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Final
Feasibility Study Report for the Site 518 Dredge Spoil Disposal Area Fort Edward, New York

Site Number 5-58-028

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Prepared for:

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

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List of Abbreviations and Acronyms

APEG	alkaline polyethylene glycol
ARAR	applicable or relevant and appropriate requirement
BCD	base-catalyzed decomposition
BEST	basic extractive sludge treatment
BGS	below ground surface
BUD	Beneficial Use Determination
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm/sec	centimeters per second
COC	contaminant of concern
EEEPC	Ecology and Environment Engineering, P.C.
EPA	United States Environmental Protection Agency
ERA	ecological risk assessment
ESMI	Environmental Soil Management, Inc.
°F	degrees Fahrenheit
FS	feasibility study
HTTD	high-temperature thermal desorption
IC	institutional control
ISTD	in situ thermal desorption
ISV	in situ vitrification
KPEG	potassium polyethylene glycol
LTM	long-term monitoring

List of Abbreviations and Acronyms (cont.)

LTTD	low-temperature thermal desorption
mg/kg	milligram per kilogram
NCP	National Contingency Plan
NFESC	Naval Facilities Engineering Service Center
NYCRR	New York State Codes, Rules, and Regulations
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
O&M	operation and maintenance
OSHA	Occupational Safety and Health Administration
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	perchloroethylene
PPE	personal protective equipment
ppm	parts per million
RAO	remedial action objective
RCC	Resource Conservation Company
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
ROD	Record of Decision
SCG	standards, criteria, and guidelines
SVE	soil vapor extraction
SVOC	semivolatile organic compound
TAGM	Technical Administrative Guidance Memorandum
TBC	to be considered
TCE	trichloroethylene

List of Abbreviations and Acronyms (cont.)

TCL	Target Compound List
TCLP	toxicity characteristic leaching procedure
TOGS	Technical and Operational Guidance Series
TSCA	Toxic Substances Control Act
USGS	United States Geological Survey
VOC	volatile organic compound

1 Introduction

1.1 Purpose and Organization

Ecology and Environment Engineering, P.C. (EEEPC) was tasked by the New York State Department of Environmental Conservation (NYSDEC) to conduct a feasibility study (FS) at the Site 518 Dredge Spoil Disposal Area (Site 518) (Site No. 5-58-028), located in the Village of Fort Edward, Washington County, New York. The FS is conducted under State Superfund Standby Contract Work Assignment No. D004435-08. The FS was developed based on information in the United States Environmental Protection Agency's (EPA's) Guidance for Conducting Remedial Investigations and Feasibility Studies under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) (EPA 540/G-89/004) NYSDEC's Technical and Administrative Guidance Memorandum (TAGM) 4030, Selection of Remedial Actions at Inactive Hazardous Waste Sites, NYSDEC's Draft DER-10, Technical Guidance for Site Investigation and Remediation, and 6 New York State Codes, Rules, and Regulations (NYCRR) Part 375, Environmental Remediation Programs.

A remedial investigation (RI) was completed to characterize the nature and extent of on-site contamination at Site 518, as described in the Draft *Remedial Investigation Report for the Site 518 Dredge Spoil Disposal Area, Fort Edward, New York* (EEEPC 2007).

Five additional similar dredge spoil sites were investigated under separate RI/FS work assignments, the results of which are submitted under separate cover (see Appendix A for a location map of these sites).

This FS describes technologies that address the on-site contamination identified by the RI report at Site 518. The report is divided into six sections.

- Section 1 provides the study purpose and the site background information;
- Section 2 presents the identification of standards, criteria, and guidelines for various contaminants and the development of remedial action objectives (RAOs);
- Section 3 evaluates appropriate technologies for the remediation of site contamination and the development of remedial alternatives;

- Section 4 discusses the combination of remedial technologies to form remedial alternatives and the detailed analysis of the alternatives;

- Section 5 presents a detailed and comparative analysis of alternatives. Included in these analyses are the rationale and a preliminary cost estimate for the selected remedies; and

- Section 6 contains references used in this report.

1.2 Background Information

1.2.1 Site Description and Surrounding Land Uses

Site 518 is located in the southern part of Village of Fort Edward, Washington County, New York (see Figure 1-1). The property containing Site 518 occupies approximately 10.5 acres, and is currently occupied by a Canal Corporation maintenance garage and office building. The associated paved parking area and driveway occupy approximately 1 acre of the property. A strip of wooded land is present along the Hudson River. U.S. Route 4 runs along the eastern edge of the site from its northern boundary to the bridge that carries Route 4 over the Champlain Canal. U.S. Route 4 was realigned in 1989 and a remnant of the former bridge embankment lies between Site 518 and the canal. The Champlain Canal is immediately southeast of the site and Canal Lock 7 is approximately 1,000 feet south of the site. The Hudson River is located immediately west of the site. The Washington County Sewer District No. 2 wastewater treatment facility is located immediately to the north of the site. There are residential areas on both sides of U.S. Route 4 beginning immediately north of the site.

The maintenance garage facility was constructed from 1976 to 1977. Aerial photographs taken on November 2, 1976, show the building foundation under construction. Based on 1972 Soil Conservation Service soil survey mapping and the 1976 aerial photographs, it appears that the maintenance garage and office complex were built on fill.

United States Geological Survey (USGS) mapping dated 1955 indicates that prior to disposal of the sediments, the ground surface elevations at the site ranged from 120 feet near the Hudson River to 140 feet near the Champlain Canal. The Hudson River elevation is approximately 120 feet in the vicinity of the site. The current ground surface elevations at the site vary from approximately 120 to nearly 140 feet.

No NYS-mapped wetlands exist on or in the immediate vicinity of the site. A portion of the site is located within the 100-year floodplain of the Hudson River.

Currently, the site is used by the Canal Corporation for commercial/light industrial activities, but it is zoned residential for multi-unit housing (Village of Fort Edward 1984). Based on discussions with NYSDEC regarding future activities at the site, it is anticipated that current activities will continue into the future. However, the Canal Corporation activities could move to another location allowing the site to be used for its zoned land use (residential for multi-unit housing).

1.2.2 Site History

Site 518 contains PCB-contaminated dredge spoils removed from the Hudson River in the 1950s and 1960s. A previous study (Malcolm Pirnie, Inc. 1992) estimated that there are up to 23,600 cubic yards of contaminated material at the site. These previous studies also identified that black silt and sandy dredge fill materials have been placed throughout the site, with up to four disposal areas believed to contain PCB-contaminated dredge spoils from the Hudson River. These disposal areas were not believed to be lined.

In 2005, NYSDEC engaged EEEPC to perform an RI at Site 518 to characterize the dredge spoils and develop this FS. Surface soil, subsurface soil, sediment, and groundwater sampling were included in the RI. A summary of the RI findings are reported in the draft remedial investigation report (EEEPC 2007) and is presented in Section 1.2.3 through 1.2.7 of this report.

1.2.3 Site Geology and Hydrology

In general, the site overburden consists of 1 to 3 feet of fill material (topsoil and gravel) followed by 10 to 30 feet of gray to brown clays or silty clays inter-fingered with layers of brown silty sands, brown sands, brown to black gravel lenses, and dark gray silts. Inter-fingered layers and large lenses of clays, silty clays, sands, and silty sands dominate the site. The thickness of the overburden was not investigated during the RI (EEEPC 2007) as bedrock was not encountered at any of the sampling locations.

Dredge spoil materials are found throughout the site, but are predominant south and southwest of the Canal Corporation building and thickest in the center of the fill area. Dredge materials typically consist of gray to black sandy loam with fragments of wood and black shale. The thickness of the dredge spoil material ranges from 1 foot at the spoil fringes to 8 feet. The horizontal extent of the dredge spoils was determined using test pit excavations (see Section 2.4.2).

The natural site overburden is consistent with regional conditions and consists of alluvial and stratified unconsolidated glaciofluvial and glaciolacustrine deposits, except it is on a smaller scale with greater variability.

Site 518 is located in the Hudson River drainage basin where the Hudson River and the Champlain Canal each drain approximately 50% of the county, with the divide crossing the county midway between the northern and southern limits (USDA SCS 1975). North of the divide, drainage is to the Atlantic Ocean by way of Lake Champlain and the St. Lawrence River. South of the divide, the Hudson River forms the western border of the county at Hudson Falls after flowing out of the Adirondacks. The Batten Kill and Hoosic River, two major drainage systems, empty into the Hudson River from the east.

1.2.4 Nature and Extent of Contamination

The results of analyses of samples of sediment, surface soil, subsurface soil, and groundwater collected during the RI (EEEPC 2007) identified the dredge spoils as the on-site contamination source area. The dredge spoils are primarily contaminated by polychlorinated biphenyls (PCBs). Subsurface samples collected from within the dredge spoils from borings and test pits indicate elevated concentrations of PCBs. The majority of PCB contamination is located in the middle of the site with a second smaller area located north of the existing block building. Some metals were also detected above screening criteria in the site soils. Surface water samples were not collected during the RI due to little or no water present. Therefore, surface water will not be addressed in this FS.

The predominant Aroclor in surficial soils was Aroclor 1248 and the predominant Aroclor detected in the subsurface soils was Aroclor 1254. Although metals concentrations were found in some sediment, surface soil, and subsurface soil samples, very few metals were detected at concentrations that exceeded screening criteria and those that did were infrequent (e.g., arsenic in one of 22 soil samples). However, because metals were not detected at substantial concentrations above background levels or risk-based guidance values in any sample medium, PCBs are the primary contaminant of concern at the site.

The following paragraphs summarize test results for sediment, surface soil, and subsurface soil sampling as described in the RI (EEEPC 2007). Samples for each media were analyzed for PCBs and metals.

- **Sediment.** Sediment samples were obtained from depression areas and drainage ditches, which may not be representative of flowing stream conditions and are not inundated for a sufficient duration of the year to support aquatic life. Sediment samples were collected from nine locations (see the RI for sample locations). Eight of the nine sediment samples contained PCBs at concentrations ranging from 0.028 to 14 parts per million (ppm).

- **Surface Soil.** Twenty-two surface soil samples were collected from the site to a depth of 2 inches (see the RI for sample locations). A majority of surface soil samples collected on site contained PCB concentrations of less than 1 ppm, with only four samples containing PCBs concentrations greater than 1 ppm. PCB concentrations ranged from non-detect to 4.7 ppm (518-SS-16). The samples containing PCB concentrations greater than 1 ppm were randomly distributed throughout the site.

- **Subsurface Soil.** A total of 64 subsurface soil samples were collected from nine test pit and 10 test pit boreholes for the purposes of identifying the edge of fill at the site. The test pit boreholes replaced test pit locations due to existing site features that precluded excavation of test pits. Generally, at least three to four samples were collected from each test pit excavation at depths up to 8.5 feet below ground surface (BGS), while boreholes were advanced to a maximum depth of 10 feet BGS with three samples collected per borehole. Dredge spoils were encountered in most of the test pit excavations at the site. The greatest concentrations of PCBs were collected from test pits that were excavated along the western boundary of the fill area, from depths between 0.2 and 2.5 BGS. Dredge spoils were encountered in each test pit borehole with the exception of the northernmost boreholes advanced just north of the Canal Corporation building. In addition to the contamination along the western boundary, samples collected from test pit boreholes also showed PCB contamination in the southern portion of the site.

A total of 60 subsurface soil samples were collected from 15 soil borings (boreholes and monitoring wells) during drilling activities to define the thickness and extent of fill material. The subsurface soil samples exhibiting the highest PCB concentrations were collected in the center of the dredge spoil disposal area. The PCB concentrations in subsurface soil were generally the highest between 3 to 7 feet BGS.

Four rounds of groundwater samples were collected from the five monitoring wells drilled around the perimeter of the dredge spoil disposal area to observe if PCB contamination was present in groundwater. PCBs were not detected in groundwater samples from any of the monitoring wells during the four sampling events. Therefore, groundwater remediation will not be addressed in this FS.

1.2.5 Contamination Fate and Transport

PCBs in soil are the primary contaminants of concern at this site. The RI for this site (EEEPC 2007) evaluated various modes of contaminant transport and concluded PCBs in soil might be transported by surface water flow. To a lesser extent, PCBs in soil can be transported by subsurface utilities, construction activity, and vehicular traffic.

1.2.6 Qualitative Human Health Risk Evaluation

Current and potential future human exposure pathways were evaluated in the RI (EEEPC 2007). The magnitude of exposure and likelihood of potential adverse health effects were assessed qualitatively through comparisons with risk-based concentrations. Current human site users are limited to site workers and site visitors. If the site is redeveloped, potential future site users could include recreational users; site residents and site workers; both permanent commercial/ industrial workers; and temporary construction, utility, and maintenance workers. Current receptors were assumed to be exposed only to existing surface soil and sediment while future receptors were assumed to be exposed to soils to a depth of 10 feet.

The estimated excess cancer risk and non-cancer hazard for current site users are within the ranges generally considered acceptable by the EPA and NYSDEC/New York State Department of Health (NYSDOH). The estimated cancer risk and non-cancer hazard for potential future residents, recreational users, commercial/industrial workers, and construction workers were also within the acceptable ranges with the exception of the non-cancer hazard index for a potential future child resident. For this receptor, a hazard index of 3 was calculated indicating that there may be the potential for adverse health effects due to exposure to PCB-contaminated soil and sediment.

1.2.7 Screening Level Ecological Risk Assessment

The ecological risk assessment (ERA) in the RI (EEEPC 2007) evaluated potential impacts of site-related contaminants on the ecological resources at the Site 518 Dredge Spoil Disposal Area. The assessment does not include the Hudson River or Champlain Canal, which lie adjacent to the site. The following summarizes the conclusions made in the ERA:

- Although zinc concentrations in 13 soil samples exceeded benchmark criteria for protection of plant life, this result is probably of little practical significance since physical factors (i.e., regular mowing, gravel cover, and vehicle traffic) are the primary stressors affecting the types and extent of plant communities at the site.

- Although the mercury screening benchmark was exceeded at four sampling locations and zinc at one sampling location, the risks to the soil invertebrate community from chemicals in soil at the site are limited in extent.

- Based on food-chain modeling results, total PCBs in soil are likely to pose a risk to song birds, such as the American robin, and small mammals, such as the short-tailed shrew, that feed extensively on soil invertebrates. Risks to carnivorous birds and mammals are minimal.

Overall, the current levels of environmental contamination at the site pose little or no risk to communities of terrestrial plants and soil invertebrates, but may pose a risk to some wildlife species.

Figure 1-1
Site Location Map
Site 518 Dredge Spoil Disposal Area

2 Identification of Standards, Criteria, and Guidelines and Remedial Action Objectives

This section identifies the contaminants of concern (COCs) and media of interest, and establishes proposed cleanup goals and specific RAOs for contaminated on-site media. Also presented are estimates of areas and volumes of contaminated on-site media.

2.1 Introduction

The RI for this site identified PCB and metals contamination in soils (sediment, surface soil, and subsurface soil) at Site 518. Based on screening of the analytical results, the RI further identified potential risks posed by site contamination by evaluating contaminant concentrations and identifying potential exposure routes. This evaluation was conducted for both human and environmental receptors.

The evaluation identified the following potential risks at the site. It is noted that the results of the human health risk assessment will not be the basis for remedial decision making.

- Direct contact exposure to surface soils/sediments by future child resident; and
- Incidental ingestion exposure of site soils by birds.

RAOs were developed (see Section 2.3) to reduce or eliminate these potential risks by eliminating these routes of exposure or reducing the contaminant concentrations in impacted media to meet applicable chemical-specific standards at the site. Chemical-specific cleanup goals were developed for each media at the site to evaluate the area or volume of each medium that must be addressed to meet the RAOs.

Standards, criteria, and guidelines (SCGs) are used at inactive hazardous waste sites to establish the locations where remedial actions are warranted and to establish cleanup goals. SCGs include state requirements. The following sections present potentially applicable SCGs and other standards and establish proposed cleanup goals and specific RAOs for contaminated on-site media.

2.2 Potentially Applicable Standards, Criteria, and Guidelines (SCGs) and Other Criteria

SCGs include applicable or relevant and appropriate requirements (ARARs) and other applicable requirements.

- *Applicable Requirements* are legally enforceable standards or regulations such as groundwater standards for drinking water that have been promulgated under state law.

- *Applicable or Relevant and Appropriate Requirements* (ARARs) include those requirements that have been promulgated under state law that may not be "applicable" to the specific contaminant released or the remedial actions contemplated but are sufficiently similar to site conditions to be considered relevant and appropriate. If a relevant or appropriate requirement is well suited to a site, it carries the same weight as an applicable requirement during the evaluation of remedial alternatives.

- *To Be Considered (TBC) Criteria* are non-promulgated advisories or guidance issued by state agencies that may be used to evaluate whether a remedial alternative is protective of human health and the environment in cases where there are no standards or regulations for a particular contaminant or site condition. These criteria may be considered with SCGs in establishing cleanup goals for protection of human health and the environment.

The following sections present the three categories of SCGs: chemical-specific, location-specific, and action-specific.

2.2.1 Chemical-Specific SCGs

Chemical-specific SCGs are typically technology or health-risk-based numerical limitations on the contaminant concentrations in the environment. They are used to assess the extent of remedial action required and to establish cleanup goals for a site. Chemical-specific SCGs may be directly used as actual cleanup goals or as a basis for establishing appropriate cleanup goals for the contaminants of concern at a site. Chemical-specific SCGs for on-site soils at Site 518 are identified in Table 2-1. The list of chemical-specific SCGs was developed using the risk-based criteria presented as part of the screening process in the RI (EEEPC 2007).

2.2.2 Location-Specific SCGs

Location-specific SCGs are site- or activity-specific. Examples of location-specific SCGs include building code requirements and zoning requirements. Location-specific SCGs are commonly associated with features such as wetlands, floodplains, sensitive ecosystems, or historic buildings that are located on or close to the site. Location-specific SCGs for Site 518 are presented in Table 2-1.

2.2.3 Action-specific SCGs

Action-specific SCGs are usually administrative or activity-based limitations that guide how components of remedial actions are conducted. These may include record-keeping and reporting requirements; permitting requirements; design and performance standards for remedial actions; and treatment, storage, and disposal requirements. Action-specific SCGs for this site are presented in Table 2-2.

2.3 Remedial Action Objectives

The RAOs for on-site remedial actions were developed based on information contained in the RI (EEEPC 2007); including identified contaminants present in the study area and existing or potential exposure pathways in which the contaminants may affect human health and the environment.

The RAO for on-site soils is to reduce the potential for direct human and ecological contact with the contaminated soils.

2.4 Cleanup Objectives and Volume of Impacted Material

The following sections describe the process used to select numeric cleanup objectives and estimate the volume of impacted material.

2.4.1 Selection of Soil Cleanup Goals

Standards

Numeric cleanup goals identified for soils at the Site 518 dredge spoil disposal area are contained in 6 NYCRR Part 375-6.8 (NYSDEC 2006). This regulation presents SCOs for protection of ecological resources, groundwater, and public health. The public health criteria are based on land use criteria, which include:

- **Unrestricted use** is a use without imposed restrictions, such as environmental easements or other land use controls; or

- **Restricted use** is a use with imposed restrictions, such as environmental easements, which as part of the remedy selected for the site require a site management plan that relies on institutional controls or engineering controls to manage exposure to contamination remaining at a site. Restricted use is separated into four different categories:

    1. **Residential use** is a land use category that allows a site to be used for any use other than raising livestock or producing animal products for human consumption. Restrictions on the use of groundwater are allowed, but no other institutional or engineering controls relative to the residential SCOs, such as a site management plan, would be allowed. This land use category will be considered for single family housing;

    2. **Restricted-Residential use** is a land use category that shall only be considered when there is common ownership or a single owner/managing

entity of the site. Restricted-residential use shall, at a minimum, include restrictions which prohibit any vegetable gardens on a site, although community vegetable gardens may be considered with NYSDEC's approval and single-family housing. Active recreational uses, which are public uses with a reasonable potential for soil contact, such as parks, are also included under this category;

3. **Restricted-Commercial use** is a land use category for the primary purpose of buying, selling, or trading of merchandise or services. Commercial use includes passive recreational uses, which are public uses with limited potential for soil contact; and

4. **Restricted-Industrial use** is a land use category for the primary purpose of manufacturing, production, fabrication or assembly process and ancillary services. Industrial uses do not include any recreational component.

Based on Village of Fort Edward zoning maps (Village of Fort Edward 1984), the site is zoned as residential for multi-unit (up to three) housing. The site is currently used by the Canal Corporation for commercial/light industrial activities. Considering the potential (multi-unit) residential land use at this site in the future based on current zoning, the 6 NYCRR Part 375-6.8 SCOs selected for Site 518 is Restricted-Residential. In addition, SCOs presented in 6 NYCRR Subpart 375-6.8 for the protection of groundwater and ecological resources should be considered where applicable. Since PCBs were not detected in groundwater samples, cleanup goals for the protection of groundwater were not considered. SCOs for the protection of ecological resources does not apply to this site as more 45% of the site is covered by gravel (primarily over the spoil fill area) and buildings which inhibits the existence of ecological resources that can constitute an important component of the environment. Therefore, cleanup goals for the protection of ecological resources will also not be considered.

The cleanup goals for the contaminants detected at this site are presented in Table 2-3.

Criteria and Guidance Values

Guidance values identified for soils are contained in NYSDEC TAGM 4046 (January 1994). Criteria and guidance values for the contaminants detected at this site are presented in Table 2-3.

Background

Background soil sample data are used as cleanup objectives when standards and guidance values are not available. Site background samples were not collected. However, published soil background values from the New York State (NYS) background concentrations from the Brownfield cleanup program (NYSDEC

2006) and eastern United States background levels were used (Shacklette et. al 1984).

Selection Process

The selected cleanup goals for soils (sediment, surface, and subsurface) are presented in Table 2-3. These values will be used later in this report to calculate remedial volumes and subsequent cost estimates. The following logical basis was used to select the preliminary cleanup values presented in this table:

- 6 NYCRR Part 375-6.8 restricted use soil cleanup standards were selected as the cleanup goals.

- Where cleanup standards were not available, NYSDEC TAGM 4046 values were selected as the cleanup goal.

- If neither cleanup standards or guidance were not available, NYS background values were used as the cleanup goals.

- The maximum observed concentration for each compound was then compared to the selected cleanup goal in order to determine which compounds may require cleanup.

- Finally, the contaminants identified for cleanup were reviewed to determine whether they are site-related and whether cleanup is warranted.

2.4.2 Selection of Contaminants of Concern

Based on the cleanup objectives selected above and historical disposal of PCB-laden spoils, it was determined that PCBs are the primary soil contaminants of concern at the site, see Table 2-3. As stated above, some metals were detected above proposed cleanup goals. However, since soil removal/treatment remedy conducted at the site would remove other contaminants in the soil, PCBs will be considered the primary COCs at the site.

2.4.3 Determination of Contaminated Soil Volumes

The volume of contaminated dredge spoils at the site was estimated using Autodesk Civil 3D. Two surfaces were created, the first surface was comprised of the ground elevations obtained from survey data (EEEPC 2007). The second surface was the bottom of impacted material which was estimated using analytical data and boring log information collected during the RI (EEEPC 2007). Using these two surfaces the software produces a volume estimate. For soils, with the proposed cleanup goal of 1 ppm for PCBs, the volume was estimated to be 31,000 cubic yards. This volume considers sediment and surface soil contamination, in addition to contaminated subsurface soils. The estimated contamination depth was 8.5 feet BGS in the middle of the site (south of the existing block building) and 2.8 feet BGS north of the existing block building. The total area of contamination is approximately 4.1 acres including both contaminated areas.

Figure 2-1 provides the lateral extent of contamination to be further addressed in this FS.

Table 2-1 Location-Specific SCGs, Site 518 Dredge Spoil Disposal Area

Act/Authority	Criteria/Issues	Citation	Brief Description	Status	Comments
Local Location-Specific SCGs					
Town Code	Noise	Chapter 61	Restricts unnecessary noise and construction equipment noise within the village during certain timeframes	Potentially Applicable	
	Vehicles and Traffic	Chapter 99	Weight limitations on certain town/village roads during portions of the year	Potentially Applicable	
	Street and Sidewalk Closure	Chapter 85	Street closure or alteration requirements	Potentially Applicable	
	Solid Waste	Chapter 82	Waste haulers local requirements; restrictions on construction of solid waste facilities	Potentially Applicable	
State Location-Specific SCGs					
Environmental Conservation Law	Endangered and Threatened Species	6 NYCRR 182	Lists endangered and threatened species and species of special interest	Potentially Applicable	
	Freshwater Wetlands	6 NYCRR 663-665	Establishes permit requirement regulations, wetland maps and classifications	Not Applicable	No wetland on or near site.
	Wild, Scenic, and Recreational Rivers	6 NYCRR 666	Regulations for administration and management	Potentially Applicable	
	Floodplains	6 NYCRR 502	Contains floodplain management criterion for state projects	Potentially Applicable	

Table 2-1 Location-Specific SCGs, Site 518 Dredge Spoil Disposal Area

Act/Authority	Criteria/Issues	Citation	Brief Description	Status	Comments
Federal Location-Specific SCGs					
National Historical Preservation Act 16 USC Section 469	Preservation of archaeological and historical data	36 CFR Part 65	Action to recover and preserve artifacts	Potentially Applicable	
National Historic Preservation Act Section 106 (16 USC 470)	Historic project owned or controlled by Federal agency	36 CFR Part 880	Preserve historic property, minimize harm to National Historic Landmarks	Potentially Applicable	
Endangered Species Act of 1973 16 USC 1531, 661	Endangered and Threatened species	50 CFR Part 200, 402 33 CFR Parts 320-330	Determine presence and conservation of endangered species	Potentially Applicable	
Clean Water Act Section 404	Protect wetlands	40 CFR Parts 230 33 CFR Parts 320-330	Action to prohibit discharge into wetlands	Not Applicable	
Clean Water Act Part 6 Appendix A	Wetland Protection	40 CFR Part 6 Appendix A, section 4	Avoid adverse effects, minimize potential harm, preserve and enhance wetlands	Not Applicable	
Floodplain Management	Executive Order No. 11988	40 CFR 6.302 (b) (2005)	Regulates activities in a floodplain	Potentially Applicable	

Table 2-2 Action-Specific SCGs, Site 518 Dredge Spoil Disposal Area

Act/Authority	Criteria/Issues	Citation	Brief Description	Status	Comments
State Action-Specific SCGs					
New York State Vehicle and Traffic Law, Article 386; Environmental Conservation Law Articles 3 and 19.	Noise from Heavy Motor Vehicles	6 NYCRR 450	Defines maximum acceptable noise levels	Potentially Applicable	Marginally applicable; appears to apply to over-the-road vehicles, not construction equipment
Environmental Conservation Law, Articles 3 and 19.	Prevention and Control of Air Contaminants and Air Pollution	6 NYCRR 200 - 202	Establishes general provisions and requires construction and operation permits for emission of air pollutants	Potentially Applicable	
Environmental Conservation Law, Article 15; also Public Health Law Articles 1271 and 1276 (Part 288 only)	Air Quality Classifications and Standards	6 NYCRR 256, 257	Part 256: NY Ambient Air quality Classification System Part 257: Air quality standards for various pollutants including particulates and non-methane hydrocarbons	Potentially Applicable	Applicable to remediation activities at the site that include a controlled air emission source
Environmental Conservation Law, Articles 1, 3, 8, 19, 23, 27, 52, 54, and 70.	Solid Waste Management Facilities	6 NYCRR 360	360-1: General provisions; includes identification of "beneficial use" potentially applicable to non-hazardous oily waste/soil (360-1.15). 360-2: Regulates construction and operation of landfills, including construction and demolition (C&D) debris landfills	Potentially Applicable	May be applicable for establishing off-site treatment and disposal options for excavated contaminated non-hazardous soil and debris
New York Waste Transport Permit Regulations	Permitting Regulations, Requirements and Standards for Transport	6 NYCRR 364	The collection, transport and delivery of regulated waste, originating or terminating at a location with New York, will be governed in accordance with Part 364	Potentially Applicable	Applicable if site's wastes fall into regulated categories
Environmental Conservation Law, Articles 3, 19, 23, 27, and 70	Hazardous Waste Management System - General	6 NYCRR 370	Provides definition of terms and general standards applicable to 6 NYCRR 370 - 374, 376	Potentially Applicable	

Table 2-2 Action-Specific SCGs, Site 518 Dredge Spoil Disposal Area

Act/Authority	Criteria/Issues	Citation	Brief Description	Status	Comments
	Identification and Listing of Hazardous Waste	6 NYCRR 371	Identifies characteristic hazardous waste (PCBs) and lists specific wastes	Potentially Applicable	Applies to transportation and all other hazardous waste management practices in NYS Applicable if hazardous waste (PCBs > 50 ppm) is generated during remediation
	Hazardous Waste Manifest System and Related Standards	6 NYCRR 372	Establishes manifest system and record keeping standards for generators and transporters of hazardous waste and for treatment, storage, and disposal facilities	Potentially Applicable	Relevant to transportation of hazardous material by bulk rail and water shipments for off-site treatment
	Hazardous Waste Treatment, Storage, and Disposal Facility Permitting Requirements	6 NYCRR 373	Regulates treatment, storage, and disposal of hazardous waste	Potentially Applicable	Relevant to off-site treatment/disposal of hazardous waste
	Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities	6 NYCRR 374	Subpart 374-1 establishes standards for the management of specific hazardous wastes (Subpart 374-2 establishes standards for the management of used oil)	Potentially Applicable	
Environmental Conservation Law, Articles 1, 3, 27, and 52; Administrative Procedures Act Articles 301 and 305.	Inactive Hazardous Waste Disposal Site	6 NYCRR 375	Identifies process for investigation and remedial action at state funded Registry site; provides exception from NYSDEC permits. Part 375-6.8: Provides soil cleanup objectives used for this report	Applicable	
Environmental Conservation Law, Articles 3 and 27.	Land Disposal Restrictions	6 NYCRR 376	Identifies hazardous wastes that are restricted from land disposal. Defines treatment standards for hazardous waste.	Potentially Applicable	To be considered if on-site disposal is chosen as the remedial alternative

Table 2-2 Action-Specific SCGs, Site 518 Dredge Spoil Disposal Area

Act/Authority	Criteria/Issues	Citation	Brief Description	Status	Comments
New York Environmental Quality Review Regulations		6 NYCRR Part 617	Implements provisions of State Environmental Quality Review Act (SEQR)	Potentially Applicable	
Implementation of SPDES Program in New York	General permit for Stormwater	6 NYCRR 750 – 758	Regulates permitted releases into waters of the state	Not Applicable	
Primary and Principal Aquifer Determinations (5/87)		NYSDEC TOGS 2.1.3	Provides guidance on determining water supply aquifers in upstate New York	Not Applicable	Drinking Water supplied by the local drinking water supply system in the Town Fort Edward, NY
Environmental Justice and Permitting	Environmental Justice	Commissioner Policy (CP) 29	Policy incorporates environmental justice concerns into DEC's public participation provisions	Potentially Applicable	Relevant to actions that involve discharges to surface water, solid/hazardous waste disposal or siting an industrial hazardous waste facility
Federal Action-Specific SCGs					
Comprehensive Environmental Response, Compensation, and Liability Act of 1980 and Superfund Amendments and Reauthorization Act of 1986 (SARA)	National Contingency Plan	40 CFR 300, Subpart E	Outlines procedures for remedial actions and for planning and implementing off-site removal actions	Potentially Applicable	
Occupational Safety and Health Act	Worker Protection	29 CFR 1904, 1910, and 1926	Specifies minimum requirements to maintain worker health and safety during hazardous waste operations. Includes training requirements and construction safety requirements	Potentially Applicable	Under 40 CFR 300.38, requirements of OSHA apply to all activities that fall under jurisdiction of the National Contingency Plan

Table 2-2 Action-Specific SCGs, Site 518 Dredge Spoil Disposal Area

Act/Authority	Criteria/Issues	Citation	Brief Description	Status	Comments
Executive Order	Delegation of Authority	Executive Order 12316 and Coordination with Other Agencies	Delegates authority over remedial actions to federal agencies	Potentially Applicable	
Clean Air Act	National Primary and Secondary Ambient Air Quality Standards	40 CFR 50	Establishes emission limits for six pollutants (SO_2, PM_{10}, CO, O_3, NO_2, and Pb)	Potentially Applicable	
	National Emission Standards for Hazardous Air Pollutants	40 CFR 61	Provides emission standards for 8 contaminants. Identifies 25 additional contaminants, including PCE and TCE, as having serious health effects but does not provide emission standards for these contaminants.	Potentially Applicable	
Toxic Substances Control Act	Rules for Controlling PCBs	40 CFR 761	Provides guidance on storage and disposal of PCB-contaminated materials	Potentially Applicable	
Resource Conservation and Recovery Act	Criteria for Municipal Solid Waste Landfills	40 CFR 258	Establishes minimum national criteria for management of non-hazardous waste	Potentially Applicable	Applicable to remedial alternatives that involve generation of non-hazardous waste. Non-hazardous waste must be hauled and disposed of in accordance with RCRA.
	Hazardous Waste Management System - General	40 CFR 260	Provides definition of terms and general standards applicable to 40 CFR 260 - 265, 268	Potentially Applicable	Applicable to remedial alternatives that involve generation of a hazardous waste (e.g., contaminated soil). Hazardous waste must be handled and disposed of in accordance with RCRA
	Identification and Listing of Hazardous Waste	40 CFR 261	Identifies solid wastes that are subject to regulation as hazardous wastes	Potentially Applicable	

Table 2-2 Action-Specific SCGs, Site 518 Dredge Spoil Disposal Area

Act/Authority	Criteria/Issues	Citation	Brief Description	Status	Comments
	Standards Applicable to Generators of Hazardous Waste	40 CFR 262	Establishes requirements (e.g., EPA ID numbers and manifests) for generators of hazardous waste	Potentially Applicable	
	Standards Applicable to Transporters of Hazardous Waste	40 CFR 263	Establishes standards that apply to persons transporting manifested hazardous waste within the United States	Potentially Applicable	
	Standards Applicable to Owners and Operators of Treatment, Storage, and Disposal Facilities	40 CFR 264	Establishes the minimum national standards that define acceptable management of hazardous waste	Potentially Applicable	
	Standards for owners of hazardous waste facilities	40 CFR 265	Establishes interim status standards for owners and operators of hazardous waste treatment, storage, and disposal facilities	Potentially Applicable	
	Land Disposal Restrictions	40 CFR 268	Identifies hazardous wastes that are restricted from land disposal	Potentially Applicable	
	Hazardous Waste Permit Program	40 CFR 270, 124	EPA administers hazardous waste permit program for CERCLA/Superfund Sites. Covers basic permitting, application, monitoring, and reporting requirements for off-site hazardous waste management facilities.	Potentially Applicable	
Clean Water Act	EPA Pretreatment Standards	40 CFR 403	Establishes responsibilities of federal, state, and local government to implement National pretreatment standards to control pollutants that pass through to a POTW	Not Applicable	

Table 2-3 Selected Cleanup Goals for Soils, Site 518 Dredge Spoil Disposal Area

Analyte	NYSDEC Cleanup Goals[a] Protection of Public Health - Restricted Residential	NYSDEC TAGM 4046[b]	New York State Background[c]	Maximum Detected Concentration[d]		Selected Cleanup Goal
Total PCB by Method 8082 (mg/kg)						
Total PCBs	1	1 / 10	-	20		**1**
Metals by Method 6010/7471 (mg/kg)						
Cadmium	4.3	1	2.4	1.4		-
Chromium	180	10	20	40.1	J-	-
Lead	400	SB	72	118		-
Mercury	0.81	0.1	0.2	0.216		-
Aluminum	-	SB	15,800	14,100	J-	-
Antimony	-	SB	2.17	ND		-
Arsenic	16	7.5	12	55		**16**
Barium	400	300	165	189		-
Beryllium	72	0.16	1	0.79	J	-
Calcium	-	SB	9,190	11,500	J	**9,190**
Cobalt	-	30	13.3	18.2		**13.3**
Copper	270	25	32	34.8		-
Iron	-	2,000	25,600	267,000	J	**2,000**
Magnesium	-	SB	5,130	6,500	J	**5,130**
Manganese	2,000	SB	1610	4,570	J	**2,000**
Nickel	310	13	25	39.1		-
Potassium	-	SB	1,890	2,950		**1,890**
Selenium	180	2	3.7	ND		-
Silver	180	SB	0.6	ND		-
Sodium	-	SB	211	466		**211**
Thallium	-	SB	16.3	ND		-
Vanadium	-	150	31	26.1		-
Zinc	10,000	20	140	366	J	-

Notes:

[a] Cleanup goals obtained from 6 NYCRR Part 375-6.8 Soil Cleanup Objective Tables (NYSDEC December 14, 2006).

[b] NYSDEC Technical and Guidance Memorandum (TAGM) 4046 (Jan 1994) Soil Cleanup Objectives. PCB value in surface soil is 1 ppm and 10 ppm in subsurface soils.

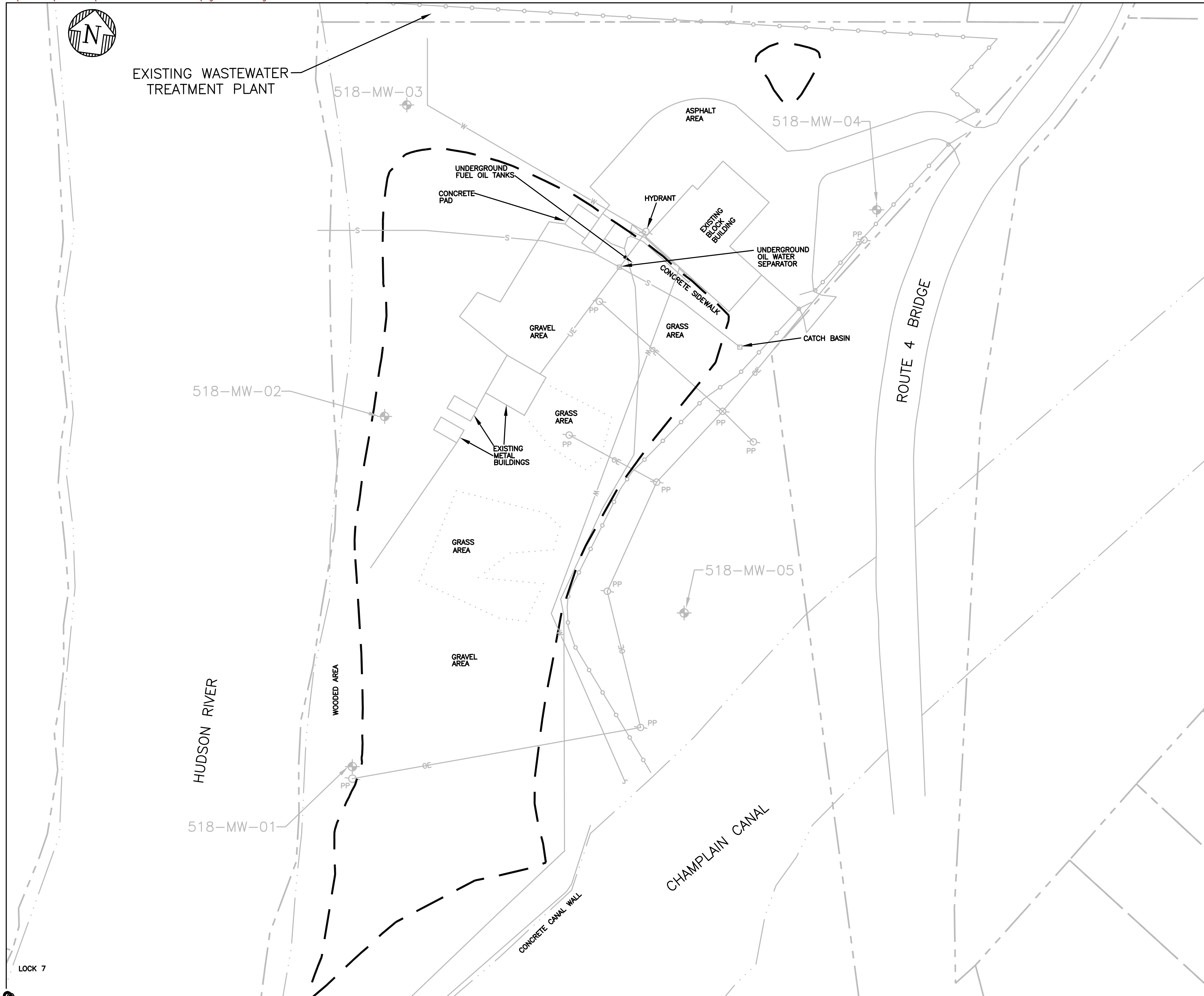
[c] Background values obtained from NYS background (95th percentile), Source-Distant Data Set from NYS Brownfield Cleanup Program, Technical Support Document, Appendix D, (NYSDEC September 2006) for metals presented except thallium and antimony for which background values were obtained from Eastern United States background (95th percentile) (Shacklette and Boerngen 1984).

[d] Concentration listed is the maximum detected value from surface soil, subsurface soil or sediment samples collected during the Site 518 RI (EEEPC 2007).

Key:

J = Estimated value ("-" is biased low and "+" is biased high).
mg/kg = Milligrams per kilogram.
ND = Non-detect.

F:\NYSDEC\Site 518\HUDSON FS JUNE 2007\Figure 2-1.dwg



ecology and environment

LEGEND:

- APPROXIMATE EDGE OF WATER BOUNDARY
- APPROXIMATE LOCATION OF PROPERTY BOUNDARY (SEE NOTE 2)
- EXTENT OF CONTAMINATION (SEE NOTE 4)
- EXISTING FENCE
- EXISTING OVERHEAD ELECTRIC
- APPROXIMATE LOCATION OF UNDERGROUND ELECTRIC
- APPROXIMATE LOCATION OF EXISTING WATER LINE
- APPROXIMATE LOCATION OF EXISTING STORM SEWER LINE
- APPROXIMATE LOCATION OF EXISTING STRUCTURE
- 518-MW-01 EXISTING MONITORING WELL
- PP EXISTING POWER POLE

NOTES:

1. SITE FEATURE LOCATIONS BASED ON 2003 AERIAL PHOTOGRAPHY.
2. PROPERTY LINES ARE APPROXIMATE IN LOCATION AND ARE BASED ON WASHINGTON COUNTY PARCEL DATA, 2006.
3. EXISTING ABOVEGROUND UTILITIES, AND POWER POLES TAKEN FROM LU ENGINEERS DRAWING 10623-07 AREA 518.DWG, DATED 11/07/05. EXISTING SUBSURFACE UTILITIES APPROXIMATELY LOCATED BASED ON DISCUSSIONS WITH CANAL CORPORATION PERSONNEL (JULY 2007). ADDITIONAL ABANDONED UTILTIES EXIST THROUGHOUT THE SITE, HOWEVER NOT IDENTIFIED ON THIS FIGURE.
4. EXTENT OF CONTAMINATION BASED ON INFORMATION CONTAINED IN THE RI (EEEPC 2007).
5. DEPTH OF CONTAMINATION EXTENDS TO MAXIMUM 8.5' IN THE CENTER OF THE SITE AND 2.8' IN THE CONTAMINATED AREA NORTH OF THE EXISTING BLOCK BUILDING.

APPROXIMATE SCALE IN FEET

0 100 200 300

FIGURE 2-1 EXTENT OF CONTAMINATION
SITE 518
FORT EDWARD, NEW YORK

3 Identification and Screening of Remedial Alternatives

3.1 Introduction

This section presents the results of the preliminary screening of remedial actions that may be used to achieve the RAOs. Potential remedial actions, including general response actions and remedial technologies are evaluated during the preliminary screening on the basis of effectiveness, implementability, and relative cost. Past performance (e.g., demonstrated technology) and operating reliability were also considered in identifying and screening applicable technologies. Technologies which were not initially considered effective and/or technically or administratively feasible were eliminated from further consideration.

The purpose of the preliminary screening is to eliminate remedial actions that may not be effective based on anticipated on-site conditions, or cannot be implemented at the site. The general response actions considered herein are intended to include those actions that are most appropriate for the site and, therefore, are not exhaustive.

3.2 General Response Actions

Based on the information presented in the RI (EEEPC 2007) and the RAOs established in Section 2, this section identifies general response actions, or classes of responses for contaminated soils. General response actions describe classes of technologies that can be used to meet the remediation objectives for contaminated site soils. As previously discussed, PCB contamination in soil will be the focus of remedial actions addressed by this FS.

General response actions identified for the contaminated soils are as follows:

- No action;
- Institutional controls;
- Containment;
- In situ treatment;
- Ex situ treatment; and

- On- and off-site disposal.

3.2.1 Criteria for Preliminary Screening

In accordance with guidance documents issued by NYSDEC (TAGM 4030) and the EPA (Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA [October 1988]), the criteria used for preliminary screening of general response actions and remedial technologies include the following:

- **Effectiveness**. The effectiveness evaluation focuses on the degree to which a remedial action is protective of human health and the environment. An assessment is made of the extent to which an action: (1) reduces the mobility, toxicity, and volume of contamination at the site; (2) meets the remediation goals identified in the RAOs; (3) effectively handles the estimated areas and volumes of contaminated media; (4) reduces impacts to human health and the environment in the short-term during the construction and implementation phase; and (5) has been proven or shown to be reliable in the long-term with respect to the contaminants and conditions at the site. Alternatives that do not provide adequate protection of human health and the environment are eliminated from further consideration.

- **Implementability.** The implementability evaluation focuses on the technical and administrative feasibility of a remedial action. Technical feasibility refers to the ability to construct and operate a remedial action for the specific conditions at the site and the availability of necessary equipment and technical specialists. Technical feasibility also includes the future maintenance, replacement, and monitoring that may be required for a remedial action. Administrative feasibility refers to compliance with applicable rules, regulations, statutes, and the ability to obtain permits or approvals from other government agencies or offices and the availability of adequate capacity at permitted treatment, storage, and disposal facilities and related services. Remedial actions that do not appear to be technically or administratively feasible or that would require equipment, specialists, or facilities that are not available within a reasonable period of time are eliminated from further consideration.

- **Relative Cost.** In the preliminary screening of remedial actions, relative costs are considered rather than detailed cost estimates. The capital costs and operation and maintenance costs of the remedial actions are compared on the basis of engineering judgment, where each action is evaluated as to whether the costs are high, moderate, or low relative to other remedial actions based on knowledge of site conditions. A remedial action is eliminated during preliminary screening on the basis of cost if other remedial actions are comparably effective and implementable at a much lower cost.

The results of the preliminary screening are summarized below.

3.3 Identification of Remedial Technologies

This section identifies the potential remedial action technologies that may be applicable to remediation of soils at Site 518. Table 3-1 shows a summary of results from the screening of remedial technologies.

3.3.1 No Action

The no action alternative involves taking no further action to remedy the condition of contaminated soils. NYSDEC and EPA guidance set forth in the CERCLA National Contingency Plan (NCP), requires that the no action alternative automatically pass through the preliminary screening and be compared to other alternatives in the detailed analysis of alternatives.

3.3.2 Institutional Controls and Long-Term Monitoring (LTM)

Institutional controls (ICs) are non-engineered instruments such as administrative and/or legal controls that limit the potential for human exposure to a contaminant by restricting land or resource use (EPA-OSWER 2000). ICs are meant to supplement engineering controls during all phases of cleanup and may be a necessary component of the completed remedy. They typically include easements, deed restrictions, covenants, well drilling prohibitions, zoning restrictions, building, or excavation permits. Physical barriers like fences that restrict access to sites should also be considered in addition to the ICs.

ICs are not generally expected to be the sole remedial action unless active response measures are determined to be impracticable. However, for this site, ICs will be evaluated independently as a stand alone alternative and will also be considered in conjunction with other engineering alternatives to achieve RAOs.

Long-term monitoring (LTM) can be performed in multiple environmental media, but is most applicable in groundwater and surface water at this site. LTM in groundwater generally uses an array of monitoring wells that are regularly sampled and tested by an analytical laboratory for contaminants of concern. These wells are placed such that they would detect migration toward potential receptors. LTM will not actively reduce contamination levels; it can be useful in demonstrating that exposures do not occur. LTM of groundwater will be further considered.

3.3.3 Containment

3.3.3.1 Capping

Containment of impacted soils can be achieved by capping contaminated materials in place, consolidating and capping, excavating selective areas and capping or surface sealing. Capping is a means to limit direct contact with impacted material and reduce the potential for rainfall infiltration into groundwater, thus limiting contaminant mobility and exposure. Capping systems use materials such as soil, synthetic membranes, asphalt, concrete, and chemical sealants.

Capping of the entire effected area is generally performed when subsurface contamination at a site precludes excavation and removal of contaminated materials because of potential hazards and/or prohibitive costs. Capping also may be performed as an interim remedial measure to reduce infiltration of precipitation and to control air releases. The main disadvantages of capping are uncertain design life and the need for long-term maintenance and monitoring.

Capping systems (single and multi-layered) considered applicable and represent the range of available options include asphalt cover (single-layered cap), 6 NYCRR Part 360, and 6 NYCRR Part 373 (RCRA cap). These cover systems would be effective in limiting infiltration of surface water.

- **Bituminous Concrete Cover (Asphalt):** A standard asphalt cover system typically includes a layer of stone (6 to 8 inches), followed by an asphalt binder course (typically 4 inches), and a final wearing course (typically 2 inches). Site grading is typically required to achieve an adequate slope for drainage. Although asphalt covers serve to limit infiltration into groundwater, they are more permeable than 6 NYCRR Part 360 composite cap and 6 NYCRR Part 373 Resource Conservation and Recovery Act (RCRA) cap. Furthermore, asphalt is susceptible to cracking and settlement, and thus would require more operation and maintenance (O&M) in the long term.

- **Concrete Cover:** An alternate “hard” cover is a concrete cap. A concrete cap would typically consist of a layer of stone/gravel (6 to 8 inches); followed by a layer of concrete (typically 6 to 12 inches). Site grading will be required to provide adequate slope for drainage. The permeability of concrete is similar to the asphalt cap described above, however, concrete is more prone to shrinkage cracks and there is a higher potential for infiltration through joints. Special considerations to limit cracks and infiltration through joints can be addressed during design. Thus the level of effort for O&M for this type of cap is anticipated to be slightly more than an asphalt cap. Due to the current activities at the site which involves driving of heavy equipment around the site, a concrete cap is preferred over an asphalt cap.

- **6 NYCRR Part 360 Cap:** A 6 NYCRR Part 360 cap is commonly used in NYS to close municipal solid waste landfills. The cap system consists of the following components:

  1. A 12-inch gas venting layer with a hydraulic conductivity equal or greater than $1x10^{-3}$ centimeters per second (cm/sec) directly overlying the waste material. A filter fabric is typically directly below and above the venting layer to limit the migration of fines into the venting layer. This layer is intended to transmit methane for high organic waste material, and is therefore optional. This layer might not be required for Site 518, because the PCB-containing waste material does not readily decompose.

2. An 18-inch layer of compacted low permeability barrier soil overlying the gas venting layer with a hydraulic conductivity equal to or less than $1x10^{-6}$ cm/sec.

3. A synthetic 40 mil or thicker geomembrane overlying the low permeability soil barrier.

4. A 24-inch compacted soil layer to protect the low permeability layer and geomembrane from root penetration, desiccation, and freezing.

5. A final 6-inches of topsoil placed on top of the protective layer to promote vegetative growth for erosion control.

- **6 NYCRR Part 373 (RCRA) Cap:** RCRA caps are typically required at hazardous waste sites. A RCRA cap is most applicable when a significant potential for leaching of contaminants from the unsaturated zone to the saturated zone exists. Basic requirements for cover systems being designed and constructed today are described in 6 NYCRR Part 373. These requirements are also consistent Subparts G, K, and N of RCRA of Subtitle C regulations (for hazardous waste). The recommended design for a RCRA Subtitle C cap system consists of the following (from bottom to top):

1. A low hydraulic conductivity geomembrane/soil layer consisting of a 24-inch layer of compacted natural or amended soil with a hydraulic conductivity of $1x10^{-7}$ cm/sec, and a minimum 20-mil (0.5 mm) geomembrane liner.

2. A minimum 12-inch soil layer having a minimum hydraulic conductivity of $1x10^{-2}$ cm/sec, or a layer of geosynthetic material having the same characteristics.

3. Minimum 24-inch top vegetative soil layer.

The following presents the preliminary screening of containment technology:

- **Effectiveness.** Placement of a cover/cap over the contaminated soils would be effective in helping to achieve the RAOs for soil, since it would reduce the potential for direct contact with the contaminated soils and limit erosion and transport of contaminated materials.

- **Implementability.** The materials, equipment, and labor for construction of a cover/cap are available and can be readily implemented.

- **Cost.** Capital costs for installing a NYCRR Part 360 cap are around $165,000 per acre while it is $225,000 per acre for a RCRA Subtitle C cap (FRTR 2002). Capital costs may include materials, labor, and equipment to construct the cap. O&M costs would be minimal.

In summary, due to the current activities at the site, which involve driving heavy equipment around the site, a concrete cap is preferred over an asphalt cap. Soil with PCB concentrations at or exceeding 50 parts per million (ppm) is considered hazardous under New York State and Toxic Substances Control Act (TSCA) regulations and requires using a RCRA cap. Since the contaminated soil at Site 518 have PCB concentrations detected at less than 50 ppm, a non-RCRA cap (or Part 360 cap) could be used for capping. Ultimately, a concrete cap is preferred over a Part 360 cap due to ongoing site activities. Furthermore, a concrete cap will achieve the containment requirements of a PCB cap, described in 40 CFR 761.61, as this type of cap will minimize human exposure, infiltration of water, and erosion. Based on the above, a concrete cap will be retained for further consideration.

3.3.4 In Situ Treatment Technologies

In situ treatment technologies for soil remediation typically fall in the following three categories:

- Thermal treatment;
- Physical/chemical treatment; and
- Biological treatment.

The following sections present a discussion of applicable soil remediation technologies under each general response category.

3.3.4.1 Thermal Treatment

Thermal treatment processes generally involve application of heat to contaminated material to vaporize the contaminants into a gas stream (i.e., physically separate from the host medium), and then treating the gas stream prior to discharge into the atmosphere. Various gas treatment technologies can be used to collect, condense, or destroy the volatilized gases. The three common types of in situ thermal treatment technologies are: in situ thermal desorption using thermal blankets and thermal wells, vitrification using electrodes, and enhanced soil vapor extraction (SVE).

Thermally enhanced SVE is a full-scale technology that uses electrical resistance/electromagnetic/radio frequency heating, or hot-air steam injection to facilitate volatilization and extraction of the contaminant vapors. The process is otherwise similar to soil vapor extraction. However since SVE does not remove PCBs and heavy hydrocarbons (only applicable to volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs) with Henry's constant greater than 0.01) it will not be retained for further consideration.

In Situ Thermal Desorption (ISTD) - Thermal Blankets and Thermal Wells

This type of technology was developed in Shell Research labs over the last 25 years as part of its enhanced oil recovery efforts, and has been one of the few in situ forms of thermal desorption technologies that has been demonstrated to work effectively on a commercial scale. At the present time, thermal blankets and thermal wells are proprietary technologies of TerraTherm Environmental Services, an affiliate of Shell Oil Company. The thermal blanket system consists of electric heating "blankets" approximately 8 by 20 feet that are placed on top of the contaminated ground surface. The blankets can be heated to 1,800° Fahrenheit (F), and by thermal conduction are able to vaporize most contaminants down to about 3 feet. Vapors are drawn out of the soil and through the blanket system by means of a vacuum system. The contaminated vapors are then oxidized at high temperature in a thermal oxidizer near the treatment area, and finally cooled and passed through activated carbon beds to collect any trace levels of organics not oxidized prior to discharge to the atmosphere.

Thermal wells use the same process as thermal blankets, except that heating elements are placed in well boreholes drilled at an average spacing of 7 to 10 feet. Similar to the blanket modules, the vacuum is drawn on the manifold so that extracted vapors are collected and destroyed. Estimated in situ thermal desorption (ISTD) treatment costs obtained from TerraTherm Environmental Services range from $100 per cubic yard for a 100,000-cubic yard site to $600 per cubic yard for a 1,000-cubic yard site (TerraTherm, Inc. 2007).

ISTD using thermal wells and blankets has been successfully demonstrated by TerraTherm for a number of PCB-contaminated sites. PCB reduction of 99.9% was achieved from initial concentrations of as high as 20,000 mg/kg at a contaminated site in Missouri. Contamination depth varied between 6 to 18 inches for blankets, and up to 12 feet with thermal wells for these demonstrations. ISTD is a more appropriate technology for volumes of contamination up to 10,000 cubic yards (Naval Facilities Engineering Service Center 1998). A treatability study is generally recommended to determine the effectiveness of thermal treatment as a remediation technology at a site

- **Effectiveness.** Thermal treatment has been demonstrated in treating PCB-contaminated soil at depths of less than 12 feet, so this would be effective at this site (the depth of dredge spoils is approximately 8.5 feet BGS).

- **Implementability.** Contractors and treatment facilities are available to implement this technology. Treatability studies may be necessary to evaluate the effectiveness of the type of thermal treatment needed to treat the soil at these site acceptable levels.

- **Cost.** The cost of an in situ treatment is high but may be comparable to other in situ treatment technologies considering the lifetime for treatment and O&M costs of other technologies.

In summary, due to contaminated soil volumes greater than 10,000 cubic yards other in situ technologies may be more feasible based on implementability and cost. Therefore, this technology will not be retained for further analysis.

In Situ Vitrification

In situ vitrification (ISV) is a process which uses electrical power to heat and melt soil contaminated with organics, inorganics, and metal-bearing wastes. The molten material cools to form a hard, monolithic, chemically inert, stable glass and crystalline product that incorporates the inorganic compounds and heavy metals in the hazardous waste. The organic contaminants within the waste are vaporized or pyrolyzed and migrate to the surface of the vitrified zone where they are oxidized under a collection hood. Residual emissions are captured in an off-gas treatment system.

ISV uses electrodes that are inserted into the ground to the desired treatment depth. Electrical power is charged to the electrodes, which heats the surrounding soil to 2,000º Celsius (C), which is above the initial melting temperature of typical soils. With favorable site conditions, it is estimated that a processing depth of up to 30 feet can be achieved.

Although ISV has been tested for a range of organic and inorganic contaminants including PCBs, and has been operated for demonstration purposes at the pilot scale, few full-scale applications of this technology exist. Treatability studies are generally required to determine the effectiveness of ISV as a remediation technology at a site. Once vitrified, the original volume of soil would decrease by approximately 20 to 50%, requiring backfilling with clean material, grading and restoring.

- **Effectiveness.** ISV processing requires that sufficient glass-forming materials (e.g., silicon and aluminum oxides) be present within the contaminated soil to form and support a high-temperature melt. If the natural soil does not contain enough of these materials, then a fluxing agent, such as sodium carbonate, can be added. If metals of high concentrations and/or large dimensions are present in the soil to be treated, the electrodes may short circuit.

  ISV can treat soils saturated with water; however, additional power is required to dry the soil prior to melting. The presence of large inclusions in the area to be treated can limit the effectiveness of the ISV process. Inclusions are highly concentrated contaminant layers, void volumes, containers, metal scrap, general refuse, demolition debris, rock, or other heterogeneous materials within the treatment volume.

- **Implementability.** ISV is considered an emerging technology. The only vendor currently supplying commercial systems for in situ vitrification of hazardous wastes is Geosafe Corporation. Four units are in operation ranging from bench scale to commercial scale. A large-scale test was conducted at Hanford, Washington, on mixed radioactive and chemical wastes which contained chromium. A fire involving the protective hooding occurred. Materials of construction (e.g., for the collection hood) and electrode-feeding mechanisms are still being tested and developed.

- **Cost.** Two studies conducted on the West Coast and Midwest estimated ISV costs between $1,320 and $2,900 per cubic yard of contaminated soil treated (EPA 2007). Factors that influence the cost of remediation by ISV are the moisture content of the soil, the amount of additives required to create the required "recipe," the amount of site preparation required, the specific properties of the waste soil, the depth of processing, and the unit price of electricity.

In summary, since few full-scale applications of this technology exist and this technology has relatively high implementation costs, in situ vitrification will not be further considered.

3.3.4.2 Physical/Chemical Treatment

A number of in situ physical/chemical treatment processes for soil have been developed to chemically convert, separate, or contain waste constituents. These include solidification/stabilization and soil flushing.

In Situ Solidification/Stabilization

Solidification/stabilization treatment systems, sometimes referred to as fixation systems, seek to trap or immobilize contaminants within their "host" medium instead of removing them through chemical or physical treatment. Solidification is a process whereby contaminants are physically bound or enclosed within a stabilized mass. Stabilization is a process where chemical reactions are induced between the stabilizing agent and contaminants to either neutralize or detoxify the wastes, thus reducing their mobility.

Solidification/stabilization methods used for chemical soil consolidation can immobilize contaminants. Most techniques involve a thorough mixing of the solidifying agent and the waste. Solidification of wastes produces a monolithic block. The contaminants do not necessarily interact chemically with the solidification reagents but are mechanically locked within the solidified matrix. Solidification/stabilization systems have generally targeted inorganics (i.e., heavy metals) and radionuclides, not PCBs. Stabilization methods usually involve the addition of materials (e.g., molten bitumen, asphalt emulsion, portland cement) that limit the solubility or mobility of waste constituents even though the physical handling characteristics of the waste may not be improved. Remedial actions involving combinations of solidification and stabilization techniques are often used to yield a product or material for land disposal, or in other cases, that can be applied to beneficial use. Auger/caisson systems and injector head systems are techniques used in soil solidification/stabilization systems.

- **Effectiveness.** In situ solidification/stabilization systems have generally targeted inorganics (i.e., heavy metals) and radionuclides. The auger/caisson and reagent/injector head systems have limited effectiveness in treating organics, although systems are currently being developed and tested for treating PCBs.

- **Implementability.** Treatability studies are generally required to assess compatibility of waste material and reagent used.

- **Cost.** In situ solidification/stabilization costs around $150 to $250 per cubic yard for deeper applications (FRTR 2002). However, based on the extent of the contamination and depth of the contaminated soil, we believe the cost of this treatment alternative would be moderate at best. Treatability studies would be required to better determine the cost of this alternative in a full-scale operation.

In summary, since this technology has not been successfully demonstrated on a full-scale basis for treating organics and because the solidified material may hinder future site use, this technology will not be retained for further consideration.

In Situ Soil Flushing

Soil flushing is an extraction process by which organic and inorganic contaminants are washed from contaminated soils. An aqueous solution is injected into the area of contamination, and the contaminant elutriate is pumped to the surface for removal, re-circulation, or on-site treatment and re-injection. During elutriation, sorbed contaminants are mobilized into solution because of solubility, formation of an emulsion, or chemical reaction with the flushing solution. An in situ soil-flushing system includes extraction wells installed in the area of contamination, injection wells installed upgradient of the contaminated soil areas, and a wastewater treatment system for treatment of recovered fluids. Similar to solidification/stabilization systems, in situ soil flushing generally targets inorganics (i.e., heavy metals) and radionuclides, not PCBs.

Cosolvent flushing, another type of soil flushing involves injecting a solvent mixture (e.g., water plus a miscible organic solvent such as alcohol) into vadose zone, saturated zone, or both to extract organic contaminants. Cosolvent flushing can be applied to soils to dissolve either the source of contamination or the contaminant plume emanating from it.

- **Effectiveness.** The effectiveness of this technology decreases in heterogeneous soils similar to Site 518. The tendency of PCBs to adsorb to soil particles also reduces the effectiveness.

- **Implementability.** In situ soil flushing has had very limited commercial success. This technology can be used only in areas where flushed contaminants and soil flushing fluid can be contained or recaptured. Typically, treatability studies must be performed under site-specific conditions before this technology can be selected.

- **Cost.** In situ soil flushing is a low cost technology with costs ranging from $25 to $250 per cubic yard (FRTR 2002). Treatability studies would need to be performed to estimate the cost for installing a full-scale system. Also, the above ground separation and treatment of recovered fluids can drive the cost of the whole process.

In summary, it is believed that in situ soil flushing is not effective in heterogeneous soils found at this site. Due to its limited success and high costs involved, this technology will therefore not be retained for further consideration.

3.3.4.3 Biological Treatment

Biological treatment processes use indigenous or selectively cultured microorganisms to reduce hazardous organic compounds into water, carbon dioxide, and chlorinated hydrogen chloride. Available in situ biological treatment technologies include bioventing, enhanced biodegradation (aerobic and anaerobic), natural attenuation, and phytoremediation. Factors that affect the rate of biodegradation include the type of contaminants present and their concentrations, oxygen, nutrients, moisture, pH, and temperature. Treatability studies are typically conducted to determine the effectiveness of bioremediation in a given situation. A review of completed remediation projects and demonstration projects where biological treatment technologies were used for soil remediation indicates that these technologies have primarily been used for soils contaminated with petroleum hydrocarbons, volatile organic compounds (e.g., trichloroethylene [TCE] and perchloroethylene [PCE]), pesticides and wood preservatives. Because PCBs have relatively higher chlorine content, they are more persistent in the environment and less susceptible to biodegradation.

- **Effectiveness.** Bioremediation of PCB-contaminated soil is not very effective.

- **Implementability.** Vendors and organisms to biologically treat contaminated soil are readily available.

- **Cost.** Costs vary based on the type of technology used and can range from $20 to $80 per cubic yard (FRTR 2002).

Since biological treatment technologies are not well demonstrated for PCBs, and due to the relatively longer remediation periods, these technologies were not retained for further consideration.

3.3.5 Ex Situ Treatment

Ex situ treatment requires soil to be excavated before treatment. Ex situ treatment allows for greater flexibility in establishing the physical, chemical, or biological conditions; or any combination of these conditions that are required to remove or destroy the contaminant. Available ex situ treatment technologies that would be applicable at the site and the contaminant include thermal desorption, incineration vitrification (thermal treatment processes), dehalogenation, solvent extraction (chemical processes), and soil washing (physical process).

3.3.5.1 Thermal Treatment

Thermal treatment processes generally involve the application of heat to physically separate, destroy, or immobilize the contaminant. A number of ex situ thermal treatment technologies exist to treat a range of contaminants including high-temperature and low-temperature thermal desorption, hot gas decontamination; open burning/open detonation, pyrolysis, and incineration. This section will focus on high temperature thermal desorption, incineration, and vitrification, because the other technologies are either not applicable to PCB contamination (hot gas decontamination, open burning/open detonation, low-temperature thermal desorption), or have not been successfully demonstrated on a full-scale basis for sites contaminated with PCBs (pyrolysis). High-temperature thermal desorption, incineration, and vitrification are described below.

High-Temperature Thermal Desorption

Thermal desorption is a physical separation process that uses heat to volatilize organic wastes, which is subsequently collected and treated in a gas treatment system. Thermal desorption differs from incineration because the decomposition or destruction of organic material is not the desired result, although some decomposition may occur. A variety of gas treatment technologies are used to collect, condense, or destroy the volatilized gases. A vacuum system is typically used to transport volatilized water and organics to the treatment system. As described above, thermal desorption technologies can be grouped into high-temperature thermal desorption (HTTD) and low-temperature thermal desorption (LTTD) systems. LTTD is primarily used for non-halogenated VOCs and SVOCs with low boiling points (i.e., below 600° F), and is therefore not considered as an applicable technology for PCB contamination.

HTTD systems are able to heat materials to temperatures in the range of 600° F to 1,200°F, and therefore can target SVOCs, polycyclic aromatic hydrocarbon (PAH), and PCBs. In general, thermal systems can be differentiated by the method used to transfer heat to the contaminated material and by the gas treatment system. Direct-contact or direct-fired systems (i.e., rotary dryer) apply heat directly by radiation from a combustion flame. Indirect-contact or indirect-fired systems (i.e., thermal screw conveyor) apply heat indirectly by transferring it from the source (combustion or hot oil) through a physical barrier that separates the heat source from the contaminated material.

Of the several vendors working in the thermal treatment industry, Environmental Soil Management Inc. (ESMI) currently owns and operates three fixed location thermal treatment facilities in the northeast region, one each in New York, New Jersey, and New Hampshire. In addition, ESMI owns a portable thermal treatment unit that can be transported as needed based on site-specific conditions. Depending on the material volume to be treated and chemical concentrations, material may be more appropriately sent to one facility versus another.

HTTD is a full-scale technology that has been successfully demonstrated in the field for treatment of PCB contaminated soils. Typically, systems that have been used for PCB contamination consist of a rotary dryer (primary chamber) to volatilize the contaminated material, and an afterburner (secondary chamber) where the off-gas is oxidized at temperatures in the range of 1,400°F to 1,800°F. The off-gas is then cooled, or quenched, and passed through a baghouse to remove any trace organics not oxidized prior to discharge into the atmosphere. HTTD units are considered to be incinerators, and must meet the RCRA incinerator emission requirements (40 CFR Parts 264 and 265, Subpart O).

- **Effectiveness.** HTTD technology is effective in treating PCB contamination and the treated soils can be returned to the site as backfill.

- **Implementability.** This technology can be implemented fairly quickly. The equipment can be set up at on site or maybe mobilized so that it could potentially be moved from site to site. Furthermore, existing HTTD facilities are currently in operation throughout the United States.

- **Cost.** HTTD is a moderate cost technology with costs typically ranging from $300 per cubic yard to $500 per cubic yard depending on the volume of contaminated soils (FRTR 2002).

In summary, HTTD is a demonstrated technology which could be implemented effectively at this site and, therefore, will be retained for further consideration.

Incineration

Incineration uses high temperatures (1,600° to 2,200°F) to volatilize and destroy organic contaminants and wastes. A typical incineration system consists of the primary combustion chamber into which contaminated material is fed and initial destruction takes place, and a secondary combustion chamber where combustion byproducts (products of incomplete combustion) are oxidized and destroyed. From the secondary chamber, the off-gases are drawn under negative pressure into an air pollution control system which may include a variety of units depending on the contaminants and site-specific requirements.

The two primary types of incinerators are rotary kiln and liquid injection incinerators. The rotary kiln is a refractory-lined, slightly inclined, rotating cylinder that serves as the primary combustion chamber operating at temperatures up to 1,800°F. The kilns can range in size from 6 to 14 feet in diameter. The liquid injection incinerators are used to treat combustible liquid, sludge, and slurries. Liquid injectors would not be applicable for the contamination at Site 518, since liquid waste is not present at the site.

Ex situ on-site incineration is a demonstrated treatment technology for PCB-contaminated soils. Incineration is considered an effective technology, achieving a greater than 99% reduction requirement of PCBs and dioxins concentrations in soil, thus providing long-term protection. Incinerators burning hazardous wastes must meet RCRA incinerator regulations (40 CFR Parts 264 and 265, Subpart O) as well as state and local regulations. Furthermore, on-site incinerators used to treat PCB-contaminated material with concentration greater than 50 mg/kg may also be subject to the requirements under TSCA set forth in 40 CFR Part 761.

- **Effectiveness.** Incineration is an effective, demonstrated technology that can treat PCB-contaminated soils.

- **Implementability.** Incineration can be implemented at this site since the equipment can be used for multiple sites. However, permitting of an incinerator may prove to be a significant effort as the public may mount an effort to keep it out of their community.

- **Cost.** Ex situ incineration is a high cost technology with costs ranging from $600 per cubic yard to $1,100 per cubic yard (FRTR 2002).

In summary, because the effectiveness of incineration to remediate site-contaminated soil would be similar to HTTD, however at much higher costs, incineration will not be retained for further consideration.

Vitrification

Thermal vitrification of contaminated material uses a natural gas and oxygen-enhanced power source or an electrical power source to treat PCB impacted soil and produce a glass-like material. Natural gas fired vitrification is less costly than the electric powered system. For thermal vitrification, soils must be excavated, segregated and stockpiled prior to treatment using an on-site glass furnace. This alternative may require the soils to be “dried” so that the soils entering the system contain less than 15% moisture.

The glass furnace is a “melter” constructed of refractory brick. A series of oxy-fuel burners combine natural gas and oxygen, which raise the temperature of the melter to 2,900^{o}F. PCBs are destroyed and the soil melts and flows out of the system as molten glass. Molten glass then flows into a water-filled quench tank that hardens the molten glass into glass aggregate that makes it inert to the environment. Water is continuously added to the quench tank as the molten glass causes the water to evaporate. The glass aggregate can be beneficially reused as backfill in the original excavation, or can be sold for use as a loose-grain abrasive, as highway aggregate, or in a number of other applications.

A pilot-scale ex situ vitrification process using glass furnace technology was demonstrated to treat PCB-contaminated river sediment at Minergy Glass Pack Test Center, Wisconsin. The process attained greater than 99% total PCBs removal or destruction, and the glass aggregate met the state of Wisconsin's requirements for beneficial reuse. Other vitrification technologies that historically converted waste materials to glass aggregate have been applied in New York State, and the resulting materials met NYSDEC Beneficial Use Determination (BUD) requirements.

In October, 2005, soil samples from a nearby dredge spoil disposal area (Old Moreau Site [see Appendix A for its location]) were submitted to Minergy for initial screening tests to determine the feasibility of this technology (Minergy 2006). The results concluded that the mineral content of site soils is similar to those seen in other full-scale vitrification projects that were able to produce a glass aggregate end product and vitrification is an applicable technology for this site. Additional bench-scale testing would be required to establish design parameters for full-scale implementation.

- **Effectiveness.** Ex situ vitrification of soils is an effective method of treating PCB-contaminated soils. In addition, this action reduces/eliminates the potential for future contamination of groundwater from soil contamination.

- **Implementability.** Contractors are available to implement this technology. The system would be set up at a location central to the site and the soil would be transported to it. A bench-scale study would be necessary prior to implementation of this technology.

- **Cost.** Estimated costs for vitrification obtained from Minergy Vitrification range from $100 per cubic yard to $475 per cubic yard (Minergy 2007; 2003). Compared with other ex situ treatment technologies, vitrification has a much greater up-front capital cost. There are some financial risks associated with this technology as a major cost-factor is the price of natural gas, which can fluctuate significantly over the life of the operation.

In summary, ex situ vitrification is a moderate cost technology with proven effectiveness to remediate PCB contamination. However, the volume of soil to be treated (31,000 cubic yards) does not warrant the capital costs associated with the construction of the system. For this reason, vitrification will not be retained for further consideration.

3.3.5.2 Physical/Chemical Treatment

A number of ex situ physical/chemical treatment processes for soils have been developed to chemically convert, separate, or contain waste constituents. These include dehalogenation (or dechlorination), soil washing, and solvent extraction.

Dehalogenation

Dehalogenation is a chemical process that is achieved either by replacement of the halogen molecule of the organic compound or decomposition and partial volatilization of the contaminant through adding and mixing specific reagents. This technology typically consists of excavating, screening, and crushing the contaminated soils, mixing with the reagent in a heated reactor, and then treating the wastewater or the volatilized contaminants. Two types of dehalogenation technologies exist: base-catalyzed decomposition (BCD) and glycolate/alkaline polyethylene glycol (APEG).

Glycolate technology involves the replacement of halogen molecules in the organic contaminant by mixing the contaminant with an APEG-type reagent (commonly potassium polyethylene glycol (KPEG) in a heated reactor. The byproducts of the reaction include glycol ether and/or hydroxylated compound and an alkali metal, which are all water soluble. Typically, treatment and disposal of wastewater generated by the process is required. The APEG process has been successfully used and demonstrated for cleanup of contaminated soils containing PCBs ranging between 2 and 45,000 mg/kg.

- **Effectiveness.** This technology has been approved by EPA's Office of Toxic Substances under TSCA for PCB treatment, and has been selected for cleanup at three Superfund sites.

- **Implementability.** The EPA has been developing the BCD technology since 1990, in cooperation with the Naval Facilities Engineering Service Center (NFESC), as a remedial technology specifically for soils contaminated with chlorinated organic compounds such as PCBs. Although this technology has been approved by EPA's Office of Toxic Substances under TSCA for PCB treatment, and one successful test run in 1994 was completed, BCD has had no commercial application to date.

- **Cost.** Ex situ dehalogenation is a high cost technology with costs ranging from $440 per cubic yard to $1,100 per cubic yard (FRTR 2002). Excavation and material handling cost would be higher with this alternative compared with more established technologies.

In summary, since dehalogenation was not commercially implemented on a large-scale basis and is moderately expensive, this technology will not be retained for further consideration.

Solvent Extraction

Solvent extraction is a chemical process whereby the target contaminant is physically separated from its medium (soil) using an appropriate organic solvent. This technology, therefore, does not destroy the waste, but reduces the volume of material that must be treated. Solvent extraction is typically accomplished by homogeneously mixing the soil, flooding it with the solvent, then mixing thoroughly again to allow the waste to come in contact with the solution. Once mixing is complete, the solvent is drawn off by gravity, vacuum filtration, or some other conventional dewatering process. The solids are then rinsed with a neutralizing agent (if needed), dried, and placed back on site or otherwise treated/disposed of. Solvents and rinse water are processed through an on-site treatment system and recycled for further use. Solvent extraction has been shown to be effective in treating sediments, sludges, and soils containing primarily organic contaminants such as PCBs, VOCs, halogenated solvents, and petroleum wastes.

- **Effectiveness.** An on-site demonstration of the solvent extraction technology was completed in 2000 at a similar site contaminated with PCB soils. Although analytical results from the demonstration showed on average a greater than 99% total PCB removal, operational problems were encountered during start-up, and multiple extractions were needed to achieve the required cleanup criteria.

- **Implementability.** This technology was demonstrated successfully at a number of superfund sites for PCB-contaminated soils and sediments. The performance data currently available are mostly from the Resource Conservation Company's (RCC's) full-scale basic extractive sludge treatment (BEST) process. However, full-scale application of the technology has been limited, especially with large volumes of soil as is the case at Site 518. Additional concerns with this technology include the potential for presence of solvent in the treated soil, and regeneration and reuse of the spent solvent.

- **Cost.** The costs involved in the implementation of this technology would typically range between $275 to $1,300 per cubic yard depending on site-specific conditions and volume of treated material (FRTR 2002).

In summary, solvent extraction has not been commercially implemented and is costly compared to other ex situ treatment technologies. For these reasons, solvent extraction is not being retained for further consideration.

Soil Washing

Soil washing segregates the fine solid fractions from the coarser soils through an aqueous washing process and uses a washing water treatment system. Typically, soil washing has been used to remediate SVOCs, fuels, and heavy metals in soils, with limited success in remediating PCB-contaminated soils. This technology is based on the observation that the majority of contaminants are found adsorbed into the fine soils (typically silt and clay-size particles) due to their greater specific surface area. The finer, contaminated fraction of soils would require further treatment/disposal. The coarser soils (expected to be relatively free of contamination) would be backfilled on site once site cleanup goals have been achieved, which might require the soil to pass through the soil washing process multiple times. This alternative, on average, returns 80 to 90% of the treated soil or sediment back to its source. Commercially available surfactants are commonly used in the aqueous washing solution to transfer contaminants from the soil matrix to the liquid phase. Bench-scale studies are generally required prior to implementation of a full-scale soil washing operation to determine site-specific parameters and selection of surfactant(s).

- **Effectiveness.** Soil washing offers the ability to clean a wide range of contaminants from coarse-grained soils. However, the effectiveness of the technology decreases with complex waste mixtures, which make choosing the washing fluid difficult. However, because contaminated site soils are primarily glacial deposits that consist of unsorted glacial till and lacustrine deposits of gravel, sand, silt, and clay as opposed to exclusively finer soils, soil washing is expected to be effective in reducing the volume of contaminated on-site soils.

- **Implementability.** Bench-scale studies are generally required prior to implementation of a full-scale soil washing operation to determine site-specific parameters and selection of surfactant(s). The equipment for this process would be fairly inexpensive, readily-available and mobile.

- **Cost.** Ex situ soil washing is a moderate cost technology with costs ranging between $333 per cubic yard to $444 per cubic yard depending on the site conditions, target waste quantity and concentration (FRTR 2002).

In summary, there is not a high level of confidence in the effectiveness of soil washing of PCB contaminated soil. Furthermore, since the cost to construct an on-site processing facility and the cost to operate the facility for the contaminated volume (the facility would be operation for less than one year) are high, ex situ soil washing is not feasible at this site. Therefore, ex-situ soil washing will not be retained for further consideration.

3.3.6 On- and Off-Site Disposal

Land disposal of contaminated wastes has historically been the most common remedial action for hazardous waste sites. The two disposal options: on-site disposal in a constructed landfill, or off-site disposal in a commercial facility.

3.3.6.1 On-Site Disposal

On-site disposal of material classified as hazardous waste by New York State Hazardous Waste Regulations and TSCA, requires construction of a secure landfill that meets RCRA and state requirements. These requirements include the following:

1. The landfill must be designed so that the local groundwater table will not be in contact with the landfill;

2. The landfill must be lined with, natural and synthetic material of low permeability to inhibit leachate migration;

3. A low permeability cover must be employed to limit infiltration and leachate production; and

4. Periodic monitoring of surface water, groundwater, and soils adjacent to the facility must be conducted to confirm the integrity of the liner and leachate collection system.

- **Effectiveness.** Construction of a landfill onsite would be an effective technology because it would limit the direct contact with and mobility of the contaminated material.

- **Implementability.** The implementability of this option is limited by the shallow groundwater table and the high volume of contaminated soil at the site, and the anticipated difficulty in meeting permit requirements.

- **Cost.** The costs involved in a construction of an on-site landfill are high.

In summary, migration of soil contamination into groundwater is not a significant transport mechanism and containment of the waste material could be achieved by capping. Therefore, construction of an on-site landfill is not warranted. On-site disposal of contaminated materials was not retained as an applicable technology.

3.3.6.2 Off-Site Disposal

Off-site disposal of contaminated soils and sediments involves hauling excavated materials to an appropriate commercially licensed disposal facility. The type of disposal facility depends on whether the waste is considered hazardous or non-hazardous. Waste material classified as hazardous waste may only be disposed of in a RCRA-permitted facility. In accordance with New York State Hazardous Waste Regulations and TSCA, materials containing PCBs at or above 50 ppm (if excavated and removed from the site), are subject to regulation as both hazardous waste and TSCA waste. Contaminated waste materials containing less than 50 ppm of PCBs are considered non-hazardous waste, and can be disposed of in a non-hazardous/solid waste facility.

- **Effectiveness.** Excavation and disposal of contaminated soil at a permitted landfill is an effective method of reducing potential for direct contact with contaminated soils. In addition, this action reduces the potential for future contamination of groundwater.

- **Implementability.** Contractors and disposal facilities are available to implement both disposal options.

- **Cost.** The cost for disposal of contaminated soils ranges between $100 and $150 per cubic yard for non-hazardous soils and $200 to $300 per cubic yard for hazardous soils (Waste Management 2007).

In summary, off-site disposal of contaminated materials in an off-site permitted disposal facility is a demonstrated alternative that effectively reduces exposure risks and provides long-term protection of human health and the environment. For these reasons, off-site disposal will be retained as an applicable alternative.

Table 3-1 Summary of Soil Remedial Technologies, Site 518 Dredge Spoil Disposal Area, Fort Edward, New York

General Response Actions and Remedial Technology	Brief Description	Preliminary Screening Evaluation	Passes Screening
No Action			
	No further action to remedy soil conditions at the Site.	Ineffective for the protection of human health and the environment.	Yes
Institutional Controls			
	Include public notification, deed restrictions, fencing, and signs.	Do not reduce contamination levels but can reduce potential exposure to the contaminated media.	Yes
Containment			
Capping			
Bituminous Concrete Cover (Asphalt)	Selective excavation and/or standard asphalt cover system including layer of stone, asphalt binder course and final wearing course.	Does not reduce contamination levels but can reduce potential exposure to the contaminated media.	No
Concrete Cap	Selective excavation and/or standard concrete cap including a layer of gravel.	Does not reduce contamination levels but can reduce potential exposure to the contaminated media.	Yes
6 NYCRR Part 360 Cap	Selective excavation and/or non-RCRA cap typically used to close Municipal Solid Waste Landfills.	Does not reduce contamination levels but can reduce potential exposure to the contaminated media.	No
6 NYCRR Part 373 (RCRA) Cap	Selective excavation and/or RCRA cap typically required at Hazardous Waste Sites.	Does not reduce contamination levels but can reduce potential exposure to the contaminated media.	No
In-Situ Treatment			
Thermal			
Thermally Enhanced Soil Vapor Extraction (SVE)	Uses electrical resistance/electromagnetic/radio frequency heating, or hot-air steam injection to facilitate volatilization and extraction of the contaminant vapors.	SVE is not effective in removing non-volatile organics such as PCBs.	No
Thermal Desorption (thermal blankets and wells)	Thermal blankets and thermal wells are placed on contaminated ground surface. A majority of contaminants are vaporized out by thermal conduction. Vapors are drawn out by vacuum system, oxidized, cooled, and passed through activated carbon beds.	More expensive than other established remedial technologies.	No
Vitrification (ISV)	Contaminated soils are melted at extremely high temperatures using probes inserted into the ground delivering an electric current. The soil is heated to extremely high temperatures, and are cooled to form a stable, glassy crystalline mass.	Only a few commercial applications of this technology exist. Treatability studies are generally required to determine the effectiveness of ISV as a remediation technology at a given site. End product of the technology may hinder future site use, and there is relatively high implementation cost.	No
Physical/Chemical			
Solidification/stabilization	Solidification/stabilization treatment systems, sometimes referred to as fixation systems, seek to trap or immobilize contaminants within their "host" medium using chemical reactions instead of removing them through chemical or physical treatment.	Stabilization technologies have not been successfully demonstrated on a full-scale basis for treating organics.Solidified material may hinder future site use.Treatability studies would be required prior to implementing this technology.	No

Table 3-1 Summary of Soil Remedial Technologies, Site 518 Dredge Spoil Disposal Area, Fort Edward, New York

General Response Actions and Remedial Technology	Brief Description	Preliminary Screening Evaluation	Passes Screening
Soil Flushing	An extraction process by which organic and inorganic contaminants are washed from contaminated soils through the injection of an aqueous solution into the area of contamination, and the contaminant elutriate is pumped to the surface and removed from the site.	Capture of the impacted solution is critical to the effectiveness of this technology. Contamination depths and PCBs' strong tendency to adhere to soil particles may limit this technology's effectiveness.	No
Biological			
Biological Treatment	Uses indigenous or selectively cultured microorganisms to reduce hazardous organic compounds into water, carbon dioxide, and chlorinated hydrogen chloride.	Biological treatment technololgies are not well demonstrated for PCBs. This technolgoy also involves a relatively longer remediation period compared to other treatment technologies.	No
Ex-Situ Treatment			
Thermal			
High Temperature Thermal Desorption (HTTD)	A physical separation process that uses heat to volatilize organic wastes, which are collected and treated in a gas treatment system.	Moderate cost, full-scale technology that has been successfully demonstrated in the field for treatment of PCB contaminated soils. HTTDs are permitted as incinerators.	Yes
Incineration	Uses high temperatures to volatilize and destroy organic contaminants and wastes.	A moderate cost technology that has a demonstrated success; however, the public is generally adverse to this technology.	No
Vitrification	Thermally vitrifies and destroys PCBs at high temperatures using a gas/oxygen power source. Soils are excavated and stockpiled, and a fluxing agent is introduced to aide in the melting process.	Moderate cost technology that is successful in destroying PCBs. The inert glass aggregate byproduct can be returned to the site for backfill or can be sold as a construction aggregate.	No
Physical/Chemical			
Dehalogenation	A chemical process that is achieved either by replacement of the halogen molecule of the organic compound or decomposition and partial volatilization of the contaminant through adding and mixing specific reagents.	Although EPA has been developing this technology since 1990, it has not yet been sucessfully demonstrated in a commercial application.	No
Solvent Extraction	A chemical extration process whereby the target contaminant is physically separated from the soil using an appropriate organic solvent to dissolve PCBs.	This technology has not been commercially implemented, and may require multiple extractions so that solvent-contaminated soils are not returned to the site.	No
Soil Washing	A volume reduction technology that segregates the fine solid fractions from the coarser soils through an aqueous washing process and washing water treatment system.	Successful at reducing volume of on-site contaminated soils. Returns 80-90% of treated soil back to site.	No
On- and Off-Site Disposal			
On-Site Disposal	Requires construction of a secure landfill that meets RCRA and state requirements.	Migration of soil contamination into groundwater is not a significant transport mechanism and containment of the waste material in an on site landfill is not necessary.	No
Off-Site Disposal	Involves the excavation and hauling of contaminated mterial to appropriate commercially licensed disposal facilities. The non-hazardous spoils would go to a non-haz/solid waste facility, while the hazardous spoils would go to a RCRA-permitted facility.	Excavation and disposal of contaminated soil at a permitted landfill is an effective method of reducing potential for direct contact with contaminated soils and future contamination of the groundwater. Backfill materials would need to be imported to fill the site.	Yes

4 Identification of Alternatives

This section combines the technologies selected in Section 3 into alternatives. In collaboration with NYSDEC, the following five alternatives were identified for the soil contamination at Site 518. A detailed description and evaluation of the alternatives is presented in Section 5.

4.1 Alternative No. 1: No Action

The no-action alternative was carried through the FS for comparison purposes as required by the NCP. This alternative would be acceptable only if it is demonstrated that the contamination at the site is below the remedial action objectives, or that natural processes will reduce the contamination to acceptable levels. This alternative does not include institutional controls.

4.2 Alternative No. 2: Institutional Controls and Long Term Monitoring

The ICs alternative will consist of access/use and deed restrictions at the site to limit the potential for human exposure to contaminated site soils. Fencing and signage will be used as a physical barrier and warning to further restrict human contact with site soils. Lastly, LTM will include monitoring of existing groundwater wells located along the Hudson River to demonstrate that PCBs do not migrate into the river.

4.3 Alternative No. 3: Selective Excavation and On-Site Consolidation/Containment

This alternative consists of consolidation and covering the contaminated soil at the site. This containment alternative reduces direct contact exposure, migration of fugitive dust, and limits the infiltration of precipitation. The cover system will consist of a combination of soil and crushed stone to retain the existing land types at the site. Institutional controls (to include deed restrictions) and LTM will also be implemented in combination with the cover installation to maintain the integrity of the cover system.

4.4 Alternative No. 4: Excavation and Off-Site High Temperature Thermal Desorption

This alternative consists of excavation and thermal treatment of contaminated soils that exceed site cleanup goals. An off-site HTTD system was selected to thermally treat the contaminated soils (see Section 5.2.5). This process uses heat to contaminated material to volatilize the contaminants (i.e., physical separation process), and then collecting and treating the gas stream.

4.5 Alternative No. 5: Excavation and Off-Site Disposal

This alternative consists of excavation and off-site disposal of contaminated soils that exceed the site cleanup goals. The excavated material will be stockpiled, sampled, and disposed of accordingly. As maximum PCB concentrations in soil at this site were detected at approximately 20 ppm, contaminated soils are considered non-hazardous waste (i.e., less than 50 ppm) and are anticipated to be disposed of in a non-hazardous/solid waste facility.

5 Detailed Analysis of Alternatives

5.1 Introduction

The purpose of the detailed analysis of remedial action alternatives is to present the relevant information for selecting a remedy for the site. In the detailed analysis, the alternatives established in Section 4 are described in detail and evaluated on the basis of environmental benefits and costs using criteria established by NYSDEC in TAGM 4030, Draft DER-10, and 6 NYCRR Part 375. This approach is intended to provide needed information to compare the merits of each alternative and select an appropriate remedy that satisfies the remedial action objectives for the site.

5.1.2 Detailed Evaluation of Criteria

This section first presents a summary of 10 evaluation criteria that were used to evaluate the alternatives.

Overall Protection of Human Health and the Environment

This criterion provides an overall assessment of protection of human health and the environment and is based on a composite of factors assessed under the evaluation criteria, especially short-term effectiveness, long-term effectiveness and performance, and compliance with cleanup goals.

Compliance with SCGs

This criterion is used to evaluate the extent to which each alternative may achieve the proposed cleanup goals. The proposed cleanup goals were developed based on SCGs presented in Section 2.

Short-Term Impacts and Effectiveness

This criterion addresses the impacts of the alternative during the construction and implementation phase until the RAOs are met. Factors to be evaluated include protection of the community during the remedial actions; protection of workers during the remedial actions; and the time required to achieve the remedial action objectives. Several alternatives described within the following sections may not be effective in meeting RAOs in less than 30 years. Therefore, references to short-term impacts and effectiveness may include discussions of impacts/effectiveness over a period of 30 years.

Long-Term Effectiveness and Permanence

This criterion addresses the long-term protection of human health and the environment after completion of the remedial action. An assessment is made of the effectiveness of the remedial action in managing the risk posed by untreated wastes and/or the residual contamination remaining after treatment and the long-term reliability of the remedial action.

Reduction of Toxicity, Mobility, and Volume

This criterion addresses NYSDEC's preference for selecting "remedial technologies that permanently and significantly reduce the toxicity, mobility and volume" of the COCs at the site. This evaluation consists of assessing the extent to which the treatment technology destroys toxic contaminants, reduces mobility of the contaminants using irreversible treatment processes, and/or reduces the total volume of contaminated media.

Implementability

This criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of services and materials required during implementation. Technical feasibility refers to the ability to construct and operate a remedial action for the specific conditions at the site and the availability of necessary equipment and technical specialists. Technical feasibility also considers construction and O&M difficulties, reliability, ease of undertaking additional remedial action (if required), and the ability to monitor effectiveness. Administrative feasibility refers to compliance with applicable rules, regulations, and statutes and the ability to obtain permits or approvals from government agencies or offices.

Cost

The estimated capital costs, long-term O&M costs, and environmental monitoring costs are evaluated. The estimates included herein (unless otherwise noted) assume engineering and administrative costs would equal 10% of the capital costs and contingency costs would equal 15% of the capital costs. A present-worth analysis is made to compare the remedial alternatives on the basis of a single dollar amount for the base year. For the present-worth analysis, assumptions are made regarding the interest rate applicable to borrowed funds and the average inflation rate. According to the *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*, the Superfund program recommends that a discount rate of 5% before taxes and after inflation be assumed. Also, the CERLA guidance states that in general, the period of performance for costing purposes should not exceed 30 years for the purpose of the detailed analysis. Therefore, the following detailed analysis of remedial alternatives will follow this guidance. The comparative cost estimates are intended to reflect actual costs with an accuracy of +50% to –30%.

State Acceptance

This assessment evaluates the technical and administrative issues and concerns the state may have regarding each alternative. This criterion will be addressed in the Record of Decision (ROD) once comments are received on the proposed plan. Therefore, state acceptance will not be discussed further in this report.

Community Acceptance

This assessment evaluates the issues and concerns the public may have regarding each alternative. This criterion will be addressed in the ROD once comments on the proposed plan have been received. Therefore, community acceptance will not be discussed further in this report.

Land Use

The land use criterion evaluates the issues and concerns regarding the current, intended, and reasonably anticipated future land uses of the site. Other considerations include the sites' surroundings, compatibility with applicable zoning laws, compatibility with comprehensive community master plans and Local Waterfront Revitalization plans, proximity to incompatible property in proximity to the site, accessibility to existing infrastructure, and a number of other concerns as identified in 6 NYCRR Part 375-1.

A detailed description of the alternatives listed in Section 4 and evaluation criteria are described below. Cost estimates for each alternative are presented in Tables 5-1 through 5-4. Table 5-5 presents a summary of these costs.

5.2 Remedial Alternatives

5.2.1 Alternative No. 1: No Action

5.2.1.1 Description

The no-action alternative involves taking no further action to remedy site conditions. The NCP at Title 40 Code of Federal Regulations (40 CFR) §300.430(e) (6) provides that the no action alternative be considered at every site as a baseline for comparison with other alternatives. This alternative does not include remedial action, institutional or engineering controls, or LTM.

5.2.1.2 Detailed Evaluation of Criteria

Overall Protection of Human Health and the Environment

This alternative is not protective of human health and the environment, because the site would remain in its present condition. Soil contamination exceeding target risk levels and regulatory levels will continue to exist at the site and will be available for potential future exposure. Uncontrolled excavations could lead to PCB exposure and therefore risk to human health. In addition, ingestion exposure of contaminated soil by certain wildlife may be a risk.

Compliance with SCGs

The contaminants (PCBs) are resistant compounds by nature and are not expected to decrease appreciably over time. Therefore, this alternative would not comply with the chemical-specific SCGs for the site.

Short-Term Impacts and Effectiveness

No short-term impacts (other than those existing) are anticipated during the implementation of this alternative since there are no remedial activities involved.

This alternative does not include source removal or treatment and would not meet the RAOs (as defined in Section 2.3) in a reasonable or predictable timeframe.

Long-term Effectiveness and Permanence

Because this alternative does not involve removal or treatment of the contaminated soil, the volume of contamination and risks associated with exposure to the soil will essentially remain the same. This alternative is therefore not effective in the long term.

Reduction of Toxicity, Mobility, and Volume though Treatment

This alternative does not involve removal or treatment of contaminated soil, and therefore, the toxicity, mobility, and volume of contamination will not be reduced.

Implementability

There are no actions to implement under this alternative.

Cost

There are no costs associated with this alternative.

Land Use

The site is currently owned by NYS and operated by the Canal Corporation. Daily activities at the site are ongoing and include industrial type activities. Based on village zoning maps (Village of Fort Edward 1984), the site is zoned as residential for multi-unit housing. NYSDEC indicated the future use of this site is expected to be the same as current use. However, since there is a potential for the site to become residential based on current zoning, implementation of this alternative may limit future use at this site.

5.2.2 Alternative No. 2: Institutional Controls and Long-Term Monitoring

5.2.2.1 Description

Institutional controls including access/use and deed restrictions and physical barriers such as fencing and posting signs (herein referred to as institutional controls) will be applied at this site. Deed restrictions would be filed to control future use/activities at the site from exposing or contacting contaminated soil. Site fencing will be installed to encompass soil contamination as shown on Figure 5-1. If this alternative is selected with current site activities to occur in the future, occupational Safety and Health Administration (OSHA) regulations must be followed to ensure protection of the workers. Like Alternative No. 1, this alternative does not include remedial action. LTM of five existing monitoring groundwater wells will be performed to observe PCB levels in groundwater. Monitoring wells 518-MW-01 through 518-MW-03 are located between the contaminated soil and the Hudson River while 518-MW-04 and 518-MW-05 are located between the contaminated soil and the Champlain Canal. These wells will be sampled every five years and analyzed for TCL PCBs (EPA Method 8082) at an off-site laboratory. A five-year duration between sampling events was selected as no PCB contamination was detected in groundwater. Thus frequent groundwater monitoring is not warranted.

As portions of the site are located within the 100-year floodplain, an evaluation would need to be performed to determine the impacts of installing a fence along the western perimeter of the site prior to implementation of this alternative. Pending results from this evaluation that indicate installation of a fence would be acceptable, this alternative can be readily implemented.

5.2.2.2 Detailed Evaluation of Criteria

Overall Protection of Human Health and the Environment

Placement of institutional controls such as access and deed restrictions (that would control future use/activities at the site) would provide some long-term protection of human health. Fencing and signs alone may not be adequate to prevent unauthorized access to the site by trespassers (who could potentially directly contact contaminants). In addition, fencing would provide limited protection for certain wildlife from ingestion of site contaminants.

Compliance with SCGs

The contaminant levels in soil are not expected to decrease appreciably over time. Therefore, this alternative would not comply with the chemical-specific SCGs for the site. Action-specific and location-specific SCGs (e.g., safety regulations) would be included in the institutional controls and complied with for site activities.

Short-Term Impacts and Effectiveness

No short-term impacts (other than those existing) are anticipated during the implementation of this alternative since there are no remedial activities involved. Controlling future use and activities on-site would protect workers' health. This alternative would provide some protection to the community by notifying the public and limiting site access. This alternative will achieve RAOs through limiting direct human contact with impacted material.

Long-Term Effectiveness and Permanence

This alternative would not be effective in the long term (in terms of protecting human health and the environment) because this alternative does not involve removal or treatment of contaminated soil. The risks involved with direct contact with on-site contaminants would be limited to some extent with this alternative. In addition, the potential for erosion to occur would remain. Deed or other restrictions would be effective in the long term as long as they are interpreted correctly, not modified by future site users, and are enforced.

Reduction in Toxicity, Mobility, or Volume through Treatment

This alternative does not involve the removal or treatment of contaminated soil. Therefore, neither the toxicity, nor mobility, nor volume of contamination is expected to be reduced.

Implementability

Pending acceptable results from the floodplain evaluation, this alternative can be readily implemented on a technical and administrative basis using typical institutional control practices and procedures. However, it may be difficult to ensure long-term enforcement.

Cost

The 2009 total present-worth cost of this alternative based on a 30-year period is $210,000. Table 5-1 presents the quantities, unit costs, and subtotal costs for the various work items in this alternative. Cost estimating information was obtained from RS Means Cost Data series and engineering judgment. Groundwater sampling and renewal of institutional controls are assumed with this alternative.

Land Use

The site is currently owned by NYS and operated by the Canal Corporation. Daily activities at the site are ongoing and include industrial type activities. Based on village zoning maps (Village of Fort Edward 1984), the site is zoned as residential for multi-unit housing. NYSDEC indicated the future use of this site is expected to be the same as current use. However, since there is a potential for the site to become residential based on current zoning, implementation of this alternative may limit future use at this site.

5.2.3 Alternative No. 3: Selective Excavation and On-site Consolidation/Containment

5.2.3.1 Detailed Description

This remedial alternative involves the consolidation and containment (covering) of contaminated soils by means of a soil/crushed stone cover, and the implementation of institutional controls to protect the integrity of the cover. This containment alternative reduces direct contact exposure, migration of fugitive dust, and limits the infiltration of precipitation. Areas that are currently grassed (i.e., northwest portion of this site) will be covered with 6 inches of soil to maintain existing ground cover to the extent practicable. Institutional controls (to include deed restrictions) and long-term monitoring would also be implemented in combination with the cover installation to maintain the integrity of the cover.

As portions of the site are located within the 100-year floodplain, an evaluation would need to be performed to determine the impacts of raising grades at the site due to construction of a cover prior to implementation of this alternative. Pending results from this evaluation that indicate placement of a cover at this site would be acceptable, this alternative can be readily implemented as follows.

In an effort to minimize the containment area, contaminated soil in the northeastern portion of the site would be consolidated to the main area of dredge spoils, and covered by soil (or crushed stone where work areas currently exist) over existing soil contamination in the central portion of the site. It is estimated that approximately 270 cubic yards of soil would be excavated to a maximum depth of 2.8 feet and consolidated on site. The consolidated soil would then be graded and compacted for the cover system installation.

As shown in Figure 5-2, the covered area would encompass a surface area of approximately 4 acres. The proposed cover configuration was selected to cover the existing on site soil contamination, in addition to maintaining the general site topography. Existing metal buildings and equipment are assumed to be temporarily relocated during construction of the cover. The cover installation would be sloped to drain to remaining grassy areas surrounding the new cover. During the remedial design phase of this project, a stormwater management plan would need to be completed to make sure that current applicable standards and guidance are followed.

Installation of the cover system is estimated to be complete within one year.

Institutional controls including access/use and deed restrictions and physical barriers, such as environmental easements and posting signs (i.e., institutional controls) would be applied at this site. Deed restrictions/environmental easements would be filed to control future use/activities at the site from exposing or contacting contaminated soil. A site management plan would specify that contaminated soil exists below the demarcation layer of the soil/crushed stone cover, and that OSHA regulations must be followed to ensure protection of workers.

Institutional controls and groundwater monitoring would be implemented as described in Alternative 2, in combination with the cover installation, in order to prevent future uses of the site that would compromise the integrity of the cover system.

Long-term monitoring of five existing monitoring groundwater wells would be performed to observe PCB levels in groundwater. These wells would be sampled every five years and analyzed for Target Compound List (TCL) PCBs (EPA Method 8082) at an off-site laboratory. A five-year duration between sampling events was selected since no PCB contamination was detected in groundwater.

5.2.3.2 Detailed Evaluation of Criteria

Overall Protection of Human Health and the Environment

Although contamination will remain on site, this alternative will be protective of human health since the cover system will significantly reduce the potential for direct human exposure. Additionally, this alternative is considered to be protective of the environment since the cover design will help to limit the infiltration of rainwater into the subsurface. This will reduce the potential for migration of the contaminants in the saturated zone.

In order to maintain protection of human health and the environment, institutional controls, such as restrictions on subsurface excavation of the covered area, will need to be implemented so that future uses of the site are consistent with the intent of the cover.

Compliance with SCGs

This alternative does not comply with SCGs for the COC, since contamination will remain on site. However, the site-specific data indicate that the groundwater is not being impacted. Considering this, the SCO is met because the surface soils would be less than 1 ppm with the half-foot of clean cover.

Short-Term Impacts and Effectiveness

A minimal amount of short-term impacts to the community and workers may arise during the installation of the cover system. Canal Corporation activities may be impacted due to relocation of equipment and metal storage buildings while the cover is being installed. Other short-term impacts include dust and noise during the installation process. To minimize short-tem impacts, site access will be restricted during construction and remediation activities. Health and safety measures, including use of appropriate personal protective equipment, and decontamination of equipment leaving the site, will be in place to protect the workers and surrounding community. Action levels will be set prior to any intrusive activities, and an appropriate correction action will be implemented if these action levels are exceeded.

Because this alternative does not involve removal or treatment of contaminated soil from the site, site RAOs will be not be achieved at the completion of this work. However, the site-specific data indicate that the groundwater is not impacted. Considering this, the SCO is met because the surface soils would be less than 1 ppm with the half-foot of clean cover. Installation of the cover system is estimated to be complete within one year. Additional time would be needed for engineering, design, mobilization/demobilization, etc.

Long-Term Effectiveness and Permanence

With proper inspection and routine maintenance, this alternative is considered adequate and effective in the long term. However, since contamination would remain on site, the potential for future human exposure remains if the integrity of the cover system is jeopardized, or future use of the site changes. Institutional controls along with proper maintenance of the cover would limit the potential for future exposure. Deed or other restrictions would be effective in the long term as long as they are interpreted correctly, not modified by future site users, and are enforced.

Reduction in Toxicity, Mobility, or Volume through Treatment

This alternative does not involve treatment of contaminated material, and therefore the toxicity, mobility, or volume of contamination will not be reduced. Covering is expected to indirectly reduce the potential mobility of the contaminants into the saturated zone as a result of the expected reduction in rainwater infiltration.

Implementability

Pending acceptable results from the floodplain evaluation, this alternative can be readily implemented on a technical and administrative basis using standard construction means/methods and typical institutional control practices/procedures. No technical difficulties are anticipated during construction activities. No availability problems have been identified and there is no delay anticipated in obtaining the necessary approvals/permits from state and local agencies or in placing institutional controls for implementation of this alternative.

Cost

The 2009 total present-worth cost of this alternative based on a 30-year period is $720,000. Table 5-2 presents the quantities, unit costs, and subtotal costs for the various work items in this alternative. Cost estimating information obtained from RS Means Cost Data series, engineering judgment, and vendor provided costs. Annual site monitoring costs, maintaining institutional controls, and groundwater sampling were assumed for this alternative.

Land Use

The site is currently owned by NYS and operated by the Canal Corporation. Daily activities at the site are ongoing and include industrial type activities. Based on village zoning maps (Village of Fort Edward 1984), the site is zoned as residential for multi-unit housing. NYSDEC indicated the future use of this site is expected to be the same as current use. However, since there is a potential for the site to become residential based on current zoning, implementation of this alternative may limit future use at this site.

5.2.4 Alternative No. 4 - Excavation and Off-Site High Temperature Thermal Desorption

5.2.4.1 Detailed Description

This alternative involves the excavation, off site treatment, and backfill of treated soils at the site. Figure 5-3 presents the extent of excavation while Figure 5-4 presents a conceptual process for this alternative. As indicated in Section 2.4.3, a total of approximately 31,000 cubic yards of soil will be excavated from the site and hauled to an off site HTTD facility for treatment. It is assumed that the existing monitoring wells will be decommissioned, without replacement, in the excavated areas as groundwater monitoring is not included in this alterative (see Figure 5-3).

Excavation of the contaminated soil will be performed using conventional construction equipment such as a hydraulic excavator and bulldozers. As shown in Figure 5-3, the primary excavation area is located in the center of the site with one additional smaller area to the north. The maximum depth of excavation in the primary excavation area is approximately 8.5 feet BGS and 2.8 feet in the northern area. To ensure safe working conditions in the excavation at all times sloping of the excavation sides will be required. Based on a cutback slope of 3:1, EEEPC estimated that approximately 2,700 cubic yards of clean soil will need to be excavated from the site.

During the excavation process, PCB field screening tests will be used in accordance with 40 CFR 761.61, analytical sampling for metals, and the approval of NYSDEC to verify contamination levels. The goal will be to determine if the remaining soil has PCB or metals levels above cleanup criteria, thus requiring additional excavation, or providing documentation that additional excavation is not necessary if the results indicate that PCB and metals levels are less than the respective clean up goals. A sampling grid will be developed over each soil area for the NYSDEC's approval.

Based on groundwater elevations collected during the RI (EEEPC 2007) it does not appear that the excavation at this site will extend into the groundwater table. Therefore, excavation dewatering is not assumed at this site. Some site utilities (as shown in Figure 5-3) are anticipated to be encountered during excavation activities. Adequate protection of these utilities should be performed to prevent service interruption.

After excavation, contaminated soils will be loaded into trucks and transported to an a HTTD treatment facility that can accept site soils. For this alternative, lined and covered dump trucks were assumed for transportation of site soils.

After each dump truck unloads the contaminated soil at the treatment facility, the dump truck will then load soil that has been treated and return to the site to be used as backfill. The off-site treatment facility requires a week to process soils and there will be a one-week lag period between the initial unloading of contaminated soils and receiving treated soils. The reuse of treated site soils versus new backfill was preferred as a cost-saving and resource saving alternative. Instead of trucks returning to the site (from the treatment facility) empty, they can return with the backfill needed for the site. Furthermore, reuse of treated soil eliminates the need for the treatment facility to dispose of the material and reduces the need to use natural resources (soil).

Negligible soil loss is anticipated through the treatment process, thus it was assumed no additional backfill will be required for the site. Considering activities at the site, a geotextile fabric and 6-inch layer of gravel or topsoil and grass will be placed to restore the site to pre-construction conditions.

5.2.4.2 Detailed Evaluation of Criteria

Overall Protection of Human Health and the Environment

This alternative is considered protective of human health and the environment since the contaminated material is excavated and thermally treated off site to meet site cleanup levels. Because the contaminants will be treated and destroyed, exposure risks associated with soil contamination will be eliminated.

Compliance with SCGs

This alternative will meet SCGs since the PCB contamination in site soils will be effectively treated to meet cleanup goals at the site. Applicable action- and location-specific SCGs including noise limitations and OSHA regulations will be in compliance during implementation of the alternative.

Short-Term Impacts and Effectiveness

Several short-term impacts to the community and workers may arise during excavation of contaminated soil from the site. Primarily, Canal Corporation activities will be significantly impacted during the excavation and backfilling activities as storage of equipment, vehicles, and metal storage buildings are located above contaminated areas to be excavated. Furthermore, an increased risk to workers is imposed due to the equipment required to excavate the soil. Community impacts include dust and noise from equipment operation. To minimize other short-term impacts, site access will be restricted during excavation and remediation activities. Health and safety measures, including air monitoring, use of appropriate personal protective equipment (PPE), and decontamination of equipment leaving the site, will be in place to protect the workers and surrounding community. Action levels for the site will be set prior to any intrusive activities, and an appropriate correction action will be implemented if these action levels are exceeded.

Off-site transportation of contaminated soil to the disposal facility will be performed by a licensed hauler. While there is a risk of spills due to accidents, this risk will be minimized by using closed and lined containers for transport.

This alternative involves treatment of contaminated soil off site, so the preliminary remediation goals will be achieved at the completion of this work. Excavation and thermal treatment of the contaminated soil is estimated to be complete in less than 1 year. Additional time would be needed for engineering, design, mobilization/demobilization, etc.

Long-Term Effectiveness and Permanence

This alternative is considered to be an effective remedy in the long term, since contaminants in site soils will be destroyed using thermal treatment. Treated soil will meet site cleanup criteria, therefore human health and environmental risks will be eliminated.

Reduction in Toxicity, Mobility, or Volume through Treatment

The volume of contamination will be reduced at the site because this alternative actively treats PCB contamination in site soils. Consequently, the toxicity and mobility of the contaminants will also be reduced.

Implementability

This alternative can be readily implemented using standard construction means and methods. The treatment facility has been contacted and can readily accept contaminated site soils.

Cost

The 2009 total present-worth cost of this alternative based on a 30-year period is $7,554,000. Table 5-3 presents the quantities, unit costs, and subtotal costs for the various work items in this alternative. Technology-specific costs were obtained from ESMI of New Hampshire in 2007, while other cost estimating information was obtained from RS Means cost data series and engineering judgment. No long-term O&M costs are anticipated with this alternative.

Land Use

The site is currently owned by NYS and operated by the Canal Corporation. Daily activities at the site are ongoing and include industrial type activities. Based on village zoning maps (Village of Fort Edward 1984), the site is zoned as residential for multi-unit housing. NYSDEC indicated the future use of this site is expected to be the same as current use. However, since there is a potential for the site to become residential based on current zoning, implementation of this alternative would not limit future use at this site.

5.2.5 Alternative No. 5 - Excavation and Off-Site Disposal

5.2.5.1 Detailed Description

This alternative involves the excavation and off-site disposal of contaminated soils at Site 518 (see Figure 5-3). The excavated soil will be stockpiled, characterized, and properly disposed of off site. Due to the fact that contamination within this site does not exceed 50 mg/kg, according to NYS regulations the contaminated soil is considered to be a non-hazardous waste. As such non-hazardous soils can be disposed of at an acceptable solid waste landfill. Temporary facilities will be required for on-site storage of contaminated material after excavation. Clean fill will be used to backfill the excavated areas to bring final grades to preconstruction grades.

Excavation of the contaminated soil and analytical testing will be performed as described in Alternative 4. Excavated soils will be stockpiled on plastic-lined areas on site for characterization in accordance with disposal facility requirements. The contractor will be responsible for the characterization sampling, which will be conducted at a NYSDOH certified laboratory.

After the results of the characterization sampling are received, the soil will be cleared for disposal by NYSDEC. For this alternative, lined and covered dump trucks were assumed at $45 per ton for transportation of the non-hazardous soil. Trucks will be weighed with an empty load. The soil will be loaded onto the trucks then weighed again to determine the loaded weight of the vehicle. The trucks will then transport the soil to the appropriate disposal facility.

Excavated soils with PCB concentrations less than 50 mg/kg are considered non-hazardous. These soils can be disposed of in a permitted NYSDEC approved non-hazardous/solid waste landfill. A number of disposal locations are available for non-hazardous soils. For example, Waste Management, Inc. accepts soil with PCBs less than 50 mg/kg at a landfill in Fairport, New York. For costing purposes, unit costs from this Waste Management facility with the understanding that a landfill closer to the site may be located at the design stage. The contractor will be responsible for characterization sampling in accordance with disposal facility requirements. At a minimum, EEEPC assumed that toxicity characteristic leaching procedure (TCLP), pesticides/PCB, PAH, RCRA ignitability, RCRA corrosivity, and RCRA reactivity analyses will be performed on samples collected every 1,000 cubic yards. Based on the volume estimate in Section 2.4.3 approximately 31,000 cubic yards of contaminated soil will be excavated and disposed of as non-hazardous material.

Following excavation and removal of designated soil from the site, imported clean fill will be placed and compacted in the excavation area. Considering activities at the site, a geotextile fabric and 6-inch layer of gravel or topsoil and grass will be placed to restore the site to pre-construction conditions.

5.2.5.2 Detailed Evaluation of Criteria

Overall Protection of Human Health and the Environment

This alternative is protective of human health and the environment since contaminated soils will be removed from the site and properly disposed of in an environmentally acceptable facility. The contaminated soil will no longer present an exposure risk.

Compliance with SCGs

This alternative complies with SCGs since contaminated soils will be removed from the site and properly disposed of in an environmentally acceptable facility. Off-site disposal will comply with all applicable land disposal restrictions and analytical requirements. Action- and location specific SCGs including noise limitations and OSHA regulations will be in compliance with during implementation of this alternative.

Short-Term Impacts and Effectiveness

Several short-term impacts to the community and workers may arise during excavation of contaminated soil at the site. Primarily, Canal Corporation activities will be significantly impacted during the excavation and backfilling activities as storage of equipment, vehicles, and metal storage buildings are locate above contaminated areas to be excavated. Other impacts include dust, noise, and potential spills during handling and transportation of contaminants. To minimize short-tem impacts, site access will be restricted during construction and remediation activities. Health and safety measures, including air monitoring, use of appropriate PPE, and decontamination of equipment leaving the site, will be in place to protect the workers and surrounding community. Action levels will be set prior to any intrusive activities, and an appropriate correction action will be implemented if these action levels are exceeded.

Off-site transportation of contaminated soil to the disposal facility will be performed by a licensed hauler. While there is a risk of spills due to accidents, this risk will be limited by using closed and lined containers for transport.

Because this alternative involves removal of the contaminated soil from the site and replacement with clean fill, site RAOs will be achieved at the completion of this work. The time to complete this alternative is estimated to be less than one year.

Long-Term Effectiveness and Permanence

Removal and off-site disposal is considered to be an adequate and effective remedy in the long-term since the contaminated soil will no longer represent a human health or ecological risk through exposure.

Reduction in Toxicity, Mobility, or Volume through Treatment

This alternative does not reduce the toxicity, mobility, or volume of contaminated soil through treatment. However, excavation and off-site disposal of contaminated soils will eliminate concerns associated with toxicity and mobility of the contaminants at the site. Since the non-hazardous soil will be disposed of in an engineered permitted facility, the mobility of the contaminants will be within acceptable limits and would be practically reduced.

Implementability

This alternative is readily implemented using standard construction means and methods. No technical difficulties are anticipated during excavation and removal of contaminated soil. Contaminated soil will be excavated, tested, and disposed of at a non-hazardous waste facility. Several facilities have been identified which can accept the contaminated soil from the site. No capacity or availability problems have been identified. Finally, no delay is anticipated in obtaining the necessary approvals from the state and local agencies for implementation of this alternative.

Cost

The 2009 total present-worth cost of this alternative based on a 30-year period is $7,742,000. Table 5-4 presents the quantities, unit costs, and subtotal costs for the various work items in this alternative. Disposal costs were obtained from Waste Management, Inc., of New York in 2007, while other cost estimating information was obtained from RS Means Cost Data series and engineering judgment. No long-term O&M costs are anticipated with this alternative.

Land Use

The site is currently owned by NYS and operated by the Canal Corporation. Daily activities at the site are ongoing and include industrial-type activities. Based on village zoning maps (Village of Fort Edward 1984), the site is zoned as residential for multi-unit housing. NYSDEC indicated the future use of this site is expected to be the same as current use. However, since there is a potential for the site to become residential based on current zoning, implementation of this alternative would not limit future use at this site.

5.3 Comparative Evaluation of Alternatives

Overall Protection of Human Health and the Environment

Since Alternative 1 employs no action, contaminated site soils will remain on site providing no protection for potential future exposure. Alternatives 2, 3, 4 and 5 are more protective of human health and the environment; each at a different level. By only using institutional controls in Alternative 2, fencing and signage could reduce human exposure; however, inadequate enforcement could lead to potential health risks in the future. Wildlife may also not be properly protected with this alternative. By covering the contaminated areas of the site in Alternative 3, potential direct human exposure pathways would be eliminated as well as reducing migration of contamination by minimizing infiltration of precipitation. Institutional controls must be implemented to maintain protection of human health and the environment. Alternatives 4 and 5 provide a higher level of protection than Alternative 2 and 3 because the contaminated soils will be excavated and either treated or properly disposed of off site.

Compliance with SCGs

PCBs are recalcitrant compounds by nature and, therefore, their levels in the soil are not expected to decrease over time. Alternatives 1 and 2 do not comply with SCGs because the contaminated soils will remain on site. Although Alternative 3 may not comply with the subsurface restricted residential cleanup goal of 1 ppm, the site-specific data indicate that the groundwater is not impacted. Considering this, the SCO is met and the surface soils would be less than 1 ppm with the half-foot of clean cover. Alternatives 4 and 5 comply with SCGs since soil contamination will be either treated or properly disposed of off site.

Short-Term Impacts and Effectiveness

Short-term impacts are not anticipated for Alternatives 1 and 2, since no remediation activities will take place. Several similar short-term impacts may affect the community during remedial activities for Alternatives 3, 4, and 5 such as dust and noise due to excavation of the contaminated soil. Canal Corporation activities may be impacted due to relocation of equipment and metal buildings while the cover is being installed or excavation/backfilling takes place. A continuous influx of dump trucks would be needed on a daily basis as well as the potential for spills of contaminated soils during the off-site transport of soils by trucks with Alternatives 4 and 5. It is anticipated that the remedial construction duration for Alternatives 3, 4, and 5 will be on the same timeframe, however, LTM would continue for the next 30 years in Alternative 3. Noise impacts are inherent of excavation activities, therefore, affecting Alternatives 4 and 5.

Long-Term Effectiveness and Permanence

Since Alternative 1 employs no action, contaminated soil will remain on site providing no protection for potential future exposure. Alternative 2 is effective in the long term provided proper enforced is performed. Similarly, Alternative 3 is effective in the long term provided proper inspection and routine maintenance is performed. Alternatives 4 and 5 have a higher level of long-term effectiveness and permanence than Alternatives 1, 2, and 3 because contaminated soils will be either treated to eliminate on-site PCB contamination or properly disposed of.

Reduction in Toxicity, Mobility, or Volume through Treatment

Reduction in toxicity, mobility, or volume through treatment will be achieved through treatment in Alternative 4. Alternatives 1, 2, and 3 will not treat contaminated soils, therefore, reduction in toxicity, mobility, or volume will not take place. However, Alternative 3 is expected to indirectly reduce mobility of contamination through covering of the site. Similarly, Alternative 5 will essentially eliminate concerns of toxicity, mobility, and volume of contaminated soil at the site through off-site disposal at permitted disposal facility.

Implementability

There are no actions to implement for Alternative 1. Alternatives 2 through 5 are readily implemented using standard construction means and methods. However, a floodplain evaluation would need to be performed prior to implementation of Alternatives 2 and 3. Off-site treatment and disposal facilities are able to readily accept contaminated site soils.

Cost

Alternative 1 calls for no action, and thus incurs no costs. Alternative 2 has a lower total present worth and O&M cost than Alternatives 3 through 5 because no soil excavation is required for this alternative. Alternative 5 is the most expensive alternative with Alternative 4 estimated approximately 5% less than Alternative 5.

Land Use

As contaminated soil will be left in place for Alternatives 1, 2, and 3, future uses at the site may be limited based on current zoning. For Alternatives 4 and 5, contaminated soil will be either removed or treated thus future uses at the site would not be limited.

Table 5-1 Cost Estimate for Alternative 2 - Institutional Controls and Long-term Monitoring
Site 518 Dredge Spoil Disposal Area

Item Description	Comment	Unit	Quantity	Unit Cost	Cost
Capital Costs					
Institutional Controls		Each	1	$5,000	$5,000
Subtotal					$5,000
Physical Barriers/Warnings					
Cut and Chip Trees	Trees to 12" dia.	Acre	0.5	$4,950	$2,475
Grub Stumps and Remove		Acre	0.5	$3,225	$1,613
Fence	Chain link industrial, 6' H, 6 gauge wire with 3 strands barb wire	LF	3,000	$29.00	$87,000
Gate	Double swing gates, incl posts with 12' opening; 2 along the eastern boundary and 1 along the western boundary	Each	3	$1,250.00	$3,750
Signs	Reflectorized 24"x24" sign mounted to fence	Each	5	$150.00	$750
Subtotal					$95,588
				Capital Cost Subtotal:	$100,588
				Adjusted Capital Cost Subtotal for Glens Falls, New York Location Factor (0.92):	$92,541
				10% Legal, administrative, engineering fees:	$9,254
				15% Contingencies:	$15,269
				Total Capital Cost:	**$118,000**
Annual Costs					
Not Applicable				$0.00	$0
Subtotal					$0
				Annual Cost Subtotal:	$0
				Adjusted Capital Cost Subtotal for Glens Falls, New York Location Factor (0.92):	$0
				10% Legal, administrative, engineering fees:	$0
				15% Contingencies:	$0
				Annual Cost Total:	**$0**
				30-Year Present Worth of Annual Costs:	**$0**
5-Year Costs					
Groundwater Sampling (Labor)	2-people @ $100/hr; 8 hr/day; total of 5 wells; assume 3 wells/day	Day	2	$1,600.00	$3,200
Parameter Analysis	Includes TCL PCBs	Each	5	$100.00	$500
Data Evaluation and Reporting		HR	32	$100.00	$3,200
10% of Fence Replaced	Chain link industrial, 6' H, 6 gauge wire with 3 strands barb wire	LF	300	$29.00	$8,700
Institutional Controls	Maintain/update documentation	Each	1	$1,000.00	$1,000
Subtotal					$16,600
				5-Year Cost Subtotal:	$16,600
				Adjusted Annual Cost Subtotal for Glens Falls, New York Location Factor (0.92):	$15,272
				10% Legal, administrative, engineering fees:	$1,527
				15% Contingencies:	$2,520
				5-Year Total:	**$19,400**
				30-Year Present Worth of 5-Year Costs:	**$73,000**
				2007 Total Present Worth Cost:	*$191,000*
				2009 Total Present Worth Cost:	**$210,000**

Assumptions:

1. Length of fencing obtained from EEEPC CAD department August 2007.
2. Wooded area assumed to be = 5% of capping area, or 0.2 acres
   0.2 acres, total (round to nearest 0.5 acre)
3. Present worth of costs assumes 5% annual interest rate.
4. Unit costs listed were obtained from 2007 RS Means Cost Data and engineering judgement.
5. RS Means Historical Cost Index used to escalate 2007 costs to 2009 costs:

Year	Index #
2007	169.4
2009	185.9

Abbreviations:

HR = Hour
LF = linear foot

Table 5-2 Cost Estimate for Alternative 3 - Selective Excavation and On-site Consolidation/Containment
Site 518 Dredge Spoil Disposal Area

Item Description	Comment	Unit	Quantity	Unit Cost	Cost
Capital Costs					
Construction Management (2.5% of total capital cost)	Includes submittals, reporting, meetings	LS	1	$25,000.00	$25,000
Institutional Controls		Each	1	$5,000.00	$5,000
Subtotal					$30,000
Site Preparation					
Surveying Crew	2-person crew @ $100/hr, 8hr/day; assume 25% of project duration	Day	46	$1,600.00	$73,000
Cut and Chip Trees	Trees to 12" dia.	Acre	0.5	$4,950.00	$2,475
Grub Stumps and Remove		Acre	0.5	$3,225.00	$1,613
Signs	Reflectorized 24"x24" sign mounted to fence	Each	5	$150.00	$750
Subtotal					$77,838
Health and Safety					
Construct Decontamination Pad & Containment	For equipment & personnel	Setups	2	$3,000.00	$6,000
Community/Exclusion Zone Air Monitoring	Particulate meter purchase (Qty 4)	Each	4	$7,500.00	$30,000
Site Safety Officer	10 hrs/day, 5days/wk, $100/hr; 100% of project duration	manweeks	26	$5,000.00	$130,000
Subtotal					$166,000
Excavation					
Excavation	Backhoe, hydraulic, 2 CY bucket = 130 CY/hr	BCY	262	$1.86	$1,000
Placement of Consolidated Soil	Front End Loader, 5 CY bucket	BCY	262	$1.48	$1,000
Spread Soil	300 Horsepower Bulldozer w/ 50' haul	BCY	262	$1.26	$1,000
Compaction	Vibrating roller, 12" compacted lifts, 4 passes	BCY	262	$0.44	$1,000
Confirmation Sampling (PCB Screening)	Immunoassay testing; includes bottom and sidewall testing	Each	46	$75.00	$3,484
Confirmation Sampling (PCB)	10% samples collected by PCB screening	Each	5	$100.00	$500
Confirmation Sampling (Metals)	TAL metals	Each	46	$200.00	$9,291
Off-Site Disposal (Drums)	Waste decon water (<500 mg/kg PCB, <1% solids); price per 55 gal drum including transportation	Drum	1	$200.00	$200
Subtotal					$17,475
Cover Installation					
Geofabric	over soil and crushed stone cover areas	SY	19,506	$2.57	$50,131
Snow Fence (Demarcation Layer)	over soil and crushed stone cover areas	SF	175,556	$0.30	$52,667
Gravel	Crushed stone, 6-inch thick layer	LCY	2,720	$28.00	$76,157
Backfill (Material)	Includes material and transportation to site; 3" layer for soil cover area	LCY	473	$10.00	$4,727
Topsoil (Material only)	3" thick layer for soil cover area	LCY	473	$12.50	$5,908
Placement of Gravel, Backfill and Topsoil	300 Horsepower Bulldozer w/ 50' haul	BCY	3,251	$1.26	$4,096
Compaction of Gravel, Backfill and Topsoil	Vibrating roller, 6 to 12" compacted lifts, 4 passes	BCY	3,251	$0.44	$1,430
Temporary Relocation and Restoration of Existing Metal Structures	Assumes 1 large and 2 small structures	LS	1	$5,000.00	$5,000
Subtotal					$200,117
Site Restoration (of Excavated Area)					
Backfill (Material)	Includes material and transportation to site; backfill excavated area	LCY	293	$10.00	$2,934
Placement of Backfill	300 Horsepower Bulldozer w/ 50' haul	BCY	262	$1.26	$330
Compaction	Vibrating roller, 12" compacted lifts, 4 passes	BCY	262	$0.44	$115
Topsoil (Material only)	0.5 ft thick layer	LCY	52	$12.50	$656
Placement of Topsoil	300 Horsepower Bulldozer w/ 50' haul	BCY	47	$1.26	$59
Seeding (w/ mulch and fertilizer)	Bluegrass 4#/MSF w/ mulch and fertilizer, hydroseeding; add 10% for disturbed areas outside of excavation area	LS	1	$250.00	$250
Subtotal					$4,345
				Capital Cost Subtotal:	$495,775
				Adjusted Capital Cost Subtotal for Glens Falls, New York Location Factor (0.92):	$456,113
				10% Legal, administrative, engineering fees:	$45,611
				15% Contingencies:	$75,259
				Total Capital Cost:	**$577,000**

Table 5-2 Cost Estimate for Alternative 3 - Selective Excavation and On-site Consolidation/Containment
Site 518 Dredge Spoil Disposal Area

Item Description	Comment	Unit	Quantity	Unit Cost	Cost
Annual Costs					
Site Monitoring	2-person @ $100/hr; 8hr/day; 1 day/yr	Day	1	$1,600.00	$1,600
Data Summary		HR	8	$100.00	$800
Subtotal					$2,400
				Annual Cost Subtotal:	$2,400
				Adjusted Capital Cost Subtotal for Glens Falls, New York Location Factor (0.92):	$2,208
				10% Legal, administrative, engineering fees:	$221
				15% Contingencies:	$364
				Annual Cost Total:	**$2,800**
				30-Year Present Worth of Annual Costs	**$44,000**
5-Year Costs					
Groundwater Sampling (Labor)	2-people @ $100/hr; 8 hr/day; total of 5 wells; assume 3 wells/day	Day	2	$1,600.00	$3,200
Parameter Analysis	Includes TCL PCBs	Each	5	$100.00	$500
Data Evaluation and Reporting		HR	32	$100.00	$3,200
Institutional Controls	Maintain/update documentation	Each	1	$1,000.00	$1,000
Subtotal					$7,900
				5-Year Cost Subtotal:	$7,900
				Adjusted Annual Cost Subtotal for Glens Falls, New York Location Factor (0.92):	$7,268
				10% Legal, administrative, engineering fees:	$727
				15% Contingencies:	$1,199
				5-Year Total:	**$9,200**
				30-Year Present Worth of 5-Year Costs:	**$35,000**
				2007 Total Present Worth Cost:	*$656,000*
				2009 Total Present Worth Cost:	**$720,000**

Assumptions:

1. Total contaminated soil volume = 31,000 BCY
2. Contaminated Soil Volume to be excavated = 262 BCY
3. Total excavation area = 0.1 acres, as obtained from EEEPC CAD department July 2007, or 2,530 SF
4. Excavation perimeter = 200 ft
5. Excavation area less than or equal to 2.8' BGS = 0.1 acres, as obtained from EEEPC CAD department July 2007
6. Wooded area assumed to be = 0% of total excavation area, or 0.0 acres, and 5% of capping area, or 0.2 acres; 0.2 acres, total (round to nearest 0.5 acre)
7. Assume confirmation sampling spacing = 10 foot grid spacing (per 40 CFR 761.265)
8. Maximum excavation depth = 2.8 ft BGS
9. Assumed production rate of excavation = 130 BCY/hr; 75% assumed effective production rate; 98 BCY/hr, effective production rate; 780 BCY/day, effective production rate; 284,700 BCY/year, effective production rate
10. Assuming effective production rate, time to excavate soil = 1 day
11. Cover area = 4.0 acres, as obtained from EEEPC CAD department July 2007, or 175,556 SF
    - Proposed gravel cover area = 129,978 SF
    - Proposed soil cover area = 45,578 SF
12. Concrete layer thickness = 0.50 ft
13. Assumed time to install cover = 6 months, or 0.5 years
14. Mob/demob assumed to be = 4 months, or 0.33 years
15. Topsoil volume for site restoration (0.5ft thick in excavated areas) = 47 BCY, or 52 LCY
16. Based on geotechnical data from the RI (EEEPC 2007) and typical soil properties, in-situ bulk density of site soils = 1.5 Tons/BCY
17. For loose soil assume sandy, dry soil with swell factor = 12%
    (Means Estimating Handbook. United States of America : Means Southern Construction Information Network, 1990).
18. For dry gravel assume swell factor of 13%
    (Means Estimating Handbook. United States of America : Means Southern Construction Information Network, 1990).
19. Topsoil density assumed to be 1.2 Tons/LCY
20. Present worth of costs assumes 5% annual interest rate.
21. Unit costs listed were obtained from 2007 RS Means Cost Data and engineering judgement.
22. RS Means Historical Cost Index used to escalate 2007 costs to 2009 costs:

Year	Index #
2007	169.4
2009	185.9

Abbreviations:

BCY = bank cubic yards
BGS = below ground surface
ft = feet
LCY = loose cubic yards
LF = linear foot
LS = lump sum
MSF = thousand square feet
SF = square feet
SY = square yard

Table 5-3 Cost Estimate for Alternative 4 - Excavation and Off-Site High Temperature Thermal Desorption
Site 518 Dredge Spoil Disposal Area

Item Description	Comment	Unit	Quantity	Unit Cost	Cost
Capital Costs					
Construction Management (2.5% of total capital cost)	Includes submittals, reporting, meetings	LS	1	$167,198.35	$167,198
Subtotal					$167,198
Site Preparation					
Surveying Crew	2-person crew @ $100/hr, 8hr/day; assume 50% of project duration	Day	73	$1,600.00	$116,821
Cut and Chip Trees	Trees to 12" dia.	Acre	0.7	$4,950.00	$3,377
Grub Stumps and Remove		Acre	0.7	$3,225.00	$2,200
Install Construction Fence	Chain link fence rental, 6' high	LF	3,000	$9.55	$28,650
Subtotal					$151,048
Health and Safety					
Construct Decontamination Pad & Containment	For equipment & personnel	Setups	2	$3,000.00	$6,000
Community/Exclusion Zone Air Monitoring	Particulate meter purchase (Qty 4)	Each	4	$7,500.00	$30,000
Site Safety Officer	10 hrs/day, 5days/wk, $100/hr; 100% of project duration	manweeks	21	$5,000.00	$104,018
Subtotal					$140,018
Excavation					
Excavation	Backhoe, hydraulic, 2 CY bucket = 130 CY/hr	BCY	33,300	$1.86	$61,938
Transport Soil to Stockpile	Front End Loader, 5 CY bucket	BCY	33,300	$1.48	$49,284
Stockpiling	300 Horsepower Bulldozer w/ 50' haul	BCY	33,300	$1.26	$41,958
Protect Existing Utilities		LS	1	$15,000.00	$15,000
Confirmation Sampling (PCB Screening)	Immunoassay testing; includes bottom and sidewall testing	Each	2,073	$75.00	$155,474
Confirmation Sampling (PCB)	10% samples collected by PCB screening	Each	207	$100.00	$20,730
Confirmation Sampling (Metals)	TAL metals	Each	2,073	$200.00	$414,597
Off-Site Disposal (Drums)	Waste decon water (<500 mg/kg PCB, <1% solids); price per 55 gal drum including transportation	Drum	10	$200.00	$2,000
Temporary Relocation and Restoration of Existing Metal Structures	Assumes 1 large and 2 small structures	LS	1	$5,000.00	$5,000
Subtotal					$765,981
High Temperature Thermal Desorption					
HTTD (Treatment)	Includes off-site equipment, labor, maintenance, utilities, testing of effluent at ESMI facility in New Hampshire	Ton	46,500	$43.00	$1,999,500
Soil Testing (Characterization)	Includes TPH, VOCs, PAHs, RCRA 8 metals, PCBs	Each	105	$560.00	$58,800
Transporting Soil to HTTD Facility (off site)	Includes trucks, labor, gas	Ton	46,500	$32.00	$1,488,000
Transporting Soil from HTTD Facility (back to site)	Includes trucks, labor, gas, handling fees	Ton	46,500	$18.00	$837,000
Subtotal					$4,383,300
Backfilling					
Placement of Backfill	300 Horsepower Bulldozer w/ 50' haul	BCY	33,300	$1.26	$41,958
Compaction	Vibrating roller, 12" compacted lifts, 4 passes	BCY	33,300	$0.44	$14,652
Subtotal					$56,610
Site Restoration					
Topsoil (Material only)	0.5 ft thick layer; in pre-existing grassy areas	LCY	1,508	$12.50	$18,848
Gravel (Material only)	1/8" Crushed Stone, 0.5 foot thick layer; in pre-existing gravel areas	LCY	2,641	$28.00	$73,944
Geofabric (for Gravel Area)	1/4" thick geocomposite	SF	126,200	$1.18	$148,285
Placement of Topsoil & Gravel	300 Horsepower Bulldozer w/ 50' haul	BCY	3,683	$1.26	$4,641
Seeding (w/ mulch and fertilizer)	Bluegrass 4#/MSF w/ mulch and fertilizer, hydroseeding; add 10% for disturbed areas outside of excavation area	MSF	80	$49.50	$3,960
Subtotal					$249,678
Capital Cost Subtotal:					$5,913,833
Adjusted Capital Cost Subtotal for Glens Falls, New York Location Factor (0.92):					$5,440,726
10% Legal, administrative, engineering fees:					$544,073
15% Contingencies:					$897,720
Total Capital Cost:					**$6,883,000**

Table 5-3 Cost Estimate for Alternative 4 - Excavation and Off-Site High Temperature Thermal Desorption
Site 518 Dredge Spoil Disposal Area

Item Description	Comment	Unit	Quantity	Unit Cost	Cost
Annual Costs					
Not Applicable				$0.00	$0
Subtotal					$0
				Annual Cost Subtotal:	$0
				Adjusted Capital Cost Subtotal for Glens Falls, New York Location Factor (0.92):	$0
				10% Legal, administrative, engineering fees:	$0
				15% Contingencies:	$0
				Annual Cost Total:	**$0**
				Present Worth of Annual Costs	**$0**
				2007 Total Present Worth Cost:	*$6,883,000*
				2009 Total Present Worth Cost:	**$7,554,000**

Assumptions:

1. Total contaminated soil volume =	31,000	BCY
Additional volume to be excavated due to cutback =	2,300	BCY
Total excavated volume =	33,300	BCY
2. Contaminated soil excavation area =	178,086	SF, or
	4.1	acres, as obtained from EEEPC CAD department July 2007, or
Additional area due to cutback =	20,814	SF
Total excavation area =	198,900	SF
3. Excavation perimeter (primary area) =	2,100	ft
(northern area) =	200	ft
4. Wooded area assumed to be =	5%	of total excavation area, or
	0.7	acres
5. Assume confirmation sampling spacing =	10	foot grid spacing (per 40 CFR 761.265)
6. Maximum excavation depth =	8.5	ft BGS
7. Assumed production rate of excavation =	130	BCY/hr
	75%	assumed effective production rate
	98	BCY/hr, effective production rate
	780	BCY/day, effective production rate
	284,700	BCY/year, effective production rate
8. HTTD facility can accept up to =	450	tons/day
9. Assuming effective production rate, time to treat contaminated soil and backfill =	5	months, or 0.40 years
10. Mob/demob assumed to be =	4	months, or 0.33 years
11. Soil testing for off-site HTTD unit assumes:		
Characterization - 1 sample for every	200	Tons, up to 4,000 tons then 1 sample every
	500	Tons
12. Assume % of treated soil to be used as backfill =	100%	
13. Assume % reduction by volume of soil from HTTD process =	0%	
14. Backfill volume for site restoration =	33,300	BCY, or
	37,296	LCY
15. For site restoration, gravel area =	126,200	SF
grassed area =	72,700	SF
16. Total soil/gravel volume required for site restoration (0.5ft thick) =	3,683	BCY
17. Topsoil by volume as backfill =	1,346	BCY, or
	1,508	LCY
18. Gravel by volume as backfill =	2,337	BCY
	2,641	LCY

19. No storage facilities are assumed for treated or untreated soil. However, these facilities may be added at a later time.
20. Effluent sampling for PCBs (after treatment) included in HTTD treatment cost.
21. No additional backfill will be imported to the site. Final elevations will be graded to drain to existing catch basins or adjacent grassy areas.
22. Based on geotechnical data from the RI (EEEPC 2007) and typical soil properties, in-situ bulk density of site soils = 1.5 Tons/BCY
23. For loose soil assume sandy, dry soil with swell factor = 12%
(Means Estimating Handbook. United States of America : Means Southern Construction Information Network, 1990).
24. For dry gravel assume swell factor of 13%
(Means Estimating Handbook. United States of America : Means Southern Construction Information Network, 1990).
25. Topsoil density assumed to be 1.2 Tons/LCY
26. Present worth of costs assumes 5% annual interest rate.
27. HTTD costs supplied by vendor, Environmental Soil Management, Inc. (ESMI), July 2007. Other unit costs listed were obtained from 2007 RS Means Cost Data and engineering judgement.
28. RS Means Historical Cost Index used to escalate 2007 costs to 2009 costs:

Year	Index #
2007	169.4
2009	185.9

Abbreviations:
BCY = bank cubic yards
BGS = below ground surface
ft = feet
LCY = loose cubic yards
LF = linear foot
LS = lump sum
MSF = thousand square feet
SF = square feet
SY = square yard

Table 5-4 Cost Estimate for Alternative 5 - Excavation and Off-Site Disposal
Site 518 Dredge Spoil Disposal Area

Item Description	Comment	Unit	Quantity	Unit Cost	Cost
Capital Costs					
Construction Management (2.5% of total capital cost)	Includes submittals, reporting, meetings	LS	1	$171,342.00	$171,342
Subtotal					$171,342
Site Preparation					
Surveying Crew	2-person crew @ $100/hr, 8hr/day; assume 50% of project duration	Day	30	$1,600.00	$48,667
Cut and Chip Trees	Trees to 12" dia.	Acre	0.7	$4,950.00	$3,377
Grub Stumps and Remove		Acre	0.7	$3,225.00	$2,200
Install Construction Fence	Chain link fence rental, 6' high	LF	3,000	$9.55	$28,650
Subtotal					$82,894
Health and Safety					
Construct Decontamination Pad & Containment	For equipment & personnel	Setups	2	$3,000.00	$6,000
Community/Exclusion Zone Air Monitoring	Particulate meter purchase (Qty 4)	Each	4	$7,500.00	$30,000
Site Safety Officer	10 hrs/day, 5days/wk, $100/hr; 100% of project duration	manweeks	9	$5,000.00	$43,333
Subtotal					$79,333
Excavation					
Excavation	Backhoe, hydraulic, 2 CY bucket = 130 CY/hr	BCY	33,300	$1.86	$61,938
Transport Soil to Stockpile	Front End Loader, 5 CY bucket	BCY	33,300	$1.48	$49,284
Stockpiling	300 Horsepower Bulldozer w/ 50' haul	BCY	33,300	$1.26	$41,958
Protect Existing Utilities		LS	1	$15,000.00	$15,000
Confirmation Sampling (PCB Screening)	Immunoassay testing; includes bottom and sidewall testing	Each	2,073	$75.00	$155,474
Confirmation Sampling (PCB)	10% samples collected by PCB screening	Each	207	$100.00	$20,730
Confirmation Sampling (Metals)	TAL metals	Each	2,073	$200.00	$414,597
Off-Site Disposal (Drums)	Waste decon water (<500 mg/kg PCB, <1% solids); price per 55 gal drum including transportation	Drum	10	$200.00	$2,000
Temporary Relocation and Restoration of Existing Metal Structures	Assumes 1 large and 2 small structures	LS	1	$5,000.00	$5,000
Subtotal					$765,981
Off Site Disposal					
Off-Site Disposal of Non-Hazardous Soil (PCB concentration < 50 ppm)					
Characterization Sampling	Includes TCLP, Pesticides/PCB, PAH, RCRA ignitability, RCRA corrosivity, RCRA reactivity analyses; Assume 24-hr turnaround; one sample for first 500 LCY, and one sample for each additional 1000 LCY	Each	35	$1,440.00	$50,717
Loading Trucks	Front End Loader, 5 CY bucket	BCY	31,000	$1.48	$45,880
Transportation	Dump truck transport from Site 518 to Fairport, NY; includes taxes/fees	Ton	46,500	$45.00	$2,092,500
Off-Site Disposal (Soil)	Disposal at High Acres Landfill (Fairport, NY); includes taxes/fees	Ton	46,500	$45.00	$2,092,500
Subtotal					$4,281,597
Backfilling					
Backfill (Material)	Includes material and transportation to site; assume 10' layer of backfill over excavated area	LCY	37,296	$10.00	$372,960
Placement of Backfill	300 Horsepower Bulldozer w/ 50' haul	BCY	33,300	$1.26	$41,958
Compaction	Vibrating roller, 12" compacted lifts, 4 passes	BCY	33,300	$0.44	$14,652
Subtotal					$429,570
Site Restoration					
Topsoil (Material only)	0.5 ft thick layer; in pre-existing grassy areas	LCY	1508	$12.50	$18,848
Gravel (Material only)	1/8" Crushed Stone, 0.5 foot thick layer; in pre-existing gravel areas	LCY	2641	$28.00	$73,944
Geofabric (for Gravel Area)	1/4" thick geocomposite	SF	126200	$1.18	$148,285
Placement of Topsoil & Gravel	300 Horsepower Bulldozer w/ 50' haul	BCY	3683	$1.26	$4,641
Seeding (w/ mulch and fertilizer)	Bluegrass 4#/MSF w/ mulch and fertilizer, hydroseeding; add 10% for disturbed areas outside of excavation area	MSF	80	$49.50	$3,960
Subtotal					$249,678
				Capital Cost Subtotal:	$6,060,395
				Adjusted Capital Cost Subtotal for Glens Falls, New York Location Factor (0.92):	$5,575,563
				10% Legal, administrative, engineering fees:	$557,556
				15% Contingencies:	$919,968
				Total Capital Cost:	**$7,054,000**

Table 5-4 Cost Estimate for Alternative 5 - Excavation and Off-Site Disposal
Site 518 Dredge Spoil Disposal Area

Item Description	Comment	Unit	Quantity	Unit Cost	Cost
Annual Costs					
Not Applicable				$0.00	$0
Subtotal					$0
				Annual Cost Subtotal:	$0
				Adjusted Capital Cost Subtotal for Glens Falls, New York Location Factor (0.92):	$0
				10% Legal, administrative, engineering fees:	$0
				15% Contingencies:	$0
				Annual Cost Total:	**$0**
				Present Worth of Annual Costs:	**$0**
				2007 Total Present Worth Cost:	*$7,054,000*
				2009 Total Present Worth Cost:	**$7,742,000**

Assumptions:

1. Total contaminated soil volume =	31,000	BCY
Additional volume to be excavated due to cutback =	2,300	BCY
Total excavated volume =	33,300	BCY
2. Contaminated soil excavation area =	178,086	SF, or
	4.1	acres, as obtained from EEEPC CAD department July 2007, or
Additional area due to cutback =	20,814	SF
Total excavation area =	198,900	SF
3. Excavation perimeter (primary area) =	2,100	ft
(northern area) =	200	ft
4. Wooded area assumed to be =	5%	of total excavation area, or
	0.7	acres, round to nearest 0.5 acre)
5. Assume confirmation sampling spacing =	10	foot grid spacing (per 40 CFR 761.265)
6. Maximum excavation depth =	8.5	ft BGS
7. Assumed production rate of excavation =	130	BCY/hr
	75%	assumed effective production rate
	98	BCY/hr, effective production rate
	780	BCY/day, effective production rate
	284,700	BCY/year, effective production rate
8. Assuming effective production rate, time to excavate soil =	2	months, or 0.17 years
9. Mob/demob assumed to be =	4	months, or 0.33 years
10. Taxes and fees for non-haz landfill transportation	26%	
11. Taxes and fees for non-haz landfill disposal	12%	
12. Volume of backfill needed =	33,300	BCY
13. Total soil/gravel volume required for site restoration (0.5ft thick) =	3,683	BCY
14. Topsoil by volume as backfill =	1,346	BCY, or
	1,508	LCY
15. Gravel by volume as backfill =	2,337	BCY, or
	2,641	LCY
16. Based on geotechnical data from the RI (EEEPC 2007) and typical soil properties, in-situ bulk density of site soils =	1.5	Tons/BCY
17. For loose soil assume sandy, dry soil with swell factor =	12%	
(Means Estimating Handbook. United States of America : Means Southern Construction Information Network, 1990).		
18. For dry gravel assume swell factor of	13%	
(Means Estimating Handbook. United States of America : Means Southern Construction Information Network, 1990).		
19. Topsoil density assumed to be	1.2	Tons/LCY

20. Present worth of costs assumes 5% annual interest rate.
21. Disposal costs supplied by vendor, Waste Management, Inc., February 2007. Other unit costs listed were obtained from 2007 RS Means Cost Data and engineering judgement.
22. RS Means Historical Cost Index used to escalate 2007 costs to 2009 costs:

Year	Index #
2007	169.4
2009	185.9

Abbreviations:
BCY = bank cubic yards
BGS = below ground surface
ft = feet
LCY = loose cubic yards
LF = linear foot
LS = lump sum
MSF = thousand square feet
SF = square feet
SY = square yard

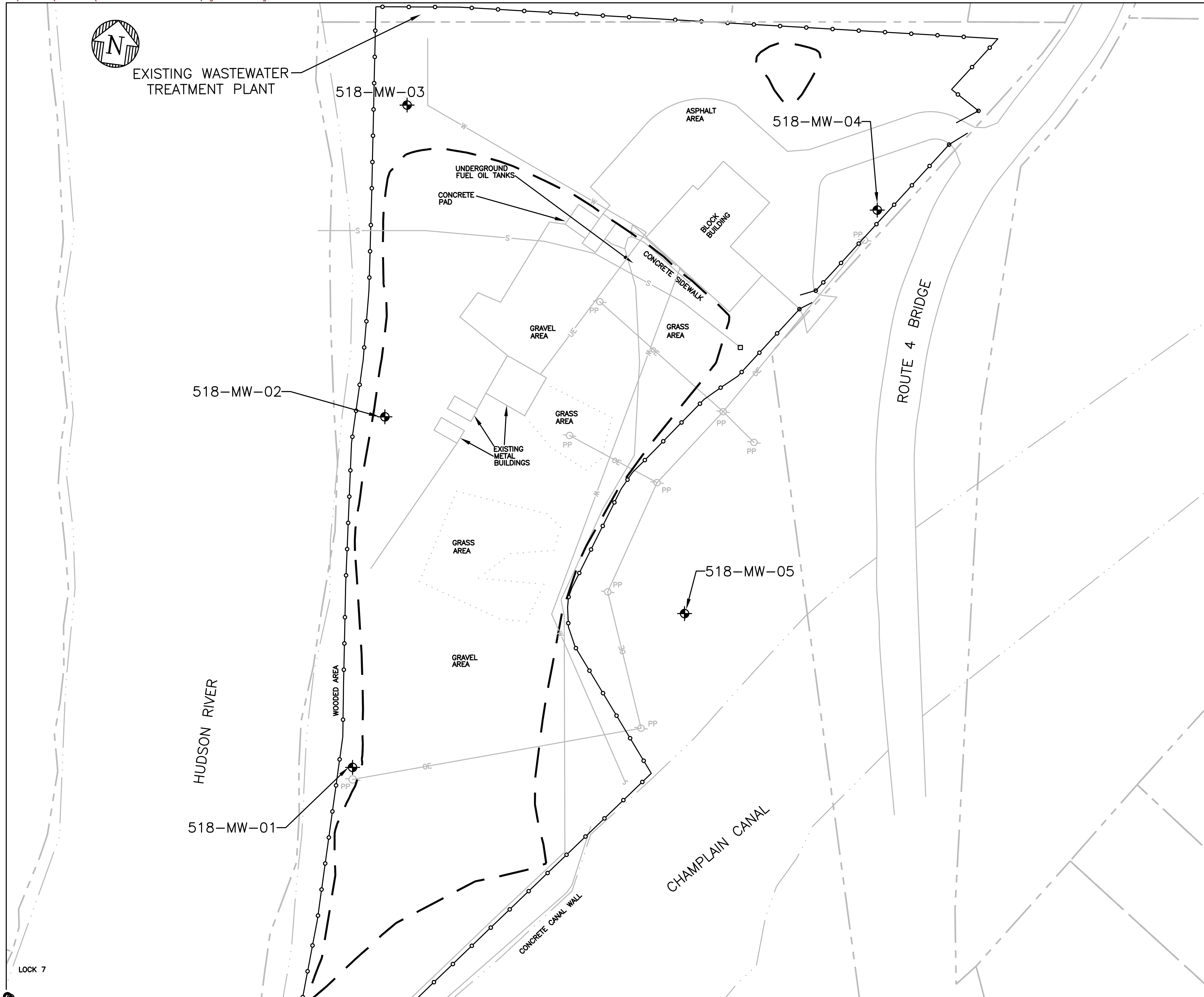
Table 5-5 Summary of Total Present Values of Alternatives at Site 518 Dredge Spoil Disposal Area

Description	Alternative 1 No Action	Alternative 2 Institutional Controls and Long-term Monitoring	Alternative 3 Selective Excavation and On Site Consolidation/ Containment	Alternative 4 Excavation and Off-Site High Temperature Thermal Desorption	Alternative 5 Excavation and Off Site Disposal
Estimated Total Project Duration (years)	0	30	30	1	1
Capital Cost (in 2007 $)	$0	$118,000	$577,000	$6,883,000	$7,054,000
Annual O&M (in 2007$)	$0	$0	$2,800	$0	$0
Periodic O&M (in 2007$)	$0	$19,400	$9,200	$0	$0
2007 Total Present Value of Alternative	*$0*	*$191,000*	*$656,000*	*$6,883,000*	*$7,054,000*
2009 Total Present Value of Alternative	**$0**	**$210,000**	**$720,000**	**$7,554,000**	**$7,742,000**

Notes:

1. RS Means Historical Cost Index used to escalate 2007 costs to 2009 costs.

F:\NYSDEC\Site 518\HUDSON FS JUNE 2007\Figure 5-1.dwg



LEGEND:

- APPROXIMATE EDGE OF WATER BOUNDARY
- APPROXIMATE LOCATION OF PROPERTY BOUNDARY (SEE NOTE 2)
- EXTENT OF CONTAMINATION
- PROPOSED FENCE
- EXISTING OVERHEAD ELECTRIC
- APPROXIMATE LOCATION OF UNDERGROUND ELECTRIC
- APPROXIMATE LOCATION OF EXISTING WATER LINE
- APPROXIMATE LOCATION OF EXISTING STORM SEWER LINE
- APPROXIMATE LOCATION OF EXISTING STRUCTURE
- 518-MW-02 EXISTING MONITORING WELL IN LTM PROGRAM
- PP EXISTING POWER POLE

NOTES:

1. SITE FEATURE LOCATIONS BASED ON 2003 AERIAL PHOTOGRAPHY.
2. PROPERTY LINES ARE APPROXIMATE IN LOCATION AND ARE BASED ON WASHINGTON COUNTY PARCEL DATA, 2006.
3. EXISTING ABOVEGROUND UTILITIES, AND POWER POLES TAKEN FROM LU ENGINEERS DRAWING 10623-07 AREA 518.DWG, DATED 11/07/05. EXISTING SUBSURFACE UTILITIES APPROXIMATELY LOCATED BASED ON DISCUSSIONS WITH CANAL CORPORATION PERSONNEL (JULY 2007). ADDITIONAL ABANDONED UTILITIES EXIST THROUGHOUT THE SITE, HOWEVER NOT IDENTIFIED ON THIS FIGURE.

APPROXIMATE SCALE IN FEET

0 100 200 300

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FIGURE 5-1 ALTERNATIVE 2 - INSTITUTIONAL CONTROLS AND LONG-TERM MONITORING
SITE 518
FORT EDWARD, NEW YORK

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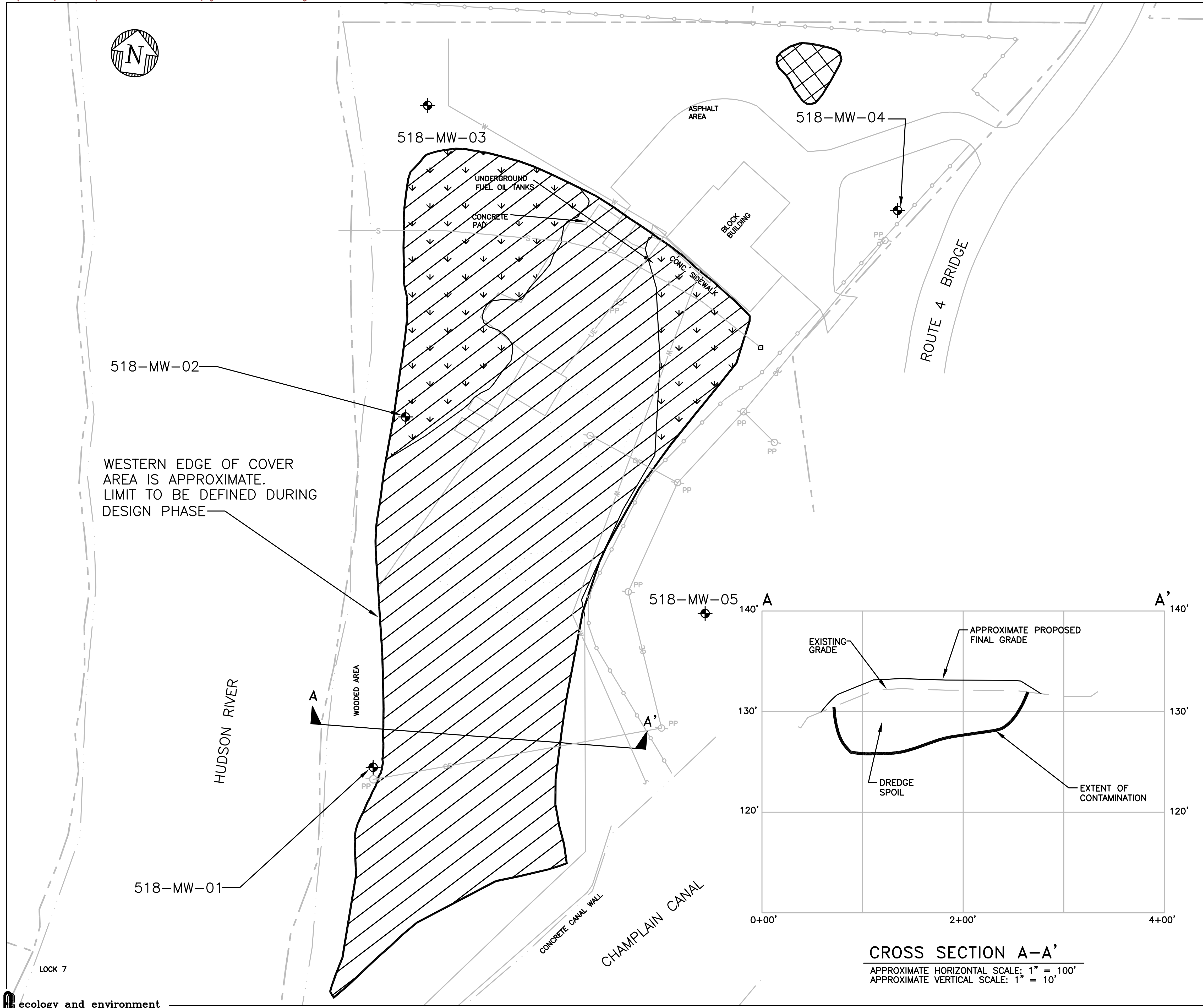

LEGEND:

- APPROXIMATE EDGE OF WATER BOUNDARY
- APPROXIMATE LOCATION OF PROPERTY BOUNDARY (SEE NOTE 2)
- EXISTING FENCE
- EXISTING OVERHEAD ELECTRIC
- APPROXIMATE LOCATION OF UNDERGROUND ELECTRIC
- APPROXIMATE LOCATION OF EXISTING WATER LINE
- APPROXIMATE LOCATION OF EXISTING STORM SEWER LINE
- APPROXIMATE LOCATION OF EXISTING STRUCTURE
- 518–MW–02 EXISTING MONITORING WELL IN LTM PROGRAM
- PP EXISTING POWER POLE
- PROPOSED GRAVEL COVER AREA
- PROPOSED SOIL COVER AREA
- PROPOSED SOIL AREAS TO BE EXCAVATED TO MAXIMUM OF 2.8 FEET BELOW GROUND SURFACE AND CONSOLIDATED UNDER CAP AREA

NOTES:

1. SITE FEATURE LOCATIONS BASED ON 2003 AERIAL PHOTOGRAPHY.
2. PROPERTY LINES ARE APPROXIMATE IN LOCATION AND ARE BASED ON WASHINGTON COUNTY PARCEL DATA, 2006.
3. EXISTING ABOVEGROUND UTILITIES, AND POWER POLES TAKEN FROM LU ENGINEERS DRAWING 10623–07 AREA 518.DWG, DATED 11/07/05. EXISTING SUBSURFACE UTILITIES APPROXIMATELY LOCATED BASED ON DISCUSSIONS WITH CANAL CORPORATION PERSONNEL (JULY 2007). ADDITIONAL ABANDONED UTILTIES EXIST THROUGHOUT THE SITE, HOWEVER NOT IDENTIFIED ON THIS FIGURE.
4. EXISTING FENCE LOCATION TAKEN FROM DRAWING 0623–07 AREA 518.dwg, PROVIDED BY LU ENGINEERS, DATED 11/07/05.

APPROXIMATE SCALE IN FEET

0 100 200 300

FIGURE 5–2 ALTERNATIVE 3 – SELECTIVE EXCAVATION AND ON-SITE CONSOLIDATION/CONTAINMENT
SITE 518
FORT EDWARD, NEW YORK

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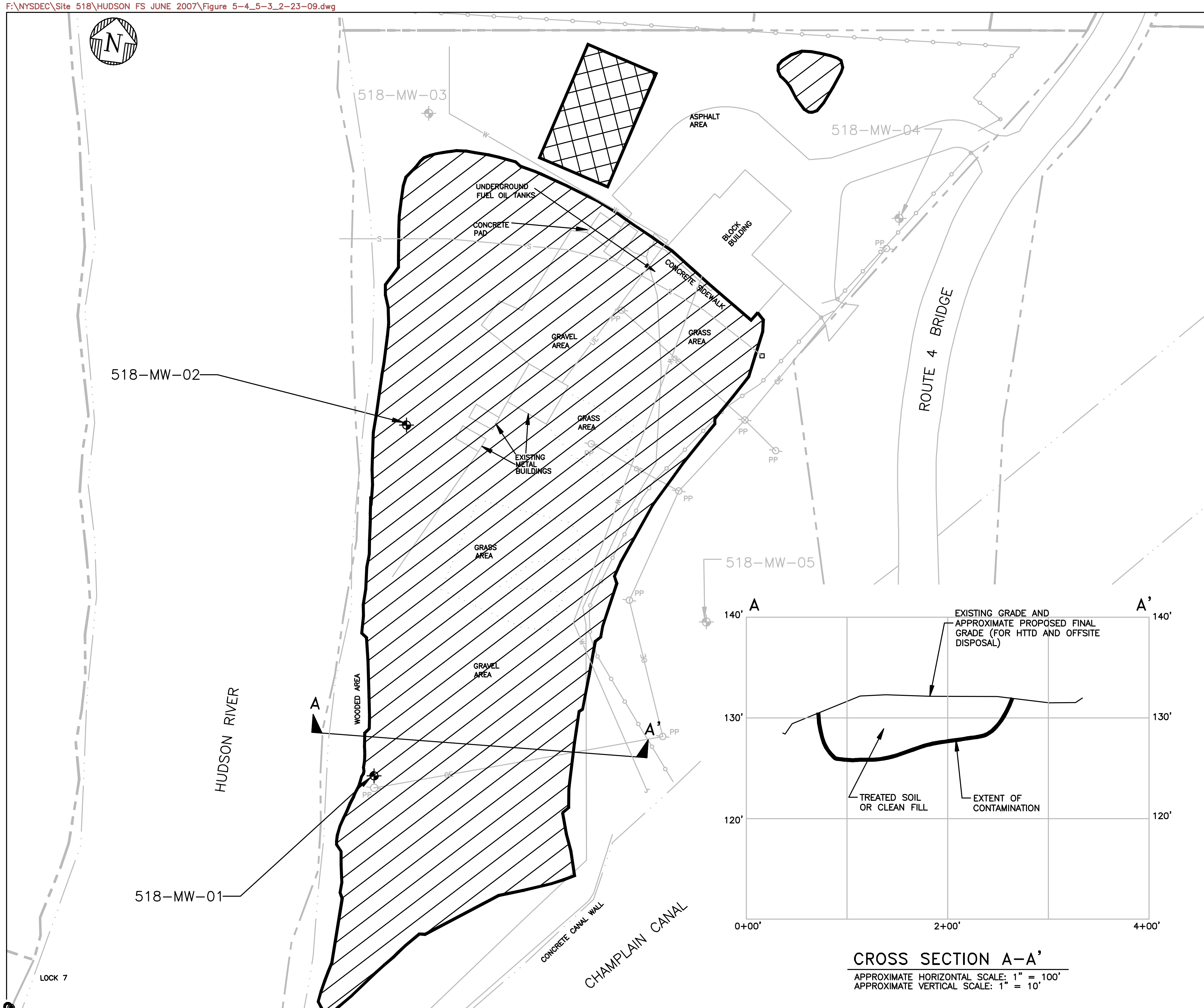


ecology and environment

LEGEND:

- APPROXIMATE EDGE OF WATER BOUNDARY
- APPROXIMATE LOCATION OF PROPERTY BOUNDARY (SEE NOTE 2)
- EXISTING FENCE
- OE — EXISTING OVERHEAD ELECTRIC
- UE — APPROXIMATE LOCATION OF UNDERGROUND ELECTRIC
- W — APPROXIMATE LOCATION OF EXISTING WATER LINE
- S — APPROXIMATE LOCATION OF EXISTING STORM SEWER LINE
- APPROXIMATE LOCATION OF EXISTING STRUCTURE
- 518-MW-02 — EXISTING MONITORING WELL TO BE DECOMMISIONED
- 518-MW-01 — EXISTING MONITORING WELL
- PP — EXISTING POWER POLE
- PROPOSED SOIL AREAS TO BE EXCAVATED AND TREATED AT OFF-SITE HTTD FACILITY OR DISPOSED OF OFF-SITE
- PROPOSED STOCKPILE AREA

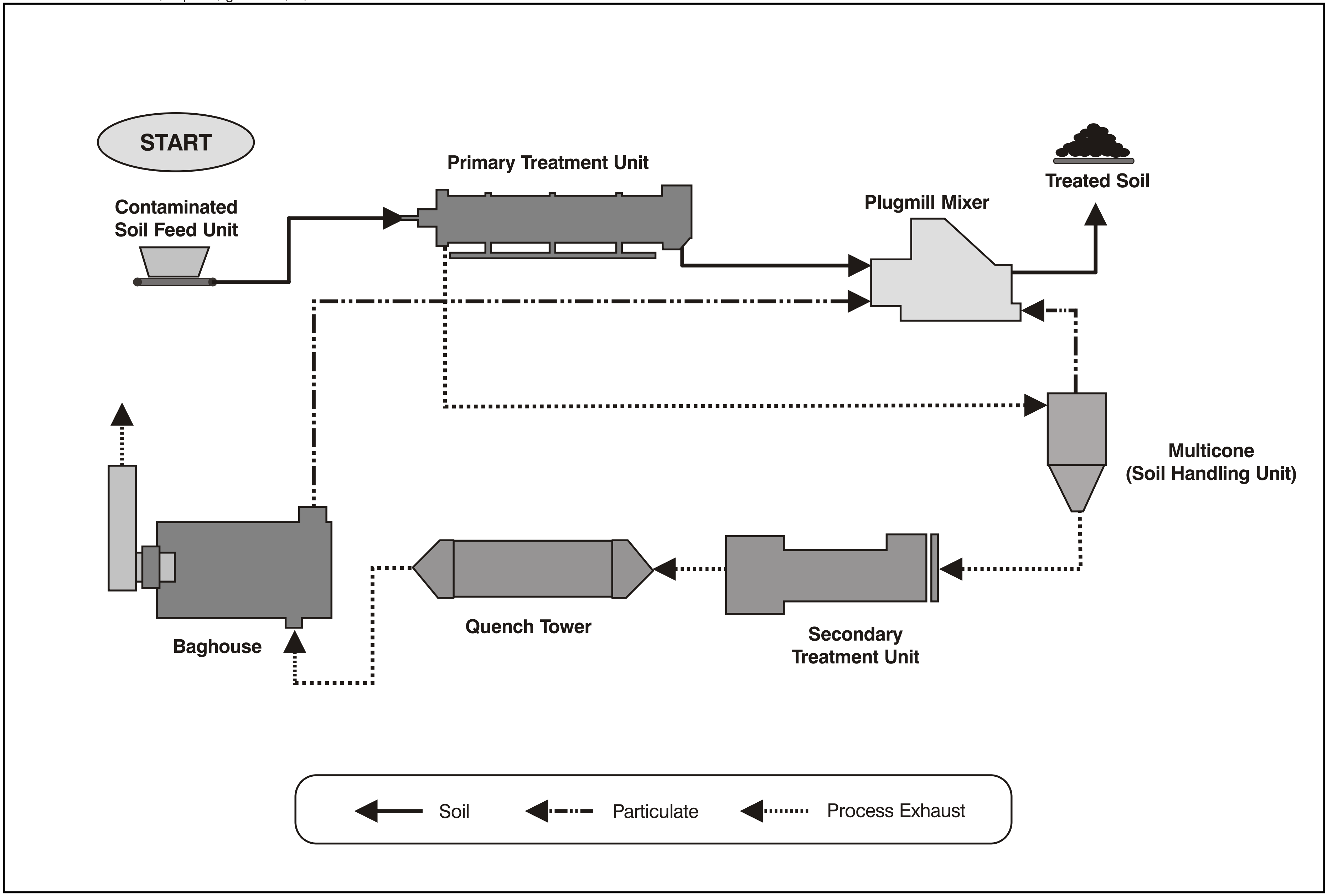
NOTES:

1. SITE FEATURE LOCATIONS BASED ON 2003 AERIAL PHOTOGRAPHY.
2. PROPERTY LINES ARE APPROXIMATE IN LOCATION AND ARE BASED ON WASHINGTON COUNTY PARCEL DATA, 2006.
3. EXISTING ABOVEGROUND UTILITIES, AND POWER POLES TAKEN FROM LU ENGINEERS DRAWING 10623-07 AREA 518.DWG, DATED 11/07/05. EXISTING SUBSURFACE UTILITIES APPROXIMATELY LOCATED BASED ON DISCUSSIONS WITH CANAL CORPORATION PERSONNEL (JULY 2007). ADDITIONAL ABANDONED UTILTIES EXIST THROUGHOUT THE SITE, HOWEVER NOT IDENTIFIED ON THIS FIGURE.
4. LIMITS OF EXCAVATION ARE SHOWN AT GRADE AND INCLUDE A CUTBACK OF 3:1 ON SIDE SLOPES.
5. DEPTH OF CONTAMINATION EXTENDS TO APPROXIMATELY 8.5' IN CENTRAL PORTION OF THE SITE AND 2.8' IN NORTHERN PORTION OF THE SITE.

APPROXIMATE SCALE IN FEET

0 100 200 300

FIGURE 5-3 ALTERNATIVES 4&5 – EXCAVATION AND OFF-SITE HTTD, AND EXCAVATION AND OFF-SITE DISPOSAL
SITE 518
FORT EDWARD, NEW YORK



SOURCE: Environmental Soil Management Inc., 2007

Figure 5-4 High Temperature Thermal Desorption System (off-site) Process Flow Diagram

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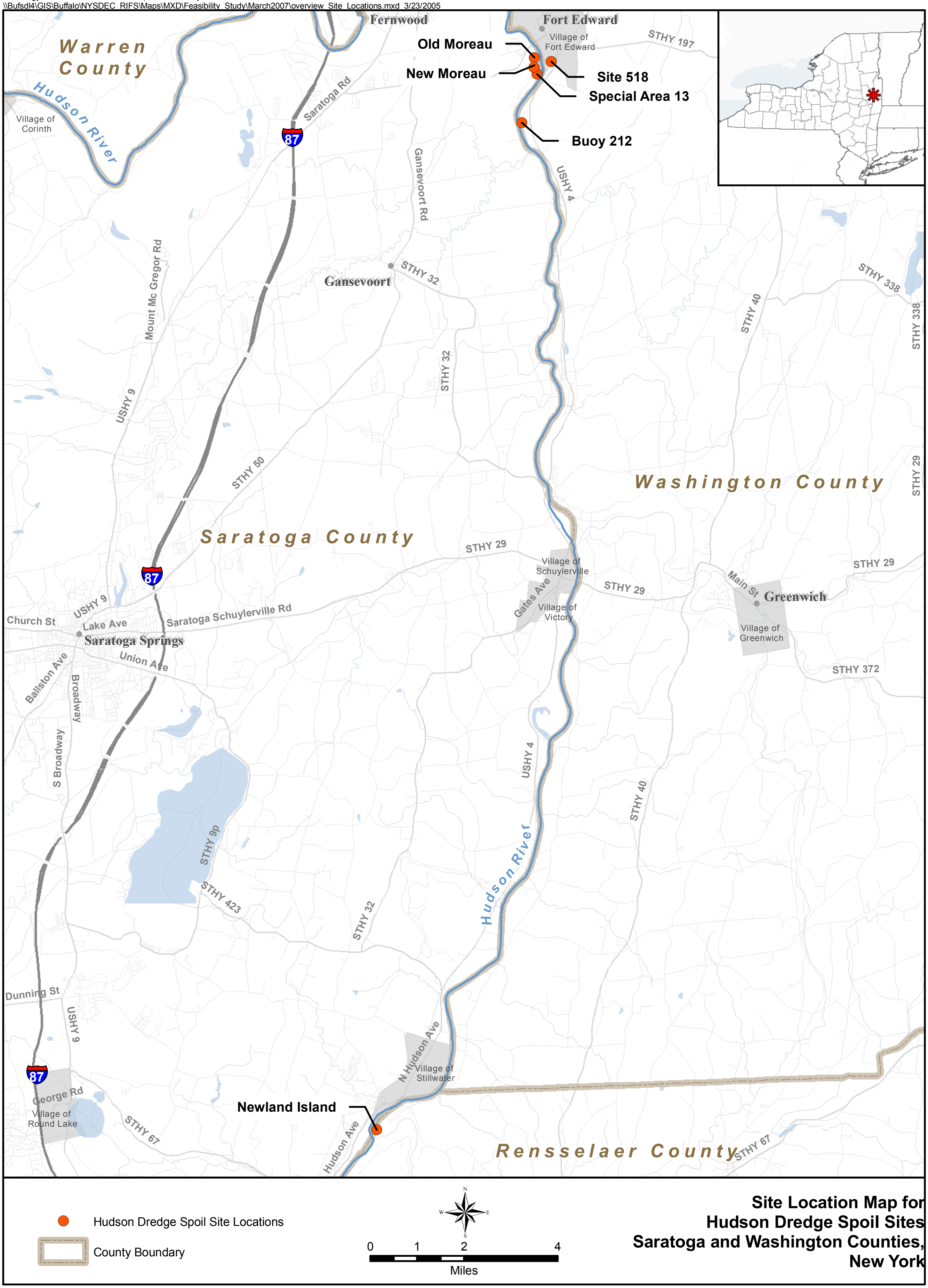
A Overview Map of Dredge Spoil Disposal Sites



Site Location Map for Hudson Dredge Spoil Sites Saratoga and Washington Counties, New York