005) for further details regarding these areas.

Additional investigation activities were proposed in the Phase 1 ARA Report, including field reconnaissance and (if necessary), archeological field survey. Those data collection activities are ongoing and the results will be incorporated into the Phase 1 Final Design.

2.3.8.3 Data Uses and Limitations

The data from the CARA activities will be considered during development of the dredging element of the Phase 1 Final Design, so that measures to avoid physical impacts on key cultural areas or historical properties can be incorporated into the design.

2.3.9 River Hydrodynamic Analyses

As discussed in Section 2.3.6, river hydrodynamic analyses have been conducted to characterize river hydrodynamics within the Phase 1 dredge areas. The specific purpose of these analyses was to define the likely range of in-river conditions that would be encountered in the project area so these conditions could be considered in the design. River flow characterization (both velocity and flow volume) was used in the design of the following project elements: dredging, resuspension controls, backfilling/capping, and habitat replacement and reconstruction. The validated hydrodynamic model was applied during Phase 1 Intermediate Design to predict resuspension transport, evaluate barge accessibility to dredge areas, and provide a basis for cap design. The model will be used during Phase 1 Final Design to predict forces on the resuspension control structures which have been proposed in this Phase 1 IDR (Section 3.5).

2.3.9.1 Scope of the River Hydrodynamic Analysis

Hydrodynamic analyses were conducted using a two-dimensional (2-D), vertically-averaged hydrodynamic model, which accounts for near-field spatial variations in bathymetry and river velocity, as well as temporal changes in flow rate. The model applied in this analysis is Environmental Fluid Dynamics Computer Code (EFDC), which has been used by the EPA and other groups during studies on other riverine systems. This model, and its calibration and validation are discussed in Section 3.5 and in Attachment E.

Numerous modeling simulations were performed to provide information on current velocity distributions in Phase 1 dredge areas over a wide range of flow conditions. Specific flow ranges (discharge in cfs) based on the USGS Fort Edward gauging station were targeted to determine how variations in flow rate affect current velocities at different locations during the dredging season (mid-May through October). The flow records also aid in determining the recurrence interval of high-flow events. Long-term flow data for Fort Edward are available either directly or indirectly from various USGS gauging stations on the Upper Hudson River, including the Fort Edward gauging station, which has been operating since 1977.

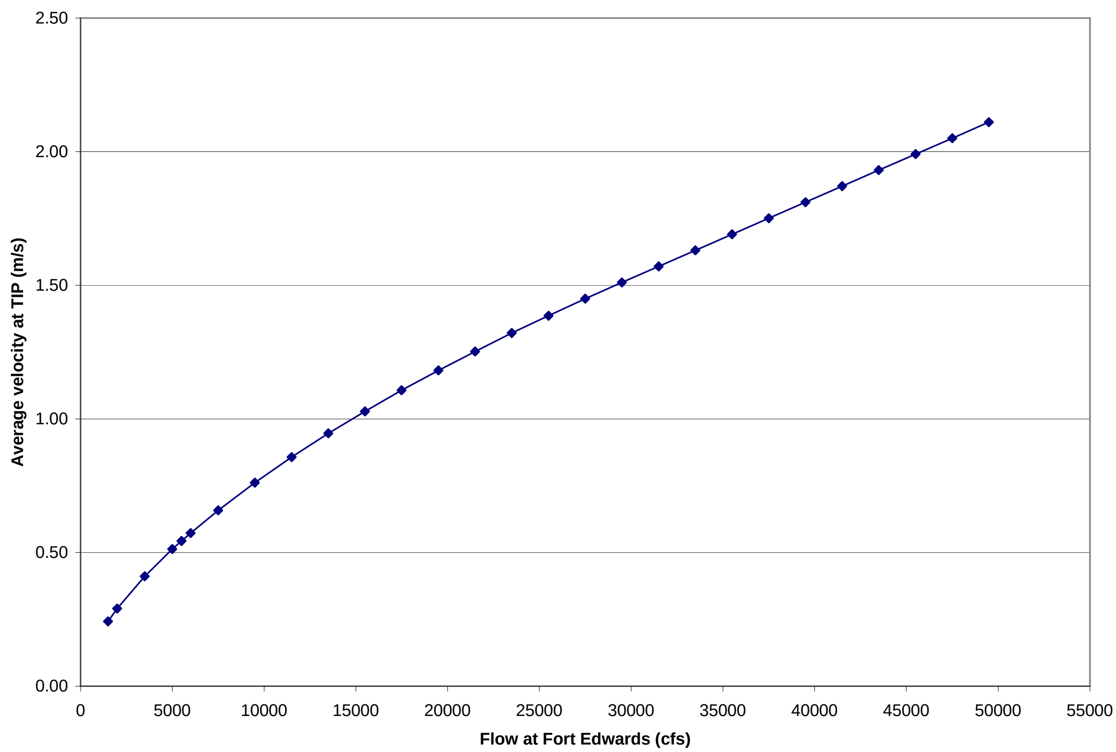
Predictions of current velocity distributions in the river were also made for high-flow events with specific return periods, such as the 2-, 10-, 50-, and 100-year floods, to develop an understanding of the flow regimes under various storm conditions.

2.3.9.2 Summary of Findings

Average current velocity in River Section 1 (Thompson Island Pool) as a function of flow rate at Fort Edward was determined using hydrodynamic model predictions. A graphical plot of this relationship is presented on Figure 2-1, below.

Figure 2-1

Average Thompson Island Pool Current Velocity as a Function of Flow Rate at Fort Edward



Current velocity measurements collected during the SEDC Program provide an additional data set for model validation. River velocity information (based on the targeted flow events) was collected along seven transects: five transects in River Section 1 and two transects in River Section 2 (near Northumberland Dam). The model was used to simulate flow conditions in the river during the periods when current velocity data were collected. Validation of the hydrodynamic model was achieved by comparing predicted and observed current velocities at the transect locations where the data were obtained.

Current velocity distributions within the Phase 1 areas were determined using hydrodynamic model simulations performed by QEA to estimate the river velocities associated with the 2-, 10-, 50-, and 100-year flood events. Results of hydrodynamic model simulations were used to determine the area-weighted average velocities in River Section 1 for a range of flood return periods, as shown in Table 2-3, below.

Table 2-3 – Relationship between Average Thompson Island Pool Current Velocity and Flood Return Period

Return Period (years)	Volumetric Flow (cfs)	Average Velocity (m/s)	Average Velocity (ft/s)
2	23,000	0.71	2.39
5	30,000	0.86	2.82
10	34,500	0.95	3.12
20	38,000	1.01	3.31
50	44,000	1.11	3.64
100	47,300	1.17	3.84

Notes:
1. m/s = meters per second
2. ft/s = feet per second

In-river activities may be conducted during a wide range of river flows and as such a primary objective of the remedial action is to conduct the in-river activities without adversely affecting safety, effectiveness, or support vessel operations. Information from the hydrodynamic analysis regarding the stage-discharge relation (i.e., relationship between river water surface elevation and flow rate at a particular location) was used to evaluate potential access limitations during dredging and other in-water activity. The hydrodynamic analysis was used to indicate when river flows may be too high to allow for proper anchoring or installation of resuspension control system components. The results of the hydrodynamic analysis also indicate areas that may be unable to be accessed during certain low-flow conditions.

The hydrodynamic analysis was also used to determine if certain flow conditions might limit the use of certain equipment. For example, silt curtains used for resuspension control are generally limited to use in lower-velocity environments (less than 1.5 ft/s) due to the potential for damage caused by high velocities and an increase in flaring of the curtain under high flows. The hydrodynamic modeling was used to evaluate possible secondary impacts of select options, such as the change in velocity and direction of river currents as a result of temporary obstructions (e.g., sheet pile walls).

During remedial activities, river current velocity will affect the transport of resuspended solids, turbidity, and dissolved phase PCBs. Hydrodynamic information is an important component of a model used to assess the potential transport of PCBs as a result of dredging activity. This type of model includes GE's near-field modeling framework, which is used to conduct near-field simulations of the dredge plume; and GE's PCB fate and transport model, which is used to predict losses to the water column and bed PCB concentrations in the far field. These models will be applied to individual reaches as needed. One use of these models is evaluation of the effects of resuspension containment options at various locations within the river. Results from this type of modeling analysis can assist in determination of whether such options are necessary and which of the systems would be most appropriate for specific locations. Results of this fate and transport modeling as it pertains to the Phase 1 IDR are summarized in Section 3.5, and the details of the model are presented in Attachment E.

For the backfilling/capping element, the hydrodynamic analysis provided information on the magnitude and probabilities of select storm return intervals. Predicted hydrodynamic forces on the bed (i.e., bottom shear stress and associated current velocities) were used to determine if an armor layer for caps will be necessary to protect the underlying isolation layer, and what size armor material would be required. A similar analysis of current velocities was required to determine whether protective measures would be required for shallow and shoreline areas. The velocity delineations show that only a small fraction (about 5%) of shorelines adjacent to the Phase 1 dredge areas will likely require a larger armor stone size (i.e., for 5 ft/s or higher velocities). More specific discussion of this modeling and how it was used in design of capping can be found in Section 3.9 and Attachment H.

River hydrodynamics is also important from a habitat reconstruction and replacement perspective. For example, areas of high velocity will likely require coarser backfill placement for stability reasons, while low-velocity areas may need only fine-grained backfill.

2.3.9.3 Data Use and Limitations

While hydrodynamic characteristics (i.e., stage height, current velocity, bottom shear stress) are generally predicted with sufficient accuracy, there are limitations and uncertainties in the application of model results to the *insitu* conditions. Many of the relations between hydrodynamic forces and their effects during the dredging/resuspension control and backfilling/capping programs are based on empirical observations at other locations. Even where equations have been developed for certain relations (e.g., bed scour at an obstruction or armor sizing), the basis for the equation is largely empirical. The precise nature of the interaction of flow with individual techniques or equipment in the Upper Hudson River environment will only be known once in-river activities are initiated. Finally, the results of the modeling do not account for the localized influence of smaller scale features or anomalies within the river.

2.3.10 Baseline Monitoring Program

The BMP is described in the *Baseline Monitoring Program – Quality Assurance Project Plan* (BMP- QAPP [QEA, 2003a]). The BMP is an ongoing program as part of the remedial design, and is intended to establish baseline conditions for river water quality to which future remedial action monitoring results can be compared. As data become available, results will be integrated, if appropriate, into the appropriate remedial action activities.

2.4 Consideration of Phase 2 Dredging on Phase 1 Design

Because implementation of Phase 1 includes a 1-month test at the average production rate anticipated during Phase 2 dredging, the Phase 1 design incorporates a key design variable, monthly productivity, of the Phase 2 dredging. For example, the processing facility sizing must be sufficient to handle the anticipated dredging rates during the 1-month test, even though the long-term production rate in Phase 1 will be lower. The Phase 2 production rate requirements, as well as other aspects of Phase 2 that influence the Phase 1 design, are discussed in the Phase 1 design analysis (Section 3) for each design element.

The location of areas to be dredged and the volume of sediment to be removed in Phase 2 will not be known until after the Phase 2 DAD is complete. For purposes of the Phase 1 Intermediate Design, the scope of Phase 2 (in terms of dredging productivity and processing rate requirements) is based on the ROD estimate with the annual removal target volumes taken from the Productivity Performance Standard. These variables will be modified, as appropriate, after the Phase 2 DAD is complete.

3. Phase 1 Design Analysis

3.1 General

This section describes how the findings from the data collection programs presented in Section 2 have been used in developing the Intermediate Design for Phase 1 of the remedial action. The discussion includes descriptions of how key findings from the supporting studies and investigations were used to develop the specific basis of design for individual components of the remedy. The rationale for the engineering decisions (e.g., equipment selection, dredge prism development) is provided. Interrelationships between project elements are described. Supporting details such as engineering calculations and engineering evaluations are presented in the attachments to this report.

This design analysis presents the Phase 1 design at the intermediate stage, and only includes provisions for redundant or contingent measures that are currently known to be required. Additional measures may be included in the Phase 1 Final Design.

3.2 Phase 1 Remedial Action Components

As described in the PDR (BBL, 2004a), the remedial action can be broken into eight key components or project "elements." Each of these elements is briefly described below.

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 controls, sediment processing and water treatment, transportation and disposal, and the rate at which dredged areas can be backfilled or capped.

Dredged Material Transport: Once material is dredged from the river, it will be transported to the land-based processing facility. The dredged material transport project element includes the barging of mechanically dredged material. In some shallow dredging locations where barge access is restricted, hydraulic transportation (via pipeline) of dredged material to barges in the navigation channel will be required – this activity is also included in the dredged material transport element.

Resuspension Control: Resuspension control involves physical methods to reduce the transport of sediment and PCBs that will be resuspended during dredging activities. Modeling the potential for resuspension of PCBs during dredging is integral to this design analysis.

Sediment and Water Processing: At the processing facility, water will be separated from the dredged material and then treated to meet discharge requirements. These solids streams will be transported for disposal. Debris and vegetation removed as part of the dredging activities will also be handled and transported for offsite disposal.

Transportation for Disposal: After the dredged sediments are processed, the resulting solid material (as well as debris and vegetation removed during dredging activities) will be transported to one or more disposal facilities. The ROD (EPA, 2002a) requires processed material be transported out of the project area by rail or barge.

Disposal: The disposal element involves the unloading and placing for final disposal of processed material at one or more disposal facilities, in accordance with each disposal facility's relevant permit conditions.

Backfilling/Capping: Following removal of targeted sediment from the river, the areas that have been dredged will be backfilled or capped as appropriate to isolate residual sediments and support habitat replacement and reconstruction. Backfill will not be placed in areas of the navigation channel that are included in the dredge prisms.

Habitat Replacement and Reconstruction: The habitat replacement and reconstruction program is intended to replace the functions of Upper Hudson River habitats, through the use of both active and passive replacement and reconstruction techniques, to within the range of functions found in similar physical settings in the Upper Hudson River.

3.3 Dredging

Dredging is the first step of the sediment removal and disposal process. As discussed above, the dredging production rate will affect subsequent project elements, including: the need for and degree of resuspension control; the amount of solids and water requiring transport to the processing facility; sediment processing; water treatment; sediment transportation and disposal throughput rates; and the rate at which dredged areas can be backfilled or capped.

The design of the dredging element involves the identification of dredge area boundaries and development of dredge prisms that define the horizontal and vertical limits of planned sediment removal. Based on these and other factors, the dredging design includes the evaluation and selection of dredge type(s) and the development of plans for both inventory and residuals dredging. The design analysis for the dredging element is presented below.

3.3.1 Basis of Design

The specific basis of design for the dredging is summarized below. These items are in addition to, or further develop, the general basis of design discussed in Section 2.

Table 3-1 - Basis of Design for Dredging

Item	Basis	Source/Notes
PCB MPA threshold for sediment removal	3 g/m^2 Tri+ PCBs in River Section 1	The ROD specifies this design criterion.
Surface sediment threshold for sediment removal	10 mg/kg Tri+ PCBs	Specified in 2005 Phase 1 DAD Report.
Residuals dredging criteria	Varies, but dredge depths are based on removal to 1 mg/kg total PCBs	PCBs in residual sediment (prior to backfilling). From Hudson EPS, 1 mg/kg Tri+ PCBs (additional criteria of 3, 6, 15, and 27 mg/kg Tri+ PCBs – as discussed in Attachment C).
Air, odor, noise, lighting, and navigation standard	Varies	Specified in Hudson QoLPS.
Dredging hours of operation	24 hours/day; 6 days/week (with contingency 7th day)	Design criteria identified to satisfy Hudson EPS based on removal volume, equipment performance characteristics, and river access.
Phase 1 target sediment removal volume	265,000 cy	Specified in Hudson EPS for Phase 1. Required volume is 200,000 cy.
Additional volume based on engineering considerations	15%	Based on engineering design experience and initial analysis of NTIP02B.
1-month peak inventory production dredging requirements	3,500 cy/day	89,000 cy for a 1-month period to demonstrate required Phase 2 removal volume specified in Hudson EPS (490,000 cy/hr) and adjusted for a 5.5-month per year inventory dredging period.
Dredging uptime	70%	30% downtime allowed for barge movement, shift changes, maintenance and repair.
Dredge type	Mechanical	Based on design evaluation (see section 3.3.4).
Bucket cycle time	120 to 300 seconds	Based on site conditions and expected equipment performance (see Section 3.3.5.1).
Clamshell bucket	4 cy	Based on design evaluation (see section 3.3.4).
Dredge bucket overlap	20%	Based on engineering design evaluation, documented in the dredging plan (see Section 3.3.5.1).

Item	Basis	Source/Notes
Percentage of *insitu* sediment by volume per dredge bucket load	80% inventory 50% residuals	Design evaluation based on engineering judgment and equipment characteristics. Remaining volume assumed to be water.
Dredging season (both inventory and residual)	24 weeks (May 15 – Oct. 31)	Design evaluation based on the estimated length of the navigational season.
Limiting water depth for dredge access	3 feet	Discussions with dredging equipment vendors and previous project experience.
Shoreline definition	Location varies	Shoreline is based on river flow during conditions in spring 2002 (approximate flow rate of 5,000 cfs at the Fort Edward United States Geological Survey Gauge Station) and are also presented in the February 2005 DAD Report (QEA, 2005a).
Lock operations	24 hours/day, 7 days/week	Required to support Dredge Plan for meeting EPS production rate.
Existing conditions river bottom contours	Varies	OSI surveys conducted in 2001 and 2005 for the Illustrative Dredge Prism in the east channel of Rogers Island.
Geotechnical properties of subsurface materials	Varies	Data collected during the SEDC Program.
Water depths	0-25 ft	Data collected during the SEDC Program and during engineering evaluation of river hydraulic analysis; a flow of 3000 cfs results in a water surface elevation of 120 feet (NAVD88) using the 2001 bathymetric data from OSI.
Subsurface chemistry	Varies	SSAP database.
In-river debris	As shown on existing conditions drawings	OSI surveys conducted in 2001 and 2005. Nature and location could change by 2007.
Presence of shoreline structures	As shown on existing conditions drawings	Data collected during SEDC Program.
Presence of in-water structures	As shown on existing conditions drawings	Data collected during SEDC Program.
Presence of bedrock or hardpan	Varies	Data collected during SEDC and SSAP Programs.
Navigation channel	As shown on existing conditions drawings	Working definition is based on historic maps, dredging charts, and bathymetric data.
Presence and type of vegetation	As shown on existing conditions drawings	*Habitat Delineation Report* (HD Report) (BBL and Exponent, 2005a) and *Habitat Assessment Report for Phase 1 Areas* (Phase 1 HA Report) (BBL and Exponent, 2005b).
Total dredge volume EGIA01 (sub-areas BG1A01A and BG1A01B)	29,154 cy	Design evaluation based on PCB concentration plus an additional 15% to account for engineering considerations (e.g., dredging side slopes that extend beyond the DAD footprint).
Total dredge volume NTIP01	11,615 cy	Design evaluation based on PCB concentration plus an additional 15% to account for engineering considerations.

Item	Basis	Source/Notes
Total dredge volume NTIP02 (sub-areas NTIP02A – NTIP02G)	224,231 cy	Design evaluation based on PCB concentration plus an additional 15% to account for engineering considerations.

3.3.2 Identification of Dredge Area Boundaries

The dredge areas identified in the September 2004 Phase 1 TAI Report (QEA, 2004a) and refined in the February 2005 Phase 1 DAD Report (QEA, 2005a) were further subdivided in this Phase 1 IDR to assist in the dredging design (e.g., dredges, resuspension controls, and dredged material transport). The location of the main dredge areas and the associated sub-areas are presented on Figure 3-1. The three main dredge areas delineated in the NTIP are NTIP01, NTIP02, and NTIP03. NTIP01 covers approximately 3.5 acres and is located in the east channel at the north end of Rogers Island. NTIP03 encompasses 1.7 acres on the east side of the river north of the Snook Kill and the boundary with the Phase 2 areas. NTIP01 and NTIP03 were not divided into sub-areas because of their relatively small size.

NTIP02 spans the length of the NTIP and covers approximately 133 acres. To make formulation of dredge prisms more manageable, NTIP02 was divided into 11 sub-areas, generally based on physical characteristics, depositional environment, and geometric configuration. These sub-areas are labeled NTIP02A through NTIP02K and are shown on Figure 3-1. Not all of these areas will be subject to dredging in Phase 1 since they represent approximately 40% more volume than the 265,000 cy target for Phase 1 removal. The actual areas to be targeted in Phase 1 are determined through the dredge prism development process described in Section 3.3.3. A brief discussion of the Phase 1 dredge sub-areas follows. A detailed summary of the characteristics of the Phase 1 dredge sub-area is presented in Table 3-2.

NTIP02A is the northernmost portion of NTIP02 on the east side of Rogers Island. It covers approximately 2 acres characterized by a relatively thin veneer of sediments intermixed with cobbles, gravel, and rock. Sediment was unobtainable from many of the coring locations within this area and these locations generally had probe depths less than 6 inches. The boundary between NTIP02A and NTIP02B was drawn north of the mouth of Bond Creek where sediment thickness begins to increase. NTIP02B covers the remainder of the east side of Rogers Island, extending to the southern end of the island, just north of Lock 7. NTIP02B is approximately 15 acres in size.

NTIP02C covers about 19 acres and is at the northern portion of the west side of Rogers Island. NTIP02C includes a rocky area with a relatively thin layer of sediment to the north that increases in thickness in the southern portion.

NTIP02D is approximately 1.2 acres in the back water area of the northernmost small island in the west channel of Rogers Island. It was defined separately from NTIP02C because of differences in the nature and depth of sediments. NTIP02D generally contains fine-grained, organic-rich sediments.

The boundary between NTIP02C and NTIP02E was drawn where the dredge area becomes thinner along the west side of the river north of river mile (RM) 194. NTIP02E is approximately 9.1 acres and extends to south of RM194 where the dredge area again thins along the west side of the river.

NTIP02F is 12.8 acres and extends from the boundary with NTIP02E to south of Lock 7 where the width of the dredge area narrows to about 70 feet in the center portion of the river.

NTIP02G extends from the boundary with NTIP02F to north of RM193 where the dredge area narrows to approximately 100 feet across, near the east shore. NTIP02G covers 18.7 acres.

EGIA01 is about 14 acres in size and extends from the rock and cobble area at the northern portion of the east side of Griffin Island along the eastern shoreline of the river to the southern extent of the Phase 1 areas in EGIA. EGIA01 contains predominantly fine-grained sediments.

3.3.3 Development of Dredge Prisms

The approach to the development of dredge prisms is based on the RD Work Plan (BBL, 2003a) and includes a two-part process. The first part of the process identifies the sediments targeted for removal based on comparison of the chemistry and physical data and the requirements of the ROD. The second part of the process includes the development of dredge cutlines based on constructability considerations. As discussed in Section 2 of this Phase 1 IDR, the Phase 1 DAD Report (QEA, 2005a) approved by the EPA on March 30, 2005 identified the footprint of the Phase 1 dredge areas and provided estimated sediment volumes for these areas based on kriging estimates for the DoC. These areas were described above in Section 3.3.2. The Phase 1 DAD Report also reported that when the kriging results were compared with the SSAP data, the result was that the DoC was underestimated in some portions of the dredge areas and overestimated in others. To address these concerns, the approach for defining the DoC has been refined. The refined approach described in this report includes inverse distance weighting to estimate the maximum sediment thickness in a given area with a total PCB concentration equal to or greater than 1 mg/kg. This sediment thickness is subsequently adjusted to conform to a confining geologic layer to form the DoC. Further detail on the development of this DoC surface is provided in Attachment D.

The 13-step approach to develop the dredge prisms is described below in Section 3.3.3.1, including establishment of the DoC surface in Step 1 through 4. To highlight application of the process, a dredge prism has been developed for the Bond Creek area on the east side of Rogers Island. Contract Drawings appended to this Phase 1 IDR are referenced where appropriate in the 13 steps. Final dredge prisms for all the Phase 1 areas will be included in the Phase 1 FDR. A discussion of uncertainty in the DoC is included in Section 3.3.3.2. Specific responses to the comments affecting Phase 1 Intermediate Design that were provided by the EPA on March 30, 2005 in the Phase 1 DAD Report approval letter are included in Attachment D.

3.3.3.1 Dredge Prism Development Steps

<u>Development of Dredge Prisms</u>

The 13-step process for the development of dredge prisms is explained below. A discussion of the application of the steps follows.

1. Develop the thickness of sediment below which the total PCB concentration is less than 1 mg/kg (i.e., DoC). Interpolate on a 10-foot x 10-foot grid total PCB (tPCB) concentration for the following layers: 0-2 in., 2-12 in., 12-24 in., 24-30 in., and every 6 inches until the maximum DoC is reached in a given area. Establish the DoC at each grid point as the bottom depth of the deepest layer with a total PCB (tPCB) concentration equal to or greater than 1 mg/kg (as defined by the core data described below), thereby forming a contoured DoC surface. This surface of sediment depth is converted to an elevation surface using bathymetry data.

   In conducting the interpolation, data treatment is dependent on the confidence level of the core (as defined in the Phase 1 DAD Report):

   - 1, 2A, 2B, 2E, 2F, 2G: tPCB for all measured and extrapolated sections are used to the maximum depth (2 times recovery depth). Below maximum depth tPCB=0.

- 2C and 2R: tPCB measured concentrations are used. From recovery depth to top of rock or clay, tPCB = -999 (coding technique to reflect no data). Below rock or clay, tPCB=0.
- 2D: tPCB measured concentrations used. Below the last measured section, tPCB=-999 (coding technique to reflect no data).
- 2H: No measured tPCB concentrations are used. Below probing depth tPCB= 0.
- 2I: Ignored.
- 2J: Below probing depth tPCB=0.
- 2K: Below probing depth tPCB=0.
- 2L: Ignored.

2. Map the elevation of Glacial Lake Albany clay ("glacial clay") for use as a confining geologic stratum. Develop a clay elevation data set by establishing the elevation at which clay was encountered in those SSAP cores that penetrated into glacial clay (the elevation for the SSAP cores will be established by assigning each core the elevation of the closest bathymetric contour) and supplementing these data with the elevation of clay measured in SEDC borings. Note that the clay elevation data will not be applicable everywhere in dredge areas. The bottom layer in cores that did not have clay will be used as an upper bound of the elevation of clay in that area (i.e., the clay must be below the bottom layer). Five-foot contours will be hand drawn using the clay elevation data. One-foot contours will be interpolated between the five-foot contours using a triangulated integrated network (TIN) developed from the clay elevation data. The contours will then be modified based on the bathymetry contours and the elevation of the bottom of the cores where the clay was not found.

3. Identify areas where there is no layer of clean sediments (i.e., have a total PCB concentration of less than 1 mg/kg) on top of the glacial clay (i.e., where the clay surface defines the DoC). The difference between the DoC and the top of glacial clay will be plotted, and areas where the clay layer is equal to or less than the DoC will be identified as areas where the clay layer will be used to define the dredge depth.

4. Integrate the 1 mg/kg total PCB surface (Step 1) with the top of the glacial clay layer (Step 2) and the delineation of areas where the clay layer will be used to define the dredging depth (Step 3) to establish the DoC on an elevation basis.

5. Straighten the jagged sides of the 2-D dredge areas identified in the Phase 1 DAD Report using straight line segments that:

a. do not decrease or increase the overall size of the 2-D dredge areas; and
b. do not exclude sample locations above the MPA or surface sediment criteria.

6. Develop preliminary dredge prisms by combining the refined 2-D dredge areas developed in Step 5 with the DoC developed in Step 3, and present as a 3-D surface on an elevation basis.

7. Propose specific areas for exclusion from the preliminary 3-D dredge prisms. Conduct the practicability assessment described in the RD Work Plan (p. 2-12). This exclusion process is conducted in two steps. The first step (Step 7A) involves an engineering practicality assessment and results in the identification of candidate exclusion areas. In the second step (Step 7B), these candidate exclusion areas are evaluated to assess whether excluding them would have a measurable impact on remedy benefits. These proposed areas would be presented to EPA for review and approval on a case-by-case basis.

   a. Step 7A - The goal of this is to identify portions of the preliminary dredge prisms for which dredging may present unsafe work conditions, very inefficient operations and create risk to the schedule. The individual factors used for this initial screening are described below and are generally used in combination to identify candidate areas. However, a single factor alone may be sufficient in some cases to identify a candidate exclusion area. These factors will be considered alone or in combination when evaluating project inefficiencies (e.g., low productivity) and risk (e.g., schedule, structural integrity and safety). These engineering factors include, but are not limited to:

      i. Thin sediment layer;
      ii. Rocks and cobbles;
      iii. Shallow water; and
      iv. In-river and shoreline structures - The design will require the development of operational plans describing the equipment and procedures to be used to avoid compromising the integrity of structures located in and along the banks of the river. Representative structures that may require setbacks include, but are not limited to the following (see RD Work Plan, p. 2-12):

         1. Structures (such as bridge abutments, dams, locks, wing walls, etc.) whose structural integrity may be compromised by dredging;
         2. Low clearance structures (such as bridges and piers);

3. Other physical obstacles within the waterway that cannot be removed (such as concrete ribs, very large boulders, bedrock, sewer outfalls, drinking water intakes, etc.); and
4. Buried utilities.

v. In addition to not compromising the integrity of structures, the design will require the contractor to identify equipment and procedures to provide a safe working environment while working near structures in and along the river. This includes the requirement for the contractor to comply with Occupational Safety and Health Administration (OSHA) and other project-related safety requirements. Operational plans must identify a safe working distance from each structure; and must include procedures and equipment so that the project can be implemented safely. For working around dams, operational plans must consider people and property downstream of the dam, the dredge crew and equipment, and support personnel and equipment including sampling and oversight crews. Operational plans may or may not identify small portions of the dredge prisms to be excluded due to safety concerns.

The assessment will identify each area within the dredge prisms where dredging is impracticable based on the operational characteristics of the dredging equipment (including specialty dredges) and the presence of permanent structures or obstructions that could potentially interfere with sediment removal activities. In situations where the dredge cannot remove the material due to obstructions, GE will evaluate appropriate alternate means for sediment removal to allow removal of such material to the maximum extent reasonably practicable, before proposing eliminating an area that exceeds removal criteria from remediation. In some circumstances, removal in the vicinity of certain obstructions will require structural assessments of the obstructions by qualified structural and/or geotechnical engineers; in such cases, alternate means for sediment removal will be evaluated on a case-by-case basis (see RD Work Plan, p. 2-12).

Operational plans that describe the equipment and procedures to be used to avoid compromising the integrity of structures located in and along the banks of the river will be presented in the *RA Work Plan for Dredging and Facility Operations*. In establishing setbacks for structures, GE will comply with all legally required setbacks (if any) and setbacks established by the owner. GE will also work to minimize the area proposed for exclusion.

b. Step 7B – In this step, GE will present its rationale for each of the candidate exclusion areas previously identified in Step 7A. GE will quantify the following metrics: 1) volume of sediment; 2) mass of PCBs in sediment; and 3) surface sediment concentrations. EPA will evaluate GE's rationale for proposing to exclude each area on a case-by-case basis and will also consider the areas collectively and determine whether such areas should be excluded.

8. Compare the DoC surface to the underlying DoC data to identify inconsistencies or instances in which single data values at variance with neighboring data have caused localized mounds or troughs in the interpolated surface developed during Step 4. Use weight of evidence to adjust the DoC surface to ensure conformity with the surrounding data. Included in the weight of evidence assessment will be the confidence designation of the cores, the heterogeneity of the local sediments, and the tendencies indicated by the preponderance of data in the local area. The weight of evidence evaluation shall take the following into consideration:

   - The depth of cut will not be adjusted upward based on an interpolated clay elevation (in lieu of the PCB concentrations taken within a core), unless supported by the PCB data from surrounding cores;
   - The depth of cut may need to be adjusted in areas where the total PCB concentrations were assigned 0 based on observations of rock or clay if such assignment appears to have caused a low bias.

9. Develop engineering cross-sections (vertical slices) for the dredge prisms after completing Step 8. The horizontal distance between the cross-sections may vary from 25 feet to 200 feet based on sediment bathymetry and the variability of removal thicknesses in the local area. Areas with significant changes in the elevation of the sediment bed or varying thickness of sediment removal will require more frequent cross-section drawings. These cross-sections will be developed using a combination of horizontal cut lines, the DoC and stable side slopes (maximum of 3 horizontal to 1 vertical) as follows:

   a. In places where the 3 to 1 side slope from the edge of the dredge area daylights in the river, this location will define the lateral limits of construction (non-target materials will be dredged); or
   b. In shoreline areas where dredging extends to the river bank, side slopes will be extended toward the river from the shoreline (beginning with a sediment removal cut of 2 feet at the shoreline unless the DoC in that location is less than 2 feet below the existing sediment surface at the shoreline) as defined in the DAD Report. This slope will be extended until it intersects the dredge prism developed using Steps 1 through 8 above.
   c. Following removal of sediment to the cut lines defined above, sampling will be conducted following the residuals sampling protocols. If PCB concentrations are found that exceed 50 mg/kg total PCBs, those

sediments will be removed. If the sediments are less than 50 mg/kg total PCBs, GE may elect to do additional sediment removal or a cap will be placed following the capping criteria summarized in Section 3.9 of this Phase 1 IDR. The 2 feet (or greater if additional dredging is performed, or less if the removal depth is set according to the DoC) cut will be replaced with backfill (or backfill/cap if capping is implemented) to maintain pre-existing shoreline configuration and river bathymetry in the backfilled or backfilled/capped area.

10. Create plan view drawings of post-dredge elevations using the engineering cross-sections developed in Step 9. These plan view drawings will identify locations where the thickness of sediment removal will be controlled by the presence of clay and not the target post-dredge elevation. The thickness of sediment removal in the other portions of the dredge prism will be controlled by the elevation contours identified on the drawings.

11. Where warranted, modify dredge prism boundaries to avoid impacting unique or sensitive habitats; and significant cultural resources. Revise cross-sections and plan view drawings to reflect these changes.

12. The results of the geophysical surveys analyses (GPR, multibeam bathymetry, magnetometry) shall be incorporated in the dredge prism development as appropriate.

13. The results of the 2005 Data Gap sampling program shall be incorporated into the final dredge cut lines.

The results of the dredge prism development process are shown on Drawings D-0105 to D-0110.

Application of Dredge Prisms

The application of the steps is as described below.

1. Figures 3-2 through 3-4 present the thickness of the sediment layer with total PCB concentrations greater than or equal to 1 mg/kg for the candidate Phase 1 areas that result from this interpolation effort.

2 and 3. Figures 3-5 through 3-7 present an overlay where glacial clay is present and where it coincides with the dredge areas. The clay layer is a barrier below which PCBs will not be present and thus dredging deeper than the surface of the clay layer is not necessary.

4. Depictions of the final combined surfaces, which show the proposed sediment removal thicknesses as determined from the interpolator and the elevation of glacial clay layer, are presented on Figure 3-8.

5. An example showing the straightened line and the original footprint of the dredge area from the Phase 1 DAD Report is presented on Figure 3-9. In addition, the footprints for the Phase 1 dredge areas presented in the Phase 1 DAD Report have been straightened and are presented on Drawings D-0002 through D-0024 appended to this Phase 1 IDR.

6. This step has been completed for all the candidate Phase 1 dredge areas identified in the Phase 1 DAD and TAI Reports. These preliminary dredge prisms are presented on the Contract Drawings appended to this Phase 1 IDR. With the exception of a portion of dredge area NTIP02B in the east channel at Rogers Island just downstream of Bond Creek, the preliminary dredge prisms are based on the 2001 single beam bathymetric data. These prisms will be updated with the multi-beam bathymetric data collected during the summer of 2005 and will be included in the Phase 1 FDR.

7. Step 7A identified one specific area within the candidate Phase 1 dredge areas for exclusion. This area is the northern portion of NTIP02A (Figure 3-10) and is primarily rock and cobble intermixed with a small quantity of sediment. Of the five locations where sediment sampling was attempted in this area, four locations were abandoned due to the lack of sediment. The single location where a sample could be collected included only 2 inches of coarse sand and gravel.

   The results of the Step 7B evaluation support the elimination of this area. The quantity of sediment in the northern portion of NTIP02A is less than 10 cy and spread out over 1.2 acres. The calculated PCB mass associated with these sediments is 0.2 kg and represents less than 0.002% of the PCB mass estimated for the delineated Phase 1 areas. Given its small size, limited sediment volume and PCB mass, the northern portion of NTIP02A will be eliminated at this stage of the design and not carried forward into the Phase 1 Final Design.

8. In the east channel of Rogers Island, there are 37 cores inside the dredge areas that have a measured or extrapolated DoC that is more than 2 inches deeper than that predicted by the 1 mg/kg interpolator. The profiles of these 37 cores were reviewed to assess the strength of the evidence that

the actual DoC exceeds that predicted by interpolation. The following information was considered in this review:

a. The depth at which PCBs were found by measurement (as opposed to extrapolation); and
b. The vertical profile of total PCBs in the vicinity of the interplolated DoC – in particular, whether the deeper DoC was due to a low-concentration section (1 mg/kg>x>5 mg/kg section sandwiched between 2 sections with < 1 mg/kg).

Locations were flagged for possible dredge prism adjustment if there was direct evidence of total PCBs > 1 mg/kg below the interpolated DoC (i.e., the deeper DoC was not based on extrapolation) and the measurement supporting the deeper DoC was not a low total PCB concentration between sections with < 1 mg/kg. Locations were also flagged for possible dredge prism adjustment if the overall total PCB profile in the core strongly suggested a DoC greater than the interpolated value (e.g., high total PCB concentration in the bottom measured section or an increasing total PCB profile to the bottom measured section). In the East Rogers Island Area, 15 locations were flagged for possible dredge prism adjustment. The cores supporting this adjustment are presented in Table 3-3.

Table 3-3 - East Rogers Island Cores with Measured DoC Greater Than 2 Inches Than That Predicted by the 1 mg/kg Interpolator and Total PCB Profiles

Core	Comments	Adjustment
RS1-9594-AB013	High tPCB concentrations in last segment (220 mg/kg)/wood in core	P
RS1-9493-WT017	High tPCB concentrations in last segment (890mg/kg)	Y
RS1-9493-WT024	1.2 mg/kg in 48- to 54-inch segment	N
RS1-9493-WT037	1.09 mg/kg in the 42- to 48-inch segment	N
RS1-9493-AR033	tPCB concentration in 12- to 18-inch segment is 2.71	P
RS1-9493-WS100	24- to 30-inch segment is 1.8 mg/kg	N
RS1-9493-WS626	2- to 24-inch core in co-located core cluster that has clustered cores with DoC @ 12 inches	N
RS1-9493-CL003	2- to 24-inch core in co-located core cluster that has clustered cores with DoC @ 12 inches	N
RS1-9493-WT702	High tPCB concentrations in last segment (126 mg/kg)/wood in core	Y
RS1-9493-WT011	High tPCB concentrations in last segment (76 mg/kg)	P
RS1-9493-WT014	High tPCB concentrations in last segment (1,109 mg/kg)	P
RS1-9493-WT015	Measured PCBs to 61 inches	Y
RS1-9493-WT023	High tPCB concentrations in last segment (84 mg/kg)	P
RS1-9493-WT076	High tPCB concentrations in last segment (1,010 mg/kg)	P
RS1-9493-WT077	High tPCB concentrations in last segment (461 mg/kg)	P

Notes:
P = Consider adjusting the prism.
Y = Recommend adjusting the prism.
N = Not recommending adjusting the prism.

Downward adjustments of the DoC for this area will not be made for this area in the Phase 1 IDR, but will be further evaluated in the Phase 1 FDR based on the results of additional cores collected following submittal of the Phase 1 IDR. The general locations of these cores are presented on Figure 3- 11.

This analysis was also performed to establish whether there were complete cores (i.e., CL1) that had measured DoCs that were at least 2 inches less than that predicted by the 1 mg/kg interpolator. For these cases, additional data may be collected prior to Phase 1 Final Design so that the dredge prism may be adjusted upwards, to avoid over-dredging. For the East Rogers Island Area, there were 14 cores in dredge areas that fit this description (Table 3-4). Of the cores cited below, nine fall within the example dredge prism and the remainder are located outside of the prism. When the dredge prism is expanded further north and south during the Phase 1 Final Design process, these cores will be reviewed again to determine if the DoC will need to be adjusted in these areas.

Table 3-4 - Confidence Level 1 Cores with Measured DoC at Least 2 Inches Less Than That Predicted By the 1 mg/kg Interpolator

Cores	Measured DoC (in.)	Depth Predicted from 1 mg/kg Interpolation (in.)
RS1-9594-IN064	6	12
RS1-9594-WT141	5	12
RS1-9493-WT027	8	11
RS1-9493-WT706	36	47
RS1-9493-WT044	48	62
RS1-9493-WT051	36	42
RS1-9493-WT052	13	19
RS1-9493-WT062	24	81
RS1-9493-WT063	0	12
RS1-9493-WT069	30	35
RS1-9493-AR027	0	12
RS1-9493-AR030	0	12
RS1-9493-WT086	18	24
RS1-9493-EP007	2	12

9 and 10. For the Bond Creek area, cross-section drawings are presented on Drawings D-0105 through D-0110. Cross-sections were developed for this area in this Phase 1 IDR as recent multi-beam bathymetric survey data became available. The area where these cross-sections are located is presented in plan view on Drawings D-0004 through D-0006. Removal elevations for this area

are also presented on Drawings D-0004 through D-0006 and highlight the portion of the dredge prism where the presence of Glacial Lake Albany clay will control the vertical extent of removal as opposed to an elevation. For locations where the elevation will control the vertical extent of removal, these elevations are considered minimum elevations that the contractor must achieve. The specific amount of allowable over-dredge beneath this elevation will be developed in the Phase 1 FDR. As noted below, the remaining Phase 1 dredge prisms will be updated with the results of the multi-beam bathymetric data and included with the Phase 1 FDR. For purposes of volume calculations in this Phase 1 IDR, it has been assumed that engineering considerations, such as those associated with Steps 9 and 10, will add 15% to the volume of the preliminary dredge prisms (i.e., Step 6 of the dredge prism development process).

11 through 13. These steps will be addressed in the Phase 1 FDR based on the location of unique and sensitive habitats, the multi-beam bathymetric survey data, and the results from the 2005 Data Gap cores.

3.3.3.2 DoC Uncertainty

The sediment cores provide point estimates of DoC on a nominal 80-foot triangular grid (note that the grid deviates from 80 feet in some areas due to the presence of additional cores collected to fill data gaps or reliance on screening sampling on a 160-foot triangular grid). The continuous interpolated surface developed from the point estimates is based on the assumption of a specific defined spatial correlation. That correlation is approximate and there is some likelihood that actual DoC exceeds that calculated by the interpolation model (just as there is some likelihood that the actual DoC is less than that calculated by the model).

The likelihood that the actual DoC exceeds that calculated by the interpolation model is reduced by the fact that the measurements of DoC used to develop the surface are biased high, i.e., the actual DoC likely is less than that indicated by the data. This conclusion is based on the following reasons:

- The PCB method used to measure total PCBs (GEHR8082) is biased high at concentrations in the range of the 1 mg/kg value used to define DoC. A study conducted by GE that examines the precision and accuracy of GEHR8082 and two other methods (ESI and QEA, 2005) when measuring PCBs with the composition characteristic of the Hudson River sediments found that GEHR8082 was biased high by about 20% at a PCB concentration of 1 mg/kg.

- The coarse sectioning of the sediment cores (i.e., 15 cm or greater) causes a downward mixing of the declining PCB profile that occurs as the DoC is approached, such that the 1 mg/kg interface is typically crossed above the bottom of the deepest core section with a PCB concentration of 1 mg/kg or greater. Analyses of high resolution cores indicate that this fact tends to result in DoC estimates that are several inches deeper than the depth at which the PCB profile declines below 1 mg/kg (QEA, 2005a).
- The downward movement of the core tube into the sediment tends to drag contaminated sediment downward along the walls of the tube, causing an artificial deepening of the PCB concentration profile. This phenomenon is evidenced by the occasional finding of PCB concentrations in Glacial Lake Albany clay (Cores RSI-9493-W5603 and RSI-9594-W5603).
- The equation used to extrapolate the PCB concentration profile below the measured concentrations in cores that did not penetrate to clean sediments was purposely developed to provide a conservatively high PCB concentration profile (QEA, 2005a).

Given the conservative nature of the core data, the interpolated DoC surface was not adjusted to account for uncertainty. Although it is inevitable that the surface underestimates DoC at some locations, it is likely that it most often overestimates DoC.

To reduce the effect of error in the interpolated surface on the efficacy and efficiency of PCB removal by dredging, an evaluation was made to determine if a stratigraphic marker observable by the dredge operators could be used to define DoC. It was found that in several of the Phase 1 dredge areas, the DoC extends to the top of Glacial Lake Albany clay. This condition is found in areas previously dredged (i.e., where navigation dredging must have reached or penetrated the clay and sediments with PCBs that subsequently accumulated) and in areas that must not have been historically depositional, but which accumulated sediment released downstream as a result of the Fort Edward Dam removal. As described in Attachment D, the "dredge to clay" areas were delineated by a detailed analysis of the core data, mapping of the elevation of the clay surface and joining of the clay surface elevation with the elevation of the DoC surface determined by interpolation.

3.3.4 Evaluation of Dredges

To meet the project requirements for dredging, a variety of dredges was evaluated based on how effectively and efficiently each could potentially remove sediments within Phase 1 dredge areas. As dredging is the first of several linked project elements, selection of dredge equipment will dictate a number of factors, such as the consistency of the dredged material (i.e., a slurry generated during hydraulic dredging or a less dilute mixture of sediment and water generated during mechanical dredging operations). This and other aspects of dredging will have a significant effect on elements of the remedial action, including the method of dredged material transport and design of the processing facility.

The evaluation of dredge equipment in this report is a function of 23 Key Process Variables (KPVs) presented in Table 3-5. The KPVs were described in Section 5.1.2 of the PDR, and included factors such as production rate, capability of the dredge, location of the dredge area (including accessibility and distance to the processing facility), characteristics of the sediment to be dredged (e.g., type, consistency, presence of debris), water depth, equipment maneuverability, and shoreline characteristics (presence and type of vegetation and shoreline structures), among others. As part of the Phase 1 Intermediate Design, 13 different mechanical, hydraulic, and pneumatic dredges were evaluated based on the KPVs, site-specific characteristics of the Phase 1 dredge areas, and other project requirements.

There were several dredges initially identified in the PDR that were not carried through this evaluation. Several of these dredges were eliminated based on their large size and overall lack of applicability to environmental dredging (e.g., hopper, dipper, bucket, ladder, and conventional clamshell). Several other dredges were not evaluated further as they were essentially duplicative of other dredges that were carried through the evaluation. These dredges – plain suction, dust pan, matchbox, Seaway, Eddy pump, and Tornado – are designed to operate in a manner that is similar to one of the dredges that is being carried through the evaluation or are "vendor-specific" versions of a general dredge type (e.g., the Seaway dredge can be considered under both the crane and backhoe-operated categories of watertight clamshell dredges). One dredge, the "dry dredge," was not carried through the evaluation as the dredge was not commercially available. A final dredge, the Toyo pump, was determined to be more applicable to the transport of dredged material from barge to barge, or for barge offloading, and not appropriate for *insitu* sediment removal.

As discussed in the PDR, the approach for evaluating dredges recognizes the need to achieve a balance of the advertised yet potentially undemonstrated nature of so called "innovative dredge equipment" and the ROD requirement to remove 2.65 million cy of sediment in Phase 1 and Phase 2. The KPVs considered in this evaluation and the range of dredges assessed is listed in Tables 3-5 and 3-6, respectively. The Phase 1 dredge areas were evaluated in detail, and then a more general evaluation, focusing primarily on limiting factors (e.g., distance from dredging to the sediment processing facility and accessibility of the dredge areas [i.e., the land-locked area]), was completed for the Phase 2 areas.

The evaluation presented herein builds upon the initial assessment described in the PDR. Similar to that assessment, an evaluation matrix was developed to summarize the comparison of dredges to KPVs; however, for this report, an individual matrix was created for each Phase 1 dredge sub-area. The only exception was the EGIA where dredges were evaluated based on the characteristics of the area as a whole. The evaluation was completed for this entire area as the sub-areas include one large area and five other small sub-areas that while not contiguous with the larger area, have sufficiently similar physical and chemical characteristics. In each matrix (Tables 3-7 through 3-17), the relative capabilities and limitations of the dredges were considered in light of the dredge sub-area specific characteristics described in Section 3.3.1 (e.g., sediment types, water depths, dredging depth, presence of debris, presence of vegetation or critical habitat) and other pertinent factors (e.g., attainment of the Hudson EPS and QoLPS). For each KPV and dredge type, a qualitative rating – H (high), M (medium), or L (low) – was assigned. An additional component incorporated in this evaluation was the use of "weighting factors" for each KPV. Each KPV was subjectively assigned a relative level of importance, ranging from 1 (less important) to 5 (more important), to reflect the fact that the KPVs do not all affect the dredge selection process in the same way. For example, a dredge's ability to achieve horizontal and vertical accuracy and consistently meet production rate goals are more critical in the equipment selection process than the portability of the dredge or the operability over a range of surface water flow characteristics. A score for each dredge in each dredge sub-area was developed by multiplying the qualitative ratings (an H was given 9 points, M equaled 3 points, and a rating of L earned 1 point) by the weighting factors for the associated KPV, then summing the results. In the dredge sub-area NTIP01, dredge scores ranged from a low of 87 for an Archimedean screw and match box hydraulic dredges to a high score of 350 for a backhoe-operated environmental clamshell mechanical dredge.

KPVs that did not vary significantly between dredge areas or sub-areas (the thin lift/residual removal, surface water flow characteristics, Hudson QoLPS, presence of cultural and archaeological resources, and representativeness to Phase 2) were not included in Tables 3-7 through 3-17. The results of the dredge equipment evaluations for inventory dredging in the Phase 1 areas are summarized in Table 3-18, and detailed results for each dredge sub-area are included in the individual matrices presented in Tables 3-7 through 3-17.

However, in the case of a few of these KPVs, the performance considerations for particular dredge options are described below in Table 3-19.

Table 3-19 – Dredge Option Considerations for Select KPVs

For the KPV of thin lift/residuals removal, diver-assisted dredging is accurate but has been shown to be a very time-consuming process, and debris is particularly troublesome for the environmental disk cutter.
Mechanical dredges as well as diver-assisted dredges are a practical solution when working in the presence of debris associated with cultural and archaeological resources.
Mechanical dredges as well as diver-assisted dredges are a practical solution when working in the presence of debris associated with cultural and archaeological resources.

3.3.4.1 Inventory Dredging

For each of the 14 Phase 1 dredge sub-areas, the backhoe-operated environmental clamshell mechanical dredge received the highest score, and has been selected for Phase 1 inventory dredging. In a number of cases, the cutterhead suction hydraulic dredge scored in a similar range, and if not for other mitigating factors, a hydraulic dredge may have been a reasonable choice. A summary of the dredge evaluation is presented below.

Debris Removal: A principal reason that the mechanical dredge often scored higher than hydraulic or pneumatic dredges was its ability to remove sediment without having to first have debris removed. There are two impacts of this debris: clogging of transport pipelines that reduces hydraulic dredge productivity and sediment resuspension associated with debris removal prior to dredging. While large debris targets will still need to be removed prior to mechanical dredging, hydraulic or pneumatic dredging will require more extensive debris removal operations to remove objects that would otherwise clog the dredge head or hydraulic pipeline transport system linked to the dredge. Extensive debris removal is time consuming. It also disturbs the sediment surface and leads to sediment resuspension and the downstream loss of PCBs. This is further complicated as portions of the Phase 1 areas (i.e., the east channel of Rogers Island) include the removal of more than 4 feet of sediment in certain locations. As a result, multiple debris removal steps would be needed between dredge passes in this area. Other favorable reasons include the ability of a mechanical dredge operated from an excavator or backhoe to work in and around structures that are quite prevalent in the Phase 1 areas. This ability would also be useful for a significant amount of shoreline dredging in tree-lined shallow water areas with root systems from the trees extending to the shoreline and into the water. This is especially the case for NTIP02D which is a backwater area that could not be sufficiently accessed by a hydraulic dredge without the removal of significant quantities of non-target sediment.

Dredged Material Transport: Other concerns for hydraulic dredging include the difficulty of arranging hydraulic dredge pipelines from as many as four dredges simultaneously operating in a single area so as not to impede navigation. The concerns with pipelines are magnified given the prevalence and size of debris in the dredge areas and the associated potential for clogging of hydraulic transport lines.

Applicability to Phase 2: The equipment used for some portion of the Phase 1 dredging must be representative of what will be used in Phase 2. After the detailed, sub-area-by-sub-area equipment evaluation for the Phase 1 dredging was completed, a more general assessment was completed for the Phase 2 dredge areas. The assessment for the Phase 2 areas focused on the key limiting factors of dredge area accessibility and dredged material transport. The selection of the Energy Park site as the location for the processing facility essentially eliminated hydraulic dredging as a feasible approach for River Sections 2 and 3. The same conclusion applies if the other final candidate processing facility site, the OG Real Estate site, is considered for the processing facility. If pipelines were used to transport the dredged materials for the two river sections, maintenance and operation of lines as long as 35 to 40 miles would present numerous technical and logistical challenges that could lead to significant down time. To complicate matters, each of the four inventory dredges that would be required to meet the Productivity Performance Standard would need individual transport pipelines. Additional dredges for residuals dredging would add more individual pipelines (see Section 3.3.4.2.). The possibility of using a manifold to join the pipelines from the four individual pipelines into one large pipeline to accommodate the production rate required by the Hudson EPS was also evaluated. Through discussions with equipment vendors and contractors, the only possible way to construct such a system given the high probabilities of frequent shutdowns of the individual dredges (due to debris or having to move to accommodate non-project river traffic) was the use of a large confined disposal facility (CDF) that could act as a flow equalization chamber. The use of a CDF or on-barge treatment of up to 15 million gallons per day (mgd) of slurried sediment were not deemed to be viable options. If barges were used to haul the hydraulically dredged material, its relatively low solids content would greatly increase the number of barges necessary to transport the material to the processing facility, and an enormous quantity of water would have to be treated (up to 20 mgd), as compared to the processing needs of mechanically dredged material. The effects would also include transportation logistics for over 100 barges per day. Even if barge transport was possible, the additional water associated with hydraulic dredging that would have to be treated would significantly increase the size of the processing facility.

Applicability in Land-Locked Area: The challenges of operating in the land-locked area (i.e., the portions of the river in River Section 2 that are accessible only from land between Thompson Island Dam and Fort Miller

Dam) would be similar for both a mechanical and a hydraulic dredge. These include mobilizing the dredge and transport equipment into the area and transporting the dredged material to the processing facility. While hydraulic dredging in this area would appear to offer the theoretical advantage of pumping the dredged sediment to the sediment processing facility thus avoiding the logistical difficulty of transporting sediment via a barge from a land-locked area, pumping the sediment up to 9 miles would present other operational challenges, and the system would not likely operate reliably. Even if hydraulic dredging was employed in the land-locked area, debris would still need to be removed mechanically and transported to the dewatering facility via barge or truck. An alternative approach would be to place the sediment into modular deck barges that could be assembled and deployed at the shore of the land-locked area. These barges could be used to transport the sediment to a location where a high solids pump could be used to transfer the sediment to a second barge located in the navigable portion of the river. From there, the sediment could be transported to the Energy Park site for processing. Given the advantages of using a mechanical dredge for Phase 1 and the other Phase 2 areas, there is no significant advantage associated with using a hydraulic dredge in the land-locked area that would warrant its testing in Phase 1. The selected method for dredging and transport of materials from the land-locked area will be developed during Phase 2 design.

Conclusion: Although either mechanical or hydraulic equipment could be appropriate in many of the Phase 1 areas, mechanical dredging is a clear choice for River Sections 2 and 3 and there does not appear to be a compelling reason to incorporate hydraulic dredge equipment into the Phase 1 dredging. As such, a backhoe-operated environmental clamshell mechanical dredge has been selected as the dredge for all inventory dredging during Phase 1.

Prior to dredging, large debris items would be removed. Only the large items would be removed in advance of dredging, since a mechanical dredge is capable of removing the smaller debris during dredging. The debris removal approach used for this Phase 1 IDR includes a backhoe staged on a deck barge. The backhoe would be equipped with a hydraulic grappling hook so that it could remove trees and other large objects. Debris would be placed on the deck barge and transported to the process facility where it would be offloaded and managed as described in Section 3.6. Manmade debris would be subsequently shipped to the offsite disposal facility. Natural debris such as trees, wood, and large boulders may be pressure washed and used for shoreline and habitat reconstruction. The actual approach for debris removal and disposition will be further evaluated during Phase 1 Final Design.

3.3.4.2 Residuals Dredging (Re-dredging)

Although the inventory dredging effort will be designed and executed to be efficient and effective, there will still be residual sediment that may need to be re-dredged or capped. Sediments with PCB concentrations above the criteria in the Residuals Performance Standard may result from the situations listed in Table 3-20:

Table 3-20 – Sources of Sediment Residuals

Redeposition of sediment initially lifted from the riverbed but not captured by the dredge during inventory dredging, such as bucket overflow and cohesive sediments clinging to the exterior of the bucket.
Settling of resuspended sediments associated with vessel traffic.
Sediment which is missed despite the use of good practices, since no dredge can remove all the targeted sediments.
Incidental and inadvertent mixing of targeted sediments with underlying materials.
Side slopes of excavated areas sloughing onto the dredged surface.

Evaluation of other environmental dredging projects, including at the St. Lawrence River, New Bedford Harbor, Manistique River and Harbor, and Fox River, among others, reveals that hydraulic dredges do not offer any significant advantages over mechanical dredges with respect to either minimization or management of residuals. The concept of using a hydraulic dredge with barge transport was also considered. However, the dilute dredge slurry (estimated to be less than 5% solids) associated with removing a six-inch residual layer would fill a large barge (i.e., 195-feet by 35-feet with a 12-foot draft) with predominantly water in less than 3 hours. The end result would be an unworkable number of barges on the river given the 24-hour/day nature of residuals dredging, and further given that up to four residuals dredges may be needed to keep pace with inventory dredging operations. Finally, the experience at the environmental dredging projects listed in Table 3-21 were also considered, experience that reveals that hydraulic dredges to not offer significant advantages over mechanical dredges with respect to either minimization or management of residuals.

Table 3-21 – Environmental Dredging Projects Evaluated

St. Lawrence River, NY
New Bedford Harbor, MA
Manistique River and Harbor, MI
Fox River, WI

Based on these considerations, mechanical dredges, similar to those used for inventory dredging will also be used to remove residual sediment if re-dredging is necessary.

3.3.4.3 Navigational Dredging

In some areas of the site, dredging may be necessary to facilitate navigation/movement of project-related vessels and to provide access to certain shallow areas. The mechanical dredge equipment selected for the inventory and residuals dredging will also be applicable for any navigational dredging. Areas where navigational dredging will be required will be identified in the dredge prisms developed for the Phase 1 FDR, as described in Section 3.3.3 using the updated bathymetric data to evaluate water depths. Based on the existing bathymetric data, navigational dredging during Phase 1 is expected to be required only to construct the waterfront area at the processing facility site (see Section 3.6). The Phase 1 FDR will also identify if and where navigational dredging would be required for locations to temporarily moor barges.

3.3.5 Dredging Plan Development

As previously described, dredging is the first of several linked and mutually dependent project elements. Consistent with the RD Work Plan (BBL, 2003a), an overall dredging strategy was developed to guide the process of inventory and residuals dredging in an effort to achieve the project requirements, performance standards, and other goals. The Phase 1 Inventory Dredging and Residuals Dredging Plans described below were developed to identify how many dredges may be necessary during Phase 1 activities, where each would be placed, the timing and duration of operations, and what issues may affect schedule and dredge operations. In addition, the transport of dredged material must be planned so that the appropriate number of barges can be estimated and the processing facility can be designed to handle the delivery of sediments and associated water. Furthermore, based on the ROD, the Phase 1 Inventory Dredging and Residuals Dredging Plans must also be designed to achieve the Phase 2 production target for a 1-month period. The results from this 1-month test will be used to assess the feasibility of achieving the required Phase 2 removal rate of 490,000 cy per year.

Outputs from the Phase 1 Inventory Dredging and Residuals Dredging Plans are also inputs to the resuspension model (see Section 3.5). To provide inputs to the resuspension model in a usable format, the dredging plans were developed using the 2-D model grid from the resuspension model. The specific outputs from the Phase 1 Inventory Dredging and Residuals Dredging Plans for the modeling effort include the day and duration that a given dredge is in a dredge cell and the mass of sediment removed.

These outputs were used in combination with the sediment characteristics for each grid cell (% of fine grained material and associated PCB concentration) as inputs to the resuspension modeling effort described in

Attachment E. It is important to understand that the Phase 1 Inventory Dredging and Residuals Dredging Plans present one approach that is deemed to be feasible and appears to support achievement of the Hudson EPS and QoLPS. Without question, it is not the only acceptable plan. To help promote creativity and innovation in this environmental dredging project, each contractor awarded a dredging contract will be required to submit a Dredging Plan. Such plans may differ from the plans presented in this Phase 1 IDR. They will be reviewed by GE for compatibility with the overall design and project objectives and will be approved if satisfactory to GE.

3.3.5.1 Phase 1 Inventory Dredging Plan

The Phase 1 Inventory Dredging Plan (Table 3-22) is based on the following assumptions:

- Dredging will begin in sub-area NTIP01, and will be conducted through the remaining Phase 1 sub-areas from upstream to downstream, with the exception of sub-area EGIA01, where dredging will start approximately 2 weeks into the Phase 1 program. NTIP01 was selected as the starting location because it is farthest upstream and the targeted sediments are typically coarse-grained with relatively low PCB concentrations. In contrast, due to the nature of sediments in EGIA01, it has been selected as an area where resuspension will be monitored early in the project. The sequence of dredging in EGIA01 is influenced by resuspension control and detailed in Section 3.5.3.1. Work in both of these Phase 1 dredge sub-areas is expected to provide valuable information that will likely influence activities in the remainder of the Phase 1 dredging program.
- Dredging activities are scheduled to take place 24 hours/day, 6 days/week (subject to scheduled and unscheduled downtime), from approximately mid-May through October 2007.
- Inventory dredging will be carried out using up to four mechanical dredges, each equipped with a 4-cy environmental clamshell bucket.
- Target removal rates for inventory sediments are:
  - 3,500 cy/day on average; and
  - 89,000 cy for the 1-month Phase 1 demonstration period, which is designed to evaluate the feasibility of achieving the required Phase 2 production rates while simultaneously conforming to the Hudson EPS and QoLPS.

The 89,000 cy per month is derived from the 70,000 cy per month value provided by the EPA in the Hudson EPS document; specifically, the EPA based the 70,000 cy value on a 7-month dredging season to produce the annual required volume of 490,000 cy. The dredging plan presented herein is based on a 5.5-month season of inventory dredging (i.e., 490,000 cy / 5.5 months equals 89,000 cy/month). The average daily removal rate target of 3,500 cy/day is derived from the typical 26 dredging days available per month using a 24 hours/day, 6 days/week dredging schedule, and is the average daily production rate (rounded) required to achieve the 89,000 cy monthly rate.

- Target removal volume for Phase 1 is 265,000 cy. This volume includes the sediments identified for removal based on PCB concentration, as well as an additional 15%. The 15% addition is an assumption in the intermediate design to account for engineering considerations developed to address the differences between the DAD and the final dredge prisms and based on initial prisms developed in NTIP02B. Examples of these considerations include the additional sediment associated with the wedge of non-target sediment (i.e., side slope material) that is removed when dredging the target sediment, and the additional non-target sediment (overdredge) that is typically removed when dredging to a design elevation. The complete dredge prisms to be presented in the Phase 1 FDR will reflect the sediment volume that will be contracted for removal in Phase 1.

Production rates for the dredges were established based on a variety of factors, including characteristics/ capabilities of the dredges, total dredge cycle time, and predicted uptime. The "bucket cuts" of the dredges – the actual length and width of the removal area created by each pass of the dredge bucket – will be overlapped by 20% to reduce the potential for targeted materials to be missed. Other dredge characteristics that affect the design of the dredging plan are the total cycle time (the amount of time it takes to move the dredge bucket from the disposal barge into position and then into the water, remove the targeted sediment, and travel back to the barge) and the fact that some water will be captured in the bucket, preventing the dredge bucket from being completely filled with sediment. In addition, consideration must be given to the fact that the dredges will not operate continuously due to shift changes, routine maintenance, unexpected maintenance, dredge positioning, encountering debris, and the need to periodically switch out the barges used to collect dredged sediment. Assumptions used in the development of this plan were shown on the basis of design table in Section 3.3.1 as follows: 20% bucket overlap, total cycle time of 150 seconds, 70% uptime, and a bucket load of 80% *insitu* sediment and 20% water by volume. These assumptions are based on engineering judgment, familiarity with conditions at other projects and discussions with dredging contractors.

Dredge Volumes

Estimates of the actual removal volume targeted in each of the Phase 1 dredging sub-areas were developed by dividing the dredge areas and sub-areas into grid cells. These same grid cells are used to support the resuspension modeling and provide an explicit link between the dredging plan output and the input for the resuspension model. The sub-areas, associated grid cells and thickness of sediment in each grid cell are depicted on Figures 3-12 through 3-14, and are used to estimate the removal volume by grid cell. As described above, these volumes were increased by 15% to account for engineering considerations. These considerations include both the horizontal and vertical expansion associated with the dredge prism configuration.

Factors Affecting Uptime and Cycle Time

The general assumption of 70% uptime was reduced for certain grid cells depending on difficulties introduced by proximity to the shoreline (due to the presence of overhanging trees, shallow water, and additional dredge movement) and the proximity of obstacles such as bridge abutments and locks. Uptime in cells within 30 feet of the shoreline was decreased to 60%, and uptime in cells affected by in-river structures was reduced to 40%. Dredge cycle time will similarly be affected by various physical constraints/characteristics in the individual grid cells. The cycle time was increased if rock and gravel were observed in those areas (additional time necessary to penetrate the harder sediment surface) or if a thin layer of sediment is targeted for removal (additional time necessary for positioning for precise removal of a single thin layer). For the purposes of this plan, cycle time in particular grid cells was increased to 300 seconds if rock and gravel are present, and to 240 seconds if there is a thin layer of sediment to be removed. Locations where gravel, rock, or refusal have been encountered are shown on Figures 3-15 through 3-17.

Transportation of Dredged Material

Another factor that will affect the overall dredging production rate is the need to move the dredged material from the dredge to the barge and then move the barge to the processing facility. A variety of approaches will be used to fill barges depending on the characteristics of the grid cell (e.g., physical layout, sediment type). For example, an individual dredge may place dredged material directly into a barge, or multiple dredges might place dredged material into a hopper where it will be pumped to a single barge using a high solids pump. The rate at which barges can be moved out of the dredging areas and to the processing facility will be affected by:

- The number of dredges that are loading a barge at any one time;
- The distance from the dredge to the transport barge (in the event that sediment is pumped from the dredge to the barge);
- The solids content of the dredged material; and
- The need to offload dredged material to another transport barge if the dredge area is contained/restricted in some way (e.g., by natural obstructions or resuspension controls).

The time to dredge each cell is also adjusted by a transportation factor ranging from 50% to 100%, where 100% means the dredging rate is not affected, and 50% means dredging will only be able to proceed at one-half of the designated rate. The two locations where transportation factors other than 100% were applied are the northern portion of the east channel of Rogers Island (NTIP01 and NTIP02A) and the portion of NTIP02C north of the Route 197 Bridge. While it is possible to move a small or lightered barge (a barge not fully loaded to lessen the draft) up to NTIP01 and NTIP02A, there is a narrow channel in this area that limits barge mobility. Given this constraint, a transport factor of 75% has been used for dredging these sediments. For NTIP02C, which is located west of Rogers Island, barge transport north of the Route 197 Bridge is not practical due to a combination of the shallow water depth and the difficulties of mooring and operating a barge in the vicinity of this bridge and the railroad bridge just to the south. While the barges could pass under these structures, the limited water depth north of the Route 197 Bridge would require the barges to be moored beneath the structures for extended periods of time; this is considered an unnecessary risk to these structures. To address these issues, the transport barge was assumed to be located 1,500 feet away from the dredging operations (downstream of the railroad bridge) with a "single slot" for the barge to come in and out, resulting in a transportation factor of 50% being assigned for this portion of NTIP02C. The approach for this area may be changed in the Phase 1 Final Design based on the findings from the constructability review.

Timing

Finally, after considering all the factors discussed above and assigning a dredging order by grid cell and sub-area, a detailed schedule, identifying days, start and end times, and overall duration of inventory dredging was developed. The schedule, depicted in Table 3-22, lays out how many dredges may be working in each sub-area on each day of the 5.5-month dredging season, identifies a daily removal volume target (i.e., cy) for each dredge, and identifies how many barge loads may be generated in each sub-area for each dredge. The targeted Phase 1 inventory dredging volume of 265,000 cy is expected to be reached in dredge sub-area NTIP02G, assuming that dredging proceeds from upstream to downstream (with the exception of EGIA01 where dredging will be started 2 weeks into the Phase 1 program) and that production rates in each sub-area are achieved consistent with the assumptions presented above. As discussed above, the "output" from the dredging plans – timing, location, and volume and mass of material removed – become the "inputs" for the resuspension model.

The Phase 1 Inventory Dredging Plan is also presented on Figures 3-18 through 3-20 for the areas expected to be dredged during Phase 1. The figures are colored to reflect the position of each of the four inventory removal dredges. The individual grid cells also include the schedule dates that each dredge would be operating within the cells. The barging of the materials dredged during inventory dredging is described in Section 3.4.

3.3.5.2 Phase 1 Residuals Dredging Plan

Dredging for residuals will be necessary; however, it is not possible to predict where residuals dredging may be necessary and to what extent. The Phase 1 Residuals Dredging Plan (Table 3-23) helps to understand the potential effects of residuals dredging on the project and to guide the design of in-river logistics, the waterfront and processing facilities, and transportation logistics. Residuals dredging operations will have to be flexible to allow for daily adjustments in the field based on the results of residual PCB sampling.

The assumptions made in developing the Phase 1 Residuals Dredging Plan are as follows:

- Residuals dredging will begin approximately 1 month after the start of inventory dredging, and will last approximately 1 month longer;
- Residuals dredging activities will take place 24 hours/day, 6 days/week;
- Residuals dredging will be carried out using up to four mechanical dredges, each equipped with a 4-cy environmental clamshell bucket;
- Dredging will require 20% bucket overlap, total cycle time of 150 seconds, 70% uptime, and a bucket load of 50% *insitu* residual sediment and 50% water by volume;
- Target removal sediment thickness is 6 inches;
- One re-dredging pass will be performed over the entire dredged Phase 1 area; and
- The targeted daily average residuals dredging volume is 500 cy/day. This volume is in addition to the average of 3,500 cy/day for inventory dredging (refer to Section 3.3.5.1).

The schedule for residuals dredging, depicted in Table 3-23, depicts by color how many dredges may be working in each sub-area on each day of the dredging season, identifies a daily calculated removal volume for each residuals dredge, and identifies how many barge loads will be removed from each sub-area for each residuals dredge. Due to the approximate 1-month delay between inventory and residuals dredging operations, it is anticipated that residuals dredging will be conducted with separate dedicated equipment and crew. The barging of the materials dredged during residuals dredging is described in Section 3.4.

3.3.6 Residuals Sampling and Determination of Dredging Completion

The decision regarding when dredging is complete is described in the Residuals Performance Standard and the Phase 1 ID PSCP Scope (Attachment C). Sampling of residuals to verify achievement of the objective will only begin after it has been verified that the dredging has met the inventory design cut lines.

The routine monitoring requirements, contingency monitoring, and other responses in the event of an exceedance of an applicable action level, as well as notification and reporting requirements upon completion of dredging, will initially be defined in the *RA Monitoring Plan* (scope of which is presented in Attachment A) and subsequently detailed in a RAM QAPP and PSCP (both of which will be developed during the remedial action). In addition, a checklist to be used to certify completion of dredging is under development and will be included in the Phase 1 FDR. This section describes the sampling of residuals and the determination of appropriate response based upon the results of the sampling.

Sample collection and processing shall follow the approach presented in the Phase 1 ID RA Monitoring Scope (Attachment A). The standard specifies the collection of surface (0- to 6-inch depth) sediment samples to determine PCB concentration in residual sediment after dredging. The results are to be evaluated on a CU basis. A CU is defined as an approximately 5-acre contiguous dredge area; the standard specifies that 40 evenly spaced samples are to be collected from each CU along a triangular grid.

The need for and type of response actions to be taken in a CU after completion of inventory or residuals dredging passes (including the decision regarding the completion or continuation of dredging) will be based on comparing both the arithmetic average Tri+ PCB concentrations and the individual sample node concentrations to the Residuals Performance Standard criteria. Table 3-24 summarizes the action levels and required actions, and is derived from Table 2-5 of Volume 1 of the Hudson EPS (EPA, 2004a). The Phase 1 ID PSCP Scope (Attachment C) provides greater detail of the methods used to evaluate the sample data. Three general scenarios could exist in the field:

1. <u>Dredging has successfully achieved the standard and dredging is considered complete:</u>
   This occurs if the average Tri+ PCB concentration of the CU (or multiple CUs for the 20-acre evaluation) is $\leq$ 1 mg/kg, no node has a Tri+ PCB sample result $\geq$ 27 mg/kg, and there are no more than one individual node with greater than 15 mg/kg Tri+ PCBs. The areas can then be backfilled and demobilization can take place. In CUs where the average Tri+ PCB concentration is > 1 mg/kg and < 3 mg/kg, and the average Tri+

PCB concentration in the 20-acre evaluation area including the CU is ≤ 1 mg/kg, backfill will be placed as described above. However, for CUs where the 20-acre evaluation was employed, the backfill shall be placed and sampled to confirm that the average backfill surface concentration is ≤ 0.25 mg/kg Tri+ PCBs.

2. Re-dredging of the area must be performed:

   If two inventory dredging attempts have been completed and the average Tri+ PCB average for a CU is still > 6 mg/kg, up to two residual re-dredging attempts will be performed in the non-compliant areas. If after two residual passes, the average is still > 6 mg/kg, EPA will be petitioned to place a cap over the non-compliant area.

   Regardless of the average Tri+ PCB concentration, if two or more samples within a CU have Tri+ PCB concentrations ≥ 15 mg/kg, or if one or more sample(s) has Tri+ PCB concentration ≥ 27 mg/kg, such sampling nodes will be re-dredged and re-sampled. After these node-specific re-dredging efforts are completed, the CU will be re-evaluated. No more than two re-dredging attempts will be required.

3. Re-dredging is optional:

   In certain cases, the Residuals Performance Standard provides for a choice between re-dredging or constructing a subaqueous cap. If re-dredging is selected, the surface sediment of the re-dredged area will be sampled, and the CU re-evaluated. If subaqueous capping is selected, the capped area will be selected such that the arithmetic average Tri+ PCB concentration of the uncapped nodes is 1 mg/kg or less and no individual node has a Tri+ PCB concentration ≥ 15 mg/kg.

   The options for dredging to end and a subaqueous cap to be constructed exist in the following cases:

   - If the Tri+ PCB average for a CU is > 3 mg/kg and ≤ 6 mg/kg, no Tri+ PCB sample result is ≥ 27 mg/kg, and not more than one Tri+ PCB sample result is ≥ 15 mg/kg; or
   - If, after two re-dredging attempts, a CU has a Tri+ PCB average > 1 mg/kg (and the 20-acre area-weighted arithmetic average is > 1 mg/kg), two or more samples show Tri+ PCB concentrations ≥ 15 mg/kg, or one or more samples show Tri+ PCB concentration ≥ 27 mg/kg.

Delineation of Non-Compliant Areas for Re-Sampling, Re-Dredging, or Capping

The extent of a non-compliant area around each sample node will be determined using the equation set forth in the Hudson EPS, Volume 3, pp. 58 to 59 (EPA, 2004a) and additional methods presented in Attachment C. The vertical extent of non-compliant areas will be no less than 6 inches for purposes of establishing dredge prisms for re-dredging purposes.

Where the arithmetic average Tri+ PCB concentration in the CU is > 1 mg/kg but ≤ 6 mg/kg, the horizontal extent of non-compliant areas subject to further response action will be delineated by designating for further action the individual sample nodes with the highest Tri+ PCB concentrations (ensuring removal of those ≥ 27 mg/kg and 15 mg/kg and others as necessary), and then re-calculating the average Tri+ PCB concentration in the CU, until that average concentration is ≤ 1 mg/kg.

Additional details regarding the delineation of the noncompliant areas are provided in Attachment C.

Methodology for Determining Whether to Re-Dredge or Construct a Subaqueous Cap

Engineering judgment in the field will be used to decide whether to cap or to re-dredge the CU in an attempt to meet the criteria considering a number of conditions such as:

- ***Existing or anticipated dredge productivity:*** When the dredge productivity is low, conditions will favor capping. Also, if previous re-dredging passes were made in the same area, the success of these will be considered.

- ***Sub-bottom conditions:*** Continued dredging will not be as effective in areas with hard or rocky sub-bottom conditions. Debris and other obstructions along the bottom affect both alternatives and will be evaluated on a case by case basis.

- ***Residual PCB concentration and inventory:*** Lower levels of PCBs will generally favor selection of capping.

- ***Hydraulic conditions:*** Areas that experience greater shear stresses during high flows may be less favorable to capping or, at a minimum, require a greater degree of armoring. These areas have been identified in the Contract Drawings for engineered capping.

- ***Habitat considerations:*** Depending on the habitat reconstruction being planned, the ability of backfill or cap material to function as an effective substrate will be considered.

- ***Equipment availability:*** The allocation of equipment across the entire project area may factor into the decision between capping and dredging.

- ***Cost considerations:*** The costs of subaqueous cap construction and OM&M will be compared to costs of re-dredging and backfilling.

This process involves engineering judgment, and does not exclude a hybrid approach, using both re-dredging in some areas and capping in others, to differentiate non-compliant areas of a given CU if conditions warrant. Figure 3-21 summarizes the decision process related to cap type selection after dredging operations are complete.

<u>Preparation of Drawings Showing Areas for Re-Dredging or Capping</u>

Decisions made regarding both the choice of capping versus re-dredging and the boundaries of the areas to be capped or re-dredged must be prepared and communicated to the contractor performing the work. For drawings showing the re-dredging option, the dredge prisms will be provided (using methods similar to those described in Section 3.3.7), as well as location of residuals sampling points after dredging. For the capping options, specifics regarding the cap design will be included.

3.3.7 Interrelationships with Other Project Elements

The location and pace of dredging operations will affect each element of the overall project, including monitoring, dredged material transport, resuspension controls, processing operations, and hence, final transport for disposal. The dredging plans described in this section have been used to develop the design of these other project elements. While a framework and conceptual approach for dredging has been developed for this Phase 1 IDR and will be updated in the Phase 1 FDR, the actual approach used by the selected remedial action contactor may vary. The actual approach used by the contractor, however, will still need to comply with the project's requirements and be compatible with other aspects of the project design.

3.4 Dredged Material Transport

This section presents the evaluation of potential transport methods for material dredged during inventory dredging and re-dredging for residuals removal.

Once material is dredged from the river, it will be transported to the land-based processing facility for processing (e.g., offloading, solids separation, dewatering, water treatment). This section focuses on the transport of sediment removed with a mechanical dredge during both inventory and residuals dredging.

3.4.1 Basis of Design

The specific basis for the dredged material transport element design is summarized below (Table 3-25). These items are in addition to, or further develop, the general basis of design discussed in Section 2. Some items in this basis of design may be adjusted during Phase 1 Final Design, after further consultation with the New York State Canal Corporation (NYSCC).

Table 3-25 - Basis of Design for the Dredged Material Transport Element

Item	Basis	Source/Notes
Dredged material transport hours of operation (including lock operations)	24 hours/day; 6 days/week	Project has been designed on the basis of 24 hours/day, 6 days/ week with a contingency of 7 days/week if needed to achieve the Productivity Performance Standard.
Canal season	May 15 to Nov 15	NYSCC.
Dredge type	Mechanical	Based on design evaluation.
Maximum lock length	300 feet	NYSCC design records.
Tugboat dimensions	60-foot length 17-foot height	Typical size of tugs required to move barges.
In-river and shoreline structures	Various locations throughout the river	SEDC data (see General Contract Drawings for Existing Conditions).
Air, odor, noise, lighting and navigation standard	Varies	Specified in Hudson QoLPS (see Section 3.11 for evaluation).
Navigation channel	As shown on existing conditions drawings	Working definition is based on historic maps, dredging charts, and bathymetric data.
One-way lockage	40 minutes	Approximate time required to stage and position vessel in the lock, drain or fill the lock, and exit the lock.
Barges	195-foot by 35-foot barges 100-foot by 30-foot barges	Design evaluation based on minimizing barge movements while maximizing volume of material moved within the navigation channel. Additional (separate) barges will be used for backfill.

Item	Basis	Source/Notes
Barge capacity (*insitu* sediment volume)	Inventory Dredging: 195-foot barge – 1,050 cy, 100-foot barge – 500 cy Residuals Dredging: 195-foot barge – 656 cy, 100-foot barge – 313 cy	Design evaluation based on the size, draft, and maneuverability of the barge(s) and the water depth in a given portion of the river. The cy represents how much *insitu* sediment can be carried in the respective barges.
Material transport time between Locks 7 and 8	30 minutes	Passage will be limited to one-way traffic for barge/tug combinations.
Barge staging locations	Sta. 48+00 Sta. 65+00 to 85+00	Barges can be staged outside of Lock 7 or outside the navigation channel where there is sufficient water depth, such as south of the proposed West River Road Boat Launch Facility and just north of Lock 7.
Average speed of tug and barge (loaded, upstream)	6 mph	Design evaluation based on weight of barge, material in barge, horsepower (hp) of tug, and vessel maneuvering characteristics for safe operations.
Average speed of tug and barge (empty, downstream)	7 mph	Design evaluation based on weight of barge, material in barge, hp of tug, and vessel maneuvering characteristics for safe operations.
Water depth	0 to 25 feet	Based on water depth at a flow of 3,000 cfs and a water surface elevation of 120 feet (NAVD88) using the 2001 bathymetric data from OSI. The difference between NAVD88 at elevation at seasonal low flows (1,700 cfs) will not affect barge accessibility.
Number and size of barges	Varies; output of the dredging and backfill plans	The number and size of barges are determined by 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.

3.4.2 Evaluation of Transport Methods

3.4.2.1 Inventory Dredging

Three transport methods were evaluated for mechanically dredged material: 1) placing the dredged sediment directly in a barge with the dredge bucket; 2) pumping the sediment with a high-solids pump from the dredge to a near-by barge; and 3) pumping a mixture of sediment and additional “make-up water” using a hydraulic pump and pipeline directly to the processing facility.

The first method includes placing the dredged material directly from the dredge bucket into a barge. This method is preferred over the two methods that use pumps and pipelines because it minimizes the amount of material handling. However, sufficient water depth must be present for the barge to move alongside the dredge throughout the dredge area. Given the water depths in the dredge areas (Figures 3-22 through 3-24) and the fact that fully loaded barges draft up to 12 feet of water, there are many areas where fully loaded barges cannot directly accompany the dredge. While lightered barges or smaller capacity shallow-draft barges can be used, this results in additional barge movements, number of barges, and river traffic.

One alternative in shallower water is to use a high-solids pump to transfer the sediment from the point of dredging a short distance (to a maximum distance of 1,500 feet without having to add make-up water) to a barge. This process includes placing the dredged material into a hopper on the deck of the dredge barge that is equipped with a debris screen that removes the oversized materials (i.e., over 3 inches) before the sediment is pumped to the transport barge through high-density polyethylene (HDPE) pipeline. Water and other additives may also be added to facilitate transport, but doing so reduces the efficiency of barge operations by adding water to the barge load. Removal of the material greater than 3 inches that accumulates on the screen may be accomplished with a small excavator located next to the sediment hopper and screen assembly. The material would be staged on the dredge barge. Alternative approaches may include the use of a vibrating screen. Specifications for managing the oversized material from this operation, if selected, will be identified in the Phase 1 FDR and the contractor submittals.

Another option is to use a traditional hydraulic pump that would pump a mixture of sediment and make-up water through a steel or HDPE pipeline directly to the processing facility. While slurry units have been developed for mechanical dredges that operate at relatively high-solids rates (as high as 35%) and re-circulate the make-up water, the constraints associated with hydraulic pipeline transport discount its use at this site. These constraints include a complex network of pipelines from four individual dredges, the increased downtime associated with inevitable pipeline blockages due to debris, the additional water generated during flushing of the pipeline, and the limited applicability of hydraulic transport to Phase 2 of the project due to the long pumping distances for Rivers Sections 2 and 3. As a potential variation to this approach, the option of placing a barge pumpout station adjacent to Lock 7 was also considered, but eliminated due to the more than 600 feet of river frontage with a minimum depth of greater than 14 feet required for staging and offloading barges in this manner.

The two approaches selected for the transport of sediment during inventory dredging in this Phase 1 IDR include: 1) direct placement of the sediment in a barge from the clamshell dredge; and 2) pumping the dredged sediment from a hopper located on the dredge a short distance to a barge staged in a deeper water area.

3.4.2.2 Residuals Dredging (Re-dredging)

The three transport options evaluated for inventory dredging were also evaluated for transporting sediment generated during residuals dredging (i.e., re-dredging). Since the residuals dredge equipment defined is the same as the inventory removal equipment, the same two transportation options are selected for transporting residual sediment. It is recognized that the residual barges will, however, contain a higher percentage of water due to the additional free water that will be entrained in the dredge bucket as a relatively thin layer of sediment (6 inches) is removed during residuals dredging.

3.4.3 Selection of Transport Methods

This section presents details for the transport methods selected for material dredged during inventory and residuals dredging.

3.4.3.1 Inventory Dredging

Sediment generated during inventory dredging will be transported with the two methods described above in Section 3.4.2.1. To highlight where fully loaded barges can be expected to accompany the dredges and where a high-solids pump will likely be used to pump to barges staged in deeper water areas, Figures 3-22 through 3-24 present water depths overlain with the footprint of the dredge areas. Most of the transport will be conducted using barges approximately 35 feet wide by 195 feet long, with a draft of 12 feet when fully loaded. These barges have an approximate capacity of 1,300 cy, including 1,050 cy of *insitu* sediment and about 260 cy of free water that will be entrained during inventory dredging. This loading is based on the assumption that the inventory removal dredge bucket will include 80% *insitu* sediment and 20% entrained water on a volumetric basis.

Smaller barges with a capacity of approximately 600 cy (including the additional water entrained during dredging) will be used for transporting sediment from several dredge areas located in the northernmost portion of the project area, including NTIP01, NTIP02A, NTIP02C, NTIP02D, NTIP02E, and the northern portion of NTIP02F. The approximate dimensions of these smaller barges are 30 feet wide by 100 feet long. These smaller barges have a draft of 8 feet when fully loaded. To support dredging in the northern portion of NTIP02C, the smaller barge will be staged within 1,500 feet of the dredging operation. This will allow the dredged sediment to be pumped with a high-solids pump without having to add make-up water. The reduced efficiency on the dredging operation resulting from the use of smaller barges is taken into account in the Phase 1 Inventory and Residuals Dredging Plans. Figure 3-25 presents the operating locations for the large and smaller barges, including locations where the dredge can work directly alongside the barge (i.e., sufficient water depth for the loaded barge) and locations where the dredged material will be pumped to either a large or small barge. The barges are shown to scale in the legend to provide perspective.

The number and timing of barges from the dredge areas are presented for inventory dredging operations in Table 3-26. The Barge Plan (for material removed during Inventory dredging) assumes 24-hour/day operations, including transit through Lock 7, and represents the number of barges required to support the Phase 1 Inventory Dredging Plan (Table 3-22). The table also presents the total number of barges associated with inventory dredging in each dredge sub-area and the number of barges that would be dispatched to the processing facility on a daily and weekly basis. When two dredges are working adjacent to one another in a dredge area, each may pump dredged materials to a single barge. This will reduce the number of vessels in a given portion of the river at the same time.

In advance of dredging, a debris removal operation for large items such as partially submerged trees and boulders will be undertaken. This debris will be placed on deck barges and transported to the processing facility. For design planning purposes, it is assumed that one to two debris barges per day will be sent to the processing facility for unloading (approximately 100 cy/day).

Tugboats will be used for pushing and maneuvering the barges. Each will be approximately 60 feet in length and powered with engines ranging from 700 to 1,000 hp. Depending on the rate of dredging and proximity to the navigation channel, the tug may stay alongside the barge, or alternatively, the barge may be temporarily anchored or secured to the dredge without need for a tug.

3.4.3.2 Residuals Dredging (Re-dredging)

The approach for transporting dredged material generated from residuals dredging is the same as used for inventory dredging with the exception that each full barge would transport less *insitu* sediment and more free water than for inventory dredging. For the 35-foot by 195-foot barge, the load would be reduced from approximately 1,050 cy of sediment (*insitu* volume) to approximately 650 cy (*insitu*) of sediment. This is due to the assumed 50% water entrained while removing a thin (6-inch) layer of sediment during residuals dredging. The number and timing of barges from the dredge areas are presented for residuals dredging operations in Table 3-27. Similar to the transport of inventory sediment, the plan assumes 24-hour/day operations, including transit through Lock 7. This Barge Plan for material removed during residuals dredging represents the number of barges required to support the Phase 1 Residuals Dredging Plan (Table 3-23). The table also presents the total number of barges associated with residuals dredging in each dredge sub-area and the number of barges with residual sediments that may be sent to the processing facility on a daily and weekly basis. A summary of the total estimated daily vessel traffic through Lock 7, including project-related and recreational vessels, is presented in Table 3-28.

3.4.4 Interrelationships with Other Project Elements

The loads from the transport operations and frequency of delivery and unloading are critical to the design and operation of the processing facility. This includes the quantity, character, and amounts of sediment, debris, and water brought to the facility, as well as the timing of these materials. Unlike product manufacturing operations that generate a steady product stream, it is difficult to generate a consistent stream of dredged material of constant character and quantity because dredging will occur in areas with a range of material characteristics and operating conditions. As a result, the processing facility will be equipped and sized to accommodate variations in both the character and volume of materials (sediment and water) that it will receive on a daily and weekly basis. These variations in daily and weekly dredging rates also affect rail transport operations and result in having to accumulate a sufficient volume of processed sediment at the facility. This is further discussed in Section 3.7. The Barge Plan is also a critical component that will be evaluated by the logistics model which is under development and described in Section 3.12.

Also important is the fact that the transport rate is directly related to the dredging rate. If dredging slows due to debris removal or implementation of contingencies for resuspension releases, then sediment transport to the processing facility and other subsequent operations (e.g., processing, rail transport, and backfill) will also be slowed. The logistics of sequencing the return of empty barges from the processing facility, after being unloaded, to support dredging operations will also be evaluated and developed with the logistics model. While a framework and approach for dredged material transport has been developed for this Phase 1 IDR, and will be refined in the Phase 1 FDR, the actual approach used by the selected remedial action contractor may vary.

3.5 Resuspension Control

PCBs will be released to the river when bed sediments are resuspended by in-water construction activities (e.g., dredging, debris removal, backfilling, capping, propeller wash associated with moving and anchoring barges and work boats, and pile-driving). Once the sediments are resuspended, the larger particles (i.e., coarse and medium sands) quickly fall back to the river bottom close to their point of origin, whereas the smaller particles (i.e., fine sands, silt, and clay) remain in suspension for a longer period of time and may be transported some distance away. While the sediment particles are in suspension, some fraction of any associated PCBs desorb into a dissolved phase. Depending on a number of factors including, but not limited to, the type of sediment and associated PCB concentration, the rate at which the sediment is being resuspended, and surface water flow conditions, the TSS and/or PCB concentrations may exceed the Resuspension Performance Standard criteria described in Section 2 and detailed in Attachment C. The assessment of the need to design resuspension controls to keep in-river TSS and PCB levels below the criteria and the nature of those controls are the focus of this section of the Phase 1 IDR.

3.5.1 Basis of Design

The specific basis for the resuspension control element design is summarized in the following Table 3-29. These items are in addition to, or further develop, the general basis of design discussed in Section 2.

Table 3-29 – Basis of Design for the Resuspension Control Element

Item	Value	Source/Notes
Percent of resuspendible dredged sediment that is released to the water column (%R)	0.35% and 0.70%	0.35% is used for design. As discussed in Attachment E (Section E.2), this value was derived by EPA based on a review of data from dredging projects (EPA, 2000). Based on the resuspension studies underlying the value derived by the EPA, it is not clear whether or not 0.35% includes resuspension associated with other project activities (e.g., vessel movement, spud placement). The design assumes that the value of 0.35% includes resuspension from all project activities. The modeled resuspension estimates do not include impacts of non-project vessels; however, these impacts are part of the Resuspension Performance Standard and will be assessed in the field during implementation. The value of 0.70% is used as the basis to develop contingency plans in the event that resuspension is twice that assumed for purposes of design.
Resuspension Performance Standard criteria for PCB concentration, total PCB load and Tri+ PCB Load and TSS	Varies depending on location and Resuspension Performance Standard Action Level	EPA, 2004a.
River velocity	Seasonably variable	SSAP data, Hydrodynamic Model (as described in Attachment E).
River flow used during resuspension modeling	Seasonably variable	SSAP data, Hydrodynamic Model (as described in Attachment E).
Sediment type	Varies	SSAP data, QEA (QEA, 2005) and the associated DSRs (Phase 1 DSR – QEA, 2004c, and 2004 DSR – QEA, 2005b).
Sediment PCB concentration	Varies	SSAP data, QEA (QEA, 2005) and the associated DSRs (Phase 1 DSR [QEA, 2004b], and 2004 DSR [QEA, 2005b]).
Percent resuspension for backfilling/capping	Negligible	Based on low sediment PCB concentrations identified in the EPS for residuals.
Bathymetry (water depth)	Varies (typically less than 25 feet)	2001 and 2005 bathymetric studies.
Riverbed geotechnical characteristics	Varies	SEDC data (BBL, 2005b).
Dredged material transport method	Barge	Dredging and dredged material transport design.
Duration of inventory dredging	Mid-May through October	Based on opening of canal lock system in early May and the time needed to complete inventory dredging as described in Section 3.3.

3.5.2 Control Options

Two approaches can be taken to control resuspension from dredging:

- Limit resuspension of sediments by controlling the agitation caused by the dredging equipment; and
- Limit downstream transport of resuspended sediments and associated PCBs by installing resuspension control structures.

Each of these approaches is briefly discussed below. During the Phase 1 Intermediate Design stage, the need for resuspension controls was evaluated using the results of water quality modeling in conjunction with the selection factors discussed in Section 3.5.3. The general steps taken to design a resuspension containment system around a dredge area, and the Phase 1 application of the resuspension control design process are described in Section 3.5.3.

3.5.2.1 Resuspension Control Options

Controlling the agitation caused by the dredge equipment typically involves modifications to the operation of the dredge or, on a more limited basis, modifications to the dredging equipment such as the addition of sampling intakes on the dredge bucket to provide data regarding the dredge's performance. One option is to reduce the rate of dredging; however, such action would be limited by the need to meet the Productivity Performance Standard.

3.5.2.2 Downstream Transport Control Options

Several alternatives to limit downstream transport of resuspended sediments and associated PCBs were described in Section 6.3 of the PDR (BBL, 2004a), including:

- Silt curtains;
- Sheet pile walls; and
- King piles, caissons, air curtains, and porta-dams

These methods have been employed on other environmental dredging projects or are being developed by various vendors for use in dredging applications.

3.5.3 Containment Design

This section describes the steps taken during Phase 1 Intermediate Design to design a containment system around a dredge area.

Step 1: Resuspension Modeling: Modeling of the fate and transport of sediment and associated PCBs resuspended by the dredging operation was conducted to assess various dredge scenarios in terms of compliance with the near-field and far-field water quality requirements set forth in the Resuspension Performance Standard. This process is described in Attachment E and the results are discussed in Section 3.5.3.1.

Step 2: Selection of Containment Systems: The location and type of resuspension controls are based on an evaluation of the modeling results, with those areas of the river contributing significantly to the TSS and/or PCB loads to the river being likely candidates for the installation of controls. In addition to the ability to keep TSS and PCB levels below the Resuspension Performance Standard criteria, the following factors influence the location and type of controls:

- Riverbed geotechnical characteristics: strength and compressibility of riverbed sediments; depth of bedrock at the river bottom or within its close vicinity; and presence of boulders, rip rap, and other debris in the river. These factors affect the selection and sizing of resuspension control process options.
- River hydraulics: the hydrodynamic forces on resuspension containment structures.
- Dredged material transport: vessels enter and exit the dredge area and travel adjacent to the resuspension control system. These movements must be accommodated in the design of the resuspension containment system.
- Navigational requirements: channel width that must be maintained to accommodate river traffic.

Once the locations where resuspension controls will be placed have been established, the basic design parameters are calculated for either or both of the following:

- **Rigid Control Systems** – In the design, the computer program ProSheet (Arbed, 2004) was used, with average sediment geotechnical properties as inputs, to determine the potentially required embedment of a rigid system. Hand and spreadsheet calculations using earth-pressure theory were conducted to check the validity of the ProSheet results. These calculations were not used to specifically design any control structures but were used to provide a general indication of embedment depths that might be required. Specific design calculations will be performed in final design as described in Section 3.5.3.2.1.

- **Flexible containment structures** (e.g., silt curtains) – Curtain parameters (suspended solids retention capacity, opening size, permeability, etc.) were reviewed using the United States Army Corps of Engineers (USACE) Engineering Design Handbook (USACE, 1997), and design guides published by manufacturers and vendors (e.g., Parker Process Options, Inc., 2003 and Elastec/American Marine, 2003). The detailed design of the silt curtain systems will be performed by the silt curtain manufacturer so as to take into account proprietary components of the curtain system. The parameters to be provided to the silt curtain manufacturer/vendor will by summarized following the water quality modeling, during the preparation of the Phase 1 FDR.

Step 3: Development of Drawings and Specifications: This step consolidates the results of the design process steps onto design drawings and specifications that will provide guidance to the contractor, whose responsibility it will be to properly install and operate the resuspension containment structures.

The following sections describe how Steps 1 and 2 were executed during the Phase 1 Intermediate Design.

3.5.3.1 Resuspension Modeling

Dredging Without Control Structures

As described in Attachment E, modeling of the fate of resuspended sediments and associated PCBs was initially conducted assuming no controls and a %R of 0.35. This modeling was conducted using the dredging plan presented in Table 3-22.

Under the no control scenario and a design loss rate of 0.35%, the daily average total PCB concentrations at the Thompson Island Dam (TID) are predicted to range from 25 ng/L to 260 ng/L and are below the Primary Standard (24-hour average of 500 ng/L). The flux of total PCB past TID over the entire dredging season is 40 kg and is below the Control Level of 65 kg. The 7-day average PCB flux exceeds the Evaluation Level for about 34% of the dredging season and the Control Level for about 18% of the dredging season. The finding that the annual flux can be substantially below the Resuspension Performance Standard while the 7-day average flux exceeds the Resuspension Performance Standard criterion for a portion of the dredging season reflects the fact that the dredging occurs in sediments covering a wide range of PCB concentrations and grain-size distribution (model grid cell-average PCB concentrations range from 0.21 mg/kg to over 1,650 mg/kg). Since the fundamental objective of the Resuspension Performance Standard with regard to downstream PCB flux is to keep the cumulative mass transport below the annual criterion, the annual criterion has been used in the evaluation of the need for resuspension controls. During construction, compliance with the seasonal criterion can be monitored by examining cumulative flux in relation to the cumulative removal of targeted PCB mass. For example, at the point where half of the targeted PCB mass has been removed, the cumulative flux should be less than half of the allowable annual flux.

The variability exhibited by the 7-day average PCB load is a result of the range of sediment characteristics (i.e., grain size and PCB concentration) in the areas to be dredged. As noted in Section E.7.4 of Attachment E, the higher releases are associated with dredging the east channel at Rogers Island and EGIA. Portions of both areas have relatively high percentages of fine-grained sediment with high PCB concentrations. Percentages of resuspendible sediment (i.e., silt, clay, and very fine sand) for the east channel at Rogers Island and EGIA are presented on the following Attachment E figures: Figures E.4-9a and E.4-9c present percentages of silt and clay for both locations, and Figures E.4-10a and E.4-10c present the respective percentages of very fine sand. The range of PCB concentrations for the silt and clay fraction for the east channel at Rogers Island and EGIA are presented on Figures E.5-2a and E.5-2c. The range of PCB concentrations for the very fine sand fraction in the east channel at Rogers Island and EGIA are presented on Figures E.5-3a and E.5-3c, respectively. Factors also influencing the resuspension modeling results include the number and location of the individual dredges operating at a given time and their associated sediment removal rates (i.e., kg of sediment per unit time). The wide range in dredging rates including the number of dredges and their associated removal rates are presented in the dredging plan (Table 3-22).

The model results were also compared with the Resuspension Performance Standard for TSS. This comparison demonstrated that 6-hour average net TSS concentrations remain below the associated Resuspension Performance Standard values throughout the dredging season.

While resuspension modeling was not conducted with a %R value of 0.70 and no controls, the model results are approximately linear with respect to the %R value and thus the results of the modeling with a %R of 0.35% can be used to assess the potential impacts including:

- An annual PCB load above 65 kg (approximately 2 times the 40 kg/year result modeled using a %R of 0.35);

- PCB concentrations above the Primary Resuspension Performance Standard of 500 ng/L at TID (approximately 2 times the 260 ng/L result using a %R of 0.35); and
- Conditions would be above the 7-day load levels for most of the project (significantly longer than being above the Evaluation Level 34% of the time and above the Control Level 18% of the time using a %R of 0.35).

Given the estimated conditions with a %R value of 0.70% and model results for the 7-day load levels with a %R of 0.35, resuspension controls will be implemented in certain dredge areas as described below.

Dredging with Control Structures

The modeling results indicate that dredging in the East Channel at Rogers Island and in EGIA contribute a significant fraction of the PCBs lost to resuspension. Since conditions are estimated to be above the Resuspension Performance Standard with a %R value of 0.70, controls are being identified for these two areas. The controls for the East Channel at Rogers Island include placing a sheet pile wall across the northern entrance to the channel and a silt curtain at the southern end of the channel and are presented on Drawings D-0200 and D-0201. These controls will be installed during the first 2 weeks of the project as dredging is progressing in NTIP01. The reason for including these controls in the front end of the project is to minimize potential impacts on productivity. These controls can be installed in parallel with dredging in NTIP01 given the sediment characteristics for this area that include a relatively low percentage of resuspendable sediment and relatively low PCB concentrations. Locations for contingent controls in the East and West Channels at Rogers Island are identified on Figure 3-26. Contingent controls in these areas would only be included if the results of monitoring indicated that they were needed.

Controls in EGIA are included as part of the baseline project to reduce downstream transport of PCBs and to test the effectiveness, reliability and operation of different resuspension control structures. The assessment will include the degree to which the controls minimize the release of dissolved and particulate PCB releases, the potential impacts of the controls on residuals PCB concentrations, and potential impacts associated with the installation and removal of the control systems. The resuspension controls in EGIA will be utilized as follows:

- 2 weeks of dredging with no controls;
- 1 week of dredging within a sheet piled enclosure; and
- 2 weeks of dredging within an area enclosed by silt curtains.

There would be a 2-week delay between the initial dredging in EGIA (with no controls) and dredging within the containment enclosures. During this 2-week period, the resuspension controls (sheet piling and silt curtain enclosures) would be installed and the data collected during the first 2 weeks of dredging with no controls would be evaluated. A period of 1 month would elapse between completion of dredging within the sheet pile structure and release of the contained water. This will provide an opportunity to understand water column PCB concentrations in the containment structure as a function of time following dredging.

With the baseline controls identified above in place, the estimated annual PCB load is below the Resuspension Performance Standard using both the 0.35 value and the 0.70 value for %R (31 kg and 56 kg per season, respectively). The model results also indicate that with a %R value of 0.35, the 7-day average for the PCB flux is above the Evaluation Level for about 26% of the dredging season and the Control Level for about 7% of the dredging season. The 7-day load only is above the Control Level for two periods – one period for several days in early June and a second several-day period in early August.

With a %R value of 0.70, the 7-day load results are above the Control Level for a greater portion of the time, yet the annual load of 56 kg is still below Resuspension Performance Standard of 65 kg. The total PCB concentrations at the TID range from 40 to 220 ng/L and are below the Primary Standard (24-hour average of 500 ng/L). The 7-day average PCB flux exceeds the Evaluation Level for about 43% of the dredging season and the Control Level for about 29% of the dredging season. These model results show that no additional contingent controls are anticipated being needed, other than those provided for in the Phase 1 ID PSCP Scope (Attachment C). If additional controls are needed, the potential locations of these controls are presented on Figure 3-26.

3.5.3.2 Description of Containment Systems

3.5.3.2.1 East Channel of Rogers Island

Cantilever Sheet Piles at Northern End of Rogers Island: The cantilever sheet piles are planned for the northern end of the island with the alignment shown on Drawing D-0200. The elevation view is shown on Drawing D-0204. At present no geotechnical information is available within the immediate vicinity of the proposed structure; soil parameters were based on conditions encountered in explorations located further to the south. The design will be updated as necessary during Phase 1 Final Design based on the results of explorations planned at the northern end of the island (a proposed Year 2 SEDC Work Plan Addendum No. 2 currently is in preparation and will be finalized to reflect the alignment of the containment structures as presented in this Phase

1 IDR). During the preparation of the Phase 1 FDR, detailed numerical analyses will also be performed to refine the hydrodynamic forces acting on the wall.

Silt Curtain Containment at Southern End of Rogers Island: Silt curtains are generally designed by silt curtain vendors based on parameters provided by the design team and project performance specifications. Based on input from the design team, a single silt curtain or a series of silt curtains may be used. A gate will be employed to allow vessel access to and from the dredge areas. The alignment of the silt curtain and generalized silt curtain details for the southern end of Rogers Island are shown on Drawings D-0201 and D-0205, respectively. In environmental dredging projects, the obligation to design the details of a silt curtain system is typically left to the contractor/vendor, since most silt curtain systems used in such projects involve proprietary materials, details, and installation procedures.

3.5.3.2.2 EGIA

Although EGIA is broken down into six separate dredge sub-areas, only a portion of EGIA01 is included in the Phase 1 program. EPA has identified this area for a test of the effectiveness of resuspension controls. As shown on Drawings D-0202 and D-0203, two near-shore areas within EGIA 01A are selected for the evaluation of rigid and flexible containment systems. The details of the areas, sequence, and overall performance of the dredging in this area will be presented in the Phase 1 FDR.

3.5.4 Interrelationships with Other Project Elements

The resuspension control project element interacts with a number of other project elements, such as dredging, dredged material transport, and backfilling/capping. The resuspension control element both receives inputs from these elements and provides outputs to them.

The most important project element influencing the resuspension control design is dredging and sediment type. The selection of dredge type, operational characteristics of the dredge, and dredge production rate will all influence the resuspension control design. The selection of the dredge method and its operational parameters, together with the type of sediment to be dredged, will define the turbidity generation potential or source strength at the point of dredging, providing one of the important inputs to the resuspension control project element.

Other resuspension factors associated with dredging include vessel movement, spud and anchor placement, and the placement and removal of the resuspension containment system itself.

In addition to dredging, the resuspension control project element is affected by the dredged material transport method selected. Barge and vessel movement may affect the selection and design of the resuspension control system.

The output from the resuspension control project element may affect the dredging process, through prescription of needed operational controls on the dredge equipment. Resuspension control could also affect the dredged material transport project element because the final selection and specification of resuspension process options in the river will influence navigability in the vicinity of the location of the structures.

3.6 Sediment and Water Processing

The sediment and water processing element follows dredged material transport, and involves the unloading and preparation of dredged sediments for transportation and offsite disposal. As discussed previously, sediment and water processing will be accomplished at the processing facility, which will be located at the Energy Park site on the Champlain Canal land cut above Lock 7 (refer to Figure 3-27 for the Site Plan Overview).

The facility will receive barges and unload dredged sediment from the barges at the waterfront. Debris and other large objects will be separated from the sediment, and then the sediment will be slurried in water, and classified according to particle size into fine and coarse fractions. The fine fraction of the sediment will be thickened and dewatered, and stockpiled for subsequent loading and transportation to a disposal site(s). The separated coarse fraction will also be stockpiled for subsequent loading 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.

The following processing facility components are discussed in this section:

- Site work, roads, utilities, and administrative areas;
- Buildings and coverings;
- Waterfront and unloading facilities;
- Processing facilities;

- Structural, electrical, and instrumentation; and
- Processed material stockpile area, loadout facilities, and rail yard.

For each component, the specific basis for the design of each component is summarized, followed by a discussion of the Phase 1 Intermediate Design analysis for that component.

3.6.1 Site Work, Roads, Utilities, and Administrative Areas

This section addresses the following design components:

- Clearing, grubbing, and grading;
- Site roadways;
- Signage and pavement markings;
- Site fencing;
- Utilities; and
- Stormwater management.

The proposed site plan is shown on Drawing P-0003. Details of specific construction components are provided in the following sections.

3.6.1.1 Basis of Design

The facility siting process has been summarized in Section 2.3.4. The Energy Park site was selected because of the following:

- The site is close to the area where most of the dredging will occur;
- The site has access to the river via the Champlain canal and the frontage along the canal is sufficient to support marine operations, including sediment offloading;
- The site is near the main rail line; and
- The topography across the site is relatively flat.

The existing conditions are presented on Drawing P-0002.

The specific basis of design for this component of the processing facilities is summarized in the following Table 3-30.

Table 3-30 – Basis of Design for Site Work, Roads, Utilities, and Administrative Areas

Item	Value	Source/Notes
Land clearing	5 acres	Most of the site is already cleared. Heavy brush and trees need to be cleared near the rail tracks and west of Bond Creek.
Grading	100,000 cy	Imported backfill will be needed to achieve required elevations. Quantity to be refined in Phase 1 Final Design.
Roadways	9,700 feet	Internal roadways to be developed.
Stormwater control – contact areas (Type I)	Return interval: 100-year; 24-hour. Area of drainage = 37 acres	Stormwater controls include curbed areas, catch basins and conveyance piping, storage tanks, and water treatment systems.
Stormwater control – non-contact areas (Type II)	Area of drainage = 24 acres	Stormwater controls include sediment basins.
Utilities - electrical	7,000 hp	Motors required for Phase 1.

3.6.1.2 Design Analysis

Civil engineering of the waterfront, sediment processing, water treatment, material staging, and rail yard are described in this section. The scope of work for the development of the site is presented in Section 4.4.

Clearing, Grubbing, and Grading

The Energy Park site is primarily undeveloped and only a small percentage of the site should require significant clearing and grubbing of trees. The major areas to be cleared include approximately 3 acres of heavy brush and small trees along the existing railroad tracks and approximately 2 acres of similar growth along the west side of Bond Creek. Where practicable, areas of the site that will not be needed for general operations activities will be left undisturbed. The wetland delineated during the facility siting process will not be impacted. The site development plan and preliminary cut and fill cross-sections are presented on the Drawings P-0003, P-0004, and P-0005.

Prior to grading, areas of the site that are to be graded will be stripped of topsoil to a nominal depth of approximately 6 inches and the topsoil will be stockpiled onsite for reuse. Material excavated during construction of the waterfront will also be used as fill onsite. Due to the existing ground elevations throughout the site, approximately 100,000 cy of imported backfill material will be required to achieve the anticipated design grades. Final earthwork quantities will be determined as the design progresses and Phase 1 Final Design grades are established.

Site Roadways

The overall roadway layout is shown on Drawing P-0040. The site roadways are divided into five categories depending on their usage: main haul road, interior access roads, Lock 8 access road, main site access road, and temporary site construction access road. Each of these roadways is discussed below.

Main Haul Road

The main haul road will be entirely on the Energy Park site.

The main haul road will handle all of the truck and heavy equipment traffic transporting debris and coarse materials from the waterfront area to the material storage areas adjacent to the rail yard. Trucks and/or heavy equipment will also use this road to transport processed materials between the filter press building and the fine material storage areas. The flow of trucks and heavy equipment to and from the waterfront area will be maintained at all times by using two-way traffic on the main haul road.

The main haul road will consist of two 12-foot wide travel lanes for heavy equipment and hauling vehicles. Additionally, the main haul road will contain two 6-foot wide shoulders and a 6-foot wide median/clearance area separating each lane. This width includes the placement of concrete safety barriers between the two 12-foot lanes. Asphalt pavement will be used for the main haul road. In areas where the pavement will be exposed to frequent turning movements by trucks and loaders (e.g., in front of the coarse material and fine material storage areas), a concrete pavement may be used instead. Asphalt pavement thickness design will be based upon the Asphalt Institute's *Manual for Thickness Design of Asphalt Pavement for Heavy Wheel Loads* (1996) for the anticipated design vehicle and pavement service life. Concrete pavement, if used, will be designed in accordance with the American Association of State Highway and Transportation Officials (AASHTO) *Guide for Design of Pavement Structures* (1993). Since this road will be used for hauling coarse sediments containing PCBs, provisions for stormwater control and an under-drain have been designed.

Interior Access Roads

These roads will be entirely on the Energy Park site.

Light-duty interior access roads will provide connections from the offsite local access road to areas of the site outside of the main materials handling areas and traffic-ways. The predominant traffic on these roads will be light vehicles for personnel movement, deliveries to the site, security, and maintenance. The interior access roads will consist of two 12-foot wide lanes with 2-foot wide shoulders for a total width of 28 feet. Asphalt pavement will be used for the interior access roads and will be designed in accordance with the AASHTO *Guide for Design of Pavement Structures* (1993).

Lock 8 Access Road

This road passes through the Energy Park site immediately west of the water front, from East Street to Lock 8.

Currently, an existing roadway running along the east side of the site, parallel to the Champlain Canal, provides access to Lock 8 from East Street. This road will be relocated to the west, closer to Bond Creek, to accommodate the waterfront processing facilities. NYSCC vehicles will have access to the lock at all times on the relocated access road, but movement through the site will be controlled during working hours to reduce the risk of accidents, as described below. The Lock 8 access road will consist of two 10-foot wide lanes with 2-foot wide shoulders, for a total width of 24 feet. Asphalt pavement will be used and will be designed in accordance with the New York State Department of Transportation's (NYSDOT) *Compliance Pavement Design Manual* (2000).

The Lock 8 Access Road will be in a support area of the site. This road will not be used to haul PCB containing materials. NYSCC personal will have authorization to enter gates at the north and south site perimeters. The Lock 8 access road crosses the main haul road near the waterfront unloading facility. This intersection will be a controlled crossing with flashing lights to prevent project-related traffic from crossing the Lock 8 Access Road when in use by NYSCC vehicles. The surface of the intersection will consist of steel grating spanning a concrete sump. The grating will be decontaminated, if necessary, after project trucks pass through the intersection. During non-working hours, security gates on the haul road on either side of the crossing will prevent access to the processing area and waterfront unloading area. Use and modification of the Lock 8 access road will be coordinated with the NYSCC.

Main Site Access Road

A new access road will be constructed from East Street across from the Fort Edward rail station along the railroad right-of-way to the southwest end of the processing facility site. The location of this driveway is shown on the site plan (Figure 3-27). This main site access road will provide a means for site personnel and delivery vehicles to access the site from East Street during facility construction and operations. The main site security station will be constructed at the site entrance from this main site access road.

Temporary Site Construction Access Road

During the construction of Phase 1 processing facilities, mobilization of heavy equipment will be made to the north end of the site from Towpath Road using an existing railroad crossing. A signal person will be stationed at this crossing during equipment mobilization. After completion of construction of the onsite rail yard, this access road will no longer be used during Phase 1.

Signs and Pavement Markings

Signage will be placed along the roadways as needed to identify main haul routes, dredged material handling areas, and pedestrian/vehicle crossings, and to direct and control traffic around the site. Pavement markings will be placed on roadways to define travel lanes and pedestrian crossings, as needed.

Site Fencing

Site security fencing will be placed around the perimeter of the processing facility. Additional fencing on the interior of the site will also be used to control access to dredged material handling, haul roads, and processing areas. The preliminary layout of site fencing is presented on Drawing P-0050.

Utilities

Utilities required by site operations include potable water, electric, gas, telephone, and sanitary sewer.

Water

The Village of Fort Edward water distribution system has 6-inch and 8-inch water mains on East Street that are located approximately 500 feet from the south boundary of the site. A privately owned 4-inch water main service from the Fort Edward system is located approximately 1,000 feet from the southwest boundary of the site. Permission for hookup to the public water supply will be established in the Final Design for Phase 1. Alternatives, such as drilling of a well or extraction of water from the canal will also be considered.

Electric

There is 3-phase power serviced by Niagara Mohawk at three locations around this site, as follows:

- A 3-phase power source is located at the west portion of the industrial park, near Towpath Road. This pole (#NM16) is the end of a 3-phase transmission. The preceding pole (also 3-phase) is #NM15, and the following pole (single phase) is #NM17. This location requires a railroad crossing, which may be difficult due to infrastructure obstructions (e.g., pole development across rail lines) and would require consultation with the railroad.
- A second 3-phase distribution is located at the entrance to the Canadian Pacific Railway (CPR)-operated Fort Edward Rail Yard. This line enters the rail yard on pole #NM3/1 and ends with pots (i.e., pole-mounted transformers) on pole #NM3/2. This location also requires a railroad crossing and is a considerable distance from the site.
- The third 3-phase distribution is located at the western foot of the East Street Champlain Canal crossing (East Street Bridge) at the south end of the site. The closest pole is #NM 4/2, the pole to the west is #NM 4/1, and the pole to the east (on the east side of the Champlain Canal crossing) is #NM 4/3. This is the closest power source to the site; it is located at the entrance to existing access road to Lock 8 along the canal.

The power source and distribution design will be specified during Phase 1 Final Design.

Gas

Natural gas is supplied to the industrial park on the west side of the main rail line. The final location and availability of existing underground gas transmission utilities will be determined during Phase 1 Final Design. Liquefied natural gas (LNG) will be considered as an alternative to the existing natural gas supply lines.

Telephone

The location and availability of existing overhead and/or underground telephone utilities will be determined during Phase 1 Final Design.

Sanitary Sewer

The location and availability of existing sanitary sewers in the vicinity of the processing facility will be determined during Phase 1 Final Design. An alternative to using existing sanitary sewers is to develop an onsite sanitary wastewater treatment and discharge/recharge system.

Stormwater Management

Stormwater will be managed differently during the processing facility construction and Phase 1 remedial operations. During construction operations, best management practices will be applied to limit erosion. The pre-construction erosion control plan is presented on Drawing P-0010. Silt fences will be installed and sheet flow will be directed from disturbed areas to sediment basins.

During remedial operations, stormwater will be classified into three types based on the activities in the areas where the stormwater is captured. The stormwater management plan is presented on Drawing P-0007. The three types of stormwater runoff are as follows:

Type I Stormwater

Type I stormwater will be collected in areas that have contacted materials containing PCBs, including: 1) the barge offloading and size separation area; 2) the main haul road; 3) processed sediment staging areas; 4) rail car loading aprons; and 5) secondary containment areas for sediment slurry tanks. Stormwater from these areas will be captured by a collection system consisting of curbing, catch basins, and storm sewer piping. Type I stormwater will flow by gravity to wet wells, where it will be pumped to aboveground storage tanks. The stormwater will then be pumped from the aboveground storage tanks to the onsite water treatment plant for treatment prior to discharge to the Champlain Canal.

Site roadways will consist of a main haul road, interior access roads, and the Lock 8 access road, as described above. The main haul road and portions of the interior access roads located within dredged material handling/hauling areas will be curbed with catch basin inlets to capture and convey stormwater runoff from dredged material haul routes to onsite stormwater storage tanks. Decontamination stations will be located at points where the interior access roads transition from dredged material handling/hauling areas to non-handling/hauling areas.

The Type I stormwater collection system will be designed to contain runoff from storm events up to and including the 100-year, 24-hour storm. The components of the Type I stormwater collection system will be sized as follows:

- The aboveground storage tanks will be capable of containing the total volume of runoff (from Type I stormwater collection areas) from the 10-year, 24-hour storm event (3.9 inches), assuming onsite water treatment occurs during the storm. This storm event size is typically used as the basis for stormwater runoff controls at commercial facilities.

- The Type I stormwater pumping and piping system will be sized so the combined storage capacity within the piping and aboveground tanks will be able to contain a total volume of runoff from the 25-year, 24-hour storm event (4.5 inches). This condition assumes that the pump stations that convey water to the aboveground tanks are fully operational and the pumps that convey water from the tanks to the onsite treatment plant are operational.

- The curbing and aboveground storage capacity within the Type I stormwater collection area will be sized to contain the total volume of runoff from the 100-year, 24-hour storm event (5.5 inches), when combined with the capacity of the Type I stormwater collection system piping and aboveground storage tanks. This condition also assumes that the pump stations that convey water to the aboveground tanks are fully operational and the pumps that convey water from the tanks to the onsite treatment plant are operational. The treatment system has been sized such that the flooding of curbed areas can be removed within 72 hours after the 100-year 24-hour event has passed. If the capacity of the process water treatment plant is available (in the event that dredging operations are ceased during this large storm event), then this time may be reduced to less than 24 hours.

Type II Stormwater

Type II stormwater consists of runoff from impervious non-contact areas of the site (i.e., paved areas of the site where dredged materials are not being handled/hauled/staged, building rooftops, railroad track ballast areas, and any gravel-covered areas of the site). Runoff from these areas will be collected and conveyed to onsite stormwater sediment basins prior to discharging to Bond Creek, the Champlain Canal, or the Lock Diversion Canal. The design of the stormwater sediment basins will be consistent with NYSDEC requirements for stormwater pollution prevention plans. A typical section is given on Drawing P-0060.

Type III Stormwater

Type III stormwater consists of runoff from pervious non-contact areas and undisturbed areas of the site. Runoff from these areas will be diverted, as needed, to existing drainage features and will ultimately drain to Bond Creek, the Champlain Canal, or the Lock Diversion Canal.

Prior to the start of construction, soil erosion and sediment control measures will be installed to control stormwater runoff during construction. Silt fencing will be placed along the perimeter of the site and temporary/permanent stormwater sediment basins will be constructed, as needed, to collect stormwater runoff from construction areas. Where needed, temporary check dams (e.g., hay bale dikes) will also be placed in ditches that outlet to existing water courses to further reduce the potential for offsite migration of suspended sediments.

The Lock 8 access road will be graded to shed runoff to Bond Creek and the Champlain Canal.

Approximate drainage area boundaries and stormwater management area types are shown on Drawing P-0007. The site drainage plan, including location of stormwater retention tanks and piping is presented on Drawing P-0020.

3.6.2 Buildings and Coverings

Buildings and coverings may be provided to protect equipment from the weather, reduce stormwater contact in Type I areas (see above), prevent freezing during winter operations (e.g. stormwater treatment operations), and potentially reduce quality of life impacts (if any).

3.6.2.1 Basis of Design

The specific basis of design for this component of the processing facility is summarized in the following table.

Table 3-31 – Basis of Design for Buildings and Coverings

Item	Value	Source/Notes
Waterfront and Size Separation System	No enclosures	Unloading and hydrocyclone operations would be difficult to operate in an enclosure. Operations will meet QoLPS.
Thickening and Dewatering Operations	1 building	Thickening will be performed outside, but dewatering operations will be enclosed.
Water Treatment	1 building	These operations can be outside, but the portion of the system to be operated during winter should be enclosed.
Railside Staging of Fines Solids	2 structures for fines	Preliminarily assumes > 90-day storage, building to meet TSCA requirements. Basis to be reviewed in Phase 1 Final Design.

Item	Value	Source/Notes
Railside Staging of Coarse Solids and Debris	TBD	Building would reduce volume of rainfall designated by Type 1.
Administration & Maintenance	2 buildings	Trailers or modular buildings.
Contractor Offices	TBD	Trailers or modular buildings provided by contractors. Will need basic utilities.

3.6.2.2 Design Analysis

Processing facility operations will include dredged sediment offloading, processing, stockpiling and loading to rail cars (as discussed in Section 3.7, rail has been selected over barging as the mode of transport for offsite disposal) and process water and stormwater treatment. Reasons for buildings or coverings include one or more of the following:

- Protect facilities from weather (wind, rain, sun, snow, ice, and temperature variations);
- Protect workers during nighttime work and adverse weather conditions;
- Reduce noise, light, and air emissions at receptors (if necessary);
- Prevent vandalism and theft;
- Prevent contact with electrical hazards;
- Prevent interference from animals and insects;
- Promote more efficient operations in the facilities; and
- Protect facilities from vehicle accidents.

Process operation areas were evaluated to determine if buildings or other coverings may be required. A summary of the results of this evaluation is presented below.

- Waterfront unloading, size separation operations, and other processing facility activities will be located adjacent to the Champlain Canal. Enclosure of these operations is impractical. Exposure to rainfall is not expected to compromise the separation results. The operator of the unloading equipment will be in an enclosed cab.
- Conveyors may be enclosed to protect them from rainfall. Except for stackers and short conveyors, longer conveyors will not be used during Phase 1. Enclosure of these conveyors, if necessary, will be specified in the Phase 1 FDR.
- Processed material storage areas may be enclosed because stockpiles of dewatered material can potentially be a source of PCB air emissions. In addition, while coarse sediments can be exposed to rainfall without

significant moisture increase (provided adequate drainage is installed under the storage area), stockpiles of finer materials may be covered to reduce the amount of moisture that is absorbed from precipitation. These areas may also be enclosed to reduce the volume of Type I stormwater to be captured, contained, and treated.

- Stormwater treatment operations will likely continue during winter conditions and should be protected from freezing.
- Administration staff will need a protected, enclosed environment for monitoring, communication, and recordkeeping activities.
- The maintenance shop will contain tools and work bays that should be protected from weather.
- Security stations will include monitoring and recordkeeping activities that should be protected from weather.

A screening analysis of estimated fence-line and receptor impacts due to emissions of odor, noise, and lighting from operation of the processing facility is presented in Section 3.11. These factors do not require enclosure of any sediment processing or water treatment operations. Impacts due to emissions of air quality will be determined during the Phase 1 Final Design. The rationale for enclosure of these operations is described below.

Administration, maintenance, security, and contractor offices will be outfitted with heating, ventilation, air conditioning, and/or humidity controls. Facilities, if not staffed year-round, will have provisions for piping evacuation or winterization.

Enclosed portions of dewatering areas and enclosed sediment staging areas will have provisions for ventilation. The enclosures that are a significant source of PCB emissions to the air will have negative pressurization and air emission controls. The need for mitigations measures for air quality issues will be determined during the Phase 1 Final Design.

A portion of the water treatment facility will be enclosed for winter operations. This enclosed area will have provisions for heating and ventilation.

Enclosure of processed material staging areas is described in Section 3.6.6.2

Air Handling and Emissions Control

The Phase 1 Final Design will consider the need for heating, ventilation, and air conditions of buildings and enclosures. In some cases air handling and emission controls may be required to meet OSHA standards or Hudson QoLPS for odor or air emissions. These structures could include the following:

- Storage areas for processed material;
- Dewatering (filter press) building;
- Waterfront facility; and
- Water treatment plant.

The design of air handling and emissions control systems will be completed during the Phase 1 Final Design.

3.6.3 Unloading and Waterfront Facilities

3.6.3.1 Basis of Design

The basis of design for the unloading and waterfront facilities component is presented in Attachment F and summarized in Table 3-32, below. The basis for the unloading wharf design is the dredged material transport design and the Phase 1 dredged material delivery rate during the 30-day peak period. The design can accommodate up to 10 barges per day of varying size and a peak volume of 5,106 cy/day. Attachment F presents calculations for a number of daily barge and volume combinations. This peak volume used in the calculation is substantially larger than the average 4,000 cy/day, which is the design basis for dredging.

Table 3-32 – Basis of Design for Unloading and Waterfront Facilities

Item	Value	Source/Notes
Design Survey Controls		
Vertical Control	NAVD-88	
Horizontal Control	NAD-83	New York State Plane – East Zone
Existing Site Conditions		
Approx. Channel Width	75 feet	NYSCC Historical Drawings
Bottom of Channel El.	+117 feet +/-	NYSCC Historical Drawings
Existing Grade El.	+133 feet +/-	NYSCC Historical Drawings
Low Water Surface	+129 feet +/-	NYSCC Historical Drawings
Proposed Site Conditions		

Item	Value	Source/Notes
Approx. Channel Width	115 feet	
Bottom of Channel El.	+117 feet +/-	
Proposed Grade El.	+136 feet +/-	
Low Water Surface El.	+129 feet +/-	Water surface elevation controlled by NYSCC
Structural Design Criteria		
Wharf Structures	NA	2000 International Building Code
Uniform Live Load	800 PSF	Recommended uniform surcharge
Equipment Load	140 Ton Crane	Design as per specific crane requirements
Wind Speed	90 mph	Assumed maximum design wind speed for Hudson River project area
Ice/Snow	50 PSF	Not governing
Fender System	NA	2002 PIANC Guidance for the Design of Fender Systems
Vessel Characteristics		Data based on industry standards for the expected size for the larger dredged material barge
Vessel Displacement	1,900 tons	Unpowered Jumbo Barge Fully Loaded
Length Overall (LOA)	200 feet	
Beam	40 feet	
Approach Velocity	0.5 feet/s	Tug Assisted
Draft	9 feet	Fully Loaded
Freeboard	3 to 10 feet	10 ft empty

3.6.3.2 Design Analysis

Attachment F presents a design analysis for the unloading and waterfront facilities. Drawings P-0200 through P-0205 illustrate details of the waterfront facility design. The following sections provide an overview of the current waterfront site conditions and a summary of the selected facilities that will be constructed.

<u>Existing Site Description</u>

The existing site has approximately 3,400 linear feet of shoreline along the Champlain Canal, and is constructed primarily of riprap (see Drawing P-0201). Immediately landward of the canal on the western shore is the Lock 8 access road. The access road extends from the southern end of the site to the Lock 8 facility.

The southern end of the site is bounded by the East Street Bridge, and the northern end of the site is bounded by the Lock 8 facility, which consists of the lock structure and a concrete retaining wall. The concrete retaining wall extends south of Lock 8 approximately 1,000 feet.

The Lock 8 facility includes a bypass canal identified as the Lock Diversion Canal. The bypass canal cuts through the waterfront site and is operated by a manual valve at the upstream side of the lock. Flow will need to be maintained in the bypass canal throughout the project to recharge the canal, since opening Lock 7 without having Lock 8 operate (as may be the case during dredged material transport through Lock 7) causes drainage of approximately 1,000,000 gallons from the canal.

The Champlain Canal channel has a design width of 75 feet (at the toe of the sloping sides). The sides of the canal have a design slope of 1V:2H and the canal has a design width of 123 feet at the Low Water Surface (LWS). The bottom of the canal is at Elevation +117.0 feet. The design canal depth is 12 feet.

The LWS elevation between Locks 7 and 8 is maintained at Elevation +129.0 feet (NAVD88). The LWS elevation upstream of Lock 8 is maintained at Elevation +140.0 feet. The LWS elevation downstream of Lock 7 fluctuates with river elevation.

General Site Plan

The unloading and work wharf will be located along the eastern boundary of the Energy Park site. An area will be excavated, using land-based equipment, along the western shoreline of the canal that will extend approximately 1,450 linear feet (see Drawing P-0201). The excavation will extend vertically downward so that the excavation box will be at the same elevation as the originally designed bottom of the canal (Elevation 117.0 feet). Side slopes of the excavation will be cut back on a 1:1.5 slope (to be confirmed during the Phase 1 Final Design) and will be armored with riprap. The excavated soils will be stockpiled onsite and used for general site grading. This excavation has been sized such that when the barges with the maximum beam are secured to the unloading wharf, they will be outside the limits of the existing navigation channel.

Unloading Wharf

The unloading wharf has been designed to accommodate the Phase 1 production rate, while the entire waterfront has been sized for the estimated Phase 2 production rate. The unloading wharf area is designed to be approximately 750 feet long, which includes a 150-foot long, 30-foot wide unloading wharf (see Drawing P-0201) and two barge staging areas. Two 300-foot staging areas are provided for; one adjacent to the existing Lock 8 concrete retaining wall (to the north of the unloading wharf), and the other staging area is to the south of the wharf.

The unloading wharf is designed for access by one unloading crane (or excavator) and one 200-foot barge (maximum length). The wharf could also handle two smaller 100-foot barges, if needed. The surface of the wharf will be sloped away from the canal to collect runoff. The wharf structure will consist of an open pile supported structure or a steel sheet pile bulkhead, and the structure surface will be a concrete slab supported on steel framing or designed to be a slab-on-grade. Mooring hardware will be mounted onto the deck of the wharf.

The barge staging structures consist of a row of breasting dolphins (structures that the barges will contact when they are delivered to the site) along the fender line and are located to the north and south of the unloading wharf. The dolphins, which will consist of round fenders (donut fenders) that float and are able to rotate mounted on steel pipe piles, will be approximately 300 feet long and will be used for staging loaded and unloaded barges. The 48-inch donut fenders will allow the barge to "roll" along the fender line while it is being moved into place for unloading by the barge haul system or for pick-up by a tugboat. The dolphins will be accessible by a catwalk structure, which will include the hardware for the barge haul system. Stationed along the staging areas will be a platform that supports pumps, which will be used to dewater the barges prior to and during material offloading. The suction hoses will be draped into the barge with a fixed jib crane.

Work Wharf

The work wharf will provide an area for vessel maintenance and for staging and mobilizing marine construction equipment such as resuspension barriers. The work wharf will be 200 feet long, located adjacent to the southern end of the unloading wharf area (see Drawing P-0201). This wharf will have a design similar to the unloading wharf. Idle barges could be moored here temporarily.

The design assumes that backfill/cap material stockpiling will not occur at the processing facility (i.e., the fill materials will be delivered directly to river locations where they are to be applied). However, the contractor may choose to have a contingency stockpile of backfill/cap material, which could be loaded at this wharf, if needed.

Wharf Construction

The unloading and work wharves will be constructed in a similar manner and using the same design criteria, so that all wharves will be able to support the crane loads anticipated during unloading/loading processes. There are two feasible construction types that are considered herein – a pile supported wharf and a steel sheet pile bulkhead. The pile support wharf would consist of a concrete slab supported on steel framing and founded on steel piles. The piles would be driven or socketed into bedrock depending on the top of rock elevation. A reinforced concrete deck would be poured in place using galvanized steel stay-in-place formwork. The steel sheet pile bulkhead would consist of steel sheet piles driven to bedrock and anchored by a concrete deadman anchor system. A design will be specified in the Phase 1 FDR after collection of geotechnical data in this area, constructability reviews, and consultation with the NYSCC.

The construction of the unloading facility requires the following activities to be performed:

- Excavation;
- Installation of riprap shoreline protection;
- Installation of pile foundations;
- Construction of wharf framing and decking;
- Drilling and socketing of pipe piles; and
- Installation of catwalk and barge haul system structures.

It is anticipated that construction will be performed during the off-season when the canal is drained and closed to navigation. Therefore, no adverse impact is anticipated to fin fish or other aquatic organisms.

All construction will be performed by land-based equipment. Sedimentation and erosion controls, such as silt fence and hay bales, will be utilized to minimize erosion into the canal.

Excavation will be performed using a backhoe. Due to the possible presence of ledge, a hoe-ram attachment may be required or blasting will be performed. Once rough grades are achieved, riprap material will be placed. Material excavated that is not suitable for use along the waterfront will be used upland.

Pile installation will be performed with a land-based crane with fixed leads to secure the pile laterally during driving. Where ledge is encountered, sockets will be drilled and the pile grouted into place. Excess rock material will be used with the riprap or upland as needed.

Installation of framing, catwalk, and barge haul system will be performed from land using a land-based crane to set material. Concrete will be brought by ready-mix trucks and placed with a chute. Concrete will not be allowed to overspill into the canal.

The wharf structures are designed using a concrete deck pitched landward and concrete bulkhead (curb) along the perimeter to ensure unloaded material does not wash into adjacent water bodies. Final grading of the site will include positive drainage away from the canal. Stormwater runoff and incidental material will be drained into the stormwater drainage system which is brought to the process system.

Specially designed fixed drip plates will be extended over the edge of the wharf and coaming of the barge. The drip plate is designed to direct spillage from the bucket when the barge is being unloaded onto the wharf or back into the barge. The drip plates will be permanently mounted to the hopper and supported on the wharf deck. This will eliminate the need to adjust the drip plates during barge relocation operations.

Fender System

Two fender systems have been designed for loaded and unloaded barges, which will also be capable of handling the dredge equipment. The wharf structures will be protected using a system of untreated oak fender piles, untreated oak chocks, and extruded resilient rubber fender units. The timber elements will be secured to the rubber units and the rubber units will be secured to the concrete deck of the wharf. The timber fender elements will be subjected to wear and tear on a regular basis and will have to be replaced during the life of the project. Although this is a relatively extensive maintenance requirement, the additional cost of pressure treating the timber as a way to avoid the maintenance is not justified for a 6-year project. Furthermore, pressure treatment can make timber brittle and not suitable for fender systems.

There will be a series of dolphins located to the north and south of the unloading wharf. These provide safe berthing for a loaded dredged material since most barges will be landed on these dolphins when they arrive for unloading.

Barging Operations

Tugboats will bring the barges from the Hudson River, through Lock 7, and to the berthing area at the processing facility. The barges will be secured, with the assistance of the tug, using breast lines after they are moored to the wharf or at the staging areas. After delivering a barge, the tugboat will have to turn by maneuvering into the setback area between the channel and the fender line (see Figure 3-28). Since the width of the channel is only 75 feet, the work wharf will be designed to allow adequate space for the tugboat to turn around.

Support Vessel Floating Dock

The support vessel floating dock system will be located at the West River Road boat launch site (see Contract Drawing P-0205). The purpose of the support vessel floating dock is to provide an area for support vessels to dock during both operating hours and off-hours. The types of support vessels that the dock is designed to handle are listed in Table 3-33, below.

Table 3-33 –Types of Support Vessels for the Support Vessel Floating Dock

Vessel Type	Est. No.	Length (feet)	Beam (feet)	Draft (feet)
Bathymetry Survey Boats	2	20 – 30	8 – 12	2 – 4
Sediment Sampling Boats	2	20 – 30	8 – 12	2 – 4
Dredging Crew Boats	4	35 – 45	10 – 15	4 – 6
Near-field Water Quality Monitoring Boats	9	20 – 30	8 – 12	2 – 4
Oversight Boats	5	20 – 30	8 – 12	2 – 4
Far-field Water Quality Monitoring Boats	4	20 – 30	8 – 12	2 – 4
TOTAL	**26**			

The floating dock system will consist of a heavy-duty aluminum dock system anchored with moorings and chains, pipe piles, or a combination thereof. The 10-foot wide floating dock will be accessed from the shore by 4-foot wide ramps. The floating dock system with a total float area of 6,695 square feet, consisting of a 10-foot wide walkway float (approximately 522 feet in length) and 17 finger floats, will be placed at this location. There will be 15 finger floats measuring 3 feet by 25 feet and two finger floats measuring 5 feet by 35 feet to accommodate anticipated project support vessel demand. The dock system will have a capacity for approximately 26 support vessels, and will be secured with anchored moorings, steel pipe piles, or a combination thereof. River current and ice are both potential concerns for the dock anchor system at this location so the floats will be removed seasonally and stored upland in the parking lot.

Construction of the West River Road Support Vessel and Launch Facility will be performed using land-based and barge-mounted equipment. These activities include the following:

- Improvements to the launch ramp;
- Installation of the marina floats and piles; and
- Site grading.

Since this site is located along the river, portions of the work will occur in the water. Floats will be anchored using steel pipe piles. Piles will be driving using a land-based or barge mounted crane, depending on the ability of the contractor to reach the pile location.

The existing ramp will be re-graded using land based equipment. Precast concrete planks will be installed over a sub-base of gravel. Construction of the ramp will include appropriate erosion control measures.

Once the ramp is complete, the floats (fabricated offsite) will be delivered upland and launched from the ramp. Finally, floats will be secured to the anchor piles. Prior to the start of the season, piles may have to be re-driven into place before floats are re-installed after upland winter storage.

Site grading work includes removal of topsoil and installation of the gravel parking lot in order to minimize stormwater runoff. The access road will be paved with asphalt. No stormwater drainage is required for this facility. Utilities will be brought in from West River Road and sanitary facilities will be temporary and pumped out on a regular basis. The details of the sanitary facility operations will be determined in Final Design.

Navigational Aids

Navigational lighting will be required to allow for safe navigation through the locks and on the Hudson River during night hours or inclement weather. Lighting will be installed at the upstream and downstream ends of any fixed structure, and on the floating docks planned for the West River Road site. Any barge temporarily secured at an in-river staging area or along the unloading dock will also have appropriate lighting (see Section 3.11.2.4).

3.6.4 Processing Facilities

3.6.4.1 Basis of Design

Key elements of the basis of design are summarized in the following Table 3-34. The basis of design for processing equipment is given in the mass balance (Table 3-35) and preliminary specifications for equipment (Table 3-36).

Table 3-34– Basis of Design for Processing Facilities

Item	Value	Source/Notes
Operating Period	24 hours/day, 6 days/week	Flexibility to operate 7 days/week if needed to achieve the Productivity Performance Standard.
Barge Unloading	25,800 cy/week (6 days) 30,100 cy/week (7 days)	Dredging basis of design (4,000 cy/day) during 1-month productivity test, plus a factory of safety.

Item	Value	Source/Notes
Solids Staging for Size Separation Area at Waterfront	3-hour coarse solids; 24-hour 6-inch plus material; 24-hour debris	Temporary storage at waterfront area prior to transport to railside staging.
Process Water Treatment System	Two 500-gpm trains	One train required for inventory dredging. Two trains are required for residuals dredging.
Stormwater Treatment System	One 500-gpm train; 100-year, 24-hour storm; surface flooding drawdown in 24 to 72 hours	For larger storm flows, a portion of the process system will be available.

The processing facility throughput is based on the daily barge delivery and sediment offloading rate planned for Phase 1, i.e., the rate planned during the 1-month demonstration period. For the 1-month demonstration period, the daily average delivery rate is estimated to be 4,000 cy/day (3,500 cy of inventory plus 500 cy of residuals). The basis for the design of the processing plant is 4,300 cy/day (*insitu*), plus water entrained during dredging.

The maximum dredged material delivery and offloading rate for Phase 2 will not be determined until the Phase 2 dredging plan is developed, as part of the Phase 2 Intermediate Design. However, the infrastructure for Phase 1 will be designed to anticipate Phase 2 requirements. As a contingency, flexibility to make some modifications between Phase 1 and Phase 2 has been provided in the layout.

A summary of the properties that are expected to represent the range of sediments dredged from the delineated areas is provided below. Additional information regarding this sediment type classification can be found in the Treatability Studies Report Appendix. The set of sediment data from the SSAP was separated into quartiles, based on the grain size distribution. The specific gravity, solids content, PCB concentration, and total organic carbon (TOC) concentration for each quartile were averaged, as shown in Table 3-37.

Table 3-37 – Summary of Sediment Characteristics, Hudson River SSAP

Sediment Type	Cumulative % passing size (mm) – Quartile Avg						Solids Specific Gravity (g/mL)	%Solids (w/w)	PCB conc. (mg/kg)	TOC (mg/kg)	No. of Samples
	0.005	0.074	0.425	2	4.75	76.2					
S1	1.6	4.8	41.7	76.7	85.7	99.5	2.70	79.1	15.1	4,900	325
S2	7.0	23.3	75.6	90.2	94.0	100.0	2.56	64.9	77.2	21,400	325
S3	15.1	51.2	93.2	98.1	98.8	100.0	2.48	55.6	109.7	33,500	325
S4	28.1	80.7	97.9	99.8	99.9	100.0	2.42	48.5	137.6	39,200	324
Avg	**12.9**	**40.0**	**77.0**	**91.1**	**94.6**	**99.9**	**2.54**	**62.0**	**90.0**	**24,700**	1,299

Material balances through the sediment dewatering process were determined using METSIM process simulation software (Proware, Tucson, AZ). Table 3-35 presents a summary of material balances that were prepared using METSIM – these serve as the basis of design for individual unit processes throughout the facility. The stream numbers in Table 3-35 correspond to those shown on process flow diagrams presented on Drawings P-2002 and P-2003. Table 3-35 also shows the anticipated daily mass and volumetric flow rates resulting from estimated daily dredging rates for each sediment type (S1, S2, S3, and S4), as well as an overall average sediment type (S-Av). Estimated quantities of each sediment type for Phase 1 will be presented in the Phase 1 FDR. These sediment types represent the range of materials the processing facilities will be designed to process. Since the loading to the processing equipment varies with the type of sediment being processed, the size of different unit processes may be dictated by different sediment types. For example, the coarse material separation process flow rate and solids mass loading are greatest for sediment type S1. However, for thickening and dewatering processes, the finer S3 and S4 sediment types become the design basis.

The flow rates and mass rates shown in Table 3-35 represent daily loadings. For processes that are not operated continuously, the design flow rate was based on this daily loading rate adjusted to reflect the actual operating period. Similarly, the designed loading to filter presses was adjusted to reflect periods of cake unloading and step-up for the next run. The design of thickeners and sediment storage tanks allows them to serve as a buffer between the semi-continuous waterfront operations and the continuous dewatering facilities. Results of adjustments to mass or volumetric loadings are used to develop draft specifications for the major process equipment, which are given in Table 3-36 for each unit operation. These operations are described in the design analysis section below.

Processing operations, like dredging operations, are sized for 24 hours/day, 6 days/week operation. The seventh day is reserved as downtime for maintenance, unplanned outages, or as contingency to meet production goals.

The basis for the processing facility design is more fully discussed in the Design Analysis: Processing Facilities (Attachment G).

3.6.4.2 Design Analysis

Process flow diagrams for the Phase 1 sediment dewatering and water treatment facilities are given on Drawings P-2002 and P-2003, respectively. The tables in the drawings provide mass balance and flow rate data for the nominal case (i.e., average sediment type and 1-month demonstration at full productivity). The components of the processing facilities are:

- Size separation;
- Thickening and dewatering;
- Process water treatment;
- Stormwater treatment; and
- Processed material staging.

The design of each of these components is described below.

Size Separation

The size separation process area is located at the waterfront (adjacent to the canal). The primary objective of the size separation system is to separate coarse dredged sediments from fine sediments to reduce the amount of material to be dewatered mechanically. The size separation facility is designed to:

- Screen debris (6 inch +) from sediment offloaded from barges;
- Separate oversize material (3/8 inch +) from the screened sediment;
- Slurry the remaining sediments (3/8 inch minus) to approximately 25% solids;
- Separate the slurry into coarser sediments (No. 200+) and fine sediments;
- Drain water from the separated coarser sediment; and

- Temporarily stage debris, oversize material, and coarser sediments prior to being transferred to the storage area or loading pads at rail yard.

The major components of the size separation facility include the following:

- Receiving hopper with pipe grizzly;
- Pump to remove free water from barges;
- Trommel screen;
- Sediment slurry tank;
- Hydrocyclone system;
- Vibratory dewatering screens;
- Process water tanks, including storage of free water pumped from barges; and
- Solids storage pads with drainage control.

The Phase 1 size separation facility will be equipped with a single mechanical unloader capable of offloading a barge at a rate of 335 cy/hour (1,000 cy barge offloaded in 3 hours). Based on calculated offloading efficiencies presented in Attachment F (accounting for barge staging, barge moving, shift changes, etc.), the Phase 1 basis of design for the process facility of 4,300 cy/day could be moved through the offloading facility in 16 to 24 hours. The unloader is expected to use a 5-cy clamshell bucket. A drip pan will be installed to prevent spills during offloading of sediment from the barge.

Receiving Hopper with Pipe Grizzly

The unloader operator may remove large visible debris (approximately 2 feet or larger) from the barge. Removed debris will be temporarily staged on the pad to drain free water prior to being transported to the debris storage area, located near the rail yard. Drainage water from debris on the pad will run into a catch basin and be pumped for storage and treatment. The mechanical unloader will place dredged materials and debris less than 2 feet in diameter onto a pipe grizzly (angled 35° to 45° from horizontal) within an unloading receiving hopper. The pipes will be slightly tapered and mounted 6 inches apart. The plus 6-inch oversize material is designed to roll off the pipes at the low side of the hopper. Materials greater than 6 inches will be staged within the size separation area to drain off free water prior to being transported to the debris storage area, located near the rail yard, for offsite loadout and disposal. Material less than 6 inches, which passes between the pipes, will be directed to the rotary trommel screen via a belt feeder and conveyor.

Free Barge Water Handling

During mechanical unloading of barges, free water in the barges will be pumped directly to the hydrocyclone overflow wet well pump station located at the size separation facility. Water collected at the hydrocyclone overflow wet well will be pumped to the dredge slurry holding (equalization) tanks located at the thickening system area. In addition, stockpile drainage water that accumulates on the debris and coarse sediment storage pad will be directed to the local stormwater storage tank.

Trommel Screen

The primary scalping stage will consist of a trommel screen. The trommel screen is a common primary scalping technology in aggregate separation applications. The trommel screen will be designed to remove dredged material greater than 3/8-inch at a maximum feed rate of 335 cy/hour of S1 type sediment (510 wet tons/hour). The trommel screen requires a continuous water feed via a spray pipe assembly in order to break up and flush through cohesive sediment that may otherwise blind the screen. The water feed to the spray bar system is anticipated to be on the order of 1 to 3 gpm per ton per hour of material processed. This spray water flow rate will be manually adjusted by an operator and/or turned on or off in response to unsteady flow of solids on the belt feeder or conveyor. At a maximum feed rate of 510 tons/hour, the minimum water feed to the rotary screen will be on the order of 500 to 4,000 gpm. The water feed source to the rotary screen is a recycle stream from the dewatering system (gravity thickener overflow and filter press filtrate). In special circumstances (startup or insufficient flow rate from solids processing), the water feed source may need to be from the Champlain Canal and/or treated water from the water treatment facility.

A trommel was selected to make this 3/8-inch cut because, based on experience with similar applications, it can handle a wide range of material properties, including rocks, twigs, and aquatic vegetation, as well as cohesive sediments which may or may not need to be de-agglomerated for further processing. The plus 3/8-inch material is staged and drained at the waterfront area, then transferred and staged at railside adjacent to the coarse material staging. As stated above, drainage is captured and treated.

Sediment Slurry Tank

Sediment less than 3/8-inch passing through the rotary trommel screen will be directed into a sediment slurry tank. The sediment slurry tank will be equipped with a density meter to regulate the amount of make-up water needed to achieve 25% solids. The required make-up water will be added to the sediment slurry tank from the process water tanks.

The sediment slurry tank will be sized for a maximum residence time between 5 and 8 minutes and will be constructed with steep sloping sides to direct the sediment to the discharge pump suction pipe. Based on a maximum rotary trommel screen feed rate of 510 tons/hour and a sediment slurry tank concentration of 25% solids, the maximum sediment slurry tank discharge pumping rate is approximately 5,000 gpm. Therefore, the sediment slurry tank will be sized to hold a working volume between 25,000 and 40,000 gallons. From the sediment slurry tank, the 25% slurry will be pumped to the hydrocyclone system to further separate coarse sediment from fine sediment.

Hydrocyclone System

The hydrocyclone feed pumps will direct the 25% sediment slurry from the sediment slurry tank to the hydrocyclone system at a maximum rate of 5,000 gpm. Based on a maximum rotary screen influent feed rate of 510 dry tons/hour, the hydrocyclone system will be sized for a maximum feed rate of 5,000 gpm at 25% solids; a hydrocyclone over flow rate of 4,000 gpm at 2 to 16% solids; and a hydrocyclone under flow rate (vibratory dewatering screen feed rate) of 1,000 gpm at 68% solids. When treating the nominal (S2 or S3 types) sediment, the hydrocyclones would see a feed rate of 3,100 gpm with overflow of 2,500 gpm and underflow of 600 gpm (shown on Drawing P-2002).

Krebs Engineers (Tucson, Arizona), a hydrocyclone vendor, provided performance estimates for hydrocyclones with cyclowash at loadings similar to those in the material balance tables. The cyclowash is an optional device that introduces a small amount of water near the underflow outlet to reduce fines content in the underflow and achieve a cleaner particle size cut. This option will be further evaluated in final design. The METSIM model simulated performance (percent of solids to underflow), which is in agreement with the Krebs Engineers calculations. These calculations are presented in Attachment G. Based on these calculations, it is estimated that each 6-inch diameter hydrocyclone can process an influent flow rate of up to 155 gpm at a solids concentration of 25%. Solids separations observed in the treatability studies were similar to those predicted by the Krebs Engineers calculations.

The hydrocyclone system used as a basis for this design consists of approximately 34 operating 6-inch diameter hydrocyclones, each sized to handle approximately 145 gpm. The hydrocyclones would be installed in two banks of 20, including installed spares. The hydrocyclone feed system will be equipped with flow controls and recycling capability necessary to maintain a consistent feed pressure to each hydrocyclone. Hydrocyclone overflow containing fine sediments will be directed to the hydrocyclone overflow wet well, where it will be pumped to the dewatering system. Hydrocyclone underflow containing coarse sediments will discharge from each bank of hydrocyclones directly to a vibratory dewatering screen.

Alternatively, the use of a smaller number of 8-inch or 10-inch hydrocyclones will also be considered in final design. The specification of hydrocyclone equipment or performance will be completed during Phase 1 Final Design.

Vibratory Dewatering Screens

Each bank of hydrocyclones will be equipped with a vibratory dewatering screen. Underflow from each bank of hydrocyclones will be discharged to the vibratory dewatering screen via a common header pipe for further dewatering. Dewatered underflow (coarse sediment) will be discharged from each dewatering screen via a common conveyor to a temporary staging area within the size separation facility to drain off free water prior to being transported to the coarse material storage area, located near the rail yard, for loadout and disposal. Water removed from the hydrocyclone underflow at the vibratory dewatering screen will be directed to a sump, and will be pumped to the hydrocyclone wet well (or alternatively to the process water tanks for recycle to the hydrocyclone feed).

Process Water Tanks

The size separation facility will be equipped with one 240,000-gallon process water storage tank and one 24,000-gallon treated water storage tank. The process water storage tank will store untreated water pumped from gravity thickener overflow and filter press filtrate via the dewatering facility process water equalization tank and pump station. Make-up water, as needed, can be transferred from the storage tanks or extracted from the Champlain Canal.

Each tank will be equipped with level controls to regulate the operations of pump stations feeding untreated water from the dewatering facility and treated water from the water treatment facility.

Solids Staging Areas

Debris and oversize materials collected from barges, the bar screen, and the trommel screen and dewatered coarse material discharged from the vibratory dewatering screen will be stockpiled at temporary staging areas within the size separation facility to drain off free water. This drainage will be collected and treated. Debris and oversize material staging areas at the waterfront have been sized to store a 24-hour quantity of material. A contingency plan will be developed to enable this material to be moved more quickly, if necessary, to final staging, since this material has a slight potential to be a source of odor (due to vegetation and animal matter). The dewatered coarse material staging areas at the waterfront have been sized to store 3 hours of material based on the daily dredging rate of 4,300 cy/day of S1 material.

Based on this daily dredge rate of coarse S1 sediment, it is estimated that up to 100 cy of debris, 500 cy of oversize material, and 3,000 cy of dewatered coarse material will need to be transported from the respective staging areas to the storage and loadout facility near the rail yard. Approximately four or five 15-cy dump trucks (operating 24 hours/day, 6 days/week) will be required for daily transport of this material to the debris/coarse material staging area near the rail loading apron, assuming a truck cycle time of two to three trips per hour.

Thickening and Dewatering

The primary objective of the thickening and dewatering system is to concentrate and dewater the fine particulate slurry from the size separation processes to the desired dry solids concentration for transport to an offsite disposal facility. The design basis for the dewatered sediment slurry is a minimum dry solids concentration of 55% (see Attachment G).

The fine particulate slurry from the hydrocyclones will be conveyed by slurry pumps to the gravity thickeners and/or dredge slurry holding tanks. Two treatment trains, each with a slurry pump and a separate gravity thickener, will be installed to further concentrate and thicken the slurry. Polymer will be added to the gravity thickener feed lines to facilitate and enhance settling of the slurry. In addition, two dredge slurry holding tanks will be installed to provide a process equalization basin and/or temporary storage of slurry to accommodate process downtime or peak influent slurry loading. Thickened sediment slurry from the underflow of each gravity thickener will be conveyed to two dewatering conditioning tanks where polymer addition and blending will provide preconditioning prior to final dewatering of the slurry. From each dewatering conditioning tank, conditioned sediment slurry will be fed to three plate and frame filter presses for final dewatering. A more detailed description of each of the thickening and dewatering process components is provided below.

Sediment Slurry Pump

Two sets of two sediment slurry pumps (total of four pumps, two pumps as back-ups) will convey a maximum of 5,000 gpm (each pump sized to convey 2,500 gpm) of fine particulate slurry approximately 1,200 feet to the gravity thickeners and/or dredge slurry holding tanks. The pumps will be horizontal, centrifugal type, designed to pump dense and abrasive slurries, and each will be approximately 125 hp. The pumps will be operated by a level control system in each of the hydrocyclone wet wells. The slurry will be conveyed through four 8-inch diameter force mains to the gravity thickeners. Provisions for flushing/draining connections will be provided in the force mains to enable dewatering and flushing of the mains during process shutdowns. In addition, a fifth sediment slurry pump will be installed to convey approximately 1,150 gpm of water accumulated during barge pump out at the waterfront. This water will be discharged into one hydrocyclone wet well and then conveyed by the fifth sediment slurry pump to either the gravity thickeners or the dredge slurry holding tanks via a separate 8-inch diameter force main.

Dredge Slurry Holding Tank

A dredge slurry holding tank will be provided to temporarily store the excess sediment slurry due to surges or as a contingency for downtime in the filter press operations. The total tank volume, which is approximately 1,400,000 gallons, assumes 8 hours of hydraulic retention time as a reasonable contingency. This volume will be optimized during final design. Each of the two 700,000-gallon tanks will consist of an aboveground bolted steel tank, 70 feet in diameter by 24 feet high. Each tank will be equipped with five interference style mixers to provide high shear mixing and to maintain solids in suspension. Each mixer will be equipped with a 75 hp motor. Flow from each tank will be conveyed by two transfer pumps to the gravity thickener tanks or directly to the dewatering conditioning tanks for further dewatering. Each pump will be equipped with a 50 hp motor. In addition to dealing with inconsistent barge offloading schedules, the dredge slurry holding tanks will accommodate water imbalances as a result of changes in sediment types and water load variabilities between inventory and residuals barges.

Polymer Feeding Systems – Gravity Thickener Feed

Provisions for feeding polymer to the gravity thickeners will also be provided. These facilities will include additional day tanks and feed pumps for the same liquid cationic polymer coagulant used for the filter presses. In addition, the gravity thickeners will have provisions for adding an anionic polymer flocculent after the liquid cationic polymer coagulant. The anionic polymer flocculent will be prepared in separate polymer and water blending tanks, with transfer to two anionic polymer flocculent mixing/aging tanks.

Gravity Thickener

Two gravity thickeners will be used to separate and concentrate the fine sediments from the water fraction of the sediment slurry. Each gravity thickener will consist of an above-grade steel thickener tank with a conical bottom to concentrate the slurry. Each tank will be equipped with a center shaft and cone scraper, two rake arms, and a bridge supported walkway and drive mechanism. The gravity thickeners, each sized for a solids loading rate of 0.3 ton of dry solids per square foot per day, will be 60 feet in diameter and have a 12-foot side water depth. In order to enhance the settling of fine solids in the sediment slurry, two polymers, a cationic coagulant, and an anionic flocculant will be introduced into each gravity thickener feed pipe. The polymers will be mixed into the process stream via static in-line mixers. Supernatant from the thickener will overflow a weir and be conveyed to the recycle water collection wet well and then the recycle water equalization tank for process use or further treatment at the water treatment system.

The thickeners will be controlled by a local control panel that will include a rake drive controller, torque transmitter, and position indicator. A sludge blanket position indicator will also be provided to monitor tank sludge inventory.

Two pumps from each gravity thickener will convey up to 700 gpm of up to 15% solids slurry to the dewatering conditioning tanks. The pumps will be equipped with 30 hp motors and variable frequency drives to maintain a preset level in the dewatering conditioning tanks.

Filter Press Feed Conditioning Tank

To condition the sediments for dewatering, thickened sediments will be combined with a cationic polymer (coagulant) in the dewatering conditioning tanks prior to being fed to the filter presses for final dewatering. The tanks will be equipped with high flow, low shear mixers to provide sufficient sludge and polymer blending and an ultrasonic level sensor to monitor the sediment level. Specific dewatering conditioning tank configurations available from vendors may be considered.

Polymer Feed Systems – Filter Press Feed

In the prior process step, a liquid cationic polymer coagulant and a liquid anionic polymer flocculent were specified to enhance settling in the gravity thickeners. Further conditioning of the sediment slurry to enhance the dewatering process will be accomplished with the addition of a liquid cationic polymer coagulant. Polymer will be delivered in bulk rail cars and transferred by bulk polymer transfer pumps to a bulk storage facility consisting of multiple storage tanks located adjacent to the dewatering building. In the dewatering building the polymer may be blended with water and stored in a polymer mixing/aging day tank. The blending of the polymer and water will be controlled by a polymer blending system. Polymer feed pumps will convey the blended polymer from the day tank to the dewatering conditioning tank, where it will be dosed to thickened sludge prior to being dewatered in the filter presses. The polymer coagulant feed system will be designed to deliver 7 to 19 pounds of polymer per dry ton of sediment (see Attachment G).

Filter Press System

Conditioned sediment from the dewatering conditioning tanks will be fed by positive displacement pumps to a total of 12 plate and frame presses for final dewatering, and each dewatering conditioning tank will supply conditioned sediment to three filter presses. The design assumes that each plate and frame filter press will consist of approximately 156 polypropylene, non-gasketed, 2-meter by 2-meter recessed chamber plates, with a total nominal press volume of 600 cubic feet. The filter presses may be equipped with diaphragm squeeze plates to maximize filter cake dry solids concentration.

The 12 plate and frame presses will be arranged into two separate six-unit process trains housed in a dewatering area approximately 250 feet long by 165 feet wide. The plate and frame filter presses will be arranged so that filter cake unloading will be accomplished via 30-cy roll-off containers through bay doors located on each side of the dewatering building.

The filter presses will operate at a pressure of 100 pounds per square inch (psi) to produce a minimum dry solids concentration of 55% by weight. At this solids concentration the filter cake is expected to pass the paint filter test. During the 1-month demonstration period, the filter press filter cake output will be approximately 63,000 cubic feet/day, corresponding to about nine drops/day per press for a 2.7-hour cycle time. The filter presses will be elevated approximately 12 feet above grade and deposit filter cake into the 30-cy roll-off containers positioned under the platforms on an at-grade base slab. The roll-off containers will be transported by trucks to the filter cake staging and testing area. As a contingency, a solidification agent will be available to add to the press cake, if moisture limits prescribed by the disposal facility are not satisfied.

Water Treatment

The water treatment facility will be designed to treat waters generated from site stormwater runoff and sediment processing. The water treatment facility will be designed to remove suspended solids, PCBs, and other analytes, as required to achieve the effluent limits established by the WQ requirements summarized in Section 2.2.4 and described in the Phase 1 ID PSCP Scope (Attachment C). The primary objectives of the stormwater and process water treatment facilities are to collect and treat site stormwater and facility process water and provide necessary decontamination/wash water and process water for reuse in the equipment. Treated water that is not recycled for process operations will be directly discharged to the Champlain Canal in accordance the effluent limits listed in Phase 1 ID PSCP Scope. To minimize complications that might arise from treating two water sources that may have differing water quality, under normal operations two treatment trains will be designated to treat stormwater, and the remaining two treatment trains will be designated to treat process water. However, there will be a piping cross-over between each of the four treatment trains, so each will be capable of treating both stormwater and process water interchangeably on an as-needed basis to provide maximum flexibility.

Process water fed to the water treatment plant is anticipated to come primarily from the dewatering system. The dewatering system is anticipated to operate 24 hours/day, 6 days/week. Based on a maximum Phase 1 inventory dredging rate of 4,300 cy/day, the process water influent flow rate to the water treatment facility is less than 720,000 gallons/day (500 gpm) for all sediment types, assuming that all make-up waters required at the size separation facility are recirculated from the dewatering system. Based on offloading a 1,000-cy residuals barge in 3 hours, a Phase 1 residuals dredging rate of 4,000 *insitu* cy/day can be accommodated, generating an anticipated process water flow rate to the water treatment facility of less than 1,000 gpm, assuming that all make-up waters required at the size separation facility are recirculated from the dewatering system. It is proposed to install one 500-gpm process water treatment train to cover normal 500 gpm needs for inventory dredging, plus an additional 500-gpm to cover additional requirements from offloaded residuals barges. In the event that make-up water, feeding the size separation facility, needs to be treated water and/or supplied from the Champlain Canal due to water availability or quality issues, additional water treatment capacity will be required through the stormwater treatment train.

It is estimated that about 5 million gallons of stormwater will be contained within the site during a 100-year storm event. It is proposed to install a 500-gpm stormwater treatment train to supplement the two 500-gpm process water treatment trains. This capacity will allow removal and treatment of flooded areas (1.6 million gallons during the design 100-year storm) within 24 to 72 hours (24 if process water treatment plant capacity used). The average annual stormwater treatment quantity is estimated at 42 million gallons.

The process water and stormwater trains will be piped so that they can treat the sources separately or combined. The unused stormwater capacity can be available for temporary contingent process water treatment capacity.

The water treatment plant will be equipped with stormwater and process water equalization tanks capable of providing a minimum 1-hour retention time based on estimated influent stormwater and process water flow loadings. The equalization tanks serve as pump sumps, but also equalize any varying mixture of feeds from specific stormwater tanks or process and stormwater combinations. The major components of the water treatment facilities include:

- Equalization tanks;

- Rapid mix and flocculation tanks;
- Clarifiers;
- Clarifier effluent tanks;
- Process water filters;
- GAC;
- Backwash holding tanks; and
- Outfall and monitoring station.

A description of the equipment and operations associated with these major components is provided below.

Equalization Tanks

Site stormwater, gravity thickener overflow, and filter press filtrate process waters not used as slurry make-up water at the size separation facility, and decontamination/wash water used at various areas of the facility will be pumped to two 60,000-gallon equalization tanks located at the onsite water treatment plant. Each equalization tank will be connected to a treatment train consisting of a rapid mix and flocculation tank, clarifier, process water filtration system, and GAC system.

Rapid Mix and Flocculation Tanks

Site stormwater and process water will be pumped from the two equalization tanks to three rapid mix and flocculation basins to enhance solids removal. Based on water samples collected during the treatability study, metals removal does not appear to be necessary to comply with the WQC effluent limits. Each rapid mix and flocculation basin will consist of an initial mixing chamber and a flocculation chamber. Coagulant will be added to and mixed with the influent stream in the initial rapid mix chamber, which will be sized to provide an approximate 3-minute retention time for a designed flow rate of 500 gpm (i.e., minimum 1,500-gallon chamber). From the initial chamber, water will flow into the flocculation chamber to form flocs. The flocculation chamber will be sized to provide an approximate 5-minute retention time for the designed flow rate (i.e., minimum 2,500-gallon chamber). The three rapid mix and flocculation tanks will each be capable of treating 500 gpm (total 1,500 gpm).

Clarifiers

Site stormwater and process water will be directed from the rapid mix and flocculation tanks to clarifiers. Three inclined plate clarifiers have been preliminarily selected for the Phase 1 IDR. Inclined plate clarifiers will allow the process area space requirements to be reduced; this is important because the treatment trains will need to be enclosed for winter operation. This selection will be reviewed during the Phase 1 Final Design. The clarifiers will settle solids with a specific gravity greater than the surrounding liquid into the sludge chamber. Solids within the sludge chamber will be pumped to the gravity thickener system. Supernatant will overflow through the top of the clarifiers through an adjustable weir into clarifier effluent tanks. The inclined plate clarifiers will each be capable of handling the design flow rate of 500 gpm and will have a minimum hydraulic loading rate of 0.23 gpm per square foot (see Attachment G).

Supernatant discharged from each inclined plate clarifier will be directed to a clarifier effluent tank. The clarifier effluent tank will be sized to provide a minimum of 5 minutes of retention time for the design flow rate of 500 gpm (minimum 2,500-gallon clarifier effluent tanks). The clarifier effluent tanks will be equipped with level controls and discharge pumps. From the clarifier effluent tanks, water will be pumped to the process water filters for additional solids polishing.

Process Water Filters

Water will be pumped from the clarifier effluent tanks to the three process water filter systems. Each filter system will act as a polishing filter to remove particulate matter down to 10 to 20 microns. Each system will contain two filters connected in parallel and will be sized to handle the design flow rate of 500 gpm at a hydraulic loading rate of 4 gpm per square foot.

Granular-Activated Carbon

Polished effluent exiting the process water filters will be directed to GAC units for PCB removal. Each GAC unit will consist of two vessels operating in series. Each vessel will be sized to provide a minimum of 20 minutes empty bed contact time. The effluent leaving the GAC units may contain solids that are approximately 5 to 10 microns in size or less (effective filtering capability of GAC). To capture any solids that are discharged by the GAC system, bag or cartridge filter housings will be installed to treat the GAC effluent. Each bag/cartridge filter housing will be equipped with filters that have an effective filter rating of 1 to 10 microns.

Backwash Holding Tanks

After final treatment in the GAC systems, the effluent water will be directed into one 200,000-gallon backwash holding tank. The backwash tank overflow will discharge by gravity to the Champlain Canal. The backwash holding tank will be equipped with backwash feed pumps that will pump water to the process water filter systems and GAC systems on an as-needed basis. The backwash holding tank will also be equipped with pump stations necessary to provide process make-up water and wash water for various plant operations.

Outfall and Monitoring Station

Treated water not used for backwashing or other process operations will gravity discharge from the backwash holding tanks via a common outfall pipe to the Champlain Canal. The outfall effluent will be sampled/ monitored at the outfall pipe in accordance with the protocols discussed in the Phase 1 ID RAM Scope (Attachment A). The location and specification for the outfall(s) will be provided in final design.

The design analysis indicates that the effluent will meet the requirements of the WQ requirements for suspended solids, PCBs, cadmium, chromium, copper, lead, and mercury. See Sections G.5 and G.6 of Attachment G (Design Analysis: Processing Facilities). A summary of the results is presented in the table below.

Table 3-38 - Estimated Outfall WQC Compliance from MMF and GAC Pilot Columns for Four Sediment Types

Sed. Type	Pilot GAC2 Concentration						
	PCB	**TSS**	**Cd**	**Cr**	**Cu**	**Pb**	**Hg**
WQC Conc.	0.0003	50	0.04	0.21	0.062	0.062	0.0002
S1	0.00000934	0.95	0.00100	0.00115	0.00102	0.00057	ND *
S2	0.00000934	1.00	0.00100	0.00153	0.00223	0.00148	ND
S3	0.00000934	1.02	0.00100	0.00133	0.00127	0.00150	ND
S4	0.00001029	1.73	0.00077	0.00178	0.00482	0.00365	ND
Safety Factor = (WQC conc/Pilot GAC2 conc)							
S1	32	53	40	183	61	46	--
S2	32	50	40	137	28	18	--
S3	32	49	40	158	49	17	--
S4	29	29	52	118	13	7	--

Notes:

* During RSSCT carbon testing, effluent mercury concentrations were below 0.00000051 mg/L using EPA Method 1631.

1. Concentrations shown as mg/L.
2. Average results from pilot column testing use Method Detection Limit (MDL) for data points below detection level; all Hg results below MDL.
3. Average results from pilot column testing combine the results from all hydraulic loadings tested.
4. Blank correction not applied when analyte found in blanks (Cd, Cr, Cu, and Pb results).
5. WQC concentrations calculated for discharge at 1.44 mgd (1,000 gpm) when mass limit applies.
6. WQC limit for PCB applies to each Aroclor. Pilot data used total PCBs.
7. For full table of results, see Table 24 in appended *Treatability Studies Report*.
8. Note also that RSSCT carbon testing has shown no PCB breakthrough at simulated durations exceeding 1 year.

Redundant Equipment and Reserve Capacity

This design analysis presents the Phase 1 design at the intermediate stage, and does not yet include final provisions for redundant or contingent measures that may be included in the Phase 1 Final Design. As part of the development of the Phase 1 FDR, an FMEA will be conducted to guide the specification of redundant and/or contingent equipment and operations. The reserve capacity within the processing plant for solids handling and dewatering, and water and stormwater treatment that is shown in this Phase 1 Intermediate Design will be re-evaluated with respect to the possible addition of redundant or contingent equipment.

3.6.5 Structural, Electrical, and Instrumentation

3.6.5.1 Basis of Design

The specific basis of design for this component of the processing facilities is summarized in the following Table 3-39.

Table 3-39 – Basis of Design for Structural, Electrical, and Instrumentation

Item	Value	Source/Notes
Subsurface Conditions	TBD	SEDC investigations ongoing.
Electrical Demand	TBD	
Utilities – Electrical	7,000 hp	Motors required for Phase 1.
Instrumentation Needs	TBD	

3.6.5.2 Design Analysis

In preparation for the Phase 1 Final Design, a series of subsurface investigations (soil borings and geotechnical testing) is being conducted at the Energy Park site to determine existing soil conditions, depth to bedrock and groundwater, and anticipated structural foundation requirements. It is anticipated that conventional reinforced concrete slab-on-grade construction will be used to support building and equipment loads. Once the subsurface investigations are completed, the results of the investigations and the design requirements for structural foundations will be incorporated into the Phase 1 Final Design.

Electrical distribution and control of motors at the processing facility will be from a series of motor control centers centrally located in electrical rooms adjacent to specific processing areas. Preliminary electrical one-line diagrams are provided on Drawings P-3003 to P-3009. Additional design details will be developed and included in the Phase 1 Final Design.

Instrumentation will be required to energize pumps, mixers, and chemical feed equipment when the dredged material processing is initiated and to monitor tank levels, sediment densities, and feed rates during process operations. Some instruments will be mounted in control panels and some will be field mounted. Additional design details will be developed and included in the Phase 1 Final Design.

3.6.6 Processed Material Storage Area, Loadout Facilities, and Rail Yard

3.6.6.1 Basis of Design

The specific basis of design for this component of the processing facilities is summarized in the following Table 3-40.

Table 3-40– Basis of Design for Processed Material Storage Area, Loadout Facilities, and Rail Yard

Item	Value	Source/Notes
Railside Staging Area	100-feet x 400 feet	Stockpile outer dimensions.
Railside Staging Area	10,000 to 20,000 cy	Stockpile capacity at 10 to 20 feet high.
Railside Staging Area	Underdrain system	Required per TSCA/RCRA.
Processing Rate	20,000 cy/week	Average processing output to staging during 1-month demonstration.
Loadout Rate	17,000 to 25,000 cy/week	Capacity of two to three unit trains of 81 cars.
Rail yard	38,000 feet of track	Designed to handle four 81-car unit trains per week; Phase 1 will be two to four unit trains per week.
Chemical Delivery Spur	700 feet of track	Designed to accommodate up to three rail cars of liquid polymer and up to two rail cars of solidification reagent.

3.6.6.2 Design Analysis

This component of the processing facility design involves facilities for storing processed sediment and loading the materials into rail cars for transportation to the selected disposal facilities, and construction of a rail yard to accommodate incoming and outgoing unit trains (as discussed in Section 3.7, rail has been selected over barging as the mode of transport for offsite disposal). The design of each of these facilities is discussed below.

Rail Yard

The size and shape of the rail yard are designed to:

- Receive empty inbound trains;
- Break down empty trains and spot empty rail cars at the loading tracks in preparation for loading;
- Provide suitable roadways between selected tracks to inspect inbound and outbound trains;
- Provide facilities to perform inspections and make running repairs, as required, on the rail car fleet;
- Facilitate the loading of empty rail cars with materials destined for disposal;
- Facilitate the assembly of outbound loaded rail cars into trains that are ready to depart; and
- Receive and spot inbound materials that are shipped by rail that support the day-to-day operation of the processing facility.

A wide variety of possible rail yard configurations and associated facilities to support the staging of rail cars for loading have been evaluated. Key elements considered in the design of the rail car staging and loadout facility are:

- Number of material streams to be loaded;
- Size of trains to be loaded;
- Expected frequency of trains;
- Types of rail equipment (e.g., specification of rail cars);
- Rail car loading equipment;
- Equipment decontamination requirements; and
- Capture and collection of water within the rail car loading, staging and storage area.

There are four main types of tracks in the planned rail yard. The receiving and departure (R&D) tracks, which as their name implies, are designed to receive inbound trains and depart outbound trains. Each one of the tracks in the R&D area is long enough to hold an 81-car unit. At the current time, it is thought that this is the typical unit train that will be assembled at the processing facility site to move processed materials to the disposal site destination. As designed, there will be adjacent inspection roadways that can be used to inspect both arriving and departing rail cars. Because of the overall expected unit train length, the general shape of the site, and the configuration of the serving railroad's mainline, the planned rail yard is rectangular in nature with the long axis generally parallel to the mainline of the serving railroad.

As part of the rail yard design, two 2,400-foot long loading tracks are necessary to support the loading of processed materials from designated stockpiles in the material storage areas into rail cars. The loading tracks are positioned on the site in an area that is close to both the processing plant and planned storage facilities. Each loading track has been sized to hold 41 rail cars so the loading of materials can be progressed in an efficient manner with a minimum amount of switching and re-spotting of either loaded or empty rail cars. The layout developed for Phase 1 Intermediate Design could accommodate the loading of two waste streams (i.e., materials above and below 50 mg/kg PCBs) into separate blocks of rail cars for transportation to separate disposal facilities.

Additionally, there are repair and inspection tracks and an engine house track on site. These tracks are required to support the continued operation of the onsite switching locomotive and provide trackage and facilities where inspection and repairs to rail cars can be made daily. Because product for the processing plant may be received via rail, there will be a delivery spur on site.

As previously discussed, the rail yard is rectangular in shape with the long axis of the yard approximately parallel to the serving railroad's right of way. Therefore, most of the tracks in the rail yard are somewhat parallel to this same right of way. The R&D tracks are double-ended so that an inbound train from the south can pull in and drop its cars on an R&D track, make a progressive move with the locomotives out the north end of the track, then move south through a clear track and couple into the south end of a loaded train on another track that is ready for departure.

The track furthest to the west in the planned rail yard is a combination yard lead and runaround track. This yard track is connected to the main track of the serving railroad by means of switches located at two existing control points on the railroad's property. The existing control points presently are used to regulate switches that provide access from the main line to a passing siding immediately to the west. Using the existing control points to govern the operation of the switches that provide access to the rail yard will reduce the complexity of signal installation and the schedule for connecting with the main line.

In summary, as designed, the rail yard has been sized to build outbound loaded unit trains and to receive empty unit trains that are broken down and spotted for loading. Cars are inspected inbound, spotted for loading, loaded, and assembled into outbound trains. As presently configured in Phase 1, the rail yard can hold at least three unit trains in the R&D tracks, along with another unit train on the loading tracks.

The rail yard has been designed to support the loading of 2 to 4 unit trains per week. The capacity of the rail yard, as designed for Phase 1, will be ample for the Phase 2 production rates. As a contingency, an area has been reserved for future expansion.

Rail Car Uncovering, Loading and Covering

Rail cars will be received, loaded, and readied for transport to accommodate reliable rail service. Because of the different types of materials to be loaded (debris, coarse material, and fine filter cake), current industry practice and the overall versatility of a gondola, the rail yard loading tracks and material storage area are designed to support the loading of a high-side and/or low-side (mill) gondola. In addition, there may be dedicated rail cars that may be segregated by waste disposition (i.e., material with PCB concentrations of less than or greater than 50 mg/kg). The material will be fully contained in the rail car. Depending on individual rail carrier requirements and landfill unloading infrastructure available, either sealed cars equipped with watertight, hard lids or cars individually fitted with a plastic liner that is wrapped over the material and sealed may be specified for the project; this determination will be made during Phase 1 Final Design.

The type of rail car used and its cover or liner have implications on the design of the rail loading yard and material storage area. The material storage areas will be located in reasonable proximity to the rail car loading tracks. As envisioned, empty rail cars will be spotted on one or more of the unloading tracks. Lids (if used) will be removed and placed on an apron to the west of the loading track. If liners are used, this apron will be used as a base for liner installation. Materials will be loaded from the material storage area and/or the 75-foot apron adjacent to (east of) the unloading tracks directly into the rail cars. After a rail car has been loaded, the lid will be reinstalled. At any given time during the loading process on one of the material loading tracks, the following activities will likely be taking place:

- Removing lids from watertight rail cars (or as a contingency, installing liners in non watertight rail cars);
- Loading rail cars using front end loaders;
- Replacing and locking lids into position on watertight rail cars (or as a contingency, sealing liners after the rail cars are loaded);
- Inspecting all loaded cars (before the cars are moved to the R&D tracks); and
- Spot decontamination of cars if material adheres to the outside of the rail cars during loading (before the cars are moved to the R&D tracks).

Runoff Water Collection in the Rail Car Loading Area

Stormwater from the rail car loading tracks, loading aprons, lid lay-down aprons, and material storage areas will be designated Type I and will be collected and treated. A drainage system has been designed to capture free water (stormwater or decontamination water) in these areas. The drainage system will lie directly under the rail loading track, and will consist of a concrete boat section. This sealed boat section will capture water during a storm (or decontamination water) that falls on the pavement between the rails on the railroad loading tracks and runs down through the flangeway adjacent to the two rails on each track. Pipe and drainage structures associated with the boat section will convey the water to a pump station for transport to the stormwater treatment facilities.

Type I stormwater that falls on the apron adjacent to the material storage areas or aprons between loading tracks will run to catch basins. Once collected in the basins, the water will be conveyed to the stormwater treatment facilities. A liner will be placed under the drainage system for the loading area (aprons and tracks)

Runoff Collection from R&D Tracks

The R&D tracks are used for receiving empty train sets and assembling and staging loaded and sealed train sets. Materials staged on these tracks will be fully contained in rail cars, therefore this is designated a Type II stormwater collection area. Stormwater drainage will be collected from these tracks and routed to Sediment Basin B.

Delivery Spur (Chemicals and Other Materials)

The delivery spur will support the delivery of materials that are used in the onsite processing and treatment facilities. The track will be conventional ballasted track and sized to accommodate up to three rail cars of liquid polymer and up to two rail cars of solidification reagent.

<u>Processed Sediment Storage and Loadout Procedures</u>

The storage and loadout facilities are adjacent to the loading tracks in the rail yard. Materials from the processing facility can either be directly loaded into rail cars or brought to the storage areas and stockpiled. During Phase 1, there will be a need to load a maximum of three unit trains per week.

Storage Areas

During Phase 1 operations, five storage areas have been designated to stockpile processed materials, including:

- Stockpile 1: Debris that is directly offloaded from the barges and oversize material collected from the grizzly (bar screen) at the waterfront;
- Stockpiles 2&3: Coarse material discharged from the trommel and hydrocyclone/dewatering screen; and
- Stockpiles 4&5: Fine material discharged from the filter presses in the dewatering plant.

The debris storage area will accommodate the larger material (such as tree stumps, tires, or other large debris) taken from the barges that is not capable of going through typical processing. This material will be transported to the storage area via truck, where it will be prepared for loadout via special rail cars. This area will be built alongside the coarse material storage structure to reduce the travel distance to and from the waterfront facility.

The coarse material piles will accommodate coarse screened solids transported via truck from the vibratory dewatering screens, and the oversize solids from the rotary trommel screens located at the waterfront. The coarse material storage areas will be located at the northern section of the storage and loadout facility to reduce the travel distance to and from the waterfront facility.

The fine material storage structures will accommodate filter press cake transported from the dewatering system via roll-off containers by either forklift and/or trucks. These fine material storage structures will be located at the southern section of the storage and loadout facility to reduce the travel distance to and from the dewatering area.

The purpose of having two stockpiles for both the fine and coarse material is to allow for the material to be stockpiled in one area while being offloaded to the rail cars from the other. The staging areas required are dependent on the amount of dredged material being processed through the facilities and the amount of material being taken off site via rail cars on a daily basis. Storage area requirements were estimated based on an assumed facility loadout rate of approximately 17,000 to 25,000 tons per week (two to three unit trains per week). The projected 23-week average Phase 1 dredging rate is approximately 19,000 tons per week (after processing). However, the peak generation of processed material is 28,000 tons per week (based on 23,500 cy dredged).

During operations, the total volume of material stockpiled at any time will depend on the variability of the rate of dredging and sediment processing and the variability of rail service. Therefore the amount of material in storage will change constantly. With the dredging plan as a basis and assuming two unit trains per week, the maximum storage requirement would be approximately 83,000 cy. During Phase 1 Final Design, a logistics model will be developed to account for potential variability in dredging rates and rail service. This model will be used to determine the final design size of the stockpiles.

The processed material staging area provides buffering between sediment processing flows and rail car loading rates. This staging area also has contingent secondary storage to minimize the impact of upsets in rail service on other project elements.

The design of enclosures, if any, for the stockpiles, will be completed during Phase 1 Final Design. The objectives for enclosure of areas were described in Section 3.6.2.2.

In addition, while coarse sediments can be exposed to rainfall without significant moisture increase (provided adequate drainage is installed under the storage area), stockpiles of finer materials may be covered to reduce the amount of moisture that is absorbed from precipitation. These areas may also be enclosed to reduce the volume of Type I stormwater to be captured, contained, and treated. The stormwater containment, conveyance, and treatment design will be modified if these areas are enclosed.

Loadout Procedures

For Phase 1, it is anticipated that one to two wheel loaders will operate at each end of the loadout facility. The trains being used to relocate the material offsite will be 81 cars long, and since both loadout aprons are 2,450 feet long, each will be capable of accommodating 41 rail cars. Therefore, two wheel loaders at each end of the apron will be responsible for loading approximately 41 rail cars (20 or 21 on each track). After 21 rail cars are loaded at each end of track number two and the lids/tarps are secured, the rail cars will be shifted and track number one will be loaded. This method will increase traffic safety at the facilities because only two wheel loaders will be operating at a single location at one time, resulting in less interference, both at the rail car apron and at the storage facility. Assuming the contractor uses a wheel loader similar to the 988H Caterpillar with a bucket size of 8.7 cy, and a rail car capacity of 80 cy of processed material, this would result in an average loading time of approximately 4 to 8 hours per track (41 cars), accounting for shift changes or required train movement.

The rail yard as designed would be able to support crews as they remove and then reinstall lids onto rail cars. Once a rail car is loaded, the lid can be picked up off the pavement and secured on the loaded rail car. It is anticipated that during Phase 1, after 41 rail cars are spotted on the unloading tracks, the rail cars can then be prepared for loading by removing the lids and/or adding liners and tarps, as necessary. Rail cars can be loaded as this preparatory work progresses on each of the cars. The preparation and loading of rail cars is expected to be a continuous process from the time the rail cars are spotted for loading until the last of the 41 cars is loaded and the lid and/or tarp is placed.

3.6.7 Interrelationships with Other Project Elements

The design of the processing facilities directly interacts with other project elements, such as dredging, dredged material transport, rail transportation, and disposal. The integration of these project elements affects productivity and costs. The design includes features to reduce the effects of downtimes, surges in flow, and changes in composition. Features in the sediment processing plant that facilitate the interface between dredging and dredge material transport include: staging capacity for empty and full barges at the waterfront, backup, redundant, or modular processing equipment, equalization of fines before thickening, and redundant pumps. The water treatment plant has equalization tanks for process water and stormwater, parallel treatment operations, a cross-over line to balance processing and stormwater surges, redundant pumps, standby filters for change over during backwash operations, and two carbon vessels in series. The processed material staging area provides buffering between sediment processing flows and rail car loading rates. This staging area also has contingent secondary storage to minimize the impact of upsets in rail service on other project elements. Within limits, these features are intended to allow reliable operations of land-based facilities and dredging and processing operations to continue when rail transport schedules are upset. As discussed in Section 1, an FMEA will be performed during Phase 1 Final Design which may affect the specification of redundant or back-up equipment.

Specific interrelationships result from selection of dredge type and design of an operating plan, which affect the quantity and composition of dredged material for processing. Other influences include the transport methods, rates, volumes, and solids concentrations in the dredged material slurry. Landfill disposal criteria and discharge water quality limits also influence the processing facility design.

Similarly, the processing facilities design decisions affect the operation of other project elements, including dredging, dredged material transport, and transportation for disposal. Bottlenecks created by limited processing facilities capabilities could affect dredging and barging flexibility and rail transport schedules. Quantities and physical/chemical characteristics of the processed material influence the transportation and disposal project elements. The incorporation of storage facilities allows rail loading and transport to continue during unplanned outages or down times of dredging or processing operations.

3.7 Transportation for Disposal

The transportation for disposal element involves the movement of processed sediment and other project waste material to one or more approved disposal facility locations. As discussed in Section 2, the ROD (EPA, 2002a) requires the use of rail or barges to move processed material out of the Hudson River Valley for disposal. Depending on how the material is transported to its final destination, and the final destination itself, the material may have to be transferred from one mode of transportation to another before final disposal. For example, if the material is loaded into rail cars at the processing facility site, but the disposal site lacks direct rail access for unloading, the material will have to be transferred from rail cars to trucks (transloaded) for final delivery to the landfill, most likely at a transload facility in the vicinity of the landfill. Materials that are acceptable for beneficial use can also be transported from the processing facility site by any of three modes: barge, railroad, or truck.

During the design of this element, various transportation scenarios, including those summarized below, were evaluated to determine the safest and most efficient transportation system for the project given the quantities of materials contemplated by the Productivity Performance Standard and the other project parameters and constraints. In general, movement of the large volumes of processed material required to be transported under the ROD and related EPA directives will require the design and development of a large-scale transportation system. This system will require significant infrastructure at the processing facility site and destination landfill, dedicated to moving project materials. Transportation scenarios evaluated include:

- Transportation of processed materials in "unit trains" (i.e., trains consisting entirely of rail cars of project waste traveling from the origin to the destination, instead of small groups of rail cars of project waste that are intermingled with rail cars carrying other commodities traveling to different destinations) from the processing facility site to one or more of the following destinations:
  - Landfill(s) with existing or proposed direct rail service;
  - Existing or proposed transload facilities where the materials can be loaded into trucks for delivery to the landfill(s);

- Transportation of processed materials in river barges to a terminal location with rail access, and transfer to rail cars for delivery to the landfill(s) in unit train service, as described above; and

- Transportation of processed materials in river barges to a deep-water location, and transfer to larger capacity oceangoing barges for shipment to one or more of the following destinations:
  - Landfill(s) with existing or proposed barge terminal service at the site;
  - Existing terminal facilities where the materials can be loaded into trucks or rail cars for delivery to the landfill(s).

In addition, the evaluation of rail options included consideration of the use of containers on flatbed rail cars or bulk commodity ("gondola") rail cars. Each option entails unique logistical and operational considerations, which are referred to below.

The transportation analysis considered several combinations of destinations for processed materials, including the following:

- Separately located transload (existing and proposed) and/or final landfill destinations for waste materials containing PCBs at concentrations equal to or greater than 50 mg/kg, and materials with PCB concentrations less than 50 mg/kg;
- A single transload facility (existing and proposed) that could handle both types of materials, with truck transportation to separate landfills permitted to dispose of each type; and
- A single transload and/or final landfill destination for all materials, without differentiation as to PCB concentration (i.e., treat all material as though it contains greater than 50 mg/kg PCB and dispose of it in a landfill authorized to accept such waste) – this option was defined in the PDR (BBL, 2004a) as the "monofill" scenario.

A more detailed discussion of the potential destination logistics for Phase 1 is presented in Section 3.8.

3.7.1 Basis of Design

The specific basis for the transportation element design is summarized in the following Table 3-41. These items are in addition to, or further develop, the general basis of design discussed in Section 2.

Table 3-41 – Basis of Design for Transportation Element

Item	Value	Source/Notes
Tonnage requiring transportation during Phase 1	390,000 tons	Based on Phase 1 dredging plan (265,000 cy inventory; plus 500 cy/day residual, 6 days/week, 21 weeks); average processing facility output of approximately 1.2 tons/*insitu* cy.
PCB concentration for waste disposal characterization	50 mg/kg	Assumes post-processing sampling and analysis for waste characterization; separate landfill destinations based on PCB concentration can be used based on TSCA PCB remediation waste risk-based disposal (see Section 2.2.5).
Processed sediment shipping season	May 15 to December 31 (33 weeks)	Based on EPS requirement of all material shipped from processing facility by end of calendar year.
Available stockpile capacity for processed material	80,000 cy (120,000 tons)	Processing facility design. Space has been reserved for secondary stockpiles, if rail service is unreliable.

3.7.2 Results of Rail and Barge Transportation Analysis

The analysis of the rail and barge transportation options described above was conducted in conjunction with the evaluation of the preferred processing facility site and the evaluation of disposal facilities suitable to handle project wastes (see Section 3.8 below). This section provides a summary and the results of the analysis.

3.7.2.1 Rail Analysis

The preferred processing facility site is adjacent to a rail line owned and operated by the Delaware & Hudson Railway Company, Inc., (D&H), a subsidiary of the Canadian Pacific Railway (CPR). For purposes of this report, both the D&H and CPR will be referred to as "CPR". The most efficient means of transporting project materials by railroad would be to create unit trains of rail cars of project material that would be transported solely by the CPR to a single destination landfill or transload facility and back again for re-loading. Such a "shuttle" service, which is used by CPR and other railroads to transport large volumes of coal, grain, and other bulk commodities, provides an opportunity to ship such volumes in an operationally efficient manner with a minimum of service disruptions or other delays. However, CPR does not serve any candidate landfill sites directly, nor does it currently serve any existing transload facilities that could be used to transfer project wastes to trucks for final delivery to a candidate landfill. This limitation necessitates the creation of a joint-line movement of the processed material to the ultimate disposal destination (i.e., the "handoff" by CPR of trains carrying the material to one or more different railroads for delivery to the destination from agreed-upon interchange points). Joint line rail movements can be efficient, but the introduction of additional railroads and interchanges into a rail movement complicates the overall logistics and significantly increases the possibility of service disruptions and other delays. Under the options currently being considered for Phase 1, the locations of suitable landfills/transload facilities, combined with the limitations of CPR described above, mean that potential rail movements could utilize up to four separate Class 1 and short line railroads for the complete rail movement.

Numerous factors were considered in the analysis of the rail option for transporting processed sediment and other project waste for disposal, including the following:

- The availability of adequate numbers of gondola rail cars (or containers and flat bed rail cars) and locomotives to accommodate the large volume of project materials;
- The ability to construct a rail yard of sufficient capacity at the selected processing facility site to allow loading of rail cars and staging of unit trains of both empty and loaded cars, potentially for separate waste streams and landfill destinations to accommodate materials with different PCB concentrations;
- The relative space requirements of using containers versus gondola rail cars and whether such requirements limit or preclude either option given the acreage of the processing facility site locations;
- The ability of the landfill (or transload) destination(s) to unload rail cars and assemble unit train sets of empty rail cars (this is discussed in more detail in Section 3.8); and
- The expected degree of reliability of rail transportation, and whether contractual assurances of reliable rail service could be obtained. In the absence of such assurances, the analysis included determining the extent to which, the design would have to include measures to enable dredging and processing to continue in the event rail service was disrupted or delayed.

The development of the Phase 1 Intermediate Design of the transportation element for Phase 1 involved a number of steps that followed the extensive initial investigations described in Sections 9.2 and 9.3 of the PDR (BBL, 2004a). In July 2004, a Request for Proposals (RFP) was developed and sent to each railroad that could (depending on the potential processing site location and landfill destination) participate in the project. The RFPs were preceded by face-to-face discussions between GE and railroad representatives. The RFPs solicited potential pricing information and service/financial terms for Phase 1 of the project, based on combinations of origins, points of interchange with other railroads, and destinations. Based on the information provided in the RFP responses, discussions with potential landfill destinations, and ongoing analysis of potential processing site locations among the final candidate sites, discussions were held with CPR as well as with several other Class 1 railroads with whom CPR would connect to deliver processed materials to the final disposal destination(s).

These included CSX Transportation (CSX), Canadian National Railway (CN), Union Pacific Railroad Company (UP), and Norfolk Southern Railway Company (NS). In addition, GE has contacted various short line railroads that, depending on destination, would also participate in the project. The discussions with the individual railroads are ongoing, and are expected to be finalized once the final landfill destination(s) is determined during the Final Design for Phase 1. The information exchanged during the RFP process and subsequent discussions with candidate railroads and landfills has shaped the Phase 1 Intermediate Design of the transportation element. However, GE notes that until transportation terms and conditions are finalized with the railroads, the scenarios and design conclusions discussed in this report are subject to significant change.

As stated above, because of the volume of material to be produced by the project, the use of unit trains was determined to be the only viable approach. This was the consensus after the initial investigations and discussions with the railroads, and this was reflected in the RFPs. The railroad industry prefers unit train service of large volumes of a single commodity, as it makes it easier for them to try and schedule service at regular, defined intervals. Such service enables very large quantities of certain commodities to be transported over the interstate railroad network in relatively short periods of time (for example, the Class 1 carriers transport hundreds of thousands of tons of coal monthly for their utility customers). However, such regular defined service has not been promised for movement of project waste by any railroad during the discussions to date, thus creating the risk of accumulations of processed waste at the origin facility and adverse effects on the project as a whole. This uncertainty requires that project design include processed sediment storage areas at the processing facility site of sufficient capacity to permit the continuation of dredging and processing operations in the event of railroad service delays or interruptions, and also to allow the steady flow of materials leaving the site in the event of peaks and valleys in sediment dredging and processing rates.

Another important aspect of the rail transportation design is the supply of rail cars and/or containers necessary to ensure regular unit train service from origin to destination. Based on GE's discussions with the railroads, and on the logistics and space constraints associated with the loading, unloading, storing and managing a large number of individual containers for a project of this size, it has been determined that movement of processed materials in bulk using gondola-type rail cars will be the most efficient means of accomplishing project objectives.

To avoid decontaminating individual rail cars each time they are unloaded at the landfill destination, and to assist the rail carriers to provide reliable and predictable rail service, a fleet of rail cars dedicated to the project is required. The dedicated rail cars would be acquired and supplied to the railroads to be used exclusively for this project. The actual fleet size requirements will not be determined until the final landfill(s) is selected during the Phase 1 Final Design, but will be based on a number of factors including:

- Estimates from the railroads of the time it will take to deliver a unit train from origin to destination and back again ("movement cycle time");
- Whether it will be necessary to have extra trainsets of rail cars stationed at both origin and destination so that the railroads can simply "drop off" empty and loaded trains, respectively, and "grab" another loaded or empty trainset, as the case may be, instead of waiting for the delivered train to be loaded or unloaded; and
- The number of spare rail cars required to accommodate the need for maintenance and repairs.

As part of the Phase 1 Intermediate Design, the existing rail car market in the United States has been evaluated, and discussions with rail car suppliers have been initiated to determine the availability of adequate numbers of cars. Since the ROD was issued, the availability of rail cars in the United States has decreased dramatically. Consequently, it is expected that a fleet of between 350 and 650 new rail cars (depending on the landfill destination) fabricated specifically for the project will be required. Depending on individual rail carrier requirements and landfill unloading infrastructure available, either sealed cars equipped with watertight, hard lids or cars individually fitted with a plastic liner that is wrapped over the material and sealed (referred to as a "burrito-wrap" technique) may be specified for the project. This determination will be made during Phase 1 Final Design.

3.7.2.2 Barge Analysis

Under the barge scenarios considered by GE, the processing facility site could be used for loading river barges with processed materials for delivery downriver to a location where the materials would be transferred to larger, ocean-going vessels or to rail cars for delivery to the landfill destination(s). Several key factors were considered during the Phase 1 Intermediate Design evaluation of the barge options for transportation of processed material for disposal; these are discussed below.

- ***Champlain Canal lock logistics, cycle times, and availability of river barges for the shipment of processed material downriver from the processing facility to the Port of Albany area:*** To utilize the barge option, processed sediment must be loaded onto river barges at the processing facility and floated downriver to a point where they can be offloaded to either rail cars or larger, ocean-going vessels. This necessitates navigating seven locks, using a fleet of approximately eight to ten, 1,500-ton capacity river barges during peak Phase 1 production.

- ***Availability of contingency measures in the event of a spill or other accident at sea:*** If the processed material were to be transferred to an ocean-going barge for transportation to a major port facility outside the Hudson River valley for subsequent transfer to rail cars or trucks, the risks associated with an accidental release during transit (e.g., due to the capsizing of a barge in bad weather) would be greater than the risks associated with a release on land. The design of a barge transportation option would also have to consider contingency actions to address such releases.

- ***Ability to stockpile processed materials to facilitate transfer from river barges to rail cars or oceangoing barges:*** To accommodate potential delays in railroad or barge service, a stockpile area near the rail transfer or ocean-going barge loading facility would be necessary as a "buffer." It is anticipated that such a stockpile area would be designed and operated in accordance with TSCA regulations, which require, among other things, secondary containment and covers.

- ***Availability of port facilities to unload materials containing PCBs for transfer to rail cars or trucks:*** The analysis of the barge transportation option during the Phase 1 Intermediate Design considered several possible major ports for the transfer of processed sediment from ocean-going vessels to rail cars or trucks, including Norfolk, Savannah, Houston, Corpus Christi, Port Arthur, and Portland (Oregon). Several other smaller ports were also evaluated for their ability to handle project materials. None of the ports and terminals that were evaluated had experience with the transfer of waste materials containing PCBs, and all would require special infrastructure improvements (such as dedicated barge unloading equipment) and regulatory approval to accommodate the receipt of processed material from the project.

In addition to these factors, use of the barge option for transportation of processed materials would require double- or triple-handling of contaminated materials. Each time the material must be transferred from one mode of transport or vessel to another, the risks and costs associated with the transportation element increase significantly.

3.7.2.3 Summary of Results

The results of the rail and barge analyses described above are that transportation by rail in bulk (gondola) rail cars as described in this report should provide the safest, most efficient means of transporting project waste in the volumes contemplated by the ROD and other EPA directives. However, the refusal of the railroads to commit to provide regular, predictable service, which is due in part to current industry-wide capacity, service issues, and equipment problems, introduces certain risks that require the project design to include mechanisms to try and limit the disruptions to the project and overall project objectives that will be caused by delays in processed materials being removed from the processing facility site. Nevertheless, despite the risks associated with using railroad transportation to move project waste to final disposal facilities, the multiple handling of materials, potential releases to aquatic environments in the event of an accident during transportation, and limited industry experience with handling PCB materials under the barge scenarios were judged at this time to have too much risk to justify selection of the barge option as the means of transporting project waste in Phase 1.

As discussed, the selection of the train routing, rail car fleet size, and participating railroads for Phase 1 of the project is expected to be made upon the identification of the final landfill destination(s) during development of the Phase 1 Final Design.

3.7.3 Interrelationships with Other Project Elements

The transportation of project waste for final disposal is intertwined with and directly dependent upon other project elements. Transportation of project materials is dependent on: 1) the linehaul railroads' willingness/ability to pick up loaded trains of waste and deliver empty trains of rail cars at a rate that enables the project to meet the EPA's production goals and performance standards; 2) the amount and type of "commodity" to be shipped (i.e., monthly and total volumes for disposal, processing facility production rates, sediment physical characteristics, other processed materials to be shipped, sediment chemical characteristics, and back-end storage capacity at the processing facility); and 3) the capability of the final disposal location to expeditiously unload trains of project materials and return them to the railroads for delivery back to the origin.

Similarly, the transportation project element directly influences the choice of a final disposal location. As discussed in the PDR (BBL, 2004a), the number of potential disposal facilities that have rail or barge accessibility is quite limited. Moreover, even though certain disposal facilities are connected to a railroad, most are not connected to more than one. Consequently, selection of a particular railroad or combination of railroads and other transportation modes results in further narrowing the list of available disposal sites. Specific disposal facility waste receipt and unloading capabilities (e.g., current and planned facility capacity or the ability to expeditiously unload gondola rail cars) will influence the design of the processed material storage and loading facilities, as well as the design of the rail yard layout and operational logistics at the project area.

Finally, the choice of multiple disposal facilities versus a single site able to accept all waste streams from the project will have major effects on both the sediment processing and the storage and loading of processed material. Multiple waste streams (assuming the appropriate EPA Regions approve disposal of materials with PCB concentrations less than 50 mg/kg under a risk-based disposal determination – see Section 2.2.5) will require multiple storage and loadout areas, while a single waste stream would allow a single storage and loadout capability. Multiple waste streams will also have a significant effect on the number and use of the rail cars used for the project, in that multiple routings and destinations will require additional rail cars, as will decontamination requirements. Finally, the identification of a viable beneficial use for a fraction of the processed material may require that the processing facility design include the facilities necessary to separately accumulate Beneficial Use Determination (BUD) material and, potentially, to accommodate transportation of processed material via trucks. This issue will continue to be evaluated during Phase 1 Final Design.

3.8 Disposal

The disposal element of the Hudson River project involves the unloading and landfilling of processed sediment at one or more disposal facilities, in accordance with their permit conditions. Potential beneficial use of a fraction of the processed material is also addressed as part of this project element. This section summarizes the efforts made as part of the Phase 1 Intermediate Design to identify a short list of viable candidate landfills for the disposal of processed sediment containing PCBs at concentrations of 50 mg/kg or greater, or materials with PCB concentrations of less than 50 mg/kg during Phase 1 of the remedial action.

Only nine landfills in the United States are currently authorized by the EPA to commercially accept materials containing PCBs at concentrations greater than or equal to 50 mg/kg for disposal ("TSCA landfills"). Under certain circumstances, some landfills that are permitted to accept hazardous wastes under the Resource Conservation and Recovery Act (RCRA) regulations ("Subtitle C" landfills), but that do not have federal TSCA authorization, as well as select municipal solid waste landfills ("Subtitle D" landfills) can also accept wastes containing PCBs at concentrations greater than 50 mg/kg, with specific approval of the appropriate EPA Region on a project-by-project basis. Non-TSCA materials (i.e., materials containing PCBs at concentrations less than

50 mg/kg) can generally be disposed of in municipal solid waste landfills. As discussed in the PDR (BBL, 2004a), the Phase 1 design also considered the potential for using an existing TSCA landfill as a monofill (i.e., a single location to accept all processed sediment, regardless of its PCB concentration). This approach would offer the advantages of eliminating the need for managing separate waste streams leaving the processing facilities, reducing the logistical demand of multiple storage and loading areas, material testing and segregation, and separate unit train construction.

The selection of landfill(s) for the disposal of processed materials is constrained by four requirements found in or flowing from the ROD (EPA, 2002a):

- The candidate landfill(s) must be outside the Hudson River Valley;
- The candidate landfill(s) must have adequate capacity to accept the volumes of materials to be shipped;
- The candidate landfill(s) must be capable of accepting materials with contaminant concentrations in the ranges anticipated from the project; and
- The candidate landfill(s) must be directly served by rail or barge, or be within a reasonable distance to rail or barge terminals or "transload" facilities where transfer of the materials to trucks can occur.

A summary of the process used to evaluate and select candidate landfills to serve the project is provided below.

3.8.1 Basis of Design

The specific basis for the disposal element design is summarized in the following Table 3-42. These items are in addition to, or further develop, the general basis of design discussed in Section 2.

Table 3-42 – Basis of Design for Disposal Element

Item	Value	Source/Notes
Tonnage requiring disposal during Phase 1	390,000 tons	Based on Phase 1 dredging plan (265,000 cy inventory; plus 500 cy/day residual, 6 days/week, 21 weeks); average processing facility output of approximately 1.2 tons/cy.
PCB concentration for waste disposal characterization	50 mg/kg	Assumes post-processing sampling and analysis for waste characterization; separate landfill destinations based on PCB concentration can be used based on TSCA PCB remediation waste risk-based disposal (see Section 2.2.5).

Item	Value	Source/Notes
Delivery mode	Via rail, using gondola rail cars; or via truck from a rail-to-truck transload facility	Transportation analysis. Rail delivery can be directly to landfills or to rail-to-truck transload facilities.
Moisture content of processed material	Passes paint filter test	Destination landfill.

3.8.2 Evaluation and Selection of Disposal Locations

In August 2003, GE solicited Statements of Interest (SOIs) from the nine TSCA-authorized landfills in the United States and from waste management companies, municipalities, and independent operators representing over 100 non-TSCA landfills located primarily in the eastern United States and Canada. The SOIs gathered information on a number of important parameters, including permitted and future expansion capacity, permit limitations, rail and/or barge accessibility, and landfill compliance history. Responses were received from all nine TSCA landfills, and from commercial entities representing approximately 35 non-TSCA landfills. A summary of the SOI responses was presented in the PDR (BBL, 2004a).

From the SOI responses, a "short list" of potentially viable disposal sites was identified for further evaluation as to each facility's ability to adequately serve the project. As discussed in the following subsections, five TSCA landfills and 14 non-TSCA landfills were selected for the short list based on their capacity (existing and/or future expansion capability), their existing or planned rail or barge capability, and a demonstrated interest in the project. It should be noted that the analysis of candidate disposal facilities was based on the current (2005) disposal industry market. This market continuously changes as landfill expansions are proposed and approved; new facilities are developed and/or existing facilities reach capacity and close; and emerging treatment/disposal technologies mature. Thus, options for the disposal of materials from the remedial action will continue to be evaluated during the development of the Phase 1 Final Design.

3.8.2.1 Disposal of Material with PCB Concentrations of 50 mg/kg or Greater

Table 3-43 (below) summarizes the TSCA landfills selected for the short list of candidate disposal facilities.

Table 3-43 - Short List of Candidate TSCA Landfills

Owner/Operator	Site Name	Location	Mode of Waste Delivery
Waste Management	CWM Arlington	Arlington, OR	Direct Rail (via UP)
American Ecology	US Ecology Simco	Grand View, ID	Rail-to-Truck Transfer (via UP)
Clean Harbors	Grassy Mountain	Knolls, UT	Rail-to-Truck Transfer (via UP)
The Environmental Quality Company (EQ)	Wayne Disposal	Wayne, MI	Rail-to-Truck Transfer (via CSX or Local Shortline)
Waste Control Specialists, LLC	Waste Control Specialists (WCS)	Andrews, TX	Direct Rail (via UP and Local Shortline)

During the Phase 1 Intermediate Design, RFPs were sent to each of these candidate TSCA landfills. The RFPs solicited the following information:

- Need for capital infrastructure improvements at each facility to accommodate the large volumes of project materials;
- Current and future capacity to handle unit trains;
- Current and future capacity to handle truck deliveries (for those landfills that would utilize a rail-to-truck transfer facility);
- Descriptions of current and future unloading facility capabilities, (e.g., stationary or rotary dumpers or direct rail car excavation);
- Descriptions of preferred rail car type (i.e., low- or high-walled gondola cars, hopper cars); and
- Analytical testing requirements for waste characterization prior to acceptance of materials for disposal.

In addition, meetings and discussions have been held with representatives of a number of the sites, and site visits and/or compliance audits have been completed at select facilities. Based on the RFP responses received from the candidate TSCA landfills and additional information provided during follow up discussions, the final landfill(s) for Phase 1 of the project will be selected. The results of this process will be documented in the Phase 1 FDR.

3.8.2.2 Disposal of Material with PCB Concentrations of Less Than 50 mg/kg

Table 3-44 (below) summarizes the non-TSCA landfills selected for the short list of candidate disposal facilities.

Table 3-44 - Short List of Candidate Non-TSCA Landfills

Owner/Operator	Site Name	Location	Mode of Transport
Allied Waste Industries	Lee County Landfill	Bishopville, SC	Direct Rail (via CSX)
	Wyandot Landfill	Carey, OH	Potential Future Direct Rail (via CSX)
	Ottawa County Landfill	Port Clinton, OH	Direct Rail (via NS)
	Taylor County Landfill	Mauk, GA	Potential Future Direct Rail (via CSX)
	Sauk Trail Hills*	Wayne, MI	Rail-to-Truck Transfer (via CSX or NS)
Republic Services	Carleton Farms*	Carleton, MI	Rail-to-Truck Transfer (via CSX or NS)
	Broadhurst Environmental	Screven, GA	Potential Future Direct Rail (via CSX)
	Sycamore Ridge	Pimento, IN	Potential Future Direct Rail (via CSX)
Eagle Environmental	Royal Oak Landfill	Chest Township, PA	Potential Future Rail-to-Truck Transfer (via Local Shortline)
Waste Management	Amelia Landfill	Amelia, VA	Direct Rail (via NS)
	Atlantic Landfill	Waverly, VA	Direct Rail (via NS)
	American Landfill	Canton, OH	Direct Rail (via NS)
	Five Oaks Landfill	Taylorville, IL	Direct Rail (via UP)
	Woodland Meadows*	Wayne, MI	Rail-to-Truck Transfer (via CSX or NS)

Note:

* These landfills were identified as part of a potential joint TSCA/non-TSCA rail movement with EQ.

As with the candidate TSCA landfills, RFPs were sent to each of the candidate non-TSCA landfills during the Phase 1 Intermediate Design to gather potential pricing and financial terms for Phase 1 of the project, and information on capital improvement needs, waste disposal capacity, unit train capacity and rail unloading capability, etc. Meetings and discussions have been held with representatives of a number of the short list non-TSCA sites, and site visits/compliance audits were completed at select facilities. Based on the RFP responses received from the candidate non-TSCA landfills and additional information provided during follow-up discussions, the final landfill(s) for Phase 1 of the project will be selected. The results of this process will be documented in the Phase 1 FDR.

3.8.3 Beneficial Use

As discussed in the PDR (BBL, 2004a), the potential beneficial use of any material from the project would be pursuant to a BUD in accordance with state solid waste management regulations. A number of potential beneficial uses for a portion of the dredged material were evaluated during the Phase 1 Intermediate Design, including: the use of a coarse fraction of the processed sediments as alternate daily cover at approved sanitary disposal facilities, fill material for mine reclamation, and/or river backfill materials; and the use of cobbles and boulders separated from the dredged material during processing as select structural materials for use in habitat replacement and reconstruction. Based on this evaluation, only natural debris such as cobbles and boulders separated from the dredged material and washed to remove sediment residuals will be considered for potential beneficial use in habitat replacement and reconstruction during Phase 1. The other possible beneficial use applications evaluated during the Phase 1 Intermediate Design did not provide any economic benefit compared to disposal in a landfill, were determined not to be viable because of a lack of market for the materials, or did not meet NYSDEC BUD requirements. These other uses may still be considered during Phase 2 of the project.

3.8.4 Interrelationships with Other Project Elements

The disposal element has several interrelationships with other project elements. As expected, the disposal element is influenced directly by the output of the transportation element (i.e., single or dual waste streams, final production rate, total tonnage, transload capacity, and transport mode). In addition, due to the strong influence that sediment and water processing exerts on transportation, the disposal element is also indirectly influenced by sediment and water processing rates.

Further, the ability for the disposal facilities (or in the case of a monofill solution, the single facility) to accept materials via rail (at the rate it is generated) is critical to the throughput and continuity of the overall process – from dredging and dredged material transport, to processing and processed material storage and loadout. Specific disposal facility waste receipt and unloading capabilities (e.g., the ability to handle gondola rail cars) affects the design of the processed material storage and loading facilities, as well as the design of the rail yard layout and operational logistics.

The choice of multiple disposal facilities versus a single, monofill disposal solution will affect the storage and loading of processed material; multiple waste streams will require multiple storage and loadout areas, while a single waste stream would require a single storage and loadout capability.

3.9 Backfilling/Capping

Following the completion of dredging in a CU (as discussed in Section 3.3.6), the backfilling/capping project element will commence. This section of the Phase 1 IDR describes the cap and backfill designs to be implemented for the project, along with a description of the types of backfill and caps and the circumstances in which they will be installed. Aspects of the backfilling/capping element that involve the supply, transport, and placement of materials are also addressed. Design details regarding backfilling and capping are provided in Attachment H, and referenced in this section where appropriate.

3.9.1 Basis of Design

The specific basis for the backfilling/capping element design is summarized in Table 3-45, below. These items further develop the general basis of design in Section 2.

Table 3-45 – Basis of Design for the Backfilling/Capping Element

Item	Basis	Source/Notes
Preliminary Backfill/Cap Footprint	Backfill: 40 acres assumed; with 63-acre maximum Cap: 40 acres assumed; with 80-acre maximum	Estimate is based on the size of the dredge areas for Phase 1 (assumed to be 80 acres). Proportions of area that will be capped cannot be confirmed at this time, since post-dredged residual concentrations are unknown. For this Phase 1 IDR, it is assumed that 40 acres will receive backfill and the remaining 40 acres will receive caps. No backfill material will be placed in the navigation channel. The approximate area of the navigation channel in the Phase 1 dredge plan is 17 acres.
Estimated Mass (Volume) of Backfill/Cap Material to be Placed in the River	217,000 tons (167,000 cy)	Based on the above-stated assumption of 40 acres of backfill and 40 acres of caps. Assumes 12 inches of backfill; estimate includes a 15% factor for construction tolerance; no backfill placement in 17 acres of navigation channel. Assumes 15-inch thick cap layer; estimate includes an additional 15% factor for construction tolerance. Estimate also accounts for the remedial action-specified 15% additional allowance for backfill (over 80 acres), the resultant volume of which is covered through the overall assumption that all 80 acres in Phase 1 will receive backfill or cap and the 15% construction tolerance allocation. This is basis for backfilling/capping placement and barge plan only.
Backfill Thickness	12 inches	From EPA's ROD (EPA, 2002a).
Residual Sediment Concentration Triggers Following Dredging	1 to ≥27 mg/kg Tri+ PCBs	Critical thresholds for Tri+ PCBs values include, but are not limited to: • ≤1 mg/kg (CU average) for backfilling; • 6 mg/kg (CU average) transition between Type A and Type B Isolation caps; and • ≥15 mg/kg and ≥27 mg/kg individual node concentrations requiring capping. See Attachment C for details.

Item	Basis	Source/Notes
Water Depth after Dredging	2 to 20 feet	Function of location in the river and dredging depths (range based on bathymetric data).
Flow Velocities	<1.5 ft/s (low flow); 1.5-3.5 ft/s (medium flow); >3.5 ft/s (high flow)	These three flow regimes are used as the basis for backfill and cap designs.
Flow Return Frequency	2-year 10-year 100-year	Basis of Backfill Design Basis of Isolation Cap Type A Design Basis of Isolation Cap Type B Design
Ice Conditions*	Varies	Basis for Type B cap design (see Attachment I)
Vessel Effects*	Varies	Basis for Type B cap design
Habitat Replacement and Reconstruction Objectives	Varies	See Habitat Replacement and Reconstruction (Section 3.10).
Seepage Velocity	0.18 $L/m^2/hr$	*Thompson Island Pool PCB Sediment Sources* (TIP Report) (QEA, 1998)
Dissolved Organic Carbon	33.7 mg/L	TIP Report (QEA, 1998) Butcher and Garvey (2004)
Hydrodynamic Dispersion Coefficient	1E-10 m^2/s	Tchobanoglous and Schroeder (1985)
K_{OC}	$10^{5.4}$ L/kg	TIP Report (QEA, 1998)
K_{doc}	$10^{4.4}$ L/kg	(Koc *0.1)
Sediment TOC	2.5%	Range 1-4% (GE, 2004 - SSAP) 1.8% (Butcher and Garvey, 2004)
Thickness of isolation layer	6 inches	Used to predict duration of steady state flux retardation for the caps.
TOC of isolation material	0.5%	To provide sufficient retardation properties; expected to be available from local sources.
Cap Bulk Density	1.5 g/cm^3	Assumed (typical value for sands).
Cap Porosity	0.4	Assumed (typical value for sands).
Bioturbation	<6 inches	Literature values (Thoms et al, 1995; Palermo et al., 1998; National Research Council [NRC], 2001)

Note:
* Type A Isolation caps do not account for the effects of ice or vessel effects. However, they will still resist effects associated with such phenomena.

The basis of design for the backfilling/capping element is discussed in greater detail in the Design Analysis for Backfilling/Capping (Attachment H).

3.9.2 Backfill and Cap Types

As described in the Phase 1 ID PSCP Scope (Attachment C), backfill may be placed in a certification unit when the appropriate numerical residuals standard has been met. The design objectives for placement of backfill are to:

- Stabilize residual sediment and reduce post-dredging surface sediment PCB concentrations; and
- Re-establish river bottom substrate for habitat replacement and reconstruction.

Backfill material types are selected based on overall stability (under a 2-year return flow event) as well as habitat needs. Backfill will not be placed in the navigation channel.

The placement of an engineered cap is an engineering contingency to be used only if the post-dredging residuals standard (an average of 1 mg/kg Tri+ PCBs) is not be achieved by dredging. Caps may be constructed of sand or gravel or may, if necessary, involve a more complex design using multiple layers, including the use of conventional marine construction equipment and techniques.

The design objectives for the sub-aqueous engineered caps as specified in the Engineering Performance Standards (Volume 3) include:

- *"Physically isolate the residual sediments from indigenous benthos and minimize bioturbation of the residual sediments;*
- *Resist erosion due to currents, vessel wakes and waves, propeller wash, and ice rafting, etc. and stabilize the contaminated sediments (i.e., prevent resuspension and migration of the contaminated sediments);*
- *Minimize or eliminate the flux of contaminants into the water column;*
- *Maintain integrity among the individual cap layers/components (e.g., address consolidation of compressible materials);*
- *Include consideration of additional protective measures and institutional controls that are needed (e.g., additional controls for caps constructed in any area where future navigation dredging may be necessary, notifications to boaters not to drop anchor in capped areas, etc)."*

The cap design also must address the following elements:

- Selection and characterization of materials for cap construction;
- Equipment and placement techniques to be used for cap construction;

- Appropriate monitoring and management program, including construction monitoring during cap placement, followed by a long-term monitoring and maintenance program (which will include periodic inspections and actions that may be required based on the inspection results); and
- Ability to isolate the contaminated sediments chemically such that the concentration of Tri+ PCBs in the upper 6 inches of the cap is 0.25 mg/kg or less upon placement.

The final decision regarding appropriate backfill or cap type for each dredged area will be made after dredging when residuals concentrations are known. Specific areas to be capped will be determined in accordance with the procedures described in the Phase 1 ID PSCP Scope (Attachment C). EPA will be integrated in the decision-making process through review of site-specific cap design, which is subject to EPA approval via the CU completion process. The decision regarding the appropriate cap type will be made in the field by GE's field representative (in consultation with the design engineer and subject to approval by EPA's field representative). The decision in the field will only be for which prototype is appropriate for the particular river condition (velocity, habitat, etc.), guided mainly by information in the Phase 1 FDR, in conjunction with the Tri+ PCB concentration in the areas of the CU to be capped.

Drawings C-0001 thru C-0047 present plan views illustrating potential areas and types of backfill and caps, based on flow regimes. Drawing C-0048 shows typical cross-sections for the prototypes of isolation caps.

3.9.2.1 Backfill Types

Backfill will consist of a 12-inch layer of granular material placed on top of the residual sediment in dredged areas, as defined in the ROD (EPA, 2002a). An exception will be made if less than 12 inches are removed in a particular dredge area, in which case, sufficient backfill will be added to restore it to the original (pre-dredging) river bed elevation. Details of the shoreline stabilization and slopes between backfill and capped areas will be developed for inclusion in the Phase 1 FDR.

Backfill material will be used to sequester residual PCBs and facilitate habitat replacement and reconstruction where appropriate. The desired substrates are identified and backfill material is specified to provide a geomorphically stable bed (i.e., sizing was refined to be stable under the hydrodynamic forces associated with a 2-year flow event, see Attachment H).

Figures 3-21 and 3-29 further illustrate the design logic for selection of backfill, using residual sediment characteristics (Figure 3-21) and habitat objectives (Figure 3-29). Accordingly, one of the following two types of backfill material will be placed in the dredged areas:

- **Type 1 Backfill – Medium-Grained Material:** This material will consist of medium sand of approximately 0.5 to 2.0 mm D_{50} with total organic content ranging from trace up to 2.5%. The actual TOC range of Type 1 material will be refined during the Phase 1 Final Design based on anticipated material availability. Type 1 material will be used alone or in combination with other materials (cobbles, wood debris, etc.) as a substrate for aquatic vegetation bed and riverine fringing wetland habitats. This material may also be used to replace or reconstruct unconsolidated river-bottom habitat to allow benthic macroinvertebrate colonization. Type 1 material can be placed at any water depth where flow velocities are below 1.5 ft/s.

- **Type 2 Backfill – Coarse-Grained Material (Fine Gravel):** This material will consist of fine gravel of approximately 6.0 to 12.0 mm (0.25 to 0.5 inch) D_{50} Total organic matter content is expected to be minimal. The actual TOC of Type 2 material may be refined during the Phase 1 Final Design. This material will be used to replace or reconstruct unconsolidated river bottom or aquatic vegetation bed habitat to allow benthic invertebrate recolonization and provide fish habitat. Type 2 material can be placed at any water depth where flow velocities are above 1.5 ft/s.

A plan view of potential backfill types to be placed in the river areas is shown on Drawings H-0001 through H-0024. The primary consideration when selecting the type of backfill material to be placed will be water velocity, which controls the ability of the selected backfill material to provide a stable substrate to support the habitat reconstruction and replacement goals for the area. Backfill will not be placed in the navigation channel or in sections of the river where the resultant deeper water (following remediation) is desired for habitat purposes. Backfill will not be placed in areas where post-dredged surficial Tri+ PCB concentrations are less than 0.25 mg/kg, unless necessary to meet specific habitat goals, as these areas would already meet the substantive requirements of the ROD (EPA, 2002) and the Hudson EPS (EPA, 2004a).

Details of the design process for the selection of these backfill types are presented in the Design Analysis for Backfilling/Capping (Attachment H). Further details of the habitat design aspects are presented in Section 3.10 and will be expanded in the Phase 1 Final Design.

3.9.2.2 Cap Types

The primary function of a residuals cap is to act as a physical barrier that provides both isolation and stabilization. Placement of the cap will sequester residual sediment from direct interaction with the overlying water column or benthos. An armor layer (if needed) will provide additional protection of the isolation layer through resistance to hydrodynamic forces, thereby preventing the exposure of the sediment containing residual PCB concentrations.

In cases where the average residual Tri+ PCB concentration is greater than 6 mg/kg, the second function of a residuals cap is to serve as a chemical barrier. Essentially, no driving forces would cause the movement of residual sediments upward through a cap with a chemical isolation layer (Palermo et al., 2000). With a cap present, PCB mobility is principally associated with the dissolved phase migration through the cap by diffusion or advection, both of which are very slow processes compared to mass transfer processes that occur when PCBs are present in surface sediments. The chemical isolation layer of the cap is intended to control the migration of dissolved PCBs through the cap, and is effective for containment of highly hydrophobic compounds, such as PCBs, which preferentially sorb to and concentrate in the organic fraction of the cap material.

During Phase 1 Intermediate Design, two types of caps (Isolation Cap Type A and Isolation Cap Type B) are specified as prototypes to account for various conditions in the river, including the following:

- Residual PCB concentration in sediment;
- Hydraulic forces expected to act at the particular CU;
- Stability of the sediments or cap with respect to scour;
- Bearing capacity of the underlying strata;
- Proximity to shoreline; and
- Proximity to the navigation channel.

The cap prototype design and eventual application will also be based on practical limitations and efficiency of the dredging and capping operations, and account for factors such as cap placement success (in previously capped CU areas), consolidation, and slope stability. Analysis of consolidation and slope stability will be conducted during Phase 1 Final Design; however, the final analysis of geotechnical stability of the cap will be determined in the field prior to placement, since the exact locations to be capped (and their associated geotechnical properties) will not be known until dredging in a CU is completed (i.e., after analysis of post-dredging residual Tri+ PCB concentrations).

The two types of caps are:

- **Isolation Cap Type A,** to be placed in a CU where the average Tri+ PCB concentration after dredging is less than or equal to 6 mg/kg and capping is necessary; and

- **Isolation Cap Type B,** to be placed in a CU where the average Tri+ PCB concentration is greater than 6 mg/kg after dredging and GE and the EPA have determined that additional dredging is not required.

Caps will be placed over sampling nodes in the CU such that the arithmetic average Tri+ PCB concentration of the uncapped nodes is 1 mg/kg or less, and no individual uncapped node has a Tri+ PCB concentration at or above 15 mg/kg (see Attachment C).

For purposes of design and construction of caps, the design objectives described above in Section 3.9.2 will be satisfied so long as the cap meets the bases of design set forth below.

The basis of design for Isolation Cap Type A will be as follows:

- The design objectives shall be achieved by installation of an armoring layer designed to withstand a minimum 10-year recurrence interval flow event.
- A filter layer (i.e., layer of material with smaller particle size to separate residuals from the armor) will be installed below (or mixed in with) the armor layer, if necessary, to prevent transport of residual sediment up through the armor material. An Isolation Cap Type A will have a total thickness of at least 12 inches when installed, which will satisfy the objective of isolating the residual sediments from indigenous benthos and limiting bioturbation of residual sediment.

The basis of design for Isolation Cap Type B will be as follows:

- The design objectives will be achieved by installation of an engineered isolation layer and an armor layer.

- The isolation layer will consist of material to physically and chemically isolate PCBs in contaminated sediment from the overlying water column. This layer may include a filter layer if deemed necessary for armoring purposes. An Isolation Cap Type B that includes an isolation layer that is at least 6 inches thick and have a minimum TOC content of 0.5% when installed shall satisfy the objective of reducing the flux of Tri+ PCBs from contaminated sediment into the water column. In addition, an Isolation Cap Type B will have a total thickness of at least 12 inches when installed, which will satisfy the objective of isolating the contaminated sediments from indigenous benthos and limiting bioturbation of residual sediment.
- An armoring layer will be designed to withstand a 100-year recurrence interval flow event. The armoring layer will also be designed to withstand ice events, vessel wake, and propeller wash in areas likely to be subject to such events.

Both cap types will have specifications to address the range of velocities predicted in Phase 1 areas at the appropriate flow event. The prototype cap designs selected for this project are listed below and illustrated on Drawing C-0048.

Isolation Cap Type A

Isolation Cap Type A will be placed in CUs where the average Tri+ PCB concentration is less than or equal to 6 mg/kg. The primary purpose of Isolation Cap Type A is physical isolation of residual sediments and its configuration will vary depending on the specific river flow regime. The armoring for the type A cap design is based on the Isbash approach (see Attachment H), which is the standard armor design practice in the USACE guidance document (USACE, 1998).

For low-velocity areas (areas with flow velocities less than 1.5 ft/s during a 10-year recurrence interval flow event), Isolation Cap Type A will consist of a 12-inch layer of fine gravel (0.25- to 0.5-inch D_{50}).

For medium- to high-velocity areas (areas with flow velocities greater than 1.5 ft/s during a 10-year recurrence interval flow event), Isolation Cap Type A will consist of a 6-inch armor layer of coarse gravel (2-inch D_{50}), which overlays a 6-inch layer of fine gravel (0.25- to 0.5-inch D_{50}).

Details of the design process for the cap types are presented in Attachment H.

Isolation Cap Type B

Isolation Cap Type B will be placed in CUs where the average Tri+ PCB concentration is greater than 6 mg/kg and additional dredging is not required. Isolation Cap Type B is intended to provide both chemical and physical isolation of residual sediments. Like Type A caps, the armoring for the type B cap design is based on the Isbash approach (see Attachment H), which is the standard armor design practice in the USACE guidance document (USACE, 1998). However, an additional factor of safety of 1.33 is used in the Type B caps to provide additional protection from vessel and ice forces.

For Isolation Cap Type B in low-velocity areas (areas with flow velocities less than 1.5 ft/s during a 100-year recurrence interval flow event), the cap design will consist of (from bottom to top):

- 6-inch isolation layer of fine sand with a TOC of at least 0.5%; and
- 6-inch layer of fine gravel (0.25 to 0.5-inch D_{50}).

For medium-velocity areas (areas with flow velocities greater than 1.5 ft/s but less than 3.5 ft/s during a 100-year recurrence interval flow event), Isolation Cap Type B will consist of the following layers (from bottom to top):

- 6-inch isolation layer of fine sand with a TOC of at least 0.5%;
- 3-inch filter layer of fine gravel (0.25- to 0.5-inch D_{50}); and
- 6-inch layer of coarse gravel (2-inch D_{50}).

For high-velocity areas (areas with flow velocities greater than 3.5 ft/s during a 100-year recurrence interval flow event), Isolation Cap Type B will consist of the following layers:

- 6-inch isolation layer of fine sand with a TOC of at least 0.5%;
- 3-inch filter layer of (0.25- to 0.5-inch D_{50}) fine gravel; and
- 6-inch layer of cobble (4-inch D_{50}).

Isolation Cap Type B has also been designed to resist forces from propeller wash, vessel wakes, waves, and ice. The cap has been designed for typical magnitudes of forces on the sediment bed exerted by these processes. As discussed in Attachment H, in general, vessel effects (i.e., wake and propeller wash) are likely to produce velocities less disruptive than flood events in high-velocity areas. Also, normal ice effects are likely to produce velocities less disruptive than flood events in high-velocity areas. If river conditions due to ice effects result in potentially significant damage to the cap (defined as greater than 3-inch loss over a 4,000 ft^2 area, or 20% of the capped area, whichever is less, of a contiguously capped area), those sections at the cap will be repaired as necessary. Attachment H thus evaluates the more typical range of these forces that can be anticipated and discusses how they are incorporated into the cap design. The design also recognizes that there can be some localized impacts from events such as propeller wash in shallow areas and anchor dragging. Institutional controls (i.e., sign posting) will be considered to reduce the probability of occurrence of such events.

Specifications for backfill and cap materials will be refined during Phase 1 Final Design based on additional data and information from quarries on material availability.

3.9.2.3 Shoreline Stabilization

As discussed in the steps for developing dredge prisms (Section 3.3.3.1), a 2-foot vertical cut will be made at the shoreline for dredge areas that come in contact with the shoreline. Then, the slope from the bottom of this cut to the DoC line will be 3 horizontal to 1 vertical (3:1).

Following completion of dredging activities, backfill or other appropriate materials will be used to reconstruct shoreline areas and any structures placed in the river (such as sheet piling) will be removed. In shoreline areas that require capping, the cap will be constructed so that the elevation and slope of the final cap surface results in stable shoreline conditions (3:1 side-slopes). Additional protection will likely be needed for maintained shorelines disturbed by site activities (e.g., shoreline areas with existing riprap). In these areas, the shoreline will be restored to at least its pre-remediation level of protection. For natural shorelines, there are habitat treatments that may be employed, as described in Section 3.10. The shoreline stabilization design details will be completed during Phase 1 Final Design. A conceptual detail for shoreline stabilization is presented on Drawing H-0052.

3.9.3 Backfill and Cap Material Sources, Handling, and Staging

A survey of quarries in the Upper Hudson River area was conducted to assess the availability of materials that would be suitable for backfilling and/or capping in the vicinity of the project site

3.9.3.1 Source Selection Criteria

A preliminary quarry survey was conducted during the Preliminary Design (BBL, 2004a) to identify local sources of materials for the project. Additional data gathering was completed as part of the Year 2 SEDC Program, which resulted in a list of 35 quarries in the vicinity of the Hudson River (see Figure 3-30 for quarry locations).

To further screen these options, additional evaluation criteria were developed, as discussed below.

- **Waterfront Access:** The selected option is for backfilling/capping materials to be transported by barge from a waterfront access point to be obtained by the supplier directly to the dredged area for final placement. To simplify the material transport process, quarries identified must have either direct waterfront facilities or access to waterfront in the canal system (i.e., the Hudson River, Mohawk River, or New York State Canal System). A facility with waterfront property or nearby waterfront access is preferable.

- **Material Types/Volumes:** The types and quantities of materials available at each quarry are important factors in the final quarry choice. The ability to match the necessary design material specifications with available material will reduce lead times and costs. The quantities of material necessary for this operation may tax the production capabilities of smaller facilities.

- **Staging Area:** Another important criterion for selection is the ability to stage sufficient quantities of material at the quarry. To effectively maintain an inventory of materials for impending backfill/cap operations, a relatively large staging area is required with direct water access. Staging at the quarry location reduces the number of material handling steps in the process, which will reduce the overall equipment needs and costs.

- **Transport Distance:** Distance from the quarry to the dredge areas is an important selection criterion. The material will be placed in River Section 1; therefore, minimizing the transport distance will reduce the number of locks through which the barges must pass, resulting in a more predictable and expedient delivery schedule.

- **Availability of Existing Facilities:** Availability of existing infrastructure at the candidate quarries is also considered in the decision making process.

These criteria will be applied in Phase 1 Final Design to short-list the quarry options.

3.9.3.2 Material Quantities

Quantities of backfill and cap materials have been estimated to provide a basis for the backfill/capping placement plan and barge plan.

The intermediate design basis assumes the following:

- Phase 1 total dredge area is 80 acres.
- Since backfill will not be placed in the navigation channel, the effective maximum area for backfill is 63 acres.
- For the purpose of backfill placement and barging plans, a total mass (or volume) of 217,000 tons (167,000 cy) was assumed based on the following:
  - Backfill will be placed over 40 acres:
    - Assumed thickness of backfill is 12 inches.
    - A 15% contingency over the 40 acres has been assumed for engineering purposes.
    - This results in a total backfill volume of 96,000 tons (74,000 cy).
  - Capping materials will be placed over 40 acres:
    - Assumed cap thickness is 15 inches.
    - A 15% contingency over the 40 acres has been assumed for engineering purposes.
    - This results in a total cap volume of 121,000 tons (93,000 cy).
  - An additional 15% backfill allowance (26,000 tons or 20,000 cy) over the entire 80 acres of dredge areas will be allocated for creation of SAV beds. However, for the purposes of the backfill/cap placement plan, this additional volume is already accounted for through the overall assumption that all 80 acres in Phase 1 receive backfill or cap and the 15% engineering purposes contingency (29,000 tons or 22,000 cy).

Note that the above volume estimates should be considered preliminary, and are subject to further revision during the Phase 1 Final Design. A summary of the backfill and cap types and their characteristics is provided in Tables H-2 and H-9 in Attachment H.

3.9.4 Placement Techniques and Equipment

The backfilling/capping technique selected for the Hudson River should be appropriate over the range of materials being installed and the river conditions in which backfill and capping operations will be performed. Information on candidate placement methods and equipment is presented in Attachment H. Based on a review of the methods, the clamshell method (surface or subsurface placement) is the most likely backfill/cap placement method to be used for the Hudson River. Even though both clamshell and Tremie pipes are viable options, a clamshell is more proven in placing varying material types in conditions similar to the Hudson River. The type of clamshell, operation of the clamshell, and construction tolerances, will be developed during the Phase 1 Final Design.

3.9.5 Backfill/ Cap Placement Plan

A Backfill/Cap Placement Plan has been developed to determine barge requirements and backfill/cap material volumes for backfill/capping operations (see Tables 3-46 and 3-47). The plan is based on several assumptions stated in Section 3.9.3.2, which are used to develop the backfill/cap material quantity estimates. The plan creates a schedule of daily placement volumes in each dredging sub-area, and accounts for factors such as navigable depth (resulting in two barge size selections – 500 tons and 900 tons), required placement equipment (assumed to be two, 4-cy clamshell buckets), cycle times (assumed to be 120 seconds), and downtime assumptions that account for equipment inefficiencies as well as added difficulties during placement along the shoreline and near obstructions. The resulting production volumes were then used to determine the required number of barges for delivery of backfill and cap materials for each day of placement.

Further details of the backfill/cap placement plan are presented in Attachment H. This plan should be considered as a planning tool only, and may be revised during the Phase 1 Final Design and through contractor submittals during project implementation.

3.9.6 Interrelationship with Other Project Elements

The design of the backfilling/capping element is intervelated with several other project elements. The input to the backfilling/capping process is influenced directly by the aerial extent and depths resulting from the dredging process. Actual backfill and cap material placement rate will depend on the progress of the dredging operation, since backfill/cap placement at a particular CU cannot be initiated until the residuals dredging operation is complete. Thus, backfill/cap placement will lag behind residuals dredging, and as a result, backfill/cap placement may run into mid-November depending on the actual residuals dredging volume and schedule.

Design inputs for backfilling/capping will be related to the residual Tri+ PCB concentrations following dredging. It is those residual concentrations and river conditions that determine the need for, and selection among, re-dredging, backfilling, or capping options at each CU.

The backfilling/capping design is also strongly interrelated with habitat replacement and reconstruction design. As the backfill or cap armor will serve as the substrate for habitat replacement, the materials selection process is intended to most efficiently accommodate both design objectives (i.e., backfill/cap and habitat replacement/reconstruction). Habitat replacement and reconstruction may also occur at the same time as backfilling, even if alternative materials (other than the backfill or cap armor) are needed. Thus, any substantive change in the habitat replacement and reconstruction processes may directly affect the backfilling/capping process, and vice versa.

The backfilling/capping activities will be required to comply with water-column-related construction monitoring requirements (TSS in the near-field). During Phase 1 Final Design, the need and extent for resuspension control during the backfilling and capping activities will be evaluated.

Because of the quantity of material to be handled, the backfilling/capping element must work in conjunction with the processing infrastructure, as well as the water-based transport. Backfill and cap materials will be transported on the river by barge. It is expected that the backfill/cap placement process will add from two to 14 lockages (average of approximately 8 lockages) per day. To facilitate this transport, a waterfront access point with wharf and staging area will be required at or near the selected quarries. Local truck transport from the quarry material source to the staging area or waterfront access point will be necessary.

3.10 Habitat Replacement and Reconstruction

The RD Work Plan (BBL, 2003a) calls for habitat delineation and assessment to be conducted to "support the design of habitat replacement and reconstruction to be completed as a component of the remedial design program." The habitat delineation and assessment activities are described in the HDA Work Plan (BBL, 2003b). As described in the following section, habitat replacement and reconstruction is closely related to the backfill/capping project element. As provided in the RD Work Plan, the Phase 1 Intermediate Design only provides conceptual habitat and reconstruction details based on available data.

3.10.1 Basis of Design

The specific basis for the design of the habitat replacement and reconstruction is discussed below. Habitat replacement and reconstruction design is related to the backfill/cap design in that the backfill or cap armor may serve as the substrate for habitat replacement or reconstruction.

To develop specifications for backfill, information on Upper Hudson River substrate properties (grain size and TOC content) and surface water velocities were evaluated. The substrate properties were taken from the 0 to 2 inch interval of sediment from SSAP coring locations within 100 feet of an aquatic vegetation bed. Fines data were available from this sediment interval; it is also the sediment segment to which recruiting macroinvertebrate and plant species are first exposed. This layer is directly exposed to surface water currents and, to remain in place, must be able to withstand the surface water velocities to which it is exposed.

After completing a shear-stress analysis, a velocity of 1.5 ft/sec during a 2-year flood was selected as the velocity that will be utilized to distinguish between the uses of two types of backfill:

- **Type 1 Backfill – Medium Grained Material** – This material will be placed at any water depth where velocities are below 1.5 ft/sec. It is medium sand of approximately 0.5 to 2.0 mm with total organic matter ranging from trace to 2.5%. The TOC range may be refined during Phase 1 Final Design. This Type 1 material may be used alone or in combination with other materials such as cobbles, wood debris, etc. as substrate for aquatic vegetation beds and riverine fringing wetlands. It may also be used in unconsolidated river bottom to provide a substrate for benthic macroinvertebrate colonization.

- **Type 2 Backfill – Coarse-Grained Material (gravel)** – This material will be placed at any water depth where flow velocities are above 1.5 ft/sec, but may also be placed in areas where flow velocities are below 1.5ft/sec as determined by habitat needs. It will consist of fine gravel of approximately 6 to 12 mm; TOC content will not be specified. The Type 2 material could be used in unconsolidated river bottom or in aquatic vegetation bed habitat where flow velocities are above 1.5 ft/sec to allow benthic invertebrate recolonization and provide fish habitat.

The accompanying decision matrix (Figure 3-29) graphically presents the steps involved in selecting which backfill material will be placed in a location. As shown in the decision matrix, the first decision is to determine whether the Residual Performance Standard has been met. If the residual Tri+ PCB concentrations are < 0.25 mg/kg, then backfilling is not required. However, backfill may be used in these areas to change bathymetric or substrate conditions for purposes of habitat replacement and reconstruction. Such use of contingent backfill material will be specified in the Phase 1 FDR as appropriate.

If residual Tri+ PCB concentrations are greater than 0.25 mg/kg and less than 1.0 mg/kg in the navigation channel, no backfilling will be required. Residual Tri+ PCB concentrations greater than 1.0 mg/kg will be managed through capping as described in Section 3.9; however, if residual Tri+ PCB concentrations are greater than 0.25 mg/kg but less than 1.0 mg/kg and are outside of the navigation channel, backfilling is needed, first, to meet the Residual Performance Standard and, second, to meet the needs of habitat replacement and reconstruction. For habitat, the material selected will be based on water velocity and post-dredging depth as described below.

Based on the shear-stress analysis for the 2-year flood event (Attachment H), a flow velocity of 1.5 ft/sec or less permits Type 1 or Type 2 material to be used. If flow velocities exceed 1.5 ft/sec, Type 2 material will be used. If flow velocities are less than 1.5 ft/sec, the selection of backfill material will be based on water depth and planned habitat type. In areas less than 9 feet deep (post-dredging; ordinary low water), that are planned to be vegetated habitats (i.e., aquatic vegetation beds and riverine fringing wetlands), Type 1 material will be used. If backfill is required in shoreline areas, Type 2 material will be used to provide a stable substrate. For all other areas, Type 1 or 2 material can be used. Final selection of backfill material for these areas will be based on availability and logistics (i.e., transportation and placement) and specified in the Phase 1 FDR. In addition to the backfill material, other components such as the use of large woody debris or boulder clusters, or vegetated stabilization techniques, may be used under specific circumstances as described in Section 3.10.2.

In areas that will be capped, the stability and persistence of the armoring material is the critical design element, and habitat objectives are not considered primary in the selection of cap materials. The capping material will provide suitable habitat for fish spawning and benthic macroinvertebrate recolonization. In addition, habitat replacement and reconstruction designs may include materials such as large woody debris and/or boulders that can be added to the surface of the cap material to provide structure in unconsolidated bottom habitat. However, natural riverine processes (e.g., deposition) will ultimately determine the type and extent of habitat that will exist on the armor layer.

Bathymetry and substrate will be different in the post-dredging environment. As stated in the ROD, "[a]pproximately 2.65 million cubic yards of PCB-contaminated sediment will be excavated. The selected remedy calls for 0.8 million cubic yards of fill to be placed in the river as a follow-up activity to dredging operations. Thus, EPA will remove considerably more material from the river bottom than it will place as fill" (EPA, 2002a, page A-2). In addition, as stated in the ROD, "[d]redging and backfilling will result in changes to the sediment supply and channel morphology, which in turn may lead to river bed and bank erosion and sedimentation" (EPA, 2002a, page A-3). Because post-remediation bathymetry and substrate will be different from pre-dredging conditions, replication of the extent and type of existing habitats is not practicable Specifically, there are approximately 6.56 acres within the Phase 1 areas targeted for dredging that currently support aquatic vegetation and will be dredged to a depth greater than 9 feet deep (under average flow conditions). Such areas are unlikely to support aquatic vegetation. GE will add backfill up to 15% of the total estimated during design to be placed as part of the entire project, for the purpose of raising the sediment surface of selected areas into the photic zone which supports submerged vegetation. The specific locations at which this additional material will be used will be identified based on the final dredge prisms, and will be reported in the Phase 1 FDR. The EPA may determine which areas will receive this additional backfill material.

Data collected under the HDA Program have been used to develop conceptual designs for the four target habitat types. The conceptual designs for each habitat type include both passive (e.g., natural recolonization) and active approaches that will be implemented following backfilling and/or capping of a remediated area. Data collected under the HDA Program are also being used to develop FCIs and HSIs for characterizing the range of ecological functions of unconsolidated river bottom, aquatic vegetation bed, shoreline, and riverine fringing wetland habitats. Habitat assessment data collection is ongoing and substantial amounts of information remain to be acquired.

Following remediation, data collected from reference (unimpacted) locations will be used with the pre-remediation data (as applicable) to define the bounds of expectation for habitats. These data will be used to evaluate remediated areas to determine if the habitat replacement and reconstruction goals are being met, or if adaptive measures are warranted. The process for determining whether such changes are warranted will be fully described in the *Adaptive Management Plan* and included in the Phase 1 FDR.

3.10.2 Conceptual Habitat Replacement/Reconstruction Design

In accordance with the PDR (BBL, 2004a), habitat assessment in Phase 1 areas was to be completed before conceptual habitat replacement and reconstruction designs were provided in the Phase 1 IDR. At the time of this report, that assessment has not been completed; once the EPA has approved the Phase 1 HA Report and the *Supplemental Habitat Assessment Work Plan* (SHAWP) (BBL and Exponent, 2005c), additional assessment work will be performed. Thus, the description of habitat characteristics and plans in the following sections is preliminary, as additional information may alter the analysis of Phase 1 areas. Nonetheless, conceptual approaches for each habitat type have been developed that present alternative replacement and reconstruction approaches varying in degree of intervention.

The implementation and distribution of habitat replacement and reconstruction treatments within remediated areas will be specified in the Phase 1 FDR. Criteria for selecting location-specific treatment alternatives will be developed based on habitat data and included in the Phase 1 FDR. Because the river will be substantially different following remediation, it will not be possible for habitat reconstruction and replacement to replicate either the quantity or distribution of habitats in the post-remedy environment. Under these conditions, natural engineering, in which the river dictates the nature and extent of post-remediation habitats, is necessarily an important component of the habitat replacement and reconstruction program. The approaches that require human engineering will generally be limited to smaller areas. For example, the use of riprap in replacing or reconstructing shoreline habitats requires extensive human intervention, and will be minimized to the extent practicable and consistent with achieving stability of this habitat in those areas where it is required by the design. For aquatic vegetation habitat, natural recovery and recolonization will be the presumptive approach. For each habitat, the recruitment of exotic vegetation will be evaluated as part of the OM&M program and management actions specified as part of the *Adaptive Management Plan*.

3.10.2.1 Unconsolidated River Bottom

Two approaches may be used in the replacement and reconstruction of unconsolidated river bottom habitats. The first relies on natural engineering processes governed by the river, and the second relies on human engineering, where habitat features above the substrate are replaced in accordance with specifications derived from Phase 1 area data collected in the HDA Program. Both approaches use backfill or capping material as the primary habitat substrate. Some areas outside the navigation channel will be augmented with large woody debris and/or boulders to provide structure to serve as habitat for aquatic organisms.

Treatment UCB1. Backfill or Cap Only

Treatment UCB1 for unconsolidated river bottom habitats simply replaces substrate with backfill and capping materials. In areas with surface water velocities above 1.5 ft/sec, Type 2 backfill material will be used. At velocities below 1.5 ft/sec, Type 1 or 2 backfill material will be used. As noted in Section 3.9, capping material selection is not driven by habitat needs for unconsolidated river bottoms. Natural revegetation of the river bottom by native aquatic vegetation may occur in some of these areas, but areas that extend beyond the photic limits for aquatic vegetation beds (about 8 to 10 feet in the Upper Hudson River under average summer flow and ordinary low water conditions) will remain largely unvegetated.

Treatment UCB2. Large Woody Debris and Boulder Placement

Treatment UCB2 is a human engineering approach where large woody debris and/or boulders are placed on top of Type 1 or Type 2 backfill to provide 3-D structure in unconsolidated river bottom areas (see Drawing H-0049). The placement of large woody debris and boulders will be determined from the abundance and distribution of these habitat features recorded in the HDA Program. Where natural revegetation does not occur, large woody debris and boulders can be used in select locations to provide structural habitat for fish. Boulder clusters would be used in water depths greater than 5 feet. Large woody debris would be used in shallower areas at depths less than 5 feet and would not be fully submerged, but secured by the exposed root mass on the shoreline.

The design specifications for these structures, including locations where these structures would be located, will be based on information (e.g., epifaunal substrate characteristics) collected as part of the HDA Program. Not all areas where unconsolidated river bottom is present will receive this treatment, as there are currently areas within the river that are devoid of large woody debris and boulders. Take-off specifications developed during Phase 1 Final Design will include material source(s), specific sizes, type, and desired locations for this treatment.

3.10.2.2 Aquatic Vegetation Bed

There are two replacement and reconstruction options for aquatic vegetation beds that use natural and human engineering approaches. In both, backfill and/or cap material is used as the growing medium. Under typical summer flow, aquatic vegetation extends to depths of approximately 8 to 10 feet under ordinary low water conditions in the Upper Hudson River (see HD and Phase 1 HA Reports). At the deeper edge of this range, the photic zone varies considerably based on changes in flow, resulting in unpredictable plant growth and distribution. Therefore, the maximum depth at which aquatic vegetation designs will be implemented is 8 feet below ordinary summer low water. The specific areas at which natural and human engineering approaches will be implemented will be determined using the aquatic vegetation model being developed as a part of the *Adaptive Management Plan*. This model incorporates parameters related to the pre-remediation distribution of aquatic vegetation to identify areas suitable for the establishment of aquatic vegetation following dredging. The model will be provided in the *Adaptive Management Plan* accompanying the Phase 1 FDR.

Treatment SAV1. Natural Recolonization of Vegetation

Treatment SAV1 is based on natural recolonization of backfilled areas with a depth of -1.0 to -8.0 feet. Type 2 backfill will be placed in areas where flow velocities are above 1.5 ft/sec, and Type 1 backfill material will be placed where flow velocities are below 1.5 ft/sec. This approach assumes that sufficient propagules (seeds, tubers, winter buds and plant fragments) from adjacent or upstream aquatic vegetation beds are available, will settle naturally, and grow in Type 1 or Type 2 backfill material. Therefore, natural depositional processes within the river provide the mechanism for reestablishing aquatic vegetation (Rybicki et al., 2001).

Treatment SAV2. Seed/Tuber Broadcasting and Planting

Treatment SAV2 involves active placement of tubers, seeds, and/or adult wild celery shoots to decrease the time for natural vegetative recolonization. Wild celery is the primary species that will be used for this approach, since it is the most dominant species in aquatic bed habitats sampled in Phase 1 areas (BBL and Exponent, 2005b). Seeds and tubers of other species (e.g., *Potamogeton* spp.) will be considered for use in the Phase 1 Final Design. Water chestnut (*Trapa natans*) or other exotic or invasive species will not be used in any replacement or reconstruction of aquatic vegetation beds. Drawings H-0050 and H-0051 illustrate the conceptual approach. Take-off specifications for plant spacing (e.g., 2 feet on center) and life stage (e.g., tubers, shoots) will be developed as part of the Phase 1 Final Design.

3.10.2.3 Shoreline

Shoreline treatments are based on human engineering approaches to maximize erosion control and reduce the time it takes to reestablish native vegetation. Shoreline replacement and reconstruction design will use backfill material (Types 1 or 2, depending on flow velocities and other design specifications) to conform to the dredged bankslope. The selection and placement of backfill material type for purposes of stabilizing the shoreline will be developed during Phase 1 Final Design. For those areas where previously maintained shorelines are removed, rip rap will likely be the preferred method of restabilizing shorelines. However, for natural shorelines, treatment alternatives for aiding the natural recolonization and stabilization of bankslope vegetation are being developed as part of the design process. Conceptual designs for these treatment alternatives are discussed below. Note that treatment approaches described for shoreline replacement and reconstruction may extend from the upper extent of affected river bank (but not above top of bank) down to below the water line. Shoreline elevation, bankslope, and the impact on natural vegetation will be assessed based on the final dredge prisms and treatment approaches more fully described in the Phase 1 FDR.

Treatment SHO1. Erosion Control with Hydroseeding/Planting

Treatment SHO1 uses hydroseeding and/or planting of native trees, shrubs, and herbaceous species in combination with an erosion control fabric (such as a Coir 700 fabric or similar material; see Drawing H-0052 for details). This treatment is likely to be restricted to limited areas where Type 2 backfill material is placed along most or all of the bankslope to provide stability. Coir fabric material will be installed on the backfilled shoreline to cover loose soil, trap seeds, and secure plants. Some preparation of the back slope will be required to ensure that sticks, rocks, clods or grass that may be on the surface of the backfill material are removed. Because of the planting component in this design, take-off specifications, including native species composition and corresponding seed mixtures and application procedures (e.g., spacing interval), will be included in the Phase 1 FDR.

Treatment SHO2. Rock Placement and Planting

Treatment SHO2 involves the placement of riprap in combination with Type 1 or Type 2 backfill material along most or all of the bankslope to provide stability to the shoreline (see Drawing H-0052 for details). Compared to Treatment SHO1, where vegetation is used as the primary stabilizing component of the river bank, this treatment places soil and live stakes planted in the interstices of rocks/boulders. The approach is often referred to as "dirty riprap." The planting of native vegetation is part of a bioengineering strategy to replace or "soften" the effects of new riprap installations. Take-off specifications for native species planting and stone sizes (rocks or boulders) will be included in the Phase 1 FDR.

3.10.2.4 Riverine Fringing Wetlands

The replacement and reconstruction of the riverine fringing wetlands is based, initially, on human engineering. Riverine fringing wetlands of the Upper Hudson River are generally small in size and patchily distributed. These wetlands are composed of a number of emergent and submerged species that are arranged in distinct communities relative to the depth and inundation of the surface water (BBL and Exponent, 2005b). The approach described below is premised on the placement of Type 1 backfill, material which will provide a sufficient growing medium for reestablishment of native plant species.

Treatment WET1. Seeding and Planting

Treatment WET1 is designed to provide the conditions for reestablishing riverine fringing wetlands following remediation. A WET1 candidate site would be located along the river and, if necessary, meander jams will be installed with large woody debris, rock, and/or a geotextile membrane at the surface water interface to promote bankside pooling and depositional areas behind the jam. These conditions favor an environment behind the jam for the broadcasting of a native seed mix and/or planting of native wetland species in community structure patterns (i.e., zonation) that are similar to those found in the reference fringing wetlands. A conceptual design of a reconstructed riverine fringing wetland is shown on Drawing H-0053. Seed mixtures, seed broadcasting areas, placement of the jams, and spacing of wetland plants will be addressed as part of the take-off specifications in the Phase 1 FDR.

3.10.2.5 Sediment Processing Facility Wetlands

Wetlands may be affected due to the construction of the sediment processing facility. However, such effects have been avoided or minimized to the greatest extent possible during the planning and design of the sediment processing facility. At this time, GE is awaiting EPA confirmation of the wetland boundary/delineation to confirm that there will be no impacts. Where necessary and agreed upon by GE and EPA, the mitigation design for the replacement and reconstruction of wetlands that are impacted at the sediment processing facility site will be addressed in the Phase 1 FDR.

3.10.3 Threatened and Endangered Species Considerations

On June 13, 2005, GE provided comments on the May 2005 *Hudson River PCBs Superfund Site Draft Biological Assessment* (Draft BA), prepared by Ecology and Environment, Inc. (E&E) on behalf of the EPA. The Draft BA focused on direct and indirect effects of the project, and conservation measures for the protection of two threatened or endangered species: the bald eagle and the shortnose sturgeon.

As of August 2005, three bald eagle population segments have been identified in the Hudson River corridor: the northern segment consisting of the area north of Albany; the central segment between Albany and Kingston; and the southern segment south of Kingston. The northern segment is primarily a wintering area for bald eagles, with a season from December 1 through March 31. There are no known nesting pairs in the vicinity of Phase 1 dredge areas.

As stated in the Draft BA (E&E, 2005), Phase 1 dredging, construction and operation of the sediment processing/transfer facility, and non-project-related development in the Hudson River PCBs Superfund Site area are predicted to have minimal effects on bald eagles in the area. Individual summer migrants/floaters may occasionally be disturbed by project activities, and a limited number of trees that could be used by bald eagles for perching or roosting may be cut. However, given the small number of eagles in the area, particularly during the period of the year when project activities will occur and the large amount of alternative habitat in the area, these effects are considered minimal.

The shortnose sturgeon is not present in the Phase 1 dredge areas and is therefore not expected to be directly or indirectly affected by dredging or supporting operations associated with barge traffic and sediment facility operations at the processing facility site.

The EPA will provide a Final BA to the U.S. Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) (the agencies responsible for protection of the bald eagle and shortnose sturgeon, respectively) for their review and issuance of Biological Opinions (BOs) for these species (if needed) or their written concurrence with a determination in the BA of "not likely to adversely affect." If appropriate, the BOs may include conservation measures to protect the affected species. The concurrence of "not likely to adversely affect" may include conservation measures to minimize potential effects to the species. The resource agencies BOs or determination of "not likely to adversely affect" is a prerequisite to the Phase 1 Final Design so that potential effects on these species and/or conservation measures determined necessary can be considered during the Phase 1 Final Design process.

3.11 Assessment Regarding Feasibility of Meeting Performance Standards

This section provides an overall engineering assessment, at this Intermediate Design stage, regarding the feasibility of meeting the EPS (EPA, 2004a) and the QoLPS (EPA, 2004b) (see Sections 2.2.2 and 2.2.3 for an overview of the standards). As stated in the PDR, this project is being designed to meet the Hudson EPS and QoLPS; as design proceeds, the ability to meet the performance standards, individually or collectively, will continue to be evaluated. However, given the number of assumptions that have to be made in evaluating the ability of design to achieve the standards, the actual experience in Phase 1 will provide more definite information on the ability to achieve the performance standards. The substantive requirements of the performance standards are defined in the Phase 1 ID PSCP Scope (Attachment C). The Phase 1 ID RA Monitoring Scope (Attachment A) and the Phase 1 ID RA CHASP Scope (Attachment B) describe other components of the performance standards relating to requirements for routine monitoring, contingency monitoring, reporting, and community notification.

The design analysis of meeting the EPS is discussed in detail throughout the Phase 1 IDR, and only summarized below in Section 3.11.1; however, the QoLPS design analysis is discussed in more detail below in Section 3.11.2.

3.11.1 Engineering Performance Standards

This Phase 1 IDR documents that the EPS (resuspension, residuals, and productivity) (EPA, 2004a) are included in the basis of design. This has been shown in previous sections, as follows:

- The Resuspension Performance Standard forms the basis of design for resuspension control. An assessment of the Resuspension Performance Standard is presented in Section 3.5 (Resuspension Control) and the basis for the assessment is provided in Attachment E.

- The Residuals Performance Standard forms the basis of design for dredging, backfilling, and capping operations. Meeting the numerical criteria in that standard is discussed in Section 3.3.5 (Dredging Plan Development) and Section 3.3.6 (Residuals Sampling). The standard is also the basis for the backfill and capping analysis (Section 3.9 and Attachment H).

- The Productivity Performance Standard for Phase 1 forms the basis of design for dredging (Section 3.3.1), dredged material transport (Section 3.4.1), sediment processing (Section 3.6.1), processed material storage area, loadout facility and rail yard (Section 3.6.6.1), transportation for disposal (Section 3.7.1), and disposal (Section 3.8.1). A plan to optimize the design regarding productivity during the Phase 1 Final Design is discussed in Section 3.12.

This design analysis is based upon assumptions outlined throughout the Phase 1 IDR and does not ensure achievement of the performance standards. Those assumptions will be tested during Phase 1 implementation, and there is no guarantee that they will be proven correct or that the performance standards can be met, individually or in combination.

3.11.2 Quality of Life Performance Standards

This section documents the engineering bases and assumptions for the design to evaluate whether the equipment and processes to be used in Phase 1 are expected to meet the above quantitative standards contained in the QoLPS. The following sections describe the analysis performed to assess the design's ability to meet the QoLPS and potential impacts to the public related to air quality, odor, noise, lighting, and navigation. The QoLPS provisions for responding to complaints from the public regarding these quality of life considerations cannot technically be a basis of design. These subjective provisions of the QoLPS will be considered in a contingency plan, as described in the Phase 1 ID RA CHASP Scope (Attachment B). Hence, this section focuses on the quantitative criteria in the QoLPS.

3.11.2.1 Air Quality Assessment

The QoLPS document (EPA, 2004b) provided standards for PCBs in ambient air and for opacity, and requires an analysis of achievement of the National Ambient Air Quality Standards (NAAQS). A process to evaluate the potential for air emissions is provided in this section and further details will be provided in the Phase 1 FDR. The Air Quality Performance Standard is described in the Phase 1 ID PSCP Scope (Attachment C) and may be summarized as follows:

The standards for total PCB concentrations in ambient air are 24-hour average concentrations of 0.11 micrograms per cubic meter ($\mu g/m^3$) in residential areas and 0.26 $\mu g/m^3$ in commercial/industrial areas, with "Concern Levels" at 80% of those values (0.08 $\mu g/m^3$ in residential areas and 0.21 $\mu g/m^3$ in commercial/industrial areas) (QoLPS, pp. 6-8 & 6-18) (EPA, 2004b).

The air quality standard for opacity, based on New York State regulations (6 NYCRR 211.3), is that opacity during project operations must be less than 20% as a 6-minute average, except that there can be one 6-minute period per hour of not more than 57% (QoLPS, p. 6-16) (EPA, 2004b).

In addition, the Air Quality Performance Standard requires an assessment during design of the following pollutants for which EPA has promulgated NAAQS (known as criteria pollutants): nitrogen oxides, sulfur dioxide, carbon monoxide, particulate matter with a median diameter of 10 micrometers or less, particulate matter with a median diameter of 2.5 micrometers or less, and ozone (QoLPS, pp. 6-9 to 6- 11) (EPA, 2004b).

The need for monitoring of the criteria pollutants subject to the NAAQS will be determined during the Phase 1 Final Design.

This section provides the basis for estimates of emissions of PCBs, opacity, and criteria pollutants. The sources are categorized as follows:

- Emissions during Phase 1 facility site work;
- Emissions during dredging operations; and
- Emissions during unloading and sediment processing operations.

A summary of the design analysis process is provided in Table 3-48 below, followed by the review completed for the Phase 1 IDR. The monitoring plan for air is provided in the Phase 1 ID RA Monitoring Scope (Attachment A).

Table 3-48 – Air Quality Design Analysis

Basis for Design	• Concern Level for PCB concentrations in ambient air. • PM_{10} and $PM_{2.5}$ for fugitive dust. • NAAQS and opacity emission from diesel exhaust.
Emissions Inventory	• Section 3.11.2.1.1 provides the emissions inventory of PCBs from dredging and processing operations. • Sections 3.11.2.1.2 and 3.11.2.1.3 provide the emissions inventory for NAAQS pollutants and opacity from construction, dredging, and processing operations.
Model Description	• Dispersion modeling to estimate the concentration at receptors resulting from services identified in the emission inventory will be conducted using the latest version of ISCST3. Modeling will incorporate 5 years of Glens Falls' surface data and Albany upper air data (for surface sources the upper air data has little effect on concentrations). The ISCST3 model is widely accepted for modeling applications such as the Phase 1 project, and was used by the EPA in the Responsiveness Summary (EPA, 2002a).
Model Input Parameters	• Emission factor models have been developed for most sources.
Model Output	• To be developed for operations based on the dredge plan. • To be developed for processing facility operations (High First High).
Refinements for Phase 1 FDR	• Emission factors will be refined. • Screening modeling will be completed during Phase 1 Final Design.

Note:
1. High First High is an analysis that presents the maximum concentration of a pollutant for every receptor, assuming the "worst-case" meteorology relative to every receptor.

3.11.2.1.1 Estimating PCB Levels in Air

Dredging-Related Sources

The following process will be used to estimate the potential impact of the dredging operations on PCB levels in air:

1. Develop an inventory of potential air emission sources for PCBs;
2. Develop emission factor models for each source;
3. Integrate the emission factor models into the overall air dispersion model (i.e., ISCST3);
4. Model the Phase 1 project using the dredging plan (as described in Section 3.3);
5. Predict the 24-hour average PCB concentration in air at points along the river;
6. Compare results to the control level and standard; and
7. As necessary, design controls or mitigation.

During Phase 1 Final Design, the analyses described above will be completed and documented in the Phase 1 FDR.

At this stage of design, the inventory of potential PCB emission source has been compiled and is described below. The emission factor model for PCBs which are predicted to be released to the river as a result of sediment resuspension has been completed and is documented in Attachment E. The dispersion model has been selected.

Dredge Area Emissions

Potential PCB emissions due to the dredging operations will be modeled for the following two sources:

- Volatilization from surface water after partitioning from resuspended solids: The fate and transport model, as currently integrated with the dredge plan, will be used to estimate an emission rate. This emission model is described in Attachment E. This source will include, in some instances, the effect of resuspension controls. The hourly air emissions from the surface water for the entire Phase 1 dredging season will be modeled.
- Barges loaded with sediment from dredging operations over a 4- to 6-hour period: The positions of the barge and the duration of time that the barge is at each location are taken from the dredging plan. It is

assumed that the sediment in the barge is completely covered with water. Estimates of air emissions of PCB from the barges will be prepared assuming that the PCBs first partition from the sediment into the water.

The same sediment-water-air partitioning model and constants that are assumed for the surface water volatilization (as presented in Attachment E) will be used for determining the emissions factor for barges. The average concentration of PCBs in sediment being loaded from model grid cells into barges will be an input to the model. The dispersion of emissions from these two sources will be combined and modeled with ISCST3. The data collected for the past 5 years at the Glens Falls surface station will be used to estimate meteorological conditions for each day of dredging. The estimated PCB concentrations (24-hour average) at the shoreline and nearest receptor(s) will be determined for each day of dredging through the entire dredging season.

Processing Facility Sources

The equipment, as specified in Table 3-36 and shown on the air monitoring plan (Drawing P-0008), which have the potential to emit PCBs are:

- (2) barges (at the waterfront unloading wharf);
- (2) temporary coarse piles at waterfront (hydrocyclone underflow);
- (2) coarse material stockpiles in storage area;
- (1) filter press building;
- (1) process water tank;
- (2) slurry tanks;
- (2) thickener tanks; and
- (2) fine material stockpiles in storage area.

The sediment-water-air partitioning model and constants defined in Attachment E will be used for barges, slurry tanks, and thickener tanks. The mass balance, based on treatability study data from filter press tests, will be used as a basis for PCBs in the process water tank. Henry’s law for dichlorobiphenyl will be used to develop emission factors. The emission factor models for stockpiles will be presented in the Phase 1 FDR.

The ISCT3 model will be used to estimate PCBs in ambient air at the fence-line receptors. A 5-year record of meteorological data (May 1 to Dec 31) at the Glens Falls Airport will be used to complete a High First High analysis around the perimeter of the processing facility.

Emission rates for each potential source will be developed based on the equipment dimensions, operation, type of material, and other factors potentially impacting PCB emissions.

The results of the dredge area source emission model will allow maximum 24-hour average PCB concentrations to be predicted at each location along the shoreline and at receptors nearest to the dredge areas. These discrete (24-hour average) predicted values will be compared with the Control Level. If air concentrations exceed the Control Level, mitigation measures will be designed and the effectiveness of the mitigation for source reduction will be estimated. The model will be run again, with the reduced source term, to predict if the mitigation effectively reduced the PCB concentration at the receptor to the Control Level.

3.11.2.1.2 Opacity

The QoLPS have set an opacity limit of equal to or greater than 20% (6-minute average), except for one continuous 6-minute period per hour of not more than 57% opacity, for vessels, vehicles, and equipment used in the construction or operation of the project, including:

- Marine-based equipment, including: dredges, tugs, support vessels, generators, and high-solids pumps;
- Facility processing equipment, including: offloading cranes, front-end loaders, dump trucks, generators, portable pumps (if used), and rail yard engine; and
- Facility construction equipment, including: graders, dozers, dump trucks, pile drivers, chain saws, wood chippers, backhoes, loaders, and compactors.

Equipment that only temporarily serves the operations (e.g., delivery trucks, main-line rail carrier locomotive) will not be subject to this standard. An engineering assessment of opacity will not be performed; the opacity limits will be included in the project specifications. A preventative maintenance program will be developed to control opacity.

3.11.2.1.3 NAAQS

The analysis completed by the EPA in the White Paper on *Air Quality Evaluation* included with the responsiveness summary (EPA, 2002a) will be confirmed using project-specific data regarding sources.

Dredge Areas

Emission of NAAQS criteria pollutants will be limited to the dredge and tugboat operations. This evaluation will be completed in the Phase 1 Final Design, after the logistics model is used to confirm the number of tugs and miles traveled.

Processing Facility

The emission estimated by the EPA of NAAQS criteria pollutants will be confirmed in the Phase 1 Final Design, after refining the number, size, and specification of diesel engines that will be onsite during: 1) facility site work; and 2) facility operations. A preliminary list of sources for facility operations includes:

- Emergency generator (300 hp);
- Clamshell bucket (150 hp);
- (9) front-end loaders (475 hp);
- (2) roll-off transports (410 hp);
- (6) transport trucks (500 hp); and
- Railroad switcher.

Modeling will be conducted using the latest version of ISCST3 and 5 years of Glens Falls' surface data and Albany upper air data (for surface sources the upper air data has little effect on concentrations). The ISCST3 model is widely accepted for modeling applications such as the Phase 1 project, and was used by the EPA in the Responsiveness Summary. It is capable of handling area and volume source configurations that are used to model the above emission sources. The model also has the flexibility for using emission scalar factors that can vary, an important feature for accommodating the movement of dredging operations on the river.

Model options used will be compared to those used by the EPA in its Responsiveness Summary (EPA, 2002a). Any modifications made to the ISCST3 model during model development will be clearly stated in the Phase 1 FDR. Also, a model will be used to estimate fugitive dust impacts from sediment stockpiles and haul roads.

The analyses in EPA's *White Paper – Air Quality Evaluation* (EPA, 2002a) will be repeated using the design data presented in this IDR as a basis. If this project-specific information validates the assumptions used in EPA's *White Paper – Air Quality Evaluation* (EPA, 2002a), this will be considered a determination of attainment of the QoLPS such that further demonstration by onsite or offsite sampling will not be required. If air quality compliance is not demonstrated as a result of these analyses for any NAAQS, potential design changes that could result in achievement of the NAAQS and/or the need for monitoring for such pollutant(s) will be proposed in the Phase 1 FDR.

3.11.2.2 Odor

The Odor Performance Standard is described in the Phase 1 ID PSCP Scope (Attachment C). The Odor Performance Standard has two components: 1) a numerical standard for hydrogen sulfide (H_2S), which is 0.01 part per million (ppm) (14 $\mu g/m^3$) over 1 hour; and 2) a standard for odor complaints, which is that the complaints are investigated and mitigated, if appropriate (QoLPS, p. 6-19) (EPA, 2004b).

The purpose of the Odor Performance Standard is to prevent unreasonable interference associated with project-related odors. Core samples were collected in the SSAP and bulk samples of sediment were collected for treatability studies. No odor was detected during homogenization of treatability study samples. During the implementation of the treatability studies, hundreds of tests were run with various sediment samples. In only two instances was a slight sulfur odor noted in the laboratory logs.

Nevertheless, debris from dredging operations containing wood, vegetation, shellfish, and other types of organic material will be screened out at the waterfront in the size separation area. Debris will be staged temporarily in the size separation area. If these piles have an odor that is offensive to site workers or the public, or results in H_2S concentrations at the receptor of 14 $\mu g/m^3$, the material will be transferred to the debris staging/storage area. Odor will be managed at the debris staging/storage area, if necessary, by covering stockpiles or directly loading materials into a covered rail car. The current design of material staging and loading areas accommodates these odor management concepts (see Table 3-40). As described in the Phase 1 ID RA CHASP Scope, contingencies for odor complaints and a complaint management process will be developed in the Phase 1 RA CHASP to be submitted with the Phase 1 FDR. The monitoring plan for odor is provided in the Phase 1 ID RA Monitoring Scope (Attachment A).

Table 3-49 Odor Design Analysis

Basis for Design	• Compliance with numerical standard of 0.01 ppm (14 ug/m^3) of H_2S over 1 hour.
Emissions Inventory	• Potential odor sources include dredged material, debris, and other organic matter. There is no data available to estimate emission factors.
Model Description	• If odor sources become an issue during operations, modeling may need to be conducted to assess additional potential impacts. In this case, modeling will be conducted using ISCST3 and will likely model H_2S emissions.
Model Input Parameters	• To be developed, if needed.
Model Output	• To be developed, if needed.
Refinements for Phase 1 FDR	• To be developed, if needed.

3.11.2.3 Noise

This section describes the design assessment for the project's ability to meet the Noise Performance Standard. Conservative methods have been used to be a validation of the assessment and mitigation measures, if any, which may be specified in the design.

3.11.2.3.1 Noise Performance Standard and Overview of Design Analysis

The Noise Performance Standard is described in the Phase 1 ID PSCP Scope (Attachment C). The noise standards are as follows (QoLPS, p. 6-25):

Short-term criteria – applicable to facility and other project construction, dredging, and backfilling:

- Residential Control Level (maximum hourly average):
  - Daytime = 75 dBA (A-weighted decibels)
- Residential Standard (maximum hourly average):
  - Daytime = 80 dBA
  - Nighttime (10:00 pm – 7:00 am) = 65 dBA
- Commercial/Industrial Standard (maximum hourly average):
  - Daytime and nighttime = 80 dBA

Long-term criteria – applicable to the processing facility and transfer operations:

- Residential Standard (24-hour average):

- Day-night average = 65 dBA (after addition of 10 dBA penalty to night levels from 10:00 pm to 7:00 am)

- Commercial/Industrial Standard (maximum hourly average):
  - Daytime and nighttime = 72 dBA

A summary of the design analysis to date for the noise standard is provided in Table 3-50 below. As described in the Phase 1 ID RA CHASP Scope, contingencies for noise complaints and a complaint management process will be developed in the RA CHASP to be submitted with the Phase 1 FDR.

Table 3-50 – Noise Design Analysis

Basis for Design	• Maximum hourly averages for facility construction, dredging, and backfilling: - Residential Daytime Control Level (75 dBA) - Residential Nighttime Standard (65 dBA) - Commercial/Industrial Standard (80 dBA) • Maximum hourly average for sediment-processing facility and transfer operations: - Residential Standard (65 dBA) (day-night 24-hour average)
Emissions Inventory	• The complete emissions inventory is found in Tables 3-51, 3-52, and 3-53. These tables provide noise emission levels from sources, measurement distances, and references.
Model Description (Screening)	• For construction, dredging, and short-term impacts, the following references were used: - *Highway Construction Noise: Measurement, Prediction and Mitigation* (U.S. Federal Highway Administration, 1976); and - As referenced in the QoLPS: *Assessing and Mitigating Noise Impacts* (NYSDEC, 2003). • For assessment of potential impacts from the processing facility, including unloading operations, CADNA/A noise prediction model (Datakustic Corporation, 2005) was used. CADNA/A is a Windows®-based software program that predicts noise levels near industrial noise sources. The model uses industry-accepted methods for predicting sound pressure levels.
Model Input Parameters	• Model input parameters are found in Tables 3-51, 3-52, and 3-53. The CADNA/A model inputs also include the layout of the sediment unloading and processing facility to locate significant sources relative to receptors.
Model Output (Screening)	• Screening-level model outputs predict that uncontrolled short-term noise levels will meet the basis of design analysis, with the exception of the following: - Nighttime dredging operations within 300 feet of a residential receptor may exceed the nighttime standard of 65 dBA. - Daytime dredging operations within 100 feet of a residential receptor may exceed the daytime control level of 75 dBA. - Current modeling predicts that sheet pile installation may exceed daytime control level of 75 dBA. • Predicted long-term noise levels for the processing facility meet the basis of design analysis.
Refinements for Phase 1 FDR	• Site-specific analysis of dredging operations to assess local conditions that may provide additional attenuation during dredging. • Refined assessment of on-water noise sources during dredging. • Refined assessment of sheet pile installation options. • Design of mitigation measures if necessary, after review of the refined modeling results.

Noise levels from sources do not produce an additive effect. If a sound's intensity is doubled, the sound level will increase by 3 dBA regardless of the sound level. For example, noise emissions of 70 dBA from a truck operating at the waterfront area and the nearby vibratory screen with noise emissions of 80 dBA will not produce a noise level of 150 dBA. Instead, noise levels can generally be combined using the screening method in Table 3-54, below.

Table 3-54 – Addition of Noise Sources

Difference between Sound Levels	Add to the Higher of the Two Sound Levels
1 dBA or less	3 dBA
2 to 3 dBA	2 dBA
4 to 9 dBA	1 dBA
10 dBA or more	0 dBA

The above table is used by the NYSDEC in its June 2003 policy document, *Assessing and Mitigating Noise Impacts*. This document directs NYSDEC staff on how to evaluate noise impacts from proposed and existing facilities. The above table was originally developed by the EPA, in *Protective Noise Levels* (EPA, 1978).

The hourly average equivalent source level (in dBA) is known as the $L_{eq.}$ The L_{eq} descriptor is in standard use by various agencies as the most appropriate metric for estimating the degree of nuisance or annoyance that would occur from increased noise levels occurring during a typical peak hour. The day-night noise level (L_{dn}), is defined as the weighted average sound level in decibels during a 24-hour period, with a 10-dBA weighting applied to nighttime sound levels. The 10-dBA weighting accounts for the fact that noises at night are more perceptible to humans because there are fewer background sounds to obscure the noise. The L_{dn} descriptor has been proposed by the U.S. Department of Housing and Urban Development (USHUD), the EPA, and other organizations as one of the appropriate criteria for estimating the degree of nuisance or annoyance that increased noise levels would cause in residential neighborhoods.

3.11.2.3.2 Inventory of Equipment

This section presents an inventory of noise-producing equipment to be used for the following project activities:

- Construction of the processing facility site;

- Activities related to dredging, including dredging itself, resuspension control installation, backfilling, capping, and barging of materials;
- Processing facility operations, including offloading of dredged material from the barge, size separation, dewatering, water treatment, sediment staging and loading, and rail yard operations.

At this stage of design, the analysis has focused on the sources that will generate the highest sound pressure levels.

Equipment Construction of Sediment Processing Facility

Construction of the sediment processing facility will involve general earthwork and infrastructure installation, as well as waterfront and rail yard development. Construction equipment at the processing facility is expected to include conventional earth-moving equipment, such as backhoes, front-end loaders, graders, and scrapers. This equipment will be used to grade and prepare the ground surface for construction of the processing facility. Pile drivers may also be used to sheet pile along the shoreline of the unloading area.

Equipment for Dredging and Backfill Operations

Dredging equipment may include tugs, cranes, excavators, high solids pumps for moving sediments to larger barges, and generators. Tugs will be used to maneuver barges (both barges with dredged material, backfill/cap material, and barges with cranes and excavators on them) in the river. Cranes and/or excavators will be used to dredge and place backfill/cap materials. Other sources of noise from water-borne equipment include engine noise from support boats, and light stands.

On-water site construction equipment may include pile drivers to drive sheet pile walls. Sheet pile walls or individual piles may be installed in or around dredging locations for resuspension control. The method of sheet pile installation will be specified during Phase 1 Final Design.

Table 3-51 presents the list of dredging equipment that represents the significant sources of noise; this list may be modified during Phase 1 Final Design.

Processing Facility Equipment (Including Rail Yard Equipment)

Activities at the processing facility will include offloading of dredged material from barges to the processing facility, processing of dredged material, and processed material movement and loading into rail cars for final disposal and water treatment. Table 3-52 presents a list of processing facility equipment identified to date. Table 3-53 provides further detail on specific noise sources from the unloading area.

Rail yard operations consist of rail car arrival at the processing facility, switching and alignment of rail cars at the processing facility, loading of processed material into rail cars, and departure of rail cars from the processing facility. Rail car loading equipment will include a yard locomotive and front-end loaders. The locomotive will be used to align rail cars during loading of processed material. Front-end loaders will be used in Phase 1 to load dredged material onto the rail cars. The primary source of noise will be the loading of the rail cars from the two front-end loaders.

3.11.2.3.3 Modeling

To estimate potential noise levels at receptor locations, screening-level noise modeling was conducted for three activities:

- Construction of the processing facility at the Energy Park site;
- Dredging operations on the river; and
- Processing facility operations (including rail yard operations).

Site Construction

Based on the current configuration of the processing facility, an analysis was made of a potential worst-case construction scenario. The analysis is based upon methods prescribed in *Highway Construction Noise: Measurement, Prediction and Mitigation* (U.S. Federal Highway Administration, 1976). The analysis assumes that multiple scrapers and loaders are working jointly with a compactor and a bulldozer. This is estimated to be a conservative scenario. Based upon the methodologies prescribed in the U.S. Federal Highway Administration guidance an Equivalency Factor (an adjustment made to construction equipment noise levels based upon maximum and minimum noise levels) of -2 dBA was used in the modeling.

Given the locations for grading and site development (see draft Drawing P-0003), modeling results predict that construction activities from the above worst-case scenario will not exceed the short-term daytime L_{eq} control of 75 dbA. Construction of the processing facility is expected to occur only during daytime hours; therefore, a comparison to the short-term nighttime standard was not performed.

Dredging and Backfill Operations

The noise levels at receptors from each piece of dredging equipment will vary as the dredges and associated support vessels move about the river. Production rates, weather, and other factors (e.g., river congestion, maintenance schedules) will influence on-water dredging operations and their potential noise emissions.

The modeling of noise generation and attenuation due to distance between source and receptor for on-water activities was completed by compiling noise sources that may be present during dredging operations in the day and evening. From the inventory of noise sources described above, an area of potential impact was developed for on-water dredging operations. A screening-level analysis was conducted to determine the noise as a function of distance from dredge operations. Screening-level analyses are conservative in nature, and use general assumptions for noise attenuation, instead of site-specific information. Because dredging will occur at different locations and at different times, site-specific models will be developed during the Phase 1 Final Design for areas where the screening model predicts noise impacts above the Concern Level.

The screening modeling was based on sound level reductions over distance. The NYSDEC recommends that screening-level analyses of noise sources use this methodology (see *Assessing and Mitigating Noise Impacts*[NYSDEC, 2003]). This methodology assumes that at distances greater than 50 feet, every doubling of distance produces a 6 dBA reduction in the sound. Therefore, an 80 dBA noise level 50 feet from the dredge would have a 74 dBA level at 100 feet, 68 dBA at 200 feet, and 62 dBA at 400 feet away from the dredge.

A cumulative noise level was assumed by analyzing the potential noise sources associated with dredging operations, such as dredging equipment, tug boats, potential pumping equipment, and generators. It is assumed in this Phase 1 IDR that the dredging operations will have a noise level of 80 dBA (1-hour L_{eq}) approximately 50 feet from the dredge. This is based on noise levels generated by dredging equipment and review of previous dredging operations. In the QoLPS, the EPA assumes that noise from a mechanical dredge will range from 70 to 80 dBA 50 feet from dredging operations (Figure 6-5, QoLPS, pg 6-26).

Based on this conservative analysis, dredging within 100 feet of a residential receptor has the potential to exceed the Noise Performance Standard's Control Level of 75 dBA for daytime operations. This conservative analysis also indicates that dredging operations within 300 feet of a residential receptor have the potential to exceed the nighttime standard of 65 dBA. The long-term day/night average standard does not apply to dredging operations.

However, given the variable nature of noise with local conditions, there may be circumstances that further attenuate noise in specific areas along the dredging corridor. For example, river conditions, wind, and bank slope will attenuate noise levels. Also, local vegetation may provide noise attenuation for dredging noise sources. Further refinement of potential noise emission sources considering all these factors during dredging will be conducted during Phase 1 Final Design.

As presented in Section 3.5, sheet piling may be used as a resuspension control technique in certain areas of the river. The screening-level modeling assessment has been performed for the sheet piling flow diversion structure designed for the East Channel of Rogers Island (to the north of NIP01). This assessment of noise effects from sheet pile installation assumes that vibratory sheet pile driving methods would be used.

Noise levels were calculated using a number of assumed usage factors. Table 3-55 presents the usage factors and resulting L_{eq}.

Table 3-55 – Assumed Equipment Usage Factors

Usage Factor (%)	L_{eq} (dBA)
75	79 (Standard = 80 dBA)
50	77
33	75.5 (Control Level = 75 dBA)

Since the placement and positioning of the individual sheets takes the most time during sheet pile installation, a usage factor of 33% is not unreasonable. It has been assumed that the vibratory hammer will drive sheets to depth in 20 minutes and the remainder of the hour will be used to set-up for the next sheet. This will be refined after completing constructability reviews during the Phase 1 Final Design.

Processing Facility Operations

For modeling noise at the processing facility, a site-wide noise model was developed by taking the noise inventory for the processing facility listed above. The CADNA/A Noise Prediction Model was used to estimate the sound levels generated from operations at the unloading and processing facility (Data Kustic Corporation, 2005). CADNA/A is a Windows®-based software program that predicts and addresses noise levels near industrial noise sources. The model uses industry-accepted methods for predicting sound pressure levels. The layout of the processing facility was imported into CADNA/A, and the individual sources were then inserted into the model. Many of the sources were entered with not only sound levels, but also time of day operations, geometry of the area, and type of source (point, area, or line). Figure 3-31 shows proposed receptor locations used to evaluate potential noise impacts based upon proximity to residential receptors and fence-lines.

The model has predicted 1-hour L_{eq} levels at nearby receptors for both day and nighttime scenarios, as shown on Figures 3-32 and 3-33, respectively. Based upon the assumptions used in the modeling, such as time of operation, location and sound power levels, it is anticipated that the predicted L_{eq} levels will be the maximum 1-hour L_{eq} levels. The average 1-hour L_{eq} levels should be less than the predicted levels, as the model does not account for operational maintenance, routine downtime, and staff changes. The model also predicts an L_{dn} for the unloading and processing facility (Figure 3-34). As noted above, the L_{dn} is the 24-hour L_{eq} with a penalty of 10 dBA added to the nighttime noise levels, which is the long-term noise standard for the processing facility.

As can be seen from Figures 3-32 and 3-33, predicted noise levels at the nearest receptors are within the limits specified in the basis of design analysis above. Further, as can be seen on Figure 3-34, the L_{dn} levels at nearby receptors are predicted to meet the long-term noise standard.
Based upon distances to nearby receptors, it is not anticipated that the placement of bulkhead sheet piling at the processing facility will violate the daytime noise standards. Other activities associated with construction will be assessed in the Phase 1 Final Design.

3.11.2.3.4 Potential Noise Mitigation

This section reviews the noise mitigation options based on the screening-level design analysis discussed above. A contingency plan will be developed, as described in Attachment B, for unpredicted exceedences measured during operations and complaints. The monitoring plan for noise is provided in the Phase 1 ID RAM Scope (Attachment A).

Site Construction

There are no predicted exceedances of the short-term noise standards during construction. The Phase 1 FDR will review and document modifications made to the site layout that may impact construction noise. If significant modifications are made, the screening level model will be run again.

On-Water Operations (Dredging)

For areas where dredging is within 100 feet of the receptor (or within 300 feet at night), further analysis of dredging operations will be conducted during the Phase 1 Final Design. This analysis will include more refined analysis of noise sources, inclusion of site-specific attenuation factors, and resulting mitigation measures (if any).

Predicted noise levels from sheet pile installation may exceed the short-term control level of 75 dBA. One mitigation contingency for the sheet pile installation may be the limitation of vibratory driving to 20 to 30 minutes in a given hour. The Phase 1 FDR will provide a refined analysis of predicted noise levels from sheet pile installation.

Processing Facility

There are no predicted exceedances of the noise standards for the processing facility. The Phase 1 FDR will document modifications made to site layout that may impact processing facility noise levels.

3.11.2.4 Lighting

This section provides the design analysis off the project's ability to meet the Lighting Performance Standard.

3.11.2.4.1 Lighting Performance Standard and Overview of Design Analysis

The Lighting Performance Standard is described in the Phase 1 ID PSCP Scope (Attachment C). The numerical lighting standards for light emissions attributable to the project are as follows (QoLPS, p. 6-39) (EPA, 2004b):

- Rural and suburban residential areas = 0.2 footcandle;
- Urban residential areas = 0.5 footcandle; and
- Commercial/Industrial areas = 1 footcandle.

As noted in the QoLPS, the Lighting Performance Standard will not supersede worker safety lighting requirements established by OSHA (QoLPS, p. 6-40) (EPA, 2004b).

The principal objective of the Lighting Performance Standard is to establish, for Phase 1, the allowable level of lighting from the project that would not present an unacceptable effect on the quality of life in the surrounding communities. The Lighting Performance Standard includes provisions for monitoring glare, light trespass, and sky glow. The standard defines these terms as follows:

- Glare is the sensation produced by light that is greater than the light to which the eyes are adapted, resulting in limited visibility.
- Light trespass is caused by light that can stray from work areas.
- Sky glow is the brightening of the night sky that results from reflected light.

A summary of the design analysis for the lighting standard is provided in Table 3-56 below.

Table 3-56 – Lighting Design Analysis

Basis for Design	• Lighting standard for rural and suburban residential areas (0.2 footcandle). • OSHA standards for lighting.
Emissions Inventory	• Processing facility lighting at the unloading facility assumes ten 400-watt MH floodlights. • Dredge inventory assumes three 400-watt metal halide (MH) floodlights.
Model Description	• Lighting for dredge operations was modeled using AGI32 (Lighting Analysts, Inc., 2005), a computational program that performs numerical point-by-point calculations of incident direct or reflected light on any real surface or imaginary plane. Within this scope, it was used to predict or quantify the distribution of artificial or natural light in any environment. • Lighting at the processing facility was modeled using VISUAL (Acuity Brands Lighting, 2005), a computational program that uses radiosity theory to conduct lighting analysis.
Model Input Parameters	• Emissions inventory, height of light, and work areas to be lit.
Model Output	• See Sections 3.11.2.4.4.
Refinements for Phase 1 FDR	• No additional studies required based on Phase 1 Intermediate Design. • Any lighting design completed during the Phase 1 Final Design will be compared to the Phase 1 Intermediate Design.

3.11.2.4.2 OSHA Lighting Requirements

While the design of Phase 1 is intended to comply with the Lighting Performance Standard, worker safety will not be compromised. To ensure worker safety, the project must meet all OSHA lighting requirements. As the dredging and processing facility operations are expected to be operating 24 hours a day, nighttime lighting will be required. Lighting in operational areas for dredging, barge offloading, and sediment processing will be designed to protect worker safety as mandated by the OSHA lighting requirements. Specifically, on-water work will be designed to meet OSHA Maritime Standards at 40 CFR 1917.123; and on-land work will be designed to meet OSHA Construction Standards at 40 CFR 1926.26 and 1926.56.

3.11.2.4.3 Inventory of Lighting Equipment

On-Water Operations

Lighting systems with high wattage lighting sources (1,000+ watts) may cause safety issues. Such sources are generally not intended to be used on low-mounted lighting systems without appropriate safeguards. The vision of workers who look directly into such sources, at a close range, may be impaired. Sources and equipment will be recommended that will minimize visual impairment. It is not anticipated that sources over 400 watts will be used at mounting heights less than 35 feet at any point during the project. Appropriate source shielding will be provided. Although more lighting equipment may be required as a result, lower wattage sources will be less of a potential lighting nuisance and will reduce impacts on receptors.

Processing Facility

For inventory purposes, it is assumed that the access road will be equipped with street lights. The unloading area will require several floodlights with wattage at or below 400 watts.

At the processing facility, it is anticipated that two systems of lighting will be present. The first will provide a level of lighting appropriate for general worker safety. The second system of lighting will be operations-specific and will be directed towards specific work areas.

Operations-specific lighting for waterfront operations will be turned off at times when operations are not in process. Barge-mounted lighting associated with loading or unloading activities will be turned off during transit and between dredging and processing sites if it is not also necessary for safety purposes. Lighting for navigation will be required.

3.11.2.4.4 Modeling

On-Water Operations

A screening-level analysis was conducted to determine the distance from dredge operations where exceedances of the Lighting Performance Standard could occur. Screening-level analyses are conservative in nature, and use general assumptions instead of site-specific information.

The work area of a dredge deck and barge is assumed to be 3,000 ft^2. As a screening analysis, 400-watt lights were assumed. The screening-level analysis of this lighting scenario predicted that light levels would be at or above rural/suburban residential lighting standard of 0.2 footcandle to a distance of approximately 113 feet from the dredge barge. This is a conservative analysis as it does not include shielding and dampening mitigation options.

Based on the results of the initial screening-level evaluation, a light manufacturer was contacted to perform a more refined analysis. The analysis consisted of evaluating lighting the area of the dredge to an average of 5 footcandles. The model assumed that three 400-watt MH floodlights would be placed on a dredge at a height of 35 feet, and that the fixtures would be angled, from bottom fixture to top fixture, at 5, 15, and 25 degrees. These inputs were used in the photometric model program AGI32 (Lighting Analysts, Inc., 2005). AGI32 is a computational program that performs numerical point-by-point calculations of direct or reflected light on any real surface or imaginary plane. It is used to predict or quantify the distribution of artificial or natural light in an environment. The results of the analysis, depicted on Figure 3-35, indicate that the area in which light would be at or above 0.2 footcandle extends to only 50 feet from the edge of the lit dredge barge. This modeling assumes no light attenuation from on-shore vegetation, so it is conservative.

Processing Facility

The processing facility was modeled using visual, a computational program that uses radiosity theory to conduct lighting analysis (Acuity Brands Lighting, 2005). The model was set up to evaluate lighting at the unloading area. The analysis consisted of simulating lighting the area around the unloading crane (approximately 150 feet by 150 feet) to an average of five footcandles. For the model, ten 400-watt MH flood lights were assumed to be placed on poles 30 feet high. Most of the fixtures were assumed to be pointed towards the ground, with the exception of two fixtures, which would be angled about 45 degrees towards the barge. The modeled results, depicted on Figure 3-36, indicate that light levels would meet the rural and suburban residential lighting standard, within the canal, and there are no predicted exceedances of the lighting standards on the opposite bank of the canal.

Thus, the predictions of lighting effects from modeling of the facility, as currently configured, are within the Lighting Performance Standard at the processing facility.

3.11.2.4.5 Mitigation

The dredge floodlights will be specified with protective shields creating a downlighting effect. This will reduce the visibility of direct light to receptors in residential areas. Monitoring for lighting inputs has been described in the Phase 1 ID RA Monitoring Scope (Attachment A). A complaint management plan is described in the Phase 1 ID RA CHASP Scope (Attachment B).

3.11.2.5 Navigation

The Navigation Performance Standard is described in Section 6 of the Phase 1 ID PSCP Scope (Attachment C). Review of the statutory and regulatory requirements referenced in that standard indicates that those requirements should be met. However, other aspects of this QoLPS could raise logistical issues. For example, navigation issues associated with the remedial action depend on the use of locks in the project area (Lock 7 for Phase 1) that will have to be traversed by project barges carrying dredged sediments and backfilling/capping materials. Passage through the locks is regulated by the NYSCC, and logistical issues associated with this increased traffic will be addressed in the Phase 1 FDR after consultation with the NYSCC. The proposed use of the West River Road Boat Launch for support boats is intended to reduce this traffic at Lock 7, thereby reducing project-related navigation impacts. A logistics model, as described in Section 3.12, will extend the consideration of navigational impacts into the Phase 1Final Design.

It should also be noted that due to the need for resuspension controls, as well as the need to meet the Productivity Performance Standard in a safe manner, the East Channel of Rogers Island will be closed to navigation during the performance of Phase 1 dredging.

3.11.3 Interactions Among Performance Standards

This project has been designed to achieve the numerical EPS and QoLPS on an individual basis. However, the interactions among the standards and the ability to achieve them all simultaneously also need to be considered. This is critical since the actions taken to meet one standard could present problems in attempting to achieve other standards.

For example, the contingency actions required by the Resuspension and Residuals Performance Standards could affect productivity and thus the ability to meet the Productivity Performance Standard. Further, to meet the Resuspension Performance Standard, physical barriers such as sheet piling, silt curtains, and other forms of containment will be required. The design and installation of these physical barriers may have impacts on the ability to achieve the PCB air quality and noise QoLPS, and could also have impacts on the Navigation

Performance Standard since the installation of resuspension controls will prevent navigation in those dredge areas. Also, as note above, due to the amount of project-related activity in this area, and associated safety concerns, the East Channel of Rogers Island will be closed to navigation during Phase 1 dredging.

As another example, achievement of the Productivity Performance Standard will affect the number of trips needed to transport dredged materials to the processing facility and depends on reliable rail service. As a contingency for rail service upsets, processed sediment staging areas are being designed. The operations of these staging and unloading areas could hinder the ability to achieve the PCB air quality and odor standards, and thus will be further assessed. The logistics model described in Section 3.12 will assist in the evaluation of productivity and other performance standards by confirming equipment sizing and quantities, evaluating operational sequencing, evaluating navigation impacts, optimizing processed material staging area requirements, and evaluating rail service schedules. The final design of these operations will be require a final review of QoLPS impacts.

Given these potential interactions, it is unknown at this time whether the project will be able to meet all the EPS and QoLPS simultaneously. Phase 1 will constitute a test of the ability to do so. It will be a test of the assumptions that have been made in this Phase 1 IDR and will be made in the Phase 1 Final Design, and will provide important information on the interactions among the standards.

3.12 Overall Design Optimization

A logistics model is being developed to simulate the movement of sediment from the dredge areas to the disposal facility. The simulation model will evolve with and inform the process design, provide outputs for system refinement, and be used as a communication tool to demonstrate project execution. This section describes the purpose of the model and discusses how the model will support the design of specific project elements.

3.12.1 Logistics Process Simulation Model

The logistics model provides a framework to evaluate various design scenarios; for example, the model can evaluate scenarios such as the effect of adding or removing dredges, barges, tugs, offloading equipment, and/or rail car deliveries on the overall flow of the project from dredging through landfilling of processed materials.

The model can also be used to provide computer animation of items such as complication sequence of dredge areas, movement of barges on the river, recreational traffic, lockages, sediment offloading and processing, accumulation of processed material in staging areas, and rail movement to the disposal site. While it is not intended to evaluate major changes in project design concepts, the tool can be used for sensitivity analyses by making minor adjustments to the proposed design based on an expected range of specific project variables. The ultimate goal is to validate the productivity design analysis.

3.12.2 Design of the Model

The model has a user interface to enter data such as:

- Number of inventory and residual dredges in the system;
- Dredge locations and sequencing;
- Volume of material to be dredged;
- Sediment physical properties;
- Probability of re-dredging passes being needed;
- Probability of backfill or caps being placed;
- Number of tugs and barges in use;
- Forecast of recreational traffic;
- Dredging, offloading, and processing rates;
- Backfill and cap placement rates;
- Rail car loading rates and capacities;
- Number of rail cars, locomotives, and unit train sets in the system; and
- Unit train travel times to/from the landfill and unloading rates at the landfill.

Once the data are entered, the same interface is used to activate model execution, initiate animation, and generate output graphics of system performance. The parameter values for these inputs can be entered as discrete values or as a probability distribution functions to show the influence that variations in the individual input parameters can have on the simulation output.

3.12.3 Simulation Logic

The simulation model includes logic to represent the following processes:

- Phase 1 Inventory Dredging Plan - the model uses the Phase 1 Inventory Dredging Plan presented in Table 3-22 to determine the basic prioritization for progression of dredging operations from one area to the next in the general pattern of upstream to downstream. The model applies the dredge production rate for each area, applies it to the area being dredged, simulates the probability of events that cause delays (such as weather), and when the inventory dredging is complete in that area, the dredge moves on to the next area according to the prioritization in the Phase 1 Inventory Dredging Plan. The model uses the sediment properties in each dredge area (i.e., percent solids by weight, percent fine-grained material) to determine when each barge is filled to capacity. This data are also passed to the sediment processing module.
- Phase 1 Residuals Dredging Plan - the model uses a probability distribution to predict whether one, two, or three additional dredging passes are necessary in each dredge area, and then the model applies a residuals dredging rate for the area (based on Table 3-23) and removes an additional lift of dredged material. The model assumes a time lag between the completion of each dredging pass for collection and analysis of residuals sampling data and prior to the implementation of subsequent dredging passes.
- Backfilling/capping plan - the model simulates the placement of backfill or cap materials on each dredge area following a time lag for collection and analysis of residuals samples. A probability distribution is used to predict whether backfill can be placed or a cap must be placed, and the model then simulates the placement of those materials based on material handling rate and the area being backfilled or capped. The model also restricts the placement of backfill or cap materials so that the area being addressed is not downstream of areas that are yet to be dredged.
- Tug and barge movement for dredging and backfill operations - the model simulates the movement of empty and full barges throughout the Phase 1 areas, bringing empty barges to the various dredging locations and then moving them when they are full to the processing facility.
- Movement of the barges through locks and their interaction with recreational vessels - the model simulates the lockage of barges, tugs and recreational vessels by tracking the lock status and the amount of time for one complete fill and empty cycle. Input data are provided in Table 3-28 (vessel traffic table found in Section 3.4).
- Processing including material unloading, dewatering and storage - based on the sediment properties and type of dredging operation (i.e., inventory versus residuals) the percent solids and percent fine-grained content of each barge load of material is calculated by the model. The model then applies an unloading rate to empty

the barge and used the mass balance for size separation and dewatering processes to estimate a coarse solids, fine solids and water output stream generated from each barge load of dredged material. The coarse and fine solids are placed in stockpiles which are then reduced at a rail car loading rate. The model will simulate variations in operations that affect stockpile size,

- Rail operations including the loading of material to rail cars, locomotive arrival and the movement of loaded cars to the disposal facility the model simulates the filling of a unit train of 81 gondola cars, and the movement of that unit train from the rail yard when a locomotive arrives. The model simulates the unit train movement from the processing facility to the landfill, the unloading of the rail cars at the landfill, and the return trip by the locomotive and the empty unit train to the processing facility.

The intermediate design process has resulted in the population of the inputs to the user interface, so that model runs can begin early in Phase 1 Final Design.

3.12.4 Output Data

Output from the model can be represented in several ways. The model can output animated displays of the dredging process, which can be used to visualize different scenarios and to identify possible bottlenecks during the process. The model output also includes charts and graphs to display a probability distribution of each output variable; these displays can be used to convey uncertainties and evaluate the feasibility of different scenarios of a particular process.

The types of data that can be displayed during the dredging process include, but are not limited to:

- Quantity of material being removed from each dredging area;
- Progress of inventory dredging, residuals dredging, and backfilling/capping operations;
- Cumulative amount of material dewatered in the processing facility;
- Cumulative amount of material loaded on trains and transported;
- Volume of processed material stockpiled at the facility per day;
- Frequency of barges unloaded per day; and
- Number of lockages per day.

The outputs can be provided for various input scenarios and can be used to conduct sensitivity analysis on various input parameters. Scenarios can be modeled to simulate the movement of dredged material from the dredge area to the landfill. The base simulation would be that the material is produced exactly as prescribed in the dredging plans (Section 3.3) with the material being taken to the landfill on a predictable rail schedule. This will allow the sizing of and amount of equipment needed for barging, unloading, dewatering, water treatment, material staging, rail car loading, etc. Sensitivity analysis would allow variations in the dredge plan and other key variables to see how changes in key assumptions affect the overall design. As a result, modification to the design can be made to deal with reasonable variations in key project parameters such as dredge productivity or the rail schedule.

3.12.5 Model Results

The model is being developed as a tool to be used to inform the final design. The results of the analyses described above will be provided in the Phase 1 FDR.

4. Phase 1 Scope of Work and Schedule

This section describes the scope of work for the Phase 1 RA, and provides a roadmap for moving from the design stage to the implementation stage of the project. This roadmap accounts not only for construction-related activities necessary for the project, but also for a number of activities that must be completed before construction can begin. The interrelationships between the various remedial activities that comprise Phase 1 are also described; these interrelationships form the basis for the overall project schedule. Figure 4-1 illustrates the Phase 1 RA tasks and their interrelationships.

As set forth in Section 3.2, the Phase 1 RA has eight project elements:

- Dredging;
- Dredged Material Transport;
- Resuspension Control;
- Sediment and water processing;
- Transportation for disposal;
- Disposal;
- Backfilling/capping;
- Habitat replacement and reconstruction.

In the Phase 1 FDR, an overall project schedule for Phase 1 will be presented. Estimated durations for procurement, site construction, equipment installation, and testing will be provided. These estimated durations will be incorporated into the bid-specifications used for contracting. Refinement of the schedule will occur after contracting is complete and will be presented in the RA Work Plans as described below.

The implementation of the activities described in this section require there first be an agreement between GE and EPA to perform Phase 1 of this project.

4.1 Pre-Construction Activities

Prior to construction, the activities listed below will need to be completed:

- Obtain agreements permitting access to the Energy Park site and West River Road Boat Launch facility;
- Obtain agreements for access to properties used for siting air monitoring stations and automated water column monitoring stations;
- Obtain agreements for access to other properties needed during construction at the Energy Park site, such as temporary access roads for heavy construction equipment and contractor employee vehicles;
- Obtain any required variances and access agreements for construction of access roads to be used during continuing operations at the Energy Park site;
- Complete a traffic study for new access roads to the processing facility at the Energy Park site;
- Identify and install utility service rights of way for electricity, gas (if available), telephone, potable water, and sanitary (if available) at the Energy Park site; and
- Coordinate design of the tie into the CPR Main Line with the rail yard design.

GE will retain a Construction Manager (CM) that will assist in the development and implementation of a contracting plan. The contracting plan will address:

- Contractor pre-qualification;
- Bid packaging;
- Interface and coordination of multiple contractors;
- Construction sequencing;
- Construction delivery systems (contract structures and compensation measures);
- Contract durations; and
- Planning to manage any identified labor and construction equipment availability issues.

4.2 Remedial Action Activities Overview

The equipment, materials, and services required to perform the Phase 1 RA will be provided under contracts with construction, specialty, operating, transportation, and disposal contractors. The number of contracts and the scope of each contract will be more fully developed and presented in the Phase 1 FDR. For purposes of the scope of work discussed in this Phase 1 IDR, the Phase 1 RA activities are divided into four categories:

- Phase 1 Facility Site Work Construction;
- Phase 1 Processing Equipment Installation and Remaining Site Work;
- Phase 1 Dredging and Facility Operations; and
- Phase 1 Sediment Transportation and Disposal.

As the design progresses from this Phase 1 IDR to the Phase 1 Final Design, it will be possible to delineate appropriate bid packages for each category. The Phase 1 FDR scope of work will incorporate more complete task descriptions within each category, and is planned to be organized by bid packages.

The narratives for each of the four categories of RA activities discussed below include a discussion of:

- Contracting;
- RA Work Plan development;
- Construction activities (including a preliminary scope of work);
- Major equipment procurement; and
- Contingency actions.

4.3 RA Contingencies Overview

Preliminary contingency actions to be implemented in the event of certain occurrences (e.g., the exceedance of specific air or noise performance standards during the project) are also referenced in this section. In most cases, these contingency actions are described in the attachments to this Phase 1 IDR, such as the Phase 1 ID RA CHASP Scope (Attachment B) and the Phase 1 ID PSCP Scope (Attachment C). The final plan for contingencies will be provided in the RA CHASP to be submitted with the Phase 1 FDR, as well as in the Phase 1 PSCP to be prepared as part of the remedial action.

Contingency actions for project-related operations that are not directly related to the Hudson EPS (EPA, 2004a) and Hudson QoLPS (EPA, 2004b) will be evaluated during Phase 1 Final Design and included in the Phase 1 FDR. The FMEA (discussed in Section 1) will be used to help identify the areas where such contingency actions would be needed. A preliminary list of potential occurrences that may require specific contingency actions include:

- Spills (e.g., petroleum products or dredged sediment);
- Vessel incidents (e.g., collision, fires, capsizing);
- Encountering unmarked and previously unknown under water utilities;
- Encountering artesian conditions in the river;
- Champlain Canal Lock malfunctions or failure;
- Power disruption or failure;
- Disruption of rail service;
- Fire at the sediment processing facility;
- Disruption of landfill operations; and
- Unpredictable extreme weather conditions (e.g., tornado).

4.4 Phase 1 Facility Site Work

The Phase 1 facility site work construction will consist of activities to develop the property to be used for the sediment processing/transfer facility. The site work construction efforts will be defined in the Phase 1 FDR and will generally consist of civil construction work to begin development of the site. The Phase 1 FDR will separately identify and segment the portions thereof that pertain to the Phase 1 facility site work construction, and will specify an estimated duration for the performance of such work, to be used by GE in soliciting bids for the work, for EPA review and approval. The remainder of this section includes a description of contracting activities, the development of an *RA Work Plan for Facility Site Work Construction*, a summary of Phase 1 facility site work, and identification of the major manufactured materials (e.g., pre-engineered buildings) needed for this component.

4.4.1 Contracting for Phase 1 Facility Site Work

GE will complete the contracting activities described in this section to select and retain contractor(s) to assist in development of the *RA Work Plan for Phase 1 Facility Site Work Construction* and to perform the site work construction.

Contractor Prequalification

Prior to completion of the Phase 1 FDR, GE will develop a Request for Qualifications (RFQ), based in substantial part on AGC Document 221, *Contractor Pre-Qualification Questionnaire.* Responses to RFQs will be reviewed and evaluated by GE, and its CM and consultants. A determination will be made whether the submitting entity has the skill, experience, resources (labor, management, equipment, and financial), record of successful and timely completion of similar projects, and a record of exceptional health and safety performance deemed necessary to perform the anticipated work in a timely, acceptable, and safe manner.

Bid Solicitation, Contractor Selection, and Issuance of Notice(s) of Award

GE will solicit bids for the Phase 1 facility site work construction based on the facility site work design component identified in the Phase 1 FDR. It is anticipated that plans and specifications which are ready for construction will be developed in the Phase 1 Final Design for this construction component. Adequate time will be provided for pre-qualified bidders to prepare bids for GE evaluation. Following receipt of bids, GE will review and evaluate the bids, select a contractor(s), and issue a Notice of Award to the successful bidder(s). However, GE will not issue a Notice of Award to a contractor until EPA has approved the portion of the Phase 1 FDR that has been developed for the facility site work and GE has had sufficient time to review any design changes and solicit bid revisions, if necessary based on the EPA-approved Phase 1 FDR. If GE does not receive any responsive bids, GE will develop a plan to address that situation, discuss it with EPA, and if necessary propose a revised schedule for obtaining bids and issuing a Notice of Award. The Notice of Award will authorize the contractor(s) to assist GE in developing planning documents, including the *RA Work Plan for Phase 1 Facility Site Work Construction*.

Issuance of Notice to Proceed

Following a Notice of Award to the selected facility site work contractor(s), contract(s) will be negotiated and Notice(s) to proceed issued. The Notice to Proceed will authorize the contractor(s) to order equipment and begin site work construction.

4.4.2 RA Work Plan for Phase 1 Facility Site Work Construction

After GE issues Notice(s) of Award to Phase 1 facility site work construction contractor(s), GE will submit to EPA for review and approval an *RA Work Plan for Phase 1 Facility Site Work Construction*. The *RA Work Plan for Phase 1 Facility Site Work Construction* will cover the component(s) of the Phase 1 FDR pertaining to facility site work. The *RA Work Plan for Phase 1 Facility Site Work Construction* will address the site work necessary for construction of the sediment processing/transfer facility, water treatment facilities, and ancillary and support facilities needed to implement Phase 1.

The *RA Work Plan for Phase 1 Facility Site Work Construction* will include a description of the site work construction activities, monitoring requirements applicable to facility site work construction, equipment staging, compliance monitoring, and a site work construction schedule. The construction schedule will describe the sequencing and reasonable durations for construction elements and account for seasonal limitations for construction in the Upper Hudson Work Area (e.g., frost conditions which could compromise construction quality such as rail bed installation and foundations, high water events, ambient temperature limitations for asphalt paving, etc.). This construction schedule will be integrated with the construction schedule for the processing equipment installation and remaining site work (described below).

The *RA Work Plan for Phase 1 Facility Site Work Construction* also will include a worker *Health and Safety Plan* (HASP) and a site work *Construction Quality Control/Quality Assurance Plan* (CQAP) addressing the items described in Section 4.6.2.2.1 that are relevant to this work. In addition, a *Stormwater Pollution Prevention Plan* (SWPPP) will be prepared (see Section 6.2 for a description of SWPPP). The *RA Work Plan for Phase 1 Facility Site Work Construction* may incorporate by reference those elements listed above which were provided in the Phase 1 FDR.

4.4.3 Phase 1 Facility Site Work Construction

4.4.3.1 Pre-Construction Conference

After receiving EPA's approval of the *RA Work Plan for Phase 1 Facility Site Work Construction* and GE's issuance of all Notices to Proceed to Phase 1 facility site work construction contractor(s), a Pre-Construction Conference will be held to discuss the site work construction at the sediment processing facility(ies). The agenda for the Pre-Construction Conference will include:

- The procedure to be used by GE for documenting and reporting inspection data and compliance with specifications and plans, including procedures and timelines for processing design changes and securing EPA review and approval of such changes as necessary.
- The procedure to be used for distributing and storing documents and reports.
- Work area security.
- Safety programs and requirements.

- The *Construction Management Plan* and discussion of any appropriate modifications of the Site Work CQAP to verify that site-specific considerations are addressed.
- Quality control and quality assurance procedures.
- Site tour to confirm access, laydown locations, and other issues (i.e., verify that the design criteria, plans, and specifications are understood).

A written summary of the Pre-Construction Conference will be prepared and distributed after the conference.

4.4.3.2 Construction Activities

GE will initiate and complete the facility site work construction for the Phase 1 sediment processing/transfer facility(ies) in accordance with the schedule in the *RA Work Plan for Phase 1 Facility Site Work Construction*, as approved by EPA.. Record drawings for permanent facilities will be submitted to EPA after completion of facility site work construction activities, in accordance with the schedule provided in the *RA Work Plan for Phase 1 Facility Site Work Construction*.

Construction activities under this component will involve the development of the Energy Park site (although discussed here, depending upon final contracting approach some of the work elements listed below may be included with the Phase 1 processing equipment installation and remaining site work component described in Section 4.5). Preliminary specifications for the site work activities along with a list of currently anticipated specifications that will be developed in Phase 1 Final Design are provided in the appended Phase 1 Intermediate Design Specifications. For this Phase 1 Intermediate Design, the scope of work for the Phase 1 processing facility site construction will include the following components:

- Mobilizing to the site;
- Site work, roads, and utilities;
- Pre-engineered buildings and building foundations;
- Waterfront and unloading facilities; and
- Processed material storage area, loadout facilities, and rail yard.

The scope of work for these components is summarized below.

Mobilization

Mobilization will include the delivery and set up temporary field office and equipment trailers, interim utilities (e.g., electric, communication, sanitary, potable water) and the delivery of construction equipment (e.g., backhoes, dozers, graders, scrapers, front end loaders, cranes, trucks).

Site Work, Roads, and Utilities

This work component includes the following:

- Clearing, grubbing, filling, and grading;
- Site roadways;
- Signs and pavement markings;
- Site fencing;
- Utilities; and
- Stormwater management.

Clearing, Grubbing, Filling, and Grading

The major areas of the Energy Park site to be cleared include approximately 3 acres of heavy brush and small trees along the existing railroad tracks and approximately 2 acres of similar growth along the west side of Bond Creek. Areas of the site that are to be graded will be stripped of topsoil to a nominal depth of approximately 6 inches and the topsoil will be stockpiled onsite for reuse. Due to the existing ground elevations throughout the site, approximately 100,000 cy of imported backfill material will be placed to achieve the anticipated design grades. The actual volume of imported backfill required will be re-evaluated, refined, and provided in the Phase 1 FDR.

Site Roadways

The overall roadway layout is shown on Drawing P-0040. The site roadways are divided into five categories depending on their usage: main haul road, interior access roads, Lock 8 access road, main site access road, and temporary site construction access road. Each of these roadways is discussed below.

- *Main Haul Road* – the main haul road will consist of two travel lanes for heavy equipment and hauling vehicles and a light vehicle access lane in certain locations. Asphalt pavement will be used for the main haul road. In areas where the pavement will be exposed to frequent turning movements by trucks and loaders (e.g., in front of the coarse material and fine material staging areas), a concrete pavement may be specified as an alternative in final design.

- *Interior Access Roads* – light-duty asphalt-paved interior access roads will be used by project personnel to access various areas of the processing facility.
- *Lock 8 Access Road* – the Lock 8 access road will consist of two lanes constructed of asphalt pavement. The Lock 8 access road will cross the main haul road near the waterfront unloading facility, and this intersection will have a gated crossing with flashing lights to prevent non-project-related local traffic from crossing the main haul road when in use by hauling vehicles. The surface of the intersection will consist of steel grating spanning a shallow concrete sump.
- *Main Site Access Road* – a new access road will be constructed from East Street across from the Fort Edward rail station along the railroad right-of-way to the southwest end of the processing facility site (assuming appropriate access agreements can be secured). The main site security station will be constructed at the site entrance from this main site access road.
- *Temporary Site Construction Access Road* – during the construction of Phase 1 processing facilities, construction materials deliveries will be made to the north end of the site from Towpath Road using an existing railroad crossing. After completion of construction of the new rail yard and upon commencement of dredging, this access road will no longer be used, but will be available for emergency egress, if needed.

Signs and Pavement Markings

Signs will be placed along the roadways as needed to identify main haul routes, dredged material handling areas, and pedestrian/vehicle crossings, and to direct and control traffic around the site. Pavement markings will be placed on roadways to define travel lanes and pedestrian crossings, as needed.

Site Fencing

Approximately 16,000 feet of perimeter and exclusion zone chain link fencing with road and man gates, security surveillance, and check point stations will be installed.

Utilities

Connection to existing utilities, which may include water, electric, gas, telephone, and sanitary sewer, will be required. This will include the extension of 3-phase electric service from offsite to the site from one or more locations identified in Section 3.6.2, and the installation of transformers and switch gear for the electric distribution system in the process areas. An existing water service will also be extended to the site for potable water and fire protection use.

Stormwater Management

Prior to the start of construction, soil erosion and sediment control measures will be installed to control stormwater runoff during construction. Silt fencing will be placed along the perimeter of the site and temporary sedimentation basins will be constructed, as needed, to collect stormwater runoff from construction areas. Where needed, temporary check dams (e.g., hay bale dikes) will be placed in ditches that discharge to existing water courses to further reduce the potential for offsite migration of suspended sediments. This scope of work also includes the installation of permanent collection and retention systems to manage stormwater at the processing site during remedial operations, including stormwater sediment basins, swales, culverts, road and process area curbs, catch basins, stormwater manholes, stormwater pumping stations, and stormwater holding tanks.

Approximate drainage area boundaries and stormwater management area types are shown on Drawing No. P-0007 - Proposed Site Stormwater Management Plan.

Pre-Engineered Buildings and Building Foundations

Some of the dewatering and water treatment areas will be housed in pre-engineered buildings. Construction of foundations for these buildings will involve the excavation and installation of footings, foundation walls, column piers, anchor bolts and utility penetration sleeves. Supplying and erecting pre-engineered buildings may also be a part of this scope of work. The administration, maintenance, security, and contractor offices (which may be prefabricated trailers) will be outfitted with heating, ventilation, air conditioning, and humidity controls, where required. Those facilities which will not be staffed and occupied year-round will have provisions for piping evacuation or winterization. The remaining portions of the pre-engineered buildings will have provisions for ventilation, and possibly negative pressurization and air emission controls, if needed. These process areas will also require provisions for piping evacuation and winterization, as recommended by equipment suppliers. A portion of the water treatment facility will likely be enclosed for winter operations (to allow stormwater collection and treatment year round). This enclosed area will also have provisions for heating and ventilation.

Waterfront and Unloading Facilities

The unloading and work wharves will be located at the northern end of the Energy Park site. A distance of approximately 1,450 linear feet along the shoreline of the Champlain Canal will be excavated using land-based equipment. The excavation at the top of the slope will be at elevation 117.0 feet. The excavated soils will be stockpiled on site and used, when possible, for general site grading. The excavation has been sized so that when barges are secured to the unloading wharf, they will lie outside the existing navigation channel. The side slopes of the excavation will be armored with riprap.

The unloading wharf will be designed for access by one unloading crane (or excavator) and mooring of one 200-foot barge. The surface of the wharf will be sloped away from the canal to direct runoff to a collection system and then to the water treatment facility. The wharf structure will consist of an open pile supported structure or a steel sheet pile bulkhead. The structure surface will be a concrete slab supported on steel framing or a slab-on-grade. Mooring hardware will be affixed to the deck of the wharf.

The work wharf will be 200 feet long and located adjacent to the southern end of the unloading wharf area. This wharf will have a design similar to the unloading wharf.

The wharf structures will be protected using a system of untreated oak fender piles, untreated oak chocks, and extruded resilient rubber fender units. The timber elements will be secured to the rubber units and the rubber units secured to the concrete deck of the wharf. In addition, there will be a series of dolphins located to the north and south of the unloading wharf.

A floating dock system for support vessels will be located at the West River Road Boat Launch facility. This system will consist of a heavy duty aluminum dock system anchored with moorings and chains, pipe piles, or a combination thereof. The 10-foot wide floating dock will be accessed from the shore by 4-foot wide ramps.

Processed Material Storage Area, Loadout Facilities, and Rail Yard

This portion of the facility site work will include the construction of the processed material storage areas and associated enclosures, the rail car loadout facilities and the rail yard. The rail yard includes the placement of ballast and approximately 38,000 linear feet of track and associated ties and turnouts, comprising a 10,000 linear-foot passing siding, two 5,000 linear-foot receiving and departure tracks, a 5,000 linear-foot loading track lead, two 2,400 linear-foot loading tracks, repair and inspection tracks, and a processing facility delivery spur.

Specific aspects of the scope of work for facility construction will be in the contract documents developed as part of the Phase 1 Final Design.

4.4.4 Major Equipment Procurement

Major equipment and principal materials needed as part of the site work construction contracts include transformers, switch gear, electrical wire and conduits, rail ties, steel rail, fencing, piping for water and sewer utilities and outfalls, liners, granular materials, concrete, culverts, and asphalt.

A table of materials and equipment with estimated quantities will be provided in the Phase 1 FDR. Preliminarily, an estimated volume of approximately 100,000 cy of fill will be delivered to the site by truck to achieve the initial site grading design. Equipment and materials that are unique or required in significant quantity will be identified and suppliers canvassed to further assess procurement schedules. This information, along with current labor and equipment availability data, will be included when developing the construction schedule in the *RA Work Plan for Phase 1 Facility Site Work Construction*.

4.4.5 Contingency Actions

Activities related to construction of the Phase 1 sediment processing facility will be monitored as described in the Phase 1 ID RA Monitoring Scope (Attachment A). A modeling assessment has been completed for noise and lighting, which predicts that facility construction activities will meet those Hudson QoLPS (EPA, 2004b) (see Section 3.11). A spill plan will be developed describing protocols to prevent spills of fuel used in construction equipment and contingency action for managing spills. In addition, a complaint management system will be active during facility construction, with complaints managed as described in the Phase 1 ID RA CHASP Scope (Attachment B). The QoLPS for noise and lighting require the implementation of certain contingency actions if specific monitoring thresholds are exceeded; the monitoring thresholds and contingency actions are described in the Phase 1 ID RA CHASP Scope and Phase 1 ID PSCP Scope. Additional details will be described in the Phase 1 PSCP and RA CHASP.

The CQAP for this site work will define contingency actions if inspections or testing determine that construction quality is outside specification limits. The worker HASP will include contingency actions that will be implemented as necessary to remain in compliance with site worker safety action limits.

4.5 Phase 1 Processing Equipment Installation and Remaining Site Work

The Phase 1 processing equipment installation and remaining site work will consist of activities to procure and install sediment dewatering and water treatment equipment necessary to process dredged sediment, as well as to complete remaining site work construction (if necessary) on the property to be used for sediment processing. The processing equipment installation and remaining site work efforts will be defined in the Phase 1 FDR along with an estimated duration for the performance of such work, to be used by GE in soliciting bids for the work. EPA will review and approve the estimated schedule for completion of this work. The remainder of this section includes a description of contracting activities, a description of the development of a *RA Work Plan for Phase 1 Processing Equipment Installation*, and a summary of Phase 1 processing equipment installation. In addition, the major equipment necessary (e.g., separations and dewatering equipment, water treatment equipment buildings, etc.) will be identified, and procurement of major equipment is described as appropriate.

4.5.1 Contracting for Phase 1 Processing Equipment Installation and Remaining Site Work

GE will complete the contracting activities described in this section to select and retain contractor(s) to assist in development of the *RA Work Plan for Phase 1 Processing Equipment Installation* and to install the sediment processing equipment and complete any remaining site work construction.

Contractor Prequalification

Prior to completion of the Phase 1 FDR, GE will develop an RFQ package, based in substantial part on AGC Document 221, *Contractor Pre-Qualification Questionnaire.* Responses to RFQs will be reviewed and evaluated by GE and its CM and consultants. A determination will be made as to whether the submitting entity has the skill, experience, resources (labor, management, equipment and financial), record of successful and timely completion of similar projects, and record of exceptional health and safety performance deemed necessary to perform the anticipated work in a timely, acceptable and safe manner.

Bid Solicitation, Contractor Selection, and Issuance of Notice(s) of Award

GE will solicit bids for the Phase 1 processing equipment installation and remaining site work based on the Phase 1 FDR. The bidding and contractor selection process for this aspect of facility construction will be completed in conjunction with the bidding and contractor selection process for Phase 1 dredging and facility operations, described below in Section 4.6.1. This process will culminate in the issuance of a Notice of Award to the contractor(s) selected to perform the Phase 1 processing equipment installation and remaining site work.

The Notice of Award will authorize the contractor(s) to assist GE in developing planning documents, including the *RA Work Plan for Phase 1 Processing Equipment Installation*.

Issuance of Notice(s) to Proceed

Following issuance of the Notice of Award to the selected contractor(s) for processing equipment installation and remaining site work, contract(s) will be negotiated and a Notice(s) to Proceed issued. The Notice to Proceed will authorize the contractor(s) to order equipment and begin installation of processing equipment and remaining site work construction.

4.5.2 RA Work Plan for Phase 1 Processing Equipment Installation

After GE issues its Notice of Award to the contractors(s) for Phase 1 processing equipment installation and remaining site work, GE will submit to EPA for review and approval an *RA Work Plan for Phase 1 Processing Equipment Installation* (note that the term "and Remaining Site Work" has been removed from the title of this RA Work Plan, for ease of future reference). The *RA Work Plan for Phase 1 Processing Equipment Installation* will cover the component(s) of the Phase 1 FDR pertaining to the procurement and installation of sediment processing and water treatment equipment, as well as any remaining site work to complete the sediment processing facility.

The *RA Work Plan for Phase 1 Processing Equipment Installation* will address the work necessary for the construction of necessary structures, the procurement and installation of the sediment processing/transfer and water treatment equipment, and ancillary and support equipment needed to implement Phase 1, as well as any remaining site work. The *RA Work Plan for Phase 1 Processing Equipment Installation* will describe the construction activities to be conducted to install the sediment processing and water treatment equipment and to complete any remaining site work at the Phase 1 processing facility, monitoring requirements applicable to processing equipment installation and remaining site work construction, equipment staging, compliance monitoring, and a construction schedule. The construction schedule will describe the sequencing and reasonable durations for construction elements and account for seasonal limitations for construction in the Upper Hudson work area (e.g., frost conditions that could compromise construction quality such as building/equipment foundations, waterfront dredging, seasonal high water events, etc.). This processing equipment installation and remaining site work schedule will be integrated with the construction schedule for the site work (described above).

The *RA Work Plan for Phase 1 Processing Equipment Installation* also will include a worker HASP and a CQAP that addresses the items described in Section 4.6.2.2.1 that are relevant to this work. The *RA Work Plan for Phase 1 Processing Equipment Installation* may incorporate by reference elements which were provided in the Phase 1 FDR.

4.5.3 Construction of Phase 1 Facility Equipment

4.5.3.1 Pre-Construction Conference

After GE's issuance of all Notices to Proceed to Phase 1 processing equipment installation and remaining site work site work contractor(s), a Pre-Construction Conference will be held to discuss the processing equipment procurement and installation and any remaining site work at the sediment processing/transfer facility. At this Pre-Construction Conference, GE will address the same items listed in Section 4.4.3.1 above. GE will prepare a written summary of the conference after the conference.

4.5.3.2 Construction Activities

GE will initiate and complete the processing equipment installation and remaining site work at the Phase 1 sediment processing/transfer facility(ies) in accordance with the schedule in the *RA Work Plan for Phase 1 Processing Equipment Installation*, as approved by EPA. Record drawings for permanent facilities will be submitted to EPA after completion of processing equipment installation and remaining site work, in accordance with the schedule provided in the *RA Work Plan for Phase 1 Processing Equipment Installation*.

The Phase 1 processing equipment procurement activities will begin as soon as possible following issuance of the Notice to Proceed. Equipment installation and remaining site work will be coordinated with the Phase 1 facility construction. The scope of work for this task will include:

- Procuring process equipment – purchase and deliver processing equipment to the site;
- Mobilizing to the site – deliver and set up temporary field office and equipment trailers, deliver construction and installation equipment (e.g., backhoes, front end loaders, cranes, trucks);

- Completing site work activities not completed as part of the Phase 1 facility site construction (e.g. final grading, paving, foundations);
- Installing offload crane or backhoe;
- Installing bar screens, rotary screen(s), sediment slurry tanks, hydrocyclones at offloading area;
- Installing processing equipment and piping – includes gravity thickener system, dewatering conditioner tanks, dewatering filter presses, polymer feed systems, rapid mix and flocculation tanks, clarifiers, filter system, activated carbon system, bag filters and ancillary tanks, controls, piping and foundations;
- Fabricating and constructing equipment, tanks, piping and valves appurtenances, and if necessary, additional foundations;
- Supplying and installing electric, control, communication, heating, ventilation, and air conditioning (HVAC), and plumbing services within structures;
- Supplying and erecting additional pre-engineered buildings or building components (unless completed during the initial processing facility site construction effort); and
- Installing air monitoring equipment (samplers and meteorological station).

Specific aspects of this scope of work will be further detailed in the contract documents developed as part of the Phase 1 Final Design.

4.5.4 Major Equipment Procurement

Listed below in Table 4-1 are the major systems for which equipment will be procured. The preliminary lead times for the major pieces of equipment needed for this task are based on discussions with vendors during development of this Phase 1 IDR. As the Phase 1 design progresses from the intermediate to final stage, specific equipment will be identified based on a refined understanding of the project needs. Availability of equipment and lead times will be updated based on additional supplier input.

Table 4-1 – Major Systems, Quantities, and Estimated Lead Times

System	Quantity	Lead Times (Weeks)
Barge Unloading	1	TBD
Desanding	1	20 - 24
Gravity Thickener	1	TBD
Filter Press Dewatering	1	24 – 42
Recycle Water Tanks	1	14 – 16
Stormwater Tanks	3	14 – 16
Clarification	3	14 – 16
Process and Stormwater Filtration	3	16 – 20
Granular Activated Carbon	12	12 – 14

Notes:
1. TBD = To Be Determined.
2. * Dewatering system will consist of multiple filter presses. According to one manufacturer, the lead time for the Filter Presses is dependent on the time of year the order is placed. The first press is expected to arrive on site 12 to 20 weeks after the order, with lag times for successive press deliveries. The lead time shown is based on 12 presses.

4.5.5 Contingency Actions

The contingency actions that were described above in Section 4.3 will also apply to the construction activities performed as part of this work component.

4.6 Phase 1 Dredging and Facility Operations

The Phase 1 dredging and facility operations will consist of activities to procure dredging equipment and perform the dredging, backfilling/capping, habitat reconstruction/replacement, dredged material transport, sediment processing, and rail loading. The dredging and facility operations will be further defined in the Phase 1 FDR along with an estimated duration for the performance of such work, to be used by GE in soliciting bids for the work. EPA will review and approve the estimated schedule for completion of this work. The remainder of this section includes a description of contracting activities, a description of the development of an *RA Work Plan for Phase 1 Dredging and Facility Operations*, a summary of Phase 1 dredging and facility operations scope of work, and contingencies to be employed based on results of monitoring activities. In addition, the major equipment necessary (e.g., dredges, barges, etc) is identified, and procurement of major equipment is described.

4.6.1 Contracting for Phase 1 Dredging and Facility Operations

GE will complete the contracting activities described in this section to select and retain contractor(s) to assist in development of the *RA Work Plan for Phase 1 Dredging and Facility Operations* and to implement dredging and facility operations.

Contractor Prequalification

Prior to completion of the Phase 1 FDR, GE will develop an RFQ package, based in substantial part on AGC Document 221, *Contractor Pre-Qualification Questionnaire.* Responses to RFQs will be reviewed and evaluated by GE and its CM and a determination will be made as to whether the submitting entity has the skill, experience, resources (labor, management, equipment and financial), record of successful and timely completion of similar projects, and record of exceptional health and safety performance deemed necessary to perform the anticipated work in a timely, acceptable and safe manner.

Bid Solicitation, Contractor Selection, and Issuance of Notice(s) of Award

GE will solicit bids for the Phase 1 dredging and facility operations based on the Phase 1 FDR. The bidding and contractor selection process for this aspect of Phase 1 will be completed in conjunction with the bidding and contractor selection process for processing equipment installation and remaining site work (described above in Section 4.5.1). Adequate time will be provided for pre-qualified bidders to prepare a proposal for GE evaluation. For this component of Phase 1, as well as the Phase 1 processing equipment installation and remaining site work, GE expects that contractors may submit bids with an alternate design from that specified in the Phase 1 FDR. If GE decides to proceed with such alternate design and if that alternate design is determined to represent a significant modification to the Phase 1 Final Design, GE will submit the alternate design to EPA for review and approval.

Following receipt of bids, GE will review and evaluate the bids, select a contractor(s) and issue a Notice of Award to the selected contractor(s). However, GE will not issue a Notice of Award to a contractor until EPA has approved the Phase 1 FDR (or the alternate design, if submitted for EPA review and approval) and GE has had sufficient time to review any design changes and solicit bid revisions, if necessary based on the EPA-approved Phase 1 FDR. If GE does not receive any responsive bids, GE will develop a plan to address that situation, discuss it with EPA, and if necessary propose a revised schedule for obtaining bids and issuing a Notice of Award. The Notice of Award will authorize the contractor(s) to assist GE in developing planning documents, including the *RA Work Plan for Phase 1 Dredging and Facility Operations*.

Issuance of Notice to Proceed

Following issuance of the Notice of Award to the selected dredging and operations contractor(s), contract(s) will be negotiated and a Notice(s) to Proceed issued. The Notice to Proceed will authorize the contractor(s) to order equipment and begin mobilization for dredging and facility operations.

4.6.2 Work Plans for Phase 1 Dredging and Facility Operations

4.6.2.1 Phase 1 RAM QAPP

Following submittal of the Phase 1 FDR, GE will submit a Phase 1 RAM QAPP for GE's monitoring and sampling activities to be conducted during the Phase 1 RA. The Phase 1 RAM QAPP will address sample collection, analysis, and data handling activities for samples to be collected during Phase 1, and will be consistent with the Phase 1 ID RA Monitoring Scope, which is provided as Attachment A

The Phase 1 RAM QAPP will include, but not be limited to, the following items:

- Data quality objectives (DQOs);
- Sampling location and frequency;
- Sample designation;
- Sampling equipment and procedures;
- Sampling handling and analysis;
- Testing and analysis, including analytical methods to be used;
- Schedule;
- Project Management;
- Measurement/data acquisition, including:
  - Sampling process design and rationale;
  - Sampling method requirements and Standard Operating Procedures (SOPs);
  - Sample handling and custody requirements;
  - Archival procedures for sediment and fish samples and sample extracts;

- Analytical method requirements and SOPs;
- Quality control requirements for sampling and analysis;
- Instrument/equipment testing, inspection, and maintenance requirements;
- Instrument calibration and frequency;
- Inspection/acceptance requirements for supplies and consumables;
- Data acquisition requirements (non-direct measurements); and
- Data management;

- Assessment/oversight;
- Data validation and/or verification and usability; and
- Additional quality assurance/quality control (QA/QC) procedures.

4.6.2.2 RA Work Plan for Phase 1 Dredging and Facility Operations

After GE issues its Notice of Award to the contractors(s) for Phase 1 dredging and facility operations, GE will submit to EPA for review and approval an *RA Work Plan for Phase 1 Dredging and Facility Operations*. The *RA Work Plan for Phase 1 Dredging and Facility Operations* will include those components in the Phase 1 FDR that pertain to Phase 1 dredging and sediment processing operations and will include a detailed description of major remediation and construction activities, monitoring events, construction QA procedures, equipment staging, compliance monitoring, and construction schedule. The construction schedule will describe the sequencing and reasonable durations for construction elements and account for seasonal limitations for construction in the Upper Hudson work area (e.g., ice formation, safe working conditions such as water temperatures and flow conditions, etc.).

The *RA Work Plan for Phase 1 Dredging and Facility Operations* will include the deliverables listed below in Sections 4.6.2.2.1 through 4.6.2.2.6 (unless GE has previously submitted a deliverable that is listed below, and such deliverable has been approved by EPA). In addition, a SWPPP will be prepared (see Section 6.2 for a description of SWPPP). The *RA Work Plan for Phase 1 Dredging and Facility Operations* will contain an index specifying where each deliverable requirement is addressed (e.g., submitted as part of the *RA Work Plan for Phase 1 Dredging and Facility Operations* or in the Phase 1 Final Design Report).

4.6.2.2.1 Phase 1 Dredging Construction Quality Control/Quality Assurance Plan

GE will be responsible for QA/QC and will establish and maintain an effective quality control system. The *Phase 1 Dredging Construction Quality Control/Quality Assurance Plan* (Phase 1 Dredging CQAP) will identify personnel, procedures, controls, instructions, tests, records, and forms to be used for construction QA/QC purposes. The Phase 1 Dredging CQAP referenced herein will describe the site-specific components of the performance methods and quality assurance program to confirm that Phase 1 meets the applicable design criteria, plans, and specifications. The Phase 1 Dredging CQAP will contain the following elements to cover dredging and facility operations, both onsite and offsite, including work by contractors, subcontractors, designers of record, consultants, architect/engineers, fabricators, suppliers, and purchasing agents:

- Responsibilities and Authorities. The Phase 1 Dredging CQAP will include the responsibilities and authorities of all organizations and key personnel involved in the construction of the RA.
- Qualifications of the Construction Quality Assurance (CQA) Officer. The Phase 1 Dredging CQAP will establish the minimum training and experience of the CQA Officer and supporting inspection personnel, and include the name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a Phase 1 CQAP function.
- QC Organization. The Phase 1 Dredging CQAP will describe the QC organization, including a chart showing lines of authority.
- Submittals. The Phase 1 Dredging CQAP will include procedures for scheduling, reviewing, certifying, and managing submittals, including those of contractors, subcontractors, offsite fabricators, suppliers, designers of record, consultants, architect engineers, and purchasing agents, dredged material transporters and disposal facilities.
- Performance Monitoring Requirements. The Phase 1 Dredging CQAP will present the performance monitoring requirements to demonstrate that debris removal, sediment dredging and dewatering operations, transportation of dredged material, backfilling and cap placement and restoration techniques are implemented in accordance with the EPA-approved Phase 1 FDR and the *RA Work Plan for Phase 1 Dredging and Facility Operations*.
- Inspection and Verification Activities. The Phase 1 Dredging CQAP will establish the observations and tests that will be required to monitor the construction and/or installation of the components of the RA. The plan will include the scope and frequency of each type of inspection to be conducted. Inspections will be

required to measure compliance with the EPA-approved Phase 1 FDR and the *RA Work Plan for Phase 1 Dredging and Facility Operations*.

- Construction Deficiencies. The Phase 1 Dredging CQAP will include procedures for tracking construction deficiencies from identification through acceptable corrective action. These procedures will include methods to verify that identified deficiencies have been corrected.
- Documentation. Reporting requirements for Phase 1 CQAP activities will be described in detail in the Phase 1 Dredging CQAP. This will include such items as daily summary reports, inspection data sheets, problem identification and corrective measures reports, design acceptance reports, electronic submittals of database and shapefiles, and final documentation/storage.
- EPA Approvals. The Phase 1 Dredging CQAP will include procedures for obtaining EPA approvals and certifications of completion for individual CUs.
- Field Changes. The Phase 1 Dredging CQAP will describe procedures for processing design changes and securing EPA review and approval of such changes.
- Final Reporting. The Phase 1 Dredging CQAP will identify all final Phase 1 CQAP documentation to be submitted to EPA in GE's final report on Phase 1.

4.6.2.2.2 Phase 1 Performance Standards Compliance Plan

The Phase 1 PSCP will set forth the actions that GE will implement to address the EPS, QoLPS, and WQ requirements. It will address, but not be limited to, monitoring activities (including monitoring contingencies), sampling and analysis, special studies, engineering contingencies, complaint procedures, mitigation measures, notification steps, and reporting requirements. The Phase 1 PSCP will be consistent with the Phase 1 ID PSCP Scope (Attachment C). If any items that are required to be included in the Phase 1 PSCP are set forth in another EPA-approved document, such requirements may be incorporated by reference into the Phase 1 PSCP.

4.6.2.2.3 Phase 1 Property Access Plan

The *Phase 1 Property Access Plan* will identify the procedures that GE will follow (or has followed) to obtain access agreements, easements, or title, as the case may be, with respect to all properties to which access is needed for purposes of implementing dredging and facility operations, if such access has not already been obtained for Phase 1 Facility Site Work Construction or Phase 1 Processing Equipment Installation. The *Phase*

1 Property Access Plan (if needed) will also describe any steps taken by GE before its submission of the *Phase 1 Property Access Plan* to obtain such access, easements, or title.

4.6.2.2.4 Phase 1 Transportation and Disposal Plan

The *Phase 1 Transportation and Disposal Plan* will include the following information:

- Characteristics of waste/water/material to be transported;
- Destinations;
- Transportation modes;
- Routes;
- Onsite traffic control and loading procedures;
- Recordkeeping;
- Health and safety; and
- Contingency plans for spills that occur in the Upper Hudson work area.

4.6.2.2.5 Phase 1 Facility Operation and Maintenance Plan

The *Phase 1 Facility Operation and Maintenance Plan* will address the operation and maintenance of the Phase 1 sediment processing/transfer facility, water treatment facilities, and ancillary and support facilities. The *Phase 1 Facility Operation and Maintenance Plan* will include:

- A written description of the major elements of work involved at and around the project's facilities with emphasis on dredging and dredged sediment transport (hydraulic or barge) operations, sediment dewatering and transfer operations, water treatment facilities, and environmental controls and protection measures.
- Operation and maintenance procedures required for critical machinery and equipment according to manufacturers' recommendations. This item will include major daily, weekly, and monthly maintenance activities that will require shut-down of the equipment and a schedule for inspections that are required for specific equipment and machines.
- An operation schedule to include primary labor types (e.g., dredging, processing, monitoring, etc.), number of shifts and hours of operation, and estimated number of persons required on a daily basis.

- An *Equipment Decontamination Plan* for machinery and trucks that come into contact with PCBs or any other potential constituents of concern at the site and are leaving the site or otherwise need to be decontaminated (e.g., equipment leaving an exclusion zone).
- A *Contingency Plan*, along with the names and contacts of manufacturers and maintenance professionals for critical equipment related to Phase 1 activities. Emergency contact numbers for local, state, and federal government organizations will be cross-referenced to the appropriate RA document (i.e., Phase 1 RA CHASP, RA HASP).
- Procedures for shutting down operations at the sediment processing facility for the off season (i.e., after processing of dredged sediments is completed for the season). Procedures for winterization of equipment, security and site access, demobilization of labor and equipment, and management of stormwater will be included.

4.6.2.2.6 Updates to Phase 1 RA CHASP

To the extent necessary, GE will update the RA CHASP submitted with the Phase 1 FDR. The RA CHASP update will be consistent with the Phase 1 ID RA CHASP Scope (Attachment B). Upon approval by EPA, such update will be incorporated into the RA CHASP.

4.6.2.3 RA HASP

To the extent necessary, GE will update the RA HASP submitted with the Phase 1 FDR. Such update will be submitted concurrently with the *RA Work Plan for Phase 1 Dredging and Facility Operations*.

4.6.3 Phase 1 Dredging and Facility Operations Activities

GE will implement Phase 1 of the RA in accordance with the approved *RA Work Plan for Phase 1 Dredging and Facility Operations*.

4.6.3.1 Pre-Dredging Construction Conference

Prior to the start of Phase 1 dredging and facility operations, a Pre-Dredging Construction Conference will be held. The agenda for the Pre-Dredging Construction Conference will include the following topics:

- Construction management, including but not limited to communications protocols and standing meetings.
- The procedure to be used by GE, its contractors, and other entities for documenting and reporting inspection data and compliance with specifications and plans, including procedures and timelines for processing design changes and securing EPA review and approval of such changes as necessary.
- The procedure to be used for distributing and storing documents and reports.
- Work area security.
- Safety programs and requirements.
- QA/QC procedures (including process for modifications to the Phase 1 CQAP to verify that site-specific considerations are addressed).
- Site tour to confirm access, laydown space, and other issues (including an inspection of each facility, including temporary and ancillary facilities).

A written summary of the conference will be prepared after the conference.

4.6.3.2 Implementation of Phase 1 Dredging Activities

GE will initiate and complete Phase 1 dredging activities in accordance with the construction schedule included in the approved *RA Work Plan for Phase 1 Dredging and Facility Operations*. The schedule will include time for equipment procurement and mobilization, as well as the execution of Phase 1 dredging and processing operations. The Phase 1 dredging will not begin until Phase 1 processing facility construction (including all site work and processing equipment installation) is completed, and the canal system is open to commercial traffic. The Phase 1 dredging and processing operations schedule will be consistent with the overall concepts and prioritization of the order in which specific dredge areas are addressed in the dredging plan described in Section 3.3, followed by backfilling/capping and habitat replacement and reconstruction activities.

The Phase 1 dredging and facility operations task will consist of contractor-performed activities to procure equipment and perform the dredging, resuspension control, dredged material transport, backfilling/capping, habitat reconstruction and replacement, sediment processing, water treatment, and rail loading aspects of the project. The scope of work for this task will include, but not necessarily be limited to:

- Providing dredging and transport equipment (e.g., dredges, barges, loaders, sheeting);
- Mobilizing to the site, including delivery and set-up of a temporary field office and equipment trailers, delivery dredge equipment (e.g., barges, dredges, tugs), delivery of site equipment (e.g., backhoes, dozers, front end loaders, cranes, trucks), and delivery of rigid and non-rigid containment system components;
- Installing sediment resuspension containment system components;
- Supplying and installing ancillary river access and berthing facilities (e.g., floating docks at West River Road Boat Launch facility);
- Operating dredging and river transport equipment in accordance with the contract documents;
- Supplying and installing backfill material in accordance with the contract documents;
- Supplying and installing cap material in accordance with the contract documents;
- Reconstructing and replacing habitat in accordance with the contract documents;
- Restoring the shoreline in accordance with the contract documents;
- Supplying labor, material, fuel and equipment to offload barges at the unloading facility;
- Supplying labor, material, equipment and consumables (e.g., water treatment chemicals) to operate the sediment, dewatering, and water treatment facilities;
- Supplying labor, material, and equipment to load out processed sediment and debris into rail cars and move rail cars within the rail yard at the site; and
- Winterizing the dredging and processing activities.

Specific aspects of this scope of work will be further detailed in the contract documents developed as part of the Phase 1 Final Design.

4.6.4 Major Equipment Procurement

Most of the equipment expected to be used by contractors for the Phase 1 environmental dredging is conventional. The equipment necessary for facility operations will be provided under the Phase 1 processing equipment installation and remaining site work task addressed above. Discussions with dredging contractors will take place during Phase 1 Final Design to verify dredging equipment availability for a project of this magnitude.

4.6.5 Contingency Actions

During the Phase 1 dredging and facility operations, environmental monitoring will be conducted as described in the Phase 1 ID RA Monitoring Scope (Attachment A). If the monitoring results indicate exceedances to certain numerical action levels or standards set forth in the EPS, QoLPS, and WQ requirements, contingency monitoring will be conducted as required by the Phase 1 ID RA Monitoring Scope, and GE will conduct response actions where required by the Phase 1 ID PSCP (Attachment C) and the Phase 1 ID RA CHASP Scope (Attachment B), as well as the Phase 1 PSCP and Phase 1 RA CHASP.

In addition, GE will develop and implement a *Contingency Plan* for spills and releases during remedial action field activities (including spill control, emergency procedures and coordination with the worker HASP). This plan will adhere to federal and state spill response requirements. The plan will be developed during the Phase 1 Final Design and will be presented in the Phase 1 RA CHASP and revised, if appropriate, in the updated RA CHASP submittal as part of the *RA Work Plan for Phase 1 Dredging and Facility Operations*.

4.7 Phase 1 Sediment Transportation and Disposal

The Phase 1 sediment transportation and disposal task will consist of activities to transport processed material via unit train to the selected disposal location(s), unload and place the material in appropriately licensed landfill cells, and return the empty rail cars to the processing facility. This task will be initiated in conjunction with the Phase 1 dredging and facility operation task discussed in Section 4.6. The scope of work for this task will include:

- Procuring landfill space sufficient to contain the sediment and debris volumes generated by the Phase 1 activities;
- Supplying gondola rail cars;
- Supplying labor, material, fuel, and equipment (including locomotives) as necessary to move unit trains from their origin to their destination and back;
- Supplying labor and equipment to transload material to trucks at the destination (if necessary) for transfer to the final disposal site(s); and
- Supplying labor and equipment to unload and dispose of processed materials in the selected landfill(s).

Transportation of processed materials by rail will be completed in accordance with appropriate regulations governing transportation of such materials, and landfilling will be in accordance with the operating permit requirements for the selected landfill site(s). Additional aspects of this scope of work will be specified in the contract documents developed as part of the Phase 1 Final Design.

4.7.1 Contracting for Phase 1 Sediment Transportation and Disposal

As discussed in Sections 3.7 and 3.8 of this report, GE is in the final stages of selecting the landfill site(s) that will serve Phase 1 of the project and obtaining the necessary contractual arrangements. The selection process will consider the lead-time (if any) for the construction or upgrade of the rail offloading/transload infrastructure at the disposal site. Negotiations with rail carriers will be finalized once the landfill site(s) is selected. This effort is expected to be completed as part of the Phase 1 Final Design.

4.7.2 Major Equipment Procurement

It is expected that the project will require the procurement of gondola rail cars fabricated specifically for this project. The lead time for these rail cars is currently estimated at 64 weeks, depending on the total number of rail cars needed. The market for rail cars is constantly changing and the actual procurement time will not be known until contracting is complete. In addition, the landfill(s) selected for this project may also need to procure and install certain equipment to upgrade offloading capabilities at the rail destination to accommodate the volumes of material to be disposed.

4.7.3 Implementation of Phase 1 Sediment Transportation and Disposal

Implementation of the Phase 1 sediment transportation and disposal task will take place in conjunction with the dredging and processing facility operations task discussed above. The processed material will be loaded from the staging areas at the processing site into rail cars to be shipped to the disposal facility. The completion of this task will be scheduled to occur by the end of the calendar year for Phase 1. As a contingency, the shipment of material after the end of the calendar year will be considered, in the event of significant rail service interruptions.

4.7.4 Contingency Actions

Noise and lighting related to the Phase 1 sediment transportation and disposal task at the processing facility site will be monitored as described in the Phase 1 ID RA Monitoring Scope (Attachment A) to assess achievement of the numerical standards in the Hudson QoLPS for noise and lighting. If noise or lighting levels exceed those numerical standards, GE will implement contingency response actions as described in those QoLPS and set forth in the Phase 1 ID PSCP Scope and Phase 1 ID RA CHASP Scope.

5. Monitoring During Phase 1 of Remedial Action

The environmental monitoring that will be carried out during Phase 1 of the remedial action to assess attainment of the numerical criteria in the EPS, the QoLPS, and the WQ requirements and otherwise to implement those performance standards and requirements will be performed under a Phase 1 Remedial Action Monitoring Program (RAMP). The Phase 1 RAMP is described in the Phase 1 ID RA Monitoring Scope which is Attachment A to this Phase 1 IDR. The requirements of the Phase 1 RAMP will be further specified in a Phase 1 EMP, which will accompany the Phase 1 FDR, and in a *Phase 1 Remedial Action Quality Assurance Project Plan* (Phase 1 RAM QAPP), which will be developed and submitted as part of the remedial action work plans and will include specific sampling and analytical protocols, QA/QC requirements, and other details. The Phase 1 ID RA Monitoring Scope included in Attachment A serves as an outline of the Phase 1 EMP for purposes of this Phase 1 IDR.

As described in the Phase 1 ID RA Monitoring Scope, the Phase 1 RAMP includes the following major data acquisition programs:

- Water column and fish monitoring;
- Sediment residuals monitoring;
- Air quality and odor monitoring;
- Noise monitoring;
- Lighting monitoring;
- Water discharge monitoring; and
- Special studies.

The Phase 1 RAMP will replace the Baseline Monitoring Program (BMP; QEA, 2003; QEA and ESI, 2004) during the remedial action.

In addition, the specific activities to monitor the actual dredging productivity will be described in the Phase 1 PSCP which will be developed as part of the remedial action. The Phase 1 ID PSCP Scope, provided as Attachment C, describes dredging productivity monitoring activities to be completed during the remedial action.

Additional monitoring activities to assess productivity will be specified in the *Phase 1 Construction Quality Assurance Plan* (Phase 1 Construction QA Plan), which will be part of the RA Work Plan.

Finally, the monitoring program that will be implemented, in accordance with the Navigation Performance Standard, to assess in-river activities associated with the project and non-project vessel traffic in the vicinity of the in-river activities is briefly described in Section 6.4 of the Phase 1 ID PSCP Scope (Attachment C) and will be described in greater detail in the Phase 1 FDR and the *Phase 1 Construction Quality Assurance Plan*.

6. Permit Equivalency

The Hudson River PCBs Site remedy is potentially subject to numerous federal, state, and local laws and regulations. Some of these laws and regulations require that permits be obtained before certain activities can take place. Because the remedy is being performed pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), no federal, state, or local permit is required for work being performed "on site" [42 USC § 121(e); 40 CFR § 300.400(e)]. the EPA interprets these provisions to exempt onsite activities from the procedural requirements of these laws and regulations; however, the work must comply with the substantive requirements of these laws and regulations. This section identifies the federal, state, and local laws and regulations applicable to the onsite portions of the remedy; summarizes the requirements of these laws and regulations; and describes how the remedial design and/or remedial action will satisfy these substantive requirements. The information presented in this section is informed by EPA's identification of ARARs in the ROD (EPA, 2002a), as well as by the Hudson EPS (EPA, 2004a) and the Hudson QoLPS (EPA, 2004b) issued by the EPA.

For purposes of this analysis, the term "onsite" means the Hudson River and "all suitable areas in very close proximity to" the river "necessary for implementation of the response action" [40 CFR § 300.400(e)]. Therefore, onsite activities include: 1) all on-river operations, including dredging, sediment transport, backfilling/capping, monitoring, and habitat replacement and reconstruction; and 2) all near-river operations, including construction and operation of the land-based facilities for barge unloading, sediment processing, and the rail yard.

As discussed above, the EPA has issued EPS and QoLPS that govern the implementation of the remedy. Portions of the performance standards are intended to take account of and satisfy the substantive requirements of other laws. For example, the Resuspension Performance Standard is intended, in part, to ensure that drinking water drawn from the Hudson River meets the drinking water standards for PCBs established under the Safe Drinking Water Act. Accordingly, for purposes of this permit equivalency analysis, it is presumed that compliance with an EPS or QoLPS will satisfy the relevant substantive requirements of federal and state laws that the standards are intended to address (consistent with EPA's authority under CERCLA).

In addition, certain activities being conducted as part of the remedial design, such as the HDA Program and the CARA Program, are being performed so as to satisfy relevant statutory requirements. For example, the HDA Program will provide data to satisfy the requirements of federal and state laws that mandate the evaluation of potential impacts on wetlands from the dredging program or other aspects of the remedial action. The CARA Program will provide assurance that the project will comply with federal and state laws governing the protection of cultural resources (e.g., the National Historic Preservation Act, 16 USC § 470 et seq.). Additional details pertaining to these programs are provided in other sections of this Phase 1 IDR and in other reports to be submitted under the RD AOC (EPA/GE, 2003). The data from the HDA and CARA Programs will be considered during the development of the Phase 1 Final Design, so that, if necessary, appropriate measures to mitigate adverse impacts on wetlands and to avoid adverse impacts on cultural resources that are eligible for inclusion in the National Register of Historic Places can be incorporated into the Final Design.

The following sections describe different activities that are part of the remedial action, identify and summarize the relevant federal and state environmental permitting laws and regulations that would normally apply to these activities but for CERCLA, and set out how the remedial design or remedial action will satisfy the substantive requirements of these laws and regulations.

6.1 Discharges of Process Water

The processing facilities will generate process wastewater from the dewatering and processing of dredged sediments. Pursuant to section 402 of the Federal Water Pollution Control Act (FWPCA) (33 USC § 1342), the EPA has authorized the NYSDEC to issue permits and establish requirements for such discharges. Thus, these discharges are regulated by the NYSDEC under the State Pollutant Discharge Elimination System (SPDES) (ECL Article 17, Titles 7 and 8). Under applicable SPDES regulations (6 NYCRR Part 750), permits for such discharges would be required to include effluent limits and conditions, taking into account available technology to treat such wastewater and applicable water quality standards.

The WQ requirements issued by the EPA in January 2005 include two sets of conditions and effluent limits for a variety of constituents, including PCBs, applicable to the discharge of treated water from the dredged sediment processing facilities. One set of effluent limits and conditions is applicable to discharges from the processing facilities to the Champlain Canal (land cut above Lock 7) during the performance of the remedial action, while a second set of effluent limits and conditions is applicable to discharges from the processing facilities to the Hudson River. These effluent limits and conditions were derived in accordance with the requirements for establishing effluent limits contained in NYSDEC's SPDES regulations (6 NYCRR Part 750) and guidance, taking into account applicable water quality standards. These limits and conditions include monitoring, reporting, and notification requirements.

These effluent limits and associated requirements and the actions that GE will take to meet them are set forth in the Phase 1 ID PSCP Scope (Attachment C to this Phase 1 IDR). In addition, this Phase 1 IDR includes the identification of the facilities and equipment that will be used to treat water resulting from the dewatering process (see Section 3.6). These facilities are designed to achieve compliance with the effluent limits and conditions contained in the January 2005 WQ requirements. Details regarding the monitoring of these discharges are specified in the Phase 1 ID RA Monitoring Scope (Attachment A).

6.2 Discharges of Stormwater

Pursuant to Section 402 of the FWPCA, the EPA has authorized the NYSDEC to issue permits and establish requirements for discharges of stormwater associated with construction and industrial activities. The NYSDEC, pursuant to the SPDES program, has established permitting and substantive requirements that apply to stormwater discharges during both the construction and operation of the processing facility. The relevant requirements for each phase (construction and operation) and the manner in which the remedial design or remedial action will satisfy these substantive requirements are discussed below.

Stormwater Discharges During Construction of the Sediment Processing Facility

Under applicable NYSDEC regulations (6 NYCRR Part 750), persons proposing to engage in construction activities involving more than one acre must apply for and obtain permits from the NYSDEC for the discharge of stormwater during construction. The NYSDEC has issued a general permit authorizing and containing substantive requirements applicable to stormwater discharges from construction activity (Permit No. GP-02-01). Because construction of the processing facility will impact more than one acre, these substantive requirements will apply. The general permit requires the discharger to prepare and implement a SWPPP in accordance with sound engineering practices. The SWPPP is to identify the potential sources of pollution expected to affect the quality of stormwater discharges, and describe and ensure the implementation of practices to reduce the potential for pollutants in stormwater discharges, including erosion and sediment control practices. It must be certified by a licensed or certified professional in erosion and sediment control practices and stormwater management. Technical standards for SWPPPs for construction activities are found in *New York Standards and Specification for Erosion and Sediment Control* (NYSDEC, 2004). In addition, the general permit specifies the required contents of the SWPPP and mandates weekly and post-precipitation inspections of the stormwater controls at the construction site.

Although construction of the processing facility will not require that a notice of intent to be covered by the general permit be filed with the NYSDEC, construction of the facility will comply with the substantive requirements of the permit, including preparation and implementation of a SWPPP. The management of stormwater during facility construction is addressed in Section 3.6.1.2. The details of the SWPPP for facility construction and the stormwater controls to be implemented during construction will be described in outline form in the Phase 1 FDR and will be further specified in the *RA Work Plan(s) for Phase 1 Facility Site Work Construction*.

Stormwater Discharges During Operation of the Processing Facility

In addition to stormwater discharges during construction of the processing facility, stormwater will be discharged during the facility's operation. These "operational" stormwater discharges can be divided into three categories, each of which will be addressed differently. The first category of stormwater discharges will be stormwater associated with the areas of the facility where dredged sediments and other materials are being unloaded, moved within the facility, dewatered, stored, and loaded on rail cars for offsite disposal. Stormwater from these operational areas will be captured, treated with process water at the wastewater treatment facilities, and discharged in accordance with the WQ requirements applicable to such discharges, described above in Section 6.1.

The second category of stormwater discharges will be stormwater from active areas of the facility other than those operational areas where sediments will be unloaded, moved, dewatered, stored, or loaded, such as parking lots or administrative buildings. To the extent that such stormwater is not captured and subsequently treated by the process wastewater treatment system, this stormwater will be managed and discharged as a stormwater discharge "associated with industrial activity." The NYSDEC has issued a general permit authorizing and containing substantive requirements applicable to stormwater discharges associated with industrial activity (Permit No. GP-98-03). This general permit requires the discharger to prepare and implement a SWPPP in accordance with sound engineering practices. The permit specifies the contents of such plans, including identification of potential sources of pollutants to stormwater and description of measures and controls to manage such stormwater. The general permit contains special control and monitoring requirements applicable to areas of facilities that store, process, or otherwise handle priority chemicals subject to Section 313 of the Emergency Planning and Community Right-to-Know Act.

The management of stormwater during facility operations is addressed in Section 3.6.4.2. The details of the SWPPP for such operations and the stormwater measures and controls to address the discharges associated with such industrial activity will be described in outline form in the Phase 1 FDR and will be further specified in the *RA Work Plan(s) for Phase 1 Dredging and Processing Facility Operations*.

The third category of stormwater discharges will be stormwater from inactive areas of the processing facility. There are likely to be portions of the 100-acre site where there will be no buildings or equipment, no active operations, and no management of dredged sediments or other materials. Stormwater from these areas is not considered stormwater associated with industrial activity, and is not regulated by EPA or NYSDEC. Stormwater from these inactive areas will not be managed in any fashion except to ensure that it does not come into contact with any of the active operations at the facility.

6.3 Dredged or Fill Material Discharges, Disturbance of Stream Beds and Banks, and Impacts to Wetlands

Several federal and state programs regulate: 1) the discharge of dredged or fill materials; 2) the disturbance of stream beds; and 3) activities that impact wetlands. First, Section 404 of the FWPCA would require, in the absence of the CERCLA onsite permit exemption, that all discharges of dredged or fill material into the waters of the United States be permitted (33 USC § 1344). Implementing regulations promulgated by EPA and USACE establish procedural and substantive requirements that apply to such discharges (40 CFR Parts 230 and 231; 33 CFR Parts 320-329). Second, Section 10 of the Rivers and Harbors Act (33 USC § 403) would normally mandate a permit for the excavation or filling of the channel of any navigable water of the United States. The USACE implements the Section 10 permitting program. Implementing regulations promulgated by the USACE establish procedural and substantive requirements that apply to operations subject to Section 10 of the Rivers and Harbors Act (33 CFR Parts 320, 321, and 322). Third, the State Protection of Waters Law (ECL Article 15, Title 5) and NYSDEC's implementing regulations (6 NYCRR Part 608) regulate: 1) disturbance of the bed and/or banks of a protected stream; 2) construction, reconstruction, or expansion of docking and mooring facilities; and 3) excavation or placement of fill in navigable waters and their adjacent and contiguous wetlands. Parties proposing to undertake such activities would typically be required to apply for and obtain a permit from the NYSDEC. Fourth, the State Freshwater Wetlands Act (ECL Article 24, Title 7) regulates certain activities, including dredging, excavating, and filling, that take place in freshwater wetlands. Such activities would normally be required to be permitted.

The following activities implicate these requirements: 1) dredging and backfilling; 2) constructing the sediment processing facility; and 3) constructing additional docking facilities to be employed in the performance of the

RA. A description of these activities and how the substantive requirements of these related federal and state laws will be satisfied is presented below.

Dredging and Backfilling/Capping

Dredging will result in disturbance of the river bed (and potentially river banks), as well as resuspension of sediments. Following dredging, backfill or an engineered cap will be employed as required by the ROD and the EPS. These dredging and backfilling/capping activities will result in discharges regulated under Section 404 of the FWPCA as well as the excavation and filling regulations contained in Section 10 of the Rivers and Harbors Act and the State Protection of Waters Law. Under Section 404(b) of the FWPCA and implementing regulations (33 CFR Part 323; 40 CFR Part 230), no discharge of dredged or fill material is permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences. If there is no other practical alternative, impacts must be minimized. The Rivers and Harbors Act and implementing regulations (33 CFR Part 322) do not specify any special considerations or requirements applicable to the type of excavating or filling that will occur as part of the remedial action. Under the State Protection of Waters Law and implementing regulations (6 NYCRR Part 608), any excavation or fill of navigable waters must not endanger human health, safety, or welfare or cause unreasonable, uncontrolled, or unnecessary damage to the natural resources of the State, including soil, forests, water, fish, shellfish, crustaceans, and aquatic and land-related environments. In short, these related federal and state requirements mandate that adverse impacts on the aquatic ecosystem and to human health and the environment be evaluated and minimized.

In this case, there is no practical alternative to the proposed discharges that would have less adverse impact on the aquatic ecosystem. The impacts to the environment from dredging and backfilling will be minimized as follows so as to satisfy the substantive requirements of the above laws and regulations.

First, releases of PCBs and solids during dredging will be managed in accordance with the EPS and WQ requirements established by the EPA, as specified in the Phase 1 ID PSCP Scope (Attachment C) and the Phase 1 ID RA Monitoring Scope (Attachment A). The EPS include requirements for limiting resuspension during dredging (Resuspension Performance Standard) and requirements for the placement of backfill (Residuals Performance Standard). The Resuspension Performance Standard specifies action levels applicable to PCBs and/or TSS in surface water at either near-field stations (located within 100 to 300 meters of the dredging activities) or far-field stations (located more than 1 mile downstream of dredging activities). These action levels will be used to trigger additional monitoring or contingency actions during the remedial action. The Residuals Performance Standard describes action levels for Tri+ PCBs in surface sediment that remain after dredging. In addition, EPA's *Substantive Requirements Applicable to Releases of Constituents not Subject to Performance Standards*, which are part of its WQ requirements, contain standards and requirements for in-river releases of constituents not subject to the EPS. These requirements are divided into acute water quality standards to be met at near-field stations and health-based standards to be met at far-field stations. The actions to be taken to implement these standards and requirements are described in Sections 3.3, 3.4, 3.5, and 3.9, as well as in the Phase 1 ID PSCP Scope (Attachment C) and the Phase 1 ID RA Monitoring Scope (Attachment A).

Second, to minimize the adverse impacts on the aquatic ecosystem from dredging, the ROD calls for implementation of a habitat replacement and reconstruction program. Details regarding this program are described in Section 3.10.

Third, following completion of the HDA Program, the data from that program will be considered during Phase 1 Final Design to determine whether additional measures are needed to mitigate adverse impacts on wetlands or other aspects of the aquatic ecosystem.

Construction of the Processing Facility

The construction of the processing facility at the Energy Park site has the potential to impact wetlands at the property and on the banks of the Champlain Canal. Field surveys identified 8.4 acres of wetlands at the Energy Park Site (EPA, 2004c). NYSDEC's regulations regarding freshwater wetlands under the Freshwater Wetlands Act only apply to wetlands of at least 12.4 acres, unless the wetlands have been designated by NYSDEC as having unusual local importance (6 NYCRR § 663.2(p)). Accordingly, these state requirements do not apply to the processing facility. Section 404 of the FWPCA and the USACE regulations do not contain a similar minimum size requirement for discharges to wetlands. However, as discussed in Section 3.10.2.5, effects on wetlands have been avoided or minimized to the extent practicable during the planning and design of the sediment processing facility. At this time, GE is awaiting formal EPA acceptance of the wetland delineation boundaries to confirm that there are no such impacts. If necessary, and agreed upon by GE and EPA, the Phase 1 FDR will include mitigation measures for any impacted wetlands. The construction of a wharf for unloading barges carrying dredged sediment at the processing facility will impact the bank of the Champlain Canal along the southeastern edge of the site. This construction will require a modification to the bank, installation of riprap, and construction of a wharf, as described in Section 3.6.3.2. This construction implicates both Section 404 of the FWPCA and Section 10 of the Rivers and Harbors Act. Nationwide Permit 38 under those laws authorizes the discharge of fill material during the cleanup of hazardous or toxic wastes; however, the substantive requirements established in the general conditions for the nationwide permits (including Nationwide Permit 38) apply. These conditions are intended to minimize the adverse effects to the environment from the discharge. In addition, the construction of the wharf implicates the State Protection of Waters Law and the State Public Lands Law. These laws require that a lease or other appropriate conveyance of interest authorizing the use and occupancy of state lands be obtained (ECL Article 15, Title 5; Pub. Lands Law Article 2, Section 3; 6 NYCRR § 608.4). Further, the construction of the wharf must not endanger human health, safety, or welfare or cause unreasonable, uncontrolled, or unnecessary damage to the natural resources of the State, including soil, forests, water, fish, shellfish, crustaceans, and aquatic and land-related environments (6 NYCRR § 608.8). The actions that GE will take to minimize adverse environmental and other effects during construction of the wharf, in accordance with the substantive requirements of these laws, are described in Section 3.6.3.2 (under Wharf Construction).

Construction of Additional Docking Facilities

It is likely that additional docking facilities will be employed in the performance of the remedial action. In particular, the dock at West River Road, which was utilized to moor boats used to collect samples under the SSAP and during the remedial design, may need to be expanded to provide support for the vessels to be employed in the RA. To the extent that such facilities require modification, it is conceivable that the federal and state laws described above (Section 404 of the FWPCA, Section 10 of the Rivers and Harbors Act, the State Protection of Waters Law, and the State Public Lands Law) will be implicated. As explained above, these laws require that the environmental impacts of the construction of docks be minimized. The actions that will be taken to minimize such effects are described in Section 3.6.3.2 (under Support Vessel Floating Dock).

6.4 Air Emissions

The Clean Air Act (CAA) (42 USC § 7401 et seq.) establishes several programs applicable to “major” stationary sources of air pollutants. These include the Prevention of Significant Deterioration (PSD), New Source Review (NSR), New Source Performance Standards (NSPS) (provisions applicable to certain “new” “major sources” [42 USC §§ 7411, 7470-7515]), the National Emission Standards for Hazardous Air Pollutants (provisions applicable to major sources of specified hazardous air pollutants [(42 USC § 7412]), as well as the operating permit program established under Title V of the CAA (42 USC §§ 7661-7661f). All these programs, except for the Title V program, establish substantive requirements to limit emissions from covered sources. It is highly unlikely that any of these programs will apply to the RA. As an initial matter, most of the emissions from this project will come from mobile sources or non-road engines (e.g., dredges, booster pumps, rail engines) which are not regulated as stationary sources. Further, the processing facility will not contain and does not itself qualify as a major stationary source under any of these programs, because the emissions from the facility are not likely to exceed the established major source emission thresholds.

In addition to these stationary source programs, federal projects in regions designated as non-attainment or maintenance areas for criteria air pollutants under the CAA are required, in certain circumstances, to prepare a "conformity determination" to assess the consistency of the project with the applicable State Implementation Plan (SIP) (40 CFR § 51.853). These requirements only apply if pollutant emissions from the project equal or exceed established thresholds. Further, certain projects, or portions thereof, are exempt from the conformity determination requirement. These exemptions include "[d]irect emissions from remedial and removal actions carried out under CERCLA to the extent such emissions either comply with the substantive requirements of the PSD/NSR permitting program or are exempted from other environmental regulation under the provisions of CERCLA and applicable regulations under CERCLA" (40 CFR § 51.853(d)(5)). Because, as noted above, PSD, NSR, and NSPS will not be triggered by the remedial action, this exemption excludes the remedial action from the conformity determination requirement established under EPA's regulations.

The State Air Pollution Control Law (ECL Article 19) and NYSDEC's implementing regulations (6 NYCRR Part 201) implement the permitting programs and substantive requirements of the federal CAA. Subject to certain exemptions, these requirements impose registration and permitting requirements on specified stationary sources of air pollution. Persons proposing to construct or operate covered sources would normally be required to apply for and obtain a permit from the NYSDEC. As with the federal CAA, a number of these programs only apply to "major" sources and thus will not apply to the RA. In contrast to the federal CAA, however, NYSDEC's regulations impose permitting requirements on "minor" sources, subject to a number of exemptions (6 NYCRR Part 201). In addition, NYSDEC regulations contain substantive requirements, including: 1) a general prohibition against emissions of air contaminants injurious to human, plant, or animal life or property or which unreasonably interfere with the enjoyment of property; and 2) restrictions on emissions causing opacity (6 NYCRR Part 211).

To meet the substantive requirements of these laws and regulations, GE will, as discussed in Section 3.11.2.1 complete a modeling analysis of the projected emissions of pollutants subject to the NAAQS (i.e., NO_x, CO, PM_{10}, $PM_{2.5}$, SO_2, and O_3) to assess whether they will meet the NAAQS. The results of this analysis, and if necessary, any design measures to achieve those standards, will be included in the Phase 1 FDR. In addition, as also discussed in Section 3.11.2.1, GE will include in the Phase 1 FDR a modeling analysis of whether the projected emissions of PCBs to the ambient air will meet the EPA's QoLPS for PCBs in air, as well as, if necessary, design measures developed to achieve those standards. Further, GE will perform the monitoring specified in the Phase 1 ID RA Monitoring Scope (Attachment A) to assess achievement of the QoLPS for air quality (including the standards for PCBs and opacity) and odor; if there are exceedances of those standards or complaints relating to air quality or odor, GE will take the contingency actions specified for such conditions in the Phase 1 ID PSCP Scope (Attachment C) and the Phase 1 ID RA CHASP Scope (Attachment B). Taken together, these actions will satisfy the substantive requirements of relevant federal and state air pollution control laws, including the general prohibitions contained in 6 NYCRR Part 211.

6.5 Hazardous Waste Characterization, Storage and Transportation for Disposal

RCRA (42 USC § 6901 et seq.) establishes a regulatory program governing the characterization, generation, treatment, storage, disposal, and transportation of hazardous waste. Under this program, "treatment, storage or disposal" facilities are required to apply for and obtain permits (42 USC § 6925), and EPA has adopted regulations governing the identification, generation, accumulation, transportation, and treatment, storage, and disposal of hazardous waste (40 CFR Parts 261, 262, 263, 264, 265, and 268). Pursuant to 42 USC § 6926, New York implements the federal RCRA regulatory permitting program in lieu of EPA. The State Solid and Hazardous Waste Laws (ECL Article 27, Titles 7, 9, and 11) and NYSDEC's implementing regulations (e.g., 6 NYCRR Parts 360, 364, 370, 371, 372, 373) constitute the state's implementing program. This program establishes both procedural and substantive requirements applicable to persons who manage solid and hazardous wastes, including generators, transporters, and treatment, storage and disposal facilities.

Existing test data using the Toxic Characteristic Leaching Procedure (TCLP) indicate that the dredged material will not constitute a hazardous waste under the criteria in the federal RCRA regulations. As a result, the basic RCRA requirements applicable to the generation, accumulation, transportation, and treatment, storage, and disposal of hazardous waste will not apply. Under NYSDEC's regulations, however, all dredged materials and other solid wastes containing PCBs at a concentration of 50 mg/kg by weight (on a dry weight basis for other than liquid wastes) or greater are considered hazardous wastes (6 NYCRR § 371.4(e)).

In addition, section 6(e) of TSCA (15 USC § 2605(e)) and EPA's implementing regulations establish storage and disposal requirements, including permitting requirements, for PCBs (40 CFR § 761.60 [disposal requirements] and § 761.65 [storage requirements]). The EPA's regulations establish a variety of substantive requirements applicable to these activities (although no disposal of PCBs will take place at the sediment and water processing facilities). According to 40 CFR § 761.61(a)(5)(i)(B)(2)(ii), bulk dewatered PCB remediation waste containing less than 50 mg/kg PCBs must be disposed of in accordance with 40 CFR § 761.61(a)(5)(v)(A), which in turn allows such waste to be disposed of in state-permitted municipal or industrial landfills, RCRA hazardous waste landfills, or a TSCA landfill.

As a result of the above requirements, dredged sediments and processed sediments containing 50 mg/kg or greater PCBs will be managed as hazardous wastes. To ensure compliance with the substantive requirements of TSCA and the state hazardous waste rules, the sediments and other materials removed from the Hudson River will be managed as regulated under TSCA and state hazardous waste rules from the time at which they enter the dredge through processing, including dewatering, at the processing facility. Removed sediments will be stored at the processing facility in accordance with the TSCA specifications for storage facilities – namely, either: 1) the substantive requirements for storage of bulk PCB remediation waste in piles (40 CFR § 761.65(c)(9)); or 2) the substantive requirements for regular PCB storage (40 CFR § 761.65(b)(1)). After dewatering, the solids will be sampled and characterized for disposal. The solids found to contain PCBs at 50 mg/kg or above through such characterization will be manifested and shipped offsite for disposal at a TSCA-approved disposal facility (40 CFR § 761.61(a)(5)(i)(B)(2)(iii)). In the event that GE seeks to utilize a non-TSCA landfill for the disposal of sediments having post-processing PCB concentrations less than 50 mg/kg, GE will request EPA Region 2 and the EPA Region in which the non-TSCA landfill is located to provide a risk based approval of such disposal under the TSCA regulations (40 CFR § 761.61(c)). To the extent that processed solids containing 50 mg/kg PCBs or above are stored at the sediment processing facility for more than 90 days following processing, they will be stored and managed in accordance with the substantive requirements of 6 NYCRR Part 372 or 373 for hazardous waste storage facilities, as well as the TSCA storage requirements (40 CFR § 761.65).

The transport of the dredged materials will be subject to the Hazardous Materials Transportation Act (49 USC § 5101 *et seq.*) and its implementing regulations (49 CFR Parts 171-180). For the shipment of hazardous materials subject to these regulations, GE will comply with the substantive requirements of these regulations insofar as they apply to the waste generator (i.e., the person offering the materials for transportation), including preparing a hazardous waste manifest or other applicable shipping paper, and packaging, marking and labeling the materials in accordance with relevant requirements (49 CFR Part 172). GE will then deliver the materials to a transporter who is authorized to accept and transport such materials. More details will be provided, as necessary, in the Phase 1 FDR.

6.6 Impacts on Endangered Species

Section 10(a) of the Endangered Species Act (ESA; 16 USC § 153) requires that a permit be obtained if an action will result in a "take" of a threatened or endangered species. Although such a permit is not required here, two threatened or endangered species are or may be present in the vicinity of the project area and require evaluation under the ESA – namely, the bald eagle and the shortnose sturgeon. To meet the substantive requirements of the ESA and its implementing regulations, EPA has consulted with the relevant resource agencies – the USFWS and the NMFS – and is developing a BA relating to these two species. As noted in Section 3.10.3, the Draft BA issued by EPA indicates that the Phase 1 dredging, as well as construction and operation of processing facility, would have minimal effects on the bald eagle, and that the shortnose sturgeon is not present in the Phase 1 dredging areas or in the vicinity of the processing facility and is therefore not expected to be directly or indirectly affected by those activities. The final BA will be followed by the issuance of Biological Opinions BOs by the USFWS and/or the NMFS for these species (if needed) or their written concurrence with a determination in the BA of "not likely to adversely affect." This process is described in Section 3.10.3 and may result in the need for some conservation measures. Any such conservation measures relating to Phase 1 areas will be addressed in the Phase 1 FDR. This process will satisfy the relevant substantive requirements of the ESA and its implementing regulations.

6.7 Hazardous Substance and Petroleum Bulk Storage

The State Hazardous Substances and Petroleum Bulk Storage Acts (ECL Article 17, Title 10 and Article 40) and NYSDEC's implementing regulations (6 NYCRR Parts 595-599, 612-614) establish registration and substantive requirements for the bulk storage of petroleum and hazardous substances. The requirements for storage of hazardous substances apply to: 1) aboveground tanks of 185 gallons or greater used to store hazardous substances; 2) underground storage tanks of any capacity used to store hazardous substances; and 3) non-stationary tanks used to store 1000 kg or more of a hazardous substance for a period of 90 consecutive days or more (6 NYCRR § 596.1). The requirements applicable to storage of petroleum apply to facilities with a capacity to store more than 1,100 gallons of petroleum (6 NYCRR § 613.1). It is not anticipated at this time that the processing facility will have storage tanks subject to these requirements; however, the need for fuels storage at the processing facility will be further assessed in the Phase 1 FDR.

6.8 Navigation

There are both federal and state laws and regulations governing navigation on the Upper Hudson River (33 USC Ch. 9 § 409, 33 CFR §§ 84-88, 21 NYCRR Part 151). To ensure compliance with those laws and regulations, the QoLPS contain a Navigation Performance Standard. GE will comply with the requirements of that standard as provided in Section 6 of the Phase 1 ID PSCP Scope (Attachment C). These actions will satisfy the substantive requirements of the applicable navigation laws and regulations.

The NYSCC also issues permits to allow vessels to use the NYS canal system and locks. The NYSCC uses the permits to track the number of vessels that pass through the locks and provide a semi-quantitative estimate of annual canal usage. Permits are required for commercial craft, and user fees for lock and lift passes are imposed (21 NYCRR § 150.2). In addition, the NYSCC issues permits for the temporary use of NYSCC lands and facilities (21 NYCRR § 156.1). These permits are not necessary for the RA because it is being performed pursuant to CERCLA. Moreover, the permit regulations at 21 NYCRR § 156.1 do not impose any specific substantive requirements. GE will follow up on prior meetings and communications discussions with the NYSCC and discuss in greater detail its plans for use of the canal system and locks, as well as other NYSCC lands and facilities.

6.9 Local Laws

It is possible that county or municipal laws or ordinances may require the obtaining of licenses or permits for the construction or operation of the sediment processing facility, use of the West Road marina, or installation of automated samplers. These laws may also impose zoning and construction requirements. Because the remedial action is being performed under CERCLA, no such licenses or permits will be needed. Further, to the extent that such local requirements conflict with, and present an obstacle to, the performance of the remedy, they may be preempted by CERCLA. An analysis of the substantive requirements of local laws and ordinances potentially applicable to these activities, including an evaluation of the extent to which such requirements are preempted by federal law, will be conducted during the Phase 1 Final Design process. The results of this analysis will be discussed with the EPA to determine whether and how these requirements should be addressed in the Phase 1 FDR. In addition, in the event that such local laws are implicated, GE will confer with the local authorities and attempt to address any concerns arising from the local laws to the extent that those concerns or laws do not seek to impose substantial burdens on operating the facilities or equipment in question.

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8. Acronyms

μg/L = micrograms per liter

μg/m^3 = micrograms per cubic meter

2004 DSR = *Supplemental Delineation Sampling Program Data Summary Report*

AASHTO = American Association of State Highway and Transportation Officials

AOC = Administrative Order on Consent

ARARs = applicable or relevant and appropriate requirements

BA = Biological Assessment

BBL = Blasland, Bouck & Lee, Inc.

BFP = bench-scale filter press

BMP = Baseline Monitoring Program

BMP-QAPP = *Baseline Monitoring Program – Quality Assurance Project Plan*

BO = Biological Opinion

BUD = beneficial use determination

CAA = Clean Air Act

CARA = Cultural and Archaeological Resources Assessment

CARA Work Plan = *Cultural and Archaeological Resources Assessment Work Plan*

CDF = confined disposal facility

CERCLA = Comprehensive Environmental Response, Compensation and Liability Act

cfm = cubic feet per minute

cfs = cubic feet per second

cm = centimeter

CM = Construction Manager

CN = Canadian National

CPR = Canadian Pacific Railway

CPT = Cone Penetrometer Testing

CQA = Construction Quality Assurance

CQAP = *Construction Quality Assurance/Quality Control Plan*

Cs-137 = Cesium-137

CSX = CSX Transportation

CU = certification unit

cy = cubic yards

cy/day = cubic yards per day

cy/hour = cubic yards per hour

D&H = Delaware & Hudson Railway Company, Inc.

DAD = Dredge Area Delineation

dBA = A-weighted decibels

DoC = depth of contamination

DOC = dissolved organic carbon

DQO = data quality objective

DRET = dredge elutriate tests

DSR = *Data Summary Report*

dynes/cm^2 = dynes per square centimeter

E&E = Ecology and Environment, Inc.

EBCT = empty bed contact time

EFDC = Environmental Fluid Dynamics Computer Code

EGIA = East Griffin Island Area

EMP = *Environmental Monitoring Plan*

Energy Park = Energy Park/Longe/New York State Canal Corporation

EPA = United States Environmental Protection Agency

EPS = Engineering Performance Standards

ESA = Endangered Species Act

Facility Siting Concept Document = *Hudson River PCBs Superfund Site Facility Siting Concept Document*

FCIs = Functional Capacity Indices

FCSs = final candidate sites

Final Facility Siting Report = *Hudson River PCBs Superfund Site Final Facility Siting Report*

FMEA = Failure Mode Effects Analysis

FS = Feasibility Study

ft/s = feet per second

ft/s^2 = feet per square second

ft^2 = square feet

FWPCA = Federal Water Pollution Control Act

g/day = grams per day

g/m^2 = grams per square meter

GAC = granular-activated carbon

GE = General Electric Company

GIS = geographical information system

gpm = gallons per minute

gpm/ft^2 = gallons per minute per square feet

H_2S = hydrogen sulfide

HASP = *Health and Safety Plan*

HD Report = *Habitat Delineation Report*

HDA = Habitat Delineation and Assessment

HDA Work Plan = *Habitat Delineation and Assessment Work Plan*

HDPE = high-density polyethylene

hp = horsepower

HSIs = Habitat Suitability Indices

HVAC = heating, ventilation, and air conditioning

kg = kilogram

kg/year = kilograms per year

KPVs = Key Process Variables

L = liter

lbs/day = pounds per day

lbs/ft^2 = pounds per square foot

LNG = liquefied natural gas

LWS = low water surface

m = meter

m/s = meters per second

m^3 = cubic meter

MCCs = motor control centers

MDL = Method Detection Limit

mg/kg = milligrams per kilogram

mg/L = milligrams per liter

mgd = million gallons per day

mL = milliliter

mm = millimeter

MMF = multimedia filtration

MNA = monitored natural attenuation

MPA = mass per unit area

mph = miles per hour

NAAQS = National Ambient Air Quality Standards

NAD = North American Datum

NAVD = North American Vertical Datum

NCP = National Contingency Plan

ng = nanogram

ng/L = nanograms per liter

NMFS = National Marine Fisheries Service

NOAA = National Oceanic and Atmospheric Administration

NO_x = nitrogen oxides

NS = Norfolk Southern Railway Company

NTIP = Northern Thompson Island Pool

NYSCC = New York State Canal Corporation

NYSDEC = New York State Department of Environmental Conservation

NYSDOT = New York State Department of Transportation

OM&M = Operation, Maintenance, and Monitoring

OSHA = Occupational Safety and Health Administration

OSI = Ocean Surveys, Inc.

PCBs = polychlorinated biphenyls

PCSs = preliminary candidate sites

PDR = *Preliminary Design Report*

PFP = pilot-scale plate and frame filter press

Phase 1 ARA Report = *Archaeological Resources Assessment Report for Phase 1 Dredge Areas*

Phase 1 DAD Report = *Phase 1 Dredge Area Delineation Report*

Phase 1 Dredging CQAP = *Phase 1 Dredging Construction Quality Assurance/Quality Control Plan*

Phase 1 DSR = *Phase 1 Data Summary Report*

Phase 1 EMP = *Phase 1 Environmental Monitoring Plan*

Phase 1 FDR = *Phase 1 Final Design Report*

Phase 1 HA Report = *Habitat Assessment Report for Candidate Phase 1 Areas*

Phase 1 ID PSCP Scope = *Phase 1 Intermediate Design Performance Standards Compliance Plan Scope*

Phase 1 ID RA CHASP Scope = *Phase 1 Intermediate Design Remedial Action Community Health and Safety Plan Scope*

Phase 1 ID RAM Scope = *Phase 1 Intermediate Design Remedial Action Monitoring Plan Scope*

Phase 1 IDR = *Phase 1 Intermediate Design Report*

Phase 1 RA CHASP = *Phase 1 Remedial Action Community Health and Safety Plan*

Phase 1 RA Work Plan = *Remedial Action Work Plan for Phase 1 Dredging and Facility Operations*

Phase 1 RAM QAPP = *Phase 1 Intermediate Design Remedial Action Monitoring Quality Assurance Project Plan*

Phase 1 TAI Report = *Phase 1 Target Area Identification Report*

Phase 2 DSR = *Phase 2 Data Summary Report*

PLCs = programmable logic controller

PM = particulate matter

POTW = publicly owned treatment works

ppm = part per million

processing facilities = sediment processing/transfer facilities

PSCP = *Performance Standards Compliance Plan*

PSD = Prevention of Significant Deterioration

psf = pounds per square foot

psi = pounds per square inch

QA/QC = quality assurance/quality control

QEA = Quantitative Environmental Analysis, LLC

QoLPS = Quality of Life Performance Standards

R&D = receiving and departure

RA CHASP = *Remedial Action Community Health and Safety Plan*

RCRA = Resource Conservation and Recovery Act

RD AOC = Administrative Order on Consent for Hudson River Remedial Design and Cost Recovery

RD Work Plan = *Remedial Design Work Plan*

RFP = Request for Proposal

RFQ = Request for Qualifications

RM = river mile

ROD = Record of Decision

rpm = revolutions per minute

RSSCTs = Rapid Small-Scale Column Tests

SEDC = Supplemental Engineering Data Collection

SEDC Work Plan = *Supplemental Engineering Data Collection Work Plan*

Sediment Sampling AOC = Administrative Order on Consent for Hudson River Sediment Sampling

SHAWP = *Supplemental Habitat Assessment Work Plan*

SHPO = State Historic Preservation Office

SIP = State Implementation Plan

SO_2 = sulfur dioxide

SOI = Statement of Interest

SOP = standard operating procedure

SPDES= State Pollutant Discharge Elimination System

SPT = Standard Penetration Test

SSAP = Sediment Sampling and Analysis Program

SWPPP = *Stormwater Pollution Prevention Plan*

TAI = Target Area Identification

TBD = to be determined

TCLP = Toxic Characteristic Leaching Procedure

TID = Thompson Island Dam

TOC = total organic carbon

tPCB = total polychlorinated biphenyl

TS Report = *Treatability Studies Report*

TS Work Plan = *Treatability Studies Work Plan*

TSCA = Toxic Substances Control Act

TSS = total suspended solids

UP = Union Pacific Railroad Company

Upper Hudson River = River Section 1, River Section 2, and River Section 3

URS = URS Corporation

USACE = United States Army Corps of Engineers

USCG = United States Coast Guard

USCS = Unified Soil Classification System

USFWS = U.S. Fish and Wildlife Service

USGS = United States Geological Survey

w/w = weight/weight percentage

WQC = Water Quality Certification

Year 1 DSR = *Year 1 Data Summary Report*

Year 2 SEDC IDSR = *Year 2 SEDC Interim Data Summary Report*

Tables

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Hudson River PCBs Superfund Site
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Table 3-2 -- Summary of Phase 1 Dredge Sub-Area Characteristics

Dredge Area: NTIP01

Physical Characteristics	
Total Sediment Volume (cy)	12,690
Total Area (ft^2)	153,568
Volume in Navigation Channel (cy)	0
Area in Navigation Channel (ft^2)	0

Sediment Types	
Type	**Percent of Total Volume**
Clay	0
Silt	0
Organic	10
Fine Sand	4
Medium Sand	42
Coarse Sand	25
Gravel	19

PCB Statistics	
PCB Tri+ Inventory (kg)	197
Depth of Contamination (ft)	
Minimum	0.0
Maximum	3.5
Sub-Area Average	2.6
Total PCB Concentration (mg/kg)	
Minimum	0.87
Maximum	320
Sub-Area Average	15

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Table 3-2 -- Summary of Phase 1 Dredge Sub-Area Characteristics

Dredge Sub-Area: NTIP02A

Physical Characteristics	
Total Sediment Volume (cy)	1,601
Total Area (ft^2)	87,730
Volume in Navigation Channel (cy)	0
Area in Navigation Channel (ft^2)	0

Sediment Types	
Type	**Percent of Total Volume**
Clay	0
Silt	32
Organic	0
Fine Sand	1
Medium Sand	0
Coarse Sand	6
Gravel	20

PCB Statistics	
PCB Tri+ Inventory (kg)	16.9
Depth of Contamination (ft)	
Minimum	0.0
Maximum	1.0
Sub-Area Average	0.9
Total PCB Concentration (mg/kg)	
Minimum	9.13
Maximum	1,261
Sub-Area Average	307

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Table 3-2 -- Summary of Phase 1 Dredge Sub-Area Characteristics

Dredge Sub-Area: NTIP02B

Physical Characteristics	
Total Sediment Volume (cy)	62,360
Total Area (ft^2)	645,016
Volume in Navigation Channel (cy)	0
Area in Navigation Channel (ft^2)	0

Sediment Types	
Type	**Percent of Total Volume**
Clay	5
Silt	14
Organic	2
Fine Sand	41
Medium Sand	7
Coarse Sand	28
Gravel	2

PCB Statistics	
PCB Tri+ Inventory (kg)	2,178
Depth of Contamination (ft)	
Minimum	0.0
Maximum	9.0
Sub-Area Average	3.4
Total PCB Concentration (mg/kg)	
Minimum	ND
Maximum	13,820
Sub-Area Average	150

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Table 3-2 -- Summary of Phase 1 Dredge Sub-Area Characteristics

Dredge Sub-Area: NTIP02C

Physical Characteristics	
Total Sediment Volume (cy)	38,609
Total Area (ft^2)	820,952
Volume in Navigation Channel (cy)	0
Area in Navigation Channel (ft^2)	0

Sediment Types	
Type	**Percent of Total Volume**
Clay	6
Silt	3
Organic	3
Fine Sand	18
Medium Sand	9
Coarse Sand	27
Gravel	22

PCB Statistics	
PCB Tri+ Inventory (kg)	783
Depth of Contamination (ft)	
Minimum	0.0
Maximum	5.1
Sub-Area Average	1.6
Total PCB Concentration (mg/kg)	
Minimum	ND
Maximum	660
Sub-Area Average	43

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Table 3-2 -- Summary of Phase 1 Dredge Sub-Area Characteristics

Dredge Sub-Area: NTIP02D

Physical Characteristics	
Total Sediment Volume (cy)	3,671
Total Area (ft^2)	53,471
Volume in Navigation Channel (cy)	0
Area in Navigation Channel (ft^2)	0

Sediment Types	
Type	**Percent of Total Volume**
Clay	0
Silt	5
Organic	7
Fine Sand	39
Medium Sand	19
Coarse Sand	25
Gravel	5

PCB Statistics	
PCB Tri+ Inventory (kg)	218
Depth of Contamination (ft)	
Minimum	0.0
Maximum	4.0
Sub-Area Average	2.0
Total PCB Concentration (mg/kg)	
Minimum	ND
Maximum	1,120
Sub-Area Average	125

Table 3-2 -- Summary of Phase 1 Dredge Sub-Area Characteristics

Dredge Sub-Area: NTIP02E

Physical Characteristics	
Total Sediment Volume (cy)	32,445
Total Area (ft^2)	396,234
Volume in Navigation Channel (cy)	0
Area in Navigation Channel (ft^2)	0

Sediment Types	
Type	Percent of Total Volume
Clay	6
Silt	11
Organic	2
Fine Sand	28
Medium Sand	9
Coarse Sand	39
Gravel	5

PCB Statistics	
PCB Tri+ Inventory (kg)	335
Depth of Contamination (ft)	
Minimum	0.0
Maximum	8.0
Sub-Area Average	3.9
Total PCB Concentration (mg/kg)	
Minimum	ND
Maximum	291
Sub-Area Average	33

Table 3-2 -- Summary of Phase 1 Dredge Sub-Area Characteristics

Dredge Sub-Area: NTIP02F

Physical Characteristics	
Total Sediment Volume (cy)	33,979
Total Area (ft^2)	555,845
Volume in Navigation Channel (cy)	5,493
Area in Navigation Channel (ft^2)	82,840

Sediment Types	
Type	Percent of Total Volume
Clay	9
Silt	6
Organic	2
Fine Sand	22
Medium Sand	18
Coarse Sand	35
Gravel	9

PCB Statistics	
PCB Tri+ Inventory (kg)	867
Depth of Contamination (ft)	
Minimum	0.0
Maximum	8.0
Sub-Area Average	2.4
Total PCB Concentration (mg/kg)	
Minimum	ND
Maximum	989
Sub-Area Average	41

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Table 3-2 -- Summary of Phase 1 Dredge Sub-Area Characteristics

Dredge Sub-Area: NTIP02G

Physical Characteristics	
Total Sediment Volume (cy)	54,560
Total Area (ft^2)	811,512
Volume in Navigation Channel (cy)	24,667
Area in Navigation Channel (ft^2)	362,744

Sediment Types	
Type	**Percent of Total Volume**
Clay	11
Silt	12
Organic	3
Fine Sand	32
Medium Sand	11
Coarse Sand	23
Gravel	8

PCB Statistics	
PCB Tri+ Inventory (kg)	1,364
Depth of Contamination (ft)	
Minimum	0.0
Maximum	5.3
Sub-Area Average	2.4
Total PCB Concentration (mg/kg)	
Minimum	ND
Maximum	2710
Sub-Area Average	81

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Table 3-2 -- Summary of Phase 1 Dredge Sub-Area Characteristics

Dredge Area: EGIA01

Physical Characteristics	
Total Sediment Volume (cy)	38,065
Total Area (ft^2)	611,399
Volume in Navigation Channel (cy)	5,166
Area in Navigation Channel (ft^2)	83,649

Sediment Types	
Type	**Percent of Total Volume**
Clay	3
Silt	51
Organic	2
Fine Sand	29
Medium Sand	4
Coarse Sand	8
Gravel	2

PCB Statistics	
PCB Tri+ Inventory (kg)	821
Depth of Contamination (ft)	
Minimum	ND
Maximum	5.8
Sub-Area Average	1.9
Total PCB Concentration (mg/kg)	
Minimum	ND
Maximum	1,620
Sub-Area Average	193

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Table 3-5 - Dredge Evaluation Key Process Variables

	Key Process Variables
1	Production Rate
2	Sediment Type and Consistency
3	Horizontal Accuracy
4	Vertical Accuracy
5	Maximum Water Depth
6	Minimum Water Depth
7	Sediment Resuspension
8	Barge Transport
9	Pipeline Transport
10	Positioning Control
11	Maneuverability
12	Portability
13	Availability
14	Debris/Loose Rock
15	Flexibility for Varying Conditions
16	Hardpan/Bedrock
17	Shoreline/In-Water Structures
18	Presence and Type of Vegetation
19	Thin lift/Residual Removal
20	Surface Water Flow Characteristics
21	QoLPS
22	Presence of Culteral and Archaeological Resources
23	Respresentativeness to Phase 2

Note:
1. QoLPS - Quality of Life Performance Standards

Table 3-6 - Dredge Evaluation List

Dredge	Dredge Type
Hydraulic	Cutterhead Suction
	Horizontal Auger
	Silt Wing
	Archimedean Screw
	Match Box
	Diver-Assisted
	Environmental Disk Cutter
Mechanical	Crane-Operated Watertight Clamshell
	Backhoe-Operated Watertight Clamshell
	Amphibious
Pneumatic	Airlift
	Pneuma Dredge
	Oozer

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Table 3-7 - Dredge Type Comparison for NTIP01

				Hydraulic Dredges							Mechanical Dredges			Pneumatic Dredges		
	Key Process Variables	**Description/Notes**	**Importance**	**Cutterhead Suction**	**Horizontal Auger**	**Silt Wing**	**Archimedean Screw**	**Match Box**	**Diver-Assisted**	**Environmental Disk Cutter**	**Crane-Operated Enviromental Clamshell**	**Backhoe-Operated Environmental Clamshell**	**Amphibious**	**Airlift**	**Pneuma Dredge**	**Oozer**
1	Production Rate	Production rate for inventory removal will not be hindered by thin dredge cuts (i.e., 6 inches or less) or the presence of bedrock and/or hardpan. Significant portions of this dredge sub-area are located along the shoreline (i.e., 1,450 LF) that will slow production.	5	H	H	L	L	L	L	L	H	H	L	L	M	L
2	Sediment Type and Consistency	SSAP data include 14% clay, silt, organic and fine sand, 86% medium to coarse sand and gravel.	3	H	H	L	L	L	M	L	M	H	H	L	L	L
3	Horizontal Accuracy	This variable is especially important along the shoreline and this dredge sub-area includes 1,450 LF of shoreline dredging.	5	M	M	L	L	L	M	L	M	H	M	M	M	M
4	Vertical Accuracy	Vertical accuracy is important for all portions of the dredge areas in terms of dredging to a target elevation without over-dredging and removing non-target sediment.	5	H	H	L	L	L	M	M	M	H	M	L	L	L
5	Maximum Water Depth	Maximum water depth of 8.9 feet, with an average water depth of 5.4 feet.	1	H	H	H	H	H	H	H	H	H	H	H	H	H
6	Minimum Water Depth	Minimum water depth of 1.3 feet, with an average water depth of 5.4 feet.	2	H	H	L	L	L	L	L	M	H	H	L	L	L
7	Sediment Resuspension	The amount of resuspendible sediment in this dredge area is 14% (i.e., the relative amount of fine sand, silt and clay).	5	M	M	M	M	M	M	M	M	M	M	M	M	M
8	Barge Transport	There are 13,519 ft from the lateral mid-point of this dredge dredge area to Energy Park. The average barge travel time is 1.4 hours in addition to one lock passage (Lock 7). Small barges will be required to support dredging in this dredge area due to the narrow width of the channel that services the area.	3	NE	NE	NE	NE	NE	NE	NE	L	L	L	NE	NE	NE
9	Pipeline Transport	There are 13,519 ft from the lateral mid-point of the dredge area to Energy Park. Booster pumps are required if a hydraulic dredge is used.	3	M	M	M	M	M	M	M	NE	NE	NE	M	M	M
10	Positioning Control	The additional effort to position a dredge along the shoreline of NTIP01 will slow production.	4	M	M	M	M	M	H	M	M	H	M	M	M	M
11	Maneuverability	Maneuverability in this dredge area is important as NTIP01 is adjacent to an area where recreational vessels travel to and dock in Fort Edward. Access to and from the dredge area includes passage under 2 bridges.	3	L	L	L	L	L	M	L	M	M	H	L	L	L
12	Portability	Issues related to access for NTIP01 include a single access pathway up the east channel of Rogers Island.	2	M	M	M	M	M	H	L	M	M	H	M	M	M
13	Availability	Commercial availability of dredges.	1	H	H	L	L	L	M	L	H	M	L	L	L	L
14	Debris/Loose Rock	Based on the OSI side-scan sonar data, there are 24 identified targets in NTIP01.	4	L	L	L	L	L	L	L	M	H	L	L	L	L
15	Flexibility for Varying Conditions	Water environment, water depth, and sediment types vary moderately throughout this dredge area.	2	M	M	L	L	L	L	L	M	H	H	L	L	L
16	Hardpan/Bedrock	Of the sediment to be removed, 22% is gravel, but hardpan or bedrock do not appear to be present.	3	M	M	L	L	L	L	L	L	M	M	L	L	L
17	Shoreline/In-Water Structures	The dredge area consists of 1,450 LF of shoreline with 1 dock, 1 outfall, 1 headwall, 1 waterline and 2 bridges.	2	L	L	L	L	L	H	L	M	H	H	L	L	L
18	Presence and Type of Vegetation	This dredge sub-area includes 0.13 acre of SAV, 0.0 acre of wetland, and 1,450 LF of shoreline.	1	L	L	L	L	L	L	L	M	M	M	L	L	L
		Total Scores:		**235**	**235**	**87**	**87**	**87**	**173**	**93**	**183**	**345**	**217**	**97**	**107**	**97**

Notes:

1. Processing Facility is located in Energy Park.

2. NE - Not Evaluated

	Scoring	
H	9	High - Indicates that this dredge ranks high in suitability compared to other dredges for addressing a given KPV (e.g., sediment resuspension).
M	3	Medium - Indicates that this dredge ranks medium in suitability compared to other dredges for addressing a given KPV (e.g., sediment resuspension).
L	1	Low - Indicates that this dredge ranks low in suitability compared to other dredges for addressing a given KPV (e.g., sediment resuspension).

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Table 3-8 - Dredge Type Comparison for NTIP02A

				Hydraulic Dredges							Mechanical Dredges			Pneumatic Dredges		
	Key Process Variables	Description/Notes	Importance	Cutterhead Suction	Horizontal Auger	Silt Wing	Archimedean Screw	Match Box	Diver-Assisted	Environmental Disk Cutter	Crane-Operated Environmental Clamshell	Backhoe-Operated Environmental Clamshell	Amphibious	Airlift	Pneuma Dredge	Oozer
1	Production Rate	Production rate for inventory removal will be hindered by thin dredge cuts (i.e., 6 inches or less) and the presence of bedrock and/or hardpan. Significant portions of this dredge sub-area are located along the shoreline (i.e., 1,190 LF) that will slow production.	5	M	M	L	L	L	L	L	M	M	L	L	M	L
2	Sediment Type and Consistency	SSAP data include 28% clay, silt, organic and fine sand, 72% medium to coarse sand and gravel.	3	H	H	L	L	L	M	L	M	H	H	L	L	L
3	Horizontal Accuracy	This variable is especially important along the shoreline and this dredge sub-area includes 1,190 LF of shoreline dredging.	5	M	M	L	L	L	M	L	M	H	M	M	M	M
4	Vertical Accuracy	Vertical accuracy is important for all portions of the dredge areas in terms of dredging to a target elevation without over-dredging and removing non-target sediment.	5	H	H	L	L	L	M	M	M	H	M	L	L	L
5	Maximum Water Depth	Maximum water depth of 15.6 feet, with an average water depth of 8.7 feet.	1	H	H	H	H	H	H	H	H	H	H	H	H	H
6	Minimum Water Depth	Minimum water depth of 4.4 feet, with an average water depth of 8.7 feet.	2	M	M	L	L	L	L	L	M	H	H	L	L	L
7	Sediment Resuspension	The amount of resuspendible sediment in this dredge sub-area is 28% (i.e., the relative amount of fine sand, silt and clay).	5	M	M	M	M	M	M	M	M	M	M	M	M	M
8	Barge Transport	There are 12,324 ft from the lateral mid-point of this dredge sub-area to Energy Park. The average barge travel time is 1.3 hours in addition to one lock passage (Lock 7). Small barges will be required to support dredging in this dredge sub-area due to the narrow width of the channel that services the area.	3	NE	NE	NE	NE	NE	NE	NE	L	L	L	NE	NE	NE
9	Pipeline Transport	There are 12,324 ft from the lateral mid-point of the dredge sub-area to Energy Park. Booster pumps are required if a hydraulic dredge is used.	3	M	M	M	M	M	M	M	NE	NE	NE	M	M	M
10	Positioning Control	The additional effort to position a dredge along the shoreline of NTIP02A will slow production.	4	M	M	M	M	M	H	M	M	H	M	M	M	M
11	Maneuverability	Navigation in and around NTIP02A may be difficult. During normal flow conditions in the summer and fall months, the water depths in this area are typically too shallow to permit navigation. Access to and from portions of this dredge sub-area include passage under 2 bridges.	3	L	L	L	L	L	M	L	M	M	M	L	L	L
12	Portability	Issues related to access for NTIP02A include shallow water along the shoreline, a single point of access through the east channel of Rogers Island and no public access points along the shoreline.	2	M	M	M	M	M	H	L	M	M	H	M	M	M
13	Availability	Commercial availability of dredges.	1	H	H	L	L	L	M	L	H	M	L	L	L	L
14	Debris/Loose Rock	Based on the OSI side-scan sonar data, there are 15 identified targets in NTIP02A.	4	L	L	L	L	L	L	L	M	H	L	L	L	L
15	Flexibility for Varying Conditions	Water environment, water depth, and sediment types vary moderately throughout this dredge sub-area.	2	M	M	L	L	M	M	L	M	H	H	L	L	L
16	Hardpan/Bedrock	Of the sediment to be removed, 38% is gravel, and hardpan and/or bedrock are present.	3	M	M	L	L	L	L	L	L	M	M	L	L	L
17	Shoreline/In-Water Structures	This dredge sub-area includes 1,190 LF of shoreline with 3 outfalls, 1 outlet, 1 fixed bridge, 1 RR bridge, 1 overhead power cable, 2 docks, and 2 headwalls.	2	L	L	L	L	L	H	L	M	H	H	L	L	L
18	Presence and Type of Vegetation	This dredge sub-area includes 0.19 acre of SAV, 0.0 acre of wetland, and 1,190 LF of shoreline.	1	L	L	L	L	L	L	L	M	M	M	L	L	L
		Total Scores:		**193**	**193**	**87**	**87**	**91**	**177**	**93**	**153**	**315**	**199**	**97**	**107**	**97**

Notes:

1. Processing Facility is located in Energy Park.
2. NE - Not Evaluated

	Scoring	
H	9	High - Indicates that this dredge ranks high in suitability compared to other dredges for addressing a given KPV (e.g., sediment resuspension).
M	3	Medium - Indicates that this dredge ranks medium in suitability compared to other dredges for addressing a given KPV (e.g., sediment resuspension).
L	1	Low - Indicates that this dredge ranks low in suitability compared to other dredges for addressing a given KPV (e.g., sediment resuspension).

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Table 3-9 - Dredge Type Comparison for NTIP02B

				Hydraulic Dredges							Mechanical Dredges			Pneumatic Dredges		
	Key Process Variables	Description/Notes	Importance	Cutterhead Suction	Horizontal Auger	Silt Wing	Archimedean Screw	Match Box	Diver-Assisted	Environmental Disk Cutter	Crane-Operated Environmental Clamshell	Backhoe-Operated Environmental Clamshell	Amphibious	Airlift	Pneuma Dredge	Oozer
1	Production Rate	Production rate for inventory removal will not be hindered by thin dredge cuts (i.e., 6 inches or less) or the presence of bedrock and/or hardpan. Significant portions of this dredge sub-area are located along the shoreline (i.e., 6,490 LF) that will slow production.	5	M	M	L	L	L	L	L	M	M	L	L	M	L
2	Sediment Type and Consistency	SSAP data include 62% clay, silt, organic and fine sand, 38% medium to coarse sand and gravel.	3	H	H	M	M	M	M	M	H	H	H	L	L	L
3	Horizontal Accuracy	This variable is especially important along the shoreline and this dredge sub-area includes 6,490 LF of shoreline dredging.	5	M	M	L	L	L	M	L	M	H	M	M	M	M
4	Vertical Accuracy	Vertical accuracy is important for all portions of the dredge areas in terms of dredging to a target elevation without over-dredging and removing non-target sediment.	5	H	H	L	L	L	M	M	M	H	M	L	L	L
5	Maximum Water Depth	Maximum water depth of 19 feet, with an average water depth of 10 feet.	1	H	H	H	H	H	H	H	H	H	H	H	H	H
6	Minimum Water Depth	Minimum water depth of 1.2 feet, with an average water depth of 10 feet.	2	M	M	L	L	L	L	L	M	H	H	L	L	L
7	Sediment Resuspension	The amount of resuspendible sediment in this dredge sub-area is 62% (i.e., the relative amount of fine sand, silt and clay).	5	M	M	M	M	M	H	M	M	M	M	M	M	M
8	Barge Transport	There are 10,383 ft from the lateral mid-point of this dredge sub-area to Energy Park. The average barge travel time is 1.3 hours in addition to one lock passage (Lock 7). Small barges will be required to support dredging in this dredge sub-area due to the narrow width of the channel that services the area.	3	NE	NE	NE	BE	NE	NE	NE	M	M	M	NE	NE	NE
9	Pipeline Transport	There are 10,383 ft from the lateral mid-point of the dredge area to Energy Park. Booster pumps are required if a hydraulic dredge is used.	3	M	M	M	M	M	M	M	NE	NE	NE	M	M	M
10	Positioning Control	The additional effort to position a dredge along the shoreline of NTIP02B will slow production.	4	M	M	M	M	M	H	M	M	H	M	M	M	M
11	Maneuverability	Navigation in and around NTIP02B will be difficult. During normal flow conditions in the summer and fall months, the water depths along the shoreline of this dredge sub-area are typically too shallow to permit navigation.	3	L	L	L	L	L	M	L	L	M	H	L	L	L
12	Portability	Issues related to access for NTIP02B include a single access pathway up the east channel of Rogers Island and no public access points along the shoreline.	2	M	M	M	M	M	H	L	M	M	H	M	M	M
13	Availability	Commercial availability of dredges.	1	H	H	L	L	L	M	L	H	M	L	L	L	L
14	Debris/Loose Rock	Based on the OSI side-scan sonar data, there are 172 identified targets in NTIP02B.	4	L	L	L	L	L	L	L	M	H	L	L	L	L
15	Flexibility for Varying Conditions	Water environment, water depth, and sediment types vary moderately throughout this dredge sub-area.	2	M	M	L	L	M	M	L	M	H	H	L	L	L
16	Hardpan/Bedrock	Of the sediment to be removed, 2% is gravel, hardpan or bedrock do not appear to be present.	3	M	M	L	L	L	L	L	L	M	M	L	L	L
17	Shoreline/In-Water Structures	This dredge sub-area includes 6,490 LF of shoreline with 3 outfalls, 2 boat launches, 3 headwalls, 1 overhead power line, 1 waterline, and riprap.	2	L	L	L	L	L	H	L	M	H	H	L	L	L
18	Presence and Type of Vegetation	This dredge sub-area includes 2.48 acres of SAV, 0.14 acre of wetland, and 6,490 LF of shoreline.	1	L	L	L	L	L	L	L	M	M	M	L	L	L
		Total Scores:		**193**	**193**	**93**	**93**	**97**	**207**	**99**	**171**	**321**	**223**	**97**	**107**	**97**

Notes:
1. Processing Facility is located in Energy Park.
2. NE - Not Evaluated

	Scoring	
H	9	High - Indicates that this dredge ranks high in suitability compared to other dredges for addressing a given KPV (e.g., sediment resuspension).
M	3	Medium - Indicates that this dredge ranks medium in suitability compared to other dredges for addressing a given KPV (e.g., sediment resuspension).
L	1	Low - Indicates that this dredge ranks low in suitability compared to other dredges for addressing a given KPV (e.g., sediment resuspension).

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Table 3-10 - Dredge Type Comparison for NTIP02C

				Hydraulic Dredges							Mechanical Dredges			Pneumatic Dredges		
	Key Process Variables	**Description/Notes**	**Importance**	**Cutterhead Suction**	**Horizontal Auger**	**Silt Wing**	**Archimedean Screw**	**Match Box**	**Diver-Assisted**	**Environmental Disk Cutter**	**Crane-Operated Environmental Clamshell**	**Backhoe-Operated Environmental Clamshell**	**Amphibious**	**Airlift**	**Pneuma Dredge**	**Oozer**
1	Production Rate	Production rate for inventory removal will be hindered by thin dredge cuts (i.e., 6 inches or less) and the presence of bedrock and/or hardpan in the northern half of NTIP02C. Significant portions of this dredge sub-area are located along the shoreline (i.e., 2,780 LF) that will slow production.	5	M	M	L	L	L	L	L	M	M	L	L	L	L
2	Sediment Type and Consistency	SSAP data include 29% clay, silt, organic and fine sand, 71% medium to coarse sand and gravel.	3	H	H	L	L	L	M	L	M	H	H	L	L	L
3	Horizontal Accuracy	This variable is especially important along the shoreline and this dredge sub-area includes 2,780 LF of shoreline dredging.	5	M	M	L	L	L	M	L	M	H	M	M	M	M
4	Vertical Accuracy	Vertical accuracy is important for all portions of the dredge areas in terms of dredging to a target elevation without over-dredging and removing non-target sediment.	5	H	H	L	L	L	M	M	M	H	M	L	L	L
5	Maximum Water Depth	Maximum water depth of 11.1 feet, with an average water depth of 5.7 feet.	1	H	H	H	H	H	H	H	H	H	H	H	H	H
6	Minimum Water Depth	Minimum water depth of 1.3 feet, with an average water depth of 5.7 feet.	2	M	M	L	L	L	L	L	M	H	H	L	L	L
7	Sediment Resuspension	The amount of resuspendible sediment in this dredge sub-area is 29% (i.e., the relative amount of fine sand, silt and clay).	5	M	M	M	M	M	M	M	M	M	M	M	M	M
8	Barge Transport	There are 12,233 ft from the lateral mid-point of this dredge sub-area to Energy Park. The average barge travel time is 1.3 hours in addition to one lock passage (Lock 7). Small barges will be required to support dredging in this dredge sub-area due to the narrow width of the channel that services the area.	3	NE	NE	NE	NE	NE	NE	NE	L	L	L	NE	NE	NE
9	Pipeline Transport	There are 12,233 ft from the lateral mid-point of this dredge sub-area to Energy Park. Booster pumps are required if a hydraulic dredge is used.	3	M	M	M	M	M	M	M	NE	NE	NE	M	M	M
10	Positioning Control	The additional effort to position a dredge along the shoreline of NTIP02C will slow production.	4	M	M	M	M	M	H	M	M	H	M	M	M	M
11	Maneuverability	Navigation in and around NTIP02C may be difficult. During normal flow conditions in the summer and fall months, the water depths in this area are typically too shallow to permit navigation.	3	L	L	L	L	L	M	L	L	M	H	L	L	L
12	Portability	Issues related to access for NTIP02C include shallow water, a single access pathway up the west channel of Rogers Island and a single public access point along a portion of the shoreline.	2	M	M	M	M	M	H	L	M	M	H	M	M	M
13	Availability	Commercial availability of dredges.	1	H	H	L	L	L	M	L	H	M	L	L	L	L
14	Debris/Loose Rock	Based on the OSI side-scan sonar data, there are 95 identified targets.	4	L	L	L	L	L	L	L	M	H	L	L	L	L
15	Flexibility for Varying Conditions	Water environment, water depth, and sediment types vary significantly throughout this dredge sub-area.	2	M	M	L	L	M	M	L	M	H	H	L	L	L
16	Hardpan/Bedrock	Of the sediment to be removed, 24% is gravel and hardpan or bedrock are present.	3	M	M	L	L	L	L	L	L	M	M	L	L	L
17	Shoreline/In-Water Structures	This dredge sub-area includes 2,780 LF of shoreline with 1 fixed bridge, 1 RR bridge, 1 outfall, 2 overhead power cables, and riprap.	2	L	L	L	L	L	H	L	M	H	H	L	L	L
18	Presence and Type of Vegetation	This dredge sub-area includes 9.57 acres of SAV, 0.69 acre of wetland, and 2,780 LF of shoreline.	1	L	L	L	L	L	M	L	M	M	M	L	L	L
		Total Scores:		**193**	**193**	**87**	**87**	**91**	**179**	**93**	**147**	**315**	**217**	**97**	**97**	**97**

Notes:
1. Processing Facility is located in Energy Park.
2. NE - Not Evaluated

	Scoring	
H	9	High - Indicates that this dredge ranks high in suitability compared to other dredges for addressing a given KPV (e.g., sediment resuspension).
M	3	Medium - Indicates that this dredge ranks medium in suitability compared to other dredges for addressing a given KPV (e.g., sediment resuspension).
L	1	Low - Indicates that this dredge ranks low in suitability compared to other dredges for addressing a given KPV (e.g., sediment resuspension).

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Table 3-11 - Dredge Type Comparison for NTIP02D

				Hydraulic Dredges							Mechanical Dredges			Pneumatic Dredges		
	Key Process Variables	Description/Notes	Importance	Cutterhead Suction	Horizontal Auger	Silt Wing	Archimedean Screw	Match Box	Diver-Assisted	Environmental Disk Cutter	Crane-Operated Environmental Clamshell	Backhoe-Operated Environmental Clamshell	Amphibious	Airlift	Pneuma Dredge	Oozer
1	Production Rate	Production rate for inventory removal will not be hindered by thin dredge cuts (i.e., 6 inches or less) or the presence of bedrock and/or hardpan. Significant portions of this dredge sub-area are located along the shoreline (i.e., 750 LF) of this backwater area that will slow production.	5	L	L	L	L	L	L	L	L	M	M	L	L	L
2	Sediment Type and Consistency	SSAP data include 63% clay, silt, organic and fine sand, 37% medium to coarse sand and gravel in this backwater area.	3	M	M	L	L	L	M	L	M	M	H	L	L	L
3	Horizontal Accuracy	This variable is especially important along the shoreline and this dredge sub-area includes 750 LF of shoreline dredging in a backwater setting.	5	M	M	L	L	L	M	L	M	H	M	M	M	M
4	Vertical Accuracy	Vertical accuracy is important for all portions of the dredge areas in terms of dredging to a target elevation without over-dredging and removing non-target sediment.	5	M	M	L	L	L	M	M	M	H	M	L	L	L
5	Maximum Water Depth	Maximum water depth of 4.4 feet, with an average water depth of 3.4 feet.	1	H	H	H	H	H	H	H	H	H	H	H	H	H
6	Minimum Water Depth	Minimum water depth of 1.7 feet, with an average water depth of 3.4 feet.	2	L	L	L	L	L	L	L	M	M	H	L	L	L
7	Sediment Resuspension	The amount of resuspendible sediment in this dredge sub-area is 63% (i.e., the relative amount of fine sand, silt and clay).	5	M	M	M	M	M	M	M	M	M	L	M	M	M
8	Barge Transport	There are 11,838 ft from the lateral mid-point of this dredge sub-area to Energy Park. The average barge travel time is 1.3 hours in addition to one lock passage (Lock 7). Small barges will be required to support dredging in this dredge sub-area due to the narrow width of the channel that services the area.	3	NE	NE	NE	NE	NE	NE	NE	L	L	L	NE	NE	NE
9	Pipeline Transport	There are 11,838 ft from the lateral mid-point of this dredge sub-area to Energy Park. Booster pumps are required if a hydraulic dredge is used.	3	L	L	L	L	L	L	L	NE	NE	NE	L	L	L
10	Positioning Control	The additional effort to position a dredge along the shoreline of NTIP02D will slow production.	4	M	M	M	M	M	H	M	M	H	M	M	M	M
11	Maneuverability	Navigation in and around dredge area NTIP02D will be difficult. Water depths in this backwater area are too shallow to permit navigation.	3	L	L	L	L	L	M	L	L	M	H	L	L	L
12	Portability	Issues related to access for NTIP02D include shallow water and narrow dredge areas between shoreline and small islands just to the west.	2	M	M	M	M	M	H	L	M	M	H	M	M	M
13	Availability	Commercial availability of dredges.	1	H	H	L	L	L	M	L	H	M	L	L	L	L
14	Debris/Loose Rock	Based on the OSI side-scan sonar data, no specific debris targets have been identified. However, the shallow water present in this dredge sub-area may have limited the side-scan data collection and thus some debris is anticipated based on observations elsewhere along the river.	4	L	L	L	L	L	L	L	M	H	L	L	L	L
15	Flexibility for Varying Conditions	Water environment, water depth, and sediment types vary moderately throughout this dredge sub-area.	2	M	M	L	L	M	M	L	M	H	H	L	L	L
16	Hardpan/Bedrock	Of the sediment to be removed, 5% is gravel, and hardpan or bedrock do not appear to be present.	3	M	M	L	L	L	L	L	L	M	M	L	L	L
17	Shoreline/In-Water Structures	This dredge sub-area includes 750 LF of shoreline with 1 fixed bridge and 1 overhead power cable.	2	L	L	L	L	L	H	L	M	H	M	L	L	L
18	Presence and Type of Vegetation	This dredge sub-area includes 0.21 acre of SAV, 0.24 acre of wetland, and 750 LF of shoreline.	1	L	L	L	L	L	L	L	M	M	M	L	L	L
		Total Scores:		**125**	**125**	**81**	**81**	**85**	**171**	**87**	**137**	**285**	**205**	**91**	**91**	**91**

Notes:
1. Processing Facility is located in Energy Park.
2. NE - Not Evaluated

Scoring

H	9	High - Indicates that this dredge ranks high in suitability compared to other dredges for addressing a given KPV (e.g., sediment resuspension).
M	3	Medium - Indicates that this dredge ranks medium in suitability compared to other dredges for addressing a given KPV (e.g., sediment resuspension).
L	1	Low - Indicates that this dredge ranks low in suitability compared to other dredges for addressing a given KPV (e.g., sediment resuspension).

Table 3-12 - Dredge Type Comparison for NTIP02E

				Hydraulic Dredges							Mechanical Dredges			Pneumatic Dredges		
	Key Process Variables	Description/Notes	Importance	Cutterhead Suction	Horizontal Auger	Silt Wing	Archimedean Screw	Match Box	Diver-Assisted	Environmental Disk Cutter	Crane-Operated Environmental Clamshell	Backhoe-Operated Environmental Clamshell	Amphibious	Airlift	Pneuma Dredge	Oozer
1	Production Rate	Production rate for inventory removal will not be hindered by thin dredge cuts (i.e., 6 inches or less) or the presence of bedrock and/or hardpan. Significant portions of this dredge sub-area are located along the shoreline (i.e., 1,600 LF) that will slow production.	5	H	H	L	L	L	L	L	H	H	L	L	M	L
2	Sediment Type and Consistency	SSAP data include 43% clay, silt, organic and fine sand, 57% medium to coarse sand and gravel.	3	H	H	M	M	M	M	M	H	H	H	M	M	M
3	Horizontal Accuracy	This variable is especially important along the shoreline and this dredge sub-area includes 1,600 LF of shoreline dredging.	5	M	M	L	L	L	M	L	M	H	M	M	M	M
4	Vertical Accuracy	Vertical accuracy is important for all portions of the dredge areas in terms of dredging to a target elevation without over-dredging and removing non-target sediment.	5	H	H	L	L	L	M	L	M	H	M	L	L	L
5	Maximum Water Depth	Maximum water depth of 10.4 feet, with an average water depth of 6.9 feet.	1	H	H	H	H	H	H	H	H	H	H	H	H	H
6	Minimum Water Depth	Minimum water depth of 1.3 feet, with an average water depth of 6.9 feet.	2	M	M	L	M	M	L	L	M	H	H	L	L	L
7	Sediment Resuspension	The amount of resuspendible sediment in this dredge sub-area is 43% (i.e., the relative amount of fine sand, silt and clay).	5	M	M	M	M	M	M	M	M	M	L	L	L	L
8	Barge Transport	There are 10,498 ft from the lateral mid-point of this dredge sub-area to Energy Park. The average barge travel time is 1.3 hours in addition to one lock passage (Lock 7). Small barges will be required to support dredging in this dredge sub-area due to the narrow width of the channel that services the area.	3	NE	NE	NE	NE	NE	NE	NE	M	M	M	NE	NE	NE
9	Pipeline Transport	There are 10,498 ft from the lateral mid-point of this dredge sub-area to Energy Park. Booster pumps are required if a hydraulic dredge is used.	3	M	M	M	M	M	M	M	NE	NE	NE	M	M	M
10	Positioning Control	The additional effort to position the dredge along the shoreline of NTIP02E will slow production.	4	M	M	M	M	M	H	M	M	H	M	M	M	M
11	Maneuverability	Navigation in and around dredge area NTIP02E will be difficult. During normal flow conditions in the summer and fall months, the water depths in this area are typically too shallow to permit navigation.	3	L	L	L	L	L	M	L	L	L	H	M	M	M
12	Portability	Issues related to access for NTIP02E include shallow water along the shoreline and working around the small island in the center of the Rogers Island west channel.	2	M	M	M	M	M	H	L	M	M	H	M	M	M
13	Availability	Commercial availability of dredges.	1	H	H	L	L	L	M	L	H	M	L	L	L	L
14	Debris/Loose Rock	Based on the OSI side-scan sonar data, there are 102 identified targets in NTIP02E.	4	L	L	L	L	L	L	L	M	H	L	L	L	L
15	Flexibility for Varying Conditions	Water environment, water depth, and sediment types vary moderately through this dredge sub-area.	2	H	M	L	L	M	L	L	M	M	H	L	L	L
16	Hardpan/Bedrock	Of the sediment to be removed, 5% is gravel, and hardpan or bedrock do not appear to be present.	3	M	M	L	L	L	L	L	L	M	M	L	L	L
17	Shoreline/In-Water Structures	This dredge sub-area includes 1,600 LF of shoreline and 1 headwall.	2	L	L	L	L	L	H	L	M	H	H	L	L	L
18	Presence and Type of Vegetation	This dredge sub-area includes 2.60 acres of SAV, 0.39 acre of wetland, and 1,600 LF of shoreline.	1	L	L	L	L	L	L	L	M	M	M	L	L	L
		Total Scores:		**235**	**223**	**93**	**97**	**101**	**173**	**89**	**201**	**333**	**213**	**99**	**109**	**99**

Notes:
1. Processing Facility is located in Energy Park.
2. NE - Not Evaluated

	Scoring	
H	9	High - Indicates that this dredge ranks high in suitability compared to other dredges for addressing a given KPV (e.g., sediment resuspension).
M	3	Medium - Indicates that this dredge ranks medium in suitability compared to other dredges for addressing a given KPV (e.g., sediment resuspension).
L	1	Low - Indicates that this dredge ranks low in suitability compared to other dredges for addressing a given KPV (e.g., sediment resuspension).

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Table 3-13 - Dredge Type Comparison for NTIP02F

				Hydraulic Dredges							Mechanical Dredges			Pneumatic Dredges		
	Key Process Variables	**Description/Notes**	**Importance**	**Cutterhead Suction**	**Horizontal Auger**	**Silt Wing**	**Archimedean Screw**	**Match Box**	**Diver-Assisted**	**Environmental Disk Cutter**	**Crane-Operated Environmental Clamshell**	**Backhoe-Operated Environmental Clamshell**	**Amphibious**	**Airlift**	**Pneuma Dredge**	**Oozer**
1	Production Rate	Production rate for inventory removal will not be hindered by thin dredge cuts (i.e., 6 inches or less) or the presence of bedrock and/or hardpan. Significant portions of this dredge sub-area are located along the shoreline (i.e., 2,570 LF) that will slow production.	5	H	H	L	L	L	L	L	H	H	L	L	M	L
2	Sediment Type and Consistency	SSAP data include 38% clay, silt, organic and fine sand, 62% medium to coarse sand and gravel.	3	H	H	M	M	M	M	M	H	H	H	H	H	H
3	Horizontal Accuracy	This variable is especially important along the shoreline and this dredge sub-area includes 2,570 LF of shoreline dredging.	5	M	M	L	L	L	M	L	M	H	M	M	M	M
4	Vertical Accuracy	Vertical accuracy is important for all portions of the dredge areas in terms of dredging to a target elevation without over-dredging and removing non-target sediment.	5	H	H	L	L	L	M	L	M	H	M	L	L	L
5	Maximum Water Depth	Maximum water depth of 24.6 feet, with an average water depth of 14.1 feet.	1	H	H	H	H	H	H	H	H	H	H	H	H	H
6	Minimum Water Depth	Minimum water depth of 1.5 feet, with an average water depth of 14.1 feet.	2	M	M	L	M	M	M	L	M	H	H	L	L	M
7	Sediment Resuspension	The amount of resuspendible sediment in this dredge sub-area is 38% (i.e., the relative amount of fine sand, silt and clay).	5	M	M	M	M	M	M	M	M	M	L	L	L	L
8	Barge Transport	There are 9,034 ft from the lateral mid-point of this dredge sub-area to Energy Park. The average barge travel time is 1.2 hours in addition to one lock passage (Lock 7).	3	NE	NE	NE	NE	NE	NE	NE	M	M	M	NE	NE	NE
9	Pipeline Transport	There are 9,034 ft from the lateral mid-point of this dredge sub-area to Energy Park. Booster pumps are required if a hydraulic dredge is used.	3	M	M	M	M	M	M	M	NE	NE	NE	M	M	M
10	Positioning Control	The additional effort to position the dredge along the shoreline of NTIP02F will slow production.	4	M	M	M	M	M	H	M	M	H	M	M	M	M
11	Maneuverability	Navigation in and around dredge area NTIP02F will be difficult. 14.8% of dredge area lies in the navigation channel. This dredge sub-area is also adjacent to Lock 7 that will be the focus of both project and non-project vessell traffic on the river.	3	L	L	L	L	L	M	L	M	M	H	M	M	M
12	Portability	Issues related to access for NTIP02F include shallow water along the shoreline.	2	M	M	M	M	M	H	L	M	M	H	M	M	M
13	Availability	Commercial availability of dredges.	1	H	H	L	L	L	M	L	H	M	L	L	L	L
14	Debris/Loose Rock	Based on the OSI side-scan sonar data, there are 120 identified targets in NTIP02F.	4	L	L	L	L	L	L	L	M	H	L	L	L	L
15	Flexibility for Varying Conditions	Water environment, water depth, and sediment types vary moderately throughout this dredge sub-area.	2	M	M	L	L	M	L	L	M	M	H	L	L	L
16	Hardpan/Bedrock	Of the sediment to be removed, 9% is gravel, but hardpan or bedrock do not appear to be present.	3	M	M	L	L	L	L	L	L	M	M	L	L	L
17	Shoreline/In-Water Structures	This dredge sub-area includes 2,570 LF of shoreline, Lock 7, 1 dock, 1 overhead power cable, 2 possible submerged boats, and extensive riprap along the shoreline.	2	L	L	L	L	L	H	L	M	H	H	L	L	L
18	Presence and Type of Vegetation	This dredge sub-area includes 0.47 acre of SAV, 0.12 acre of wetland, and 2,570 LF of shoreline.	1	L	L	L	L	L	L	L	M	M	M	L	L	L
		Total Scores:		**223**	**223**	**93**	**97**	**101**	**177**	**89**	**207**	**339**	**213**	**117**	**127**	**121**

Notes:
1. Processing Facility is located in Energy Park.
2. NE - Not Evaluated

	Scoring	
H	9	High - Indicates that this dredge ranks high in suitability compared to other dredges for addressing a given KPV (e.g., sediment resuspension).
M	3	Medium - Indicates that this dredge ranks medium in suitability compared to other dredges for addressing a given KPV (e.g., sediment resuspension).
L	1	Low - Indicates that this dredge ranks low in suitability compared to other dredges for addressing a given KPV (e.g., sediment resuspension).

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Table 3-14 - Dredge Type Comparison for NTIP02G

				Hydraulic Dredges							Mechanical Dredges			Pneumatic Dredges		
	Key Process Variables	**Description/Notes**	**Importance**	**Cutterhead Suction**	**Horizontal Auger**	**Silt Wing**	**Archimedean Screw**	**Match Box**	**Diver-Assisted**	**Environmental Disk Cutter**	**Crane-Operated Environmental Clamshell**	**Backhoe-Operated Environmental Clamshell**	**Amphibious**	**Airlift**	**Pneuma Dredge**	**Oozer**
1	Production Rate	Production rate for inventory removal will not be hindered by thin dredge cuts (i.e., 6 inches or less) or the presence of bedrock and/or hardpan. Significant portions of this dredge sub-area are located along the shoreline (i.e., 2,090 LF) that will slow production.	5	H	H	L	L	L	L	L	H	H	L	L	M	L
2	Sediment Type and Consistency	SSAP data include 55% clay, silt, organic and fine sand, 45% medium to coarse sand and gravel.	3	H	H	M	M	M	M	M	H	H	H	M	M	M
3	Horizontal Accuracy	This variable is especially important along the shoreline and this dredge sub-area includes 2,090 LF of shoreline dredging.	5	M	M	L	L	L	M	L	M	H	M	M	M	M
4	Vertical Accuracy	Vertical accuracy is important for all portions of the dredge areas in terms of dredging to a target elevation without over-dredging and removing non-target sediment.	5	H	H	L	L	L	M	H	M	H	M	L	L	L
5	Maximum Water Depth	Maximum water depth of 24.0 feet, with an average water depth of 13.7 feet.	1	H	H	H	H	H	H	H	H	H	H	H	H	H
6	Minimum Water Depth	Minimum water depth of 1.3 feet, with an average water depth of 13.7 feet.	2	H	H	L	M	M	M	L	M	H	H	L	L	L
7	Sediment Resuspension	The amount of resuspendible sediment in this dredge sub-area is 55% (i.e., the relative amount of fine sand, silt and clay).	5	M	M	M	M	M	M	M	M	M	M	M	M	M
8	Barge Transport	There are 11,033 ft from the lateral mid-point of this dredge sub-area to Energy Park. The average barge travel time is 1.3 hours in addition to one lock passage (Lock 7).	3	NE	NE	NE	NE	NE	NE	NE	M	M	M	NE	NE	NE
9	Pipeline Transport	There are 11,033 ft from the lateral mid-point of this dredge sub-area to Energy Park. Booster pumps are required if a hydraulic dredge is used.	3	M	M	M	M	M	M	M	NE	NE	NE	M	M	M
10	Positioning Control	The additional effort to position a dredge along the shoreline of NTIP02G will slow production.	4	M	M	M	M	M	H	M	M	H	M	M	M	M
11	Maneuverability	Navigation in and around dredge area NTIP02G will be difficult as 44.51% of this dredge sub-area is in the navigation channel.	3	L	L	L	L	L	M	L	M	M	H	L	L	L
12	Portability	Issues related to access for NTIP02G include shallow water along the shoreline and a single public access point along the shoreline.	2	M	M	M	M	M	H	L	M	M	H	M	M	M
13	Availability	Commercial availability of dredges.	1	H	H	L	L	L	M	L	H	M	L	L	L	L
14	Debris/Loose Rock	Based on the OSI side-scan sonar data, there are 118 identified targets in NTIP02G.	4	L	L	L	L	L	L	L	M	H	L	L	L	L
15	Flexibility for Varying Conditions	Water environment, water depth, and sediment types vary moderately throughout this dredge sub-area.	2	M	M	L	L	L	L	L	M	H	H	L	L	L
16	Hardpan/Bedrock	Of the sediment to be removed, 8% is gravel, but hardpan or bedrock do not appear to be present.	3	M	M	L	L	L	L	L	L	M	M	L	L	L
17	Shoreline/In-Water Structures	This dredge sub-area includes 2,090 LF of shoreline and 200 ft of docking space and riprap along the shoreline.	2	L	L	L	L	L	H	L	M	H	H	L	L	L
18	Presence and Type of Vegetation	This dredge sub-area includes 1.93 acres of SAV, 0.19 acre of wetland, and 2,090 LF of shoreline.	1	L	L	L	L	L	L	L	M	M	M	L	L	L
		Total Scores:		**235**	**235**	**93**	**97**	**97**	**177**	**129**	**207**	**351**	**223**	**103**	**113**	**103**

Notes:
1. Processing Facility is located in Energy Park.
2. NE - Not Evaluated

	Scoring	
H	9	High - Indicates that this dredge ranks high in suitability compared to other dredges for addressing a given KPV (e.g., sediment resuspension).
M	3	Medium - Indicates that this dredge ranks medium in suitability compared to other dredges for addressing a given KPV (e.g., sediment resuspension).
L	1	Low - Indicates that this dredge ranks low in suitability compared to other dredges for addressing a given KPV (e.g., sediment resuspension).

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Table 3-15 - Dredge Type Comparison for NTIP02H

	Key Process Variables	Description/Notes	Importance	Hydraulic Dredges: Cutterhead Suction	Hydraulic Dredges: Horizontal Auger	Hydraulic Dredges: Silt Wing	Hydraulic Dredges: Archimedean Screw	Hydraulic Dredges: Match Box	Hydraulic Dredges: Diver-Assisted	Hydraulic Dredges: Environmental Disk Cutter	Mechanical Dredges: Crane-Operated Environmental Clamshell	Mechanical Dredges: Backhoe-Operated Environmental Clamshell	Mechanical Dredges: Amphibious	Pneumatic Dredges: Airlift	Pneumatic Dredges: Pneuma Dredge	Pneumatic Dredges: Oozer
1	Production Rate	Production rate for inventory removal will not be hindered by thin dredge cuts (i.e., 6 inches or less) or the presence of bedrock and/or hardpan. Significant portions of this dredge sub-area are located along the shoreline (i.e., 3,640 LF) that will slow production.	5	H	H	L	L	L	L	L	H	H	L	L	M	L
2	Sediment Type and Consistency	SSAP data include 95% clay, silt, organic and fine sand, 5% medium to coarse sand and gravel. Sediment is suitable for removal by either dredge.	3	H	H	H	H	H	H	H	H	H	H	H	H	H
3	Horizontal Accuracy	This variable is especially important along the shoreline and this dredge sub-area includes 3,640 LF of shoreline dredging.	5	M	M	L	L	L	M	L	M	H	M	M	M	M
4	Vertical Accuracy	Vertical accuracy is important for all portions of the dredge areas in terms of dredging to a target elevation without over-dredging and removing non-target sediment.	5	H	H	L	L	L	M	H	M	H	M	L	L	L
5	Maximum Water Depth	Maximum water depth of 14.4 feet, with an average water depth of 5.8 feet.	1	H	H	H	H	H	H	H	H	H	H	H	H	H
6	Minimum Water Depth	Minimum water depth of 1.2 feet, with an average water depth of 5.8 feet.	2	H	H	L	L	L	L	L	M	H	H	L	L	L
7	Sediment Resuspension	The amount of resuspendible sediment in this dredge sub-area is 95% (i.e., the relative amount of fine sand, silt and clay).	5	M	M	M	M	M	M	M	M	M	M	M	M	M
8	Barge Transport	There are 13,767 ft from the lateral mid-point of this dredge sub-area to Energy Park. The average barge travel time is 1.4 hours in addition to one lock passage (Lock 7).	3	NE	NE	NE	NE	NE	NE	NE	M	M	M	NE	NE	NE
9	Pipeline Transport	There are 13,767 ft from the lateral mid-point of this dredge sub-area to Energy Park. Booster pumps are required if a hydraulic dredge is used.	3	M	M	M	M	M	M	M	NE	NE	NE	M	M	M
10	Positioning Control	The additional effort to position the dredge along the shoreline of NTIP02H will slow production.	4	M	M	M	M	M	H	M	M	H	M	M	M	M
11	Maneuverability	Navigation in and around dredge area NTIP02H will be difficult. During normal flow conditions in the summer and fall months, water depths are typically too shallow to permit navigation. 0% of dredge area lies in the navigation channel.	3	L	L	L	L	L	L	L	M	M	H	L	L	L
12	Portability	Issues related to access for NTIP02H include shallow water along the shoreline and no public access points.	2	M	M	M	M	M	H	L	M	M	H	M	M	M
13	Availability	Commercial availability of dredges.	1	H	H	L	L	L	M	L	H	M	L	L	L	L
14	Debris/Loose Rock	Based on the OSI side-scan sonar data, there are 73 identified targets in NTIP02H.	4	L	L	L	L	L	L	L	M	H	L	L	L	L
15	Flexibility for Varying Conditions	Water environment, water depth, and sediment types vary moderately throughout this dredge sub-area.	2	M	M	L	L	L	L	L	M	H	H	L	L	L
16	Hardpan/Bedrock	Of the sediment to be removed, 1% is gravel, but hardpan or bedrock do not appear to be present.	3	M	M	L	L	L	L	L	L	M	M	L	L	L
17	Shoreline/In-Water Structures	This dredge sub-area includes 3,640 LF of shoreline with 2 docks, 3 culverts, 1 storm sewer, 1 overhead power cable, 1 awash rock, and shoreline riprap.	2	L	L	L	L	L	H	L	M	H	H	L	L	L
18	Presence and Type of Vegetation	This dredge sub-area includes 10.01 acres of SAV, 0.49 acre of wetland, and 3,640 LF of shoreline.	1	L	L	L	L	L	L	L	M	M	M	L	L	L
		Total Scores:		**220**	**220**	**96**	**96**	**96**	**170**	**132**	**192**	**336**	**208**	**106**	**116**	**106**

Notes:
1. Processing Facility is located in Energy Park.
2. NE - Not Evaluated

Scoring

	Score	
H	9	High - Indicates that this dredge ranks high in suitability compared to other dredges for addressing a given KPV (e.g., sediment resuspension).
M	3	Medium - Indicates that this dredge ranks medium in suitability compared to other dredges for addressing a given KPV (e.g., sediment resuspension).
L	1	Low - Indicates that this dredge ranks low in suitability compared to other dredges for addressing a given KPV (e.g., sediment resuspension).

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Table 3-16 - Dredge Type Comparison for NTIP02I

				Hydraulic Dredges							Mechanical Dredges			Pneumatic Dredges		
	Key Process Variables	**Description/Notes**	**Importance**	**Cutterhead Suction**	**Horizontal Auger**	**Silt Wing**	**Archimedean Screw**	**Match Box**	**Diver-Assisted**	**Environmental Disk Cutter**	**Crane-Operated Environmental Clamshell**	**Backhoe-Operated Environmental Clamshell**	**Amphibious**	**Airlift**	**Pneuma Dredge**	**Oozer**
1	Production Rate	Production rate for inventory removal will not be hindered by thin dredge cuts (i.e., 6 inches or less) or the presence of bedrock and/or hardpan. Significant portions of this dredge sub-area are located along the shoreline (i.e., 700 LF) that will slow production.	5	H	H	L	L	L	L	L	H	H	L	L	M	L
2	Sediment Type and Consistency	SSAP data include 39% clay, silt, organic and fine sand, 61% medium to coarse sand and gravel.	3	H	H	M	M	M	M	M	H	H	H	M	M	M
3	Horizontal Accuracy	This variable is especially important along the shoreline and this dredge sub-area includes 700 LF of shoreline dredging.	5	M	M	L	L	L	M	L	M	H	M	M	M	M
4	Vertical Accuracy	Vertical accuracy is important for all portions of the dredge areas in terms of dredging to a target elevation without over-dredging and removing non-target sediment.	5	H	H	L	L	L	M	H	M	H	M	L	L	L
5	Maximum Water Depth	Maximum water depth of 16.8, feet with an average water depth of 11.6 feet.	1	H	H	H	H	H	H	H	H	H	H	H	H	H
6	Minimum Water Depth	Minimum water depth of 1.0, foot with an average water depth of 11.6 feet.	2	H	H	L	L	L	L	L	M	H	H	L	L	L
7	Sediment Resuspension	The amount of resuspendible sediment in this dredge sub-area is 39% (i.e., the relative amount of fine sand, silt and clay).	5	M	M	M	M	M	M	M	M	M	M	M	M	M
8	Barge Transport	There are 13,678 ft from the lateral mid-point of this dredge sub-area to Energy Park. The average barge travel time is 1.4 hours with one lock passage (Lock 7).	3	NE	NE	NE	NE	NE	NE	NE	M	M	M	NE	NE	NE
9	Pipeline Transport	There are 13,678 ft from the lateral mid-point of this dredge sub-area to Energy Park. Booster pumps are required if a hydraulic dredge is used.	3	M	M	M	M	M	M	M	NE	NE	NE	M	M	M
10	Positioning Control	The additional effort to position a dredge along the shoreline of NTIP02I will slow production.	4	M	M	M	M	M	H	M	M	H	M	M	M	M
11	Maneuverability	Navigation in and around dredge area NTIP02I will be difficult as 65.3% of dredge area lies in the navigation channel.	3	L	L	L	L	L	M	L	M	M	H	L	L	L
12	Portability	Issues related to access for NTIP02I include shallow water along the shoreline and no public access points.	2	M	M	M	M	M	H	L	M	M	H	M	M	M
13	Availability	Commercial availability of dredges.	1	H	H	L	L	L	M	L	H	M	L	L	L	L
14	Debris/Loose Rock	Based on the OSI side-scan sonar data, there are 45 identified targets in NTIP02I.	4	L	L	L	L	L	L	L	M	H	L	L	L	L
15	Flexibility for Varying Conditions	Water environment, water depth, and sediment types vary moderately throughout this dredge sub-area.	2	M	M	L	L	L	L	L	M	H	H	L	L	L
16	Hardpan/Bedrock	Of the sediment to be removed, 11% is gravel; hardpan or bedrock do not appear to be present.	3	M	M	L	L	L	L	L	L	M	M	L	L	L
17	Shoreline/In-Water Structures	This dredge sub-area includes 700 LF of shoreline with 1 overhead power cable, 1 private intake, 1 private outfall, and 1 dock.	2	L	L	L	L	L	H	L	M	M	M	L	L	L
18	Presence and Type of Vegetation	This dredge sub-area includes 0.26 acre of SAV, 0.0 acre of wetland, and 700 LF of shoreline.	1	L	L	L	L	L	L	L	M	M	M	L	L	L
		Total Scores:		**235**	**235**	**93**	**93**	**93**	**173**	**129**	**207**	**339**	**211**	**103**	**113**	**103**

Notes:
1. Processing Facility is located in Energy Park.
2. NE - Not Evaluated

Scoring

H	9	High - Indicates that this dredge ranks high in suitability compared to other dredges for addressing a given KPV (e.g., sediment resuspension).
M	3	Medium - Indicates that this dredge ranks medium in suitability compared to other dredges for addressing a given KPV (e.g., sediment resuspension).
L	1	Low - Indicates that this dredge ranks low in suitability compared to other dredges for addressing a given KPV (e.g., sediment resuspension).

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Table 3-17 - Dredge Type Comparison for EGIA

	Key Process Variables	Description/Notes	Importance	Hydraulic Dredges: Cutterhead Suction	Hydraulic Dredges: Horizontal Auger	Hydraulic Dredges: Silt Wing	Hydraulic Dredges: Archimedean Screw	Hydraulic Dredges: Match Box	Hydraulic Dredges: Diver-Assisted	Hydraulic Dredges: Environmental Disk Cutter	Mechanical Dredges: Crane-Operated Environmental Clamshell	Mechanical Dredges: Backhoe-Operated Environmental Clamshell	Mechanical Dredges: Amphibious	Pneumatic Dredges: Airlift	Pneumatic Dredges: Pneuma Dredge	Pneumatic Dredges: Oozer
1	Production Rate	Production rate for inventory removal will not be hindered by thin dredge cuts (i.e., 6 inches or less) or the presence of bedrock and/or hardpan. Significant portions of this dredge sub-area are located along the shoreline (i.e., 2,875 LF) that will slow production.	5	H	H	M	L	L	L	L	H	H	L	L	M	L
2	Sediment Type and Consistency	SSAP data includes 86% clay, silt, organic and fine sand, 14% medium to coarse sand and gravel.	3	H	H	M	M	M	M	M	H	H	M	M	M	M
3	Horizontal Accuracy	This variable is especially important along the shoreline and this dredge sub-area includes 2,875 LF along the shoreline.	5	M	M	L	L	L	M	L	M	H	M	M	M	M
4	Vertical Accuracy	Vertical accuracy is important for all portions of the dredge areas in terms of dredging to a target elevation without over-dredging and removing non-target sediment.	5	H	H	M	L	L	M	H	M	H	M	L	L	L
5	Maximum Water Depth	Maximum water depth of 18.1 feet, with an average water depth of 11.1 feet.	1	H	H	H	H	H	H	H	H	H	H	H	H	H
6	Minimum Water Depth	Minimum water depth of 1.4 feet, with an average water depth of 11.1 feet.	2	H	H	L	L	L	L	L	M	H	H	L	L	L
7	Sediment Resuspension	The amount of resuspendible sediment in this dredge area is 86% (i.e., the relative amount of fine sand, silt and clay).	5	M	M	M	M	M	M	M	M	M	M	M	M	M
8	Barge Transport	There are 27,918 ft from the lateral mid-point of this dredge area to Energy Park. The average barge travel time is 1.8 hours in addition to one lock passage (Lock 7).	3	NE	NE	NE	NE	NE	NE	NE	M	M	M	NE	NE	NE
9	Pipeline Transport	There are 27,918 ft from the lateral mid-point of this dredge area to Energy Park. Booster pumps are required if s hydraulic dredge is used	3	L	L	L	L	L	L	L	NE	NE	NE	L	L	L
10	Positioning Control	The additional effort to position a dredge along the shoreline of EGIA will slow production.	4	M	M	M	M	M	H	M	M	H	M	M	M	M
11	Maneuverability	Navigation in and around dredge area EGIA during normal flow conditions in the summer and fall months will not be prohibited with the exception of shoreline areas and portions of the dredge area that are in the navigation channel.	3	L	L	L	L	L	M	L	M	M	H	L	L	L
12	Portability	Issues related to access for EGIA include shallow water along the shoreline and no public access points.	2	M	M	M	M	M	H	L	M	M	H	M	M	M
13	Availability	Commercial availability of dredges.	1	H	H	L	L	L	M	L	H	M	L	L	L	L
14	Debris/Loose Rock	Based on the OSI side-scan sonar data, there are 110 identified targets in EGIA.	4	L	L	L	L	L	L	L	M	H	L	L	L	L
15	Flexibility for Varying Conditions	Water environment, water depth, and sediment types vary moderately throughout this dredge area.	2	M	M	L	L	L	L	L	M	H	H	L	L	L
16	Hardpan/Bedrock	Of the sediment to be removed, 2% is gravel, and hardpan or bedrock appear to be present.	3	M	M	L	L	L	L	L	L	M	M	L	L	L
17	Shoreline/In-Water Structures	This dredge area includes 2,875 LF of shoreline with 4 docks, 2 outfalls, 1 boat launch, 1 culvert, and 1 retaining wall.	2	L	L	L	L	L	H	L	M	H	H	L	L	L
18	Presence and Type of Vegetation	This dredge are includes 4.49 acres of SAV, 0.05 acre of wetland, and 2,875 LF of shoreline.	1	L	L	L	L	L	L	L	M	M	M	L	L	L
		Total Scores:		**229**	**229**	**107**	**87**	**87**	**167**	**123**	**207**	**351**	**205**	**97**	**107**	**97**

Notes:
1. Processing Facility is located in Energy Park.
2. NE - Not Evaluated

	Scoring	
H	9	High - Indicates that this dredge ranks high in suitability compared to other dredges for addressing a given KPV (e.g., sediment resuspension).
M	3	Medium - Indicates that this dredge ranks medium in suitability compared to other dredges for addressing a given KPV (e.g., sediment resuspension).
L	1	Low - Indicates that this dredge ranks low in suitability compared to other dredges for addressing a given KPV (e.g., sediment resuspension).

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Table 3-18 - Dredge Evaluation Summary Table

	Hydraulic Dredges							Mechanical Dredges			Pneumatic Dredges		
	Cutterhead Suction	Horizontal Auger	Silt Wing	Archimedean Screw	Match Box	Diver-Assisted	Environmental Disk Cutter	Crane-Operated Environmental Clamshell	Backhoe-Operated Environmental Clamshell	Amphibious	Airlift	Pneuma	Oozer
NTIP01	235	235	87	87	87	173	93	183	345	217	97	107	97
NTIP02A	193	193	87	87	91	177	93	153	315	199	97	107	97
NTIP02B	193	193	93	93	97	207	99	171	321	223	97	107	97
NTIP02C	193	193	87	87	91	179	93	147	315	217	97	97	97
NTIP02D	125	125	81	81	85	171	87	137	285	205	91	91	91
NTIP02E	235	223	93	97	101	173	89	201	333	213	99	109	99
NTIP02F	223	223	93	97	101	177	89	207	339	213	117	127	121
NTIP02G	235	235	93	97	97	177	129	207	351	223	103	113	103
NTIP02H	220	220	96	96	96	170	132	192	336	208	106	116	106
NTIP02I	235	235	93	93	93	173	129	207	339	211	103	113	103
EGIA	229	229	107	87	87	167	123	207	351	205	97	107	97

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Table 3-22 - Phase 1 Inventory Dredging Plan

Week Number	Day Number	EGIA01A				EGIA01B				NTIP01				NTIP02A				NTIP02B				NTIP02C				NTIP02D				NTIP02E				NTIP02F				NTIP02G				Daily Totals	Weekly Totals
		D1	D2	D3	D4	D1	D2	D3	D4	D1	D2	D3	D4	D1	D2	D3	D4	D1	D2	D3	D4	D1	D2	D3	D4	D1	D2	D3	D4	D1	D2	D3	D4	D1	D2	D3	D4	D1	D2	D3	D4		
1		Mobilization of Dredges and Barges to Site																																									
2																																											
	1									944																																944	
	2									873																																873	
	3									755																																755	
3	4									755																																755	4,311
	5									492																																492	
	6									492																																492	
	7																																									0	
	8	Holiday												Holiday								Holiday								Holiday								Holiday				0	
	9									492																																492	
	10									492																																492	
4	11									492																																492	2,339
	12									432																																432	
	13									432																																432	
	14																																									0	
	15				922					432																																1,353	
	16				1,159					432																																1,590	
	17				1,245					450																																1,695	
5	18								1,240	450																																1,690	9,765
	19								1,333	450																																1,782	
	20								1,175	479																																1,654	
	21																																									0	
	22								1,359	479																																1,838	
	23								1,229	479																																1,708	
	24								1,326	438																																1,764	
6	25								1,298	438																																1,737	10,110
	26								1,201	439																																1,639	
	27								960					465																												1,425	
	28																																									0	
	29													494									621	443																		1,558	
	30													341									475	583																		1,399	
	31													280									365	679																		1,324	
7	32																	928					396	376																		1,700	10,047
	33																	917					679	419																		2,016	
	34																	732					638	679																		2,050	
	35																																									0	
	36																	960					473	679																		2,112	
	37																	1,222					473	679																		2,374	
	38																	1,164					670	449																		2,283	
8	39																	810					475	427																		1,712	11,853
	40																	846					481	335																		1,661	
	41																	846					523	342																		1,712	
	42																																									0	
	43								1,082									614					409	343																		2,448	
	44								836									732					679	511																		2,759	
	45	Holiday												Holiday								Holiday								Holiday								Holiday				0	
9	46								822									1,359					311	393																		2,885	13,253
	47								1,001									1,154					335	393																		2,883	
	48								808									816					335	320																		2,278	
	49																																									0	
	50								1,122									1,164					335	320																		2,942	
	51								722									1,208					335	212																		2,477	
	52								919									1,208					352	212																		2,691	
10	53								488									1,208					352	212																		2,260	15,031
	54								488									1,208					388	212																		2,297	
	55								488									1,359					305	212																		2,364	
	56																																									0	
	57								609									1,359					305	1,054																		3,328	
	58								866									1,068					223	568																		2,724	
	59								897									1,068					223	568																		2,755	
11	60								877									776					388	517																		2,559	16,784
	61								935									776					388	574																		2,673	
	62								776									776					619	574																		2,745	
	63																																									0	
	64								776									776					695	574																		2,821	
	65								195									776					1,326	676																		2,974	
	66																	776			1,295		1,267	876																		4,215	
12	67																	776			795		1,256	413																		3,240	20,707
	68																	776			795		941	1,192																		3,704	
	69																	776			1,131		569	1,277																		3,754	
	70																																									0	
	71																	891			1,131		466	803																		3,291	
	72																	891			939		466	838																		3,134	
	73																	891			939		776	1,202																		3,808	
13	74																	1,296			1,310		776	323																		3,706	22,240
	75																	1,342			1,310		986					707														4,345	
	76																	1,198			1,064		1,313					383														3,957	
	77																																									0	
	78																	1,329			1,064		1,275					383														4,051	
	79																	1,329			1,154		837					383														3,703	
	80																	1,233			729							423			1,085											3,470	
14	81																	1,233			729							1,029			916											3,906	23,405
	82																	1,359			1,131										614	701										3,804	
	83																	1,359			1,010										1,195	908										4,471	
	84																																									0	

Table 3-22 - Phase 1 Inventory Dredging Plan

Week Number	Day Number	EGIA01A				EGIA01B				NTIP01				NTIP02A				NTIP02B				NTIP02C				NTIP02D				NTIP02E				NTIP02F				NTIP02G				Daily Totals	Weekly Totals
		D1	D2	D3	D4	D1	D2	D3	D4	D1	D2	D3	D4	D1	D2	D3	D4	D1	D2	D3	D4	D1	D2	D3	D4	D1	D2	D3	D4	D1	D2	D3	D4	D1	D2	D3	D4	D1	D2	D3	D4		
15	85																	1,217			670										926	1,215										4,028	22,491
	86																	1,308			540										1,103	1,057										4,007	
	87																	1,165			500										1,255	673										3,593	
	88																	1,165			1,151										1,319	740										4,375	
	89																	1,051			684										1,214	740										3,690	
	90																	80													1,359	1,359										2,798	
	91																																									0	
16	92																														1,301	1,359										2,659	14,642
	93																														1,301	1,344										2,645	
	94																														818	1,344										2,162	
	95																														1,119	1,208										2,327	
	96																														1,184	1,208										2,392	
	97																														1,184	1,274										2,457	
	98																																									0	
17	99																														940	1,274										2,214	11,978
	100																														1,181	770										1,951	
	101																														204					902						1,105	
	102																																		937	902						1,839	
	103																																		981	1,274						2,255	
	104																																		1,340	1,274						2,614	
	105																																									0	
18	106	Holiday												Holiday								Holiday								Holiday								Holiday				0	10,213
	107																																		859	831						1,691	
	108																																		1,244	1,038						2,282	
	109																																		1,345	776						2,121	
	110																																		978	919						1,897	
	111																																		1,127	1,095						2,222	
	112																																									0	
19	113																																		1,190	1,314						2,505	13,766
	114																																		993	867						1,860	
	115																																		1,078	972						2,050	
	116																																		1,029	1,359						2,388	
	117																																		1,359	1,199						2,557	
	118																																		1,179	1,227						2,406	
	119																																									0	
20	120																																		1,331	1,149						2,481	13,237
	121																																		1,242	1,120						2,363	
	122																																		1,243	1,210						2,453	
	123																																		74					1,202		1,276	
	124																																						1,050	1,199		2,249	
	125																																						1,057	1,359		2,416	
	126																																									0	
21	127																																						1,273	1,359		2,632	15,792
	128																																						1,258	1,359		2,617	
	129																																						1,311	1,359		2,669	
	130																																						1,257	1,359		2,616	
	131																																						1,290	1,359		2,649	
	132																																						1,251	1,359		2,609	
	133																																									0	
22	134																																						1,228	1,359		2,587	3,037
	135																																						255	195		450	
	136																																									0	
	137																																									0	
	138																																									0	
	139																																									0	
	140																																									0	
23	141																																									0	0
	142																																									0	
	143																																									0	
	144																																									0	
	145																																									0	
	146																																									0	
	147																																									0	
24	148																																									0	0
	149																																									0	
	150																																									0	
	151																																									0	
	152																																									0	
	153																																									0	
	154																																									0	
25	155																																									0	0
	156																																									0	
	157																																									0	
	158																																									0	
	159																																									0	
	160																																									0	
	161																																									0	

	EGIA01A	EGIA01B	NTIP01	NTIP02A	NTIP02B	NTIP02C	NTIP02D	NTIP02E	NTIP02F	NTIP02G	Total
Dredge Area Totals	3,326	25,828	11,615	1,580	71,343	46,960	3,307	37,388	38,958	24,696	265,000

Notes:
1) Mobilization of dredges and barges depends on lock opening date; typically the end of the first week of May.
2) Assume start date of 5/21/2007 for purpose of holidays.

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Table 3-23 - Phase 1 Residual Dredging Plan

Week Number	Day Number	EGIA01A				EGIA01B				NTIP01				NTIP02A				NTIP02B				NTIP02C				NTIP02D				NTIP02E				NTIP02F				NTIP02G				Daily Totals	Weekly Totals
		D1	D2	D3	D4	D1	D2	D3	D4	D1	D2	D3	D4	D1	D2	D3	D4	D1	D2	D3	D4	D1	D2	D3	D4	D1	D2	D3	D4	D1	D2	D3	D4	D1	D2	D3	D4	D1	D2	D3	D4		
1		Mobilization of Dredges and Barges to Site																																									
2																																											
	1																																									0	
	2																																									0	
	3																																									0	
3	4																																									0	0
	5																																									0	
	6																																									0	
	7																																									0	
	8	Holiday								Holiday				Holiday								Holiday								Holiday								Holiday				0	
	9																																									0	
	10																																									0	
4	11																																									0	0
	12																																									0	
	13																																									0	
	14																																									0	
	15																																									0	
	16																																									0	
	17																																									0	
5	18																																									0	0
	19																																									0	
	20																																									0	
	21																																									0	
	22																																									0	
	23																																									0	
	24																																									0	
6	25																																									0	0
	26																																									0	
	27																																									0	
	28																																									0	
	29																																									0	
	30																																									0	
	31																																									0	
7	32									267																																267	743
	33									252																																252	
	34									223																																223	
	35																																									0	
	36									142																																142	
	37									142																																142	
	38									142																																142	
8	39									142																																142	815
	40									124																																124	
	41									124																																124	
	42																																									0	
	43									124																																124	
	44									129																																129	
	45	Holiday								Holiday				Holiday								Holiday								Holiday								Holiday				0	
9	46									129																																129	665
	47									141																																141	
	48									141																																141	
	49																																									0	
	50									141																																141	
	51									124																																124	
	52									124																																124	
10	53									124																																124	968
	54									93																																93	
	55									93													169	99																		361	
	56																																									0	
	57													108									120	99																		328	
	58													108									161	68																		338	
	59													108									131	68																		308	
11	60													108									143	68																		319	1,881
	61													90									125	68																		283	
	62													90									104	112																		306	
	63																																									0	
	64													90									196	112																		398	
	65													95									196	112																		403	
	66													116									196	112																		423	
12	67													116									182	91																		389	2,302
	68													132									97	91																		320	
	69													152									144	72																		369	
	70																																									0	
	71													71									184	72																		327	
	72													71									127	72																		271	
	73													71									127	72																		271	
13	74																	350					196	72																		619	3,047
	75																	362					196	204																		762	
	76																	249					196	353																		798	
	77																																									0	
	78																	174					196	392																		762	
	79																	369					175	209																		753	
	80																	336					117	123																		576	
14	81																	219					187	134																		540	3,981
	82																	224					144	374																		742	
	83																	243					137	227																		607	
	84																																									0	
	85																	226					137	277																		640	
	86																	392					106	166																		663	

Table 3-23 - Phase 1 Residual Dredging Plan

Week Number	Day Number	EGIA01A				EGIA01B				NTIP01				NTIP02A				NTIP02B				NTIP02C				NTIP02D				NTIP02E				NTIP02F				NTIP02G				Daily Totals	Weekly Totals
		D1	D2	D3	D4	D1	D2	D3	D4	D1	D2	D3	D4	D1	D2	D3	D4	D1	D2	D3	D4	D1	D2	D3	D4	D1	D2	D3	D4	D1	D2	D3	D4	D1	D2	D3	D4	D1	D2	D3	D4		
	87																	242					97	166																		504	
15	88																	329					97	207																		633	3,716
	89																	388					97	207																		692	
	90																	346					103	134																		583	
	91																																									0	
	92																	224					157	153																		533	
	93																	224					120	224																		568	
	94																	224					120	163																		507	
16	95																	224					196	154																		574	3,845
	96				229													224					138	224																		815	
	97				295													224					123	208																		849	
	98																																									0	
	99				392													271					123	139																		924	
	100				300													271					112	139																		822	
	101								364									392					89	370																		1,215	
17	102								361									265					97	392																		1,114	6,297
	103								366									307					97	295																		1,065	
	104								382									363					97	316																		1,158	
	105																																									0	
	106	Holiday								Holiday				Holiday								Holiday								Holiday								Holiday				0	
	107								363									260					97	371																		1,091	
	108								392									275					97	351																		1,114	
18	109								366									389					97	194																		1,046	5,266
	110								373									383					97	361																		1,214	
	111								112									309					97	283																		801	
	112																																									0	
	113								290									309					101					188														888	
	114								222									388					136					110														856	
	115								297									278					68					110														753	
19	116								230									239										192			321											982	5,536
	117								287									239										108			233											867	
	118								261									359													179	392										1,191	
	119																																									0	
	120								164									336													211	392										1,103	
	121								166									257													318	354										1,095	
	122								166									155													336	392										1,049	
20	123								54									151													331	392										929	6,184
	124								283									160													287	349										1,079	
	125								230									224													201	275										930	
	126																																									0	
	127								280									99													315	320										1,015	
	128								223																						195	353										771	
	129								224																						271	204										699	
21	130								31																						264	332										627	4,218
	131																															234			304							538	
	132																																		262	307						569	
	133																																									0	
	134																																		321	374						695	
	135																																		374	224						598	
	136																																		346	257						603	
22	137																																		265	385						651	3,874
	138																																		201	392						593	
	139																																		342	392						733	
	140																																									0	
	141																																		392	347						739	
	142																																		236	339						575	
	143																																		278	392						670	
23	144																																		279	342						621	3,970
	145																																		304	342						646	
	146																																		325	392						717	
	147																																									0	
	148																																		342	326						668	
	149																																		166	354						520	
	150																																			93			322			415	
24	151																																						265	362		627	3,520
	152																																						332	265		597	
	153																																						322	369		692	
	154																																									0	
	155																																						326	290		616	
	156																																						392	392		784	
	157																																						368	389		758	
25	158																																						392	300		692	3,790
	159																																						389	374		763	
	160																																						87	90		177	
	161																																									0	
Dredge Area Totals		1,215				6,485				2,923				1,527				12,474				15,808				708				7,452				9,997				6,028				64,617	

Notes:
1) Mobilization of dredges and barges depends on lock opening date; typically the end of the first week of May.
2) Assume start date of 5/21/2007 for purpose of holidays.

Table 3-24 – Summary of the Residuals Performance Standard[1]

Case	CU Mean (mg/kg Tri+ PCBs)	No. of Sample Results where 27 > *result* ≥15 mg/kg Tri+ PCBs	No. of Sample Results ≥ 27 mg/kg Tri+ PCBs	No. of Re-Dredging Attempts Conducted[2]	Required Action (when all conditions are met)[3]
A	$x_i \leq 1$	≤ 1	0	N/A	Backfill CU (where appropriate); no testing of backfill required.
B	N/A	≥ 2	N/A	< 2	Re-dredge sampling node(s) and re-sample.
C	N/A	N/A	1 or more	< 2	Re-dredge sampling node(s) and re-sample.
D-Low D-High	$1 < x_i \leq 3$	≤ 1	0	N/A	Evaluate 20-acre area-weighted average concentration. • D-Low: If 20-acre area-weighted average concentration ≤ 1 mg/kg Tri+ PCBs, place and sample backfill.[4] • D-High: If 20-acre area-weighted average concentration > 1 mg/kg, follow actions for Case E below.
E	$3 < x_i \leq 6$	≤ 1	0	< 2	Construct sub-aqueous cap immediately OR re-dredge. Construct cap so that arithmetic average of uncapped nodes is ≤ 1 mg/kg Tri+ PCBs, no nodes > 27 mg/kg Tri+ PCBs, and not more than one node > 15 mg/kg Tri+ PCBs.
F-High F-Low	$x_i > 6$	N/A	N/A	0	Collect additional sediment samples to re-characterize vertical extent of contamination and re-dredge. • F-High: If CU median > 6 mg/kg Tri+ PCBs, entire CU must be sampled for vertical extent. • F-Low: If CU median ≤ 6 mg/kg Tri+ PCBs, additional sampling required only in portions of CU contributing to elevated mean concentration.
G	$x_i > 6$	N/A	N/A	1	Re-dredge.
H	$x_i > 1$ (and 20-acre average >1)	≥ 2	≥ 1	2	Construct sub-aqueous cap (if any of these mean/sample result conditions are true) as described in Case E and two re-dredging attempts have been conducted OR choose to continue to re-dredge.

Notes:

1. Information on this table taken from Page 59 of Volume 1 of the EPS document (Malcolm Pirnie and TAMS, 2004), modified where appropriate.
2. Inventory removal dredging is not included in the limit of two re-dredging attempts.
3. Except for Case H, where any of the listed conditions will require cap construction.
4. Following placement of backfill, sampling of 0 to 6 inch backfill surface must demonstrate average concentration ≤ 0.25 mg/kg Tri+ PCBs. If backfill surface average concentration is > 0.25 mg/kg, backfill must be dredged and replaced or otherwise remediated with input from EPA.
5. mg/kg = milligrams per kilogram.
6. x_i = the mean Tri+ PCB concentration in the 40 surface samples collected within the CU.

Table 3-26 - Phase 1 Inventory Barge Plan

Week Number	Day Number	EGIA01A				EGIA01B				NTIP01				NTIP02A				NTIP02B				NTIP02C				NTIP02D				NTIP02E				NTIP02F				NTIP02G				Daily Totals	Weekly Totals
		B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4		
1		Mobilization of Dredges and Barges to Site																																									
2																																											
3	1									1																															1	8
	2									2																															2	
	3									2																															2	
	4									1																															1	
	5									1																															1	
	6									1																															1	
	7																																								0	
4	8	Holiday												Holiday								Holiday								Holiday								Holiday				0	5
	9									1																															1	
	10									1																															1	
	11									1																															1	
	12									1																															1	
	13									1																															1	
	14																																								0	
5	15									1																															1	11
	16				1					1																															2	
	17				2																																				2	
	18								1	1																															2	
	19								1	1																															2	
	20								1	1																															2	
	21																																								0	
6	22								2	1																															3	13
	23								1	1																															2	
	24								1	1																															2	
	25								1	1																															2	
	26								1	1																															2	
	27								1					1																											2	
	28																																								0	
7	29													1									1																		2	16
	30																						1	2																	3	
	31													1										1																	2	
	32																	1					1	1																	3	
	33																						2																		2	
	34																	1					1	2																	4	
	35																																								0	
8	36																	1					1	1																	3	18
	37																	1					1	2																	4	
	38																	1					1																		2	
	39																	1					1	1																	3	
	40																	1					1	1																	3	
	41																	1					1	1																	3	
	42																																								0	
9	43								1														1																		2	16
	44																	1					1	1																	3	
	45	Holiday												Holiday								Holiday								Holiday								Holiday				0	
	46								1									1					1	1																	4	
	47								1									1					1	1																	4	
	48								1									1						1																	3	
	49																																								0	

Table 3-26 - Phase 1 Inventory Barge Plan

Week Number	Day Number	EGIA01A				EGIA01B				NTIP01				NTIP02A				NTIP02B				NTIP02C				NTIP02D				NTIP02E				NTIP02F				NTIP02G				Daily Totals	Weekly Totals
		B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4		
	50								1									1					1																			3	
	51								1									1					1	1																		4	
	52																	2																								2	
10	53								1									1					1	1																		4	17
	54																	1					1																			2	
	55								1									1																								2	
	56																																									0	
	57																	1					1	2																		4	
	58								1									1						2																		4	
	59								1									1					1	1																		4	
11	60								1									1					1	1																		4	24
	61								1									1						1																		3	
	62								1									1					2	1																		5	
	63																																									0	
	64																						1	1																		2	
	65								1									1					3	2																		7	
	66																	1			1		2	1																		5	
12	67																	1					3	1																		5	30
	68																				1		2	3																		6	
	69																	1			1		1	2																		5	
	70																																									0	
	71																	1			1		1	2																		5	
	72																	1			1		1	1																		4	
	73																	1			1		1	3																		6	
13	74																	1			1		2																			4	31
	75																	1			2		2					2														7	
	76																	1			1		2					1														5	
	77																																									0	
	78																	2			1		3																			6	
	79																	1			1		1					1														4	
	80																	1			1							1			3											6	
14	81																	1										2			1											4	32
	82																	2			1										2	1										6	
	83																	1			1										2	2										6	
	84																																									0	
	85																	1			1										2	3										7	
	86																	1													2	2										5	
	87																	1			1										3	1										6	
15	88																	1			1										2	2										6	38
	89																	1			2										3	1										7	
	90																	2													2	3										7	
	91																																									0	
	92																														3	3										6	
	93																														3	2										5	
	94																														1	3										4	
16	95																														3	2										5	29
	96																														2	3										5	
	97																														2	2										4	
	98																																									0	
	99																														2	3										5	
	100																														3	1										4	
	101																																			2						2	
17	102																																		2	2						4	24
	103																																		2	3						5	
	104																																		2	2						4	
	105																																									0	
	106	Holiday												Holiday								Holiday								Holiday								Holiday				0	
	107																																		1	2						3	
	108																																		1	1						2	
18	109																																		1							1	10
	110																																		1	1						2	
	111																																		1	1						2	
	112																																									0	

Table 3-26 - Phase 1 Inventory Barge Plan

Week Number	Day Number	EGIA01A				EGIA01B				NTIP01				NTIP02A				NTIP02B				NTIP02C				NTIP02D				NTIP02E				NTIP02F				NTIP02G				Daily Totals	Weekly Totals
		B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4		
	113																																		1	2						3	
	114																																		1							1	
	115																																		1	1						2	
19	116																																		1	2						3	14
	117																																		2	1						3	
	118																																		1	1						2	
	119																																									0	
	120																																		1	1						2	
	121																																		1	1						2	
	122																																		1	1						2	
20	123																																							1		1	12
	124																																						1	1		2	
	125																																						1	2		3	
	126																																									0	
	127																																						2	1		3	
	128																																						1	1		2	
	129																																						1	2		3	
21	130																																						1	1		2	16
	131																																						2	1		3	
	132																																						1	2		3	
	133																																									0	
	134																																						1	1		2	
	135																																						1	1		2	
	136																																									0	
22	137																																									0	4
	138																																									0	
	139																																									0	
	140																																									0	
	141																																									0	
	142																																									0	
	143																																									0	
23	144																																									0	0
	145																																									0	
	146																																									0	
	147																																									0	
	148																																									0	
	149																																									0	
	150																																									0	
24	151																																									0	0
	152																																									0	
	153																																									0	
	154																																									0	
	155																																									0	
	156																																									0	
	157																																									0	
25	158																																									0	0
	159																																									0	
	160																																									0	
	161																																									0	
Dredge Area Totals		0	0	0	3	0	0	0	24	23	0	0	0	3	0	0	0	50	0	0	20	0	50	42	0	0	0	7	0	0	41	34	0	0	21	24	0	0	12	14	0	368	
		3				24				23				3				70				92				7				75				45				26					

Notes:
1) Mobilization of dredges and barges depends on lock opening date; typically the end of the first week of May.
2) Assume start date of 5/21/2007 for purpose of holidays.

Table 3-27 - Phase 1 Residual Barge Plan

Week Number	Day Number	EGIA01A				EGIA01B				NTIP01				NTIP02A				NTIP02B				NTIP02C				NTIP02D				NTIP02E				NTIP02F				NTIP02G				Daily Totals	Weekly Totals
		B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4		
1		Mobilization of Dredges and Barges to Site																																							
2																																									
	1																																							0	
	2																																							0	
	3																																							0	
3	4																																							0	0
	5																																							0	
	6																																							0	
	7																																							0	
	8	Holiday								Holiday				Holiday								Holiday								Holiday								Holiday				0	
	9																																							0	
	10																																							0	
4	11																																							0	0
	12																																							0	
	13																																							0	
	14																																							0	
	15																																							0	
	16																																							0	
	17																																							0	
5	18																																							0	0
	19																																							0	
	20																																							0	
	21																																							0	
	22																																							0	
	23																																							0	
	24																																							0	
6	25																																							0	0
	26																																							0	
	27																																							0	
	28																																							0	
	29																																							0	
	30																																							0	
	31																																							0	
7	32																																							0	2
	33									1																														1	
	34									1																														1	
	35																																							0	
	36																																							0	
	37									1																														1	
	38																																							0	
8	39									1																														1	2
	40																																							0	
	41																																							0	
	42																																							0	
	43									1																														1	
	44																																							0	
	45	Holiday								Holiday				Holiday								Holiday								Holiday								Holiday				0	
9	46									1																														1	3
	47																																							0	
	48									1																														1	
	49																																							0	
	50																																							0	
	51																																							0	
	52									1																														1	
10	53																																							0	2

Table 3-27 - Phase 1 Residual Barge Plan

Week Number	Day Number	EGIA01A				EGIA01B				NTIP01				NTIP02A				NTIP02B				NTIP02C				NTIP02D				NTIP02E				NTIP02F				NTIP02G				Daily Totals	Weekly Totals
		B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4		
	54									1																																1	
	55																																									0	
	56																																									0	
	57																																									0	
	58													1									1																			2	
	59																							1																		1	
11	60																						1																			1	6
	61													1																												1	
	62																						1																			1	
	63																																									0	
	64																							1																		1	
	65																						1																			1	
	66													1																												1	
12	67																						1	1																		2	7
	68													1																												1	
	69																						1																			1	
	70																																									0	
	71																																									0	
	72													1									1	1																		3	
	73																																									0	
13	74																						1																			1	8
	75																	1						1																		2	
	76																						1	1																		2	
	77																																									0	
	78																						1	1																		2	
	79																	1						1																		2	
	80																						1																			1	
14	81																	1						1																		2	10
	82																						1	1																		2	
	83																							1																		1	
	84																																									0	
	85																	1					1	1																		3	
	86																																									0	
	87																	1						1																		2	
15	88																						1																			1	8
	89																	1						1																		2	
	90																																									0	
	91																																									0	
	92																	1					1	1																		3	
	93																							1																		1	
	94																																									0	
16	95																	1					1	1																		3	9
	96																																									0	
	97																						1	1																		2	
	98																																									0	
	99				1													1																								2	
	100																						1	1																		2	
	101								1									1						1																		3	
17	102																							1																		1	14
	103								1									1					1	1																		4	
	104								1															1																		2	
	105																																									0	
	106	Holiday								Holiday				Holiday								Holiday								Holiday								Holiday				0	
	107																	1						1																		2	
	108								1															2																		3	
18	109																	1					1																			2	11
	110								1															1																		2	
	111																	1						1																		2	
	112																																									0	
	113																						1					1														2	
	114								1									1																								2	
	115																											1														1	
19	116								1									1													1											3	13
	117																														1											1	
	118																	1													1	2										4	
	119																																									0	

Table 3-27 - Phase 1 Residual Barge Plan

Week Number	Day Number	EGIA01A				EGIA01B				NTIP01				NTIP02A				NTIP02B				NTIP02C				NTIP02D				NTIP02E				NTIP02F				NTIP02G				Daily Totals	Weekly Totals
		B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4	B1	B2	B3	B4		
	120								1																							1										2	
	121																														1	1										2	
	122																	1													1	1										3	
20	123																														2	2										4	15
	124								1																							1										2	
	125																														1	1										2	
	126																																									0	
	127								1									2													1	1										5	
	128																														1	1										2	
	129																														1											1	
21	130								1																							1										2	12
	131																															1										1	
	132																																		1							1	
	133																																									0	
	134																																			1						1	
	135																																		1							1	
	136																																			1						1	
22	137																																		1							1	6
	138																																			1						1	
	139																																		1							1	
	140																																									0	
	141																																			1						1	
	142																																		1							1	
	143																																			1						1	
23	144																																			1						1	6
	145																																		1							1	
	146																																			1						1	
	147																																									0	
	148																																		1							1	
	149																																			1						1	
	150																																						1			1	
24	151																																									0	5
	152																																						1	1		2	
	153																																									0	
	154																																									0	
	155																																						1	1		2	
	156																																									0	
	157																																						1	1		2	
25	158																																									0	8
	159																																						1	1		2	
	160																																						1	1		2	
	161																																									0	
Dredge Area Totals		0	0	0	1	0	0	0	11	9	0	0	0	5	0	0	0	20	0	0	0	0	21	28	0	0	0	2	0	0	11	13	0	0	7	8	0	0	6	5	0	147	
		1				11				9				5				20				49				2				24				15				11					

Notes:
1) Mobilization of dredges and barges depends on lock opening date; typically the end of the first week of May.
2) Assume start date of 5/21/2007 for purpose of holidays.

Table 3-28 - Total Estimated Daily Vessel Traffic at Lock 7

Day	Dredged Material Barge Daily Total Large Barge	Dredged Material Barge Daily Total Small Barge	Backfill/Capping Large Barge	Backfill/Capping Small Barge	Debris Barge	Phase 1 Barge Daily Total	Lock 7 Traffic Daily Ave. Total	Lock 7 & Phase 1 Daily Ave. Total
1	0	2			2	4	4	8
2	0	4			2	6	4	10
3	0	4			2	6	4	10
4	0	2			2	4	6	10
5	0	2			2	4	5	9
6	0	2			2	4	7	11
7							7	7
8	Holiday		Holiday				7	7
9	0	2			2	4	5	9
10	0	2			2	4	6	10
11	0	2			2	4	8	12
12	0	2			2	4	5	9
13	0	2			2	4	4	8
14							5	5
15	0	2			2	4	5	9
16	2	2			2	6	9	15
17	4	0			2	6	9	15
18	2	2			2	6	4	10
19	2	2			2	6	6	12
20	2	2			2	6	6	12
21							7	7
22	4	2			2	8	6	14
23	2	2			2	6	6	12
24	2	2			2	6	6	12
25	2	2			2	6	8	14
26	2	2			2	6	7	13
27	2	2			2	6	7	13
28							12	12
29	0	4			2	6	8	14
30	0	6			2	8	7	15
31	0	4			2	6	13	19
32	2	4			2	8	13	21
33	0	6			2	8	8	16
34	2	8			2	12	10	22
35							8	8
36	2	4			2	8	12	20
37	2	8			2	12	7	19
38	2	2			2	6	12	18
39	2	6			2	10	13	23
40	2	4			2	8	13	21
41	2	4			2	8	15	23
42							17	17
43	2	4			2	8	20	28
44	2	4			2	8	20	28
45	Holiday		Holiday				24	24
46	4	6			2	12	22	34
47	4	4			2	10	22	32
48	4	4			2	10	21	31
49							25	25
50	4	2			2	8	16	24
51	4	4			2	10	24	34
52	4	2			2	8	22	30
53	4	4			2	10	21	31
54	2	4			2	8	21	29
55	4	0			2	6	21	27
56							21	21
57	2	6			2	10	18	28
58	4	8			2	14	23	37
59	4	6			2	12	25	37
60	4	6			2	12	26	38
61	4	4			2	10	21	31
62	4	8			2	14	25	39
63							24	24
64	0	6			2	8	27	35
65	4	12			2	18	25	43
66	4	8			2	14	29	43
67	2	12			2	16	31	47
68	2	12			2	16	20	36
69	4	8			2	14	23	37
70							26	26
71	4	6		6		16	31	47
72	4	10		6		20	21	41
73	4	8		6		18	23	41
74	4	6		6		16	29	45
75	8	10		6		24	22	46
76	4	10		6		20	23	43
77							25	25

Table 3-28 - Total Estimated Daily Vessel Traffic at Lock 7

Day	Dredged Material Barge Daily Total Large Barge	Dredged Material Barge Daily Total Small Barge	Backfill/Capping Large Barge	Backfill/Capping Small Barge	Debris Barge	Phase 1 Barge Daily Total	Lock 7 Traffic Daily Ave. Total	Lock 7 & Phase 1 Daily Ave. Total
78	6	10		2		18	24	42
79	6	6		6		18	20	38
80	4	10		4		18	24	42
81	4	8		6		18	21	39
82	6	10		4		20	21	41
83	4	10		6		20	18	38
84							20	20
85	6	14		4		24	21	45
86	2	8		4		14	22	36
87	6	10		4		20	13	33
88	4	10		6		20	18	38
89	8	10		4		22	18	40
90	4	10		4		18	20	38
91							20	20
92	2	16		4		22	17	39
93	0	12		6		18	15	33
94	0	8		4		12	12	24
95	2	14		4		20	14	34
96	0	10		4		14	11	25
97	0	12		4		16	10	26
98							13	13
99	4	10		6		20	15	35
100	0	12		4		16	11	27
101	4	6		4		14	16	30
102	0	10		4		14	15	29
103	4	14		6		24	14	38
104	2	10		4		16	13	29
105							14	14
106	Holiday		Holiday				15	15
107	4	6	2	4		16	21	37
108	6	4	4	4		18	13	31
109	4	2	4	2		12	13	25
110	6	2	2	4		14	12	26
111	6	2	4	4		16	8	24
112							11	11
113	6	4	4	2		16	8	24
114	6	0	2	4		12	7	19
115	4	2	4	4		14	8	22
116	10	2	4	6		22	8	30
117	6	2	4	8		20	7	27
118	6	6	2	4		18	8	26
119							6	6
120	6	2	4	8		20	7	27
121	4	4	4	6		18	7	25
122	6	4	4	6		20	7	27
123	2	8	2	4		16	6	22
124	6	2	4	6		18	7	25
125	6	4	4	4		18	7	25
126							7	7
127	12	4	2	6		24	9	33
128	4	4	4	4		16	8	24
129	6	2	4	8		20	8	28
130	6	2	4	6		18	10	28
131	6	2	4	6		18	6	24
132	8	0	2	6		16	6	22
133							11	11
134	6		4	6		16	7	23
135	6		2	6		14	8	22
136	2		4	4		10	7	17
137	2		4	6		12	10	22
138	2		0	6		8	5	13
139	2		0	4		6	3	9
140							8	8
141	2		4	8		14	5	19
142	2		4	6		12	8	20
143	2		2	6		10	3	13
144	2		2	6		10	5	15
145	2		4	6		12	8	20
146	2		4	6		12	7	19
147							6	6
148	2		4	6		12	5	17
149	2		4	8		14	3	17
150	2		2	6		10	5	15
151	0		2	6		8	3	11
152	4		4	6		14	2	16
153	0		6	8		14	3	17
154							2	2

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Table 3-28 - Total Estimated Daily Vessel Traffic at Lock 7

Day	Dredged Material Barge Daily Total Large Barge	Dredged Material Barge Daily Total Small Barge	Backfill/Capping Large Barge	Backfill/Capping Small Barge	Debris Barge	Phase 1 Barge Daily Total	Lock 7 Traffic Daily Ave. Total	Lock 7 & Phase 1 Daily Ave. Total
155	4		4	6		14	3	17
156	0		2	6		8	2	10
157	4		6			10	4	14
158	0		8			8	4	12
159	4		6			10	4	14
160	4		8			12	3	15
161							2	2
162			8			8	2	10
163			4			4	1	5
164			8			8	3	11
165			8			8	3	11
166			8			8	3	11
167			6			6	2	8
168							1	1
169			8			8	2	10
170			6			6	1	7
171			8			8	1	9
172			6			6	0	6
173			8			8	1	9
174			6			6	2	8
175							0	0
176			6			6	0	6
177			6			6	0	6
178			10			10	0	10
179								
180								
181								
182								
183								
184								
185								
186								
187								
188								
189								
190								
Totals	418	612	274	382	116	1,802	2,026	3,828
	1,030		656					
Average/Day	3.1	5.5	4.4	5.2	2.0	12.0	11.4	21.5
Max./Day	12	16	10	8	2	24	31	47
Min./Day	0	0	0	2	2	4	0	0

Legend:
- Sunday
- Holiday
- 30 Day Prod

30 Day Phase 2 Production Standard			
Totals	470	669	1,139
Average/Day	18.1	22.3	38.0
Max./Day	24	31	47
Min./Day	8	13	20

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Table 3-35 - Loadings (METSIM Material Balances)

		Phase 1 Max. Inventory Dredging					Phase 1 Residuals Dredging				
		S1	S2	S3	S4	S-Av	S1	S2	S3	S4	S-Av
101	Volume (cy/day)	4,300	4,300	4,300	4,300	4,300	3,999	3,999	3,999	3,999	3,999
In-situ	Volume (gpm)	603	603	603	603	603	561	561	561	561	561
Sediment	Tot mass (wet T/day)	7,136	6,082	5,537	5,186	5,897	6,637	5,657	5,149	4,823	5,484
	Solids mass (dry T/day)	5,645	3,953	3,078	2,515	3,656	5,250	3,677	2,863	2,339	3,400
	Solids (%)	79.1	65	55.6	48.5	62	79.1	65	55.6	48.5	62
	% pass #40	41.7	75.6	93.2	97.9	77.0	41.7	75.6	93.2	97.9	77.0
	% pass #60	30.7	60.0	80.7	92.7	66.0	30.7	60.0	80.7	92.7	66.0
	% pass #100	19.7	44.4	68.1	87.6	54.9	19.7	44.4	68.1	87.6	54.9
	% pass #200	4.8	23.3	51.2	80.7	40.0	4.8	23.3	51.2	80.7	40.0
	% pass #400	4.0	19.1	41.9	67.2	33.0	4.0	19.1	41.9	67.2	33.0
102	Flowrate (gpm)	121	121	121	121	121	561	561	561	561	561
Dredge	Tot mass (wet T/day)	724	724	724	724	724	3,365	3,365	3,365	3,365	3,365
Uptake	Solids mass (dry T/day)	0	0	0	0	0	0	0	0	0	0
Water	Solids (%)	0	0	0	0	0	0	0	0	0	0
	% pass #40	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #60	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #100	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #200	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #400	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
103	Flowrate (gpm)	724	724	724	724	724	1,122	1,122	1,122	1,122	1,122
Dredge	Tot mass (wet T/day)	7,860	6,806	6,260	5,909	6,620	10,002	9,022	8,515	8,188	8,849
Slurry	Solids mass (dry T/day)	5,645	3,953	3,078	2,515	3,656	5,250	3,677	2,863	2,339	3,400
	Solids (%)	71.8	58.1	49.2	42.6	55.2	52.5	40.8	33.6	28.6	38.4
	% pass #40	41.7	75.6	93.2	97.9	77.0	41.7	75.6	93.2	97.9	77.0
	% pass #60	30.7	60.0	80.7	92.7	66.0	30.7	60.0	80.7	92.7	66.0
	% pass #100	19.7	44.4	68.1	87.6	54.9	19.7	44.4	68.1	87.6	54.9
	% pass #200	4.8	23.3	51.2	80.7	40.0	4.8	23.3	51.2	80.7	40.0
	% pass #400	4.0	19.1	41.9	67.2	33.0	4.0	19.1	41.9	67.2	33.0
104	Flowrate (gpm)	2,534	1,538	1,020	694	1,356	1,894	971	495	195	805
Recycle	Tot mass (wet T/day)	15,292	9,268	6,131	4,164	8,158	11,426	5,851	2,976	1,172	4,844
Water	Solids mass (dry T/day)	143	65	19	3	39	107	41	10	1	23
	Solids (%)	0.935	0.703	0.316	0.077	0.474	0.935	0.706	0.322	0.077	0.479
	% pass #40	100.0	99.9	99.8	99.1	99.9	100.0	99.9	99.8	99.0	99.9
	% pass #60	100.0	99.9	99.8	98.9	99.9	100.0	99.9	99.8	98.8	99.9
	% pass #100	100.0	99.9	99.7	98.6	99.9	100.0	99.9	99.7	98.5	99.9
	% pass #200	99.9	99.9	99.7	98.4	99.8	99.9	99.9	99.7	98.3	99.8
	% pass #400	99.9	99.9	99.6	97.7	99.8	99.9	99.9	99.5	97.3	99.8
605	Flowrate (gpm)	3,258	2,262	1,744	1,418	2,080	3,016	2,093	1,617	1,317	1,927
Water +	Tot mass (wet T/day)	23,152	16,074	12,391	10,073	14,778	21,428	14,873	11,491	9,360	13,694
Sediment	Solids mass (dry T/day)	5,788	4,019	3,098	2,518	3,695	5,357	3,718	2,873	2,340	3,423
on Trommel	Solids (%)	25	25	25	25	25	25	25	25	25	25
	% pass #40	43.1	76.0	93.2	97.9	77.2	42.9	75.9	93.2	97.9	77.2
	% pass #60	32.4	60.6	80.8	92.7	66.4	32.1	60.4	80.8	92.7	66.2
	% pass #100	21.7	45.3	68.3	87.6	55.4	21.3	45.0	68.2	87.6	55.2
	% pass #200	7.2	24.5	51.5	80.7	40.6	6.7	24.2	51.4	80.7	40.4
	% pass #400	6.4	20.4	42.3	67.2	33.7	5.9	20.0	42.1	67.2	33.5
105	Flowrate (gpm)	3,185	2,235	1,734	1,411	2,056	2,948	2,068	1,608	1,311	1,905
Offload	Tot mass (wet T/day)	22,153	15,705	12,251	9,986	14,457	20,502	14,529	11,361	9,279	13,396
Slurry	Solids mass (dry T/day)	4,890	3,686	2,971	2,440	3,405	4,523	3,409	2,755	2,267	3,155
	Solids (%)	22.1	23.5	24.3	24.4	23.6	22.1	23.5	24.3	24.4	23.6
	% pass #40	49.5	80.4	94.3	98.0	81.3	49.2	80.3	94.3	98.0	81.2
	% pass #60	37.2	64.1	81.7	92.8	69.8	36.9	63.9	81.7	92.8	69.7
	% pass #100	24.9	47.9	69.1	87.7	58.3	24.5	47.6	69.0	87.7	58.1
	% pass #200	8.2	26.0	52.1	80.8	42.8	7.7	25.6	51.9	80.8	42.5
	% pass #400	7.3	21.6	42.7	67.3	35.5	6.8	21.2	42.6	67.3	35.2
106	Flowrate (gpm)	73	27	10	6	24	68	25	10	6	22
Oversize	Tot mass (wet T/day)	998	369	140	87	321	926	344	130	81	298
	Solids mass (dry T/day)	898	332	126	78	289	834	309	117	73	268
	Solids (%)	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
	% pass #40	8.3	27.6	68.6	94.8	29.6	8.3	27.4	68.5	94.8	29.5
	% pass #60	6.3	22.0	59.4	89.7	25.4	6.2	21.8	59.4	89.7	25.4
	% pass #100	4.2	16.4	50.2	84.8	21.2	4.1	16.2	50.1	84.8	21.1
	% pass #200	1.4	8.9	37.9	78.1	15.6	1.3	8.7	37.7	78.1	15.5
	% pass #400	1.2	7.4	31.1	65.1	12.9	1.1	7.2	30.9	65.1	12.8

Table 3-35 - Loadings (METSIM Material Balances)

		Phase 1 Max. Inventory Dredging					Phase 1 Residuals Dredging				
		S1	S2	S3	S4	S-Av	S1	S2	S3	S4	S-Av
107 HC Feed	Flowrate (gpm)	3,185	2,235	1,734	1,411	2,056	2,948	2,068	1,608	1,311	1,905
	Tot mass (wet T/day)	22,153	15,705	12,251	9,986	14,457	20,502	14,529	11,361	9,279	13,396
	Solids mass (dry T/day)	4,890	3,686	2,971	2,440	3,405	4,523	3,409	2,755	2,267	3,155
	Solids (%)	22.1	23.5	24.3	24.4	23.6	22.1	23.5	24.3	24.4	23.6
	% pass #40	49.5	80.4	94.3	98.0	81.3	49.2	80.3	94.3	98.0	81.2
	% pass #60	37.2	64.1	81.7	92.8	69.8	36.9	63.9	81.7	92.8	69.7
	% pass #100	24.9	47.9	69.1	87.7	58.3	24.5	47.6	69.0	87.7	58.1
	% pass #200	8.2	26.0	52.1	80.8	42.8	7.7	25.6	51.9	80.8	42.5
	% pass #400	7.3	21.6	42.7	67.3	35.5	6.8	21.2	42.6	67.3	35.2
111 HC O/F	Flowrate (gpm)	2,540	1,804	1,456	1,252	1,709	2,349	1,670	1,352	1,167	1,585
	Tot mass (wet T/day)	15,399	11,196	9,344	8,318	10,820	14,234	10,358	8,685	7,764	10,042
	Solids mass (dry T/day)	263	597	980	1,298	914	230	552	923	1,229	858
	Solids (%)	1.7	5.3	10.5	15.6	8.4	1.6	5.3	10.6	15.8	8.5
	% pass #40	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #60	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #100	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #200	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #400	99.7	99.4	99.3	99.5	99.5	99.6	99.2	99.1	99.3	99.3
112 HC U/F	Flowrate (gpm)	645	431	278	159	347	599	398	256	145	320
	Tot mass (wet T/day)	6,755	4,510	2,907	1,668	3,637	6,268	4,171	2,676	1,516	3,354
	Solids mass (dry T/day)	4,627	3,089	1,991	1,143	2,491	4,293	2,857	1,833	1,038	2,298
	Solids (%)	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5
	% pass #40	46.7	76.6	91.5	95.7	74.4	46.5	76.5	91.4	95.6	74.2
	% pass #60	33.7	57.2	72.7	84.6	58.8	33.5	57.0	72.5	84.3	58.4
	% pass #100	20.6	37.8	53.8	73.7	43.0	20.4	37.5	53.4	73.1	42.5
	% pass #200	3.0	11.6	28.5	59.0	21.8	2.7	11.2	27.7	58.0	21.1
	% pass #400	2.1	6.5	14.9	30.8	12.0	1.8	6.1	14.1	29.4	11.3
114 Coarse Screen Solids	Flowrate (gpm)	419	268	159	76	205	389	249	148	70	191
	Tot mass (wet T/day)	5,342	3,420	2,029	972	2,616	4,968	3,177	1,884	897	2,430
	Solids mass (dry T/day)	4,541	2,907	1,725	826	2,224	4,223	2,700	1,601	763	2,066
	Solids (%)	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0
	% pass #40	45.7	75.1	90.2	94.1	71.3	45.6	75.1	90.1	94.1	71.3
	% pass #60	32.4	54.5	68.5	78.7	53.8	32.4	54.5	68.5	78.6	53.7
	% pass #100	19.1	33.9	46.7	63.7	36.1	19.1	33.9	46.6	63.4	36.0
	% pass #200	1.2	6.1	17.4	43.3	12.3	1.1	6.0	17.3	42.9	12.2
	% pass #400	0.2	0.7	1.8	4.5	1.4	0.2	0.7	1.7	4.2	1.3
115 Coarse Screen Fines	Flowrate (gpm)	227	163	119	83	142	209	149	108	74	130
	Tot mass (wet T/day)	1,412	1,089	878	696	1,021	1,299	994	792	618	924
	Solids mass (dry T/day)	86	182	267	316	267	70	157	232	276	232
	Solids (%)	6.1	16.7	30.4	45.4	26.2	5.4	15.8	29.2	44.6	25.1
	% pass #40	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #60	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #100	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #200	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #400	99.7	99.4	99.4	99.6	99.8	99.7	99.3	99.8	99.2	99.9
116 Thickener Feed	Flowrate (gpm)	2,766	1,967	1,575	1,335	1,851	2,558	1,819	1,460	1,241	1,715
	Tot mass (wet T/day)	16,811	12,285	10,222	9,014	11,841	15,534	11,352	9,477	8,382	10,966
	Solids mass (dry T/day)	349	779	1,247	1,614	1,181	300	709	1,154	1,505	1,090
	Solids (%)	2.1	6.3	12.2	17.9	10.0	1.9	6.2	12.2	18.0	9.9
	% pass #40	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #60	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #100	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #200	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #400	99.7	99.4	99.4	99.5	99.6	99.6	99.2	99.3	99.3	99.4
616 Thickener Feed	Flowrate (gpm)	2,857	2,059	1,653	1,405	1,933	2,696	1,946	1,556	1,314	1,822
	Tot mass (wet T/day)	17,384	12,865	10,719	9,457	12,361	16,403	12,155	10,086	8,844	11,642
	Solids mass (dry T/day)	398	829	1,288	1,649	1,225	377	778	1,204	1,542	1,146
	Solids (%)	2.3	6.4	12.0	17.4	9.9	2.3	6.4	11.9	17.4	9.8
	% pass #40	96.2	98.2	98.8	99.1	98.8	96.0	98.1	98.7	99.0	98.7
	% pass #60	95.3	97.7	98.5	98.9	98.5	95.0	97.6	98.4	98.8	98.4
	% pass #100	94.3	97.3	98.2	98.6	98.2	94.0	97.1	98.1	98.5	98.0
	% pass #200	93.4	96.8	97.9	98.4	97.8	93.0	96.6	97.8	98.3	97.7
	% pass #400	92.2	95.8	97.0	97.7	97.1	91.7	95.4	96.8	97.3	96.8

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Table 3-35 - Loadings (METSIM Material Balances)

		Phase 1 Max. Inventory Dredging					Phase 1 Residuals Dredging				
		S1	S2	S3	S4	S-Av	S1	S2	S3	S4	S-Av
117 Thickener U/F	Flowrate (gpm)	242	756	1,275	1,405	1,189	230	709	1,191	1,314	1,112
	Tot mass (wet T/day)	1,602	5,000	8,435	9,457	7,869	1,520	4,688	7,880	8,844	7,357
	Solids mass (dry T/day)	240	750	1,265	1,649	1,180	228	703	1,182	1,542	1,104
	Solids (%)	15.0	15.0	15.0	17.4	15.0	15.0	15.0	15.0	17.4	15.0
	% pass #40	93.7	98.0	98.8	99.1	98.7	93.4	97.9	98.7	99.0	98.6
	% pass #60	92.2	97.5	98.5	98.9	98.4	91.7	97.3	98.4	98.8	98.3
	% pass #100	90.6	97.0	98.2	98.6	98.1	90.1	96.8	98.1	98.5	97.9
	% pass #200	89.0	96.5	97.9	98.4	97.8	88.4	96.2	97.8	98.3	97.6
	% pass #400	87.1	95.4	97.0	97.7	97.0	86.3	94.9	96.7	97.3	96.7
118 Thickener O/F	Flowrate (gpm)	2,618	1,305	379	0	745	2,469	1,238	366	0	711
	Tot mass (wet T/day)	15,782	7,865	2,285	0	4,492	14,883	7,467	2,206	0	4,285
	Solids mass (dry T/day)	158	79	23	0	45	149	75	22	0	43
	Solids (%)	1.0	1.0	1.0	0.0	1.0	1.0	1.0	1.0	0.0	1.0
	% pass #40	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #60	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #100	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #200	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #400	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
120 WTF Solids Return	Flowrate (gpm)	90	92	79	70	82	137	127	96	73	107
	Tot mass (wet T/day)	573	581	497	443	520	870	803	609	462	677
	Solids mass (dry T/day)	49	50	41	36	44	77	69	50	38	57
	Solids (%)	8.63	8.55	8.28	8.06	8.41	8.80	8.64	8.18	8.13	8.40
	% pass #40	69.6	69.7	63.5	57.8	65.6	80.3	78.3	69.8	59.9	73.5
	% pass #60	61.9	62.1	54.2	47.2	56.9	75.4	72.8	62.2	49.8	66.8
	% pass #100	54.2	54.4	45.0	36.6	48.2	70.4	67.3	54.5	39.6	60.1
	% pass #200	46.5	46.7	35.7	25.8	39.5	65.4	61.8	46.8	29.4	53.4
	% pass #400	39.0	39.3	26.7	15.5	31.0	60.6	56.5	39.4	19.5	46.9
121 Press Feed	Flowrate (gpm)	242	756	1,275	1,405	1,189	230	709	1,191	1,314	1,112
	Tot mass (wet T/day)	1,602	5,000	8,435	9,457	7,869	1,520	4,688	7,880	8,844	7,357
	Solids mass (dry T/day)	240	750	1,265	1,649	1,180	228	703	1,182	1,542	1,104
	Solids (%)	15.0	15.0	15.0	17.4	15.0	15.0	15.0	15.0	17.4	15.0
	% pass #40	93.7	98.0	98.8	99.1	98.7	93.4	97.9	98.7	99.0	98.6
	% pass #60	92.2	97.5	98.5	98.9	98.4	91.7	97.3	98.4	98.8	98.3
	% pass #100	90.6	97.0	98.2	98.6	98.1	90.1	96.8	98.1	98.5	97.9
	% pass #200	89.0	96.5	97.9	98.4	97.8	88.4	96.2	97.8	98.3	97.6
	% pass #400	87.1	95.4	97.0	97.7	97.0	86.3	94.9	96.7	97.3	96.7
122 Press Filtrate	Flowrate (gpm)	194	607	1,023	1,078	955	184	569	956	1,008	893
	Tot mass (wet T/day)	1,166	3,641	6,141	6,467	5,729	1,107	3,413	5,737	6,048	5,357
	Solids mass (dry T/day)	1	2	4	5	4	1	2	4	5	3
	Solids (%)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	% pass #40	93.7	98.0	98.8	99.1	98.7	93.4	97.9	98.7	99.0	98.6
	% pass #60	92.2	97.5	98.5	98.9	98.4	91.7	97.3	98.4	98.8	98.3
	% pass #100	90.6	97.0	98.2	98.6	98.1	90.1	96.8	98.1	98.5	97.9
	% pass #200	89.0	96.5	97.9	98.4	97.8	88.4	96.2	97.8	98.3	97.6
	% pass #400	87.1	95.4	97.0	97.7	97.0	86.3	94.9	96.7	97.3	96.7
123 Press Cake	Flowrate (gpm)	48	149	251	328	234	45	140	235	306	219
	Tot mass (wet T/day)	435	1,360	2,293	2,990	2,140	413	1,275	2,143	2,796	2,001
	Solids mass (dry T/day)	240	748	1,261	1,644	1,177	227	701	1,178	1,538	1,100
	Solids (%)	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0
	% pass #40	93.7	98.0	98.8	99.1	98.7	93.4	97.9	98.7	99.0	98.6
	% pass #60	92.2	97.5	98.5	98.9	98.4	91.7	97.3	98.4	98.8	98.3
	% pass #100	90.6	97.0	98.2	98.6	98.1	90.1	96.8	98.1	98.5	97.9
	% pass #200	89.0	96.5	97.9	98.4	97.8	88.4	96.2	97.8	98.3	97.6
	% pass #400	87.1	95.4	97.0	97.7	97.0	86.3	94.9	96.7	97.3	96.7
305 Cake Loadout	Flowrate (gpm)	48	149	251	328	234	45	140	235	306	219
	Tot mass (wet T/day)	435	1,360	2,293	2,990	2,140	413	1,275	2,143	2,796	2,001
	Solids mass (dry T/day)	240	748	1,261	1,644	1,177	227	701	1,178	1,538	1,100
	Solids (%)	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0
	% pass #40	93.7	98.0	98.8	99.1	98.7	93.4	97.9	98.7	99.0	98.6
	% pass #60	92.2	97.5	98.5	98.9	98.4	91.7	97.3	98.4	98.8	98.3
	% pass #100	90.6	97.0	98.2	98.6	98.1	90.1	96.8	98.1	98.5	97.9
	% pass #200	89.0	96.5	97.9	98.4	97.8	88.4	96.2	97.8	98.3	97.6
	% pass #400	87.1	95.4	97.0	97.7	97.0	86.3	94.9	96.7	97.3	96.7

Table 3-35 - Loadings (METSIM Material Balances)

		Phase 1 Max. Inventory Dredging					Phase 1 Residuals Dredging				
		S1	S2	S3	S4	S-Av	S1	S2	S3	S4	S-Av
390 Fines Solids Loadout	Flowrate (gpm)	121	176	262	334	258	113	165	244	312	241
	Tot mass (wet T/day)	1,434	1,729	2,434	3,077	2,461	1,340	1,618	2,273	2,876	2,299
	Solids mass (dry T/day)	1,138	1,080	1,388	1,722	1,466	1,061	1,010	1,296	1,610	1,369
	Solids (%)	79.4	62.5	57.0	56.0	59.6	79.2	62.4	57.0	56.0	59.5
	% pass #40	26.3	76.3	96.1	98.9	85.1	26.5	76.3	96.0	98.8	85.1
	% pass #60	24.3	74.3	95.0	98.4	84.0	24.5	74.2	94.9	98.4	84.0
	% pass #100	22.4	72.2	93.8	98.0	82.9	22.5	72.1	93.7	97.9	82.9
	% pass #200	19.8	69.5	92.4	97.5	81.5	19.9	69.4	92.3	97.4	81.5
	% pass #400	19.3	68.3	91.0	96.2	80.4	19.4	68.1	90.8	95.9	80.3
391 Coarse Solids Loadout	Flowrate (gpm)	419	268	159	76	205	389	249	148	70	191
	Tot mass (wet T/day)	5,342	3,420	2,029	972	2,616	4,968	3,177	1,884	897	2,430
	Solids mass (dry T/day)	4,541	2,907	1,725	826	2,224	4,223	2,700	1,601	763	2,066
	Solids (%)	85	85	85	85	85	85	85	85	85	85
	% pass #40	45.7	75.1	90.2	94.1	71.3	45.6	75.1	90.1	94.1	71.3
	% pass #60	32.4	54.5	68.5	78.7	53.8	32.4	54.5	68.5	78.6	53.7
	% pass #100	19.1	33.9	46.7	63.7	36.1	19.1	33.9	46.6	63.4	36.0
	% pass #200	1.2	6.1	17.4	43.3	12.3	1.1	6.0	17.3	42.9	12.2
	% pass #400	0.2	0.7	1.8	4.5	1.4	0.2	0.7	1.7	4.2	1.3
392 Tot Loadout	Flowrate (gpm)	540	444	421	410	463	503	414	392	383	432
	Tot mass (wet T/day)	6,776	5,149	4,463	4,049	5,077	6,308	4,795	4,157	3,774	4,729
	Solids mass (dry T/day)	5,679	3,987	3,112	2,549	3,690	5,284	3,711	2,897	2,373	3,434
	Solids (%)	83.809	77.437	69.740	62.954	72.674	83.769	77.383	69.693	62.880	72.623
	% pass #40	41.8	75.4	92.8	97.3	76.8	41.8	75.4	92.8	97.3	76.8
	% pass #60	30.8	59.9	80.3	92.1	65.8	30.8	59.9	80.3	92.0	65.8
	% pass #100	19.8	44.3	67.7	86.9	54.7	19.8	44.3	67.7	86.8	54.7
	% pass #200	4.9	23.3	50.9	79.9	39.8	4.9	23.3	50.9	79.9	39.8
	% pass #400	4.0	19.0	41.6	66.5	32.8	4.0	19.0	41.5	66.4	32.8
402 Decon Water	Flowrate (gpm)	25	25	25	25	25	25	25	25	25	25
	Tot mass (wet T/day)	150	150	150	150	150	150	150	150	150	150
	Solids mass (dry T/day)	1	1	1	1	1	1	1	1	1	1
	Solids (%)	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500
	% pass #40	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0
	% pass #60	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0
	% pass #100	54.9	54.9	54.9	54.9	54.9	54.9	54.9	54.9	54.9	54.9
	% pass #200	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
	% pass #400	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0
404 Combined Recycle	Flowrate (gpm)	2,809	1,910	1,402	1,078	1,699	2,650	1,806	1,322	1,008	1,603
	Tot mass (wet T/day)	16,948	11,506	8,426	6,467	10,221	15,990	10,880	7,943	6,048	9,642
	Solids mass (dry T/day)	159	81	27	5	48	150	77	26	5	46
	Solids (%)	0.935	0.703	0.316	0.077	0.474	0.935	0.706	0.322	0.077	0.479
	% pass #40	100.0	99.9	99.8	99.1	99.9	100.0	99.9	99.8	99.0	99.9
	% pass #60	100.0	99.9	99.8	98.9	99.9	100.0	99.9	99.8	98.8	99.9
	% pass #100	100.0	99.9	99.7	98.6	99.9	100.0	99.9	99.7	98.5	99.9
	% pass #200	99.9	99.9	99.7	98.4	99.8	99.9	99.9	99.7	98.3	99.8
	% pass #400	99.9	99.9	99.6	97.7	99.8	99.9	99.9	99.5	97.3	99.8
403 Recycle Blowdown	Flowrate (gpm)	275	371	382	384	343	756	835	826	813	797
	Tot mass (wet T/day)	1,657	2,237	2,295	2,303	2,063	4,564	5,029	4,967	4,876	4,797
	Solids mass (dry T/day)	15	16	7	2	10	43	35	16	4	23
	Solids (%)	0.94	0.70	0.32	0.08	0.47	0.94	0.71	0.32	0.08	0.48
	% pass #40	100.0	99.9	99.8	99.1	99.9	100.0	99.9	99.8	99.0	99.9
	% pass #60	100.0	99.9	99.8	98.9	99.9	100.0	99.9	99.8	98.8	99.9
	% pass #100	100.0	99.9	99.7	98.6	99.9	100.0	99.9	99.7	98.5	99.9
	% pass #200	99.9	99.9	99.7	98.4	99.8	99.9	99.9	99.7	98.3	99.8
	% pass #400	99.9	99.9	99.6	97.7	99.8	99.9	99.9	99.5	97.3	99.8
405 Process WTF In	Flowrate (gpm)	300	396	407	409	368	781	860	851	838	822
	Tot mass (wet T/day)	1,807	2,388	2,445	2,454	2,213	4,715	5,180	5,118	5,027	4,948
	Solids mass (dry T/day)	16	16	8	3	11	43	36	17	4	24
	Solids (%)	0.90	0.69	0.33	0.10	0.48	0.92	0.70	0.33	0.09	0.48
	% pass #40	98.9	98.9	97.7	92.5	98.3	99.6	99.5	98.8	95.3	99.2
	% pass #60	98.4	98.4	96.6	89.0	97.5	99.4	99.2	98.3	93.3	98.8
	% pass #100	97.9	97.9	95.5	85.5	96.6	99.2	99.0	97.7	91.2	98.4
	% pass #200	97.2	97.2	94.1	80.9	95.6	98.9	98.7	97.0	88.5	97.9
	% pass #400	96.8	96.8	93.3	78.3	95.0	98.8	98.5	96.6	86.5	97.6

Table 3-35 - Loadings (METSIM Material Balances)

		Phase 1 Max. Inventory Dredging					Phase 1 Residuals Dredging				
		S1	S2	S3	S4	S-Av	S1	S2	S3	S4	S-Av
406	Flowrate (gpm)	300	396	407	409	368	781	860	851	838	822
Process	Tot mass (wet T/day)	1,807	2,388	2,445	2,454	2,213	4,715	5,180	5,118	5,027	4,948
Floc	Solids mass (dry T/day)	16	16	8	3	11	43	36	17	4	24
Effl	Solids (%)	0.90	0.69	0.33	0.10	0.48	0.92	0.70	0.33	0.09	0.48
	% pass #40	98.9	98.9	97.7	92.5	98.3	99.6	99.5	98.8	95.3	99.2
	% pass #60	98.4	98.4	96.6	89.0	97.5	99.4	99.2	98.3	93.3	98.8
	% pass #100	97.9	97.9	95.5	85.5	96.6	99.2	99.0	97.7	91.2	98.4
	% pass #200	97.2	97.2	94.1	80.9	95.6	98.9	98.7	97.0	88.5	97.9
	% pass #400	96.8	96.8	93.3	78.3	95.0	98.8	98.5	96.6	86.5	97.6
407	Flowrate (gpm)	277	375	398	409	355	721	812	834	838	794
Process	Tot mass (wet T/day)	1,661	2,245	2,389	2,453	2,129	4,324	4,866	5,000	5,026	4,758
Clar	Solids mass (dry T/day)	1.66	2.25	2.39	2.45	2.13	4.32	4.87	5.00	3.48	4.76
Effl	Solids (%)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.069294	0.1
	% pass #40	100.0	100.0	100.0	94.8	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #60	100.0	100.0	100.0	91.3	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #100	100.0	100.0	100.0	87.7	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #200	100.0	100.0	100.0	83.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #400	100.0	100.0	100.0	80.3	100.0	100.0	100.0	100.0	100.0	100.0
408	Flowrate (gpm)	272	367	391	401	348	707	795	817	827	778
Process	Tot mass (wet T/day)	1,629	2,202	2,343	2,405	2,088	4,240	4,772	4,903	4,959	4,666
Filt	Solids mass (dry T/day)	0	0	0	0	0	0	0	0	0	0
	Solids (%)	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
	% pass #40	100.0	100.0	100.0	94.8	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #60	100.0	100.0	100.0	91.3	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #100	100.0	100.0	100.0	87.7	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #200	100.0	100.0	100.0	83.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #400	100.0	100.0	100.0	80.3	100.0	100.0	100.0	100.0	100.0	100.0
409	Flowrate (gpm)	272	367	391	401	348	707	795	817	827	778
Process	Tot mass (wet T/day)	1,629	2,202	2,343	2,405	2,088	4,240	4,772	4,903	4,959	4,666
GAC1	Solids mass (dry T/day)	0	0	0	0	0	0	0	0	0	0
Out	Solids (%)	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
	% pass #40	100.0	100.0	100.0	94.8	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #60	100.0	100.0	100.0	91.3	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #100	100.0	100.0	100.0	87.7	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #200	100.0	100.0	100.0	83.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #400	100.0	100.0	100.0	80.3	100.0	100.0	100.0	100.0	100.0	100.0
410	Flowrate (gpm)	23	22	9	0	13	61	49	18	0	30
Process	Tot mass (wet T/day)	146	142	56	1	84	391	314	118	1	190
Clar	Solids mass (dry T/day)	15	14	6	0	8	39	31	12	1	19
u/f	Solids (%)	10	10	10	10	10	10	10	10	100	10
	% pass #40	98.8	98.7	96.7	0.0	97.8	99.5	99.4	98.3	79.1	99.0
	% pass #60	98.2	98.1	95.2	0.0	96.8	99.3	99.1	97.5	69.9	98.5
	% pass #100	97.6	97.5	93.6	0.0	95.8	99.1	98.8	96.8	60.6	98.0
	% pass #200	96.9	96.7	91.6	0.0	94.4	98.8	98.4	95.7	48.5	97.4
	% pass #400	96.5	96.3	90.5	0.0	93.7	98.6	98.2	95.1	39.6	97.1
411	Flowrate (gpm)	5	7	7	8	7	14	15	16	11	15
Process	Tot mass (wet T/day)	32	44	46	48	41	84	94	97	67	92
Filter	Solids mass (dry T/day)	2	2	2	2	2	4	5	5	3	5
b/w	Solids (%)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
	% pass #40	100.0	100.0	100.0	94.8	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #60	100.0	100.0	100.0	91.3	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #100	100.0	100.0	100.0	87.7	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #200	100.0	100.0	100.0	83.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #400	100.0	100.0	100.0	80.3	100.0	100.0	100.0	100.0	100.0	100.0
490	Flowrate (gpm)	272	367	391	401	348	707	795	817	827	778
Process	Tot mass (wet T/day)	1,629	2,202	2,343	2,405	2,088	4,240	4,772	4,903	4,959	4,666
Effl	Solids mass (dry T/day)	0	0	0	0	0	0	0	0	0	0
	Solids (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	% pass #40	100.0	100.0	100.0	94.8	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #60	100.0	100.0	100.0	91.3	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #100	100.0	100.0	100.0	87.7	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #200	100.0	100.0	100.0	83.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #400	100.0	100.0	100.0	80.3	100.0	100.0	100.0	100.0	100.0	100.0

Table 3-35 - Loadings (METSIM Material Balances)

		Phase 1 Max. Inventory Dredging					Phase 1 Residuals Dredging				
		S1	S2	S3	S4	S-Av	S1	S2	S3	S4	S-Av
501	Flowrate (gpm)	1,111	1,111	1,111	1,111	1,111	1,111	1,111	1,111	1,111	1,111
Storm	Tot mass (wet T/day)	6,685	6,685	6,685	6,685	6,685	6,685	6,685	6,685	6,685	6,685
Water	Solids mass (dry T/day)	33	33	33	33	33	33	33	33	33	33
	Solids (%)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	% pass #40	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.6
	% pass #60	44.4	44.4	44.4	44.4	44.4	44.4	44.4	44.4	44.4	44.4
	% pass #100	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3
	% pass #200	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2
	% pass #400	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1
505	Flowrate (gpm)	1,111	1,111	1,111	1,111	1,111	1,111	1,111	1,111	1,111	1,111
Storm	Tot mass (wet T/day)	6,685	6,685	6,685	6,685	6,685	6,685	6,685	6,685	6,685	6,685
WTF	Solids mass (dry T/day)	33	33	33	33	33	33	33	33	33	33
In	Solids (%)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	% pass #40	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.6
	% pass #60	44.4	44.4	44.4	44.4	44.4	44.4	44.4	44.4	44.4	44.4
	% pass #100	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3
	% pass #200	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2
	% pass #400	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1
506	Flowrate (gpm)	1,111	1,111	1,111	1,111	1,111	1,111	1,111	1,111	1,111	1,111
Storm	Tot mass (wet T/day)	6,685	6,685	6,685	6,685	6,685	6,685	6,685	6,685	6,685	6,685
Floc	Solids mass (dry T/day)	33	33	33	33	33	33	33	33	33	33
Effl	Solids (%)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	% pass #40	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.6
	% pass #60	44.4	44.4	44.4	44.4	44.4	44.4	44.4	44.4	44.4	44.4
	% pass #100	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3
	% pass #200	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2
	% pass #400	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1	11.1
507	Flowrate (gpm)	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070	1,070
Storm	Tot mass (wet T/day)	6,415	6,415	6,415	6,415	6,415	6,415	6,415	6,415	6,415	6,415
Clar	Solids mass (dry T/day)	6	6	6	6	6	6	6	6	6	6
Effl	Solids (%)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	% pass #40	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #60	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #100	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #200	99.7	99.7	99.7	99.7	99.7	99.7	99.7	99.7	99.7	99.7
	% pass #400	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9
508	Flowrate (gpm)	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049
Storm	Tot mass (wet T/day)	6,290	6,290	6,290	6,290	6,290	6,290	6,290	6,290	6,290	6,290
Filt	Solids mass (dry T/day)	0	0	0	0	0	0	0	0	0	0
	Solids (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	% pass #40	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #60	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #100	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #200	99.7	99.7	99.7	99.7	99.7	99.7	99.7	99.7	99.7	99.7
	% pass #400	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9
509	Flowrate (gpm)	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049
Storm	Tot mass (wet T/day)	6,290	6,290	6,290	6,290	6,290	6,290	6,290	6,290	6,290	6,290
GAC1	Solids mass (dry T/day)	0	0	0	0	0	0	0	0	0	0
Out	Solids (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	% pass #40	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #60	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #100	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #200	99.7	99.7	99.7	99.7	99.7	99.7	99.7	99.7	99.7	99.7
	% pass #400	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9
510	Flowrate (gpm)	42	42	42	42	42	42	42	42	42	42
Storm	Tot mass (wet T/day)	270	270	270	270	270	270	270	270	270	270
Clar	Solids mass (dry T/day)	27	27	27	27	27	27	27	27	27	27
u/f	Solids (%)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
	% pass #40	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
	% pass #60	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2
	% pass #100	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5
	% pass #200	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
	% pass #400	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 3-35 - Loadings (METSIM Material Balances)

		Phase 1 Max. Inventory Dredging					Phase 1 Residuals Dredging				
		S1	S2	S3	S4	S-Av	S1	S2	S3	S4	S-Av
511	Flowrate (gpm)	20	20	20	20	20	20	20	20	20	20
Storm	Tot mass (wet T/day)	125	125	125	125	125	125	125	125	125	125
Filter	Solids mass (dry T/day)	6	6	6	6	6	6	6	6	6	6
b/w	Solids (%)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
	% pass #40	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #60	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #100	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #200	99.7	99.7	99.7	99.7	99.7	99.7	99.7	99.7	99.7	99.7
	% pass #400	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9
590	Flowrate (gpm)	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049	1,049
Storm	Tot mass (wet T/day)	6,290	6,290	6,290	6,290	6,290	6,290	6,290	6,290	6,290	6,290
Effl	Solids mass (dry T/day)	0	0	0	0	0	0	0	0	0	0
	Solids (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	% pass #40	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #60	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #100	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	% pass #200	99.7	99.7	99.7	99.7	99.7	99.7	99.7	99.7	99.7	99.7
	% pass #400	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9

Notes:

1. Material balances were prepared using METSIM process simulation software by Proware, Tucson, AZ.
2. Sediment PSDs were determined by dry screening and hydrometer (ASTM D422).
3. All flowrates are expressed as gallons per minute (gpm). To express slurries or solids as cy/day (cy/d = gpm x 1440/202).
4. Phase 1 material balances are all expressed as 24-hour daily averages. Individual designers modified these rates by percent uptime to develop design rates for processing the specified daily loadings in a total period of less than 24 hours. These modifications apply to unloading and size separation facilities.
5. Material balances for Phase 1 residuals dredging assume that eight 1000-cy barges of dredged residual sediments (50% in-situ solids and 50% uptake water by volume) are delivered for processing in 1 day (24 hours). The residuals dredging materials balance may be used as guidance for assessing hourly processing rates when a barge of residuals is unloaded. These hourly rates should be used in conjunction with inventory dredging rates in estimating daily averageloadings for processing combinations of inventory and residuals dredging.
6. The following streams are on Drawings P-2002 and P-2003 but not on this Material Balance table: Filter & GAC backwash flows (412-414; 432-434;512-514; 532-534); GAC effluent from Backwash Tank for Plant Water Supply (440); Plant water for polymer delivery (443-448; 460-465); Plant water for Decon. uses (442) and Decon solids introduced (441).
7. This table was used for establishing design loadings of equipment in the Phase 1 IDR. The material balances on Drawings P-2002 and P-2003 are for average (S2/S3) loadings, include additional streams (in the note above), and differ in some internal flow routings. This additional material balance detail does not affect the equipment design loading estimates and assumptions in the Phase 1 IDR.

Table 3-36 - Preliminary Specifications for Major Process Equipment

Hudson River Design Limits	Phase 1 1-Month Performance Test Average Loadings
Size Separation System Basis of Design	
Total Volume Dredged for 30 Day Test (cy)	89,000
Daily In-situ Dredge Rate (cyd)	4,300
Maximum Volume Off-loading Rate (cyh)	335
Mechanical Unloader (Clamshell)	
Volumetric Flow (cyd)	5,162
Volumetric Flow (gpm)	1,086
Total Design Unloading Rate	
Wet Tons Per Hour	510
Dry Tons Per Hour	376
Percent Solids	72
Number	1
Size (cy)	5
Hopper With Pipe Grizzly (H-10101)	
Volumetric Flow (cyd)	4,300
Influent Mass Flow	
Wet Tons Per Hour	510
Dry Tons Per Hour	376
Percent Solids	72
Number	1
Hopper Width (ft)	20
Hopper Length (ft)	20
Pipe Grizzly Spacing (in)	6
Capacity (tons)	75
Belt Feeder (CY-10101)	
Volumetric Flow (cyd)	4,300
Influent Mass Flow	
Wet Tons Per Hour	510
Dry Tons Per Hour	376
Percent Solids	72
Number	1
Belt Length (ft)	17
Belt Width (in)	48
Motor (hp)	15
Inclined Conveyor (CY-10102)	
Volumetric Flow (cyd)	4,300
Influent Mass Flow	
Wet Tons Per Hour	510
Dry Tons Per Hour	376
Percent Solids	72
Number	1
Belt Length (ft)	63

Table 3-36 - Preliminary Specifications for Major Process Equipment

Hudson River Design Limits	Phase 1 1-Month Performance Test Average Loadings
Belt Width (in)	48
Motor (hp)	25
Rotary Trommel Screen (RS-10101)	
Influent Mass Flow	
Wet Tons Per Hour	510
Dry Tons Per Hour	376
Percent Solids	72
Makeup Water (gpm)	500 to 4,000
Makeup Water (gpd)	462,000 to 3,650,000
Number	1
Length (ft)	30
Diameter (ft)	8
Motor (hp)	125
Fixed Stack Conveyor (CY-10103)	
Volumetric Flow (cyd)	520
Influent Mass Flow	
Wet Tons Per Hour	65
Dry Tons Per Hour	58
Percent Solids	90
Number	1
Belt Length (ft)	63
Belt Width (in)	36
Motor (hp)	15
Sediment Slurry Tank (T-10301)	
Volumetric Flow (cyd)	22,700
Volumetric Flow (gpm)	4,967
Influent Mass Flow	
Wet Tons Per Hour	1,439
Dry Tons Per Hour	318
Percent Solids	22
Slurry Water Flow (gpm)	500 to 4,000
Slurry Water Flow (gpd)	462,000 to 3,650,000
Retention Time (min)	5
Number	1
Tank Volume (gal)	25,000
Length x Width	
Height	
Hydrocyclone Feed Pump (P-10301 to P-10303)	
Number of Pumps	3
Type of Pump	Centrifugal
Capacity per Pump (gpm)	2,500
Total Dynamic Head (ft)	120

Table 3-36 - Preliminary Specifications for Major Process Equipment

Hudson River Design Limits	Phase 1 1-Month Performance Test Average Loadings
Motor Size (hp)	150
Pipe Length (ft)	50
Hydrocyclone System (HS-10401 and HS-10402)	
Volumetric Flow (cyd)	22,700
Volumetric Flow (gpm)	4,967
Influent Mass Flow	
Wet Tons Per Hour	1,439
Dry Tons Per Hour	318
Percent Solids	20-30
Number of Hydrocyclones	40
Groups of Cyclones	2
Amount of Cyclones in Groups	20
Hydrocyclone Diameter	6
Underflow	
Volumetric Flow (gpm)	1,003
Wet Tons Per Hour	437
Dry Tons Per Hour	300
Percent Solids	68
Overflow	
Volumetric Flow (gpm)	3,964
Wet Tons Per Hour	1,002
Dry Tons Per Hour	18
Percent Solids	1.7
Vibratory Dewatering Screens (DS-10401 and DS-10402)	
Volumetric Flow (gpm)	1,003
Influent Mass Flow	
Wet Tons Per Hour	437
Dry Tons Per Hour	300
Percent Solids	68.5
Number	2
Size (each)	
Width (ft)	5
Length (ft)	12
Motor Size (hp)	5
Conveyor From Vibratory Dewatering Screen (CY-10401)	
Volumetric Flow (cyd)	2,980
Influent Mass Flow	
Wet Tons Per Hour	347
Dry Tons Per Hour	295
Percent Solids	85
Number	1
Belt Length (ft)	
Belt Width (in)	48

Table 3-36 - Preliminary Specifications for Major Process Equipment

Hudson River Design Limits	Phase 1 1-Month Performance Test Average Loadings
Motor (hp)	15
Size Separation Process Water Storage Tank (T-10201)	
Total Design Flow (gpm)	3,952
Number	1
Tank Volume (gal)	240,000
Diameter (ft)	42
Height (ft)	25
Hydraulic Retention Time (hrs)	1
Discharge Pumps	
Treated Process Water Day Tank (T-10501)	
Total Design Flow (gpm)	25
Number	1
Tank Volume (gal)	24,000
Diameter (feet)	17
Height (feet)	24
Hydraulic Retention Time (hrs)	16
Discharge Pumps	
Thickening, Dewatering, and Solidification Systems Basis of Design	
Hours of Operation per Day	24
Total Volume Dredged for 30 Day Test (cy)	89,000
Daily Dredge Rate (cyd)	4,300
Dewatered Sediment	55 % Solids and pass paint filter test
Sediment Slurry Pumps to Dredge Slurry Holding Tanks/Gravity Thickeners (P-20101 to P20105)	
Number of Pumps	5
Type	Horizontal Centrifugal
Total Dynamic Head (ft)	
Capacity Each Pump (gpm)	2,500
Motor Size (hp)	125
Pipe Length (ft)	1,200
Dredge Slurry Holding Tanks$_3$ (T-20201 and T-20202)	
Total Design Flow (gpm)	2,768
Percent Feed Solids (%)	2.1 to 17.9
Dredge Slurry Holding Tank T-20201 and T-20202)	
Number of Units	2
Tank Diameter (ft)	70
Tank Volume (mgal) each	0.7
Total Volume (mgal)	1.4
Hydraulic Retention Time (days)	0.33
Mechanical Mixers (type)	Vertical, Top Mount
Number of Mechanical Mixers Per Tank	5
Mechanical Mixer (hp)	75
Gravity Thickener System (T-20301 and T-20302)	

Table 3-36 - Preliminary Specifications for Major Process Equipment

Hudson River Design Limits	Phase 1 1-Month Performance Test Average Loadings
Total Design Flow (gpm)	2,768
Percent Feed Solids (%)	2.1 to 10
Percent Underflow Solids (%)	15
Gravity Thickener (T-20301 and T-20302)	
Number	2
Type	gravity, bridge supported
Design Torque (ft-lbs)	150,000
Drive Size (hp)	3
Diameter (ft)	60
Unit Area (sf/ton/day)	0.3
Side Water Depth	12
Overflow Rate (gpm/sf)	0.5
Nominal Capacity (gal)	250,000
Dredge Slurry Holding Tank Transfer Pump (P-20201 to P-20204)	
Number of Pumps	4
Type	Horizontal Centrifugal
Capacity (gpm)	1,400
Motor Size (hp)	50
Pipe Length (ft)	100
Thickener Sludge Pump to Dewatering Conditioning Tanks (P-20301 to P-20304)	
Number of Pumps	4
Type	Positive Displacement
Capacity (gpm)	226
Motor Size (hp)	30
Pipe Length (ft)	400
Dewatering Conditioning Tanks (T-20401 to T-20404)	
Total Design Flow (gpm)	902
Percent Feed Solids (%)	10 to 25
Number of Units	4
Tank Diameter (ft)	8
Depth (ft)	10
Tank Volume (gal)	3,500
Hydraulic Retention Time (min)	15
Number of Mechanical Mixers	1
Motor Size	5
Polymer Preparation and Addition System [4]	
Total Design Flow (gpm)	902
Total Mass (WTPD)	6,406
Solids Mass (DTPD)	1,601
Percent Feed Solids (%)	15
Polymer Dosage and Solution Feed Rates	
Polymer Dosage (lbs/dry ton)	7-19

Table 3-36 - Preliminary Specifications for Major Process Equipment

Hudson River Design Limits	Phase 1 1-Month Performance Test Average Loadings
Polymer Solution Characteristics	
Specific Gravity	1.1
Polymer Solution Feed Rates	
Total Design Flow at Min Dosage (gpm)	1.3
Total Design Flow at Max Dosage (gpm)	3.4
Polymer Transfer Pumps (P-21201 to P-21206)	
Number of Pumps	6
Type	Centrifugal
Polymer Storage Tanks (T-21101 to T-21102)	
Number of Tanks	2
Type	XLPE, fiberglass
Nominal Capacity (each, gal)	20,000
Total Storage Volume (gal)	40,000
Days Storage Provided at Max Dosage Rate	12
Polymer Makeup Units (T-21201 to T-21203)	
Number of Units	3
Polymer Feed Capacity (gpm neat polymer)	1.7
Dilution Water Flow Rate	17
Polymer Mixing/Aging Tanks (T-20501 to T-20504 and T-21401 to T-21404)	
Number of Tanks	8
Type	XLPE
Polymer Metering Pumps (P-20501 to P-20504 and P-21401 to P-21404)	
Number of Pumps	8
Capacity Per Pump (gpm)	1.76-9.46
Filter Press Dewatering System (FP-20601 to FP-20612)	
Total Design Flow (gpm)	987
Total Mass (WTPD)	6,945
Percent Feed Solids (%)	15
Recessed Chamber Filter Press (FP-20601 to FP-20612)	
Number of Units	12
Capacity (cy)	600
Operating Pressure (psi)	100
Filter Plate Size (m)	2.0 x 2.0
Number of Plates	156
Feed Specific Gravity	1.17
Cake Specific Gravity	1.52
Minimum Cake Percent Solids (%)	55
Average Cycle Time (min)	180
Minimum Filter Cake Thickness (mm)	32
Minimum Cake Output (cfd)	39,878
Filter Material	polypropylene
Filter Press Feed Pump (P-20601 to P-20612)	
Number of Pumps	12

Table 3-36 - Preliminary Specifications for Major Process Equipment

Hudson River Design Limits	Phase 1 1-Month Performance Test Average Loadings
Type	Positive Displacement
Total Dynamic Head (ft)	250
Capacity (gpm)	900
Motor Size (hp)	60
Pipe Length (ft)	200
Recycle Water Equalization Tank (T-21001)	
Tank Volume (gal)	1,500,000
Tank Diameter (ft)	108
Tank Material	Bolted Steel
Recycle Water Transfer Pumps (P-20802,P-21004 and P-21005)	
Number of Pumps	3
Motor Size (hp)	75
Type	Centrifugal
Lime Stabilization System [5]	
Total Mass (DTPD)	33
Percent Feed Solids (%)	35
Lime Dosage (%)	15-25
Lime Used (TPD)	5-8.25
Throughput (TPD) (solids mass and lime)	474-515
Number of Units	1
Process Water Treatment System Basis of Design	
Hours of Operation per Day	24
Estimated Influent Flow (gpm) - S4 Residuals	838
Treatment System Capacity (gpm)	1,000
Equalization Tank (T-30101)	
Total Design Flow (gpm)	1,000
Percent Feed Solids (%)	1
Equalization Tank (T-30101)	
Number of Units	1
Tank Diameter (ft)	25
Tank Volume (gal)	60,000
Hydraulic Retention Time (hrs)	1
Inlet Pipe Size	
Outlet Pipe Size	
Transfer Pumps (P-30101 and P-30103)	
Number of Pumps	2
Type	Horizontal Centrifugal
Total Dynamic Head (ft)	22
Capacity Per Unit (gpm)	500
Motor Size (hp)	10
Pipe Length (ft)	30
Rapid/Mix & Flocculation Tanks (T-30201 and T-30204)	

Table 3-36 - Preliminary Specifications for Major Process Equipment

Hudson River Design Limits	Phase 1 1-Month Performance Test Average Loadings
Total Design Flow (gpm)	1,000
Percent Feed Solids (%)	0.5
Rapid/Mix & Flocculation Tank (T-30201 and T-30204)	
Number of Units	2
Tank Length (ft)	12
Tank Width (ft)	8.5
Tank Volume (gal)	4,000
Total Volume (gal)	8,000
Hydraulic Retention Time (minutes per unit)	15
Primary Mechanical Mixer	
Mixer Type	Constant Speed
Number of Mixers Per Unit	1
Mixer Speed (rpm)	350
Mixer Horsepower	0.5
Secondary Mechanical Mixer	
Mixer Type	Variable Speed
Number of Mixers Per Unit	1
Mixer Speed (rpm)	125, Max
Mixer Horsepower	0.33
Inlet Pipe Size	
Outlet Pipe Size	
Chemical Metering Pumps	
Number of Pumps Per Unit	1
Type	Metering Pump
Total Dynamic Head (ft)	
Capacity Per Unit (gph)	0 to 20
Pipe Length (ft)	
Inclined Plate Clarifier (T-30301 and T-30302)	
Total Design Flow (gpm)	1,000
Percent Feed Solids (%)	0.5
Inclined Plate Clarifier	
Number of Units	2
Length (ft)	9' 8"
Width (ft)	20' 1"
Height (ft)	11' 6"
Capacity Per Unit (gpm)	500
Settling Area Per Unit (ft^2)	2,200
Minimum Hydraulic Loading Rate (gpm/ft^2)	0.23
Clarifier Effluent Tank (T-30401 and T-30402)	
Number of Units	2
Tank Diameter (ft)	10
Tank Volume (gal)	2,500

Table 3-36 - Preliminary Specifications for Major Process Equipment

Hudson River Design Limits	Phase 1 1-Month Performance Test Average Loadings
Total Volume (gal)	5,000
Hydraulic Retention Time Per Unit (min)	5
Inlet Pipe Size	
Outlet Pipe Size	
Transfer Pump (P-30401 and P-30403)	
Number of Pumps	2
Type	Horizontal Centrifugal
Total Dynamic Head (ft)	130
Capacity Per Unit (gpm)	500
Motor Size (hp)	30
Pipe Length (ft)	275
Multi-Media Filter Systems (MM-30501 to MM-30504)	
Total Design Flow (gpm)	1,000
Percent Feed Solids (%)	0.1
Multi-media Filter System (MM-30501 to MM-30504)	
Number of Units	2
Number of Filters Per Unit	2
Filter Diameter (ft)	9
Length (ft)	13
Width (ft)	10.5
Height (ft)	13.3
Filter Size (microns)	10 to 20
Filter Connection	Parallel
Hydraulic Loading Rate (gpm/ft^2)	4
Granular Activated Carbon Systems (C-30701 to 30708)	
Total Design Flow (gpm)	1,000
Percent Feed Solids (%)	0.003
Granular Activated Carbon System	
Number of Skids	4
Number of Vessels Per Skid	2
Vessel Size (pounds)	20,000
Vessel Diameter (ft)	12
Skid Length (ft)	30
Skid Width (ft)	13
Empty Bed Contact Time Per Vessel (min)	20
Vessel Connection	Series
Bag Filter System (BF-30801 to BF-30804)	
Number of Skids	4
Number of Bags Per Unit	3
Length (ft)	2.8
Width (ft)	2.25
Height (ft)	4.7

Table 3-36 - Preliminary Specifications for Major Process Equipment

Hudson River Design Limits	Phase 1 1-Month Performance Test Average Loadings
Bag Size (microns)	1 to 10
Filter Connection	Parallel
Backwash Holding Tank (T-30901)	
Total Design Flow (gpm)	1,500
Percent Feed Solids (%)	0.003
Backwash Holding Tank	
Number of Units	1
Tank Diameter (ft)	42
Tank Volume (gal)	200,000
Hydraulic Retention Time (days)	1
Inlet Pipe Size	
Outlet Pipe Size	
Backwash Pumps (P-30901 and P-41101)	
Number of Pumps	2
Type	Horizontal Centrifugal
Total Dynamic Head (ft)	100
Capacity (gpm)	1,000
Motor Size (hp)	40
Pipe Length (ft)	350
Storm Water Treatment System Basis of Design	
Hours of Operation per Day	24
Estimated Influent Flow (gpm)	0-500
Treatment System Capacity (gpm)	500
Equalization Tank (T-40301)	
Total Design Flow (gpm)	500
Percent Feed Solids (%)	1
Equalization Tank (T-40301)	
Number of Units	1
Tank Diameter (ft)	25
Tank Volume (gal)	60,000
Total Volume (gal)	60,000
Hydraulic Retention Time (hrs)	2
Inlet Pipe Size	
Outlet Pipe Size	
Transfer Pumps (P-40301 and P-40302)	
Number of Pumps	1
Type	Horizontal Centrifugal
Total Dynamic Head (ft)	22
Capacity Per Unit (gpm)	500
Motor Size (hp)	10
Pipe Length (ft)	30
Rapid/Mix & Flocculation Tanks (T-40401 and T-40402)	

Table 3-36 - Preliminary Specifications for Major Process Equipment

Hudson River Design Limits	Phase 1 1-Month Performance Test Average Loadings
Total Design Flow (gpm)	500
Percent Feed Solids (%)	0.5
Rapid/Mix & Flocculation Tank	
Number of Units	1
Tank Length (ft)	12
Tank Width (ft)	8.5
Tank Volume (gal)	4,000
Total Volume (gal)	4,000
Hydraulic Retention Time (minutes per unit)	15
Primary Mechanical Mixer	
Mixer Type	Constant Speed
Number of Mixers	1
Mixer Speed (rpm)	350
Mixer Horsepower	0.5
Secondary Mechanical Mixer	
Mixer Type	Variable Speed
Number of Mixers	1
Mixer Speed (rpm)	125, Max
Mixer Horsepower	0.33
Inlet Pipe Size	
Outlet Pipe Size	
Chemical Metering Pumps	
Number of Pumps Per Unit	1
Type	Metering Pump
Total Dynamic Head (ft)	
Capacity Per Unit (gph)	0 to 20
Motor Size (hp)	
Pipe Length (ft)	
Inclined Plate Clarifier (T-40501)	
Total Design Flow (gpm)	500
Percent Feed Solids (%)	0.5
Inclined Plate Clarifier	
Number of Units	1
Length (ft)	9' 8"
Width (ft)	20' 1"
Height (ft)	11' 6"
Capacity Per Unit (gpm)	500
Settling Area Per Unit (ft^2)	2,200
Minimum Hydraulic Loading Rate (gpm/ft^2)	0.23
Clarifier Effluent Tank (T-40601 and T-40602)	
Number of Units	1
Tank Diameter (ft)	10

Table 3-36 - Preliminary Specifications for Major Process Equipment

Hudson River Design Limits	Phase 1 1-Month Performance Test Average Loadings
Tank Volume (gal)	2,500
Total Volume (gal)	2,500
Hydraulic Retention Time Per Unit (min)	5
Inlet Pipe Size	
Outlet Pipe Size	
Transfer Pump (P-40601 and P-40602)	
Manufacturer	
Number of Pumps	1
Type	Horizontal Centrifugal
Total Dynamic Head (ft)	130
Capacity Per Unit (gpm)	500
Motor Size (hp)	30
Pipe Length (ft)	275
Multi-Media Filter Systems (MM-40701 and MM-40702)	
Total Design Flow (gpm)	500
Percent Feed Solids (%)	0.1
Multi-Media Filter System	
Number of Units	1
Number of Filters Per Unit	2
Filter Diameter (ft)	9
Length (ft)	13
Width (ft)	10.5
Height (ft)	13.3
Filter Size (microns)	10 to 20
Filter Connection	Parallel
Hydraulic Loading Rate (gpm/ft^2)	4
Granular Activated Carbon Systems (C-40901 to C-40904)	
Total Design Flow (gpm)	500
Percent Feed Solids (%)	0.003
Granular Activated Carbon System (C-40901 to C-40908)	
Number of Skids	2
Number of Vessels Per Skid	2
Vessel Size (pounds)	20,000
Vessel Diameter (ft)	12
Skid Length (ft)	30
Skid Width (ft)	13
Empty Bed Contact Time Per Vessel (min)	20
Vessel Connection	Series
Bag Filter System	
Number of Skids	2
Number of Bags Per Unit	3
Length (ft)	2.8

Table 3-36 - Preliminary Specifications for Major Process Equipment

Hudson River Design Limits	Phase 1 1-Month Performance Test Average Loadings
Width (ft)	2.25
Height (ft)	4.7
Bag Size (microns)	1 to 10
Filter Connection	Parallel

Note:
1. Design values from Loading (METSIM Material Balance) Table.

Table 3-46 - Phase 1 Backfilling/Capping Placement Plan (tons)

Week Number	Day Number	EGIA01A		EGIA01B		NTIP01		NTIP02A		NTIP02B		NTIP02C		NTIP02D		NTIP02E		NTIP02F		NTIP02G		Daily Totals (tons)	Weekly Totals (tons)
		C1	C2	C1	C2	C1	C2	C1	C2	C1	C2	C1	C2	C1	C2	C1	C2	C1	C2	C1	C2		
1		Mobilization of Dredges and Barges to Site																					
2																							
	1																					0	
	2																					0	
	3																					0	
3	4																					0	0
	5																					0	
	6																					0	
	7																					0	
	8	Holiday				Holiday				Holiday				Holiday				Holiday				0	
	9																					0	
	10																					0	
4	11																					0	0
	12																					0	
	13																					0	
	14																					0	
	15																					0	
	16																					0	
	17																					0	
5	18																					0	0
	19																					0	
	20																					0	
	21																					0	
	22																					0	
	23																					0	
	24																					0	
6	25																					0	0
	26																					0	
	27																					0	
	28																					0	
	29																					0	
	30																					0	
	31																					0	
7	32																					0	0
	33																					0	
	34																					0	
	35																					0	
	36																					0	
	37																					0	
	38																					0	
8	39																					0	0
	40																					0	
	41																					0	
	42																					0	
	43																					0	
	44																					0	
	45	Holiday				Holiday				Holiday				Holiday				Holiday				0	
9	46																					0	0
	47																					0	
	48																					0	
	49																					0	
	50																					0	
	51																					0	
	52																					0	
10	53																					0	0
	54																					0	
	55																					0	
	56																					0	
	57																					0	
	58																					0	
	59																					0	
11	60																					0	0
	61																					0	
	62																					0	
	63																					0	
	64																					0	
	65																					0	
	66																					0	
12	67																					0	0
	68																					0	
	69																					0	
	70																					0	
	71					1,505																1,505	
	72					1,552																1,552	
	73					1,607																1,607	
13	74					1,453																1,453	9,229
	75					1,659																1,659	
	76					1,453																1,453	
	77																					0	
	78					604																604	
	79							1,211														1,211	
	80							1,304														1,304	
14	81							1,489														1,489	6,872
	82							1,134														1,134	
	83											1,130										1,130	
	84																					0	
	85											1,130										1,130	
	86											1,042										1,042	
	87											1,130										1,130	
15	88											1,130										1,130	6,651
	89											1,096										1,096	
	90											1,122										1,122	
	91																					0	
	92											1,130										1,130	
	93											1,130										1,130	
	94											1,130										1,130	
16	95											1,108										1,108	6,743
	96											1,114										1,114	
	97											1,130										1,130	
	98																					0	
	99											1,104										1,104	
	100											1,084										1,084	
	101											1,130										1,130	
17	102											1,115										1,115	6,650
	103											1,087										1,087	
	104											1,130										1,130	
	105																					0	
	106	Holiday				Holiday				Holiday				Holiday				Holiday				0	
	107										1,556	1,127										2,682	
	108										1,486	868										2,354	
18	109										1,573	807										2,381	11,967
	110										1,453	807										2,260	
	111										1,483	807										2,290	
	112																					0	

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Table 3-46 - Phase 1 Backfilling/Capping Placement Plan (tons)

Week Number	Day Number	EGIA01A		EGIA01B		NTIP01		NTIP02A		NTIP02B		NTIP02C		NTIP02D		NTIP02E		NTIP02F		NTIP02G		Daily Totals (tons)	Weekly Totals (tons)
		C1	C2	C1	C2	C1	C2	C1	C2	C1	C2	C1	C2	C1	C2	C1	C2	C1	C2	C1	C2		
	113										1,565	807										2,372	
	114										1,682	807										2,490	
	115										1,453	1,058										2,511	
19	116										1,642	1,695										3,337	16,796
	117										1,577	1,695										3,273	
	118										1,453	1,360										2,813	
	119																					0	
	120										1,670	1,692										3,362	
	121										1,552	1,550										3,102	
	122										1,533	1,453										2,986	
20	123										1,635	1,242										2,877	17,787
	124										1,534	1,211										2,745	
	125										1,504	1,211										2,715	
	126																					0	
	127										1,482	1,211										2,693	
	128										1,695	1,398										3,093	
	129										1,519	1,695										3,214	
21	130										1,483	1,570										3,053	18,395
	131										1,694	1,572										3,265	
	132										1,453	1,623										3,076	
	133																					0	
	134										1,532	1,515										3,047	
	135										1,485	1,214										2,699	
	136										1,498			1,211								2,709	
22	137										1,211			1,171								2,382	14,368
	138										557					1,518						2,076	
	139															1,455						1,455	
	140																					0	
	141		1,695													1,532						3,228	
	142		1,695													1,506						3,201	
	143		697													1,578						2,275	
23	144				1,548											1,544						3,092	18,233
	145				1,693											1,490						3,183	
	146				1,634											1,621						3,255	
	147																					0	
	148				1,598											1,695						3,294	
	149				1,695											1,569						3,264	
	150				1,546											1,695						3,241	
24	151				642											1,628						2,269	19,307
	152				2,049											1,512						3,561	
	153				2,011											1,667						3,678	
	154																					0	
	155				2,051											1,541						3,592	
	156				1,077											1,515						2,591	
	157				1,760													1,531				3,291	
25	158				1,709													1,611				3,320	18,557
	159				803													1,663				2,466	
	160																	1,660	1,637			3,297	
	161																					0	
	162																	1,590	1,695			3,285	
	163																	1,665	1,695			3,361	
	164																	1,519	1,468			2,987	
26	165																	1,695	1,695			3,391	19,491
	166																	1,470	1,685			3,155	
	167																	1,695	1,617			3,312	
	168																					0	
	169																	1,695	1,683			3,379	
	170																	1,189	1,466			2,656	
	171																			1,677	1,695	3,372	
27	172																			1,644	1,607	3,251	18,479
	173																			1,628	1,695	3,324	
	174																			1,695	803	2,498	
	175																					0	
	176																			1,616	803	2,419	
	177																			1,695	1,695	3,391	
	178																			953	1,070	2,023	
28	179																					0	7,833
	180																					0	
	181																					0	
	182																					0	
	183																					0	
	184																					0	
	185																					0	
29	186																					0	0
	187																					0	
	188																					0	
	189	Demobilization of Dredges and Barges From Site																				0	
	190																					0	
	191																					0	
	192																					0	
30	193																					0	0
	194																					0	
	195																					0	
	196																					0	

	EGIA01A	EGIA01B	NTIP01	NTIP02A	NTIP02B	NTIP02C	NTIP02D	NTIP02E	NTIP02F	NTIP02G	Total
Backfill/Cap Material Totals (tons)	4,087	21,815	9,832	5,138	41,961	53,173	2,382	25,066	33,628	20,277	217,000
Backfill/Cap Material Totals (CY)											167,000

(orange) = Clamshell 1 (C1)
(cyan) = Clamshell 2 (C2)

Notes:
1) Inventory dredging starts on Day 1;
2) Values shown in tons; and
3) Two clamshells have been assumed for placement to meet the production requirements.

Assumptions:

1) 4 cy placement bucket, operating 24 hours per day, 6 days/week.
2) 120 sec cycle time.
3) 90% bucket fill.
4) 20% bucket placement overlap.
5) 70% uptime (downtime includes movement, breaks, personnel exchange, minor repair).
6) 50% to 75% full operational speed (slowed to not surpass residuals dredging).
7) 60% uptime along shoreline (within 30 ft of shoreline).
8) 50% uptime near obstructions (bridges, Lock 7).
9) Volumes includes an additional 15% contingency.
10) Cap/Backfill placement begins approx. 3 weeks following residuals dredging start.
11) 2 barge sizes used due to access issues in upper NTIP areas: 900 ton/692 cy large barge, 500 ton/385 cy smaller barge.
12) 900 ton barge used through EGIA, NTIP02B, NTIP02G and most of NTIP02F.
13) 500 ton barge used in NTIP01, NTIP02A, NTIP02C, NTIP02D, NTIP02E, and a portion of NTIP02F.
14) 1.3 conversion cy to tons.
15) Daily total barges represent the number of barge loads needed for that particular day from the quarry - there may be left over barge loads from the previous day that might be used for any particular day, depending on availability.
16) Assumes start date of 5/21/2007 for purpose of holidays.

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Table 3-47 - Phase 1 Backfilling/Capping Barge Plan

Week Number	Day Number	EGIA01A		EGIA01B		NTIP01		NTIP02A		NTIP02B		NTIP02C		NTIP02D		NTIP02E		NTIP02F		NTIP02G		Daily Totals	Weekly Totals
		C1	C2	C1	C2	C1	C2	C1	C2	C1	C2	C1	C2	C1	C2	C1	C2	C1	C2	C1	C2		
1		Mobilization of Dredges and Barges to Site																					
2																							
	1																					0	
	2																					0	
	3																					0	
3	4																					0	0
	5																					0	
	6																					0	
	7																					0	
	8	Holiday				Holiday				Holiday				Holiday				Holiday				0	
	9																					0	
	10																					0	
4	11																					0	0
	12																					0	
	13																					0	
	14																					0	
	15																					0	
	16																					0	
	17																					0	
5	18																					0	0
	19																					0	
	20																					0	
	21																					0	
	22																					0	
	23																					0	
	24																					0	
6	25																					0	0
	26																					0	
	27																					0	
	28																					0	
	29																					0	
	30																					0	
	31																					0	
7	32																					0	0
	33																					0	
	34																					0	
	35																					0	
	36																					0	
	37																					0	
	38																					0	
8	39																					0	0
	40																					0	
	41																					0	
	42																					0	
	43																					0	
	44																					0	
	45	Holiday				Holiday				Holiday				Holiday				Holiday				0	
9	46																					0	0
	47																					0	
	48																					0	
	49																					0	
	50																					0	
	51																					0	
	52																					0	
10	53																					0	0
	54																					0	
	55																					0	
	56																					0	
	57																					0	
	58																					0	
	59																					0	
11	60																					0	0
	61																					0	
	62																					0	
	63																					0	
	64																					0	
	65																					0	
	66																					0	
12	67																					0	0
	68																					0	
	69																					0	
	70																					0	
	71					3																3	
	72					3																3	
	73					3																3	
13	74					3																3	18
	75					3																3	
	76					3																3	
	77																					0	
	78					1																1	
	79							3														3	
	80							2														2	
14	81							3														3	14
	82							2														2	
	83											3										3	
	84																					0	
	85											2										2	
	86											2										2	
	87											2										2	
15	88											3										3	13
	89											2										2	
	90											2										2	
	91																					0	
	92											2										2	
	93											3										3	
	94											2										2	
16	95											2										2	13
	96											2										2	
	97											2										2	
	98																					0	
	99											3										3	
	100											2										2	
	101											2										2	

General Electric Company
Hudson River PCBs Superfund Site
Phase 1 Intermediate Design Report

Table 3-47 - Phase 1 Backfilling/Capping Barge Plan

Week Number	Day Number	EGIA01A C1	EGIA01A C2	EGIA01B C1	EGIA01B C2	NTIP01 C1	NTIP01 C2	NTIP02A C1	NTIP02A C2	NTIP02B C1	NTIP02B C2	NTIP02C C1	NTIP02C C2	NTIP02D C1	NTIP02D C2	NTIP02E C1	NTIP02E C2	NTIP02F C1	NTIP02F C2	NTIP02G C1	NTIP02G C2	Daily Totals	Weekly Totals
17	102											2										2	14
	103											3										3	
	104											2										2	
	105																					0	
	106	Holiday				Holiday				Holiday				Holiday				Holiday				0	
	107										1	2										3	
	108										2	2										4	
18	109										2	1										3	17
	110										1	2										3	
	111										2	2										4	
	112																					0	
	113										2	1										3	
	114										1	2										3	
	115										2	2										4	
19	116										2	3										5	24
	117										2	4										6	
	118										1	2										3	
	119																					0	
	120										2	4										6	
	121										2	3										5	
	122										2	3										5	
20	123										1	2										3	28
	124										2	3										5	
	125										2	2										4	
	126																					0	
	127										1	3										4	
	128										2	2										4	
	129										2	4										6	
21	130										2	3										5	28
	131										2	3										5	
	132										1	3										4	
	133																					0	
	134										2	3										5	
	135										1	3										4	
	136										2			2								4	
22	137										2			3								5	23
	138															3						3	
	139															2						2	
	140																					0	
	141		2													4						6	
	142		2													3						5	
	143		1													3						4	
23	144				1											3						4	29
	145				2											3						5	
	146				2											3						5	
	147																					0	
	148				2											3						5	
	149				2											4						6	
	150				1											3						4	
24	151				1											3						4	31
	152				2											3						5	
	153				3											4						7	
	154																					0	
	155				2											3						5	
	156				1											3						4	
	157				2													1				3	
25	158				2													2				4	23
	159				1													2				3	
	160																	2	2			4	
	161																					0	
	162																	2	2			4	
	163																	1	1			2	
	164																	2	2			4	
26	165																	2	2			4	21
	166																	2	2			4	
	167																	1	2			3	
	168																					0	
	169																	2	2			4	
	170																	2	1			3	
	171																			2	2	4	
27	172																			1	2	3	21
	173																			2	2	4	
	174																			2	1	3	
	175																					0	
	176																			2	1	3	
	177																			2	1	3	
	178																			2	3	5	
28	179																					0	11
	180																					0	
	181																					0	
	182																					0	
	183																					0	
	184																					0	
	185																					0	
29	186																					0	0
	187																					0	
	188																					0	
	189	Demobilization of Dredges and Barges From Site																				0	
	190																					0	
	191																					0	
	192																					0	
30	193																					0	0
	194																					0	
	195																					0	
	196																					0	

	EGIA01A C1	EGIA01A C2	EGIA01B C1	EGIA01B C2	NTIP01 C1	NTIP01 C2	NTIP02A C1	NTIP02A C2	NTIP02B C1	NTIP02B C2	NTIP02C C1	NTIP02C C2	NTIP02D C1	NTIP02D C2	NTIP02E C1	NTIP02E C2	NTIP02F C1	NTIP02F C2	NTIP02G C1	NTIP02G C2	Total
No. of Barges per Dredge Area	0	5	0	24	19	0	10	0	0	46	107	0	5	0	50	0	21	16	13	12	328
	5		24		19		10		46		107		5		50		37		25		

Orange = Clamshell 1
Cyan = Clamshell 2

Notes
1) Inventory dredging starts on Day 1.
2) Two clamshells have been assumed for placement to meet the production requirements.
3) Number of barges include a mix of 500-ton and 900-ton barges.
4) Assumes start date of 5/21/2007 for purpose of holidays.

Table 3-51 - Water-Borne Equipment and Noise Information

Equipment/Operation	Noise (dBA)	Distance from Source that Noise was Measured (ft)	Source for Noise
Tug Boat	85	50	Hudson Responsiveness Summary, Table 312685-2
Excavator Clamshell Dredge/Backfill	80	50	Caterpillar 375 lc hydraulic excavator, used in Bean HPG bucket. (See also, Hudson Responsiveness Summary, Mechanical Dredging)
Light Tower	71	23	Coleman Manufacturing
Survey Boat/Crew Boat	70	50	Yamaha Corporation
Heavy Duty Electric Generator	56 to 63	23	Manufacturer, www.multiquip.com
Pumping/Dewatering	63	30	Manufacturer, www.godwinpumps.com

Notes:
dBA = A-weighted decibel

Table 3-52 - Processing Facility and Noise Information

Equipment/Operation	Noise (dBA)	Distance from Source that Noise was Measured (ft)	Source for Noise
Front End Loader	84	50	Hudson Responsiveness Summary, Table 312685-2
Dump Trucks	88	50	Hudson Responsiveness Summary, Table 312685-2
Trommel Screens	90	50	Manufacturer, Dave Schellberg of McLanahan Corporation, conversation on July 22, 2005
Sediment Slurry Tank Feed	90	50	Manufacturer, Michael Franks of Metso Minerals, conversation on August 1, 2005
Sediment Slurry Tank	75	50	Manufacturer, Harvey of Westech, conversation on August 1, 2005
Hydrocyclone Feed Pumps	85	3	Manufacturer, Mike Wilkins of Krebs Engineers, conversation on July 25, 2005
Hydrocyclones	85	3	Manufacturer, Mike Wilkins of Krebs Engineers, conversation on July 25, 2005
Vibratory Dewatering Screens	90	50	Manufacturer, Paul Brodzik of Derrick Corporation, conversation on July 22, 2005
Gravity Thickener System	60	5	Manufacturer, Harvey of Westech, conversation on August 1, 2005
Dewatering Conditioning Feed Pumps	75	50	www.epd.gov.hk/epd/english/environmentinhk/noise/guide_ref/tm_pp_4_2.html
Filter Press Feed Pumps	92	50	Manufacturer, Marty Baldwin of JWI/US Filter, conversation on July 21, 2005
Filter Press System	75	50	Manufacturer, Marty Baldwin of JWI/US Filter, conversation on July 21, 2005

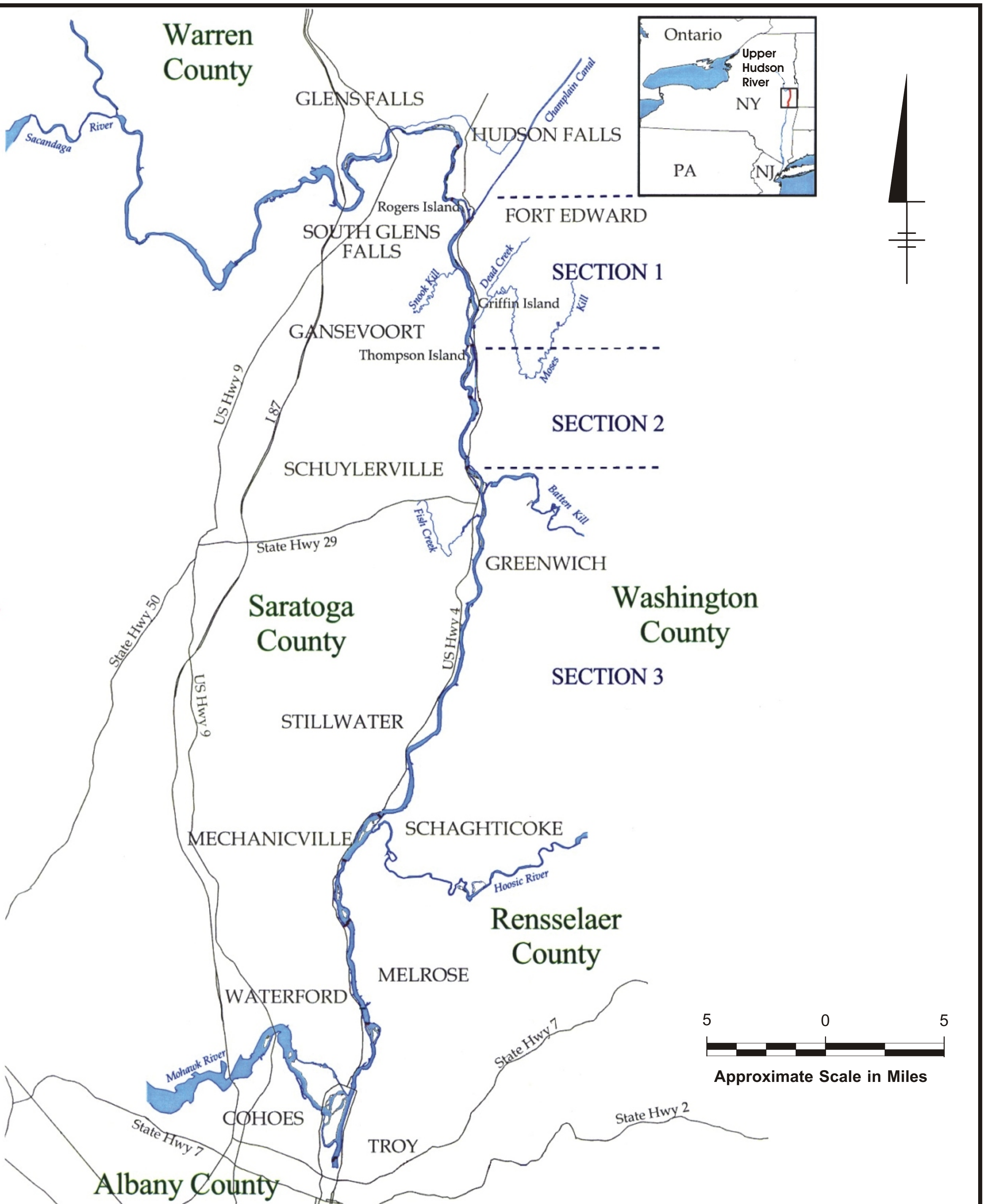
Notes:
dBA = A-weighted decibel
NA = Not available

Table 3-53 - Barge Unloading at Processing Facility and Noise Information

Equipment/Operation	Noise (dBA)	Distance from Source that Noise was Measured (ft)	Source for Noise
Tug Boat	85	50	Hudson Responsiveness Summary, Table 312685-2
Clamshell Dredge/Backfill Crane	88	50	Hudson Responsiveness Summary, Table 312685-2
Large Front End Loader	84	50	Hudson Responsiveness Summary, Table 312685-2
Dump Truck	88	50	Hudson Responsiveness Summary, Table 312685-2
Pumping/ Dewatering	63	30	Manufacturer, www.godwinpumps.com

Notes:
dBA = A-weighted decibel

Figures



NOTE:

1. All locations are approximate.
2. Adapted from EPA Feasibility Study (December 2000)

GENERAL ELECTRIC COMPANY
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PHASE 1 INTERMEDIATE DESIGN REPORT

UPPER HUDSON RIVER

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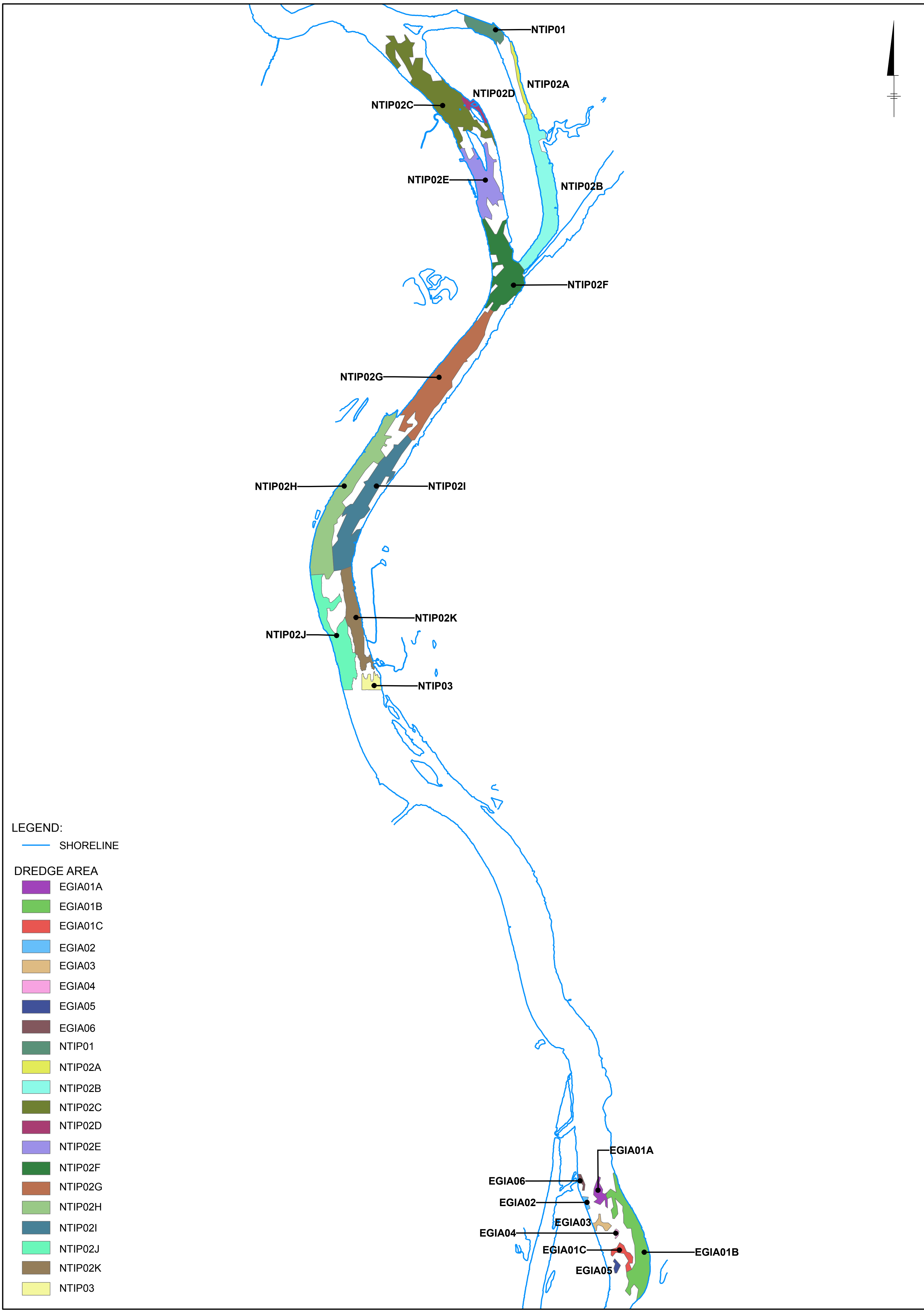
engineers, scientists, economists

FIGURE
1-1

08/17/05 SYR-D85-DJH-KLS
C:20437703/20437N03.cdr



NOTE:

1. DREDGE AREAS BASED ON FEBRUARY 28TH PHASE 1 DAD REPORT.

2. SHORELINE BASED ON AERIAL MAPPING PERFORMED BY CHAS H. SELLS, INC IN THE SPRING OF 2002.

0 1,600 3,200 Feet

GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
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PHASE 1 INTERMEDIATE DESIGN REPORT

PHASE 1 DREDGE AREAS

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FIGURE
3-1

8/20/05 SYR-85 KEW KEW MTK
GE Hudson
G:\GE_GIS\GE-HudsonRiver\DA_Prism_Classifications\mxd\ClassifyWithBBLDA\Dredge_Areas.mxd

LEGEND:

- DoC = 0 in.
- DoC = 2 in.
- DoC = 12 in.
- DoC = 24 in.
- DoC = 30 in.
- DoC = 36 in.
- DoC = 42 in.
- DoC = 48 in.
- DoC = 54 in.
- DoC = 60 in.
- > 60 in. DoC
- Dredge Areas

GENERAL ELECTRIC COMPANY
UPPER HUDSON RIVER

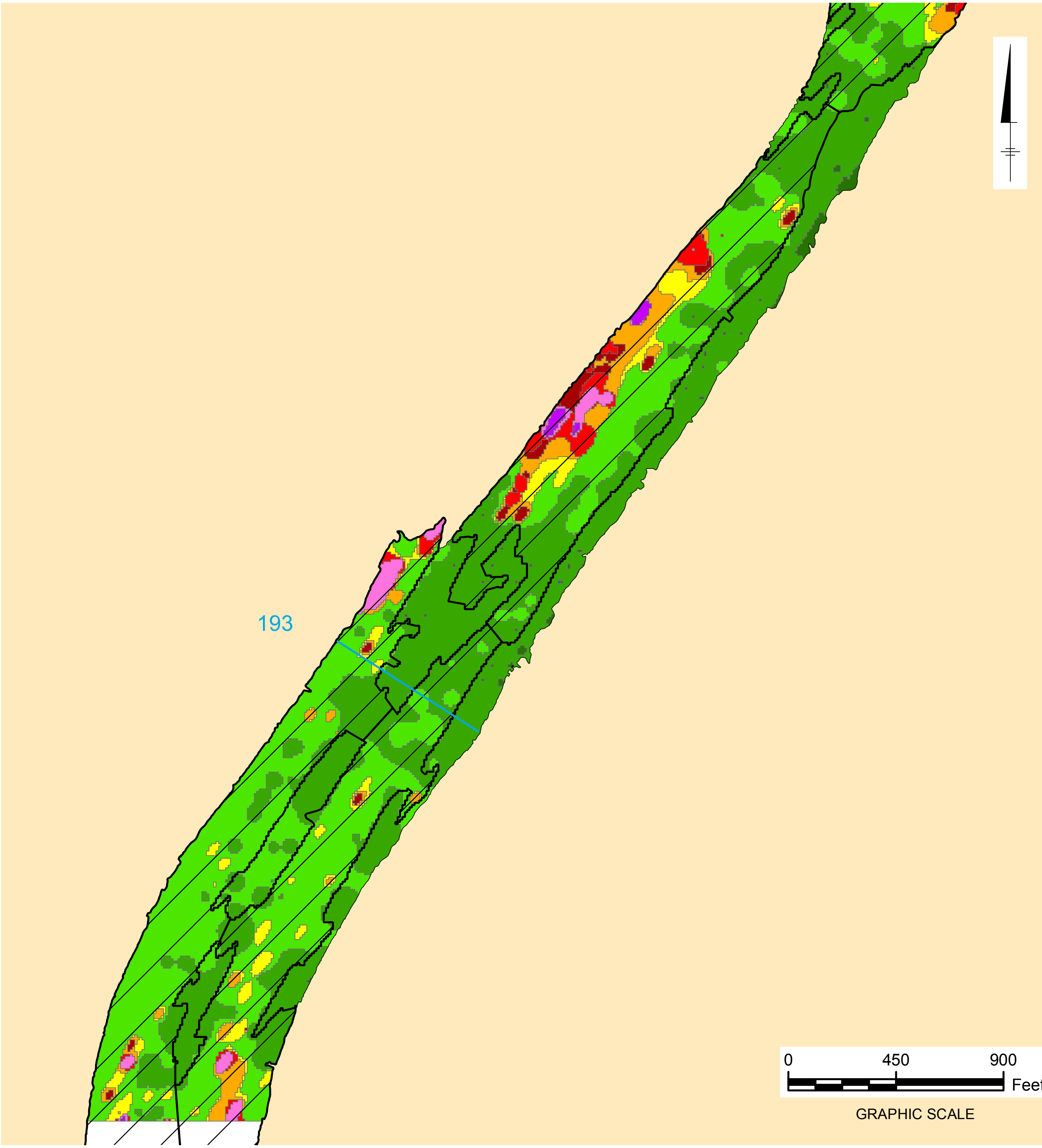
PHASE 1 INTERMEDIATE DESIGN REPORT

RESULTS OF THE TOTAL PCB CONCENTRATION AT DEPTH INTERPOLATION

QEA Quantitative Environmental Analysis, LLC

FIGURE 3-2

11/4/05 SYR-85 MTK TBR EAB KEW
QEA - GENdes:232 - \hendrix\V_Drive\Genrem\Working\Chou\documents\GENdes232\
GENdes232_BBL_8x11_1ppm_interpolator_NEGI_20050726.pdf



LEGEND:

- DoC = 0 in.
- DoC = 2 in.
- DoC = 12 in.
- DoC = 24 in.
- DoC = 30 in.
- DoC = 36 in.
- DoC = 42 in.
- DoC = 48 in.
- DoC = 54 in.
- DoC = 60 in.
- > 60 in. DoC
- Dredge Areas

GENERAL ELECTRIC COMPANY
UPPER HUDSON RIVER

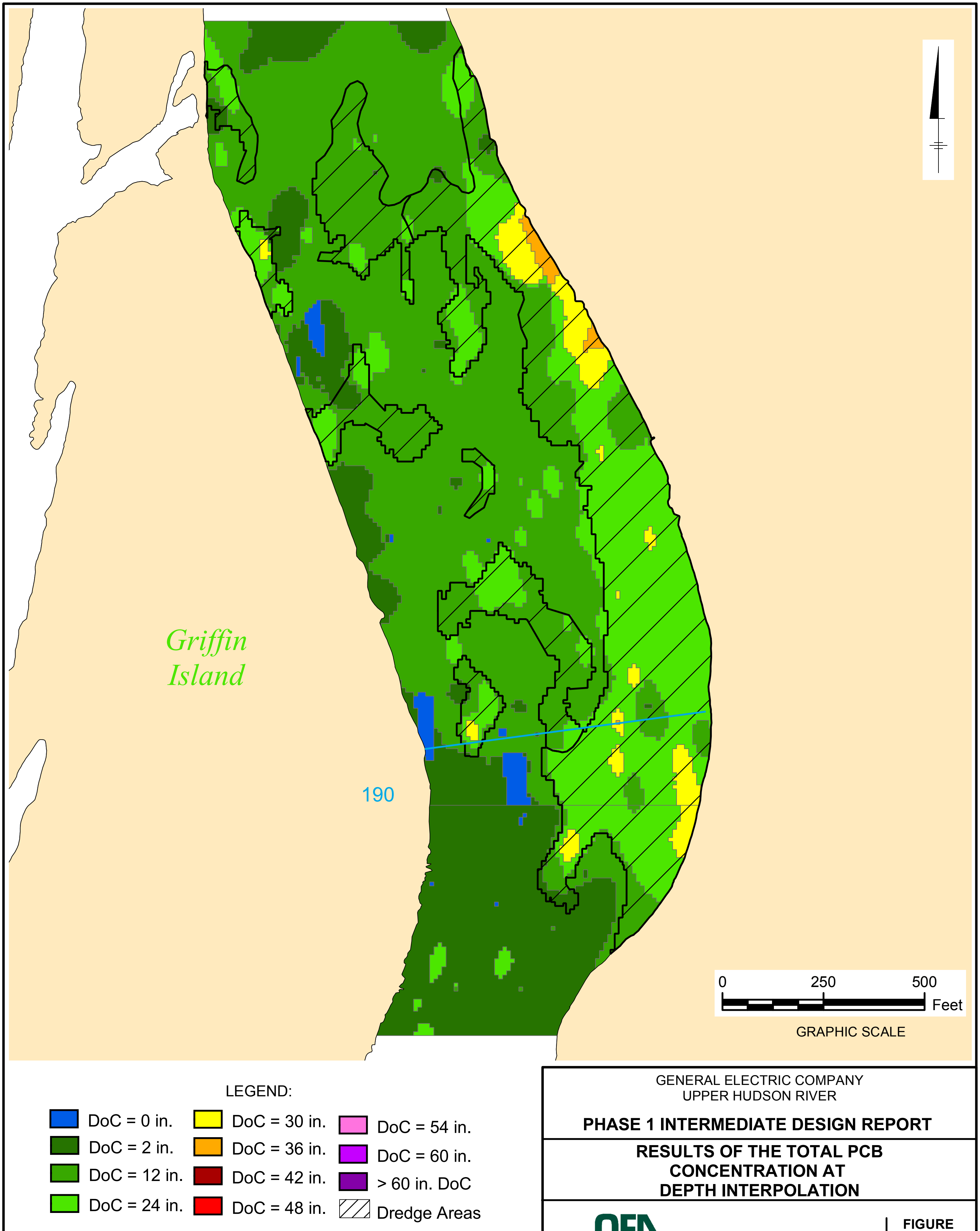
PHASE 1 INTERMEDIATE DESIGN REPORT

RESULTS OF THE TOTAL PCB CONCENTRATION AT DEPTH INTERPOLATION

QEA Quantitative Environmental Analysis, LLC

FIGURE 3-3

11/4/05 SYR-85 MTK TBR EAB KEW
QEA - GENdes:232 - \hendrix\V_Drive\Genrem\Working\Chou\documents\GENdes232\
GENdes232_BBL_8x11_1ppm_interpolator_NEGI_20050726.pdf



11/4/05 SYR-85 MTK TBR EAB KEW
QEA - GENdes:232 - \hendrix\V_Drive\Genrem\Working\Chou\documents\GENdes232\
GENdes232_BBL_8x11_1ppm_interpolator_NEGI_20050726.pdf

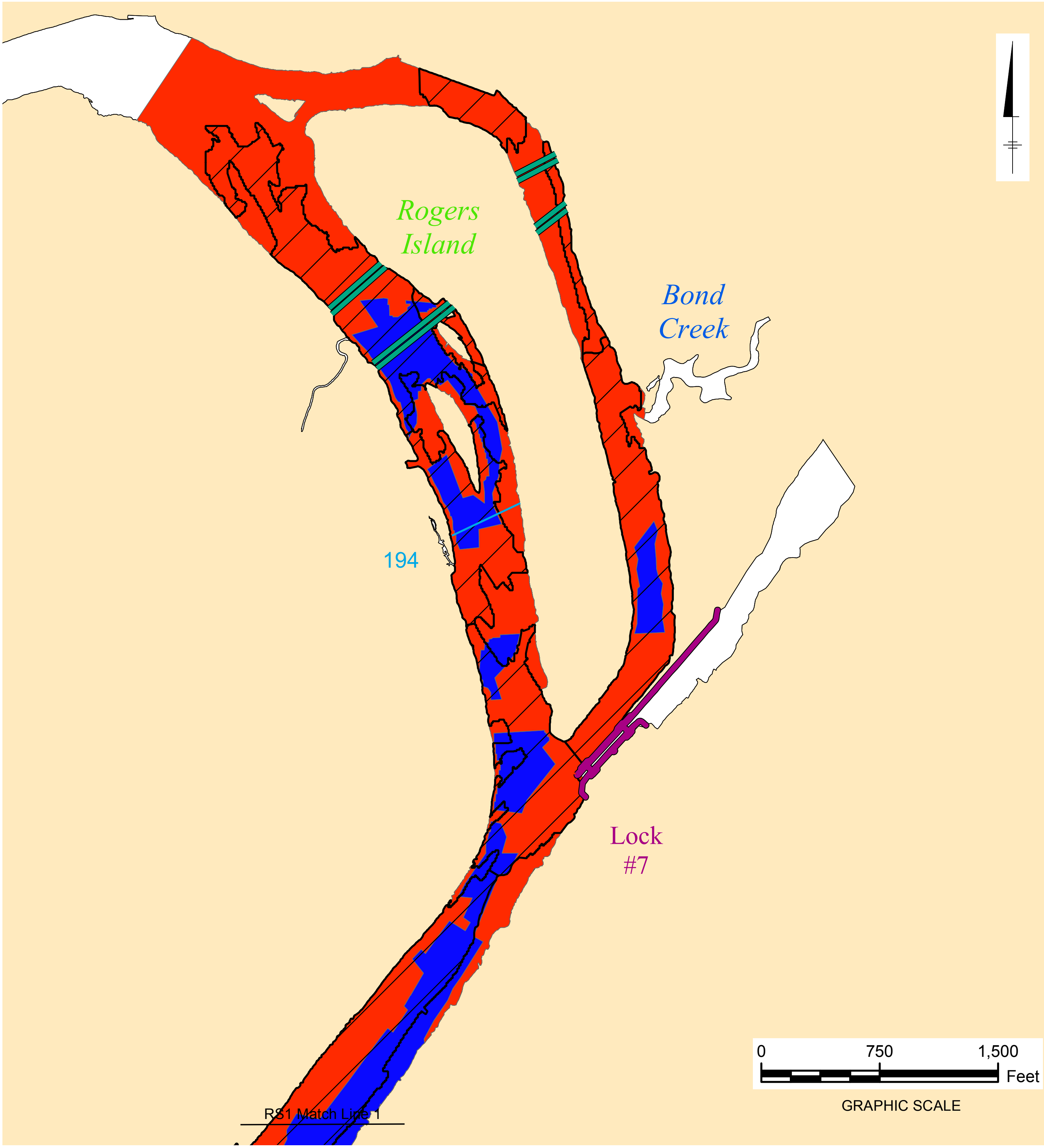
GENERAL ELECTRIC COMPANY
UPPER HUDSON RIVER

PHASE 1 INTERMEDIATE DESIGN REPORT

RESULTS OF THE TOTAL PCB CONCENTRATION AT DEPTH INTERPOLATION

QEA Quantitative Environmental Analysis, LLC

FIGURE 3-4



LEGEND:

- Clay areas
- 1 mg/kg areas
- Dredge areas

GENERAL ELECTRIC COMPANY
UPPER HUDSON RIVER

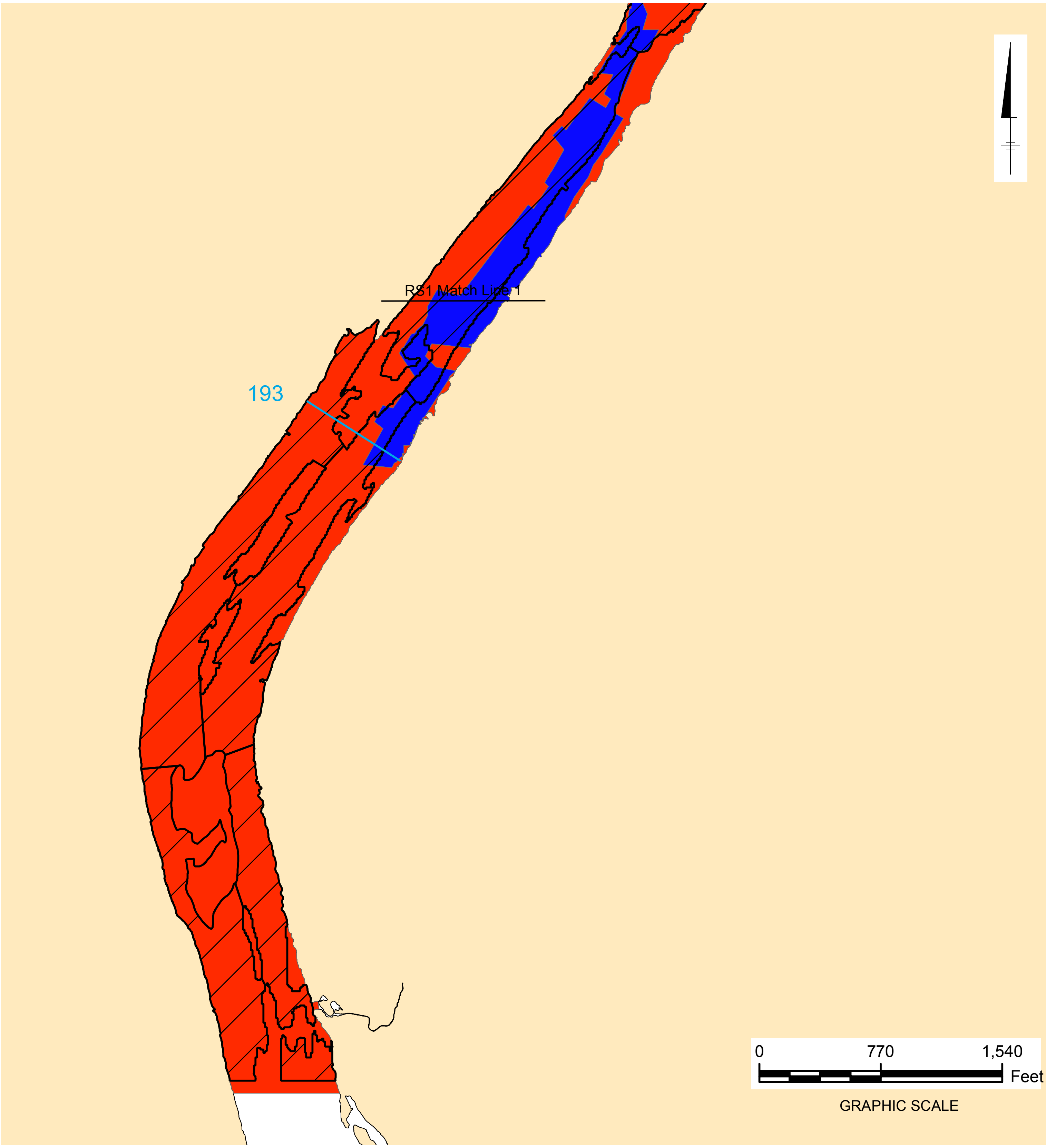
PHASE 1 INTERMEDIATE DESIGN REPORT

LOCATION OF CLAY AND 1 MG/KG AREAS

Quantitative Environmental Analysis, LLC

FIGURE 3-5

11/4/05 SYR-85 MTK TBR EAB KEW
QEA - GENdes:232 - \\hendrix\V_Drive\Genrem\Working\Chou\documents\GENdes232\
GENdes232_BBL_8x11_clay_1ppm_areas_20050726.pdf



LEGEND:

Clay areas

1 mg/kg areas

Dredge areas

GENERAL ELECTRIC COMPANY
UPPER HUDSON RIVER

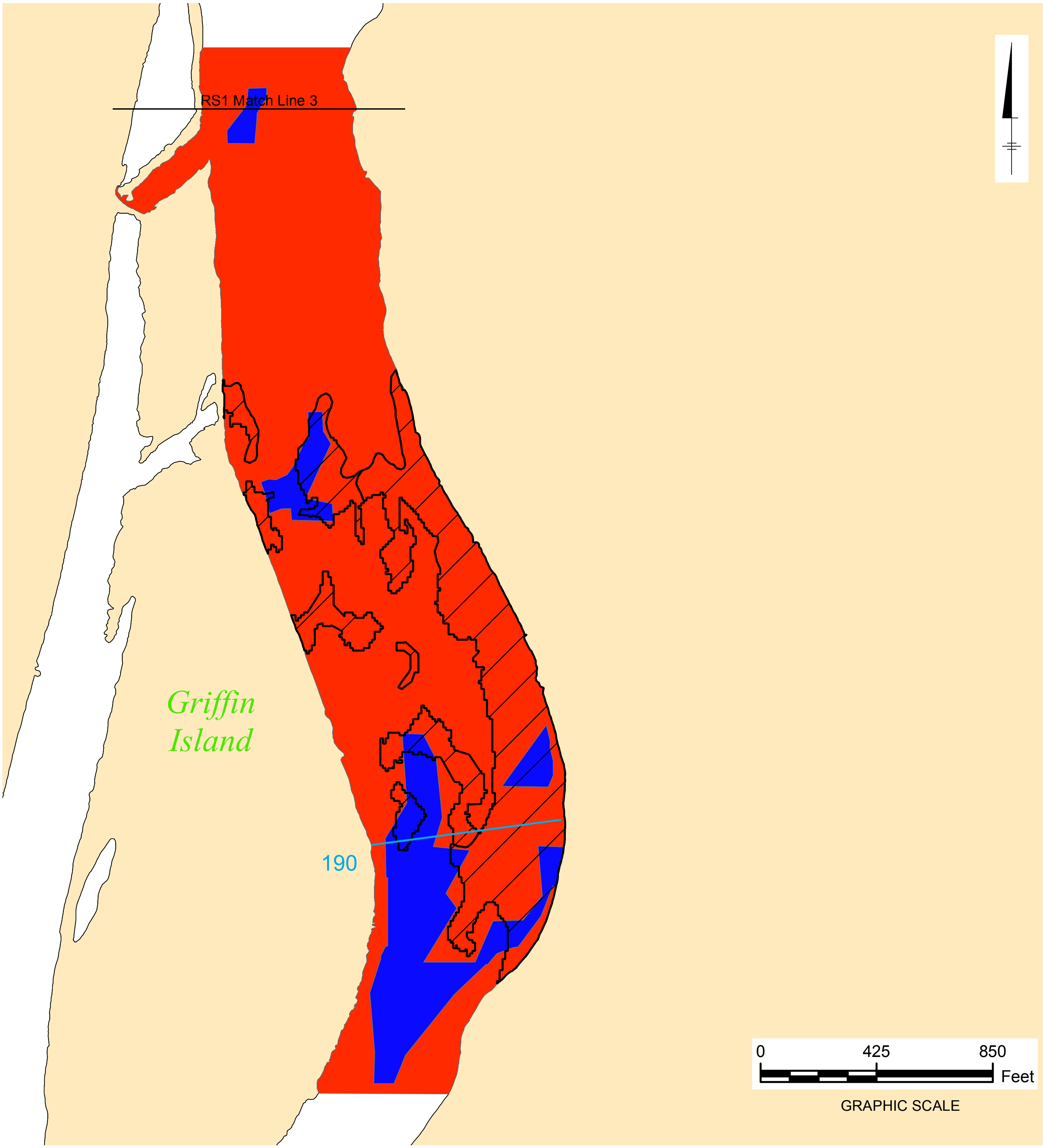
PHASE 1 INTERMEDIATE DESIGN REPORT

LOCATION OF CLAY AND 1 MG/KG AREAS

QEA Quantitative Environmental Analysis, LLC

FIGURE 3-6

11/4/05 SYR-85 MTK TBR EAB KEW
QEA - GENdes:232 - \\hendrix\V_Drive\Genrem\Working\Chou\documents\GENdes232\
GENdes232_BBL_8x11_clay_1ppm_areas_20050726.pdf



LEGEND:

- Clay areas
- 1 mg/kg areas
- Dredge areas

GENERAL ELECTRIC COMPANY
UPPER HUDSON RIVER

PHASE 1 INTERMEDIATE DESIGN REPORT

LOCATION OF CLAY AND 1 MG/KG AREAS

QEA Quantitative Environmental Analysis, LLC

FIGURE

3-7

11/4/05 SYR-85 MTK TBR EAB KEW
QEA - GENdes:232 - \\hendrix\V_Drive\Genrem\Working\Chou\documents\GENdes232\
GENdes232_BBL_8x11_clay_1ppm_areas_20050726.pdf

LEGEND:

- DoC = 0 in.
- DoC = 2 in.
- DoC = 12 in.
- DoC = 24 in.
- DoC = 30 in.
- DoC = 36 in.
- DoC = 42 in.
- DoC = 48 in.
- DoC = 54 in.
- DoC = 60 in.
- > 60 in. DoC
- Dredge Areas

GENERAL ELECTRIC COMPANY
UPPER HUDSON RIVER

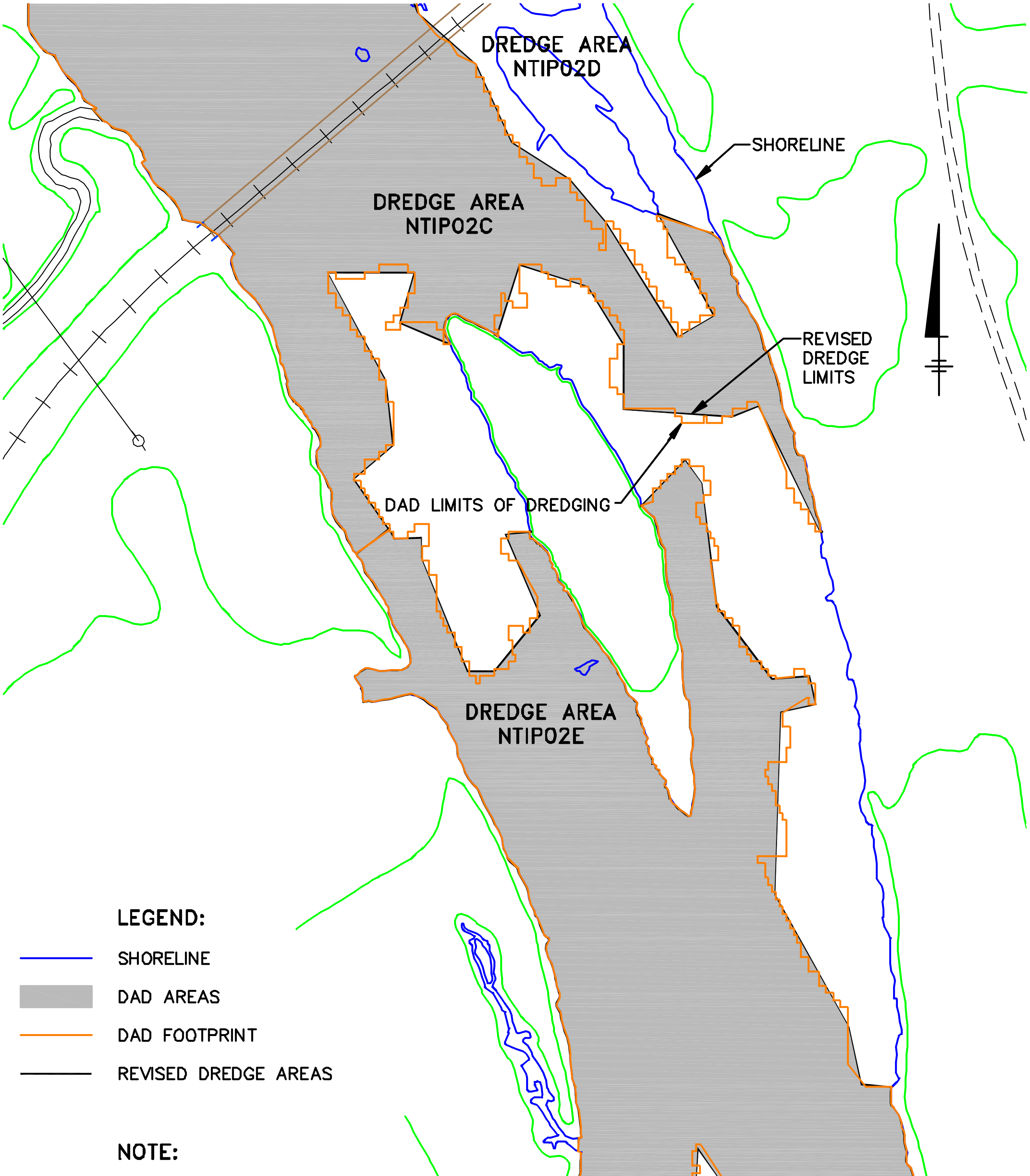
PHASE 1 INTERMEDIATE DESIGN REPORT

FINAL COMBINED SURFACE

QEA Quantitative Environmental Analysis, LLC

FIGURE 3-8

11/4/05 SYR-85 MTK TBR EAB KEW
QEA - GENdes:232 - \hendrix\V_Drive\Genrem\Working\Chou\documents\GENdes232\
GENdes232_BBL_8x11_married_grid_ERI_20050726.pdf



LEGEND:

- SHORELINE
- DAD AREAS
- DAD FOOTPRINT
- REVISED DREDGE AREAS

NOTE:

1. SHORELINE AND SHORELINE STRUCTURES BASED ON AERIAL MAPPING PERFORMED BY CHAS H. SELLS, INC. IN THE SPRING OF 2002.

0 200' 400'

GRAPHIC SCALE

X: NONE
L: ON=*, OFF=*REF*
P: PAGESET/PLT-AP1
8/20/05 ANNAP-90-TMD SYR-85-BGP DJP
C/20437700/DONEGAN1/20437G01.DWG

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PHASE 1 INTERMEDIATE DESIGN REPORT

DAD FOOTPRINT MODIFICATION

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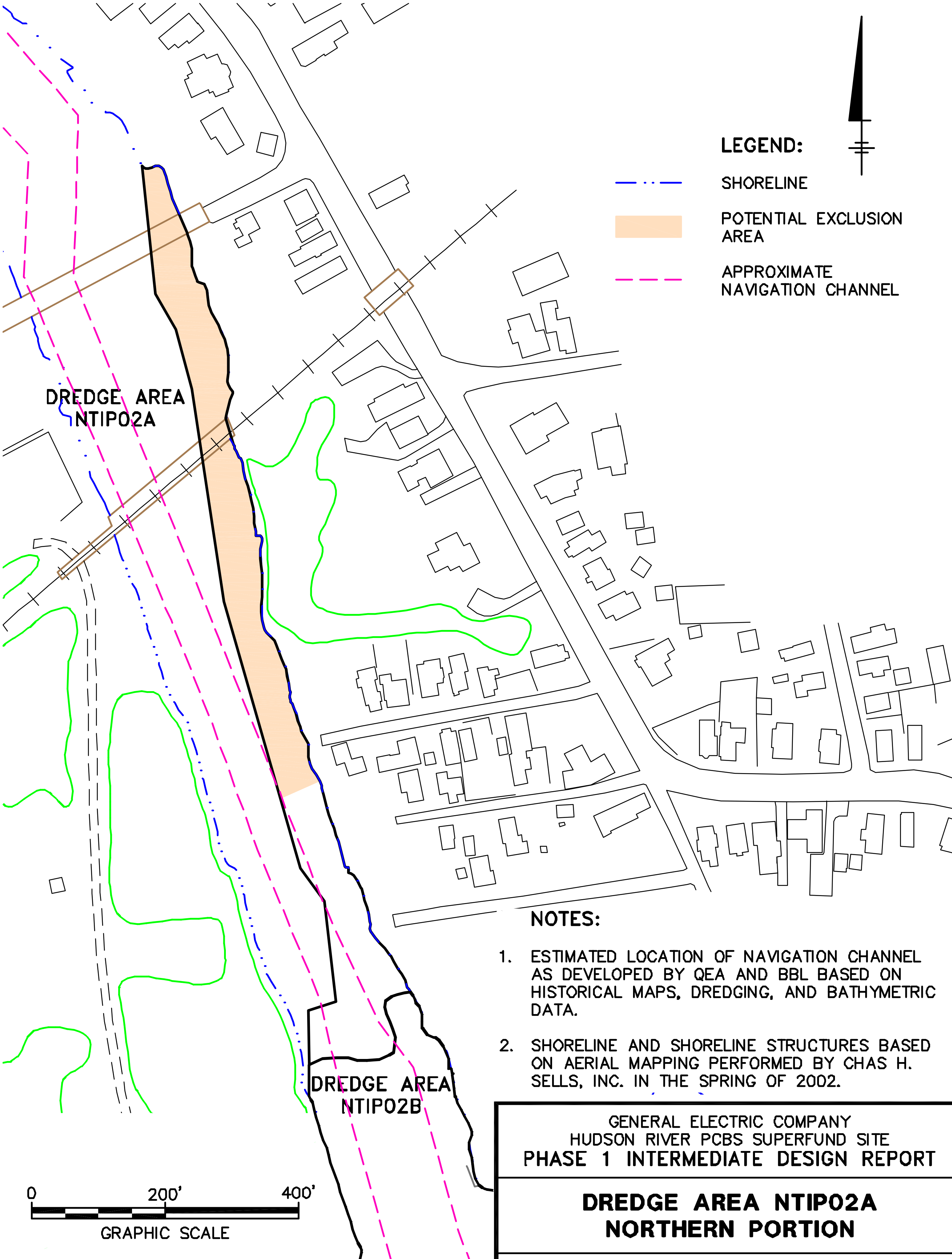
FIGURE
3-9



NOTES:

1. ESTIMATED LOCATION OF NAVIGATION CHANNEL AS DEVELOPED BY QEA AND BBL BASED ON HISTORICAL MAPS, DREDGING, AND BATHYMETRIC DATA.

2. SHORELINE AND SHORELINE STRUCTURES BASED ON AERIAL MAPPING PERFORMED BY CHAS H. SELLS, INC. IN THE SPRING OF 2002.

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HUDSON RIVER PCBS SUPERFUND SITE
PHASE 1 INTERMEDIATE DESIGN REPORT

DREDGE AREA NTIP02A NORTHERN PORTION

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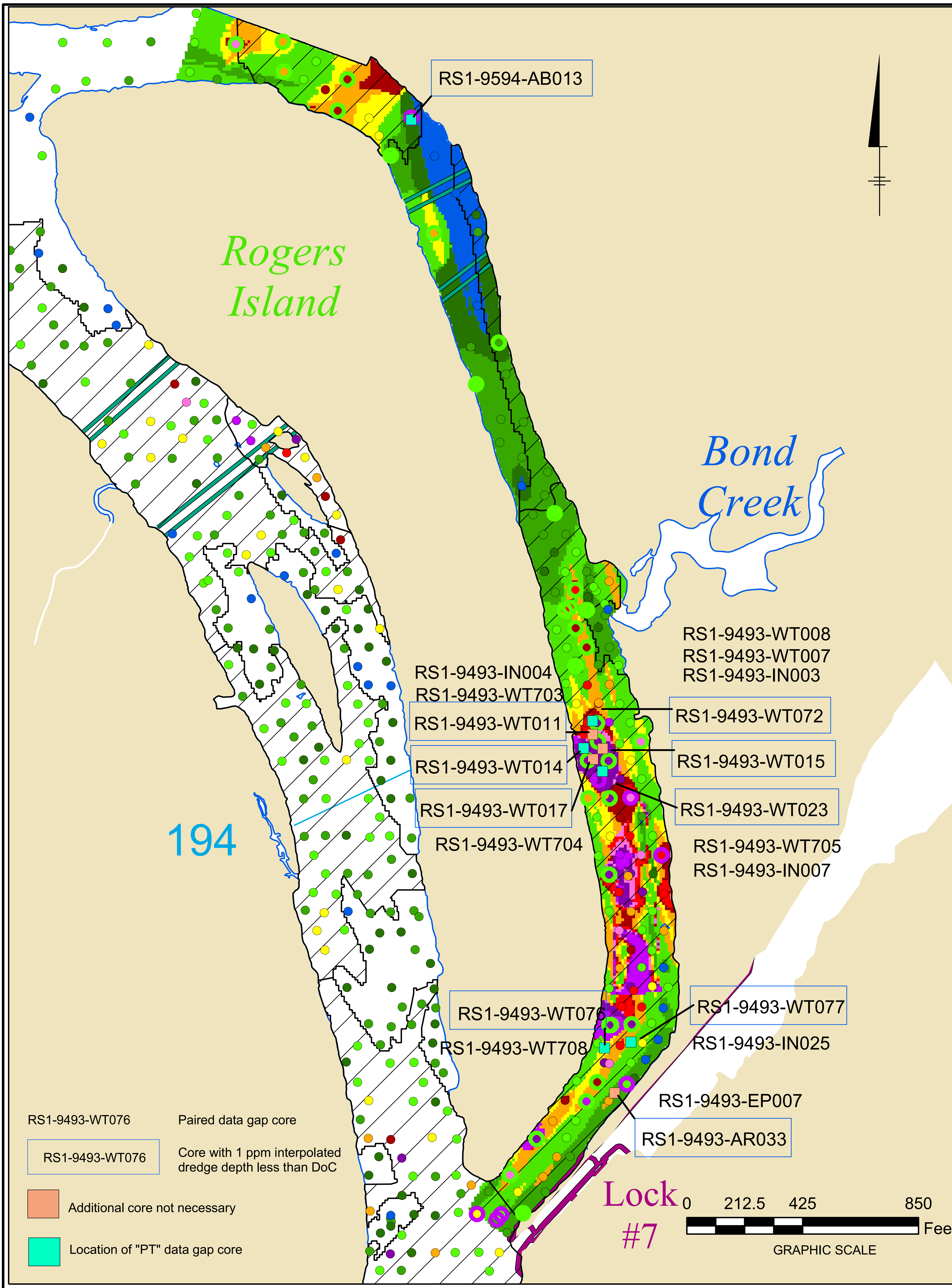
engineers, scientists, economists

FIGURE 3-10

X: NONE
L: ON=*, OFF=*REF*
P: PAGESET/PLT-AP1
8/20/05 ANNAP-90-TMD SYR-85-BGP DJP
C/20437700/DONEGAN1/20437G02.DWG



LEGEND

- River Miles
- Shore Line
- Dams and Locks
- Dredge Areas
- Pop-through that do not meet criteria
- Pop-through that meet criteria

DoC = 0 in.	DoC = 48 in.	DoC = 13-24 in.
DoC = 2 in.	DoC = 54 in.	DoC = 25-30 in.
DoC = 12 in.	DoC = 60 in.	DoC = 31-36 in.
DoC = 24 in.	> 60 in. DoC	DoC = 37-42 in.
DoC = 30 in.	DoC = 0	DoC = 43-48 in.
DoC = 36 in.	DoC = 1-2 in.	DoC = 49-54 in.
DoC = 42 in.	DoC = 3-12 in.	DoC = 55-60 in.
		DoC > 60 in.

8/15/05 SYR-85 MTK TBR EAB KEW
QEA - V:\Genrem\Working\Chou\analysis\gis\project\GENdes232
BBL 11x17.mxd

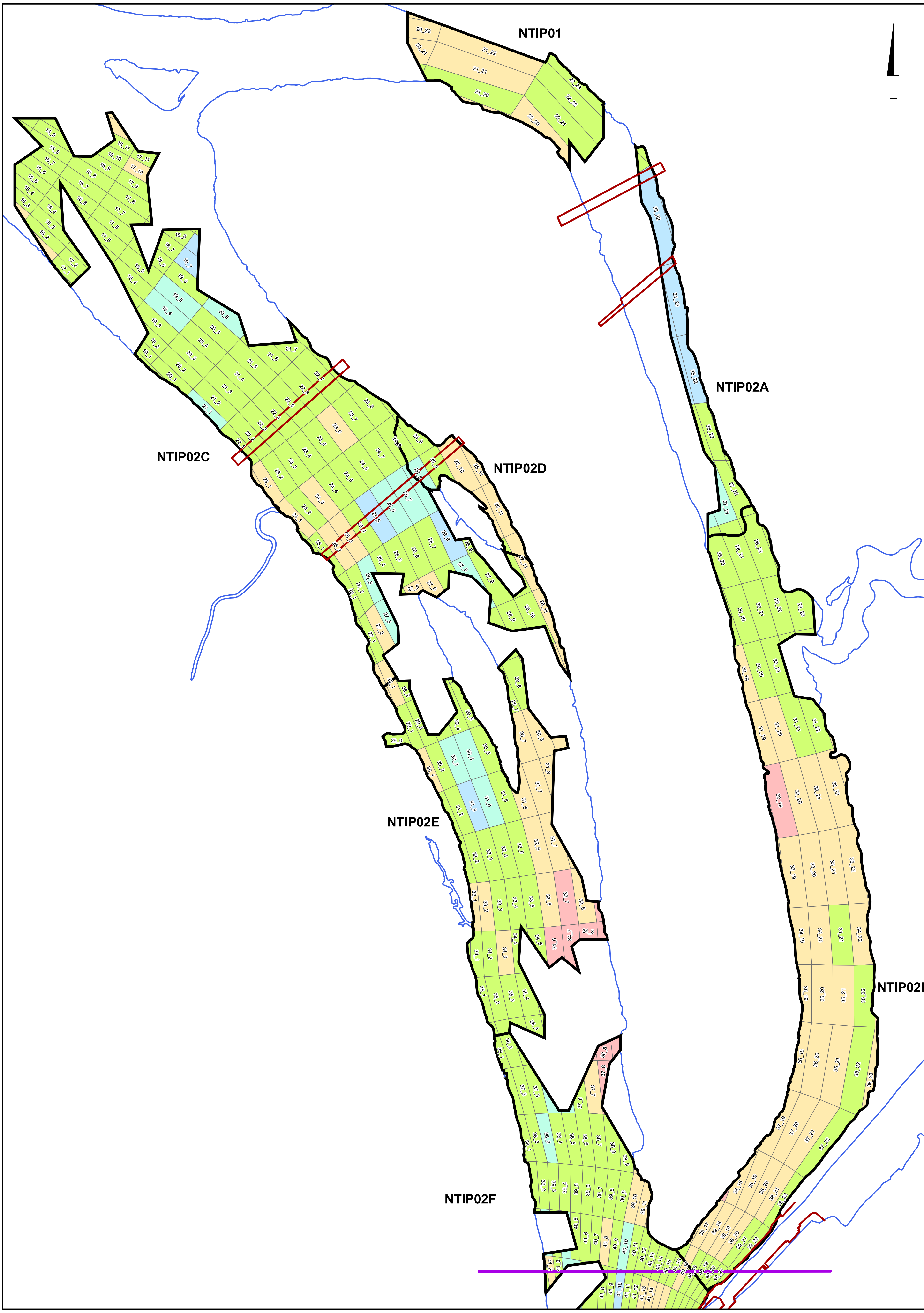
GENERAL ELECTRIC COMPANY
UPPER HUDSON RIVER

PHASE 1 INTERMEDIATE DESIGN REPORT

DATA GAP CORE LOCATIONS

QEA Quantitative Environmental Analysis, LLC

FIGURE **3-11**



LEGEND:

- EXISTING STRUCTURE
- DREDGE AREAS
- SHORELINE
- 22-3 GRID CELL ID

AVERAGE SEDIMENT REMOVAL THICKNESS (FT)

- 0 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- 2.0 - 5.0
- > 5.0

NOTE:

1. DREDGE AREAS BASED ON FEBRUARY 28TH PHASE 1 DAD REPORT.
2. GRID CELLS FROM QEA RESUSPENSION MODELING (ATTACHMENT E) WITH MODIFICATIONS BY BBL.
3. SHORELINE AND SHORELINE STRUCTURES BASED ON AERIAL MAPPING PERFORMED BY CHAS H. SELLS, INC IN THE SPRING OF 2002.

0 320 640 Feet

GRAPHIC SCALE

8/20/05 SYR-85 MTK KEW MTK
GE Hudson
G:\GE_GIS\GE-HudsonRiver\DA_Prism_Classifications\...\BBL_DredgeCellsbyRemovalThickness-NTIPNorth.mxd

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DREDGE CELLS CLASSIFIED BY REMOVAL THICKNESS - NTIP NORTH

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engineers, scientists, economists

FIGURE
3-12

LEGEND:

- EXISTING STRUCTURE
- DREDGE AREAS
- SHORELINE
- 22-3 GRID CELL ID

AVERAGE SEDIMENT REMOVAL THICKNESS (FT)

- 0 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- 2.0 - 5.0
- > 5.0

NOTE:

1. DREDGE AREAS BASED ON FEBRUARY 28TH PHASE 1 DAD REPORT.
2. GRID CELLS FROM QEA RESUSPENSION MODELING (ATTACHMENT E) WITH MODIFICATIONS BY BBL.
3. SHORELINE AND SHORELINE STRUCTURES BASED ON AERIAL MAPPING PERFORMED BY CHAS H. SELLS, INC IN THE SPRING OF 2002.

0 200 400 Feet

GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
HUDSON RIVER PCBs SUPERFUND SITE
PHASE 1 INTERMEDIATE DESIGN REPORT

DREDGE CELLS CLASSIFIED BY REMOVAL THICKNESS - NTIP NORTH CENTRAL

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FIGURE **3-13**

8/20/05 SYR-85 MTK KEW mtk
GE Hudson
G:\GE_GIS\GE-HudsonRiver\DA_Prism_Classifications\...\BBL_DredgeCellsbyRemovalThickness-NTIPNorthCentral.mxd

LEGEND:

- EXISTING STRUCTURE
- DREDGE AREAS
- SHORELINE
- 22-3 GRID CELL ID

AVERAGE SEDIMENT REMOVAL THICKNESS (FT)

- 0 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- 2.0 - 5.0
- > 5.0

NOTE:

1. DREDGE AREAS BASED ON FEBRUARY 28TH PHASE 1 DAD REPORT.
2. GRID CELLS FROM QEA RESUSPENSION MODELING (ATTACHMENT E) WITH MODIFICATIONS BY BBL.
3. SHORELINE AND SHORELINE STRUCTURES BASED ON AERIAL MAPPING PERFORMED BY CHAS H. SELLS, INC IN THE SPRING OF 2002.

0 200 400 Feet

GRAPHIC SCALE

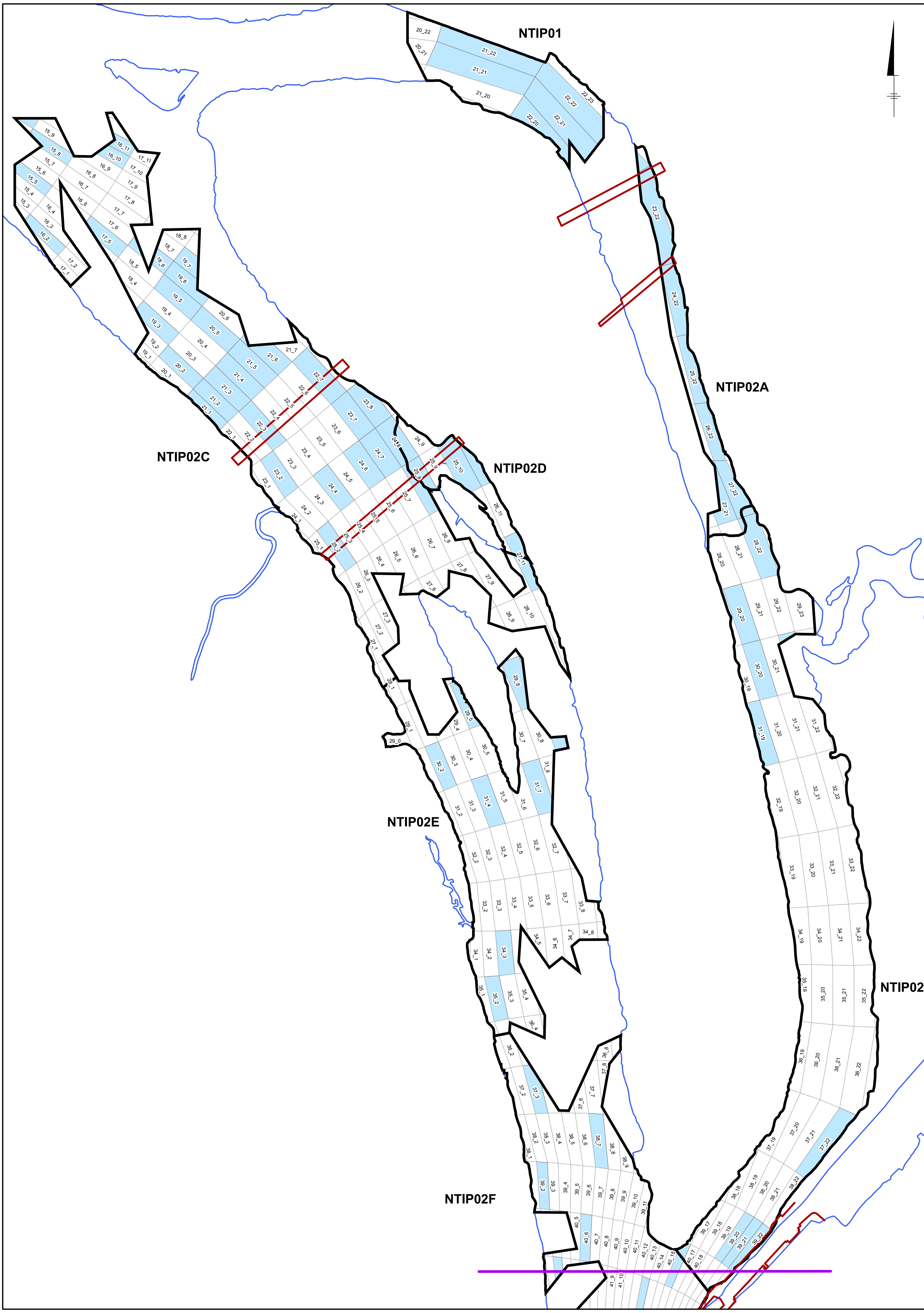
8/20/05 SYR-85 MTK KEW MTK
GE Hudson
G:\GE_GIS\GE-HudsonRiver\DA_Prism_Classifications\...\BBL_DredgeCellsbyRemovalThickness-EGIA.mxd

GENERAL ELECTRIC COMPANY
HUDSON RIVER PCBs SUPERFUND SITE
PHASE 1 INTERMEDIATE DESIGN REPORT

DREDGE CELLS CLASSIFIED BY REMOVAL THICKNESS - EGIA

BBL®
BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

FIGURE
3-14



LEGEND:

- EXISTING STRUCTURE
- DREDGE AREAS
- SHORELINE
- 22-3 GRID CELL ID
- GRAVEL, ROCK, OR REFUSAL NOT ENCOUNTERED WITHIN DREDGING DEPTH
- GRAVEL, ROCK, OR REFUSAL ENCOUNTERED WITHIN DREDGING DEPTH

NOTE:

1. DREDGE AREAS BASED ON FEBRUARY 28TH PHASE 1 DAD REPORT.
2. GRID CELLS FROM QEA RESUSPENSION MODELING (ATTACHMENT E) WITH MODIFICATIONS BY BBL.
3. SHORELINE AND SHORELINE STRUCTURES BASED ON AERIAL MAPPING PERFORMED BY CHAS H. SELLS, INC IN THE SPRING OF 2002.

0 320 640 Feet

GRAPHIC SCALE

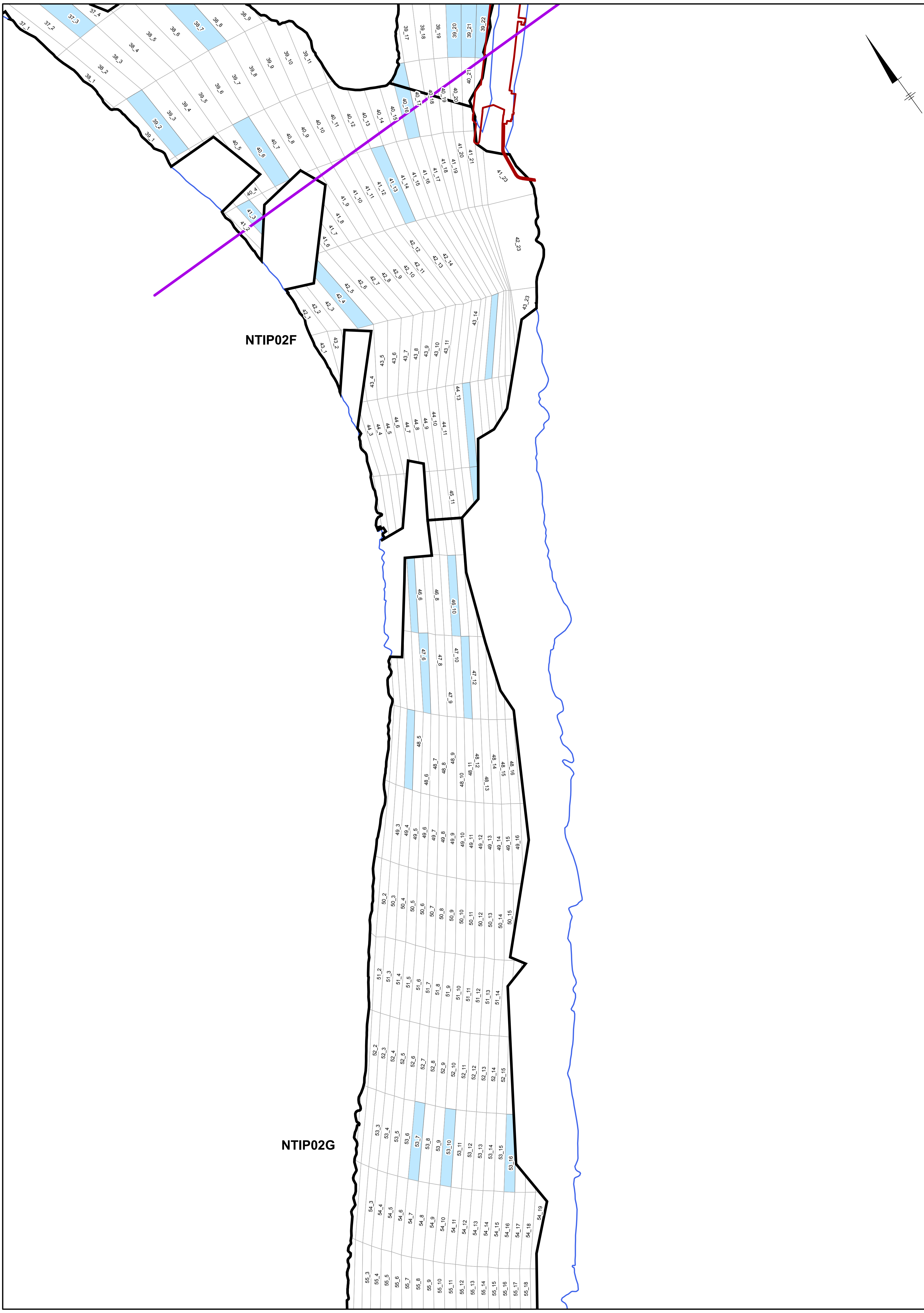
8/20/05 SYR-85 MTK KEW MTK
GE Hudson
G:\GE_GIS\GE-HudsonRiver\DA_Prism_Classifications\...\BBL_DredgeCellsbyRockClass-NTIPNorth.mxd

GENERAL ELECTRIC COMPANY
HUDSON RIVER PCBs SUPERFUND SITE
PHASE 1 INTERMEDIATE DESIGN REPORT

DREDGE CELLS CHARACTERIZED AS HAVING GRAVEL, ROCK, OR REFUSAL NTIP - NORTH

BBL® BLASLAND, BOUCK & LEE, INC. *engineers, scientists, economists*

FIGURE **3-15**



LEGEND:

- EXISTING STRUCTURE
- DREDGE AREAS
- SHORELINE
- 22-3 GRID CELL ID
- GRAVEL, ROCK, OR REFUSAL NOT ENCOUNTERED WITHIN DREDGING DEPTH
- GRAVEL, ROCK, OR REFUSAL ENCOUNTERED WITHIN DREDGING DEPTH

NOTE:

1. DREDGE AREAS BASED ON FEBRUARY 28TH PHASE 1 DAD REPORT.
2. GRID CELLS FROM QEA RESUSPENSION MODELING (ATTACHMENT E) WITH MODIFICATIONS BY BBL.
3. SHORELINE AND SHORELINE STRUCTURES BASED ON AERIAL MAPPING PERFORMED BY CHAS H. SELLS, INC IN THE SPRING OF 2002.

0 200 400 Feet

GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
HUDSON RIVER PCBs SUPERFUND SITE

PHASE 1 INTERMEDIATE DESIGN REPORT

DREDGE CELLS CHARACTERIZED AS HAVING GRAVEL, ROCK, OR REFUSAL NTIP - NORTH CENTRAL

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FIGURE 3-16

8/20/05 SYR-85 MTK KEW MTK
GE Hudson
G:\GE_GIS\GE-HudsonRiver\DA_Prism_Classifications\...\BBL_DredgeCellsbyRockClass-NTIPNorthCentral.mxd

LEGEND:

- EXISTING STRUCTURE
- DREDGE AREAS
- SHORELINE
- 22-3 GRID CELL ID
- GRAVEL, ROCK, OR REFUSAL NOT ENCOUNTERED WITHIN DREDGING DEPTH
- GRAVEL, ROCK, OR REFUSAL ENCOUNTERED WITHIN DREDGING DEPTH

NOTE:

1. DREDGE AREAS BASED ON FEBRUARY 28TH PHASE 1 DAD REPORT.
2. GRID CELLS FROM QEA RESUSPENSION MODELING (ATTACHMENT E) WITH MODIFICATIONS BY BBL.
3. SHORELINE AND SHORELINE STRUCTURES BASED ON AERIAL MAPPING PERFORMED BY CHAS H. SELLS, INC IN THE SPRING OF 2002.

0 200 400 Feet

GRAPHIC SCALE

8/20/05 SYR-85 MTK KEW MTK
GE Hudson
G:\GE_GIS\GE-HudsonRiver\DA_Prism_Classifications\...\BBL_DredgeCellsbyRockClass-EGIA.mxd

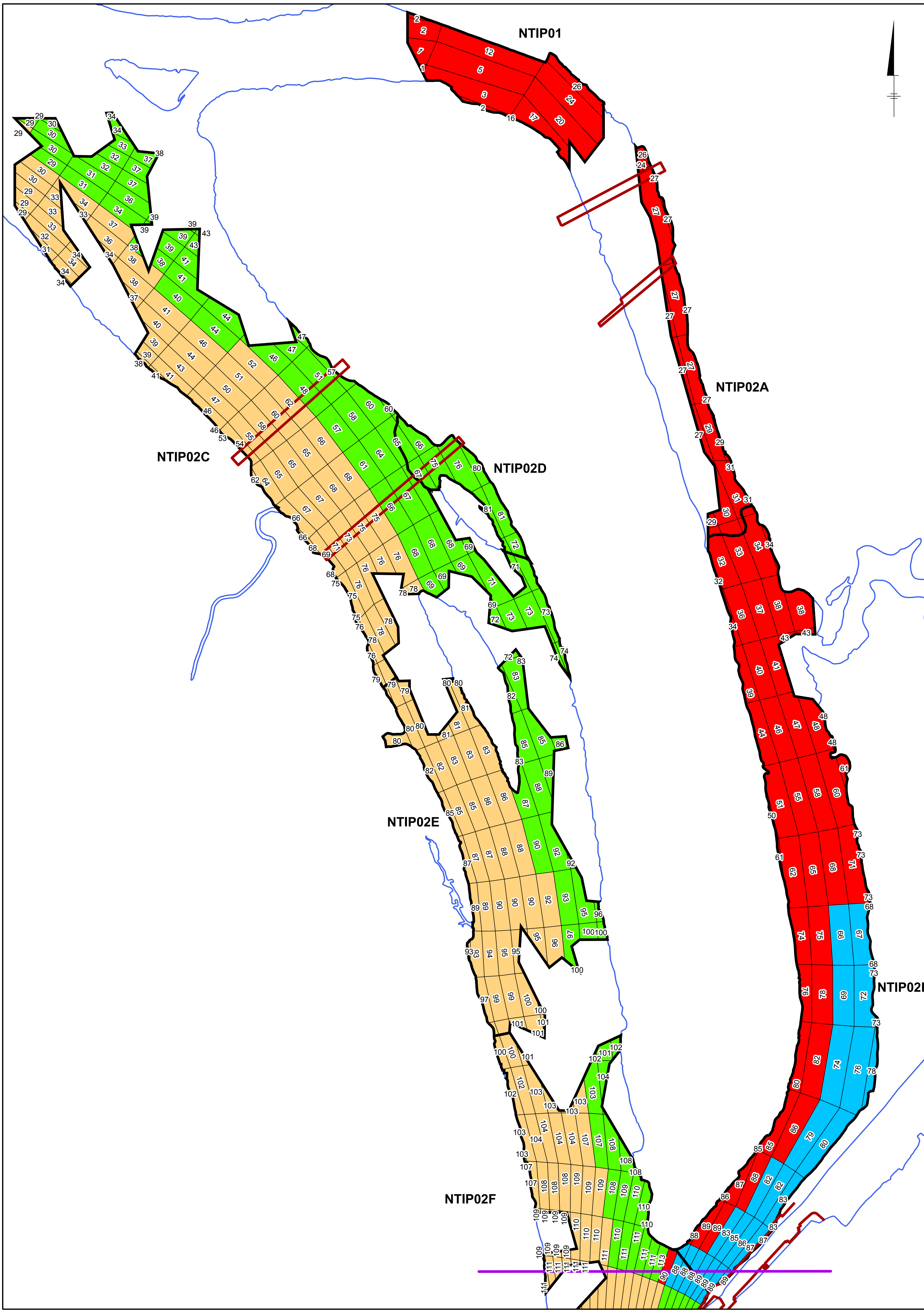
GENERAL ELECTRIC COMPANY
HUDSON RIVER PCBs SUPERFUND SITE

PHASE 1 INTERMEDIATE DESIGN REPORT

DREDGE CELLS CHARACTERIZED AS HAVING GRAVEL, ROCK, OR REFUSAL EGIA

BBL® BLASLAND, BOUCK & LEE, INC. *engineers, scientists, economists*

FIGURE **3-17**



LEGEND:

- EXISTING STRUCTURE
- DREDGE AREAS
- SHORELINE
- 15 APPROXIMATE DREDGE DAY

DREDGE ID

- DREDGE 1
- DREDGE 2
- DREDGE 3
- DREDGE 4

NOTE:

1. DREDGE AREAS BASED ON FEBRUARY 28TH PHASE 1 DAD REPORT.
2. GRID CELLS FROM QEA RESUSPENSION MODELING (ATTACHMENT E) WITH MODIFICATIONS BY BBL.
3. SHORELINE AND SHORELINE STRUCTURES BASED ON AERIAL MAPPING PERFORMED BY CHAS H. SELLS, INC IN THE SPRING OF 2002.

0 320 640 Feet

GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
HUDSON RIVER PCBs SUPERFUND SITE

PHASE 1 INTERMEDIATE DESIGN REPORT

APPROXIMATE DAY AND LOCATION OF PRODUCTION DREDGES DURING PHASE 1 NTIP NORTH

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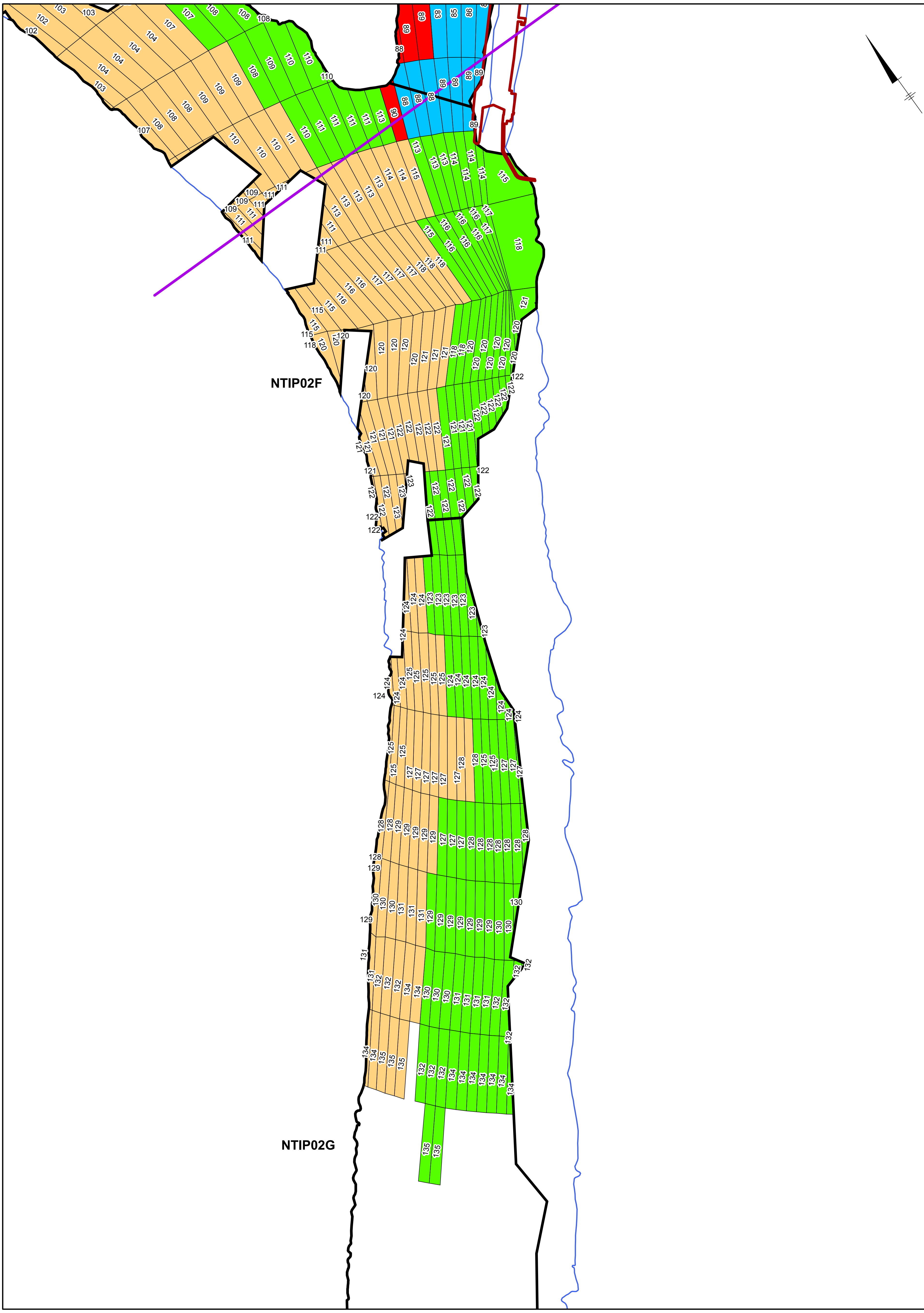
FIGURE **3-18**

8/20/05 SYR-85 MTK KEW MTK
GE Hudson
G:\GE_GIS\GE-HudsonRiver\DA_Prism_Classifications\...\BBL_DredgeCellsbyDredgeDate-NTIPNorth.mxd



LEGEND:

- EXISTING STRUCTURE
- DREDGE AREAS
- SHORELINE
- 15 APPROXIMATE DREDGE DAY

DREDGE ID

- DREDGE 1
- DREDGE 2
- DREDGE 3
- DREDGE 4

NOTE:

1. DREDGE AREAS BASED ON FEBRUARY 28TH PHASE 1 DAD REPORT.
2. GRID CELLS FROM QEA RESUSPENSION MODELING (ATTACHMENT E) WITH MODIFICATIONS BY BBL.
3. SHORELINE AND SHORELINE STRUCTURES BASED ON AERIAL MAPPING PERFORMED BY CHAS H. SELLS, INC IN THE SPRING OF 2002.

0 200 400 Feet

GRAPHIC SCALE

8/20/05 SYR-85 MTK KEW MTK
GE Hudson
G:\GE_GIS\GE-HudsonRiver\DA_Prism_Classifications\...\BBL_DredgeCellsbyDredgeDate-NTIPNorthCentral.mxd

GENERAL ELECTRIC COMPANY
HUDSON RIVER PCBs SUPERFUND SITE

PHASE 1 INTERMEDIATE DESIGN REPORT

APPROXIMATE DAY AND LOCATION OF PRODUCTION DREDGES DURING PHASE 1 NTIP NORTH CENTRAL

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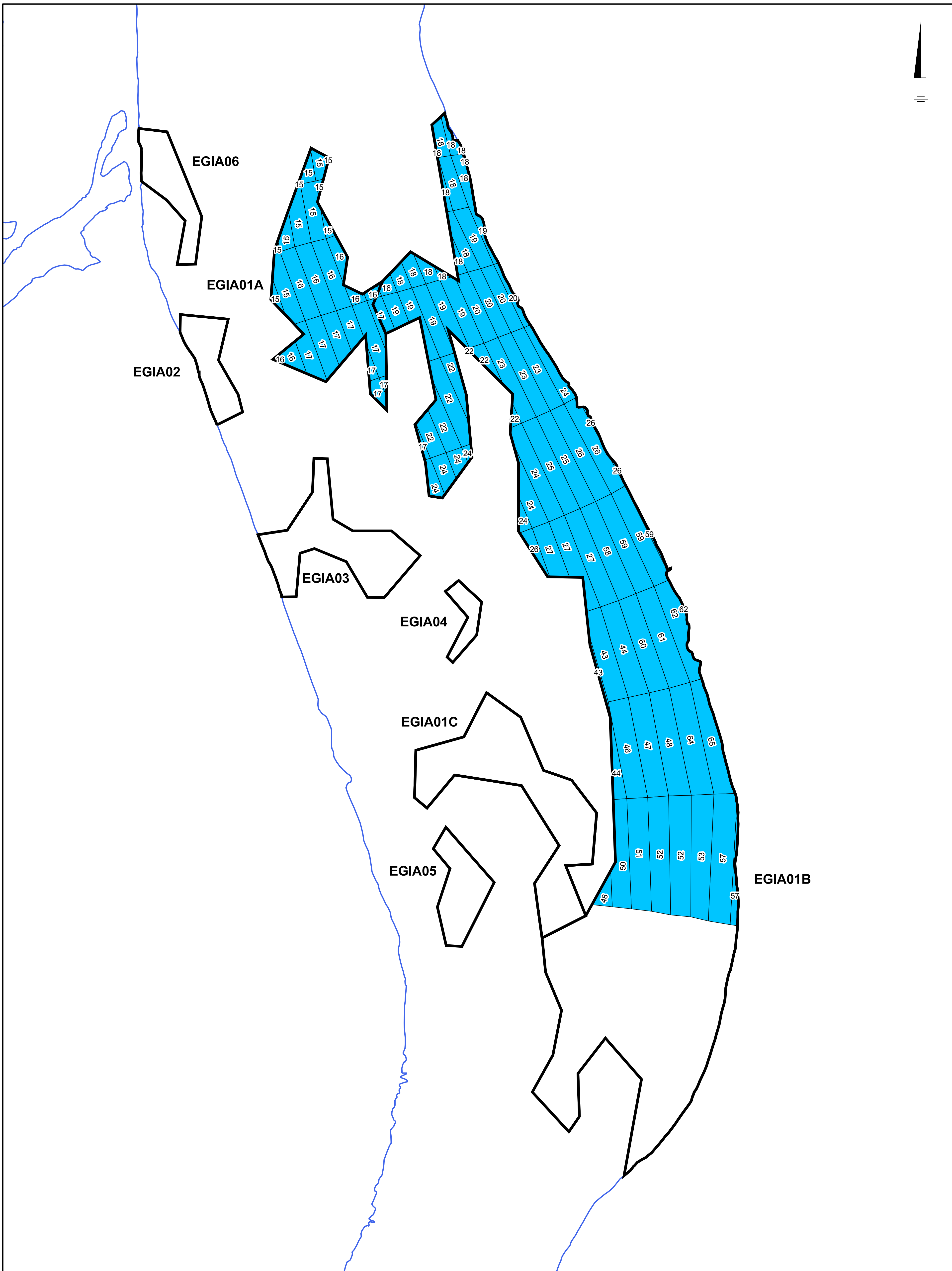
FIGURE
3-19



LEGEND:

- EXISTING STRUCTURE
- DREDGE AREAS
- SHORELINE
- 15 APPROXIMATE DREDGE DAY

DREDGE ID

- DREDGE 1
- DREDGE 2
- DREDGE 3
- DREDGE 4

NOTE:

1. DREDGE AREAS BASED ON FEBRUARY 28TH PHASE 1 DAD REPORT.
2. GRID CELLS FROM QEA RESUSPENSION MODELING (ATTACHMENT E) WITH MODIFICATIONS BY BBL.
3. SHORELINE AND SHORELINE STRUCTURES BASED ON AERIAL MAPPING PERFORMED BY CHAS H. SELLS, INC IN THE SPRING OF 2002.

0 200 400 Feet

GRAPHIC SCALE

8/20/05 SYR-85 MTK KEW MTK
GE Hudson
G:\GE_GIS\GE-HudsonRiver\DA_Prism_Classifications\...\BBL_DredgeCellsbyDredgeDate-EGIA.mxd

GENERAL ELECTRIC COMPANY
HUDSON RIVER PCBs SUPERFUND SITE

PHASE 1 INTERMEDIATE DESIGN REPORT

APPROXIMATE DAY AND LOCATION OF PRODUCTION DREDGES DURING PHASE 1 EGIA

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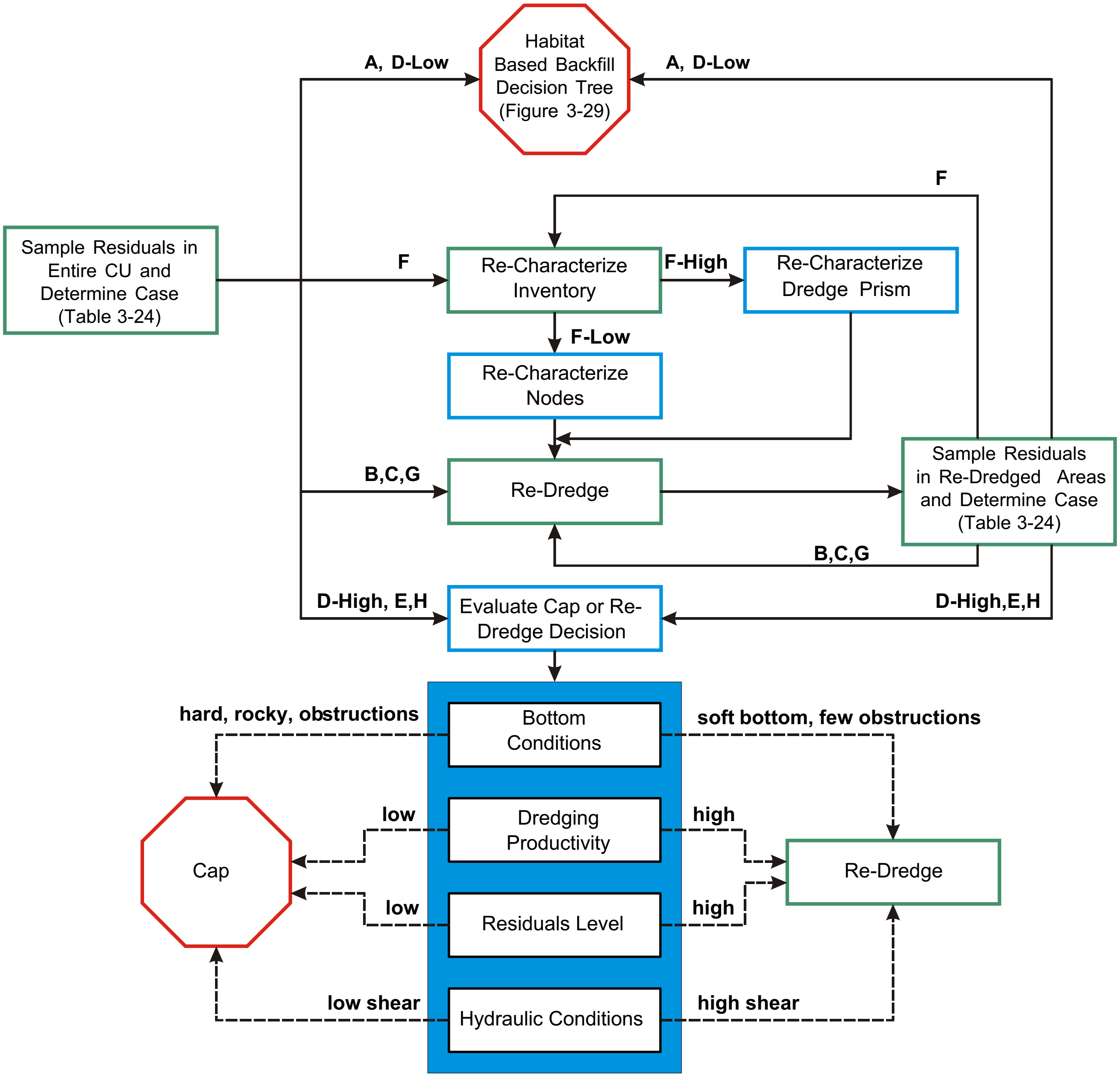
FIGURE
3-20



NOTES

1. Refer to Table 3-24 for notes on the residual sediment cases.

2. - - - - - Consideration when both capping and re-dredging are available.

GENERAL ELECTRIC COMPANY
HUDSON RIVER PCBs SUPERFUND SITE
PHASE 1 INTERMEDIATE DESIGN REPORT

RESIDUALS FRAMEWORK FLOWCHART

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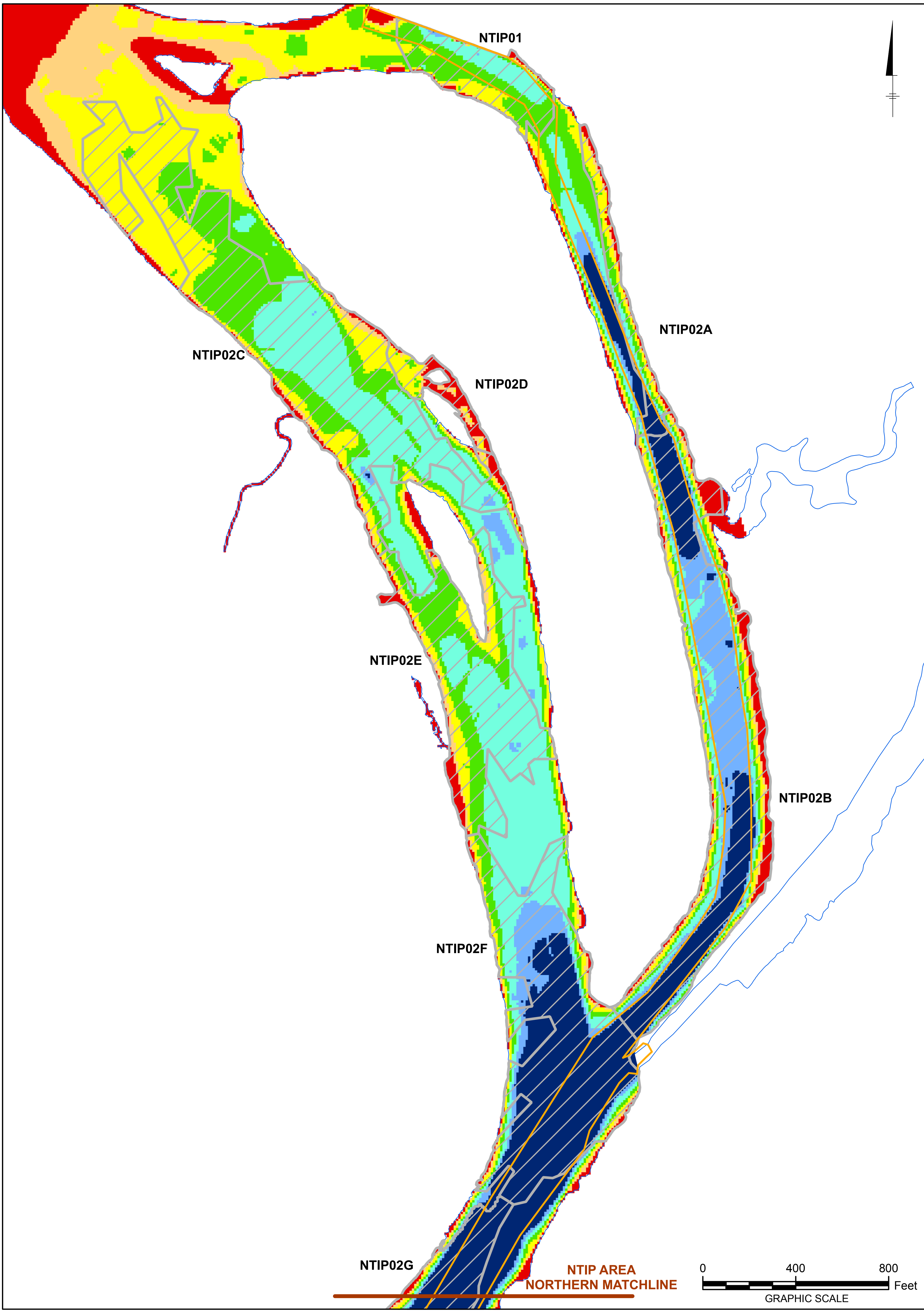
FIGURE
3-21

08/20/05 SYR-D85-DJH-KLS-DJH
N:20437007/cdr/20437007g012.cdr



LEGEND:
- SHORELINE
- NAVIGATION CHANNEL
- DREDGE AREAS

WATER DEPTH (FT)
- 0 - 2
- 2 - 3
- 3 - 5
- 5 - 7
- 7 - 10
- 10 - 12
- > 12

NOTE:
1. DREDGE AREAS BASED ON FEBRUARY 28TH PHASE 1 DAD REPORT.
2. SHORELINE AND SHORELINE STRUCTURES BASED ON AERIAL MAPPING PERFORMED BY CHAS H. SELLS, INC IN THE SPRING OF 2002.
3. WATER DEPTH CALCULATION BASED ON A SURFACE WATER ELEVATION OF 120-FT (APPROXIMATELY 3,000 CFS).
4. ESTIMATED LOCATION OF NAVIGATION CHANNEL AS DEVELOPED BY QEA AND BBL BASED ON HISTORICAL MAPS, DREDGING, AND BATHYMETRIC DATA.

8/20/05 SYR-85 MTK KEW MTK
GE Hudson
G:\GE_GIS\GE-HudsonRiver\...\WaterDepths-NTIPNorth.mxd

GENERAL ELECTRIC COMPANY
HUDSON RIVER PCBs SUPERFUND SITE
PHASE 1 INTERMEDIATE DESIGN REPORT

WATER DEPTHS THROUGHOUT THE PHASE 1 STUDY AREA - NTIP NORTH

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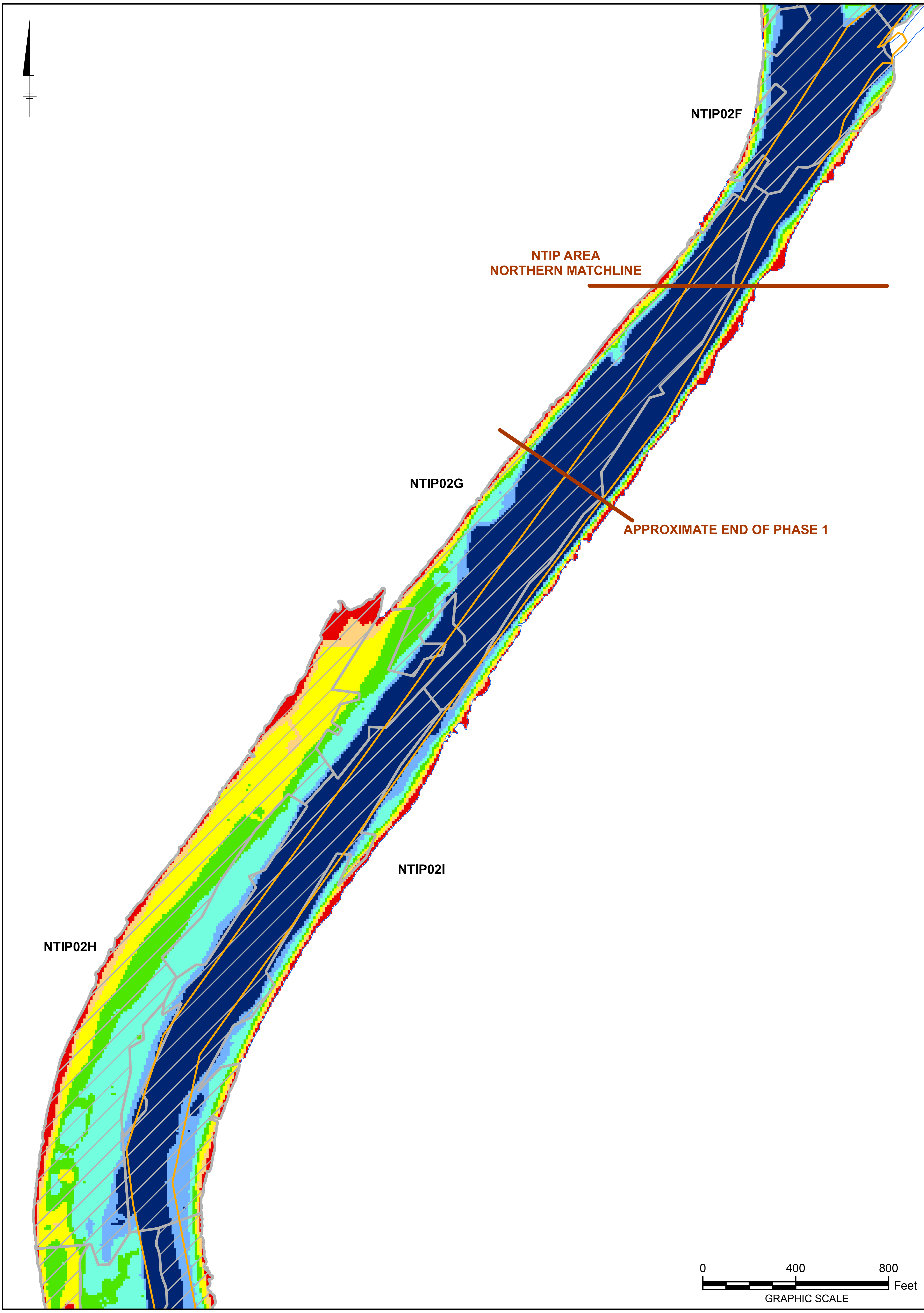
FIGURE **3-22**



LEGEND:

- SHORELINE
- NAVIGATION CHANNEL
- DREDGE AREAS

WATER DEPTH (FT)

- 0 - 2
- 2 - 3
- 3 - 5
- 5 - 7
- 7 - 10
- 10 - 12
- > 12

NOTE:

1. DREDGE AREAS BASED ON FEBRUARY 28TH PHASE 1 DAD REPORT.
2. SHORELINE AND SHORELINE STRUCTURES BASED ON AERIAL MAPPING PERFORMED BY CHAS H. SELLS, INC IN THE SPRING OF 2002.
3. WATER DEPTH CALCULATION BASED ON A SURFACE WATER ELEVATION OF 120-FT (APPROXIMATELY 3,000 CFS).
4. ESTIMATED LOCATION OF NAVIGATION CHANNEL AS DEVELOPED BY QEA AND BBL BASED ON HISTORICAL MAPS, DREDGING, AND BATHYMETRIC DATA.

8/20/05 SYR-85 MTK KEW MTK
GE Hudson
G:\GE_GIS\GE-HudsonRiver\DA_Prism_Classifications\...\WaterDepths-NTIPSouth.mxd

GENERAL ELECTRIC COMPANY
HUDSON RIVER PCBs SUPERFUND SITE
PHASE 1 INTERMEDIATE DESIGN REPORT

WATER DEPTHS THROUGHOUT THE PHASE 1 STUDY AREA - NTIP SOUTH

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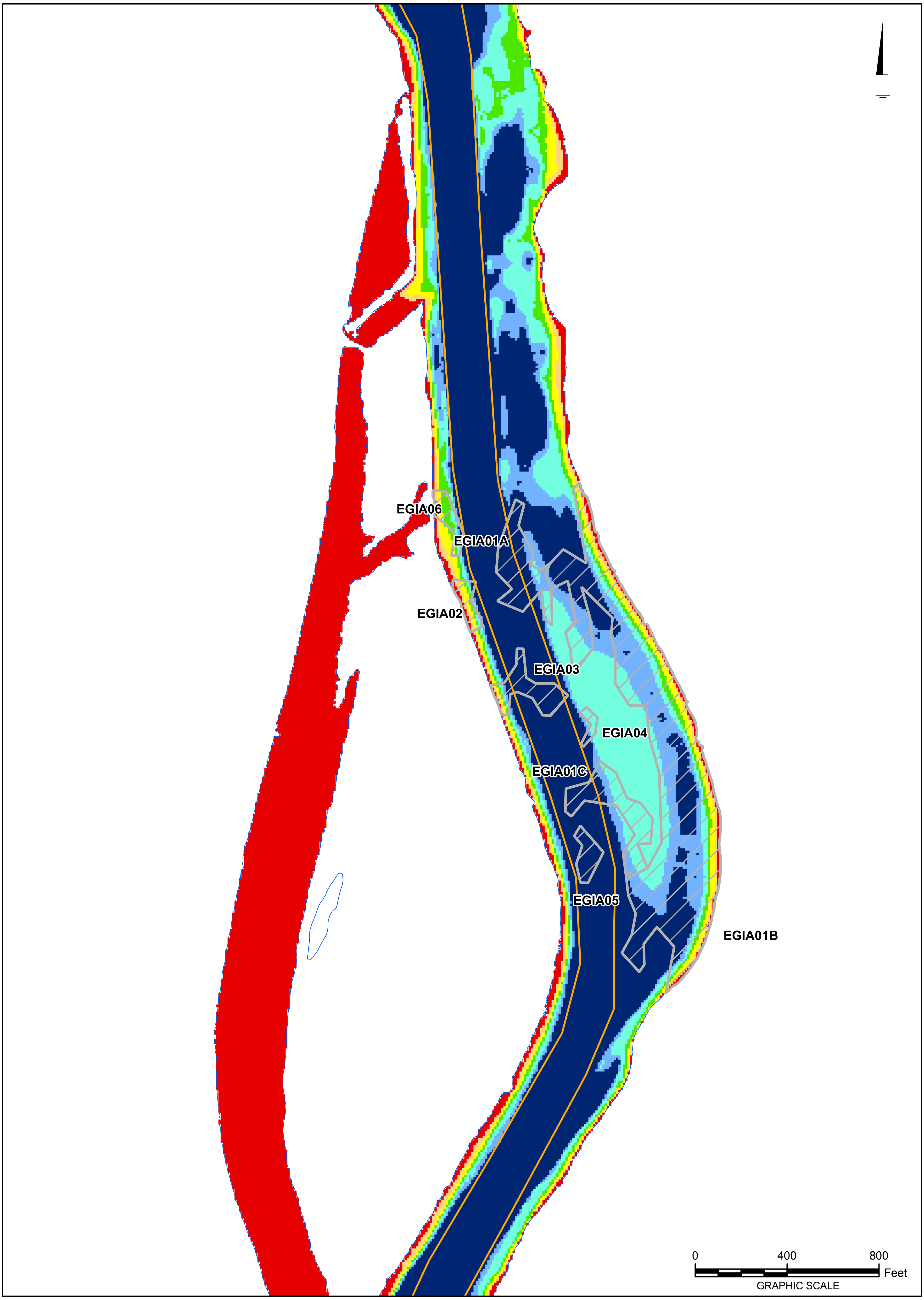
FIGURE
3-23



LEGEND:

- SHORELINE
- NAVIGATION CHANNEL
- DREDGE AREAS

WATER DEPTH (FT)

- 0 - 2
- 2 - 3
- 3 - 5
- 5 - 7
- 7 - 10
- 10 - 12
- > 12

NOTE:

1. DREDGE AREAS BASED ON FEBRUARY 28TH PHASE 1 DAD REPORT.
2. SHORELINE AND SHORELINE STRUCTURES BASED ON AERIAL MAPPING PERFORMED BY CHAS H. SELLS, INC IN THE SPRING OF 2002.
3. WATER DEPTH CALCULATION BASED ON A SURFACE WATER ELEVATION OF 120-FT (APPROXIMATELY 3,000 CFS).
4. ESTIMATED LOCATION OF NAVIGATION CHANNEL AS DEVELOPED BY QEA AND BBL BASED ON HISTORICAL MAPS, DREDGING, AND BATHYMETRIC DATA.

8/20/05 SYR-85 MTK KEW MTK
GE Hudson
G:\GE_GIS\GE-HudsonRiver\DA_Prism_Classifications\...\WaterDepths-EGIA.mxd

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HUDSON RIVER PCBs SUPERFUND SITE
PHASE 1 INTERMEDIATE DESIGN REPORT

WATER DEPTHS THROUGHOUT THE PHASE 1 STUDY AREA - EGIA

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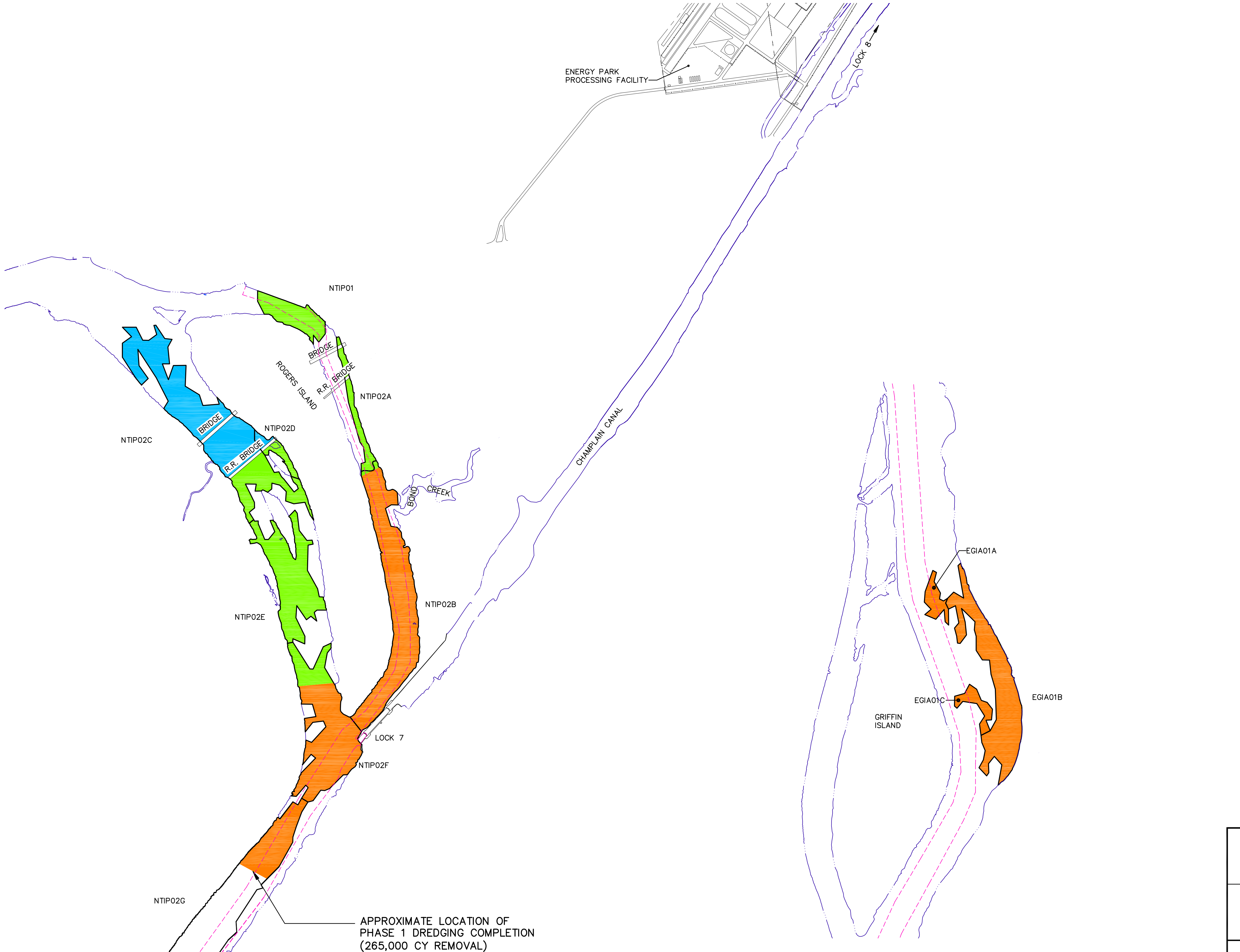
engineers, scientists, economists

FIGURE
3-24



LEGEND:

- APPROXIMATE SHORELINE
- APPROXIMATE NAVIGATION CHANNEL
- FULL LOAD BARGE (1,000 CY) 195' x 35'
- FULL LOAD SMALL BARGE (500 CY) 100' x 30'
- OUTLINE OF DREDGE AREA
- BRIDGES
- NO BARGE ACCESS
- SMALL BARGE ACCESS
- LARGE BARGE ACCESS

NOTES:

1. DREDGE AREAS BASED ON FEB. 28TH DAD REPORT.
2. MAPPING GENERATED BY CHAS H. SELLS BASED ON AERIAL PHOTOGRAPHY FROM SPRING OF 2001. SUPPLEMENTED WITH DATA ACQUIRED FROM THE NEW YORK STATE GIS CLEARINGHOUSE WEBSITE.
3. BARGES SHOWN TO SCALE IN LEGEND TO PROVIDE SIZE COMPARISON.
4. ESTIMATED LOCATION OF NAVIGATION CHANNEL AS DEVELOPED BY QEA AND BBL BASED ON HISTORICAL MAPS, DREDGING, AND BATHYMETRIC DATA.
5. SHORELINE AND SHORELINE STRUCTURES BASED ON AERIAL MAPPING PERFORMED BY CHAS H. SELLS, INC. IN THE SPRING OF 2002.

X: HUDSONRIVER01: 05511X01.DWG
L: OFF=REF
P: PAGESET/PLT-DL
8/21/05 SYR-85-SDL DJP LAF
N/20437200/20437G04.DWG

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HUDSON RIVER PCBS SUPERFUND SITE
PHASE 1 INTERMEDIATE DESIGN REPORT

BARGE ACCESSIBILITY PLAN

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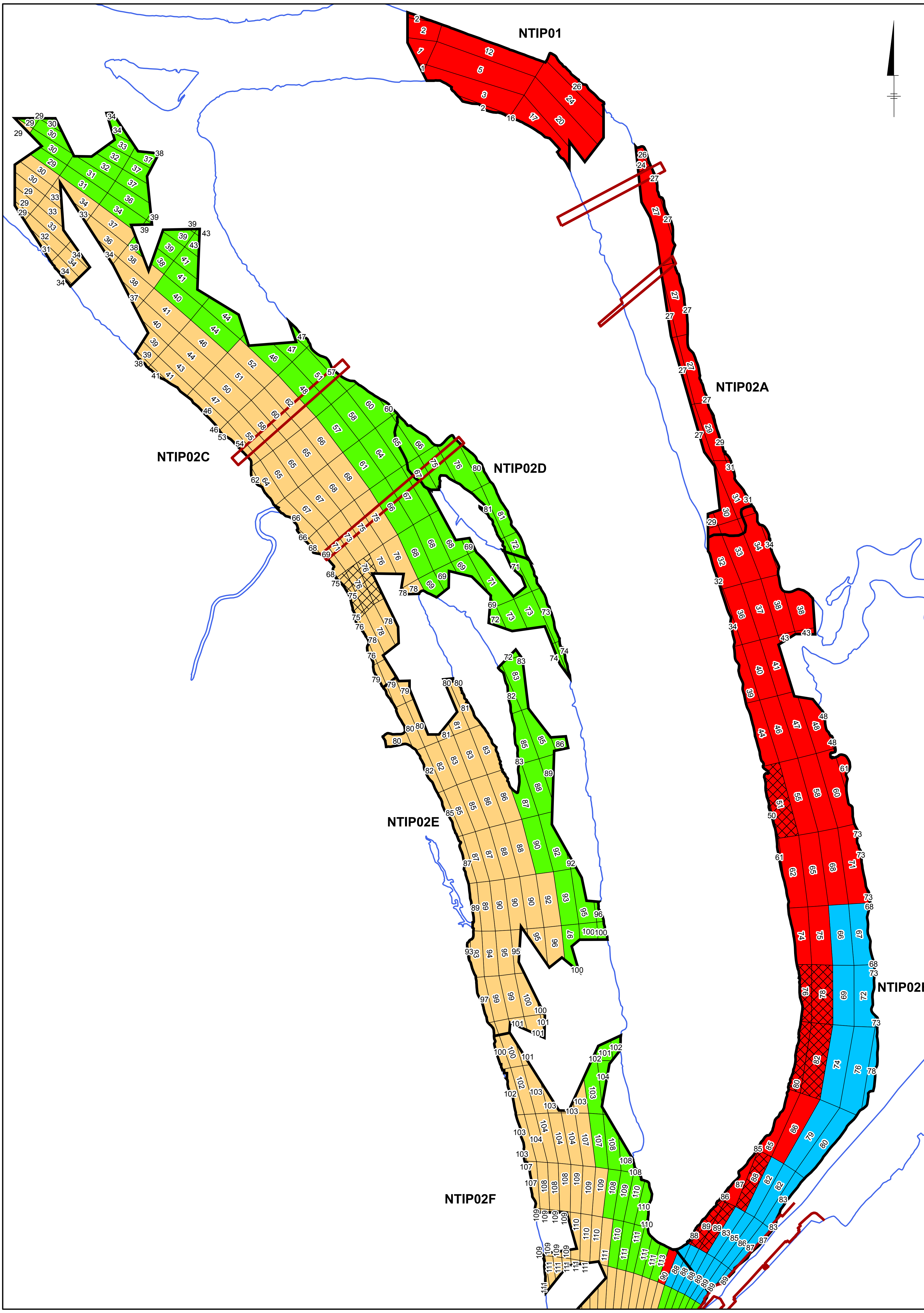
FIGURE **3-25**



LEGEND:

- EXISTING STRUCTURE
- DREDGE AREAS
- SHORELINE
- 15 APPROXIMATE DREDGE DAY
- CONTINGENT CONTROL AREA

DREDGE ID

- DREDGE 1
- DREDGE 2
- DREDGE 3
- DREDGE 4

0 320 640 Feet

GRAPHIC SCALE

NOTE:

1. DREDGE AREAS BASED ON FEBRUARY 28TH PHASE 1 DAD REPORT.
2. GRID CELLS FROM QEA RESUSPENSION MODELING (ATTACHMENT E) WITH MODIFICATIONS BY BBL.
3. SHORELINE AND SHORELINE STRUCTURES BASED ON AERIAL MAPPING PERFORMED BY CHAS H. SELLS, INC IN THE SPRING OF 2002.
4. HIGHLIGHTS/HATCHING INDICATES ADDITIONAL CONTINGENT CONTROL AREAS.

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HUDSON RIVER PCBs SUPERFUND SITE

PHASE 1 INTERMEDIATE DESIGN REPORT

CONTINGENT CONTROL AREAS DURING PHASE 1 - NTIP NORTH

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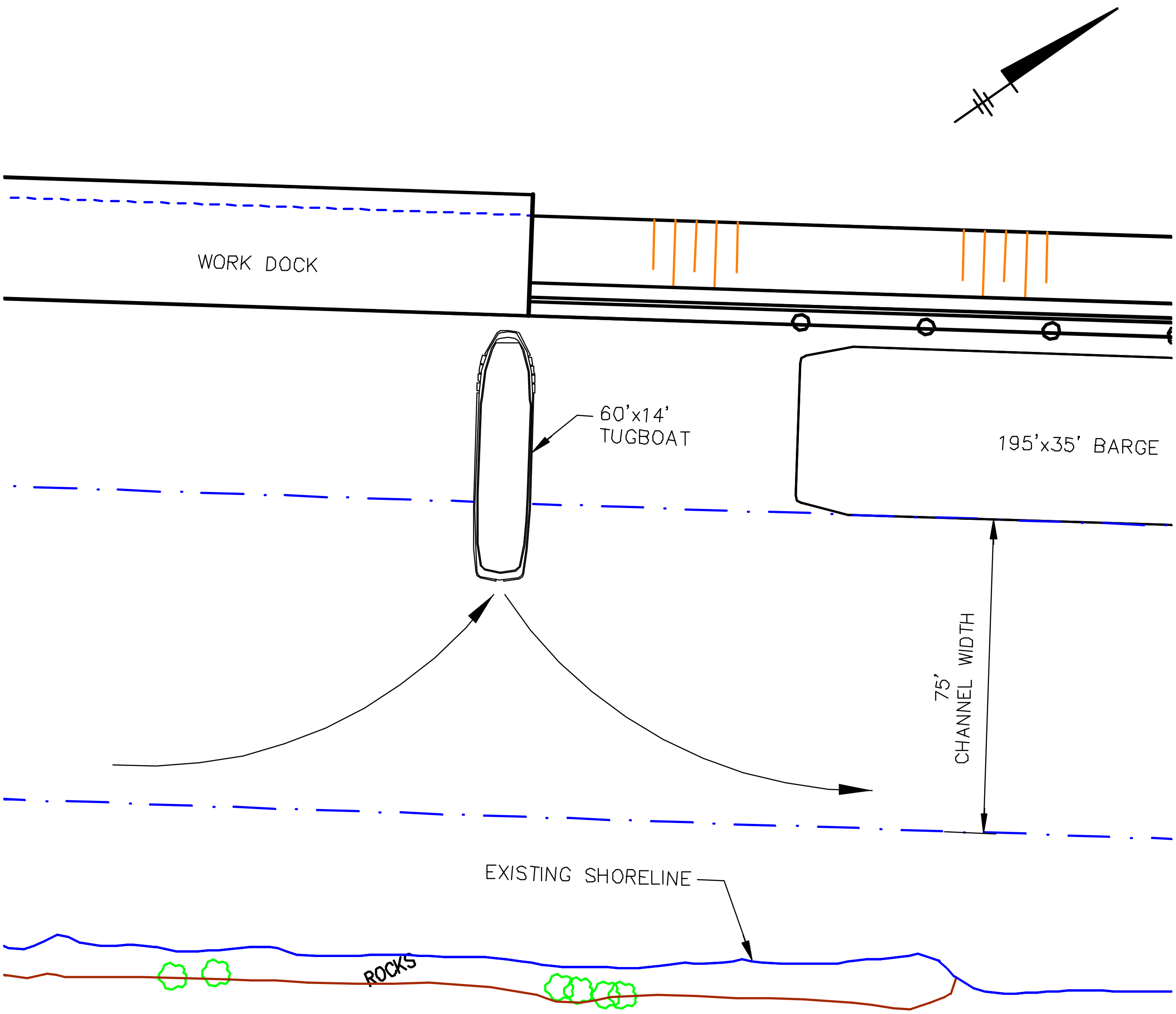
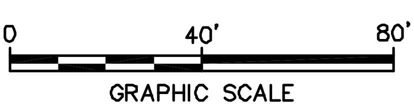
FIGURE
3-26

8/20/05 SYR-85 MTK KEW MTK
GE Hudson
G:\GE_GIS\GE-HudsonRiver\DA_Prism_Classifications\...\BBL_DredgeCells_ContingentControlAreas.mxd

FIGURE 3-27 PROVIDED IN SEPARATE FILE





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HUDSON RIVER PCBS SUPERFUND SITE
PHASE 1 INTERMEDIATE DESIGN REPORT

TUGBOAT MANEUVERING PLAN

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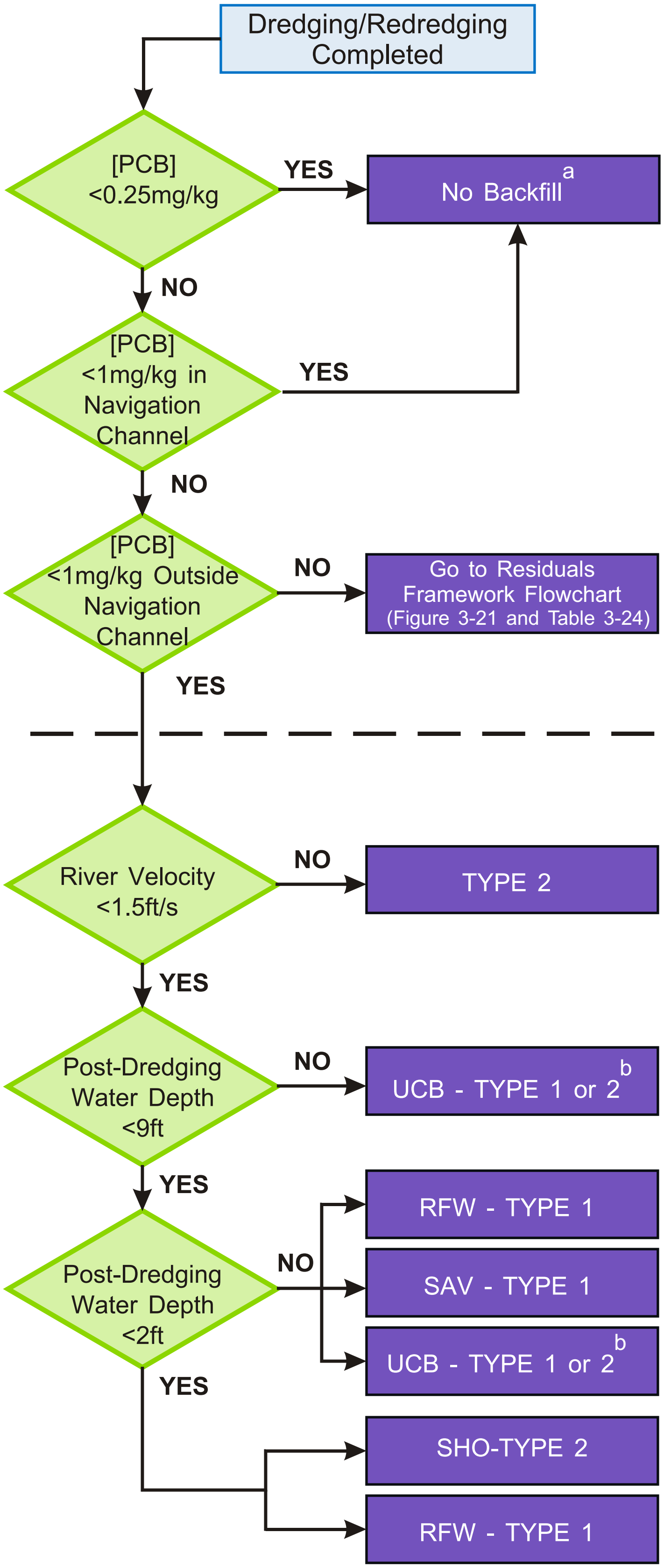
FIGURE
3-28

X: NONE
L: ON=*, OFF=*REF*
P: PAGESET/PLT-AP1
8/20/05 ANNAP-90-TMD SYR-85-BGP DJP
C/20437700/DONEGAN1/20437G24.DWG



Backfill Material Selection

NOTES:

RFW – Riverine Fringing Wetland
SAV – Aquatic Vegetation Bed
UCB – Unconsolidated River Bottom
SHO – Natural Shoreline Habitat

Type 1 – Medium-Grained Material:
This material will consist of medium sand (approximately 0.5 to 2 mm in diameter).

Type 2 – Coarse-Grained Material:
This material will consist of fine gravel (approximately 6 to 12 mm [0.25 to 0.5 inch] in diameter).

a. 15% contingent backfill volume (approximately 19,400 cy) will be available in Phase 1 specifically for habitat replacement and reconstruction purpose.

b. Use of Type 1 or Type 2 material to be determined in Phase 1 Final Design.

[PCB] = Tri+PCB

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HUDSON RIVER PCBs SUPERFUND SITE
PHASE 1 INTERMEDIATE DESIGN REPORT

HABITAT BASED BACKFILL DECISION TREE

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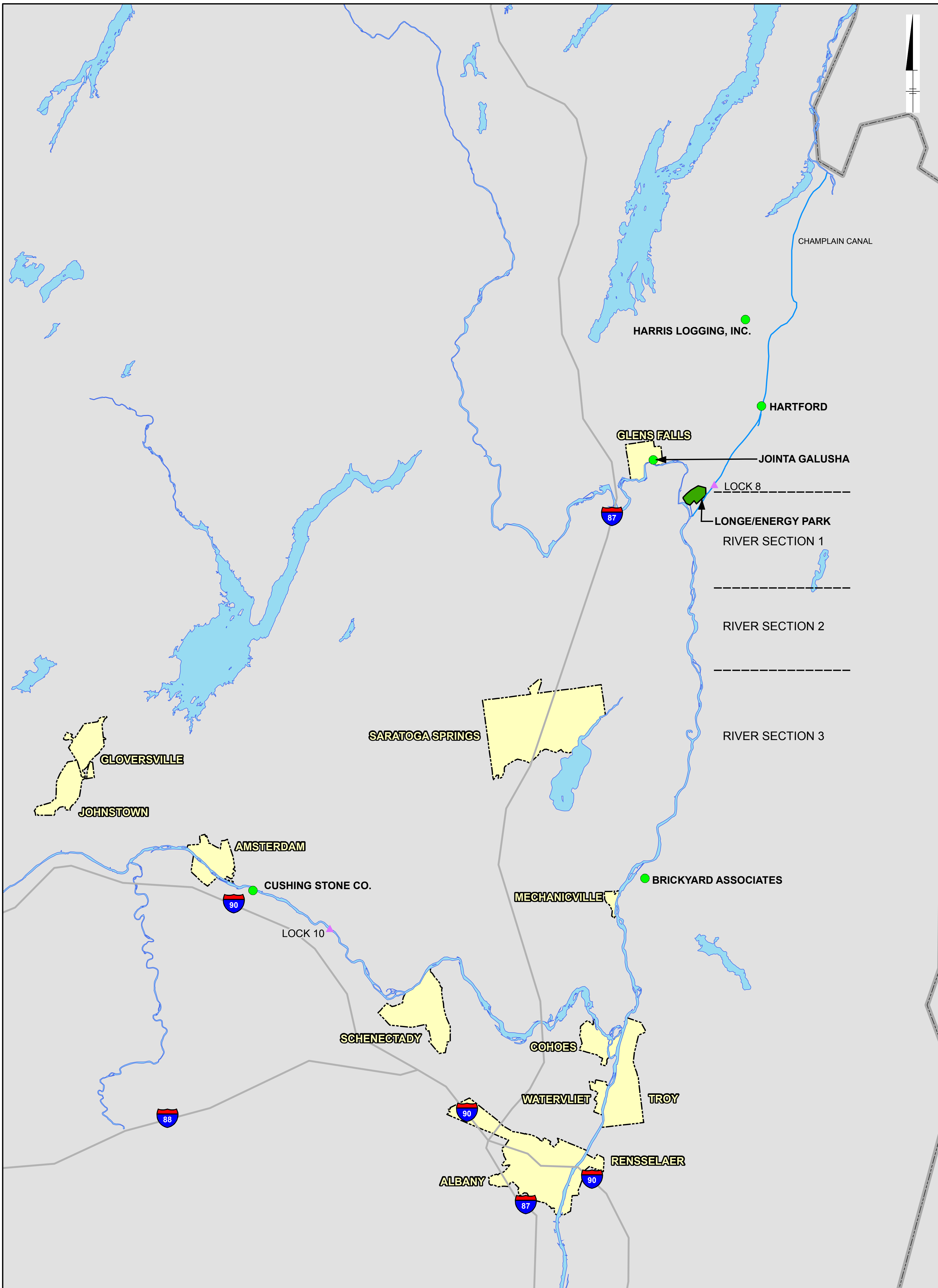
FIGURE 3-29

08/20/05 SYR-D85-DJH-DJH-KLS
n/20437007/cdr/20437g24.cdr



NOTE:

1. QUARRY LOCATIONS WERE GEOCODED USING http://www.terrafly.com/TP/advancentry.html. ALL LOCATIONS ARE APPROXIMATE.

2. BASEMAPPING PROVIDED BY QEA'S GIS DATABASE RELEASED ON 6/18/04.

0 6 12 Miles

GRAPHIC SCALE

LEGEND

- SCREENED QUARRY LOCATION
- CANAL LOCK
- WATER BODY
- CITY BOUNDARY
- STATE
- MAJOR INTERSTATE

8/20/05 SYR-85 MTK KEW MTK
GE-Hudson (20437.006)
G:\GE_GIS\GE-HudsonRiver\QuarryMap\mxd\Screened_Quarry_Locs.mxd

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PHASE 1 INTERMEDIATE DESIGN REPORT

QUARRY LOCATIONS

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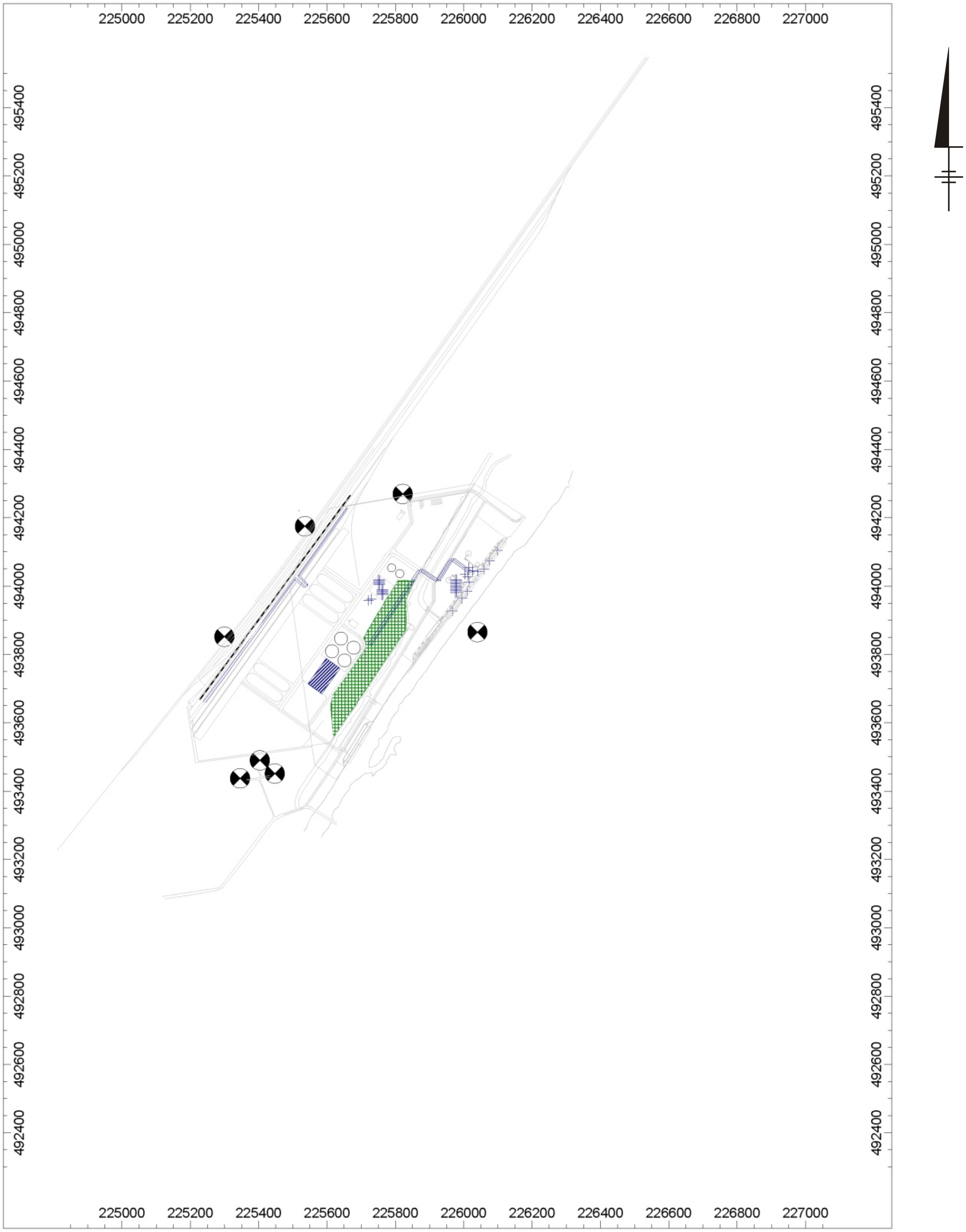
FIGURE
3-30



LEGEND:

⊗ = Approximate Receptors

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HUDSON RIVER PCBs SUPERFUND SITE

PHASE 1 INTERMEDIATE DESIGN REPORT

APPROXIMATE NOISE RECEPTOR LOCATIONS

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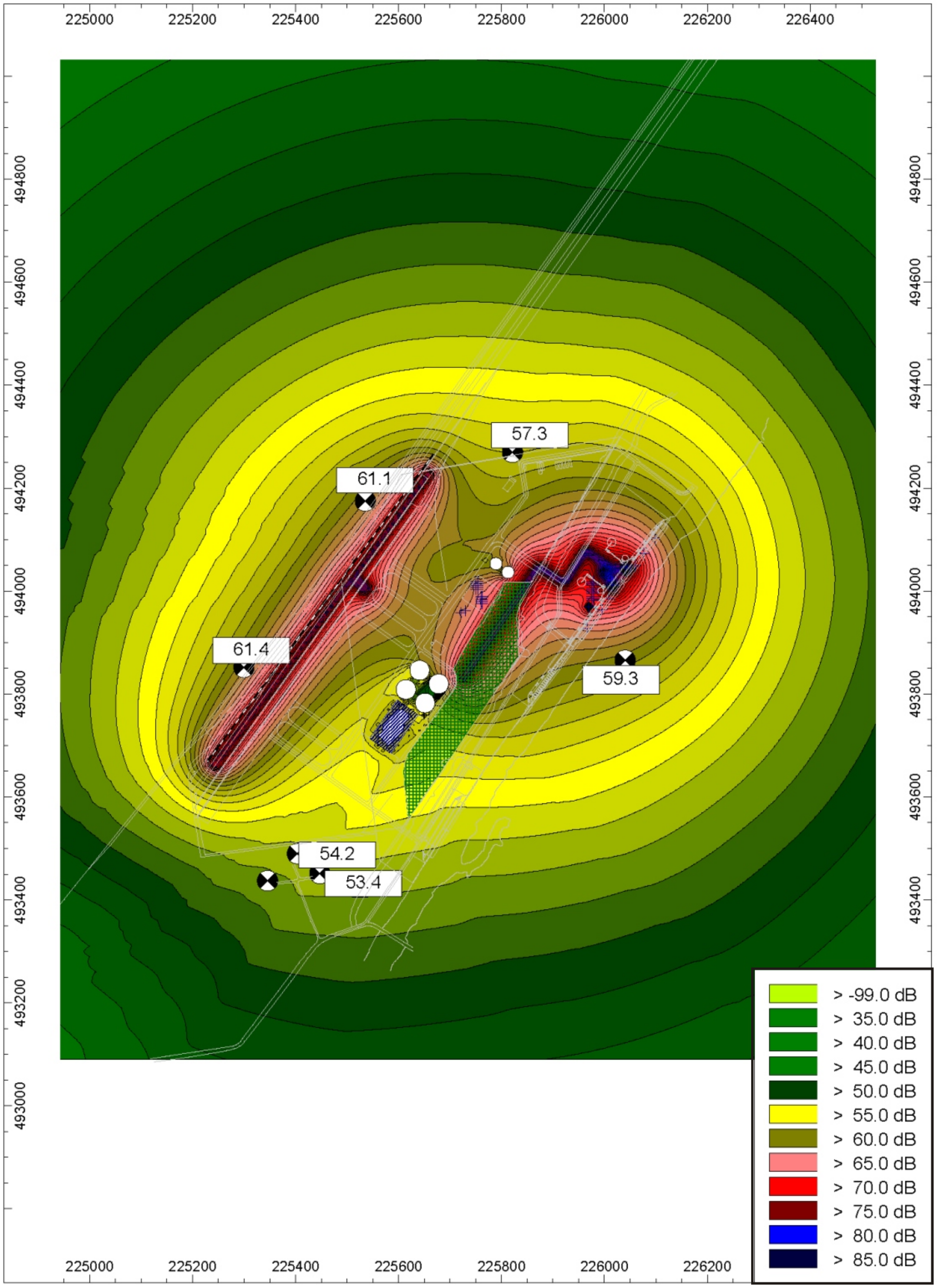
FIGURE
3-31

08/20/05 SYR-D85-DJH-KLS
N:20437703/cdr/20437G10.cdr



GENERAL ELECTRIC COMPANY
HUDSON RIVER PCBs SUPERFUND SITE
PHASE 1 INTERMEDIATE DESIGN REPORT

PREDICTED DAYTIME NOISE LEVELS

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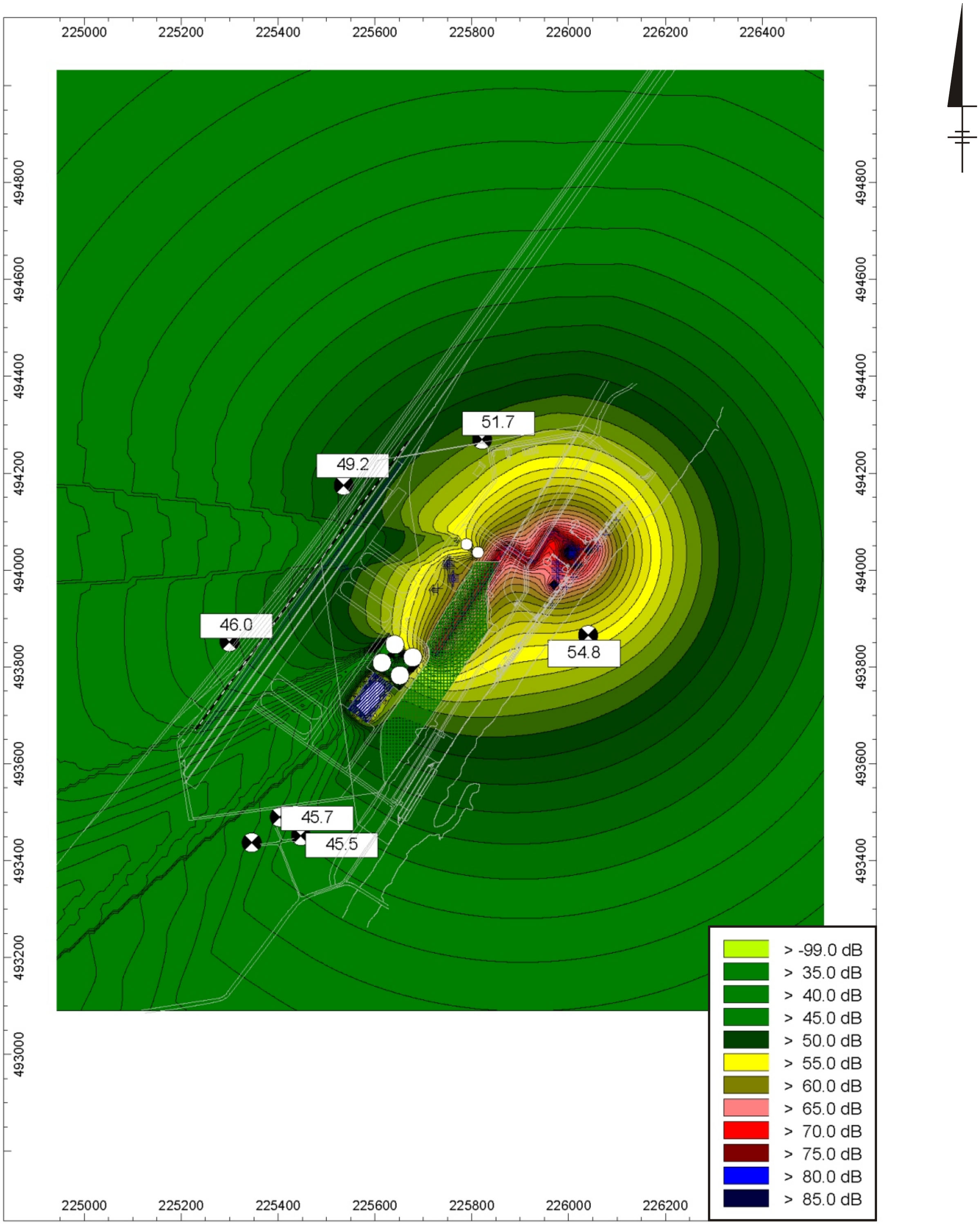
FIGURE 3-32

08/20/05 SYR-D85-DJH-KLS
N:20437703/20437G05.cdr



GENERAL ELECTRIC COMPANY
HUDSON RIVER PCBs SUPERFUND SITE
PHASE 1 INTERMEDIATE DESIGN REPORT

PREDICTED NIGHTTIME NOISE LEVELS

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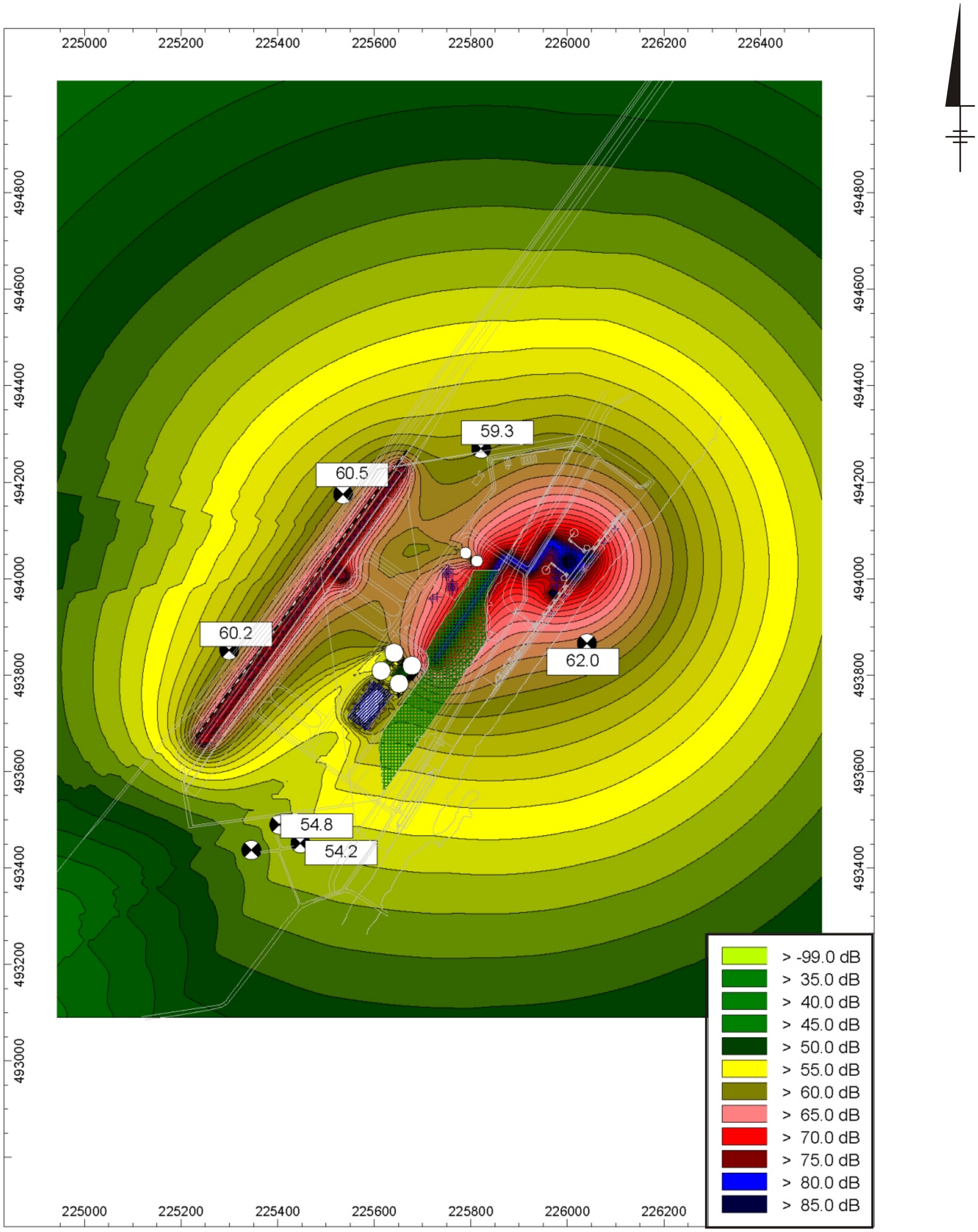
FIGURE 3-33

08/20/05 SYR-D85-DJH-KLS-DJH
N:20437703/20437G06.cdr



GENERAL ELECTRIC COMPANY
HUDSON RIVER PCBs SUPERFUND SITE

PHASE 1 INTERMEDIATE DESIGN REPORT

PREDICTED Ldn LEVELS

BBL®
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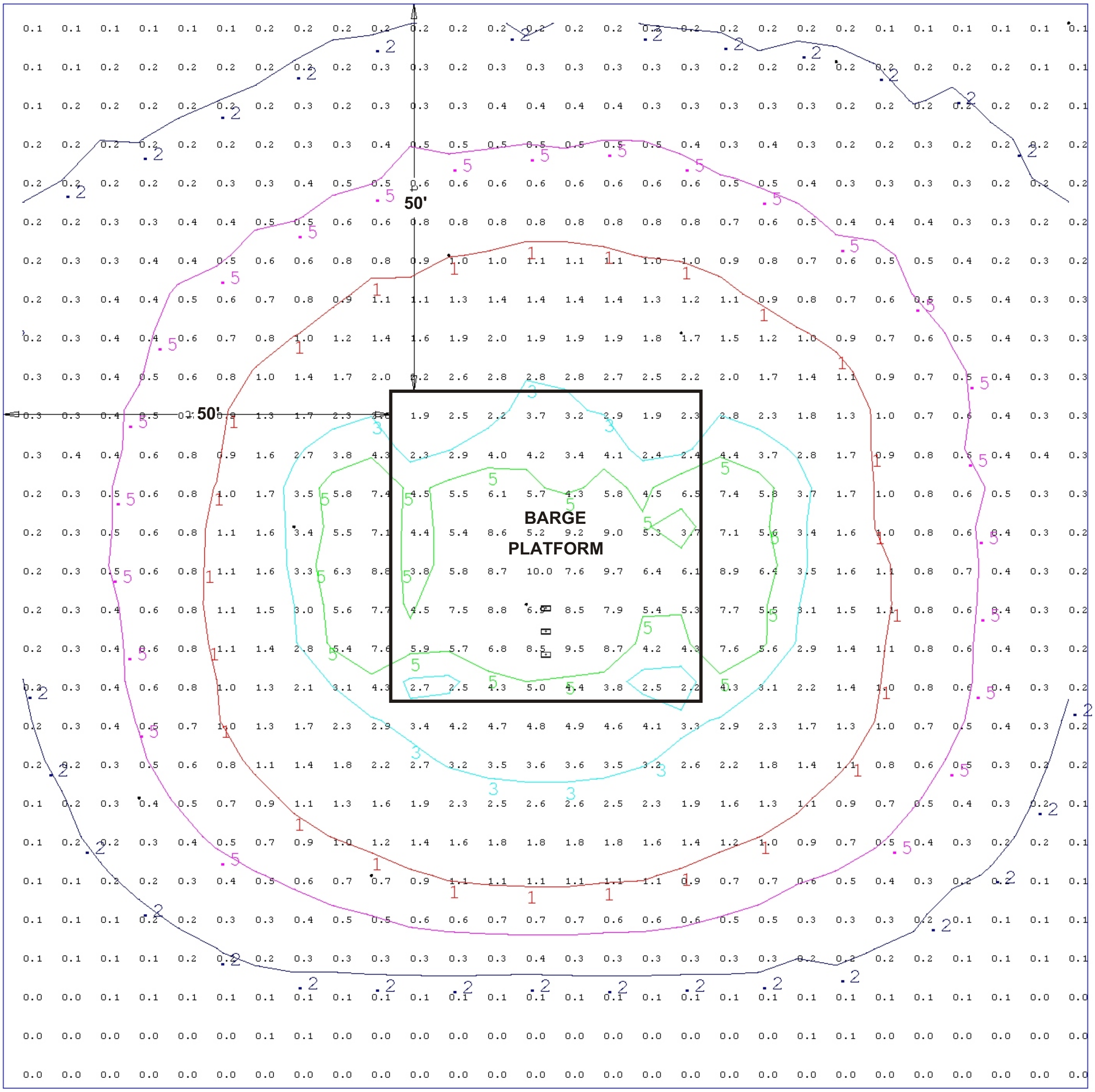
engineers, scientists, economists

FIGURE
3-34

08/20/05 SYR-D85-DJH-KLS
N:20437703/20437G07.cdr



SCALE: 1" = 20'-0"

NOTE:
Values shown in footcandles

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HUDSON RIVER PCBs SUPERFUND SITE
PHASE 1 INTERMEDIATE DESIGN REPORT

PREDICTED BARGE LIGHT LEVELS

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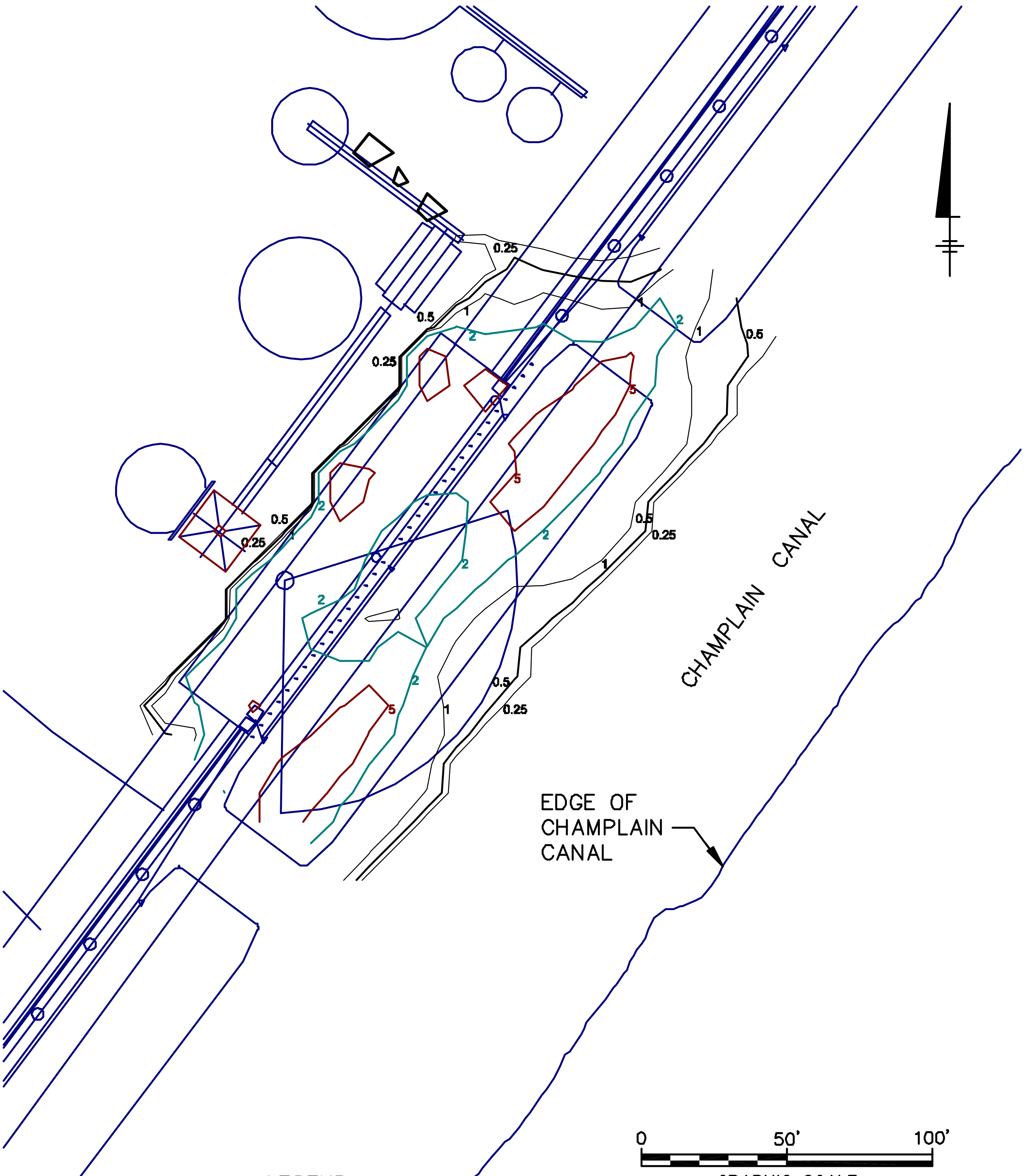
FIGURE
3-35

08/20/05 SYR-D85-DJH-KLS-DJH
C:20437703/20437G08.cdr



LEGEND:

0.25	FOOTCANDLES
0.5	FOOTCANDLES
1	FOOTCANDLES
2	FOOTCANDLES
5	FOOTCANDLES

X: 20437X02.DWG, 20437X23.DWG
L: ON=*; OFF=*REF*
P: PAGESET/PLT-AP1
8/20/05 SYR-85-KLS GHS DJP
N/20437703/PLANT/20437B02.DWG

GENERAL ELECTRIC COMPANY
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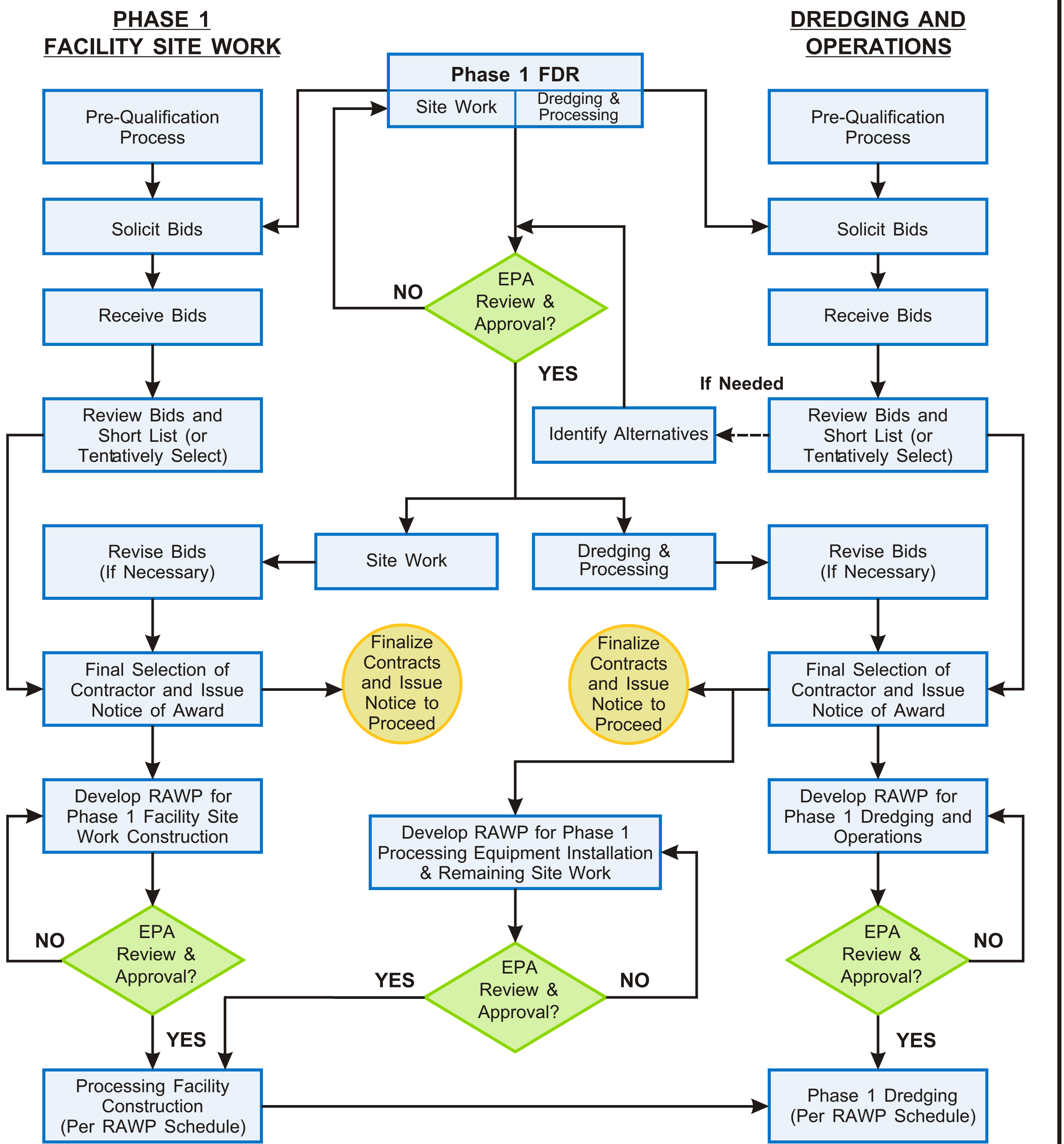
PHASE 1 INTERMEDIATE DESIGN REPORT

PREDICTED LIGHT LEVELS AT UNLOADING AREA

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

FIGURE
3-36



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PHASE 1
TASK INTERRELATIONSHIPS

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FIGURE
4-1

08/17/05 SYR-D85-DJH
20437701/cdr/20437f01.cdr