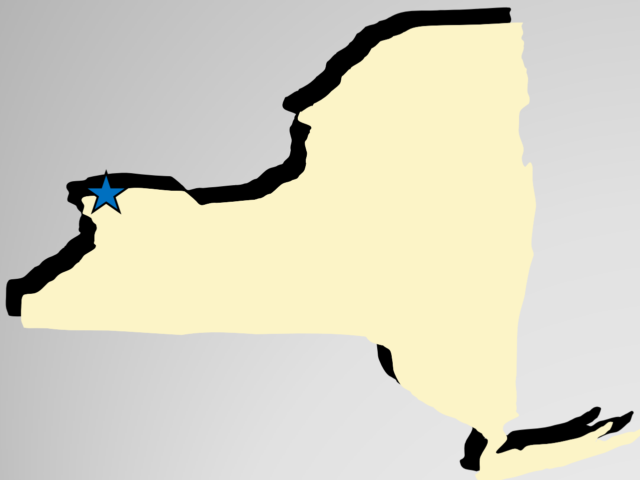
FINAL
FEASIBILITY STUDY REPORT FOR OPERABLE UNITS 1 AND 2

Old Upper Mountain Road Site (932112)
Lockport, Niagara County, New York



Prepared for:

New York State Department of Environmental Conservation
Division of Environmental Remediation

Prepared by:

EA ENGINEERING, P.C. and Its Affiliate
EA SCIENCE and TECHNOLOGY

February 2013

Feasibility Study Report for Operable Units 1 and 2 Old Upper Mountain Road (932112) Lockport, New York

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CONTENTS

Page

Page

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION AND PROJECT OVERVIEW

EA Engineering, P.C. and its affiliate EA Science and Technology (EA), under contract to the New York State Department of Environmental Conservation (NYSDEC) (Work Assignment No. D004438-41) was tasked to perform a remedial investigation (RI), supplemental RI (SRI), and feasibility study (FS) at the Old Upper Mountain Road site (NYSDEC Site No. 932112) located in the Town and City of Lockport, Niagara County, New York. Under the RI and SRI, the Old Upper Mountain Road site was evaluated as three separate operable units (OUs) defined as follows:

- OU 1 is defined as the approximately 6 acres of landfill waste which make up the Old Upper Mountain Road site. Impacts associated with OU 1 and evaluated in the RI include on-site surface and subsurface soil/fill material, and on-site groundwater.

- OU 2 is defined as surface water and sediment within Gulf Creek, from the area located at the western origin of the ravine at the bulkhead outfall located to the north of the site to an area downstream where Gulf Creek meets Niagara Street.

- OU 3 is defined as the approximately 1 acre of landfill waste that makes up the portion of the Old Upper Mountain Road site located south and west of the Somerset rail line. Impacts associated with OU 3 and evaluated in the RI include on-site surface and subsurface soil/fill material, and on-site groundwater.

This FS has been prepared for OU 1 and OU 2.

1.1 PURPOSE AND SCOPE

This FS report has been prepared to develop and evaluate alternatives for remedial action and to determine which alternative is the most appropriate, cost effective, and protective of public health and the environment for OUs 1 and 2 at the Old Upper Mountain Road site.

The FS has been conducted in accordance with the most recent versions of the *Guidance for Conducting Remedial Investigations and Feasibility Studies under Comprehensive Environmental Response, Compensation, and Liability Act* (U.S. Environmental Protection Agency [EPA] 1988) and *DER-10, Technical Guidance for Site Investigation and Remediation* (NYSDEC 2010), and focused on remedial alternatives proven effective at addressing the contaminants of concern (COCs) detected in various environmental media on this site.

1.2 REPORT ORGANIZATION

The FS report has been organized as follows:

- ***Section 1***—Introduction and Project Overview

- ***Section 2***—Summary of RI, SRI, and Exposure Assessment
- ***Section 3***—Development of Remedial Action Objectives (RAOs)
- ***Section 4***—General Response Actions
- ***Section 5***—Identification and Screening of Technologies
- ***Section 6***—Scoping and Development of Remedial Alternatives
- ***Section 7***—Costing and Evaluation Criteria
- ***Section 8***—Detailed Analysis of Alternatives and Recommendations
- ***Section 9***—References.

1.3 BACKGROUND

The following sections provide a brief discussion of the site background for the Old Upper Mountain Road site. A full description of the site is provided in the Final RI Report (EA 2011a) and SRI Report (EA 2011b), which were previously prepared and finalized as separate deliverables.

1.3.1 Site Location

The site is located along Old Upper Mountain Road, in both the Town and City of Lockport, Niagara County, New York (Figures 1-1 and 1-2). The site proper (OU 1 and OU 3) is an irregular-shaped parcel that is approximately 7 acres in size. Main access to the site is located on Old Upper Mountain Road. The site sits northeast of the intersection between NYS Route 93 and NYS Route 31. An access road exists on Otto Park Place to the southeastern portion of the site (OU 3). The site consists of seven Niagara County tax parcels and is located in a mixed use area including residential, industrial, and commercial properties. Somerset Railroad bounds the property to the south and east. The northern edge of the property is bounded by private property and a ravine containing Gulf Creek (OU 2), referred to as the Gulf.

1.3.2 Property Information

The Old Upper Mountain Road site was reportedly operated as a municipal dump by the City of Lockport from 1921 to the 1950s. Access to the landfill during that time was from the viaduct under the railroad track just north of Otto Park Place. Garbage and other industrial wastes were apparently dumped at the landfill, burned, and then pushed into the ravine. The City of Lockport moved its dumping operations in the 1950s to the area known today as the Lockport City Landfill (NYSDEC Site No. 932010) located north of the Old Upper Mountain Road site along the railroad tracks.

The Old Upper Mountain Road site was reportedly used by the same clientele as the Lockport City Landfill. There was a shift in location between the two landfills in the 1950s. Clientele reportedly included Harrison Radiator, VanDeMark Chemical, Milward Alloys, Vanchlor, Upson, and Cotton Batting. Different areas of the dump were reportedly assigned to different companies.

The site was initially discovered in 1993 during a routine inspection of the Lockport City Landfill located north of the Old Upper Mountain Road site and downstream of the landfill along Gulf Creek. Evidence of ash and glass debris was noted throughout the top portion of the landfill, while recent dumping of trash/rubbish/tires was noted at the southern portion of the site. It was also noted during the inspection that a significant quantity of waste had been pushed over the embankment into the ravine through which Gulf Creek runs.

1.3.3 Site History

Based upon a review of historical information presented in the Environmental Data Resources, Inc. report, Upper Mountain Road first appears on the 1897 United States Geological Survey (USGS) topographic map along with the New York Central and Hudson River railroads, which run along the southern boundary of the site. Access to the dumping area was historically through a viaduct located under this railroad track. An additional railroad appears in the area to the east of the site, running north to south along Gulf Creek on the 1948 USGS topographical map.

The topographic maps also illustrate changes in elevation at the site which reflect changes in the size and shape of the Gulf resulting from the historic landfill operations at the site, and development of other areas surrounding the Gulf. Based upon a review of the topographic maps, the following is known regarding impacts to the ravine from landfill activities and other site development:

- According to the 1897 topographic map, the ravine and Gulf extended almost completely to the railroad track that currently serves as the southern boundary of the site. Elevation at the top of the ravine was approximately 600 ft, while the base of the ravine was approximately 520 ft.

- The 1899 topographic map illustrates no discernible changes in the shape of the Gulf, indicating that landfill operations had not yet begun.

- The 1948 topographic map shows a large portion of the site formerly within the Gulf ravine filled to grade (approximately 587 ft). Filling appears to have been completed from the southwest corner of the site to the northeast, as a small portion of the ravine remains visible just beyond the eastern edge of the filled landfill area. Additionally, an industrial structure appears in the area of the current General Motors Components Holdings, LLC (GMCH), recently the former Delphi Thermal Systems, on the 1948 USGS topographic map to the west of the site across Upper Mountain Road.

- Landfill operations at the site appear to have continued through at least 1949. The 1949 topographic map illustrates further dumping within the ravine, as the small portion along the eastern portion of the site that was unfilled in 1948 is visible as being brought to grade in this map.

- The site appears unchanged in the 1965 topographic map. However, it appears that overburden soil was removed from the northern edge of the ravine, directly across Gulf Creek from the site during this time, as the ravine is shown to be slightly wider than observed in the 1949 map. A section of Upper Mountain Road was also abandoned between 1949 and 1965, and a new section was developed along NYS Route 93. The old section of the road was left behind and named Old Upper Mountain Road. Additionally, four structures are visible along Old Upper Mountain Road directly to the north of the site, while the GMCH property is shown to have expanded from previous maps.

- The 1980 topographic map shows an expansion in the western portion of the ravine, which appears to have coincided with the installation of a bulkhead outfall along Old Upper Mountain Road, which discharges directly into the ravine and Gulf Creek. This map also denotes the presence of the GMCH wastewater treatment plant to the north of the site, in addition to another expansion at the facility across Upper Mountain Road. A large section of water is also shown within the ravine approximately 500 ft downgradient from the site.

GMCH was started in 1910 as Harrison Radiator and has expanded over the last 100 years going through several changes of management. Harrison Radiator, later Delphi Thermal Systems, have historically made radiators for cars. A wastewater treatment plant was constructed between 1965 and 1972 across the street from the industrial facility and to the north of the Old Upper Mountain Road site. The wastewater treatment plant reportedly treated and discharged hazardous waste and chemicals including hexavalent chromium, used in coating processes, into Eighteen Mile Creek. The wastewater treatment plant was closed in 2006 when the use of hexavalent chromium was eliminated and an alternative aluminum material system was selected that replaced the previous coating processes.

Currently, two off-site houses are located approximately between 175 ft and 300 ft north of the former dumping area. The two houses were unoccupied and vacant at the time the RI report was prepared (April 2011) and appear to be serviced by public water supply from the Town of Lockport. The Somerset Railroad that bisects the site and currently serves as the eastern border of the site was installed between 1980 and 1985, replacing the line initially shown on the 1948 USGS topographic map. In 2006, vehicle tracks were found on the site indicating a potential for recent surface dumping; therefore, a fence was installed to deter trespassers from dumping at the site.

As mentioned earlier, the site currently consists of seven Niagara County tax parcels owned by various entities which include CSX Transportation, Inc., Somerset Railroad Corporation, New York State Electric & Gas Corporation, the City of Lockport, Mr. Allen Penwright, Mr. Douglas Snow, and Mr. Robert H. Matheis. Most recently, the site was used as a junkyard where abandoned vehicles, used tires, boats, concrete/asphalt debris, tires, and other surface dumping occurred. Most of the vehicles and tires were removed from the site in November 2009 during the RI. In its current state, a majority of the site is unoccupied and not being used for residential or commercial purposes. The CSX Transportation, Inc and Somerset Railroad lines are currently active and were observed with infrequent use during the field investigation efforts conducted during the RI and SRI. Figure 1-3 identifies the seven Niagara County tax parcels and their reputed owners as documented during an American Land Title Association survey completed by Popli Design Group.

1.3.4 Physiography

The subject site is located on the USGS Lockport, New York 7.5-minute topographic quadrangle map, dated 1980 (Figure 1-4).

Elevation at the site ranges from approximately 510 ft in the ravine to 595 ft above mean sea level (AMSL) near the railroad tracks. The Gulf ravine acts as the northern boundary of the site. The nearest surface water feature, as noted on the topographic map, is Gulf Creek, which is adjacent to the site along the base of the Gulf. Gulf Creek flows north towards Eighteen Mile Creek. Both creeks converge and proceed to flow north into Lake Ontario.

1.3.5 Site Geology

A review of the geologic map of New York, Niagara Sheet published by the University of the State of New York, the State Education Department and dated 1970, indicates that the subject site lies within the glacial deposits above the Guelph Dolostone, which is part of the Lockport Group. According to the Environmental Data Resources, Inc. report, the subject site is located within the silty loams and bedrock associated with the Middle Silurian Period.

According to the Soil Service Geographic Database, the site is underlain by the Farmington silt loam. This soil, which has well drained, slow infiltration rates (Class C), is described as being soil with layers impeding downward movement of water, or soil with moderately fine or fine textures. Typically this soil is less than 46-in. thick, consisting of fine-grained soil, silt and clay, and lean clay.

Within 0.25 mi of the site lies the Rockland unit. This soil, which is somewhat excessively drained and has slow infiltration rates (Class C), is described as being soil with layers impeding downward movement of water, or soil with moderately fine or fine textures. Typically this soil is less than 13-in. thick.

Also within 0.25 mi of the site lies the Cayuga silty loam. This soil, which is moderately well drained and has slow infiltration rates (Class C), is described as being soil with layers impeding downward movement of water, or soil with moderately fine or fine textures. Typically this soil is less than 127-in. thick and consists of coarse-grained soil, sand, sand with fines, clayey sand, and silty sand.

1.3.6 Site Hydrogeology

Unconsolidated, fine-grained glacial deposits in the southwestern Lockport area are relatively thin, and horizontal laminations and sand lenses are uncommon. As a result of these thin deposits, shallow, unconfined aquifer groundwater flow in the area surrounding the site is expected to be highly localized and discontinuous, with flow expected to be generally to the north towards Gulf Creek. Groundwater elevations measured during the RI and SRI varied from a high of 574.61 ft AMSL at monitoring well MW-01 in January 2010 and a low of 516.31 ft AMSL at monitoring well MW-04 in August 2010.

Groundwater in the Lockport Group bedrock is primarily influenced by vertical and horizontal fractures, particularly in the upper unit, which is extensively fractured. Other contributors to bedrock groundwater in the area surrounding the site are likely to include weathered surface fractures, bedding joints, vertical joints, and small cavities within the upper bedrock formation. In addition, bedrock groundwater flow is anticipated to be influenced by several natural and manmade structures in the area, including the Niagara Escarpment and the Gulf located north of and adjacent to the site, as well as the former Frontier Stone Products Quarry located south of the site and the Erie Barge canal located southeast of the site.

1.3.7 Upland Site Ecology

Based upon activities completed on-site and information obtained from the New York Natural Heritage Program Draft Ecological Communities within New York State (NYSDEC, 2002), several distinct ecological habitat types were identified within a 0.5-mi radius of the site. These habitat types generally coincide with abandoned agricultural uses, fields, woodlot, and brush areas; and areas which are under maintenance or disturbance by residential or commercial development.

Typical habitats associated with development include urban structures, mowed lawn with trees, unpaved roads, mowed roadside areas, and gardens. Species associated with these habitats include common nighthawk (*Chordeiles minor*), American robin (*Turdus migratorius*), house sparrow (*Passer domesticus*), mourning dove (*Zenaida macroura*), mockingbird (*Mimus polyglottos*); as well as a variety of sedges, grasses, forbs, vines, low shrubs, and trees.

More diverse upland habitat is found in successional old field areas adjacent to the site, which have been cleared and plowed (for farming or development), and then abandoned. Characteristic herbs include goldenrods (*Solidago altissima, S. nemoralis, S. rugosa, S. juncea, S. canadensis,* and *Euthamia graminifolia*), bluegrasses (*Poa pratensis, P. compressa*), timothy (*Phleum pratense*), quackgrass (*Agropyron repens*), smooth brome (*Bromus inermis*), sweet vernal grass (*Anthoxanthum odoratum*), orchard grass (*Dactylis glomerata*), common chickweed (*Cerastium arvense*), common evening primrose (*Oenothera biennis*), oldfield cinquefoil (*Potentilla simplex*), calico aster (*Aster lateriflorus*), New England aster (*Aster novae-angliae*), wild strawberry (*Fragaria virginiana*), Queen-Anne's lace (*Daucus corota*), ragweed (*Ambrosia artemisiifolia*), hawkweeds (*Hieracium* spp.), dandelion (*Taraxacum officinale*), and ox-tongue (*Picris hieracioides*). Shrubs may be present, but collectively they have less than 50 percent cover in the community. Characteristic shrubs include gray dogwood (*Cornus foemina* ssp. *racemosa*), silky dogwood (*Cornus amomum*), arrowwood (*Viburnum recognitum*), raspberries

(*Rubus* spp.), sumac (*Rhus typhina, R. glabra*), and eastern red cedar (*Juniperus virginiana*). A characteristic bird is the field sparrow (*Spizella pusilla*). This is a relatively short-lived community that succeeds to a shrubland, woodland, or forest community, but provides diverse habitat for foraging and nesting birds, as well as various mammals such as white tailed deer (*Odocoileus virginianus*). Due to the limited size of other habitat types in the vicinity of the site, larger mammalian and bird of prey species are not likely to occur at the site other than periodic transient movement across the site.

1.3.8 Aquatic and Riparian Site Ecology of Gulf Creek

Gulf Creek is a semi-wadeable freestone perennial stream with gravel bed and geologic bedrock control. Its Rosgen natural channel classification is B4/1, indicating a low-sinuosity stream of moderate slope with gravel bedload and bedrock control. In areas where fill has not impacted its valley, Gulf Creek's riparian corridor and buffer are characterized by emergent wetlands and shrub/shrub or forested wetlands with periodic open water due to beaver activity. Numerous North American beaver (*Castor canadensis)* dams were observed within Gulf Creek. The creek habitat and freshwater wetlands would be of great value to fish and other aquatic fauna that exist within Gulf Creek. No observable fish species, however, were observed to be present within Gulf Creek during the RI and SRI activities.

Beaver activity has multiple impacts on the site, causing impoundment of water and sediments, creating open water and emergent wetland habitats, and potentially limiting the transport of contaminated sediments downstream. Beaver foraging reduces canopy tree recruitment and maintains emergent and scrub-shrub wetland conditions.

As these ecological conditions are typical for the site, as well as the region, these must be integrated into the alternatives for remediating the site.

2. SUMMARY OF RI, SRI, AND EXPOSURE ASSESSMENT

The following sections briefly summarize the environmental impacts at the Old Upper Mountain Road site as determined during the RI and SRI (EA 2011a and b, respectively). This section is organized by media of potential concern. The impacts associated with the environmental media are based on analytical results and their comparison with the appropriate standards, criteria, and guidance (SCGs). The media of concern discussed are soil/fill material, sediment, and groundwater.

2.1 OU 1 SURFACE AND SUBSURFACE SOIL/FILL MATERIAL

The focus of the soil/fill material screening and characterization efforts conducted during the RI was to determine the nature and extent of contamination, and assess potential exposure pathways to develop a strategy to protect human health and the environment. Evaluation of soil/fill material was performed by collecting soil/fill material samples from the ground surface, test pit, and soil boring sampling to evaluate shallower soil, while deeper soil were accessed using a drill rig. An aerial view of the site identifying the OU boundaries and soil/fill material sampling locations is shown in Figures 2-1 and 2-2, respectively.

2.1.1 Surface Soil/Fill Material

Several target analyte list (TAL) metals were reported in on-site surface soil/fill above their applicable SCGs. Lead, a COC was reported at concentrations exceeding SCGs in each of the surface soil/fill samples collected, at concentrations ranging from 170 mg/kg to 19,000 mg/kg in surface soil/fill material within OU 1. Two out of seven (approximately 29 percent) surface soil/fill samples submitted for toxicity characteristic leaching procedure (TCLP) lead analysis exhibited hazardous waste characteristics for lead (D008). A number of semivolatile organic compounds, pesticides, and polychlorinated biphenyls were also detected within surface soil/fill samples within OU 1 at concentrations above their applicable SCGs.

2.1.2 Subsurface Soil/Fill Material

Laboratory analytical results from the on-site subsurface soil/fill sampling program identified elevated concentrations of several TAL metals. Concentrations of lead in exceedence of its SCG were detected in 97 of 101 (approximately 96 percent) subsurface soil samples collected during the RI with the deepest impacts at a depth of 70–73 ft below ground surface (bgs). In OU 1, 30 out of 67 (approximately 45 percent) subsurface soil/fill samples submitted for TCLP lead analysis were identified as characteristically hazardous waste. Vertical profile borings indicated that there is no direct correlation between metals impacts and depth of fill material on-site. It appears that the types and source(s) of waste dumped at the site, rather than migration of metals through the soil/fill material, is the primary influence on metals concentration within the subsurface at OU 1.

2.1.3 Volume of Impacted Soil/Fill Material

The estimated volume of fill material contained within the 5.5 acre area of OU 1 is approximately 135,000 yd^3 or 217,500 tons estimating that 1 yd^3 of fill material is approximately equal to 1.5 tons. This volume estimate does not account for fill material that lies along the slope of the ravine to the base of Gulf Creek, or fill material that lies beneath the railroad line and ballast which bisects OU 1 and OU 3. The estimated volume of fill material that lies along the slope of the ravine to the base of Gulf Creek is 64,000 yd^3 or 106,880 tons. The resulting volume evaluated for alternatives at OU 1 is 199,000 yd^3. It is assumed that fill material beneath the railroad line will remain in place.

2.2 OU 1 GROUNDWATER

The RI groundwater program included the installation of six groundwater monitoring wells as shown in Figure 2-3 and the completion of one round of groundwater sampling. A supplemental groundwater sampling event was implemented during the SRI to validate on-site groundwater flow patterns determined during the RI and provide additional groundwater quality data with respect to NYSDEC Ambient Water Quality Standards (AWQS). Analytical results from the RI and SRI groundwater sampling events reported concentrations of metals, anions, semivolatile organic compounds, and volatile organic compounds that are in exceedance of the NYDEC AWQS. See Section 2.5 for further discussion of groundwater quality.

Groundwater flow direction was determined to flow towards the former ravine and eventually Gulf Creek. Groundwater moving within the bedrock system from the west continues in an easterly direction until it reaches the former ravine where it then moves north toward Gulf Creek. The bedrock groundwater system flowing from areas south of the site flows in a northerly direction into the former ravine and then toward Gulf Creek, while the flow from the eastern portion of the site moves west to the former ravine and then towards Gulf Creek. The former ravine identified during the subsurface investigation acts as a likely discharge point for bedrock groundwater within the vicinity of the site. An interpreted groundwater contour map illustrating the direction of groundwater flow for the August 2010 gauging event is provided in Figure 2-4.

2.3 OU 2 SEDIMENT

Concentrations of nine TAL metals were identified above the severe effect limits (SELs) in the sediment of Gulf Creek with the most prevalent metals being lead and zinc. Figure 2-5 shows sediment sample locations. Sediment with metal concentrations above the severe effect limits is considered contaminated and significant harm to benthic aquatic life is possible. None of the sediment samples submitted for TCLP lead analysis were identified as hazardous waste. It is estimated that approximately 17,500 yd^3 of impacted sediment exists within the reaches of Gulf Creek evaluated during the RI and SRI (EA 2011a and b, respectively). The specific TAL metals reported in sediment samples correlate with the TAL metals observed within the on-site fill material (OU 1) and are likely migrating to the sediments of Gulf Creek via erosion runoff and groundwater transport pathways.

2.4 OU 2 SURFACE WATER

Surface water samples were collected from Gulf Creek during separate events as part of the RI and SRI (EA 2011a and b, respectively). Surface water was collected from SW-02 at the outfall of the bulkhead at the westernmost point of Gulf Creek during the first two events; first in November 2009 and again in May 2010. Surface water was collected from SW-04 downstream from SW-02 at the breach point of a beaver dam in November 2009. Surface water samples were collected further downstream (SW-05 and SW-06) in August 2010 during the SRI. Figure 2-6 identifies each of the surface water sampling locations. Each sample collected in November 2009 and August 2010 contained concentrations of iron exceeding the AWQS for Class D, Type H(FC) or A(A) surface waters. The sample collected at SW-04 in November 2009 contained tetrachloroethylene at a concentration exceeding the corresponding AWQS as well.

2.5 ADDITIONAL GROUNDWATER/SURFACE WATER EVALUATION

Additional limited groundwater and surface water sampling events were conducted in February and April 2012 to evaluate the quality of groundwater discharging into Gulf Creek via seeps along the east side of the fill material within the base of the ravine. The additional evaluation was focused on the assessment of total versus dissolved-phase metals observed in groundwater and surface water. This assessment of water quality characteristics allows for interpretation of potential fate and transport mechanisms that are currently active at the site and potentially mobilizing COCs to off-site areas (Gulf Creek).

Total metals analysis for water samples include the metals content both dissolved in the water and present in the particulates in the water. Typically, a dissolved metals analysis of a water sample is performed by removing the particulates with a filter, then analyzing the filtered water for metals. The most common filters used for this purpose have a 0.45 um pore size.

Total metals analysis results should always be greater than or equal to dissolved metals analysis results, because dissolved metals is a subset of total metals. Dissolved metals are generally considered more mobile and biologically available. Thus, the dissolved metals results are useful for risk assessment, and fate and transport studies.

Groundwater samples were collected from monitoring wells MW-03 and MW-04, and analyzed for total and dissolved metals and mercury. Two sets of groundwater samples from each monitoring well were submitted to the laboratory for total and dissolved metal analyses. The laboratory filtered one set of groundwater samples prior to analysis. Both monitoring wells are located east of Gulf Creek and within OU 1 fill material. Monitoring well MW-03 is screened within the uppermost section of bedrock just below the fill material from 67 to 77 ft bgs (518–528 ft AMSL). Monitoring well MW-04 is screened at the same interval, from 67 to 77 ft bgs (511–521 ft AMSL); although, not within the bedrock unit, rather within the deepest saturated layer of fill material.

Surface water samples were collected from three groundwater seeps located at the base of the fill material along the east side of the ravine. Two sets of surface water samples for each sample location were submitted to the laboratory for total and dissolved metal analyses. The laboratory filtered one set of surface water samples prior to analysis. Seep 1 was the furthest downstream, with Seeps 2 and 3 located consecutively upstream. The bottom of the ravine is at approximately 512 ft AMSL. Figure 2-7 shows seep and monitoring well sample locations with a summary of the detected metals concentrations.

Concentrations of primary COC metals (lead and zinc) in unfiltered (total) samples reported higher concentrations than concentrations reported in filtered (dissolved) samples, indicating that a majority of the reported total metals concentrations are a result of suspended particulates. This would also indicate that the primary transport mechanism of metals from groundwater to surface water, and eventually Gulf Creek sediments, is via particulate flow and then deposition. Because dissolved metals are more mobile and bio-available, the environmental risks associated with groundwater and surface water at the site are considered less significant.

Additionally noted during the evaluation was that groundwater samples reported a greater number of TAL metals than all three seep samples and monitoring well MW-04 specifically reported the most metals concentrations exceeding NYSDEC AWQS for Class GA waters.

Based on the data generated during this additional water quality evaluation, it was determined that specific RAOs for groundwater were not warranted. Rather, under the potential remedial alternatives evaluated during the development of this FS, groundwater quality would be continually monitored throughout the remedial action process and post-monitoring activities.

3. DEVELOPMENT OF REMEDIAL ACTION OBJECTIVES

Goals for the remedial program have been established through the remedy selection process stated in 6 New York Code of Rules and Regulations (NYCRR) Part 375. The remedial goal for all remedial actions is considered to be the restoration of the site to the pre-disposal/pre-release conditions to the extent practicable and legal. RAOs are defined as the medium-specific or OU-specific cleanup objectives to provide protection of public health and the environment. The RAOs are based on contaminant-specific SCGs. The RAOs for the Old Upper Mountain Road site are to meet the SCGs listed in the following table.

3.1 CLEANUP STANDARDS, CRITERIA, AND GUIDANCE

Cleanup standards for soil, groundwater, and sediment are presented in the following table along with the range of contaminant detections.

SOIL/FILL – CLEANUP STANDARDS, CRITERIA, AND GUIDANCE

	Chemical of Potential Concern	Concentration Range Detected (ppm)[1]	SCG[2] (ppm)	Frequency of Exceeding SCG
Inorganics	Lead	170-19,000 (Surface) 16-23,000 (Subsurface)	63	11/11 (Surface) 112/116 (Subsurface)
	Zinc	170-33,000 (Surface) 270-22,000 (Subsurface)	109	11/11 (Surface) 60/60 (Subsurface)

1. Based on samples collected in May 2010.
2. NYSDEC 6 NYCRR Table 375-6.8(b): Unrestricted Use Soil Cleanup Objectives.
NOTE: ppm = parts per million

GROUNDWATER – CLEANUP STANDARDS, CRITERIA, AND GUIDANCE

	Chemical of Potential Concern	Concentration Range Detected (ppb)[1]	SCG[2] (ppb)	Frequency of Exceeding SCG
Inorganics	Lead	4.3-49,000	25	7/20
	Zinc	160-120,000	2,000	3/20

1. Based on samples collected in February and August 2010 and February and April 2012.
2. NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) AWQS (Class GA), June 1998.
NOTE: ppb = parts per billion

SEDIMENT – CLEANUP STANDARDS, CRITERIA, AND GUIDANCE

	Chemical of Potential Concern	Concentration Range Detected (ppm)[1]	SCG[2] (ppm)	Frequency of Exceeding SCG
Inorganics	Lead	43-2,700	31	58/58
	Zinc	100-3,700	120	57/58

1. Based on samples collected in November 2009 and November, May and August 2010.
2. NYSDEC Technical Guidance for Screening Contaminated Sediment, 1999

3.2 REMEDIAL ACTION OBJECTIVES

The medium-specific RAOs for the Old Upper Mountain Road site are displayed in the following table.

OU1	
Soil/Fill	Prevent ingestion/direct contact with contaminated soil.
	Prevent migration of contaminants that would result in groundwater or surface water contamination.
	Prevent impacts to biota from ingestion/direct contact with soil causing toxicity or impacts from bioaccumulation through the terrestrial food chain.
OU2	
Sediment	Prevent direct contact with contaminated sediments.
	Prevent impacts to biota from ingestion/direct contact with sediments causing toxicity or impacts from bioaccumulation through the marine or aquatic food chain.
	Restore sediments to pre-release/background conditions to the extent feasible.

3.3 OTHER POTENTIALLY APPLICABLE REQUIREMENTS

The NYSDEC Environmental Remediation Programs guidance (6 NYCRR Part 375) requires that site remedies “conform to standards and criteria that are generally applicable, consistently applied, and officially promulgated, that are either directly applicable, or that are not directly applicable but are relevant and appropriate, unless good cause exists why conformity should be dispensed with (6 NYCRR Part 75, 375-1.8[f][2]).” The primary requirements are presented in the following table.

SCGS FOR THE OLD UPPER MOUNTAIN ROAD SITE REMEDY	
Requirement	Rationale
FEDERAL	
CLEAN WATER ACT **National Pollution Discharge Elimination System 40 Code of Federal Regulations (CFR)** **Parts 122 and 404/401** The National Pollution Discharge Elimination System establishes permitting requirements, technology-based limitations and standards, control of toxic pollutants, and monitoring of effluents to assure discharge permit conditions and limits are not exceeded.	Applicable if groundwater will be extracted from ground and discharged to a surface water body.
SAFE DRINKING WATER ACT **National Primary and Secondary Drinking Water Regulations) (42 U.S.C. 300f, 40 CFR Part 141, 40 CFR Part 143)** The Safe Drinking Water Act provides a national framework to ensure the quality and safety of drinking water. The primary standards establish maximum contaminant levels and maximum contaminant level goals for chemical constituents in drinking water. Secondary standards pertain primarily to the aesthetic qualities of drinking water.	The removal action is being conducted to reduce chemical concentrations in soil and groundwater, with a goal of meeting unrestricted use levels.

SCGS FOR THE OLD UPPER MOUNTAIN ROAD SITE REMEDY	
Requirement	Rationale
CLEAN AIR ACT, as Amended (42 U.S.C. 7401) The Clean Air Act is a comprehensive law which is designed to regulate any activities that affect air quality, and provides the national framework for controlling air pollution. The National Primary and Secondary Ambient Air Quality Standards (40 CFR Part 50) set standards for ambient pollutants which are regulated within a region. The National Emissions Standards for Hazardous Air Pollutants (40 CFR Part 61) establishes numerical standards for hazardous air pollutants.	The Clean Air Act will be required if any remediation alternatives produce air emissions.
RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) Provides the governing regulations for owners and operators of hazardous waste treatment, storage, and disposal facilities; and for the generators and transporters of hazardous waste.	All waste generated during the removal alternative will be characterized and handled per Resource Conservation and Recovery Act regulations, as implemented by WAC 173-303.
OCCUPATIONAL SAFETY AND HEALTH ACT (29 CFR 1910) Establishes the worker health and safety requirements for operations at hazardous waste sites.	Site activities will be conducted under appropriate Occupational Safety and Health Act standards.
Rules for Transport of Hazardous Waste (49 CFR 107, 171) The U.S. Department of Transportation establishes requirements for packaging, handling, and manifesting hazardous waste.	Any hazardous waste generated during site activities will be characterized as needed to determine packaging, handling, and transport requirements.
STATE	
NYSDEC Environmental Remediation Programs (6 NYCRR Part 375) This program applies to the development and implementation of remedial programs for environmental restoration sites.	Site cleanup will be conducted in accordance with 6 NYCRR Part 375.
Solid Waste Management Facilities (6 NYCRR Part 360) Provides standards and regulations for permitting and operating solid waste management facilities.	These regulations will be followed for off-site generation, treatment, and disposal of hazardous waste (if generated during the removal action).
Waste Transporter Permits (NYCRR Part 364) Provides standards and regulations for waste transporters.	
Land Disposal Restrictions (6 NYCRR Part 376)	
Hazardous Waste Management System (6 NYCRR Parts 370, 371, 372, 373, 375) Provides standards and regulations for the state hazardous waste management system, identification and listing of hazardous wastes, and provides standards, regulations, and guidelines for the manifest system, as well as additional standards for generators, transporters, and facilities.	
New York State Department of Transportation Rules for Hazardous Materials Transport (49 CFR, Parts 107, 171.1-500) Addresses requirements for marking, manifesting, handling, and transport of hazardous materials; applicable if off-site treatment or disposal of wastes is required.	
Water Quality Regulations for Surface Waters and Groundwater (6 NYCRR Part 700-706) Provides standards, regulations, and guidelines for the protection of waters within the state.	Water discharged from the site will comply with this guidance.
Air Quality Standards (6 NYCRR Part 257) Air quality standards are designed to provide protection from the adverse health effects of air contamination; and they are intended further to protect and conserve the natural resources and environment.	All substantive requirements of the State air pollution control regulations will be followed if air emissions are created.

SCGS FOR THE OLD UPPER MOUNTAIN ROAD SITE REMEDY	
Requirement	Rationale
LOCAL	
Land development standards, stormwater and surface water regulations, and clearing and grading requirements.	Local permits may be required depending on the selected remedial action.
Building permits and building codes.	Local permits may be required depending on the selected remedial action.

4. GENERAL RESPONSE ACTIONS

In general, remedial technologies fit into one or more category of general response actions (GRAs). GRAs are generic, medium-specific, remedial actions that will satisfy the RAOs discussed earlier. GRAs may include no action, institutional controls, containment, removal, treatment, disposal, monitoring, or a combination thereof (EPA 1988). The development of remedial alternatives for this FS begins with the identification of GRAs that can meet RAOs. These GRAs are then screened based on their effectiveness, implementability, and cost; and developed into remedial alternatives to address contaminated media at the site (e.g., soil and sediment).

4.1 SOIL

Technologies for the remediation of soil will fall into the following GRAs: no action, containment, removal, treatment, and disposal.

No Action

The no action alternative is included to be used as the baseline alternative against which other remedial alternatives are compared.

Site Management

Site management (also known as institutional controls) involves the placement of a restriction on the use of property that limits human or environmental exposure, provides notice to any individual who might come in contact with the site, or prevents actions that would interfere with the effectiveness of a remedial program or with the effectiveness and/or integrity of site management activities at or pertaining to a site.

Containment

Soil and fill containment would be accomplished by installing either a multi-media cap or impermeable liner over the waste mass to eliminate exposure and prevent transport through groundwater. Existing physical setting would require re-grading of waste surface and partial removal of waste to achieve required slopes.

Treatment

Treatment subjects contaminants to processes that alter their state, transform them to innocuous forms, or immobilize them. Potentially applicable treatment technologies for soil at this site include *in situ* biological treatment, *in situ* soil flushing, *in situ* or *ex situ* solidification, *in situ* or *ex situ* chemical stabilization, *ex situ* acid leaching, and *ex situ* vitrification.

Biological treatment involves the use of plants to treat the impacted media. This can be achieved through phytoextraction, which involves the physical removal of contaminants from the soil through plant uptake or phytoremediation, which involves contaminant break down by the plant or microbes near the root system.

Soil flushing is the use of water or other suitable aqueous solution to flush contaminants from soil. The fluid is then extracted *in situ*.

Stabilization is achieved through the use of amendments that are mixed into the soil matrix and reduce the toxicity and mobility of the contaminants. This results in the production of a monolith of waste with high structural integrity and can be done *in situ* or *ex situ*.

Acid leaching is the use of potentially hazardous acid to remove inorganic contaminants from soil.

Vitrification is the use of electric current to convert contaminants to an inert, solid form. Following vitrification, the contaminants are trapped within the treated area, eliminating mobility.

Removal

Physical removal of contaminated soil would be conducted by excavation, using standard construction equipment, i.e., excavators, to remove material from the ground and load it into transport mechanisms, i.e., trucks, for off-site treatment or disposal.

Disposal

Disposal involves transporting the soil to a landfill that will either put the soil in a lined landfill or use it for daily cover, based on characterization results. The Old Upper Mountain Road site is adjacent to the City of Lockport closed landfill, which is one location that can be considered. Another location would be an off-site commercial landfill. Alternatively, soil could be disposed of on-site, which would be followed by containment.

4.2 GROUNDWATER

No Action

The no action alternative is included to be used as the baseline alternative against which other remedial alternatives are compared.

Site Management

Site management for groundwater involves the placement of a restriction on the use of groundwater to limit exposure, provides notice to any individual who might come in contact with the groundwater, or prevents actions that would interfere with the effectiveness of a remedial program.

Containment

Groundwater containment can be accomplished by both physical and hydraulic means. Physical containment would be accomplished by installation of a physical barrier in the form of a slurry wall installed from the ground surface to the confining layer. Physical containment of contaminants such as suspended metals could be achieved by *in situ* filtration through a permeable reactive barrier. Hydraulic containment would be accomplished by pumping groundwater. This method would be followed up with treatment. Any of these methods would serve to contain contaminated groundwater or divert it from drinking water intakes or toward treatment.

Treatment

Treatment subjects contaminants to processes that alter their state, transform them to innocuous forms, or remove them from suspension. Potentially applicable treatment technologies for groundwater at this site include *ex situ* filtration, *ex situ* flocculation, or *ex situ* ion exchange. *Ex situ* filtration removes solid particles from the contaminated water by utilizing gravity or pressure differentials to run the fluid stream through a porous treatment medium.

Ex situ flocculation is the use of groundwater extraction through extraction wells or collection trenches to treatment. Contaminated water is mixed with hydroxides, carbonates, or sulfides and flocculants to precipitate metals from the groundwater and promote the settling and subsequent separation of the contaminant solids from the liquid.

Ex situ ion exchange is achieved by pumping groundwater through ion exchange resins made of synthetic or natural materials the size of a grain of sand with the opposite charge of the contaminated ion.

4.3 SEDIMENT

No Action

The No Further Action alternative is included to be used as the baseline alternative against which other remedial alternatives are compared.

Site Management

Site management involves the placement of a restriction on the use of property that limits human or environmental exposure, provides notice to any individual who might come in contact with the site, or prevents actions that would interfere with the effectiveness of a remedial program or with the effectiveness and/or integrity of site management activities at or pertaining to a site.

Containment

Sediment containment would be accomplished by installing a cap over the contaminated areas to eliminate exposure. Cap construction could consist of stone, sand, clay, or plastic. A reactive cap could also be constructed using sulfide complex minerals (mackinawite, gypsum, or phosphogypsum), biopolymers (chitin/chitosan), or other compounds (zeolite, organoclay, apatite) in a thin layer or mixed with sand.

Treatment

Treatment subjects contaminants to processes that alter their state, transform them to innocuous forms, or immobilize them. Potentially applicable treatment technologies for soil at this site include *in situ* chemical treatment or *in situ* biological treatment.

Chemical treatment can be accomplished by the addition of amendments to treat or stabilize the contaminants within the sediment. Stabilization reduces the toxicity and mobility of the contaminants. This results in the production of a monolith of waste with high structural integrity.

Biological treatment involves the use of wetland plants to treat the impacted media. This can be achieved through phytoextraction, which involves the physical removal of contaminants from the sediment through plant uptake or phytoremediation, which involves contaminant break down by the plant or microbes near the root system.

Removal

Physical removal of contaminated sediment would be conducted by mechanical or hydraulic dredging with dewatering, using standard dredging equipment to remove material from the creek bed and load it into transport mechanisms, i.e., trucks, for off-site treatment or disposal. Amendments would likely need to be used to modify chemical and physical properties of the sediment to facilitate handling and disposal.

Disposal

Disposal involves transporting the sediment to a landfill that will either place the sediment in a lined landfill or use it for daily cover, based on characterization results. Sediment may need to be dewatered, stabilized, or treated prior to transport in order to meet paint filter test requirements.

5. IDENTIFICATION AND SCREENING OF TECHNOLOGIES

The potentially applicable technologies identified earlier are screened using the process defined in DER-10, Technical Guidance for Site Investigation and Remediation (NYSDEC 2010). The screening process and summary of results are described below and the detailed technology screening is presented in Table 5-1.

5.1 SCREENING CRITERIA

Three preliminary screening criteria (i.e., effectiveness, implementability, and cost) were used to screen remedial technologies identified earlier for each media of concern. Definitions for these criteria are presented below.

5.1.1 Effectiveness

Effectiveness is a measure of the ability of an option to: (1) reduce toxicity, mobility, or volume of contamination; (2) minimize residual risks; (3) afford long-term protection; (4) comply with applicable or relevant and appropriate requirements; (5) minimize short-term impacts; and (6) achieve protectiveness in a limited duration. Technologies that offer significantly less effectiveness than other proposed technologies may be eliminated from the alternative development process. Options that do not provide adequate protection of human health and the environment likewise may be eliminated from further consideration.

5.1.2 Implementability

Implementability is a measure of the technical feasibility and availability of the option and the administrative feasibility of implementing it (e.g., obtaining permits for off-site activities, right-of-ways, or construction). Options that are technically or administratively infeasible or that would require equipment, specialists, or facilities that are not available within a reasonable period may be eliminated from further consideration.

5.1.3 Cost

Qualitative relative costs for implementing the remedy are considered. Technologies that cost more to implement, but that offer no benefit in effectiveness or implementability over other technologies, may be excluded from the alternative development process.

5.2 SCREENING SUMMARY

The results of the technology screening are summarized in the following two sections. The first section discusses technologies that were not retained for further analysis and the reasons for exclusion. The second section lists technologies that were retained for further analysis as individual components in remedial alternatives. The screening is presented in further detail in Table 5-1.

5.2.1 Technologies Not Retained for Further Analysis

From the list of technologies potentially applicable for remediation of chemicals and media of concern at this site, a few technologies were excluded from further consideration because they were considered ineffective, not implementable at this site, or too costly relative to the other technologies under consideration. The reasons for exclusion are explained below.

Technologies Not Retained for Soil/Fill Material Remediation

Phytoremediation was not retained because it was not considered effective for the existing depths of contamination. Phytoremediation is most effective to the depth of the root system of a particular plant. In addition, phytoremediation is generally used for lower levels of contamination than what exists at the site.

Soil flushing was not retained due to the high cost and unknown level of effectiveness. Soil flushing is an emerging technology which has not been widely implemented.

Disposal at the adjacent City of Lockport closed landfill was not retained due to the volume of contaminated soil requiring disposal and the limited capacity of the landfill.

Technologies Not Retained for Sediment Remediation

Thin layer capping with armor material, such as gravel or stone, was not retained due to uncertain effectiveness for source control.

Impermeable liner capping was not retained because it is not implementable for the large areas of contamination in Gulf Creek.

In situ subaqueous capping using a reactive cap was not retained due to difficulty in implementation and limited effectiveness for source control.

In situ and *ex situ* chemical treatment was not retained due to the moderately high cost and limited effectiveness for source control.

Hydraulic dredging was not retained due to difficulty of implementation, shallow water way within Gulf Creek, and high cost.

5.2.2 Technologies Retained for Further Analysis

Technologies that will be retained for further evaluation for the site are listed below for each media of concern. Soil and sediment technologies were combined to create combined alternatives for OU 1 and OU 2.

The following remedial alternatives are considered in this FS for OU 1:

- **Alternative 1A**—No Action
- **Alternative 1B—**Site Management
- **Alternative 2**—Complete Removal with Off-Site Disposal
- **Alternative 3—***Ex situ* Stabilization with Off-Site Disposal
- **Alternative 4—**Landfill Capping with a Part 360 Cap- Existing Landfill Footprint
- **Alternative 5**—Landfill Capping with a Part 360 Cap- Extended Landfill Footprint
- **Alternative 6**—Landfill Capping with a CleanSoil Cover- Extended Landfill Footprint
- **Alternative 7**—Partial Removal and Off-Site Disposal with *In Situ* Stabilization of Shallow Waste
- **Alternative 8**—Partial Removal, *Ex Situ* Stabilization and On-site Placement, with *In Situ* Stabilization of Shallow Waste.

The following remedial alternatives are considered in this FS for OU 2:

- **Alternative 1A**—No Action
- **Alternative 1B—**Site Management
- **Alternative 2**—Multi-Media Sub-Aqueous Capping
- **Alternative 3**—*In Situ* Sediment Amendment
- **Alternative 4—**Complete Removal with Disposal
- **Alternative 5—**Partial Removal with Multi-Media Sub-Aqueous Capping.

6. SCOPING AND DEVELOPMENT OF REMEDIAL ALTERNATIVES

The scoping for the FS was completed based on correspondence between EA and NYSDEC. EA completed the alternative comparison in accordance with DER-10 and the 1988 EPA publication *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA l540lG-891004). The results of the technology screening process were summarized in a letter dated 17 June 2011 from EA to NYSDEC. Comments regarding this letter were included in a letter dated 13 July 2011 from NYSDEC to EA. Copies of each letter are provided in Appendix A. The screening of alternatives was designed to provide a basis for an overall assessment of applicable technologies based on impacted media identified at the site during the RI and SRI (EA 2011a and b, respectively).

The scoping and development of the technologies/alternatives selected during the previous step of the FS process are described below.

6.1 OU 1 ALTERNATIVES FOR SOIL/FILL MATERIAL

The OU 1 treatment area was determined based on data presented in the RI and SRI (EA 2011a and b, respectively). The area and treatment depths selected address the areas of concern within the landfill (Figure 6-1). Detailed soil/fill material alternatives screening is presented in Table 6-1.

For each remedial alternative that incorporates excavation and off-site disposal, the excavation plan and associated costing is based on the feasibility to segregate hazardous from non-hazardous soil/fill material. To evaluate the practicality of segregation, EA has included a pre-design characterization work element to identify areas of soil/fill material that exhibit hazardous waste characteristics. The pre-design characterization will involve collecting samples across the fill area and vertical profile, and analyzing these samples for waste characterization parameters. The results of the pre-design characterization would be evaluated to determine if discrete areas of soil/fill material exhibit either hazardous or non-hazardous characteristics and if these areas can be practically segregated under the excavation plan. The pre-design characterization may conclude that it is not practical to segregate waste during excavation, in which case the hazardous unit rate for off-site disposal of “unstablized” soil/fill material would be applied to all excavated material under the remedial alternative increasing the cost estimate accordingly. The remedial alternative costing sheets (Appendix B) include a notation that identifies the estimated cost of full hazardous material excavation and disposal.

6.1.1 OU 1 Alternative 1A: No Action

The no action alternative is evaluated as a procedural requirement and as a basis for comparison. This alternative would leave the site in its present condition.

6.1.2 OU 1 Alternative 1B: Site Management

Alternative 1B is to implement an environmental easement on the property to control the use of the site. This alternative would leave the site in its present physical condition, but would address the RAO "Prevent ingestion/direct contact with contaminated soil". Additionally, site perimeter controls and access points would be installed, and warning signage posted.

6.1.3 OU 1 Alternative 2: Complete Removal with Off-Site Disposal

The third potential remediation alternative to be evaluated is complete excavation and off-site disposal of soil/fill material at a commercial landfill. This alternative is aimed at removing the soil/fill material exceeding the unrestricted SCGs on the site.

Excavation is a common remedy used to remove contaminated soil from a source area. This approach can be effective at eliminating exposure and preventing transport of contaminants. Special considerations would need to be made for the Old Upper Mountain Road site due to the physical setting and grades. Ravine access would need to be modified and maintained to allow for full removal. In addition, a sewer line runs through the existing fill and would preferably be permanently re-routed for excavation to take place.

Off-site treatment and/or disposal can be expensive depending on the location of the site relative to treatment or disposal facilities, the volume of soil involved, the nature of contamination, and the availability of different treatment or disposal options in the area. The excavated area would not be completely restored to pre-existing grade; however, ravine slopes would need to be brought to 3:1 slopes using backfill for constructability. Figure 6-2 provides the proposed final conditions under this alternative.

This alternative would be implemented as follows:

- A utility locator would be brought on-site to locate known underground utilities or other obstructions that may prove problematic during excavation. This information would be utilized to either re-route these utilities outside the remediation or to accommodate their locations and future anticipated maintenance so as the remediation is not jeopardized and potential for future exposure to contaminants is minimized.

- A pre-design characterization study would take place at the site prior to the remedial design process of this alternative. This type of study would involve the installation of soil borings and collection of soil/fill material samples spaced 25-ft horizontally and 20-ft vertically. Samples would be submitted to an analytical laboratory for full TCLP analysis. The objective of this study would be to evaluate the potential for the segregation of hazardous vs. non-hazardous waste for disposal.

- Existing sewer line would be re-aligned from a manhole at the end of Old Upper Mountain Road to a manhole within the ravine in consultation with the City of Lockport.

The existing sewer line within the soil/fill material area would be removed as part of the excavation activities.

- Access roads into the ravine would be improved and maintained for the duration of the remedial action.

- Five monitoring wells would be abandoned prior to excavation activities.

- Sheet piling would be installed along the railroad tracks and Old Upper Mountain Road at the southwest and southeast boundaries of the OU 1 area.

- Approximately 228,850 loose yd^3 of soil/fill material would be excavated, to a maximum depth of 80 ft bgs.

- Based on the RI, and for the purpose of this FS, EA estimates that 43 percent of the excavated soil/fill material would be classified as hazardous waste and would be disposed of at a permitted hazardous waste landfill. The remainder of the soil/fill material would be disposed of at a general waste landfill, following acceptance. Results of the pre-design characterization study would potentially change these percentages.

- It is assumed that a dewatering system would be needed since the excavation will extend into the groundwater table; however, due to the fact that the excavation activities would be completed on the side facing the ravine, water diversion methods with settling tanks could be used prior to discharge to the creek rather than conventional pumping and dewatering techniques. Samples would need to be collected prior to discharge.

- Confirmation soil sampling would be conducted during excavation to document any remaining contamination at the bottom and sides of the excavation.

- Once excavation and disposal activities are complete, the site would be restored to 3:1 slopes along the ravine using an approved backfill source. All disturbed areas would be restored with topsoil and seed and native plantings.

- To aid in stability due to flow events and sheet flow on the ravine side, rock toe and soil stabilization fabrics could be utilized to aid in stability of the graded surface. Rock toe techniques would stabilize the bottom of the slope against Gulf Creek flows and concentrated sheet flow from the slope surface. Additionally, this would help maintain a permeable pathway for natural groundwater release to Gulf Creek. Soil stabilization fabrics and the addition of benches or other flow collection devices would aid in the safe conveyance of surface water from the slope.

6.1.4 OU 1 Alternative 3: *Ex situ* Stabilization with Off-Site Disposal

Ex situ stabilization consists of excavating contaminated soil/fill material as discussed in Section

6.1.3, staging, and stabilization treatment on-site. Soil/fill material would be mixed with amendments such as Eco-Bond® prior to off-site disposal. Stabilization is expected to reduce the toxicity of the soil/fill material and therefore reduce the cost of disposal. As with Alternatives 2–4, the sewer line runs through the existing soil/fill material and would have to be re-routed for excavation to take place. Final conditions would be identical to OU 1 Alternative 2, shown in Figure 6-2.

This alternative would be implemented as follows:

- A utility locator would be brought on-site to locate known underground utilities or other obstructions that may prove problematic during excavation. This information would be utilized to either re-route these utilities outside the remediation or to accommodate their locations and future anticipated maintenance so as the remediation is not jeopardized and potential for future exposure to contaminants is minimized.

- The existing sewer line would be re-aligned from a manhole at the end of Old Upper Mountain Road to a manhole within the ravine. The existing sewer line within the soil/fill material area would be abandoned in place.

- A bench-scale or pilot study would be completed to evaluate the effectiveness of the proposed stabilization amendment.

- Access roads into the ravine would be improved and maintained for the duration of the remedial action.

- Five monitoring wells would be abandoned prior to excavation activities.

- Sheet piling would be installed along the railroad tracks and Old Upper Mountain Road at the southwest and southeast boundaries of the OU 1 area.

- Approximately 228,850 loose yd^3 of soil/fill material would be excavated to a maximum depth of 80 ft bgs.

- Soil/fill material would be treated on-site prior to disposal at an approved facility.

- It is assumed that a dewatering system would be needed since the excavation will extend into the groundwater table; however, due to the fact that the excavation will be open on the side facing the ravine, water diversion methods with settling tanks could be used prior to discharge to the creek rather than conventional pumping techniques. Samples would need to be collected prior to discharge.

- Confirmation soil/fill material sampling would be conducted during excavation to document any remaining contamination at the bottom and sides of the excavation.

- Once excavation, treatment and disposal activities are complete, the site would be restored to 3:1 slopes along the ravine using an approved backfill source. All disturbed areas would be restored with topsoil and seed.

6.1.5 OU 1 Alternative 4: Landfill Capping with a Part 360 Cap—Existing Landfill Footprint

Landfill capping consists of the construction of a Part 360 cap system comprised of a vegetated topsoil upper layer, a barrier protection layer, geotextile drainage layer, a textured or smooth 60 mil high-density polyethylene geomembrane liner, and a geotextile gas venting layer. Installation of a cap would eliminate exposure and prevent infiltration of stormwater through soil/fill material. This would result in a reduction of production of leachate which could potentially transport contaminants off-site.

Special considerations would need to be made for cap construction at the Old Upper Mountain Road site due to the physical setting and grades. Ravine access would need to be modified and maintained to allow for partial removal of excess material that cannot be contained within the landfill cap. Existing grades of the soil/fill material are steep and would require considerable earth work and waste disposal to achieve the necessary 3:1 landfill slopes. In addition, a sewer line runs through the existing fill and would have to be re-routed for partial removal to take place. Figure 6-3 provides the approximate final conditions under this alternative.

This alternative would be implemented as follows:

- A utility locator would be brought on-site to locate known underground utilities or other obstructions that may prove problematic during excavation. This information would be utilized to either re-route these utilities outside the remediation or to accommodate their locations and future anticipated maintenance so as the remediation is not jeopardized and potential for future exposure to contaminants is minimized.

- A pre-design characterization study would take place at the site prior to the remedial design process of this alternative. This type of study would involve the installation of soil borings and collection of soil/fill material samples spaced 25 ft horizontally and 20 ft vertically in the area where soil/fill material is proposed to be removed. Samples would be submitted to an analytical laboratory for full TCLP analysis. The objective of this study would be to evaluate the potential for the segregation of hazardous vs. non-hazardous soil/fill material for disposal.

- Existing sewer line would be re-aligned from a manhole at the end of Old Upper Mountain Road to a manhole within the ravine. The existing sewer line within the soil/fill material area would be abandoned in place. Removing the sewer line from the remediation area will allow for future sewer maintenance without the possibly of disturbing contaminated soil/fill material or the proposed landfill cap.

- Access roads into the ravine would be improved and maintained for the duration of the remedial action.

- Five monitoring wells would be abandoned prior to excavation activities.

- Approximately 51,000 yd^3 of soil/fill material would be excavated from the embankment in order to achieve 3:1 slopes into the ravine. Excavated soil/fill material would be treated and remain on-site within the upper sections of OU 1 and placed at 3:1 slopes. 152,000 yd^3 would be disposed of at an off-site facility.

- Once final subgrade surfaces are complete, a four part cap system would be installed by qualified personnel, complete with an anchor trench, proper surface drainage, topsoil and seed. Surface drainage would be designed to handle stormwater surface flow, as well as flow from the existing 30 in. bulkhead.

- Eight monitoring wells would be installed following restoration for groundwater monitoring purposes.

- The site perimeter would be secured using a 9-ft Galvanized fence with barbed wire and a 7-ft high swing gate.

6.1.6 OU 1 Alternative 5: Landfill Capping with a Part 360 Cap—Extended Landfill Footprint

Landfill capping consists of the construction of a Part 360 cap system comprised of a vegetated topsoil upper layer, a barrier protection layer, geotextile drainage layer, a textured or smooth 60 mil high-density polyethylene geomembrane liner, and a geotextile gas venting layer. Installation of a cap would eliminate exposure and prevent infiltration of stormwater through soil/fill material. This would result in a reduction of production of leachate which could potentially transport contaminants off-site.

Similar to Alternative 4, special considerations would need to be made for cap construction at the Old Upper Mountain Road site due to the physical setting and grades. The required 3:1 slopes would be achieved by re-grading soil/fill material into the ravine, rather than removal and disposal off-site, as is suggested in Alternative 4. Existing grades of the soil/fill material are steep and would require considerable earth work and re-grading into the existing ravine to achieve the necessary 3:1 landfill slopes. Prior to placement of fill in the ravine, a drainage layer would be constructed to allow groundwater to follow natural flow patterns into the ravine without coming into contact with contaminated fill. In addition, a sewer line runs through the existing fill and would have to be re-routed for grading activities to take place. Figures 6-4 and 6-5 provide the approximate final conditions under this alternative.

This alternative would be implemented as follows:

- A utility locator would be brought on-site to locate known underground utilities or other obstructions that may prove problematic during excavation. This information would be utilized to either re-route these utilities outside the remediation, or to accommodate their locations and future anticipated maintenance so as the remediation is not jeopardized and potential for future exposure to contaminants is minimized.

- Existing sewer line would be re-aligned from a manhole at the end of Old Upper Mountain Road to a manhole within the ravine. The existing sewer line within the soil/fill material area would be abandoned in place. Removing the sewer line from the remediation area will allow for future sewer maintenance without the possibly of disturbing contaminated soil/fill material or the proposed landfill cap.

- Access roads into the ravine would be improved and maintained for the duration of the remedial action.

- A drainage layer consisting of nonwoven geotextile, 6-in. perforated pipe, and a 24-in. layer of gravel would be placed within the extended footprint of the landfill.

- Five monitoring wells would be abandoned prior to excavation activities.

- Approximately 51,000 yd^3 of soil/fill material would be excavated from the embankment in order to achieve 3:1 slopes into the ravine. Excavated soil/fill material would remain on-site within the upper sections of OU 1 and placed at 3:1 slopes into the ravine over the drainage layer.

- Once final subgrade surfaces are complete, a four-part cap system would be installed by qualified personnel, complete with an anchor trench, proper surface drainage, topsoil, and seed. Surface drainage would be designed to handle stormwater surface flow, as well as flow from the existing 30 in. bulkhead.

- Eight monitoring wells would be installed following restoration for groundwater monitoring purposes.

- The site perimeter would be secured using a 9-ft Galvanized fence with barbed wire and a 7-ft high swing gate.

6.1.7 OU 1 Alternative 6: Landfill Capping with a Clean Soil Cover—Extended Landfill Footprint

Landfill capping with a soil cap consists of the construction of a multi-layer soil cap composed of a vegetated topsoil upper layer, and an 18 in. barrier soil layer. Installation of a cap would eliminate exposure and reduce infiltration of stormwater through soil/fill material. This would result in a reduction of production of leachate which could potentially transport contaminants off-site.

Similar to Alternatives 4 and 5, special considerations would need to be made for cap construction at the Old Upper Mountain Road site due to the physical setting and grades. The required 3:1 slopes would be achieved by re-grading soil/fill material into the ravine, rather than removal and disposal off-site, as is suggested in Alternative 4. Existing grades of the soil/fill material are steep and would require considerable earth work and re-grading into the existing ravine to achieve the necessary 3:1 landfill slopes. Prior to placement of fill in the ravine, a drainage layer would be constructed to allow groundwater to follow natural flow patterns into the ravine without coming into contact with contaminated fill.

In addition, a sewer line runs through the existing fill and would have to be re-routed for grading activities to take place. Figures 6-4 and 6-5 provide the approximate final conditions under this alternative.

This alternative would be implemented as follows:

- A utility locator would be brought on-site to locate known underground utilities or other obstructions that may prove problematic during excavation. This information would be utilized to either re-route these utilities outside the remediation or to accommodate their locations and future anticipated maintenance so as the remediation is not jeopardized and potential for future exposure to contaminants is minimized.

- Existing sewer line would be re-aligned from a manhole at the end of Old Upper Mountain Road to a manhole within the ravine. The existing sewer line within the soil/fill material area would be abandoned in place. Removing the sewer line from the remediation area will allow for future sewer maintenance without the possibly of disturbing contaminated soil/fill material or the proposed landfill cap.

- Access roads into the ravine would be improved and maintained for the duration of the remedial action.

- A drainage layer consisting of nonwoven geotextile, 6-in. perforated pipe, and a 24-in. layer of gravel would be placed within the extended footprint of the landfill.

- Five monitoring wells would be abandoned prior to excavation activities.

- Approximately 51,000 yd^3 of soil/fill material would be excavated from the embankment in order to achieve 3:1 slopes into the ravine. Excavated soil/fill material would remain on-site within the upper sections of OU 1 and placed at 3:1 slopes into the ravine over the drainage layer.

- Once final subgrade surfaces are complete, a soil cap system would be installed by qualified personnel, complete with proper surface drainage, topsoil, and seed. Surface drainage would be designed to handle stormwater surface flow, as well as flow from the existing 30 in. bulkhead.

- Eight monitoring wells would be installed following restoration for groundwater monitoring purposes.

- The site perimeter would be secured using a 9-ft Galvanized fence with barbed wire and a 7-ft high swing gate.

6.1.8 OU 1 Alternative 7: Partial Removal and Off-Site Disposal with *In Situ* Stabilization of Shallow Waste

This alternative would consist of the removal of soil/fill material from contaminated depths that range from 20 to 80 ft bgs. Soil/fill material would be removed to achieve 3:1 or otherwise stable slopes within the ravine. This area is in the center of OU 1 and would lengthen the existing ravine to the southwest. The sewer line that runs through the existing soil/fill material would have to be re-routed for partial removal to take place. Figure 6-6 provides the final conditions under this alternative.

Remaining soil/fill material would be treated *in situ* with a stabilizing amendment, such as Eco-Bond®, to reduce the mobility and leachability of the contaminants. Soil/fill material that remains at 3:1 slopes in the center of the ravine would be graded to create a flat treatment surface area, treated with an amendment, and then returned to 3:1 slopes for final restoration. Special considerations would need to be made for the Old Upper Mountain Road site due to the physical setting and grades. Ravine access would need to be modified and maintained to allow for partial removal.

This alternative would be implemented as follows:

- A utility locator would be brought on-site to locate known underground utilities or other obstructions that may prove problematic during excavation. This information would be utilized to either re-route these utilities outside the remediation or to accommodate their locations and future anticipated maintenance so as the remediation is not jeopardized and potential for future exposure to contaminants is minimized.

- A pre-design characterization study would take place at the site prior to the remedial design process of this alternative. This type of study would involve the installation of soil borings and collection of soil/fill material samples spaced 25-ft horizontally and 20-ft vertically in the area where soil/fill material is proposed to be removed. Samples would be submitted to an analytical laboratory for full TCLP analysis. The objective of this study would be to evaluate the potential for the segregation of hazardous vs. non-hazardous soil/fill material for disposal.

- Existing sewer line would be re-aligned from a manhole at the end of Old Upper Mountain Road to a manhole within the ravine. The existing sewer line within the soil/fill material area would be abandoned in place. Removing the sewer line from the remediation area will allow for future sewer maintenance without the possibly of disturbing amended soil/fill material or the proposed soil cover system.

- A bench-scale or pilot study would be completed to evaluate the effectiveness of the proposed stabilization amendment.

- Access roads into the ravine would be improved and maintained for the duration of the remedial action.

- Five monitoring wells would be abandoned prior to excavation activities.

- Sheet piling would be installed along the railroad tracks at the southwest boundary of the OU 1 area.

- Approximately 217,478 loose yd^3 of soil/fill material would be excavated, from a minimum depth of 20 ft bgs and a maximum depth of 50 ft bgs.

- Based on the RI, and for the purpose of this FS, EA estimates that 43 percent of the excavated soil is hazardous and would be disposed of at a permitted hazardous waste landfill. The remainder of the soil would be disposed of at a general waste landfill, following acceptance. Results of the pre-design characterization study would potentially change these percentages.

- It is assumed that a dewatering system would be needed since the excavation will extend into the groundwater table; however, due to the fact that the excavation activities would be completed on the side facing the ravine, water diversion methods with settling tanks could be used prior to discharge to the creek rather than conventional pumping techniques. Samples would need to be collected prior to discharge.

- To aid in stability due to flow events and sheet flow on the ravine side, rock toe and soil stabilization fabrics could be utilized to aid in stability of the graded surface. Rock toe techniques would stabilize the bottom of the slope against Gulf Creek flows and concentrated sheet flow from the slope surface. Additionally, this would help maintain a permeable pathway for natural groundwater release to Gulf Creek. Soil stabilization fabrics and the addition of benches or other flow collection devices would aid in the safe conveyance of surface water from the slope.

- Remaining soil/fill material would be treated with a stabilization amendment, such as Eco-Bond®, using deep mixing equipment (i.e., augers).

- All disturbed areas would be restored to 3:1 grades and covered with topsoil and seed.

- Eight monitoring wells would be installed following restoration.

6.1.9 OU 1 Alternative 8: Partial Removal, *Ex Situ* Stabilization and On-site Placement with *In Situ* Stabilization of Shallow Waste

Similar to Alternative 7, this alternative would consist of the removal of soil/fill material from contaminated depths that range from 20 to 80 ft bgs; however, instead of being disposed off-site, removed fill would be treated *ex situ* and disposed of on-site into the area from which it was excavated and into the ravine to achieve 3:1 slopes. A similar drainage layer as discussed for Alternatives 5 and 6 would be placed within the ravine prior to placement of the treated fill. The sewer line that runs through the existing soil/fill material would have to be re-routed for excavation to take place.

Shallow soil/fill material would be treated *in situ* with a stabilizing amendment, such as Eco-Bond®, to reduce the mobility and leachability of the contaminants.

Ravine access would need to be modified and maintained to allow for partial removal and placement. Figure 6-7 provides the final conditions under this alternative.

This alternative would be implemented as follows:

- A utility locator would be brought on-site to locate known underground utilities or other obstructions that may prove problematic during excavation. This information would be utilized to either re-route these utilities outside the remediation, or to accommodate their locations and future anticipated maintenance so as the remediation is not jeopardized and potential for future exposure to contaminants is minimized.

- Existing sewer line would be re-aligned from a manhole at the end of Old Upper Mountain Road to a manhole within the ravine. The existing sewer line within the soil/fill material area would be abandoned in place. Removing the sewer line from the remediation area will allow for future sewer maintenance without the possibly of disturbing amended soil/fill material or the proposed soil cover system.

- A bench-scale or pilot study would be completed to evaluate the effectiveness of the proposed stabilization amendment.

- Access roads into the ravine would be improved and maintained for the duration of the remedial action.

- A drainage layer consisting of nonwoven geotextile, 6-in. perforated pipe and a 24-in. layer of gravel would be placed within the extended footprint of the landfill.

- Five monitoring wells would be abandoned prior to excavation activities.

- Sheet piling would be installed along the railroad tracks at the southwest boundary of the OU 1 area.

- Approximately 217,478 loose yd^3 of soil/fill material would be excavated, to a minimum depth of 20 ft bgs and a maximum depth of 50 ft bgs.

- Excavated soil would be staged onsite and treated prior to placement within the excavation and into the ravine.

- It is assumed that a dewatering system would be needed since the excavation will extend into the groundwater table; however, due to the fact that the excavation activities would be completed on the side facing the ravine, water diversion methods with settling tanks could be used prior to discharge to the creek rather than conventional pumping techniques. Samples would need to be collected prior to discharge.
- Shallow soil/fill material would be treated with a stabilization amendment, such as Eco-Bond®, using deep mixing equipment (i.e., augers).

- All disturbed areas would be restored to 3:1 grades, and covered with topsoil and seed.

- Eight monitoring wells would be installed following restoration.

6.2 OU 2 ALTERNATIVES FOR SEDIMENT

The OU 2 treatment areas were determined based on data presented in the RI and SRI. The area and depths selected address the area of concern within the operable unit (Figure 6-8). Detailed sediment alternatives screening is presented in Table 6-1. As OU 2 includes the active stream and floodplain of Gulf Creek, special considerations are required for the safe conveyance of base and flood flow within the stream, as well as the ecological potential of the site. Alternatives must be able to work with or resist the geomorphic processes active within the riparian corridor to prevent exposure, suspension, and transport of contaminated materials.

6.2.1 OU 2 Alternative 1A: No Action

The no action alternative is evaluated as a procedural requirement and as a basis for comparison. This alternative would leave the site in its present condition.

6.2.2 OU 2 Alternative 1B: Site Management

Alternative 1B is to implement an environmental easement on the property to control the use of the site. This alternative would leave the site in its present physical condition, but would address the RAO "Prevent ingestion/direct contact with contaminated sediment". Additionally, site perimeter controls and access points would be installed, and warning signage posted.

6.2.3 OU 2 Alternative 2: *In Situ* Multi-Media Sub-Aqueous Capping

In Situ multi-media sub-aqueous capping would be utilized in the active floodplain and sediments of Gulf Creek. In this alternative, contaminated sediments would be covered by clean sand, soil, cobble, top soil, and/or organic matter to recreate a floodplain surface and stream system above the contaminated sediment. Figure 6-9 provides the final conditions under this alternative.

This alternative would be implemented as follows:

- A utility locator would be brought on-site to locate known underground utilities or other obstructions that may prove problematic during work activities within Gulf Creek. This information would be utilized to either temporarily re-route these utilities outside the remediation or to accommodate their locations and future anticipated maintenance needs.

- The existing sewer line would be re-aligned either outside of OU 2 or in such a way as to limit its impact on the remediation area and accommodate future maintenance without jeopardizing the remediation.

- A detailed 1-ft contour survey would be collected by a licensed surveyor to document the existing conditions of Gulf Creek, including limits of wetlands and waterways, trees, utilities, topographic features, and other relevant existing conditions.

- In order to understand the magnitude of flow, velocity and shear forces associated with typical floodplain conditions on Gulf Creek, a detailed hydrologic and hydraulic (H&H) study would be completed for Gulf Creek at the points of interest, including the top of OU 2 and the lower extent of remediation. This would include mapping of the existing and proposed conditions floodplain. Analysis of any tributaries or drainages contributing within the work area would also be performed.

- A detailed fluvial geomorphic analysis would be completed for Gulf Creek. Estimates of bed load and suspended sediment load would be documented using field sampling and predictive modeling techniques. Testing would be utilized to determine if contaminated sediments are being significantly transported into or out of Gulf Creek. Analysis of the stable dimensional, plan and profile forms of Gulf Creek would be documented for restoration of the stream following capping activities. If the existing condition of Gulf

Creek at this location is sufficiently impaired, a stable reference reach site would be identified and surveyed at this stage.

- Clearing, chipping and grubbing of woody material and subgrade preparation of the OU 2 area. Subgrade would be prepared by amending contaminated sediment with stone in order to stabilize softer areas which lack the bearing capacity to support a cap.

- Pipe diversion of base flow with storm capacity of Gulf Creek, as well as dewatering and maintenance of flow measures would be utilized to create a stable work area. Flow diversion of outfalls from OU 1 may be required depending on construction sequencing. The previous H&H modeling study would be used for flow diversion and pipe sizing criteria.

- Installation of the multimedia cap. The multimedia cap would be installed with surface materials and contours conforming to the restored condition of Gulf Creek through the remediation area, including new stream channel, riffles, pools, and grade controls to ensure the long-term stability of the multimedia cap. The cap would be underlain by a protective layer of geotextile, to define the lower limit of the cap in the event of any future dredging and/or excavation in Gulf Creek. This geotextile underlayment is typically non-woven geotextile and is orange in color to serve as a warning of the contaminated materials below.

- Once dredging and cap placement activities are completed, the site would be stabilized with an appropriate wetland and riparian seed mix. It is recommended that any vegetative community established be in accordance with the native ecology and beaver morphology present in similar systems. Additionally, the creation of an emergent or scrub-shrub system with beaver activity would decrease the likelihood of the establishment of large trees, which through flood flows, wind or other natural processes could uproot, damaging the multimedia capping system and risking exposure of contaminated sediments beneath.

Capping activities would have the effect of uplifting the existing stream and the shallow groundwater table. Depending on the extent of potential uplift, groundwater investigation would need to be conducted to determine the impact of this increase in shallow groundwater elevation on the remediation alternative selected for OU 1.

In order to preserve the integrity of OU 2's capping system, grade control structures maintaining the new base level of Gulf Creek would be required. To maintain a stable transition of flow to the lower reaches of Gulf Creek, as well as preserve fish passage and other functions and values of the stream system, these grade controls may be required in coordination with the remedial action area. Through geomorphic investigation, these extents should be able to be determined. The design of these grade controls is essential to preserving the integrity of the *in situ* capping system. As sediment transport cannot realistically be limited to zero, designing grade control structure capacity and shape to produce areas of net long-term sediment deposition is essential to preserving the capping system. Riffle grade control devices, where higher velocities and grade transitions can occur, would be designed for immobility under extreme flow conditions and will allow that portion of the cap to resist flood flow shear stresses and continue to prevent exposure of contaminated sediments. In addition to preserving the capping system, this will also allow a stable stream system to be restored and self-mitigating project impacts.

Following completion, the cap, including structures designed for sediment deposition and riffle grade control devices would be inspected in conjunction with surface water sampling events, which would be conducted semi-annually for the first 5 years and annually thereafter. The cap inspection and sampling event will serve to monitor effectiveness of the cap and identify any areas requiring repair.

6.2.4 OU 2 Alternative 3: *In Situ* Sediment Amendment

The third potential remediation alternative to be evaluated is the amendment of contaminated sediments with apatite and gypsum. Gypsum is typically derived from the mining industry. Apatite is typically derived from byproducts of the fishing industry because it is the primary component of fish bones. Apatite has been used in soil and sediment remediation as an amendment because it has been shown to bind lead, zinc, and other cationic metals in recalcitrant phosphate forms that are not soluble, bioavailable, or toxic. Gypsum has been used as a remediation amendment for mercury because it provides pH adjustment and a source of sulfur, both of which encourage formation of cinnabar, a form of mercury that is relatively non-toxic and non-bioavailable. The successful use of these amendments is dependent upon bench scale studies and pilot testing as part of remedial design phases of the work. It also requires construction of measures to ensure sediments remain in place to avoid downstream transport and long-term monitoring. Figure 6-10 provides the final conditions under this alternative.

The alternative would be implemented as follows:

- A utility locator would be brought on-site to locate known underground utilities or other obstructions that may prove problematic during work activities within Gulf Creek. This information would be utilized to either temporarily re-route these utilities outside the remediation or to accommodate their locations and future anticipated maintenance needs.

- The existing sewer line would be re-aligned either outside of OU 2 or in such a way as to limit its impact on the remediation area and accommodate future maintenance without jeopardizing the remediation.

- A detailed 1-ft contour survey would be collected by a licensed surveyor to document the existing conditions of the site, including limits of wetlands and waterways, trees, utilities, topographic features, and other relevant existing conditions.

- A pre-design characterization study would take place at the site prior to the remedial design process of this alternative. Such a study would involve the installation of borings and collection of sediment core samples. Sampling would focus on the top 2 ft of the sediment surface where human and ecological exposures are most likely. Borings would be located in a 25 × 25 ft grid to examine variation in metal chemistry horizontally. Samples would be submitted to an analytical laboratory for bench scale testing. Different rates of application of apatite and gypsum amendment would be tested to determine their effect on metal solubility. The objective of this study would be to determine the site-specific amounts of these amendments to be proposed for amendment, as well as the extents of amendment activity. Bench scale studies would be followed by a small pilot test of amendment rates and application method over selected plots of sediment.

- In order to understand the magnitude of flow, velocity, and shear forces associated with typical floodplain conditions on Gulf Creek, a detailed H&H study would be completed for Gulf Creek at the points of interest, including the top of OU 2 and the lower extent of remediation. This would include mapping of the existing and proposed conditions floodplain. Analysis of any tributaries or drainages contributing within the work area would also be performed.

- A detailed fluvial geomorphic analysis would be completed for Gulf Creek, documenting the existing conditions in order to serve as a template for restoring flow post-remedy. Estimates of bed load and suspended sediment load would be documented using field sampling and predictive modeling techniques. Testing would be utilized to determine if contaminated sediments are being significantly transported into or out of Gulf Creek. Analysis of the stable dimensional, plan and profile forms of Gulf Creek would be documented for restoration of the stream following capping activities. If the existing condition of Gulf Creek at this location is sufficiently impaired, a stable reference reach site would be identified and surveyed at this stage.

- Clearing, chipping, and grubbing of woody material and subgrade preparation of the OU 2 area. This would allow the amendment of sediments without being impeded by existing vegetation.

- Pipe diversion of base flow with storm capacity of Gulf Creek, as well as dewatering and maintenance of flow measures would be utilized to create a stable work area. Flow diversion of outfalls from OU 1 may be required depending on construction sequencing. The previous hydrologic modeling study would be used for diversion flow and pipe sizing criteria.

- Amendment of sediments. Sediment amendments would be applied to the surface of the sediment and worked in place by tilling. It is anticipated that final grades would match closely with existing grades unless adverse conditions or concern over the stability of newly disturbed soil adjacent to Gulf Creek were encountered. Additional amendment of soil with sand or stone may be required if materials are unsuitable for placement due to high organic content, insufficient bearing capacity, or other geotechnical issues.

- Gulf Creek would be restored to its pre-existing stream pattern and profile, or an otherwise stable and suitable stream form.

- Once sediment amendment activities are completed, the site would be stabilized with an appropriate wetland and riparian seed mix. It is recommended that any vegetative community established be in accordance with the native ecology and beaver morphology present in similar systems.

This alternative would require the complete disturbance and re-stabilization of the floodplain and creek bed in all areas where testing indicates contamination exceeding the SCGs for the site.

Following completion, surface water from the creek would be sampled to monitor effectiveness of the sediment amendment. Surface water samples would be collected on a semi-annual basis for the first 5 years and annually thereafter.

6.2.5 OU 2 Alternative 4: Complete Removal and Disposal

The fourth potential remedial alternative to be evaluated is complete excavation and on-site disposal of sediment. This alternative is aimed at removing the sediments exceeding SCGs at OU 2.

Mechanical dredging is a common remedy used to remove contaminated sediment from a source area. This approach can be effective at eliminating exposure and preventing transport of contaminants.
On-site disposal would be completed in conjunction with on-site disposal for fill at OU 1. Sediment would be dewatered, stabilized, and graded on top of OU 1 fill at a 3:1 slope. The landfill cap would be completed in accordance with the selected remedy for OU 1 (Part 360 Cap if OU 1 Alternative 3 is selected, or soil cap if OU 1 Alternative 6 is selected). In the event that on-site disposal is not possible, the cost for off-site disposal has been calculated as well.

The dredged area would be restored to a stable riparian corridor with stable stream and floodplain, and those grades may or may not match the present existing grades. Figure 6-11 provides the final conditions under this alternative.

This alternative would be implemented as follows:

- A utility locator would be brought on-site to locate known underground utilities or other obstructions that may prove problematic during dredging activities. This information would be utilized to either re-route these utilities outside the remediation or to accommodate their locations and future anticipated maintenance.

- A detailed 1-ft contour survey would be collected by a licensed surveyor to document the existing conditions of the Gulf Creek corridor, including limits of wetlands and waterways, trees, utilities, topographic features, and other relevant existing conditions.

- In order to understand the magnitude of flow, velocity and shear forces associated with typical floodplain conditions on Gulf Creek, a detailed H&H study would be completed for Gulf Creek at the points of interest, including the top of OU 2 and the lower extent of remediation. This would include mapping of the existing and proposed conditions floodplain. Analysis of any tributaries or drainages contributing within the work area would also be performed.

- A detailed fluvial geomorphic analysis would be completed for Gulf Creek. Estimates of bed load and suspended sediment load would be documented using field sampling and predictive modeling techniques. Testing would be utilized to determine if contaminated sediments are being significantly transported into or out of the site. Analysis of the stable dimensional, plan, and profile forms of Gulf Creek would be documented for restoration of the stream following dredging activities. If the existing condition of Gulf Creek at this location is sufficiently impaired, a stable reference reach site would be identified and surveyed at this stage.

- Clearing, chipping, and grubbing of woody material and subgrade preparation of the OU 2 area.

- Pipe diversion of base flow with storm capacity of Gulf Creek, as well as dewatering and maintenance of flow measures would be utilized to create a stable work area. Flow diversion of outfalls from OU 1 may be required depending on construction sequencing.

- Dredging of the contaminated sediment and replacement of the sediment with an uncontaminated soil layer at the appropriate grades to restore stream and wetland functions and enable re-vegetation and stabilization. Grade control structures may be necessary in certain location to prevent scour and erosion to the replaced soil materials.

- Dredged sediment would be stockpiled on-site for dewatering, stabilized using Portland cement or a similar product, and placed atop OU 1 graded fill. Sediment would be compacted in place prior to landfill construction completion.

- Once dredging activities are completed, the site would be stabilized with an appropriate wetland and riparian seed mix and topsoil for growing medium. It is recommended that any vegetative community established be in accordance with the native ecology and beaver morphology present in similar systems. Additionally, the creation of an emergent or scrub-shrub system with beaver activity would decrease the likelihood of the establishment of large trees, which through flood flows, wind or other natural processes could uproot.

6.2.6 OU 2 Alternative 5: Selective Dredging with Multi-Media Sub-Aqueous Capping

The fifth potential remediation alternative to be evaluated is an integration of Alternatives 2 and 4, dredging selected sediment areas and capping others. In this alternative, portions of the floodplain of OU 2 would be dredged with sediments being disposed of on-site in conjunction with on-site disposal for fill at OU 1. Dredged sediment would be dewatered, stabilized, and graded on top of OU 1 fill at a 3:1 slope. The landfill cap would be completed in accordance with the selected remedy for OU 1 (Part 360 Cap if OU 1 Alternative 3 is selected, or soil cap if OU 1 Alternative 6 is selected). In the event that on-site disposal is not possible, the cost for off-site disposal has been calculated as well.

Dredging could potentially be implemented for partial depths in this scenario, with capping of contaminated sediment taking the place of a full depth removal. Portions of the site with less potential for exposure or transport of contaminated sediment, or sediment at appropriate deep depths after dredging could then be capped to prevent exposure. This alternative would limit the quantity of dredging over a full removal. Figure 6-12 provides the final conditions under this alternative.

This alternative would be implemented as follows:

- A utility locator would be brought on-site to locate known underground utilities or other obstructions that may prove problematic during dredging and capping activities. This information would be utilized to either re-route these utilities outside the remediation or to accommodate their locations and future anticipated maintenance so as the remediation is not jeopardized and potential for future exposure to contaminants is minimized.

- A pre-design characterization study would take place at the site prior to the remedial design process of this alternative. This type of study would involve the installation of soil borings and collection of soil samples spaced 25-ft horizontally, to the termination depth of the sediment layer vertically, with samples collected every 1 ft. Samples would be submitted to an analytical laboratory for full TCLP analysis. The purpose would be to identify sediment depths with lower concentrations of metals which could be capped instead of excavated.

- A detailed 1-ft contour survey would be collected by a licensed surveyor to document the existing conditions of the site, including limits of wetlands and waterways, trees, utilities, topographic features, and other relevant existing conditions.

- In order to understand the magnitude of flow, velocity, and shear forces associated with typical floodplain conditions on Gulf Creek, a detailed H&H study would be completed for Gulf Creek at the points of interest, including the top of OU 2 and the lower extent of remediation. This would include mapping of the existing and proposed conditions floodplain. Analysis of any tributaries or drainages contributing within the work area would also be performed.

- A detailed fluvial geomorphic analysis would be completed for Gulf Creek. Estimates of bed load and suspended sediment load would be documented using field sampling and predictive modeling techniques. Testing would be utilized to determine if contaminated sediments are being significantly transported into or out of the site. Analysis of the stable dimensional, plan and profile forms of Gulf Creek would be documented for restoration of the stream following capping activities. If the existing condition of Gulf Creek at this location is sufficiently impaired, a stable reference reach site would be identified and surveyed at this stage. This model would also be used for proposed conditions to predict and modify the transport potential of any capping media to be exposed to flood flows, in such a way to size it for stability to prevent future exposure of contaminants through scour.

- Clearing, chipping, and grubbing of woody material and subgrade preparation of the OU 2 area. Additional amendment of soil with sand or stone may be required if subgrade materials are unsuitable for placement due to high organic content, insufficient bearing capacity, or other geotechnical issues

- Pipe diversion of base flow with storm capacity of Gulf Creek, as well as dewatering and maintenance of flow measures would be utilized to create a stable work area. Flow diversion of outfalls from OU 1 may be required depending on construction sequencing.

- Dredging of the contaminated sediment and replacement of the sediment with an uncontaminated soil layer at the appropriate grades to restore stream and wetland functions and enable re-vegetation and stabilization. Grade control structures may be necessary in certain location to prevent scour and erosion to the replaced soil materials.

- Dredged sediment would be stockpiled on-site for dewatering, stabilized using Portland cement or a similar product, and placed atop OU 1 graded fill. Sediment would be compacted in place prior to landfill construction completion.

- Multimedia capping of residual sediment which exceeds thresholds for exposure. The multimedia cap would be installed with surface materials and contours conforming to the restored condition of Gulf Creek through the remediation area, including new stream channel, riffles, pools, and grade controls to ensure the long-term stability of the multimedia cap. The cap would be underlain by a protective layer of geotextile, to define the lower limit of the cap in the event of any future excavation in the area. This geotextile underlayment is typically non-woven geotextile and is orange in color to serve as a warning of the contaminated materials below. Depending on the extent of contamination, this cap may only be present in certain areas where a full-depth excavation of contaminated sediments does not occur, or potentially directly over contaminated sediments at the existing ground surface.

- Once excavation and cap placement activities are completed, the site would be stabilized with an appropriate wetland and riparian seed mix to stabilize the capped and dredged areas. Topsoil amendment may be necessary. It is recommended that any vegetative community established be in accordance with the native ecology and beaver morphology present in similar systems. Additionally, the creation of an emergent or scrub-shrub system with beaver activity would decrease the likelihood of the establishment of large trees, which through flood flows, wind or other natural processes could uproot, damaging the multimedia capping system and risking exposure of contaminated sediments beneath.

In this alternative, virtually all contaminated areas would be disturbed and require stabilization, either due to dredging or capping activities.

Following completion, the cap would be inspected semi-annually for the first 5 years and annually thereafter. The cap inspection will serve to monitor effectiveness of the cap and identify any areas requiring repair.

7. COSTING AND EVALUATION CRITERIA

This section describes the process for the detailed analysis of remedial alternatives for the Old Upper Mountain Road site and also presents the cost estimates used as part of the analysis.

The detailed analysis of the remedial alternatives is presented in Table 6-2.

7.1 CRITERIA USED FOR ANALYSIS OF ALTERNATIVES

The criteria to which potential remedial alternatives are compared (and used during this detailed analysis) are defined in 6 NYCRR Part 375 and are listed below:

- Overall protectiveness of public health and the environment
- Conformance to SCGs
- Long-term effectiveness and permanence
- Reduction in toxicity, mobility, or volume of contamination through treatment
- Short-term impacts and effectiveness
- Implementability
- Cost-effectiveness
- Land use
- Community acceptance.

A description of the criteria and how alternatives are evaluated against them follows.

***Overall Protectiveness of Public Health and the Environment*—**This criterion is an overall evaluation of each alternative's ability to protect public health and the environment.

Conformance to Standards, Criteria, and Guidance—Compliance with SCGs addresses whether a remedy would meet environmental laws, regulations, and other standards and criteria. The SCGs were presented in Section 3.

***Long-Term Effectiveness and Permanence*—**This criterion evaluates the long-term effectiveness of the remedial alternatives after implementation. If wastes or treated residuals remain on-site after the selected remedy has been implemented, the following items are evaluated: (1) magnitude of the remaining risks, (2) adequacy of the engineering and/or institutional controls intended to limit the risk, and (3) reliability of these controls.

***Reduction of Toxicity, Mobility, or Volume of Contamination through Treatment*—**The degree to which the alternative permanently reduces the toxicity, mobility, or volume of hazardous substances including the adequacy of the alternative in destroying the hazardous substances, reduction or elimination of hazardous substance releases and sources of releases, degree of irreversibility of waste treatment process, and characteristics and quantity of treatment residuals generated. Preference is given to alternatives that permanently and significantly reduce the toxicity, mobility, or volume of the wastes at the site.

Short-Term Impacts and Effectiveness**—**Evaluation of the short-term effectiveness for an alternative includes consideration of the risk to human health and the environment associated with the alternative during construction and implementation, and the effectiveness of measures that will be taken to manage such risks. Impacts from remedial action implementation include vehicle traffic; temporary relocation of residences/buildings; temporary closure of public facilities; odor; open excavations; and noise, dust, and safety concerns associated with extensive heavy equipment activity. The greatest short-term risk to human health is related to safety and general construction activity.

Implementability**—**The technical and administrative feasibility of implementing each alternative is evaluated. Technical feasibility includes the difficulties associated with construction of the remedy and the ability to monitor its effectiveness. For administrative feasibility, the availability of the necessary personnel and materials is evaluated along with potential difficulties in obtaining specific operating approvals, access for construction, institutional controls, and so forth.

Cost-Effectiveness**—**Capital costs and annual operation, maintenance, and monitoring costs are estimated for each alternative and compared on a present worth basis. Although cost-effectiveness is the last balancing criterion evaluated, where two or more alternatives have met the requirements of the other criteria, it can be used as the basis for the final decision.

Land Use**—**The current and anticipated future use of the site will be considered. Land use must comply with applicable zoning laws and maps.

Community Acceptance**—**Public comments will be considered after the close of the public comment period.

7.2 COST ASSUMPTIONS

Cost assumptions were prepared for each alternative using EPA's *Guide to Developing and Documenting Cost Estimates during the Feasibility Study* (EPA 1996). Net present value of the project costs was estimated using an interest rate of 5 percent. The cost assumptions were calculated using the most common products and application methods available for a remedial alternative. The EPA guidance was used in conjunction with *DER-10 Technical Guidance for Site Investigation and Remediation* (NYSDEC 2010).

7.3 COSTS

Based on the results of the remedial technology screening in Table 6-1, the following cost estimates were prepared for each remedial alternative. Appendix B includes detailed cost estimates developed for each remedial alternative evaluated.

7.3.1 OU 1: Soil/Fill Material and Groundwater

OU 1 Alternative 1A: No Action

Present Worth *$0*
Capital Cost *$0*
Annual Costs (Years 0) *$0*

OU 1 Alternative 1B: Site Management

Present Worth *$160,000*
Capital Cost *$99,000*
Annual Costs (Years 1-30) *$4,000*

OU 1 Alternative 2: Complete Removal with Off-Site Disposal

Present Worth *$43,609,000*
Capital Cost *$43,609,000*
Annual Costs (Years 0) *$0*

OU 1 Alternative 3: *Ex situ* Stabilization with Off-Site Disposal

Present Worth *$40,509,000*
Capital Cost *$40,509,000*
Annual Costs (Years 0) *$0*

OU 1 Alternative 4: Landfill Capping with a Part 360 Cap—Existing Landfill Footprint

Present Worth *$26,975,000*
Capital Cost *$26,552,000*
Annual Costs (Years 1-5) *$34,000*
Annual Costs (Years 6-30) *$25,000*

OU 1 Alternative 5: Landfill Capping with a Part 360 Cap—Extended Landfill Footprint

Present Worth *$5,974,000*
Capital Cost *$5,693,000*
Annual Costs (Years 1-5) *$24,000*
Annual Costs (Years 6-30) *$16,000*

OU 1 Alternative 6: Landfill Capping with a Clean Soil Cover—Extended Landfill Footprint

Present Worth $4,208,000
Capital Cost $3,927,000
Annual Costs (Years 1-5) $24,000
Annual Costs (Years 6-30) $16,000

OU 1 Alternative 7: Partial Removal and Off-Site Disposal with *In Situ* Stabilization of Shallow Waste

Present Worth $41,721,000
Capital Cost $41,500,000
Annual Costs (Years 1-5) $23,000
Annual Costs (Years 6-30) $11,000

OU 1 Alternative 8: Partial Removal, *Ex Situ* Stabilization and On-site Placement, with *In Situ* Stabilization of Shallow Waste

Present Worth $23,557,000
Capital Cost $23,336,000
Annual Costs (Years 1-5) $23,000
Annual Costs (Years 6-30) $11,000

7.3.2 OU 2: Sediment

OU 2 Alternative 1: No Action

Present Worth $0
Capital Cost $0
Annual Costs (Years 0) $0

OU 2 Alternative 1B: Site Management

Present Worth $87,000
Capital Cost $41,000
Annual Costs (Years 1-30) $3,000

OU2 Alternative 2: *In Situ* Multi-media Sub-aqueous Capping

Present Worth $2,889,000
Capital Cost $2,775,000
Annual Costs (Years 1-5) $11,000
Annual Costs (Years 6-30) $5,000

OU 2 Alternative 3: *In Situ* Sediment Amendment

Present Worth $2,334,000
Capital Cost $2,295,000
Annual Costs (Years 1-5) $4,000
Annual Costs (Years 6-30) $2,000

OU 2 Alternative 4: Complete Removal with Disposal

Present Worth .... $4,638,000 ($5,239,000[a])
Capital Cost .... $4,638,000 ($5,239,000[a])
Annual Costs (Years 0) $0

OU 2 Alternative 5: Partial Removal with Multi-Media Sub-Aqueous Capping

Present Worth .... $3,887,000 ($4,603,000[a])
Capital Cost .... $3,875,000 ($4,591,000[a])
Annual Costs (Years 0) $760 ($760)

a. Indicates cost for off-site disposal.

8. DETAILED ANALYSIS OF ALTERNATIVES AND RECOMMENDATIONS

The purpose of this FS was to develop, screen, and evaluate potential remedial alternatives for the Old Upper Mountain Road site. Remedies were identified and screened in accordance with EPA and NYSDEC guidance. Individual alternatives for OU1 and OU 2 were combined for evaluation and are described below.

Remedial alternatives were developed in this FS, as identified below.

The following combinations of the OU 1 and OU 2 remedial alternatives are considered in this FS:

- **Alternative 1A—**No Action
- **Alternative 1B—**Site Management
- **OU 1 Alternative 5 or 6, and OU 2 Alternative 4—**OU 1 Landfill Capping and OU 2 Complete Removal with Disposal at OU 1
- **OU 1 Alternative 5 or 6, and OU 2 Alternative 5—**OU 1 Landfill Capping and OU 2 Partial Removal with On-site Disposal at OU 1 with Multi-Media Sub-Aqueous Capping
- **OU 1 Alternative 2 and OU 2 Alternative 2—**OU 1 Complete Removal with Off-Site Disposal and OU 2 Multi-Media Sub-Aqueous Capping
- ***OU 1 A*****lternative 7 and OU 2 Alternative 3—**OU 1 Partial Removal and Off-site Disposal with *In Situ* Stabilization of Shallow Waste with OU 2 *In Situ* Sediment Amendment
- **OU 1 Alternative 3 and OU 2 Alternative 2—**OU 1 *Ex-Situ* Stabilization with Off-Site Disposal and OU 2 Multi-Media Sub-Aqueous Capping.
- **OU 1 Alternative 4 and OU 2 Alternative 2—**OU 1 Landfill Capping with a Part 360 Cap within the Existing Landfill Footprint with OU 2 Multi-Media Sub-Aqueous Capping
- **OU 1 Alternative 8 and OU 2 Alternative 5—**OU 1 Partial Removal, *Ex Situ* Stabilization and On-site Placement, with *In Situ* Stabilization of Shallow Waste, and OU 2 Partial Removal with On-site Disposal at OU 1 with Multi-Media Sub-Aqueous Capping.

8.1 COMPARISON OF OU 1/OU 2 ALTERNATIVES

8.1.1 Overall Protection of Public Health and the Environment

This criterion is an overall evaluation of each alternative's ability to protect public health and the environment.

Alternative 1A does not fulfill this criterion. Alternative 1B will moderately protect public health by the implementation of institutional controls. Through containment, OU 1 Alternative 5 or 6 with OU 2 Alternative 4 or 5, and OU 1 Alternative 4 with OU 2 Alternative 2 close-off the soil/fill material and sediment exposure pathway and, thereby, preventing human contact with remaining contamination. OU 1 Alternative 2 with OU 2 Alternative 2 and OU 1 Alternative 3 with OU 2 Alternative 2 fulfill this criterion by completely removing the contaminants from OU 1 and closing off the sediment exposure pathway through containment. OU 1 Alternative 7 with OU 2 Alternative 3 and OU 1 Alternative 8 with OU 2 Alternative 5 moderately fulfill this criterion by reducing contaminant mobility.

8.1.2 Standards, Criteria, and Guidance

Compliance with SCGs addresses whether a remedy will meet environmental laws, regulations, and other standards and criteria.

Alternatives 1A and1B do not meet this criterion. OU 1 Alternative 5 or 6 with OU 2 Alternative 4 or 5, and OU 1 Alternative 4 with OU 2 Alternative 2 will fulfill this criterion by containing soil/fill material and sediment exceeding SCGs. OU 1 Alternative 7 with OU 2 Alternative 3 fulfills this criterion by removing a large amount of soil/fill material exceeding SCGs, and by stabilizing the remaining soil/fill and sediment. OU 1 Alternative 2 or 3 with OU 2 Alternative 2 will fulfill this criterion by removing all soil/fill material and containing all sediment exceeding SCGs. OU 1 Alternative 8 with OU 2 Alternative 5 will fulfill this criterion by stabilizing soil/fill and sediment and containing residual sediment.

8.1.3 Long-Term Effectiveness and Permanence

This criterion evaluates the long-term effectiveness of the remedial alternatives after implementation. If wastes or treated residuals remain on-site after the selected remedy has been implemented, the following items are evaluated: 1) the magnitude of the remaining risks, 2) the adequacy of the engineering and/or institutional controls intended to limit the risk, and 3) the reliability of these controls.

Alternative 1A will not provide long-term effectiveness or permanence. Alternative 1B would not provide long-term effectiveness as a stand-alone alternative; however, this alternative would complement other alternatives. The remaining combinations of alternatives would moderately fulfill this criterion; all alternative combinations involve leaving untreated waste on-site and would require periodic monitoring and maintenance.

8.1.4 Reduction of Toxicity, Mobility, or Volume of Contamination

Preference is given to alternatives that permanently and significantly reduce the toxicity, mobility, or volume of the wastes at the site.

Alternatives 1A and 1B will not reduce the toxicity, mobility, or volume of contamination. OU 1 Alternative 7 with OU 2 Alternative 3 and OU 1 Alternative 8 with OU 2 Alternative 5 will fulfill this criterion by reducing the volume and mobility of contamination by soil/fill material removal, soil/fill material treatment, and sediment containment. The remaining alternative combinations will fulfill this criterion by reducing the volume and mobility of contamination by soil/fill material removal, soil/fill material containment, sediment containment/amendment, and groundwater monitoring.

8.1.5 Short-Term Impacts and Effectiveness

This criterion evaluates the potential short-term adverse impacts of the remedial action upon the community, the workers, and the environment during the construction and/or implementation. The length of time needed to achieve the remedial objectives is also estimated and compared against the other alternatives.

Alternatives 1A and 1B do not pose additional risk to the community, workers, or environment, as there are no construction activities involved. The remaining alternative combinations pose increased short-term risks to the public during excavation/dredging, grading, treatment, and other site activities through the production of dust; these effects can be reduced through the implementation of standard dust mitigation construction practices. Workers can potentially be exposed to contaminated media during excavation and/or treatment activities involved. Risks can be minimized by implementing health and safety controls. These alternative combinations will pose increased short-term risks to the environment in the form of air emissions.

8.1.6 Implementability

This criterion evaluates the technical and administrative feasibility of implementing each alternative.

All proposed alternatives are implementable and have been used nationally.

8.1.7 Cost-Effectiveness

This criterion evaluates estimated capital costs; and annual operation, maintenance, and monitoring costs on a present-worth basis.

Alternatives 1A and 1B are the least expensive, but are also the least effective. OU 1 Alternatives 5 and 6 are similar in cost; as are OU 1 Alternatives 2, 3, and 7; and OU 1 Alternatives 4 and 8. All OU 2 alternatives are similar in cost. There are significant cost differences associated with any type of soil/fill material disposal options (i.e., OU 1 Alternatives

2, 3, and 7), as opposed to capping the soil/fill material on-site. OU 1 Alternative 2 with OU 2 Alternative 2, OU 1 Alternative 7 with OU 2 Alternative 3, and OU 1 Alternative 3 with OU 2 Alternative 2 are the most effective since a majority of the waste is removed from the site, but carry significant cost burdens, while OU 1 Alternative 5 or 6 with OU 2 Alternative 4 or 5 provide a large cost savings and meet all SCGs.

8.1.8 Land Use

Alternatives 1A and 1B would not affect the future use of the site since contamination would remain. Contaminated soil/fill material and/or sediment would remain on-site for all of the alternative combinations; however, under OU 1 Alternative 5 or 6 with OU 2 Alternative 4 or 5, remaining fill and/or sediment would be capped and the land use would be restricted to landfill use only. Under OU 1 Alternative 7 with OU 2 Alternative 3 and OU 1 Alternative 8 with OU 2 Alternative 5, the soil/fill material and sediment would be stabilized and less mobile, but land use would be restricted. Under OU 1 Alternative 2 or 3 with OU 2 Alternative 2, soil/fill material would be removed from the site but sediment would be contained in place. Under OU 1 Alternative 4 and OU 2 Alternative 2, all of the soil/fill and sediment remaining on-site would be capped and the land use would be restricted to landfill use.

8.1.9 Community Acceptance

This criterion evaluates concerns of the community regarding the investigation and the evaluation of alternatives. Remedial alternatives for the Old Upper Mountain Road site have not been presented to the community for comment at this point.

8.2 RESTORATION TO PRE-DISPOSAL CONDITIONS

OU 1 Alternative 6 with OU 2 Alternative 4 is recommended because it fulfills the screening criteria at the lowest cost.

9. REFERENCES

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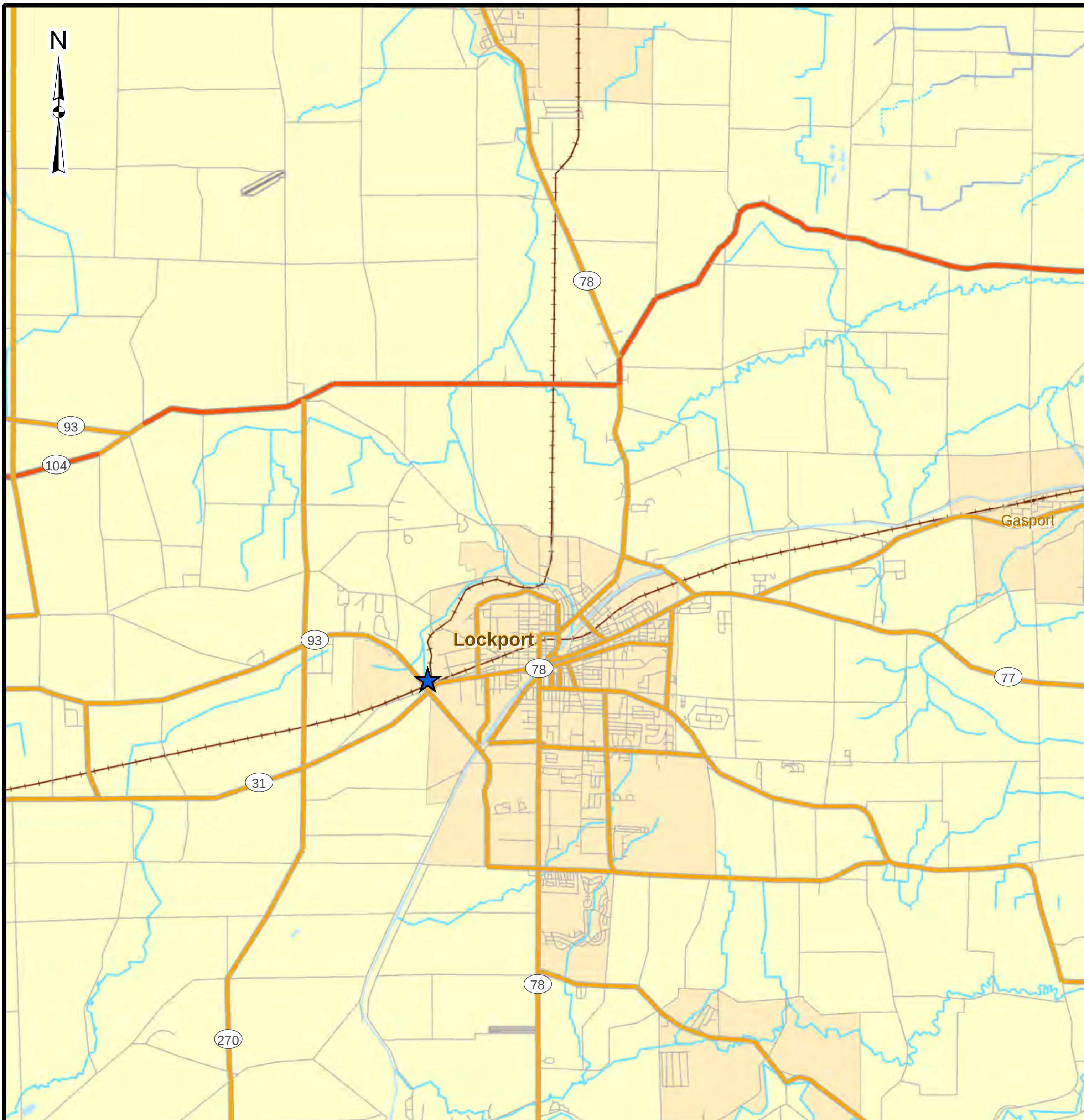
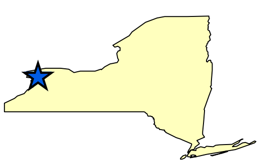




Legend

★ Old Upper Mountain Road Site Location

0 1 2 4 Miles

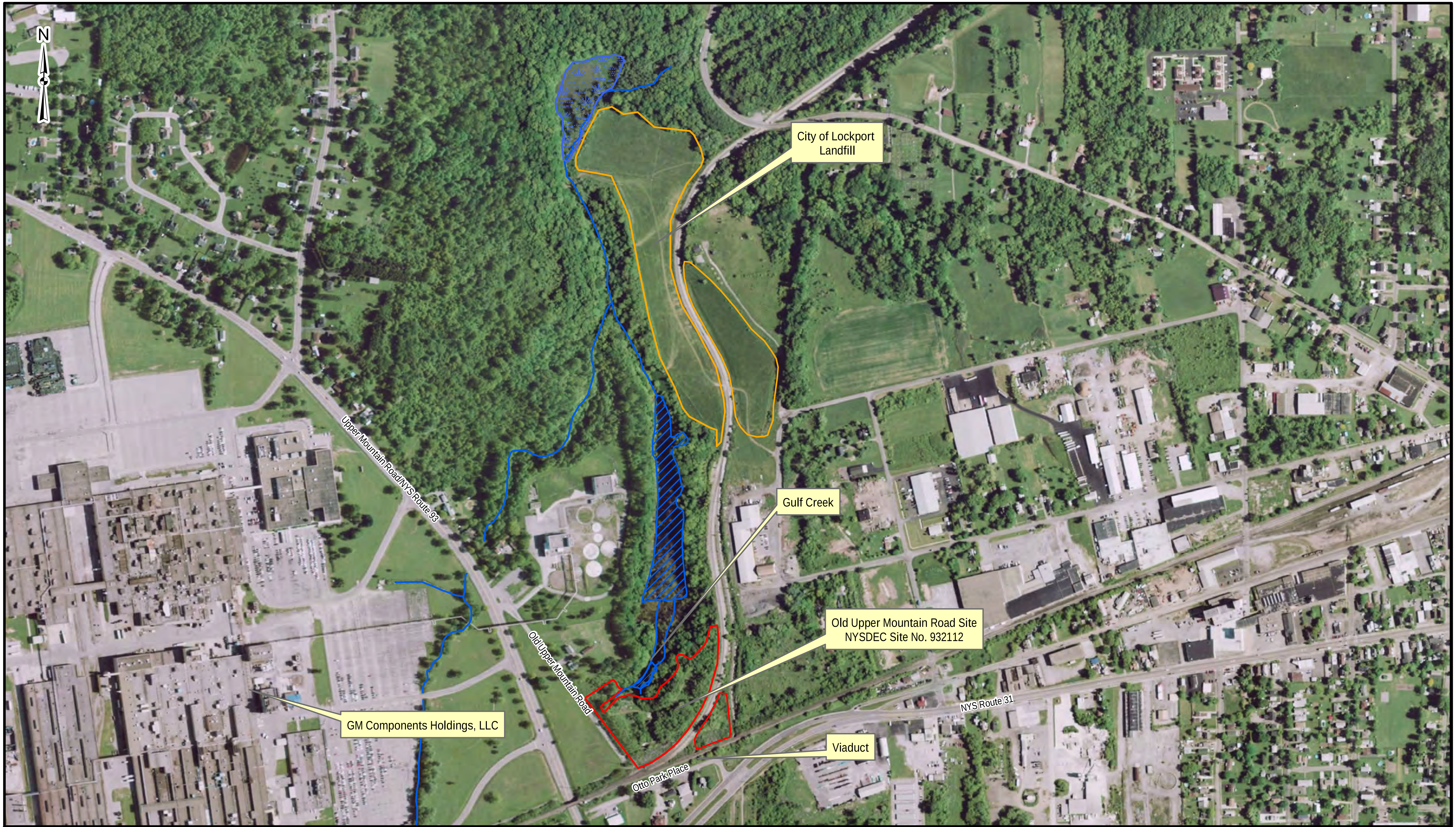
1 in = 2 miles

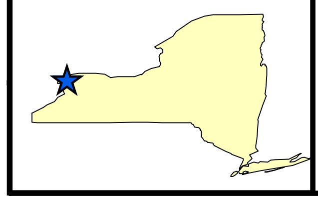
ESRI Street Maps USA

OLD UPPER MOUNTAIN ROAD (932112)
FEASIBILITY STUDY REPORT
LOCKPORT, NEW YORK

FIGURE 1-1
Site Location

PROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	SCALE:	DATE:	PROJECT NO:	FILE NO:
RSC	DCC	DCC	RSC	AS SHOWN	FEBRUARY 2013	1490705	GIS/PROJECTS/ FIGURE1-1.MXD





OLD UPPER MOUNTAIN ROAD (932112)
FEASIBILITY STUDY REPORT
LOCKPORT, NEW YORK

FIGURE 1-2
Site and Surrounding Area

Feet
0 250 500 1,000
1 inch = 500 feet

Legend

Source: NYS GIS Clearing House

- Approximate Site Boundary
- Approximate City of Lockport Landfill Site Boundary
- Streams/Surface Water
- Water

PROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	PROJECT NO:	DATE:	SCALE:	FILE NO:
RSC	DCC	DCC	RSC	1490705	FEBRUARY 2013	AS SHOWN	GIS/PROJECTS/ FIGURE1-2.MXD

OLD UPPER MOUNTAIN ROAD (932112)
FEASIBILITY STUDY REPORT
LOCKPORT, NEW YORK

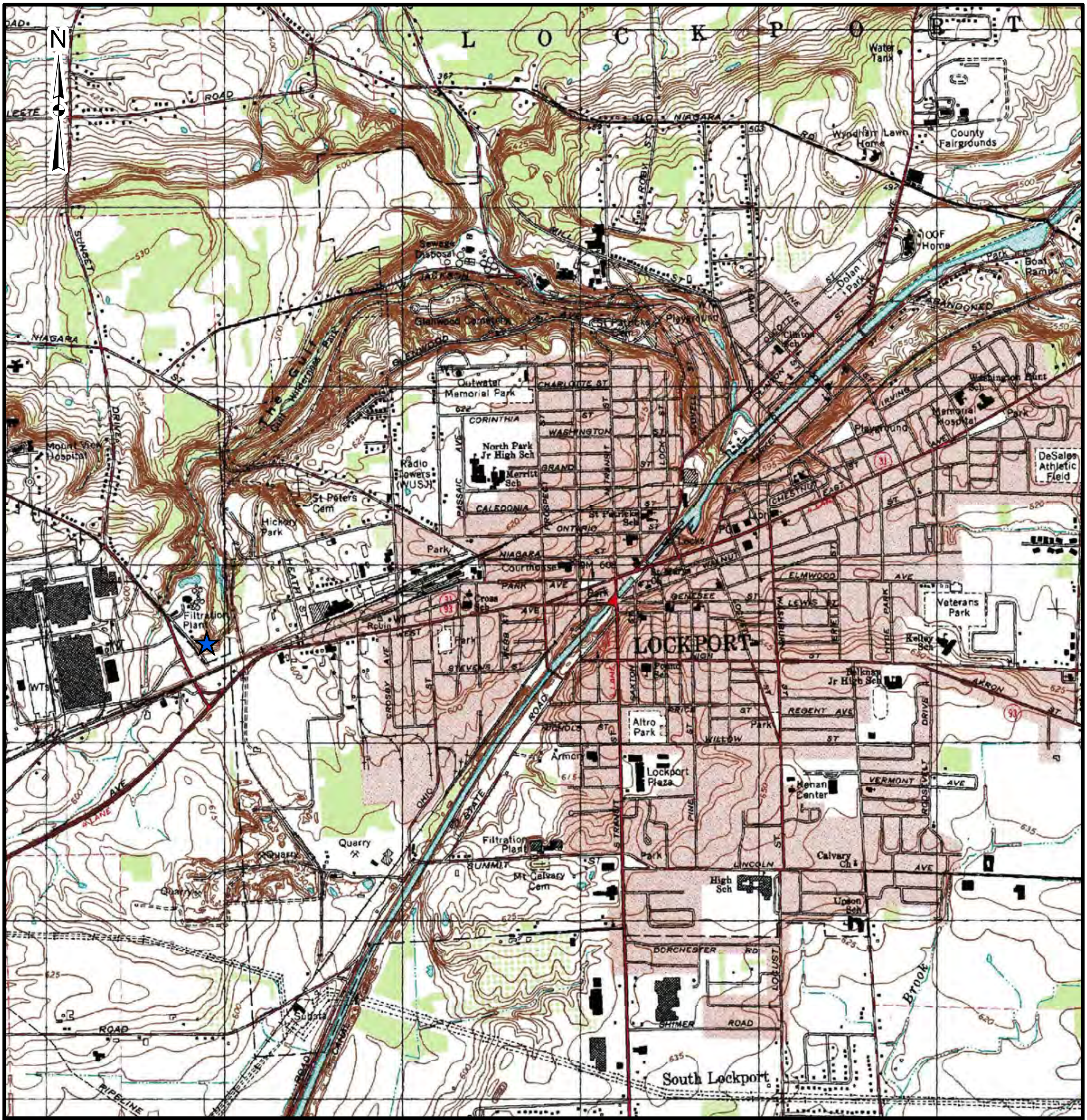
FIGURE 1-3
Niagara County Tax
Parcel Identification

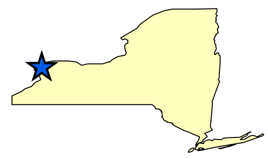
Feet: 0 50 100 200
1 inch = 100 feet

Legend
Property Line

Source: NYS GIS Clearing House

PROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	PROJECT NO:	DATE:	SCALE:	FILE NO:
RSC	RSC	JCP	RSC	1490705	FEBRUARY 2013	AS SHOWN	GIS/PROJECTS/ FIGURE1-3.MXD





Legend

★ Old Upper Mountain Road Site Location

0 150 300 600 Feet

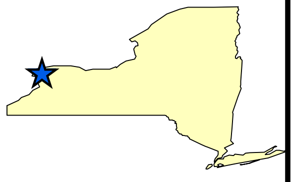
1 inch = 300 feet

Source: USGS

OLD UPPER MOUNTAIN ROAD (932112)
FEASIBILITY STUDY REPORT
LOCKPORT, NEW YORK

FIGURE 1-4
USGS Topographic Map

PROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	SCALE:	DATE:	PROJECT NO:	FILE NO:
RSC	DCC	DCC	RSC	AS SHOWN	FEBRUARY 2013	1490705	GIS/PROJECTS/ FIGURE1-4.MXD

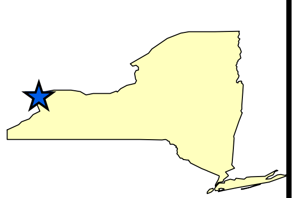


OLD UPPER MOUNTAIN ROAD (932112) FEASIBILITY STUDY REPORT LOCKPORT, NEW YORK			FIGURE 2-1 Operable Units Approximate Boundaries		0 250 500 1,000 Feet 1 inch = 500 feet		
PROJECT MGR: RSC	DESIGNED BY: DCC	CREATED BY: DCC	CHECKED BY: RSC	PROJECT NO: 1490705	DATE: FEBRUARY 2013	SCALE: AS SHOWN	FILE NO: GIS/PROJECTS/ FIGURE2-1.MXD

Legend

Source: NYS GIS Clearing House

- Operable Unit 1 - Approximate Boundary
- Operable Unit 1A - Approximate Boundary
- Operable Unit 2 - Approximate Boundary



OLD UPPER MOUNTAIN ROAD (932112)
FEASIBILITY STUDY REPORT
LOCKPORT, NEW YORK

FIGURE 2-2
Surface and Subsurface Soil
Sample Locations

0 35 70 140 Feet
1 inch = 71 feet

PROJECT MGR: RSC	DESIGNED BY: RSC	CREATED BY: JCP	CHECKED BY: RSC	PROJECT NO: 1490705	DATE: FEBRUARY 2013	SCALE: AS SHOWN	FILE NO: GIS/PROJECTS/ FIGURE2-2.MXD

Legend

Source: NYS GIS Clearing House

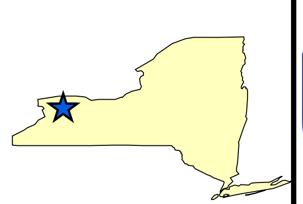
- Vertical Profile Soil Boring Location - May 2010 (Augered)
- Soil Boring Locations - May 2010 (Direct-Push and Auger)
- Surface Soil Locations
- Limits of Test Pit Excavations - May 2010

OLD UPPER MOUNTAIN ROAD (932112) FEASIBILITY STUDY REPORT LOCKPORT, NEW YORK			FIGURE 2-3 Groundwater Monitoring Well Locations		Feet 0 30 60 120 1 inch = 60 feet	
PROJECT MGR: RSC	DESIGNED BY: RSC	CREATED BY: JCP	CHECKED BY: RSC	PROJECT NO: 1490705	DATE: FEBRUARY 2013	SCALE: AS SHOWN

FILE NO:
GIS/PROJECTS/
FIGURE2-3.MXD

Legend
Monitoring Well Location

Source: NYS GIS Clearing House



OLD UPPER MOUNTAIN ROAD (932112)
FEASIBILITY STUDY REPORT
LOCKPORT, NEW YORK

FIGURE 2-4
Interpreted
Groundwater Contour Map
August 2010

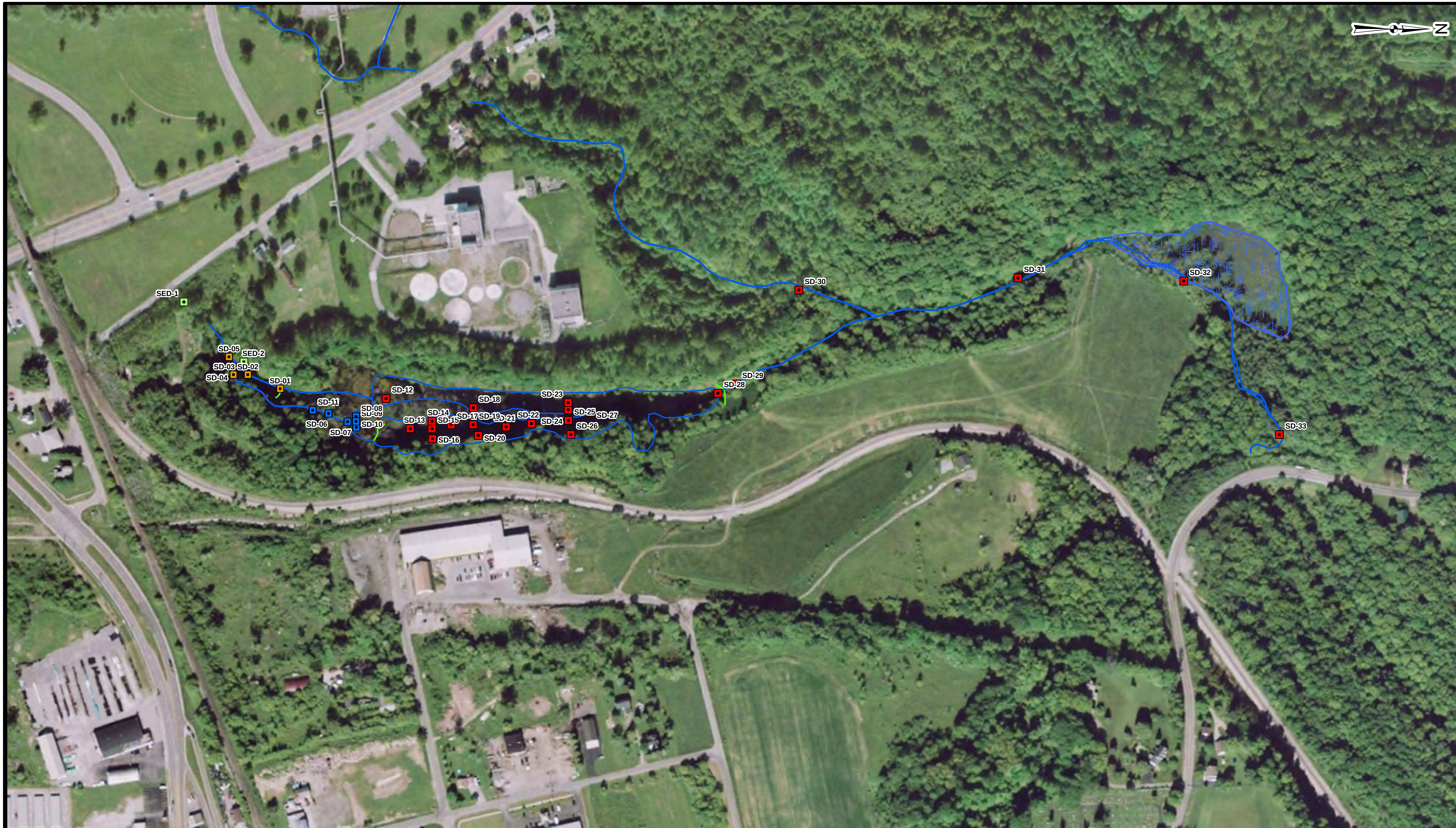
Feet
0 30 60 120
1 inch = 60 feet

Legend

- Interpreted Groundwater Contour
- Inferred Groundwater Contour
- Groundwater Flow Direction

Source: NYS GIS Clearing House

PROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	PROJECT NO:	DATE:	SCALE:	FILE NO:
RSC	RSC	SAB	RSC	1490705	FEBRUARY 2013	AS SHOWN	GIS/PROJECTS/ FIGURE2-4.MXD



Source: NYS GIS Clearing House

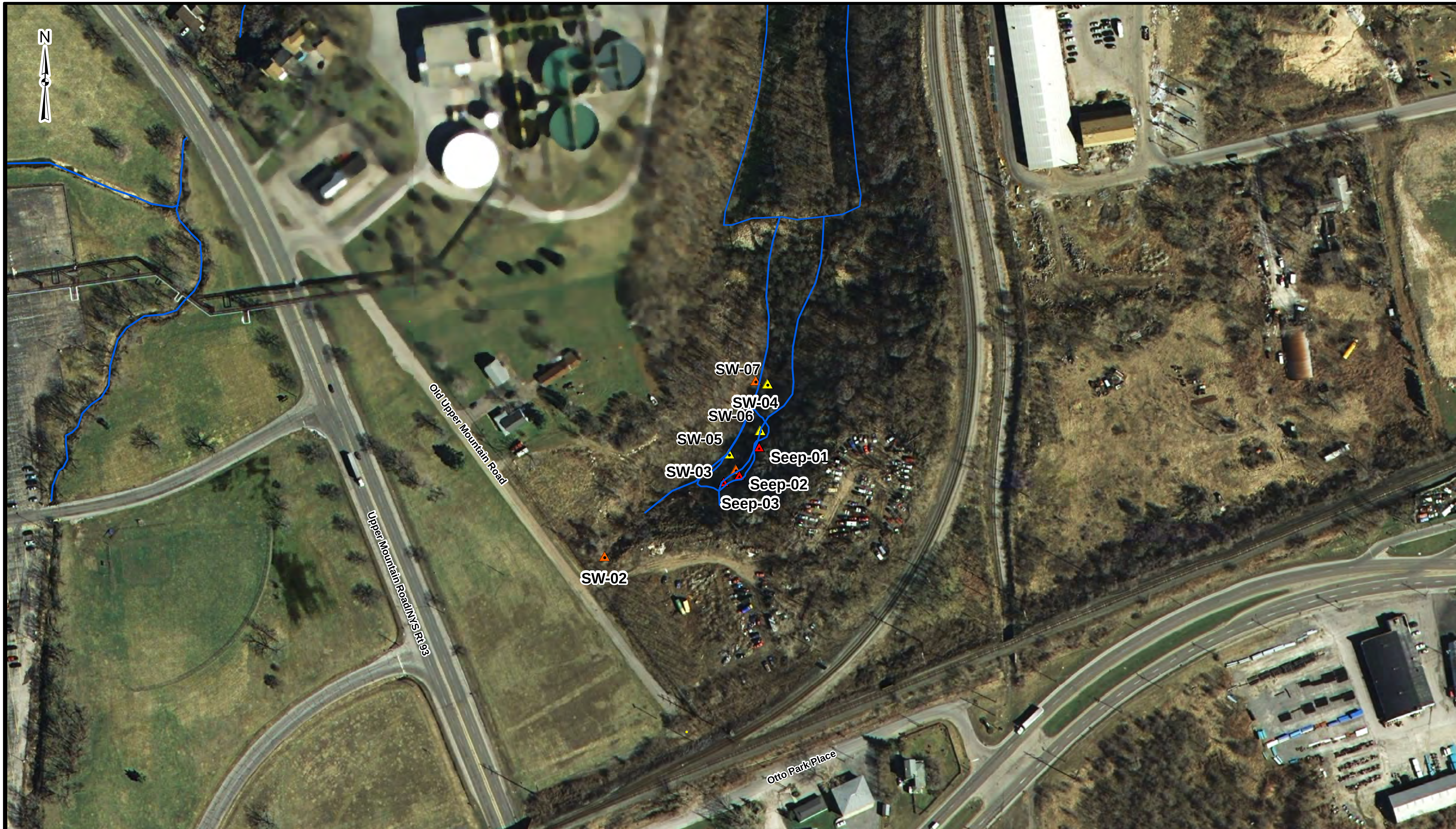
OLD UPPER MOUNTAIN ROAD (932112)
FEASIBILITY STUDY REPORT
LOCKPORT, NEW YORK

FIGURE 2-5
Sediment Sampling Locations

Feet
0 150 300 600
1 inch = 300 feet

Legend
- Sediment Sample Location - November 2009
- Sediment Sample Location - May 2010
- Sediment Sample Location - August 2010
- Sediment Sample Location - NYSDEC 2007
- Beaver Dam

PROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	PROJECT NO:	DATE:	SCALE:	FILE NO:
RSC	RSC	JCP	RSC	1490705	FEBRUARY 2013	AS SHOWN	GIS\Projects\ FIGURE2-3.MXD



OLD UPPER MOUNTAIN ROAD (932112)
FEASIBILITY STUDY REPORT
LOCKPORT, NEW YORK

FIGURE 2-6
Surface Water
Sample Locations

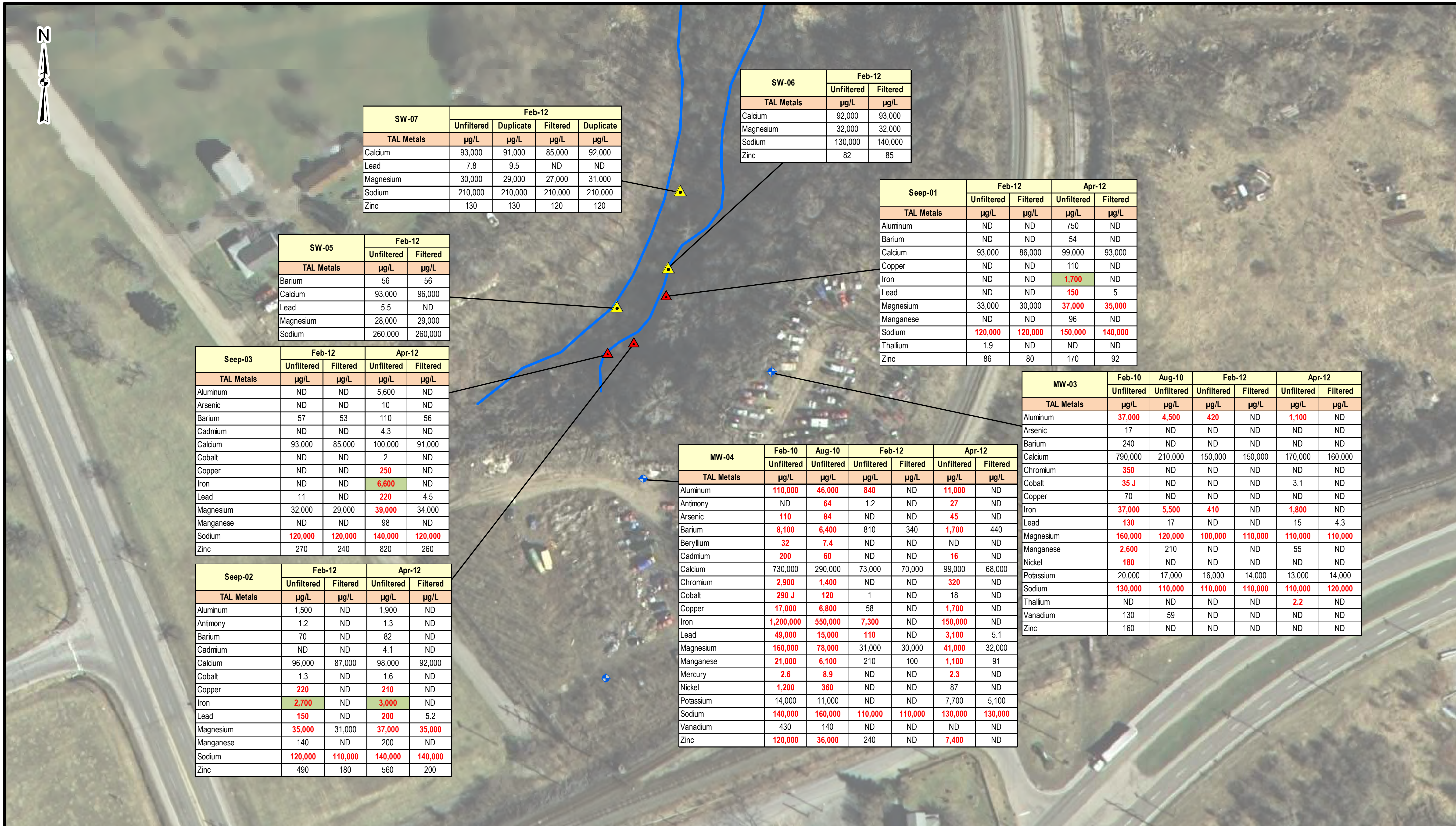
Feet
0 85 170 340
1 inch = 165 feet

Source: NYS GIS Clearing House

Legend

- Surface Water Sample Location - 2009
- Surface Water Sample Location - Aug 2010
- Surface Water Sample Location - February/April 2012
- Seep Sample Location - February/April 2012

PROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	PROJECT NO:	DATE:	SCALE:	FILE NO:
RSC	RSC	DCC	RSC	1490705	FEBRUARY 2013	AS SHOWN	GIS/PROJECTS/ FIGURE2-2.MXD



SW-07	Feb-12			
	Unfiltered	Duplicate	Filtered	Duplicate
TAL Metals	µg/L	µg/L	µg/L	µg/L
Calcium	93,000	91,000	85,000	92,000
Lead	7.8	9.5	ND	ND
Magnesium	30,000	29,000	27,000	31,000
Sodium	210,000	210,000	210,000	210,000
Zinc	130	130	120	120

SW-06	Feb-12	
	Unfiltered	Filtered
TAL Metals	µg/L	µg/L
Calcium	92,000	93,000
Magnesium	32,000	32,000
Sodium	130,000	140,000
Zinc	82	85

SW-05	Feb-12	
	Unfiltered	Filtered
TAL Metals	µg/L	µg/L
Barium	56	56
Calcium	93,000	96,000
Lead	5.5	ND
Magnesium	28,000	29,000
Sodium	260,000	260,000

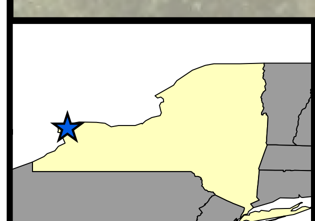
Seep-01	Feb-12		Apr-12	
	Unfiltered	Filtered	Unfiltered	Filtered
TAL Metals	µg/L	µg/L	µg/L	µg/L
Aluminum	ND	ND	750	ND
Barium	ND	ND	54	ND
Calcium	93,000	86,000	99,000	93,000
Copper	ND	ND	110	ND
Iron	ND	ND	1,700	ND
Lead	ND	ND	150	5
Magnesium	33,000	30,000	37,000	35,000
Manganese	ND	ND	96	ND
Sodium	120,000	120,000	150,000	140,000
Thallium	1.9	ND	ND	ND
Zinc	86	80	170	92

Seep-03	Feb-12		Apr-12	
	Unfiltered	Filtered	Unfiltered	Filtered
TAL Metals	µg/L	µg/L	µg/L	µg/L
Aluminum	ND	ND	5,600	ND
Arsenic	ND	ND	10	ND
Barium	57	53	110	56
Cadmium	ND	ND	4.3	ND
Calcium	93,000	85,000	100,000	91,000
Cobalt	ND	ND	2	ND
Copper	ND	ND	250	ND
Iron	ND	ND	6,600	ND
Lead	11	ND	220	4.5
Magnesium	32,000	29,000	39,000	34,000
Manganese	ND	ND	98	ND
Sodium	120,000	120,000	140,000	120,000
Zinc	270	240	820	260

Seep-02	Feb-12		Apr-12	
	Unfiltered	Filtered	Unfiltered	Filtered
TAL Metals	µg/L	µg/L	µg/L	µg/L
Aluminum	1,500	ND	1,900	ND
Antimony	1.2	ND	1.3	ND
Barium	70	ND	82	ND
Cadmium	ND	ND	4.1	ND
Calcium	96,000	87,000	98,000	92,000
Cobalt	1.3	ND	1.6	ND
Copper	220	ND	210	ND
Iron	2,700	ND	3,000	ND
Lead	150	ND	200	5.2
Magnesium	35,000	31,000	37,000	35,000
Manganese	140	ND	200	ND
Sodium	120,000	110,000	140,000	140,000
Zinc	490	180	560	200

MW-04	Feb-10	Aug-10	Feb-12		Apr-12	
	Unfiltered	Unfiltered	Unfiltered	Filtered	Unfiltered	Filtered
TAL Metals	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Aluminum	110,000	46,000	840	ND	11,000	ND
Antimony	ND	64	1.2	ND	27	ND
Arsenic	110	84	ND	ND	45	ND
Barium	8,100	6,400	810	340	1,700	440
Beryllium	32	7.4	ND	ND	ND	ND
Cadmium	200	60	ND	ND	16	ND
Calcium	730,000	290,000	73,000	70,000	99,000	68,000
Chromium	2,900	1,400	ND	ND	320	ND
Cobalt	290 J	120	1	ND	18	ND
Copper	17,000	6,800	58	ND	1,700	ND
Iron	1,200,000	550,000	7,300	ND	150,000	ND
Lead	49,000	15,000	110	ND	3,100	5.1
Magnesium	160,000	78,000	31,000	30,000	41,000	32,000
Manganese	21,000	6,100	210	100	1,100	91
Mercury	2.6	8.9	ND	ND	2.3	ND
Nickel	1,200	360	ND	ND	87	ND
Potassium	14,000	11,000	ND	ND	7,700	5,100
Sodium	140,000	160,000	110,000	110,000	130,000	130,000
Vanadium	430	140	ND	ND	ND	ND
Zinc	120,000	36,000	240	ND	7,400	ND

MW-03	Feb-10	Aug-10	Feb-12		Apr-12	
	Unfiltered	Unfiltered	Unfiltered	Filtered	Unfiltered	Filtered
TAL Metals	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Aluminum	37,000	4,500	420	ND	1,100	ND
Arsenic	17	ND	ND	ND	ND	ND
Barium	240	ND	ND	ND	ND	ND
Calcium	790,000	210,000	150,000	150,000	170,000	160,000
Chromium	350	ND	ND	ND	ND	ND
Cobalt	35 J	ND	ND	ND	3.1	ND
Copper	70	ND	ND	ND	ND	ND
Iron	37,000	5,500	410	ND	1,800	ND
Lead	130	17	ND	ND	15	4.3
Magnesium	160,000	120,000	100,000	110,000	110,000	110,000
Manganese	2,600	210	ND	ND	55	ND
Nickel	180	ND	ND	ND	ND	ND
Potassium	20,000	17,000	16,000	14,000	13,000	14,000
Sodium	130,000	110,000	110,000	110,000	110,000	120,000
Thallium	ND	ND	ND	ND	2.2	ND
Vanadium	130	59	ND	ND	ND	ND
Zinc	160	ND	ND	ND	ND	ND



OLD UPPER MOUNTAIN ROAD (932112)
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LOCKPORT, NEW YORK

FIGURE 2-7
TAL Metals Within Groundwater, Surface Water, and Groundwater Seeps - February and April 2012

0 50 100 200 Feet
1 inch = 100 feet

PROJECT MGR: RSC | DESIGNED BY: RSC | CREATED BY: DCC | CHECKED BY: RSC | PROJECT NO: 1490705 | DATE: FEBRUARY 2013 | SCALE: AS SHOWN | FILE NO: GIS/PROJECTS/FIGURE2.MXD

Legend

- Seep Samples - February and April 2012
- Surface Water Samples - February and April 2012
- Monitoring Well
- Gulf Creek

Source: NYS GIS Clearing House

TAL Target Analyte List
ND Not Detected
µg/L Micrograms per Liter (Parts Per Billion)

Values in RED indicate concentration is above the NYSDEC AWQS for Class GA waters (Groundwater)
Shaded values indicate concentration is above the NYSDEC AWQS for Class D, Type H(FC) or A(A) surface waters

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FIGURE 6-1
OU1 Treatment Areas
and Depths

Source: NYS GIS Clearing House

Feet
0 55 110 220

1 inch = 100 feet

Approximate escarpment area

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RSC	RSC	JCP	RSC	1490705	FEBRUARY 2013	AS SHOWN	GIS\Projects\ FIGURE6-1.MXD

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FIGURE 6-2
OU1 Alternative 2 and 5:
Complete Removal
Final Conditions

PROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	PROJECT NO:	DATE:	SCALE:	FILE NO:
RSC	MEM	SAB	RSC	1490705	FEBRUARY 2013	AS SHOWN	GIS\Projects\ FIGURE6-2.MXD

Upward 3:1 Backfill Slope Direction

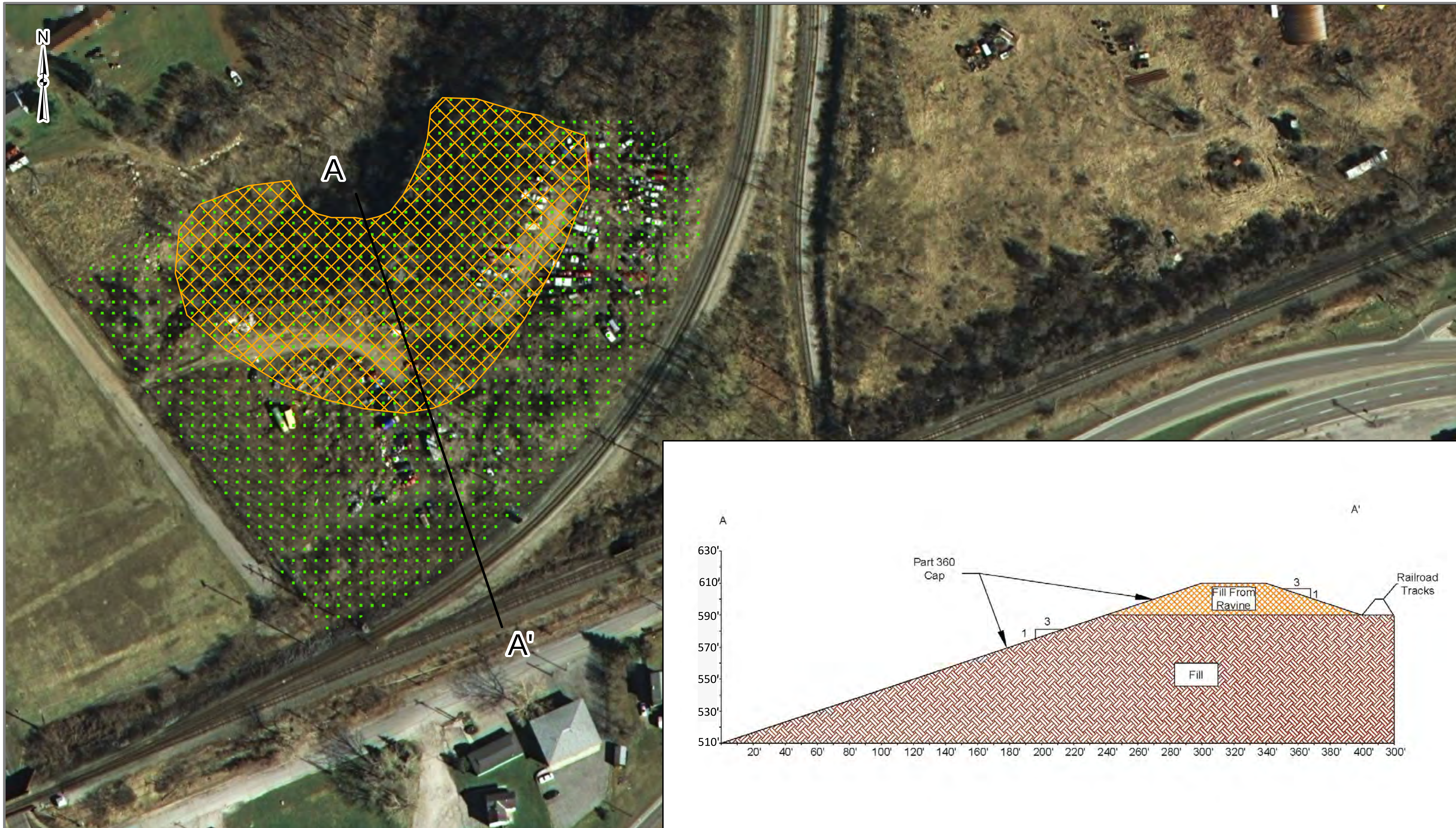
Fill Removed

Sheet Piling

Source: NYS GIS Clearing House

0 45 90 180 Feet

1 inch = 90 feet



OLD UPPER MOUNTAIN ROAD (932112) FEASIBILITY STUDY REPORT LOCKPORT, NEW YORK			FIGURE 6-3 OU1 Alternative 4: Landfill Capping with a Part 360 Cap- Existing Landfill Footprint				
PROJECT MGR: RSC	DESIGNED BY: MEM	CREATED BY: MEM	CHECKED BY: RSC	PROJECT NO: 1490705	DATE: FEBRUARY 2013	SCALE: AS SHOWN	FILE NO: GIS\Projects\ FIGURE6-3.MXD

Source: NYS GIS Clearing House

Feet
0 50 100 200

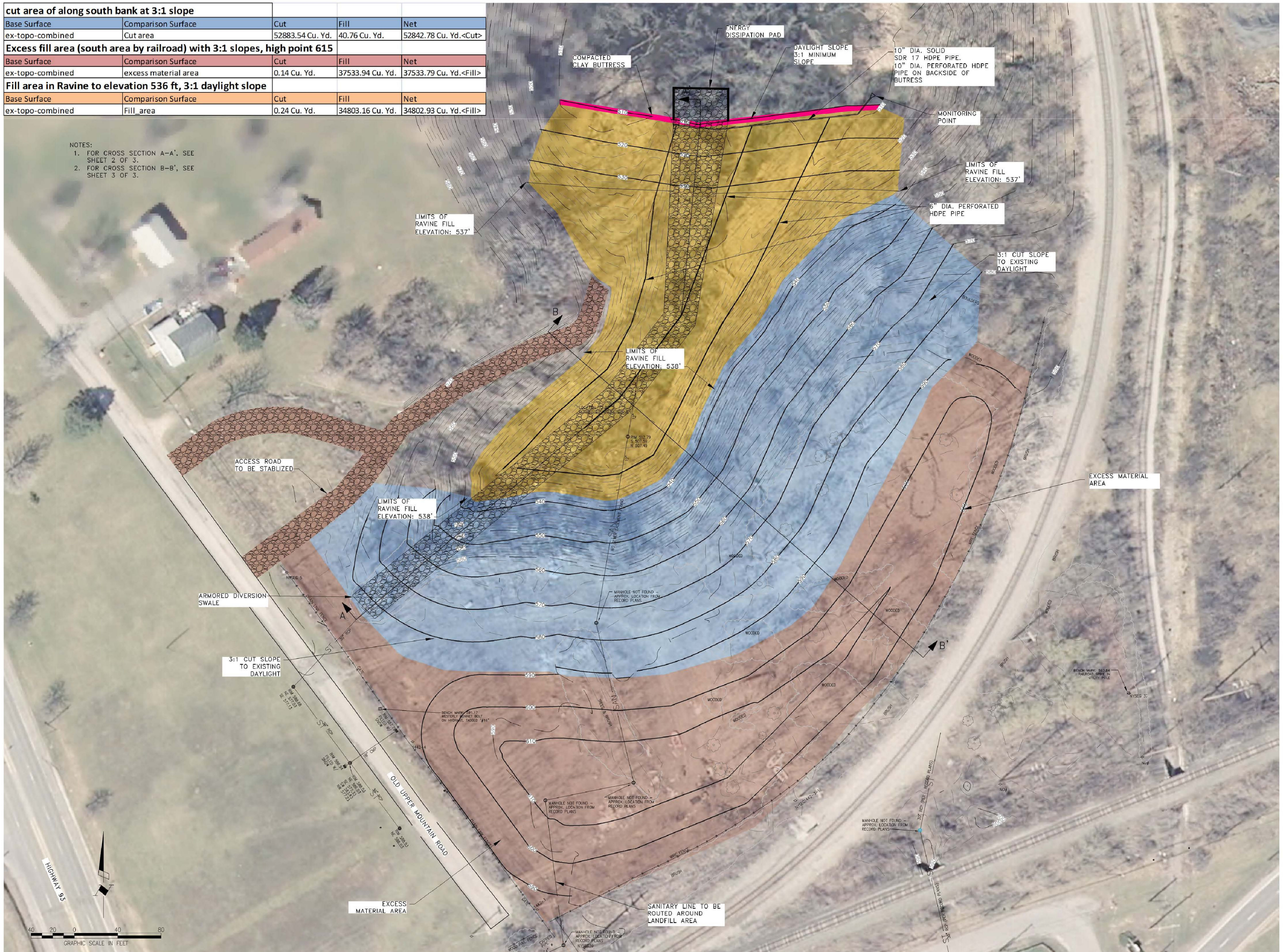
1 inch = 100 feet

Cut Back to 3:1 Slope

Cover with Part 360 Cap

cut area of along south bank at 3:1 slope				
Base Surface	Comparison Surface	Cut	Fill	Net
ex-topo-combined	Cut area	52883.54 Cu. Yd.	40.76 Cu. Yd.	52842.78 Cu. Yd.<Cut>
Excess fill area (south area by railroad) with 3:1 slopes, high point 615				
Base Surface	Comparison Surface	Cut	Fill	Net
ex-topo-combined	excess material area	0.14 Cu. Yd.	37533.94 Cu. Yd.	37533.79 Cu. Yd.<Fill>
Fill area in Ravine to elevation 536 ft, 3:1 daylight slope				
Base Surface	Comparison Surface	Cut	Fill	Net
ex-topo-combined	Fill_area	0.24 Cu. Yd.	34803.16 Cu. Yd.	34802.93 Cu. Yd.<Fill>

NOTES:
1. FOR CROSS SECTION A-A', SEE SHEET 2 OF 3.
2. FOR CROSS SECTION B-B', SEE SHEET 3 OF 3.



Source: NYS GIS Clearing House

Note: For cross-sections and details, see Figure 6-5

OLD UPPER MOUNTAIN ROAD (932112)
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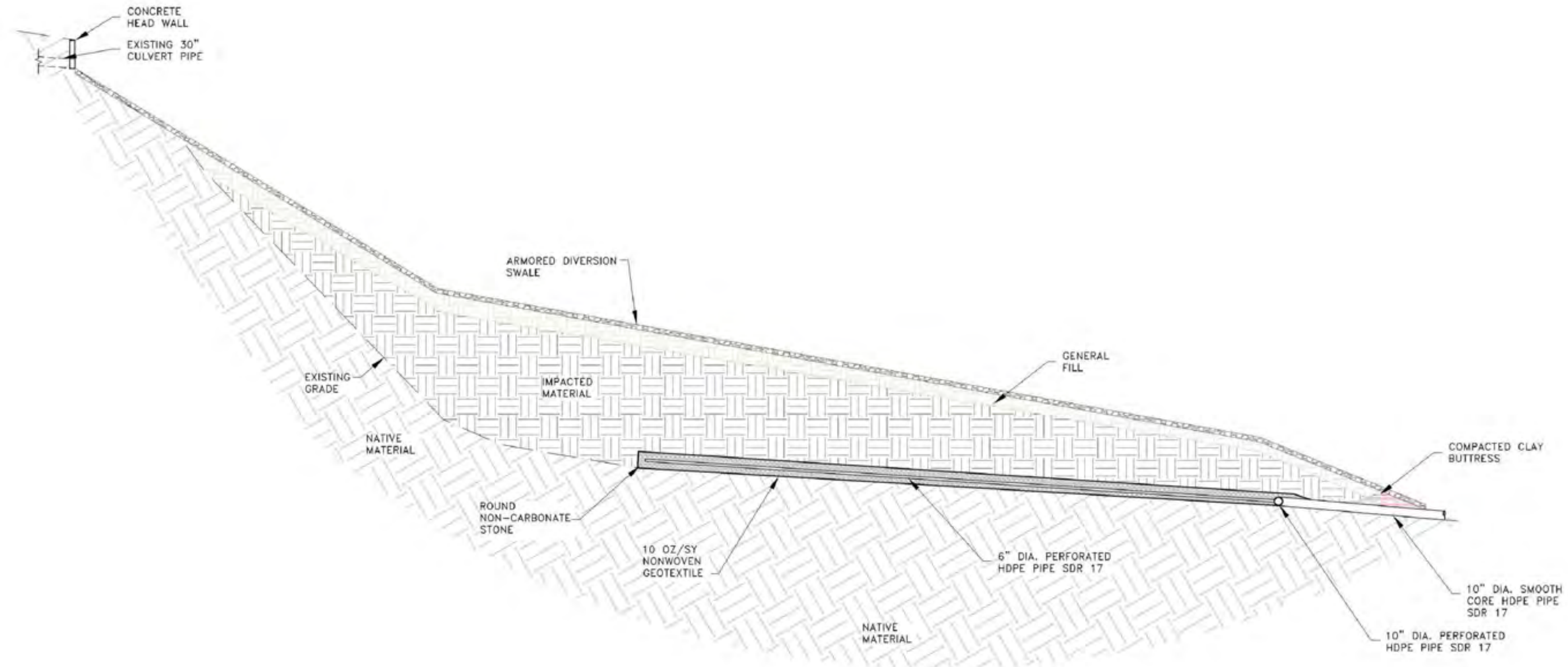
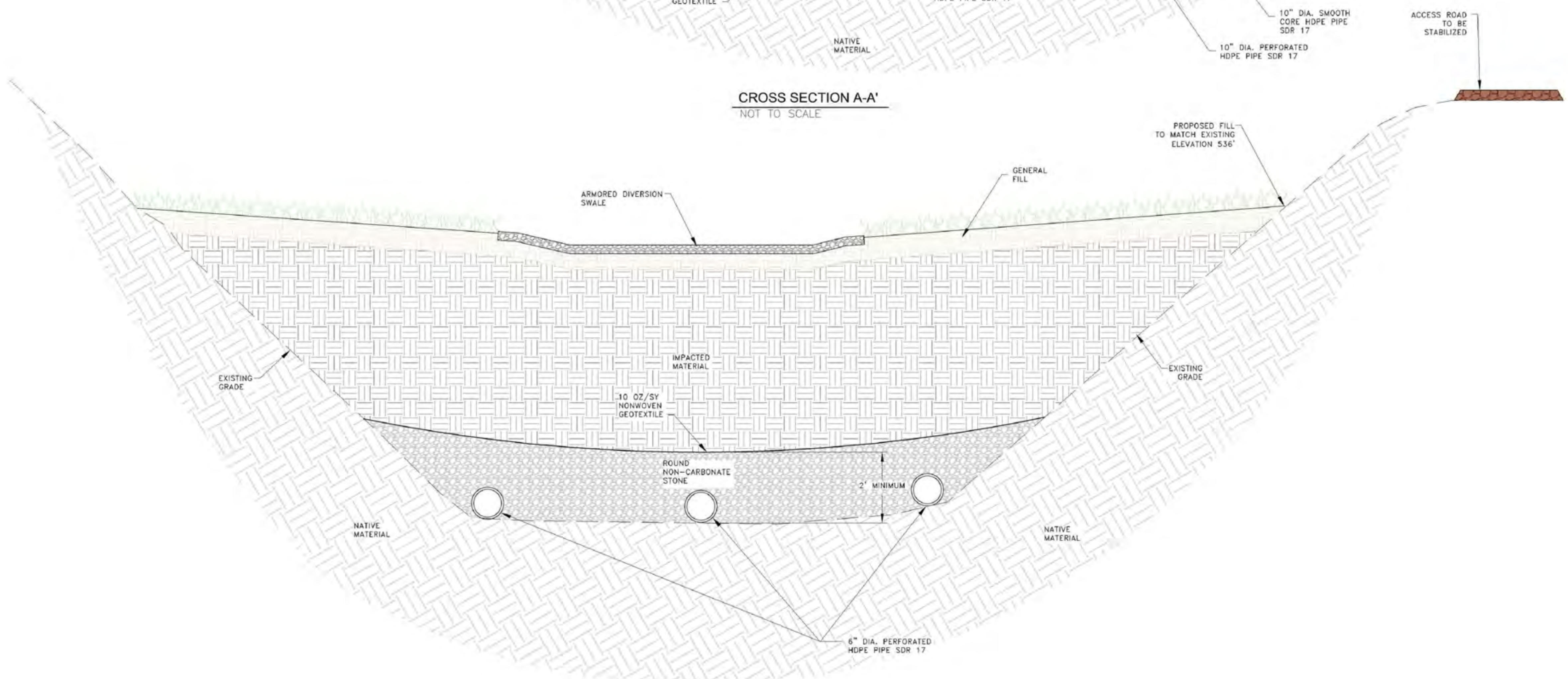
FIGURE 6-4
OU 1 Alternative 5 and 6:
Landfill Capping- Extended Landfill Footprint

PROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	PROJECT NO:	DATE:	SCALE:	FILE NO:
RSC	RSC	MEM	RSC	1490705	FEBRUARY 2013	AS SHOWN	GIS\Projects\ FIGURE6-4.MXD



CROSS SECTION A-A'
NOT TO SCALE



CROSS SECTION B-B'
NOT TO SCALE

OLD UPPER MOUNTAIN ROAD (932112) FEASIBILITY STUDY REPORT LOCKPORT, NEW YORK			FIGURE 6-5 OU 1 Alternative 5 and 6: Cross Sections and Details				
PROJECT MGR: RSC	DESIGNED BY: RSC	CREATED BY: MEM	CHECKED BY: RSC	PROJECT NO: 1490705	DATE: FEBRUARY 2013	SCALE: NTS	FILE NO: GIS\Projects\ FIGURE6-5.MXD

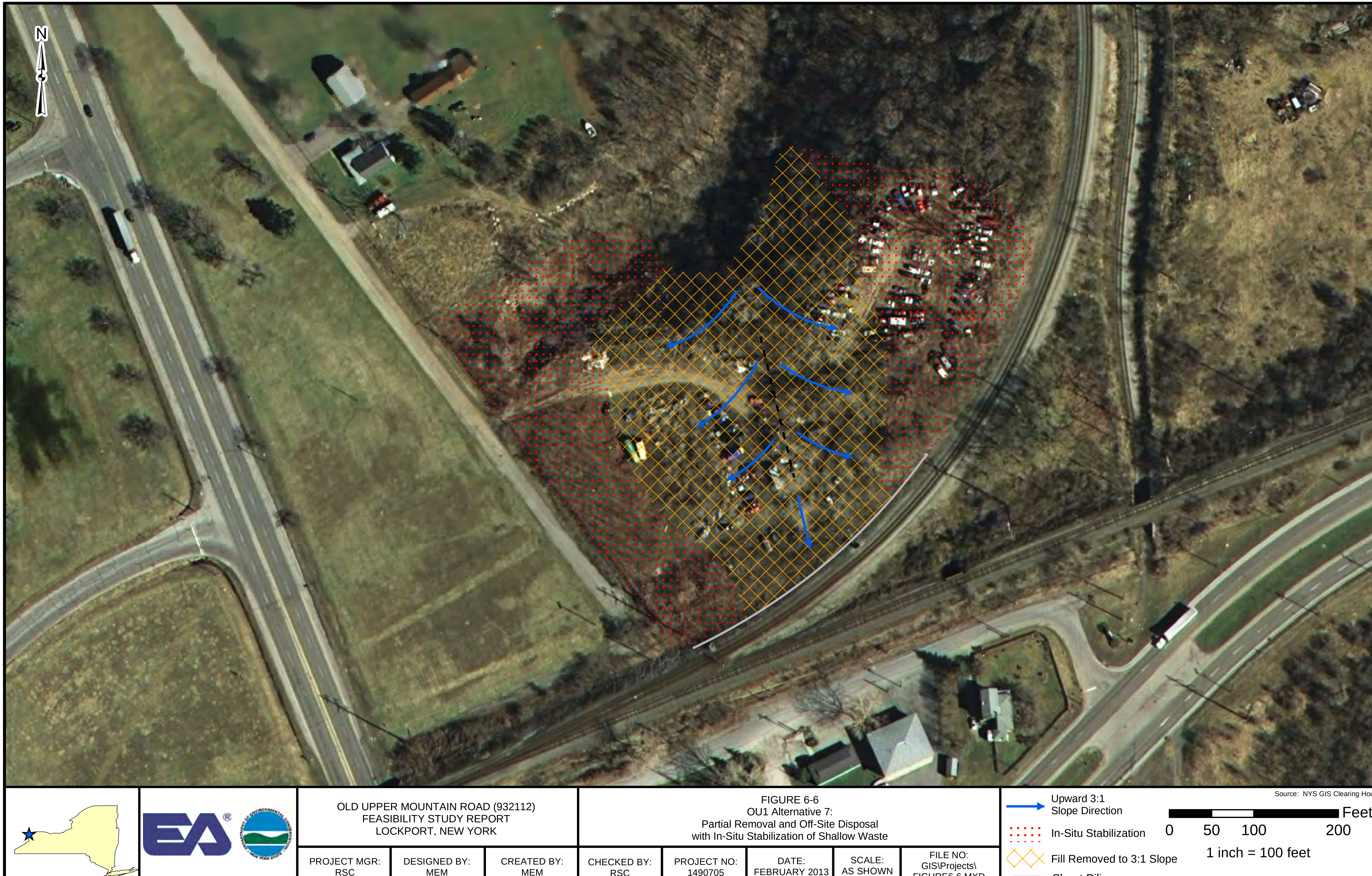


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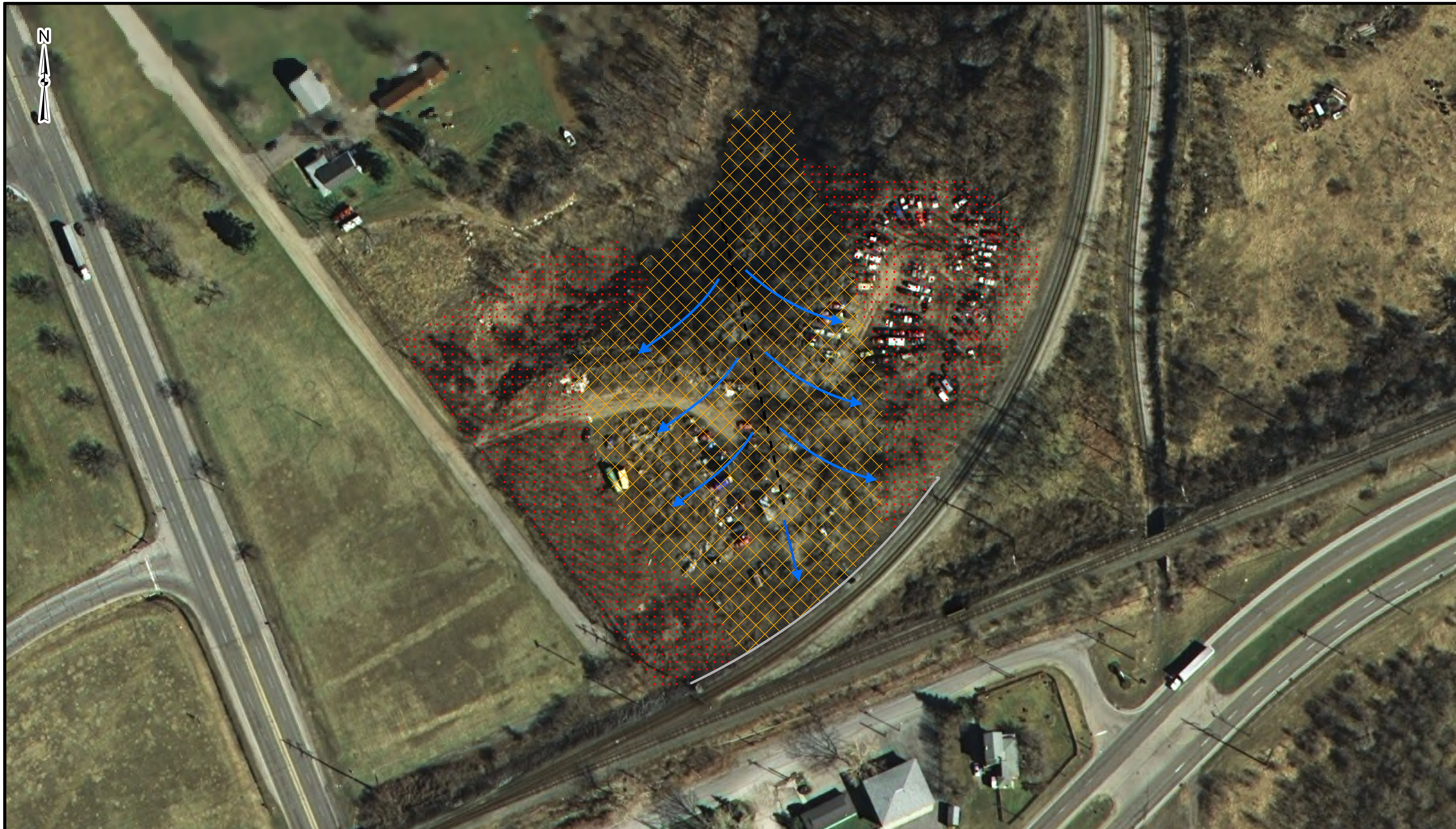
FIGURE 6-6
OU1 Alternative 7:
Partial Removal and Off-Site Disposal
with In-Situ Stabilization of Shallow Waste

PROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	PROJECT NO:	DATE:	SCALE:	FILE NO:
RSC	MEM	MEM	RSC	1490705	FEBRUARY 2013	AS SHOWN	GIS\Projects\ FIGURE6-6.MXD



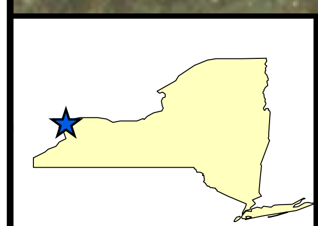


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FIGURE 6-7
OU1 Alternative 8:
Partial Removal, Ex Situ Stabilization and On-Site Placement
with In Situ Stabilization of Shallow Waste

PROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	PROJECT NO:	DATE:	SCALE:	FILE NO:
RSC	MEM	MEM	RSC	1490705	FEBRUARY 2013	AS SHOWN	GIS\Projects\ FIGURE6-7.MXD

Source: NYS GIS Clearing House

Upward 3:1 Slope Direction
In-Situ Stabilization
Excavation for Ex Situ Treatment, and Replacement at 3:1 slopes into ravine
Sheet Piling

Feet
0 50 100 200
1 inch = 100 feet

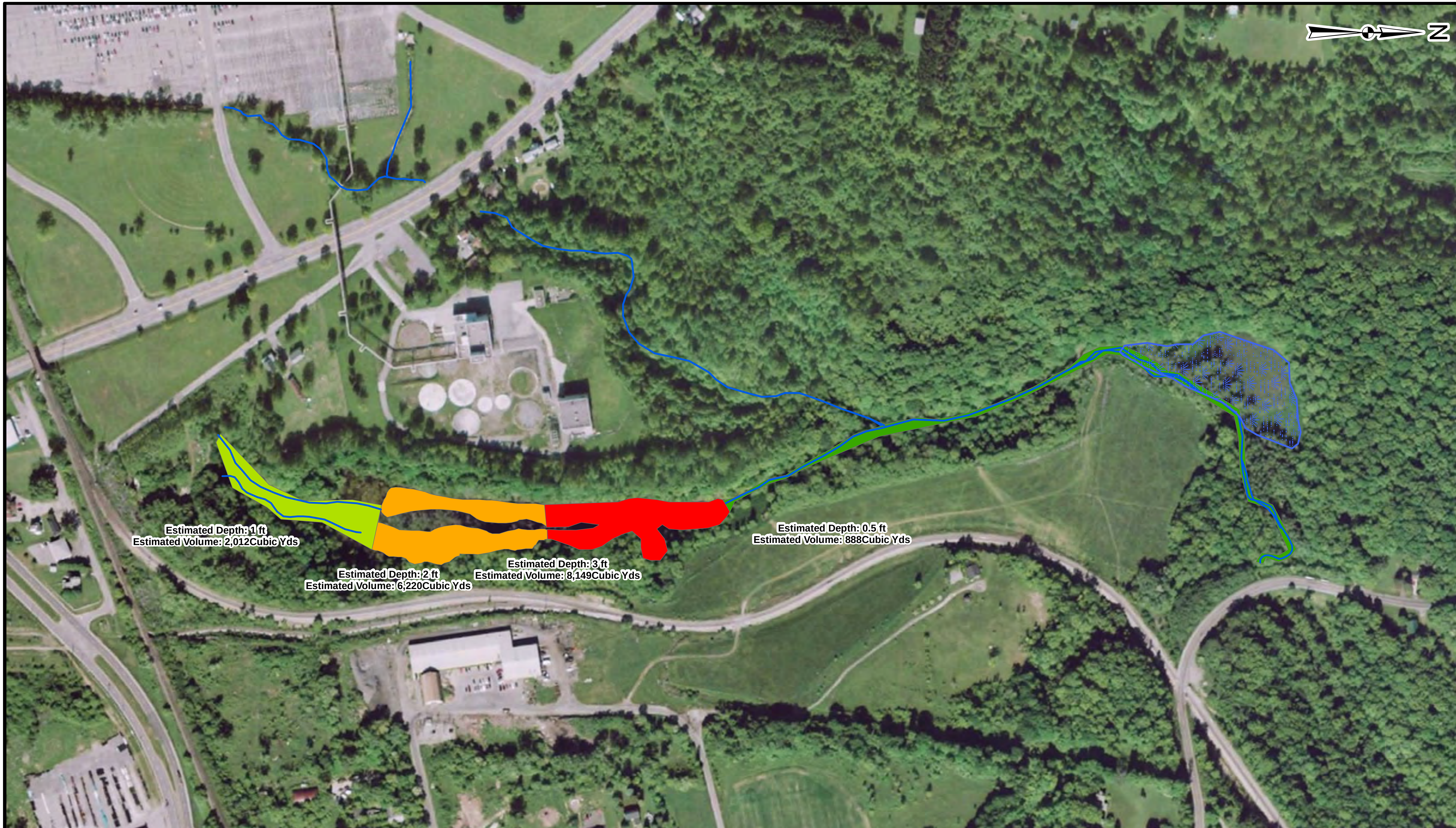

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FIGURE 6-8
OU 2 Treatment Area

Feet
0 150 300 600
1 inch = 300 feet

Legend

Estimated Sediment Depth

- 0.5 ft
- 1 ft
- 2 ft
- 3 ft

Source: NYS GIS Clearing House

PROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	PROJECT NO:	DATE:	SCALE:	FILE NO:
RSC	RSC	JCP	RSC	1490705	FEBRUARY 2013	AS SHOWN	GIS\Projects\ FIGURE6-8.MXD

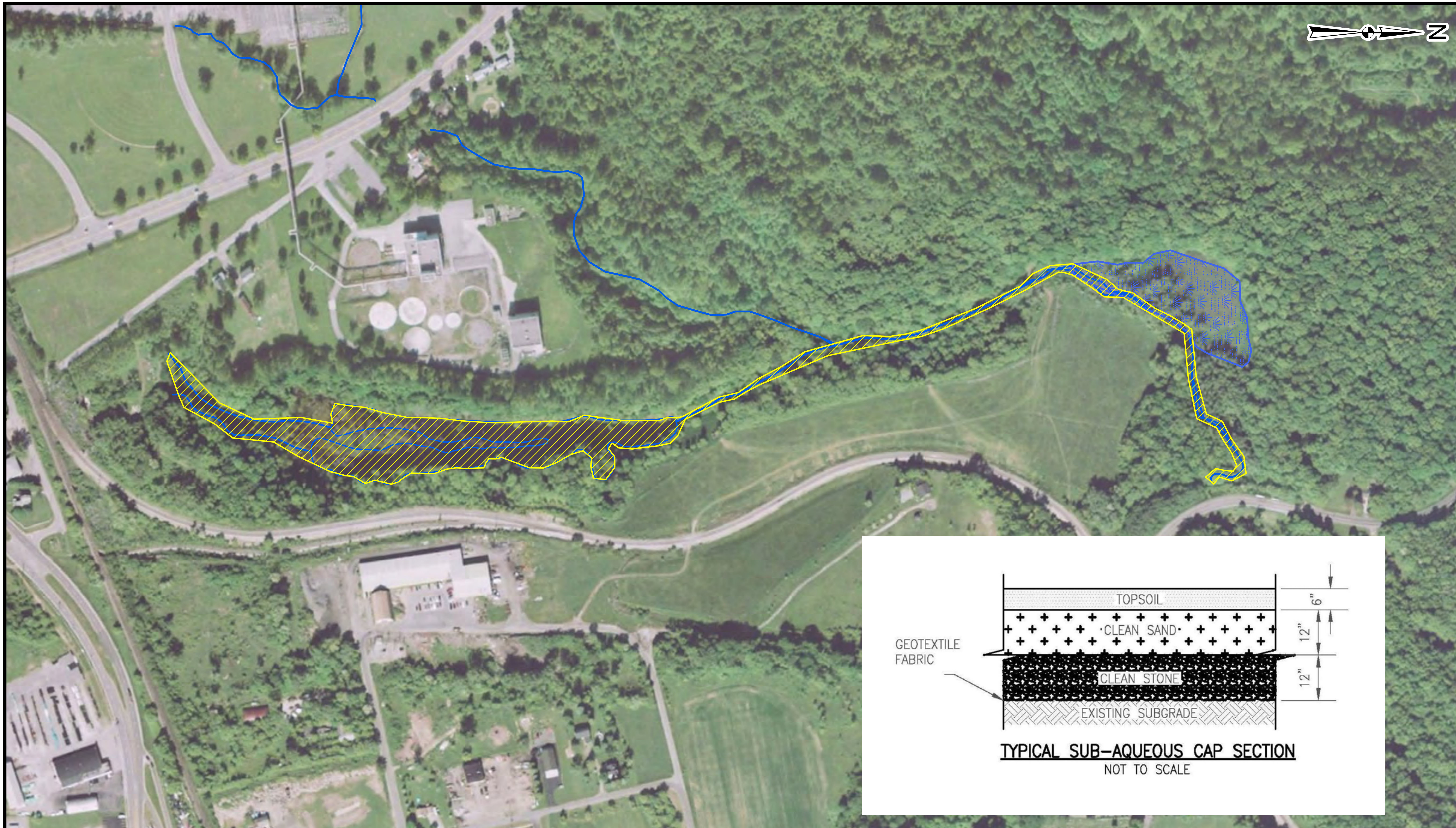

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FIGURE 6-9
OU 2 Alternative 2:
Mult-Media
Sub-Aqueous Capping

Feet
0 150 300 600
1 inch = 300 feet

Legend

Multi-media Sub-aqueous Cap Area

Source: NYS GIS Clearing House

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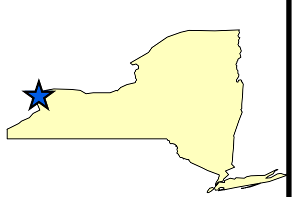
RSC	RSC	JCP	RSC	1490705	FEBRUARY 2013	AS SHOWN	GIS\Projects\ FIGURE6-9.MXD



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LOCKPORT, NEW YORK

FIGURE 6-10
OU 2 Alternative 3:
In Situ Sediment Amendment

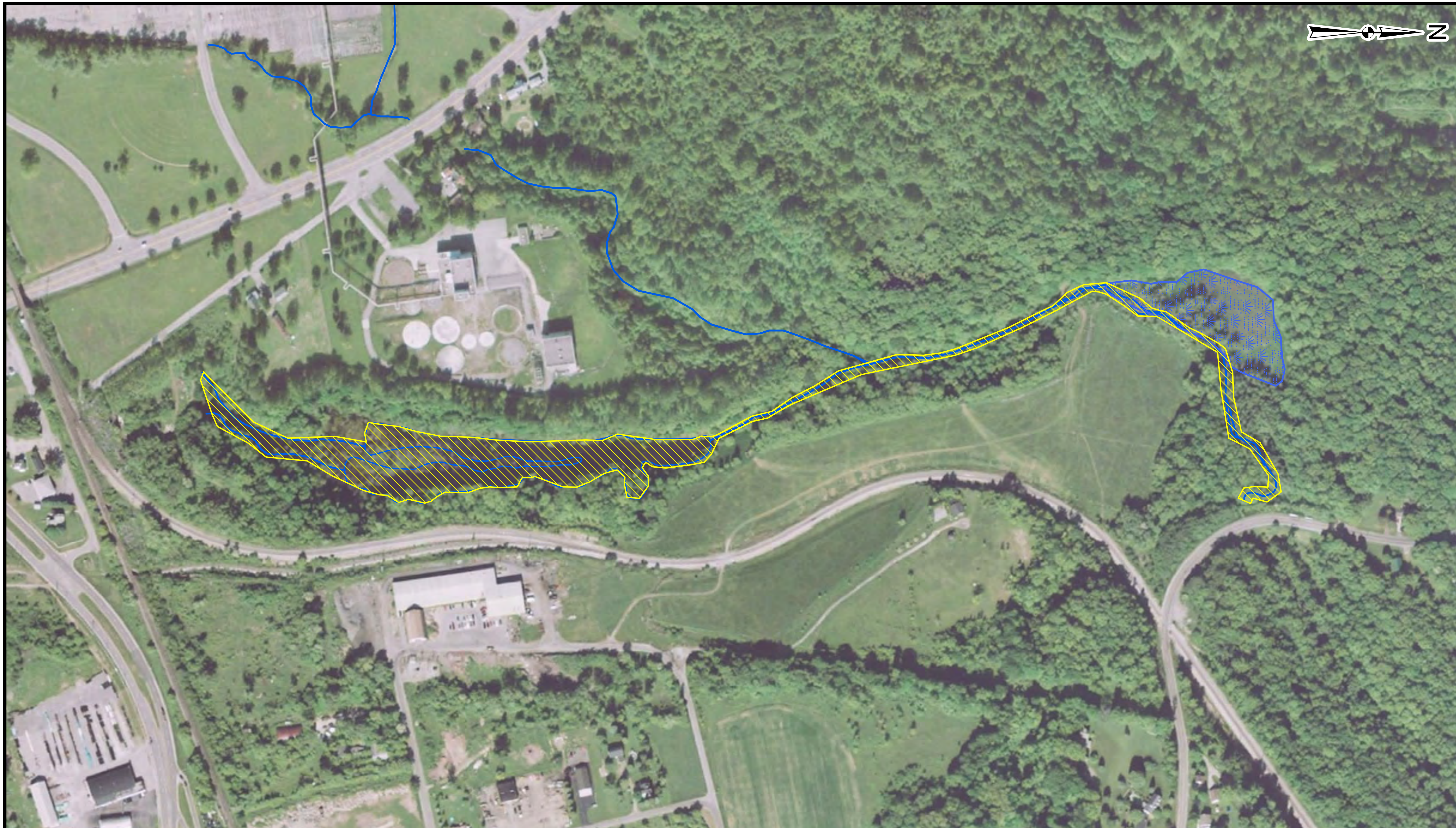
Feet
0 150 300 600
1 inch = 300 feet

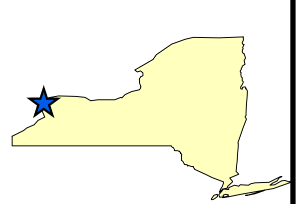
Legend

Sediment Amendment Area

Source: NYS GIS Clearing House

PROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	PROJECT NO:	DATE:	SCALE:	FILE NO:
RSC	RSC	JCP	RSC	1490705	FEBRUARY 2013	AS SHOWN	GIS\Projects\ FIGURE6-8.MXD





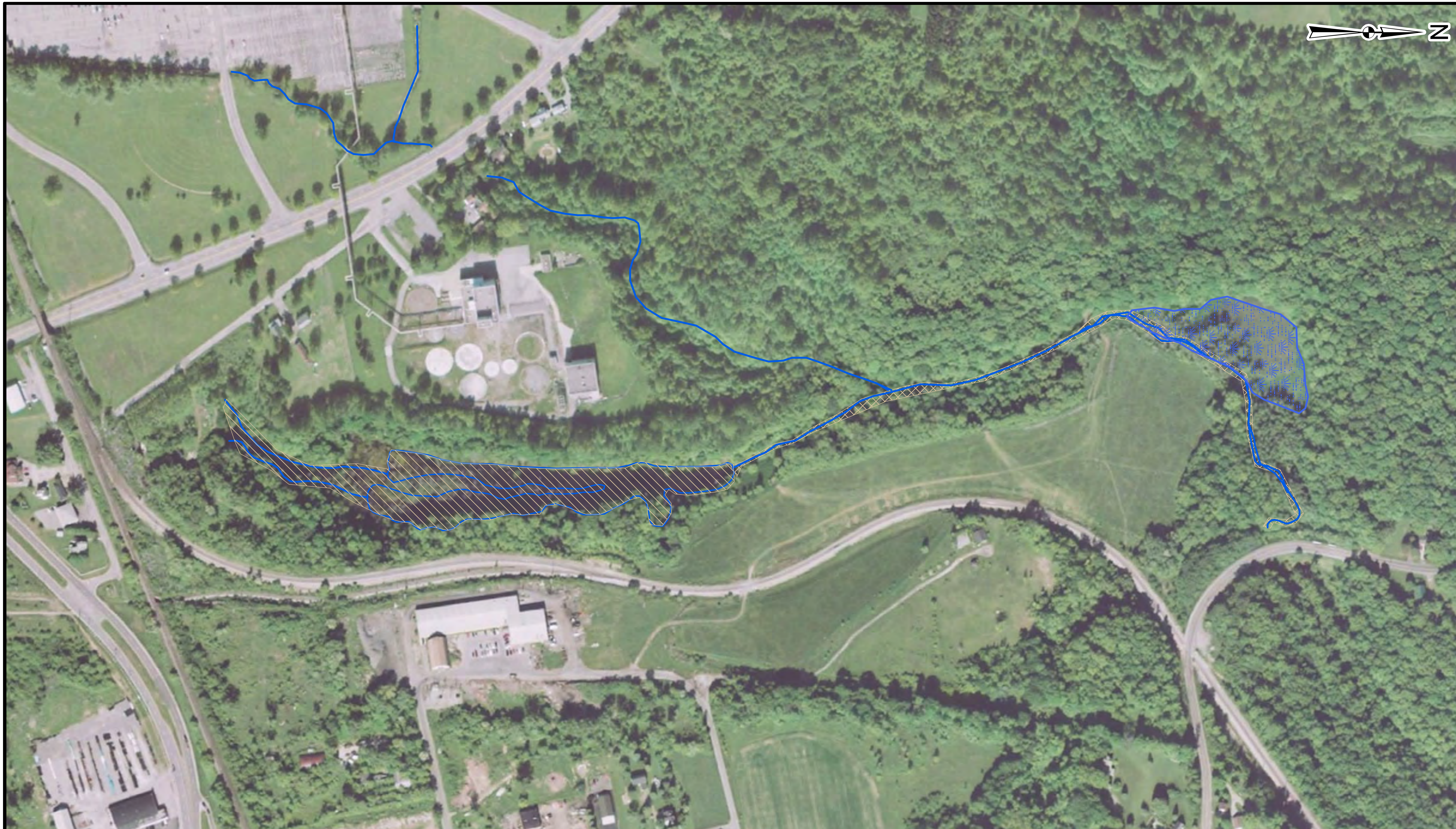
OLD UPPER MOUNTAIN ROAD (932112) FEASIBILITY STUDY REPORT LOCKPORT, NEW YORK		FIGURE 6-11 OU 2 Alternative 4: Complete Removal with Disposal		Feet: 0, 150, 300, 600 1 inch = 300 feet
PROJECT MGR: RSC	DESIGNED BY: RSC	CREATED BY: JCP	CHECKED BY: RSC	PROJECT NO: 1490705

DATE: FEBRUARY 2013	SCALE: AS SHOWN	FILE NO: GIS\Projects\ FIGURE6-11.MXD

Legend

Dredge Area

Source: NYS GIS Clearing House



Source: NYS GIS Clearing House

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FIGURE 6-12
OU 2 Alternative 5:
PartialRemoval with Multi-Media
Sub-Aqueous Capping

Feet
0 150 300 600
1 inch = 300 feet

Legend

Residual Cap Area

Dredge Area

PROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	PROJECT NO:	DATE:	SCALE:	FILE NO:
RSC	RSC	JCP	RSC	1490705	FEBRUARY 2013	AS SHOWN	GIS\Projects\ FIGURE6-12.MXD

TABLE 5-1 TECHNOLOGY SCREENING MATRIX

SOIL/FILL MATERIAL (OPERABLE UNIT 1)						
Technology	**Process Options**	**Effectiveness in Addressing RAOs**	**Implementability**	**Key Factors**	**Cost**	**Status**
No Action						
No Action	NA	Ineffective	Easily implemented	NA	None	Retained per NCP
Site Management						
Engineering and Institutional Controls	Land use restrictions	Effective for human health risk RAOs associated with contact of fill	Easily implemented	Requires regulatory and public acceptance of restricted/diminished resource use.	Low	Retained for potential combination with other technologies.
***In-situ* Biological Treatment**						
Phytoremediation	Reliance on natural processes and chemical change	Ineffective due to thickness of fill impacts	Easily implemented; requires demonstration of natural processes causing attenuation and subsequent monitoring	Appropriate only for sites where chemical contamination is relatively shallow. Requires regulatory and public acceptance of short term restrictions on resource use.	Low	Not retained due to depths of soil/fill contamination.
Containment						
Landfill Capping	Multi-media cap	Effectively addresses RAOs associated with contact of fill.	Moderately difficult to implement; requires import of sand, stone, clay placement; monitoring of cap thickness; periodic maintenance and monitoring; steepness of ravine would require substainial earthwork design.	Would require site grading changes and/or consolidation of waste; effective in long term source control; would require long-term groundwater treatment technology.	Moderate	Not retained.
	Impermeable Liner (e.g., clay, plastic, etc.)	Effectively addresses RAOs associated with contact of fill.	Moderately difficult to implement; requires periodic maintenance and monitoring, and steepness of ravine would require substainial earthwork design.	Would require site grading changes and/or consolidation of waste; effective in long term source control; would require long-term groundwater treatment technology.	Moderate	Retain for consideration.
***In Situ* Physical/Chemical Treatment**						
In-situ Stabilization	Addition of amendments/reagents to soil/fill to convert contaminants to stable compounds with reduced or eliminated leaching potential; requires *in-situ* mixing	Effective for risk-based RAOs and partially effective for source control; would require leachability testings to measure the immobility of contaminants	Depth of contaminants significantly limit the effectiveness of in-situ process; requires import and availability of suitable materials/reagents (e.g.,activated carbon, gypsum, apatite, etc.); stabilization below groundwater table is difficult; periodic monitoring.	Causes significant disturbance to site that may hinder future use; volume increase with bulk can be significant.	Moderate for Shallow Soils (~$60/yd^3) High at Depth (~$250/yd^3)	Retained for potential combination with other technology.
Soil Flushing	Extraction of contaminants from soil with water or other suitable aqueous solutions; soil flushing process includes injection or infiltration process of extraction fluid through soil *in-situ* .	Thickness and permeability of fill may hinder effectiveness	Considered an emerging technology, has not been widely implemented; Moderately difficult to implement; addition of environmentally compatible solvents may be used to increase effective solubility of some COCs; however, flushing solution may alter the physical/chemical properties of the soil system; technology offers the potential for recovery of metals and can mobilize a wide range of organic and inorganic contaminants from coarse-grained soils;	Capture of groundwater and flushing fluids with desorbed contaminants may need treatment to meet appropriate discharge standards prior to release to local, publicly owned wastewater treatment works or receiving streams; separation of solvents from recovered flushing fluid, for reuse in the process, is a major factor in the cost of soil flushing. Treatment of the recovered fluids results in process sludges and residual solids, such as spent carbon and spent ion exchange resin, which must be appropriately treated before disposal. Residual flushing additives in soil may be a concern.	High	Not retained.
Removal						
Excavation	Mechanical excavation used to remove soil/fill material	Will address relevant RAOs, assuming use of handling treatment/disposal options discussed below	Implementable; moderately difficult to implement; requires ravine access by excavation equipment; potential for dewatering needs once GW is encountered; staging/access/mobility at base of ravine will be limiting; base of ravine will need to be stabilized for excavation equipment	Could require establishment of dewatering facilities which could slow process.	High	Retain for consideration
***Ex-situ* Physical/Chemcial Treatment**						
Solidification or Stabilization	Amendments added to modify physical and chemical properties of material to facilitate handling and disposal	Effective at immobilizing inorganics within fill.	Relatively easy to implement; can be performed on small batches as material is staged for transport; requires import and addition of amendments; result is decreased water content and toxicity and mobility of contaminants; volume increase.	Requires use of amendments to achieve stabilization	Moderate	Retain for consideration.
Ex-situ chemical treatment	Acid leaching used to remove inorganics from soil/fill	Permeability of fill may hinder effectiveness.	Difficult to implement; requires establishment of a designated treatment facility using potentially hazardous chemicals to remove inorganics from fill.	Requires long term use of facilities for soil/fill treatment and disposal or recycling of leached fluids; rate of treatment may limit rate of excavation and disposal; requires use and maintenance of specialized equipment and chemicals	High	Not retained.
	Vitrification used to convert inorganic contaminants to inert forms	Permeability of fill may hinder effectiveness.	Difficult to implement; requires establishment of a designated treatment facility using high temperature processes to vitrify soil/fill	Requires long term use of facilities for soil/fill treatment and disposal; rate of treatment may limit rate of excavation and disposal; requires use and maintenance of specialized equipment	High	Not retained.
Disposal						
Off-site Disposal	Off-site commercial landfill	May be required for excavation options to meet RAOs	Low degree of difficulty to implement; requires identification of landfills capable of accepting material; landfill capacity and permitting may limit excavation and disposal rates.	Material may require dewatering, stabilization, or treatment to meet criteria for acceptance. Long range transport may be required dependent on landfill capacity/location; extensive site work and earthwork to accommodate transportation of material;	High	Retain for consideration
	Adjacent City of Lockport closed landfill	May be required for excavation options to meet RAOs	Moderately difficult to implement; requires design of a landfill capable of accepting material.	Requires permission and approval from City of Lockport for redesign of landfill; access roads would need to be constructed connecting excavation area to landfill; extensive site work and earthwork to accommodate excavation of material.	Moderate	Not retained, volume to large for available space at local site.
On-site Disposal	On-site landfill	May be required for excavation options to meet RAOs	Difficult to implement; requires designation and design of a landfill area capable of placing material.	Identification of landfill area at the site and subsequent design and construction; limited to avaiable size of site.	High	Not retained, volume to large for available space onsite.

NOTE: RAO = Remedial Action Objective
NA = Not Applicable
NCP = National Contigency Plan

TABLE 5-1 TECHNOLOGY SCREENING MATRIX

GROUNDWATER (OPERABLE UNIT 1)						
Technology	**Process Options**	**Effectiveness in Addressing RAOs**	**Implementability**	**Key Factors**	**Cost**	**Status**
No Action						
No Action	NA	Ineffective	Easily implemented	NA	None	Retained per NCP
Institutional Controls						
Engineering and Institutional Controls	Groundwater use restrictions; and long-term monitoring program	Effective for human health risk RAOs	Easily implemented	Requires regulatory and public acceptance of restricted/diminished resource use.	Low	Retained for use with other technologies
Containment						
Physical Barriers	A slurry wall is installed from the ground surface to a confining layer; contains contaminated groundwater; may also divert contaminated groundwater from drinking water intakes or toward a treatment system.	May be required for landfill capping options to meet RAOs	Easily implementable; requires the design/construction of engineered slurry wall or other type of physical barrier	Most effective when barrier is able to be keyed into a low permeability layer; cost increases greatly when installed deeper than 100 ft	Low	Retained for use with other technologies
***Ex Situ* Physical/Chemical Treatment**						
Filtration (Adsorption/Absorption)	Isolates solid particles by running a fluid stream through a porous medium; Utilizes gravity or a pressure differential across the filtration medium; chemicals are not destroyed; they are merely concentrated, making reclamation possible.	May be required for landfill capping options to meet RAOs	Moderate difficulty for implementation; would require design/construction of treatment process and facility; treatment building would be permanant and treatment times are extensive; requires long-term operation, maintence, and monitoring; hydrogeological data would be needed to determine flows rates and treatment process parameters	High concentrations of contaminants would require frequent replacement of adsorbent unit; chemicals are not destroyed, thereby requiring proper treatment, disposal, or reclamation	Moderate to High	Retained for use with other technologies
Precipitation/Flocculation	Pumping or capture of ground water through extraction wells or collection trench and then treatment to precipitate lead and other heavy metals. Metals removal employs precipitation with hydroxides, carbonates, or sulfides; Precipitating agent is added to water in a mixing tank along with flocculating agents; mixture then flows to a flocculation chamber that agglomerates particles, which are then separated from the liquid phase in a sedimentation chamber. Other physical processes, such as filtration, may follow.	May be required for landfill capping options to meet RAOs	Well designed treatment process for metals; Moderate difficulty for implementation; would require design/construction of treatment process and facility; treatment building would be permanant and treatment times are extensive; requires long-term operation, maintence, and monitoring; hydrogeological data would be needed to determine flows rates and treatment process parameters	Presence of a variety of metals may make removal of all constituents difficult, thereby requiring further treatment; resulting sludge requires TCLP testing prior to disposal; treated water may require pH adjustment	Moderate to High	Retained for use with other technologies
Ion Exchange	Groundwater is pumped through ion exchange resins. Resin is made of synthetic or natural materials the size of a grain of sand with the opposite charge of the contaminated ion. Resin can be regenerated for re-use after resin capacity has been exhausted.	May be required for landfill capping options to meet RAOs	Well designed treatment process for metals; moderate difficulty for implementation; would require design/construction of treatment process and facility; treatment building would be permanent and treatment times are extensive; requires long term operation, maintence, and monitoring; hydrogeological data would be needed to determine flows rates and treatment process parameters	High concentrations of suspended solids may cause resin blinding; groundwater pH needs to be considered when selecting the ion exchange resin; oxidants in groundwater may damage the ion exchange resin; may require additional treatment	Moderate to High	Retained for use with other technologies

TABLE 5-1 TECHNOLOGY SCREENING MATRIX

SEDIMENT (OPERABLE UNIT 2)						
Technology	**Process Options**	**Effectiveness in Addressing RAOs**	**Implementability**	**Key Factors**	**Cost**	**Status**
No Action						
No Action	NA	Ineffective	Easily implemented	NA	None	Retained per NCP
Site Management						
Engineering and Institutional Controls	Land use restrictions	Effective for human health risk RAOs associated with contact of fill	Easily implemented	Requires regulatory and public acceptance of restricted/diminished resource use.	Low	Retained for potential combination with other technologies
Containment						
In-situ Subaqueous Capping - Physical Barrier	Thin layer capping with armor material (gravel or stone, less than 1-ft thick)	Effective for risk-based RAOs; effectiveness for source control uncertain	Moderately difficult to implement; requires import of stone; placement in water; monitoring of cap thickness; periodic maintenance & monitoring.	May require filling shallow areas & may alter habitat; long term source control effective only if contaminant is of limited solubility; requires access easement for sewer.	Moderate	Not retained.
	Multi-media cap	Effectively addresses RAOs	Moderately difficult to implement; requires import of sand, stone, clay placement in water; monitoring of cap thickness; periodic maintenance and monitoring.	May require changes in bottom topography/habitat; effective in long term source control unless inorganic are soluble and upwelling is substantial; requires acceess easement for sewer.	Moderate	Retained for use
	Impermeable Liner (e.g., clay, plastic, etc.)	Effectively addresses RAOs	Implementable only for small areas because liners would destroy habitat; moderately difficult to implement; requires import of liners; placement in water; periodic maintenance and monitoring.	Covers over habitat but effectively blocks transport; requires access easement for sewer.	Moderate	Not retained.
In-situ Subaqueous Capping - Reactive Cap	Capping using activated carbon/organo-carbon in a thin layer (less than 3 in.)or mixed with sand	Effective for risk-based RAOs and partially effective for source control	Moderately difficult to implement; requires import of special materials (i.e. Sedi-mite, activated carbon, organic carbon, or similar products); placement in water; monitoring of cap thickness; periodic maintenance and monitoring.	May require filling some areas and substantial changes in bottom topography/habitat; effective in long term source control unless inorganics are soluble and upwelling is substantial; requires access easement for sewer.	Moderate	Not retained.
	Capping using sulfide complexed minerals (Mackinawite, gypsum, phosphogypsum), biopolymers (chitin/chitosan), or other compounds (zeolite, organoclay, apatite) in a thin layer (less than 3 in.) or mixed with sand	Effective for risk-based RAOs and partially effective for source control	Moderately difficult to implement; requires import of special materials (i.e. amendments); placement in water; monitoring of cap thickness; periodic maintenance and monitoring.	Causes minimal changes in bottom topography/habitat; long term effectiveness is still subject to evaluation; binding likely to decrease toxicity and dissolved phase mobility but does not inhibit physical transport; requires access easement for sewer.	Moderate	Not retained.
***In-situ* Biological Treatment**						
Phytoextraction	Reliance on natural processes for contaminant removal	Effective for risk-based RAOs and source control	Difficult to implement; limited to areas that will support wetland plant growth; requires planting of appropriate species and subsequent harvest for disposal. May require long time frames, and effectiveness may be limited.	Would require alteration of site wetland habitats; would not provide short-term risk reduction and overall effectiveness may be limited	Moderate	Retain for consideration.
***In Situ* Physical/Chemical Treatment**						
In-situ Chemical Treatment	Addition of amendments to sediment; may require *in situ* mixing	Effective for risk-based RAOs and partially effective for source control	Difficult to implement; requires import of special materials (e.g., Sedi-mite, activated carbon, gypsum, apatite, etc.); placement in water; mixing of upper layers of sediment; periodic monitoring.	Causes significant disturbance to habitat; effective long term source control for dissolved phase, but does not prevent physical transport	Moderate to high	Not retained.
In-situ Physical/Chemical Treatment	Solidification/stabilization	Effective for risk-based RAOs and source control	Difficult to implement; requires import of stabilization amendments; placement in water; mixing of upper layers of sediment; periodic monitoring.	Causes significant disturbance to habitat and long term change in sediment properties; effective long term source control	Moderate to high	Not retained.
Removal						
Hydraulic Dredging	Hydraulic excavation used to remove sediment	Will address relevant RAOs, assuming use of handling treatment/disposal options discussed below	Modertaley difficult to implement; requires waterway access by hydraulic dredging equipment; requires subsequent dewatering to remove water added by hydraulic conveyance and the addition of material amendments to facilitate handling and disposal; buried debris, rocks, or bedrock may limit dredging implementation.	Requires establishment of dewatering facilities; rate may be limited by distance to and capacity of dewatering facility; rate may also be affected by sediment type; dredging typically requires water quality monitoring and resuspension/residuals controls	High	Not retained.
Mechanical Dredging	Mechanical excavation used to remove sediment	Will address relevant RAOs, assuming use of handling treatment/disposal options discussed below	Moderately difficult to implement; requires waterway access by dredging equipment; less dewatering required than for hydraulic dredging; may require the addition of material amendments to facilitate handling and disposal; buried debris, rocks, or bedrock may limit dredging implementation.	Requires establishment of dewatering facilities; rate may be limited by dewatering practices; rate may also be affected by presence of debris or obstacles to dredging; dredging typically requires water quality monitoring and resuspension/residuals controls	High	Retained for consideration.
Disposal						
Off-site Disposal	Off-site commercial landfill	May be required for dredging options to meet RAOs	Modrately difficult to implement; requires identification of landfills capable of accepting material; landfill capacity may limit dredging and disposal rates.	Material may require dewatering, stabilization, or treatment to meet criteria for acceptance. Long range transport may be required dependent on landfill capacity.	High	Retained for consideration.
	Adjacent City of Lockport closed landfill	May be required for dredging options to meet RAOs	Moderately difficult to implement; requires design of a landfill capable of accepting material.	Material may require dewatering, stabilization, or treatment prior to placement; requires permission and approval from City of Lockport for redesign of landfill; access roads would need to be constructed connecting excavation area to landfill; extensive site work and earthwork to accommodate excavation of material.	Moderate	Retained for consideration.
On-site Disposal	On-site landfill	May be required for dredging options to meet RAOs	Difficult to implement; requires designation and design of a landfill area capable of accepting material.	Facility would require designation of landfill area and subsequent design and construction.	High	Retained for consideration.

TABLE 6-1 ALTERNATIVES SCREENING

OPERABLE UNIT 1: SOIL					
	Alternative 1A	**Alternative 1B**	**Alternative 2**	**Alternative 3**	**Alternative 4**
	No Action	**Site Management**	**Complete Removal with Off-Site Disposal**	***Ex Situ* Stabilization with Off-Site Disposal**	**Landfill Capping with a Part 360 Cap-Existing Landfill Footprint**
Size and Configuration of Process Options	NA	An environmental easement would be implemented at the site to limit the use of the property and groundwater. Groundwater monitoring would be conducted on an annual basis. A fence would be installed and maintained for site security.	Approximately 199,000 yd^3 of fill would be excavated from the site, to a 80 ft maximum depth. 119,000 tons of the excavated fill (assumed to be hazardous) would be disposed of at a permitted hazardous waste landfill. Remaining fill and debris would be transported to a general waste landfill. An approved source of fill would be used to construct 3:1 slopes into the existing ravine.	Approximately 199,000 yd^3 of fill would be excavated and treated on-site with a stabilizing amendment to be disposed of at a non-hazardous permitted disposal facility. An approved source of fill would be used to construct 3:1 slopes into the existing ravine.	Approximately165,000 yd^3 of fill would be excavated from the site to reduce the near vertical ravine walls to a 3:1 slope for the purpose of capping. Remaining fill would be covered with a full Part 360 cap.
Time for Remediation	NA	NA	Approximately 40 months	Approximately 40 months	Approximately 21 months
Spatial Requirements	None	None	Area of excavation will be inaccessible during remedial activities. Access road into the existing ravine will be necessary to accommodate excavation activities. Area for equipment storage and loading and unloading for contaminated/clean soil (~100 X 400 ft).	Area of excavation will be inaccessible during remedial activities. Access road into the existing ravine will be necessary to accommodate excavation and backfill activities. Area for treatment and utilities equipment (~100 X 400 ft).	Area of excavation will be inaccessible during remedial activities. Access road into the existing ravine will be necessary to accommodate excavation and capping activities. Area for equipment storage and loading and unloading of contaminated soil (~100 X 400 ft).
Options for Disposal	NA	NA	Off-site disposal through approved hazardous waste and general waste facilities. Consideration for treatment and reuse of soils would be handled by the facility.	Off-site disposal for treated soil through approved facilities.	Off-site disposal for ravine slope fill through approved hazardous waste and general waste facilities.
Substantive Technical Permit Requirements	None	None	None	None	None
Limitations or Other Factors Necessary to Evaluate Alternatives	None	None	Disposal facilities will require TCLP analysis for waste characterization prior to acceptance.	Pilot test will be required for full evaluation.	Disposal facilities will require TCLP analysis for waste characterization prior to acceptance.
Public Impacts	Will not reduce exposure to contaminants.	Will not physically reduce exposure to contaminants.	Noise, dust, and traffic may disturb local residents.	Noise, dust, and traffic may disturb local residents.	Noise, dust, and traffic may disturb local residents.
Beneficial and/or Adverse Impacts on Fish and Wildlife Resources	Because soil would be left untreated, the soil could contribute to further groundwater contamination.	Because the soil would be left untreated, the soil could contribute to further groundwater contamination	No known impacts on fish and wildlife resources. The potential source of groundwater contamination will be removed.	No known impacts on fish and wildlife resources. The potential source of groundwater contamination will be removed.	No known impacts on fish and wildlife resources. The potential source of groundwater contamination will be removed.
Net Present Worth	$0.00	$160,000	$43,609,000	$40,509,000	$26,975,000

NOTE: NA = Not Applicable
TCLP = Toxicity Characteristic Leaching Procedure

TABLE 6-1 ALTERNATIVES SCREENING

OPERABLE UNIT 1: SOIL				
	Alternative 5	**Alternative 6**	**Alternative 7**	**Alternative 8**
	Landfill Capping with a Part 360 Cap-Extended Landfill Footprint	**Landfill Capping with a Clean Soil Cover-Extended Landfill Footprint**	**Partial Removal and Off-Site Disposal with *In Situ* Stabilization of Shallow Waste**	**Partial Removal, *Ex Situ* Stabilization and On-Site Placement with *In Situ* Stabilization of Shallow Waste**
Size and Configuration of Process Options	Approximately 51,000 yd^3 of soil would be re-graded to convert the near vertical ravine walls to a 3:1 slope for the purpose of capping. Re-graded fill would be covered with a full Part 360 cap.	Approximately 51,000 yd^3 of soil would be re-graded to convert the near vertical ravine walls to a 3:1 slopefor the purpose of capping. Re-graded fill would be covered with a soil cap.	Approximately 152,000 yd^3 of soil would be excavated from the deepest areas of fill ranging from 20 to 80 ft bgs to be disposed of at permitted disposal facilities. An approved source of fill would be used to construct 2:1 slopes into the existing ravine. Shallow fill would be mixed with stabilizing amendment *in situ* to prevent leaching.	Approximately 152,000 yd^3 of fill would be excavated from the deepest areas of fill ranging from 20 to 80 ft bgs to be treated on-site with a stabilizing amendment to be placed back into the excavation and into the existing ravine to allow for 3:1 slopes. Shallow fill would be treated in situ with the same stabilizing amendment. Stabilized soil would be covered with a clean soil cap, topsoil and seed.
Time for Remediation	Approximately 9 months	Approximately 9 months	Approximately 34 months	Approximately 44 months
Spatial Requirements	Area of excavation will be inaccessible during remedial activities. Access road into the existing ravine will be necessary to accommodate excavation and capping activities. Area for equipment storage and loading and unloading of contaminated soil (~100 X 400 ft).	Area of excavation will be inaccessible during remedial activities. Access road into the existing ravine will be necessary to accommodate excavation and capping activities. Area for equipment storage and loading and unloading of contaminated soil (~100 X 400 ft).	Area of excavation will be inaccessible during remedial activities. Access road into the existing ravine will be necessary to accommodate excavation and backfill activities. Area for equipment storage (~100 X 400 ft).	Area of excavation will be inaccessible during remedial activities. Access road into the existing ravine will be necessary to accommodate excavation and backfill activities. Area for equipment storage (~100 X 400 ft).
Options for Disposal	All material will remain on-site.	All material will remain on-site.	Off-site disposal for deep fill through approved hazardous waste and general waste facilities.	All material will remain on-site.
Substantive Technical Permit Requirements	None	None	None	None.
Limitations or Other Factors Necessary to Evaluate Alternatives	None.	None.	Disposal facilities will require TCLP analysis for waste characterization prior to acceptance. Pilot test will be required for full evaluation.	Pilot test will be required for full evaluation.
Public Impacts	Noise, dust, and traffic may disturb local residents.	Noise, dust, and traffic may disturb local residents.	Noise, dust, and traffic may disturb local residents.	Noise, dust, and traffic may disturb local residents.
Beneficial and/or Adverse Impacts on Fish and Wildlife Resources	No known impacts on fish and wildlife resources. The potential source of groundwater contamination will be removed.	No known impacts on fish and wildlife resources. The potential source of groundwater contamination will be removed.	No known impacts on fish and wildlife resources. The potential sources of groundwater contamination will be removed and treated	No known impacts on fish and wildlife resources. The potential sources of groundwater contamination will be treated.
Net Present Worth	$5,974,000	$4,208,000	$41,721,000	$23,557,000

NOTE: NA = Not Applicable
TCLP = Toxicity Charact

TABLE 6-1 ALTERNATIVES SCREENING

OPERABLE UNIT 2: SEDIMENT						
	Alternative 1A **No Action**	**Alternative 1B** **Site Management**	**Alternative 2** **Multi-Media Sub-Aqueous Capping**	**Alternative 3** ***In Situ* Sediment Amendment**	**Alternative 4** **Complete Removal with Disposal**	**Alternative 5** **Partial Removal with Multi-Media Sub-Aqueous Capping**
Size and Configuration of Process Options	NA	A deed restriction would be implemented at the site to limit the use of the property and groundwater. Surface water monitoring would be conducted on an annual basis. A fence would be installed and maintained for site security.	Approximnately 9 acres would be cleared, graded and capped with a protective media designed to not be mobile by flood flows when vegetated. Approximately 3,600 linear feet of stream would be restored overtop of the cap.	Approximately 9 acres would be cleared, grubbed and excavated to amend with chitin. Approximately 26,000 tons of sediment would be ammended. 3,300 linear feet of stream would be restored in the disturbed floodplain.	Approximately 21,000 yd^3 of contaminated materials covering 9 acres would be dredged and dewatered for on-site disposal.	Approximately 20,000 yd^3 of contaminated materials covering 6.5 acres would be dredged and dewatered for on-site disposal. Remaining sediments would be capped with a multimedia cap designed to withstand flood flows.
Time for Remediation	NA	2 Months	24 Months	24 Months	12 Months	12 Months
Spatial Requirements	None	None	Area of excavation will be inaccessible during remedial activities. Access road into the existing ravine will be necessary to accommodate excavation activities. Area for equipment storage and loading /unloading cap materials (~100 X 400 ft). Staging would be staggered in order to minimize disturbance and potential for contamination of clean materials. Work would progress upstream to downstream. Significant disturbance for pipe diversion activities would be required.	Area of excavation will be inaccessible during remedial activities. Access road into the existing ravine will be necessary to accommodate excavation activities. Area for equipment storage and loading and unloading and mixing soils (~100 X 400 ft). Staging would be staggered in order to minimize disturbance and potential for contamination of clean materials. Work would progress upstream to downstream. Significant disturbance for pipe diversion activities would be required.	Area of excavation will be inaccessible during remedial activities. Access road into the existing ravine will be necessary to accommodate excavation activities. Area for equipment storage and stockpiling(~100 X 400 ft). Staging would be staggered in order to minimize disturbance and potential for contamination of clean materials. Work would progress upstream to downstream. Significant disturbance for pipe diversion activities would be required.	Area of excavation will be inaccessible during remedial activities. Access road into the existing ravine will be necessary to accommodate excavation activities. Area for equipment storage and stockpiling(~100 X 400 ft). Staging would be staggered in order to minimize disturbance and potential for contamination of clean materials. Work would progress upstream to downstream. Significant disturbance for pipe diversion activities would be required.
Options for Disposal	NA	NA	NA	N/A	On-site disposal in accordance with Part 360 requirements for a full cap or a soil cap.	On-site disposal in accordance with Part 360 requirements for a full cap or soil cap.
Substantive Technical Permit Requirements	None	None	Water quality monitoring to ensure no contamination moves downstream required. 404/401 permitting requirements for stream and wetland impacts. Mitigation and annual monitoring required.	Water quality monitoring to ensure no contamination moves downstream required. 404/401 permitting requirements for stream and wetland impacts. Mitigation and annual monitoring required.	Water quality monitoring to ensure no contamination moves downstream required. 404/401 permitting requirements for stream and wetland impacts. Mitigation and annual monitoring required.	Water quality monitoring to ensure no contamination moves downstream required. 404/401 permitting requirements for stream and wetland impacts. Mitigation and annual monitoring required.
Limitations or Other Factors Necessary to Evaluate Alternatives	None	None	Hydraulic and Hydrologic analysis required to evaluate potential for having a stable cap.	Pre-design characterization study required to determine extents of ammendment and contamination.	Pre-design characterization study required to determine extents of dredging.	Hydraulic and Hydrologic analysis required to evaluate potential for having a stable cap. Pre-design characterization study required to determine extents of contamination.
Public Impacts	Will not reduce exposure to contaminants.	Will not physically reduce exposure to contaminants.	Noise, dust, and traffic may disturb local residents. Existing recreation opportunities in Gulf Creek would be temporarily impacted.	Noise, dust, and traffic may disturb local residents. Existing recreation opportunities in Gulf Creek would be temporarily impacted.	Noise, dust, and traffic may disturb local residents. Existing recreation opportunities in Gulf Creek would be temporarily impacted.	Noise, dust, and traffic may disturb local residents. Existing recreation opportunities in Gulf Creek would be temporarily impacted.
Beneficial and/or Adverse Impacts on Fish and Wildlife Resources	Because soil would be left untreated, the soil could contribute to further groundwater contamination.	Because the soil would be left untreated, the soil could contribute to further groundwater contamination	Potential for surface contact would be removed. Complete restoration of the benthic community would be required. Potential for future exposure due to tree falls and burrowing activity would be present.	Potential for surface contact would be removed, however monitoring would be required to ensure effectiveness of ammendment. Complete restoration of the benthic community would be required.	Potential for surface contact would be removed. Complete restoration of the benthic community would be required.	Potential for surface contact would be removed. Complete restoration of the benthic community would be required. Potential for future exposure due to tree falls and burrowing activity would be present.
Net Present Worth	$0.00	$87,000.00	$2,889,000	$2,334,000	$4,638,000	$3,887,000

TABLE 6-2 ALTERNATIVE EVALUATION SUMMARY

OPERABLE UNIT 1: SOIL					
	Alternative 1A	**Alternative 1B**	**Alternative 2**	**Alternative 3**	**Alternative 4**
	No Action	**Site Management**	**Complete Removal with Off-Site Disposal**	**Ex Situ Stabilization with Off-Site Disposal**	**Landfill Capping with a Part 360 Cap- Existing Landfill Footprint**
(1) Overall Protection of the Public Health and the Environment					
	There is no reduction of risk with this alternative. The soil pathways would continue to pose unacceptable risk to all receptors.	Implementation of this alternative would serve to prevent ingestion or direct contact with contaminated soil and groundwater.	Removal of source reduces potential migration of contaminants to groundwater and surface water.	Removal of source reduces potential migration of contaminants to groundwater and surface water.	Capping of impacted area reduces potential migration of contaminants to groundwater.
(2) Standards, Criteria and Guidance (SCGs)					
	Does not meet SCG criterion.	Does not meet SCG criterion	Will meet SCG criteria.	Will meet SCG criteria.	Will meet SCG criteria.
(3) Long-Term Effectiveness and Permanence					
	This alternative will not provide long-term effectiveness or permanence. This alternative offers no controls.	This alternative would effectively address RAOs if implemented in conjunction with another alternative. As a stand-alone alternative, it is only moderately effective, as contamination will remain in place and no physical barriers would prevent contact or ingestion of soil or groundwater.	When designed and implemented properly, effectively eliminates exposure and prevents transport, permanently removes some habitat , eliminates need for groundwater monitoring, RAOs are achieved in short time frame.	When designed and implemented properly, effectively eliminates exposure and prevents transport, permanently removes some habitat , eliminates need for groundwater remedy, RAOs are achieved in short time frame.	Effectively addresses RAOs associated with contact of fill in short time frame, long-term monitoring of effectiveness of slurry wall, effectiveness of medium used in slurry wall will decrease with time and require replacement; Institutional (Deed Restrictions) and Engineering Controls would need to be in-place.
(4) Reduction of Toxicity, Mobility, or Volume of Contamination					
Amount of Hazardous Materials Destroyed, Treated, or Removed	None	None	Excavation will remove soil exceeding allowable risks at the impacted area.	Excavation will remove soil exceeding allowable risks at the impacted area.	Capping fill materials will not remove or destroy hazardous materials.
Degree of Expected Reductions in Toxicity, Mobility, or Volume	None	None	Contaminated soil will be disposed of in permitted facilities that use measures to reduce or eliminate the risk of toxic mobility.	Contaminant toxicity and volume will be reduced.	Contaminant mobility and volume will be reduced.
Irreversible Treatment?	No	No	Yes	Yes	Partially reversible. Remaining fill could be un-capped.
Residuals Remaining After Treatment	Yes	Yes	Trace residuals may remain after excavation is complete.	Residuals may remain in areas outside of the excavation area.	Residuals will remain under cap.
(5) Short-Term Impact and Effectiveness					
Community Protection	There is no action and therefore, no additional risk to the community.	There is no physical action and therefore, no additional risk to the community.	Increased short-term risks to the public during excavation activities and transport of equipment and materials to and from site. Dust will be produced during excavation activities. These can be mitigated through standard construction practices. Some habitats will be temporarily disturbed and/or removal.	Increased short-term risks to the public during excavation activities and transport of equipment and materials to and from site. Dust may be produced during mixing activities. These can be mitigated through standard construction practices.	Increased short-term risks to the public during excavation activities and transport of equipment and materials to and from site. Dust will be produced during excavation and grading activities. These can be mitigated through standard construction practices.
Worker Protection	There is no action and therefore no workers will be present on site.	There is no physical action and therefore, no workers will be present at the site	Workers can potentially be exposed to contaminated media during excavation activities. Work around heavy equipment carries potential risk to workers. Risks can be minimized by implementing health and safety controls.	Workers can potentially be exposed to contaminated media during activities. Work around heavy equipment and electrical power carries potential risk to workers. Risks can be minimized by implementing controls.	Workers can potentially be exposed to contaminated media during excavation and grading activities. Work around heavy equipment carries potential risk to workers. Risks can be minimized by implementing health and safety controls.
Environmental Impacts	There are no short-term impacts associated with this alternative.	There are no short-term impacts associated with this alternative.	Wastes produced will include contaminated PPE. Wastes will be managed in compliance with ARARs. Limited short term environmental impacts associated with implementation and air emissions.	Wastes produced will include contaminated PPE. Wastes will be managed in compliance with ARARs. Limited short term environmental impacts associated with implementation and air emissions.	Wastes produced will include contaminated PPE. Wastes will be managed in compliance with ARARs. Limited short term environmental impacts associated with implementation and air emissions.
Time Until Action Complete (Field Construction Time)	No action taken	Approximately 2 months for the deed restriction to be in effect.	Approximately 40 months	Approximately 40 months	Approximately 27 months
(6) Implementability					
Ability to Construct and Operate	Not Applicable.	Institutional controls can be implemented, and have been used nationally.	Excavation alternatives can be implemented, and have been used nationally.	Excavation and treatment alternatives can be implemented, and have been used nationally.	Landfill capping alternatives can be implemented, and have been used nationally.
Monitoring Requirements	Not Applicable.	Not Applicable.	Soil shall be sampled and analyzed to confirm removal of impacted area.	Soil shall be sampled and analyzed to confirm removal of impacted area.	Soil shall be sampled and analyzed to confirm removal of impacted area.
Availability of Equipment and Specialists	Not Applicable.	Specialists are available for the implementation of institutional controls.	Equipment and specialists are available for the implementation of all of these technologies.		
Ability to Obtain Approvals and Coordinate with Other Agencies	Not Applicable.	Ability to obtain approvals and coordinate with other agencies assumed to be possible.	Ability to obtain approvals and coordinate with other agencies assumed to be possible.		
(7) Cost Effectiveness					
Cost	**$0**	**$160,000**	**$43,609,000**	**$40,509,000**	**$26,975,000**
(8) Land Use					
	NA	Restricted	Unrestricted	Unrestricted	Unrestricted
(9) Community Acceptance					
	TBD	TBD	TBD	TBD	TBD

NOTE: PPE = Personal protective equipment
ARAR = Applicable or Relevant and Appropriate Requirement
NA = Not Applicable
TBD = To be determined

TABLE 6-2 ALTERNATIVE EVALUATION SUMMARY

	OPERABLE UNIT 1: SOIL			
	Alternative 5	**Alternative 6**	**Alternative 7**	**Alternative 8**
	Landfill Capping with a Part 360 Cap-Extended Landfill Footprint	**Landfill Capping with a Clean Soil Cover-Extended Landfill Footprint**	**Partial Removal and Off-Site Disposal with In Situ Stabilization of Shallow Waste**	**Partial Removal, Ex Situ Stabilization and On-Site Placement with In Situ Stabilization of Shallow Waste**
(1) Overall Protection o				
	Capping of impacted area reduces potential migration of contaminants to groundwater and surface water.	Capping of impacted area reduces potential migration of contaminants to groundwater and surface water.	Treatment of impacted area reduces potential migration of contaminants to groundwater and surface water.	Treatment of impacted fill reduces potential migration of contaminants to groundwater and surface water
(2) Standards, Criteria a				
	Will meet SCG criteria.	Will meet SCG criteria.	Will meet SCG criteria.	Will meet SCG criteria.
(3) Long-Term Effective				
	Effectively addresses RAOs associated with contact of fill in short time frame, long-term monitoring of groundwater and surface water; Institutional (Deed Restrictions) and Engineering Controls would need to be in-place.	Effectively addresses RAOs associated with contact of fill in short time frame, long-term monitoring of groundwater and surface water; Institutional (Deed Restrictions) and Engineering Controls would need to be in-place.	Effectively addresses RAOs associated with contact of fill in short time frame; Institutional (Deed Restrictions) and Engineering Controls would need to be in-place; assumes that soi/fill would be removed from areas in contact with groundwater and shallow fill would be treated via in-situ stabilization.	Effectively addresses RAOs associated with contact of fill in short time frame; Institutional (Deed Restrictions) and Engineering Controls would need to be in-place; assumes that soi/fill would be removed from areas in contact with groundwater and shallow fill would be treated via in-situ stabilization.
(4) Reduction of Toxicit				
Amount of Hazardous Materials Destroyed, Treated, or Removed	Capping fill materials will not remove or destroy hazardous materials.	Capping fill materials will not remove or destroy hazardous materials.	Partial excavation will remove most of the soil exceeding allowable risks. Treatment will reduce toxicity of the remaining soil.	Treatment will reduce toxicity in all fill
Degree of Expected Reductions in Toxicity, Mobility, or Volume	Contaminant mobility will be reduced.	Contaminant mobility will be reduced.	Contaminant toxicity and volume will be reduced.	Contaminant toxicity will be reduced
Irreversible Treatment?	Partially reversible. Remaining fill could be un-capped.	Partially reversible. Remaining fill could be un-capped.	Yes	Yes
Residuals Remaining After Treatment	Residuals will remain under cap.	Residuals will remain under cap.	Residuals will remain in treatment area, but will be less mobile.	Residuals will remain in treated fill, but will be less mobile.
(5) Short-Term Impact a				
Community Protection	Increased short-term risks to the public during excavation activities and transport of equipment and materials to and from site. Dust will be produced during excavation and grading activities. These can be mitigated through standard construction practices.	Increased short-term risks to the public during excavation activities and transport of equipment and materials to and from site. Dust will be produced during excavation and grading activities. These can be mitigated through standard construction practices.	Increased short-term risks to the public during excavation activities and transport of equipment and materials to and from site. Dust will be produced during excavation and mixing activities. These can be mitigated through standard construction practices.	Increased short-term risks to the public during excavation activities and transport of equipment and materials to and from site. Dust will be produced during excavation and mixing activities. These can be mitigated through standard construction practices.
Worker Protection	Workers can potentially be exposed to contaminated media during excavation and grading activities. Work around heavy equipment carries potential risk to workers. Risks can be minimized by implementing health and safety controls.	Workers can potentially be exposed to contaminated media during excavation and grading activities. Work around heavy equipment carries potential risk to workers. Risks can be minimized by implementing health and safety controls.	Workers can potentially be exposed to contaminated media during activities. Work around heavy equipment carries potential risk to workers. Risks can be minimized by implementing health and safety controls.	Workers can potentially be exposed to contaminated media during activities. Work around heavy equipment carries potential risk to workers. Risks can be minimized by implementing health and safety controls.
Environmental Impacts	Wastes produced will include contaminated PPE. Wastes will be managed in compliance with ARARs. Limited short term environmental impacts associated with implementation and air emissions.	Wastes produced will include contaminated PPE. Wastes will be managed in compliance with ARARs. Limited short term environmental impacts associated with implementation and air emissions.	Wastes produced will include contaminated PPE. Wastes will be managed in compliance with ARARs. Limited short term environmental impacts associated with implementation and air emissions.	Wastes produced will include contaminated PPE. Wastes will be managed in compliance with ARARs. Limited short term environmental impacts associated with implementation and air emissions.
Time Until Action Complete (Field Construction Time)	Approximately 9 months	Approximately 9 months	Approximately 34 months	Approximately 44 months
(6) Implementability				
Ability to Construct and Operate	Landfill capping alternatives can be implemented, and have been used nationally.	Landfill capping alternatives can be implemented, and have been used nationally.	Excavation and treatment alternatives can be implemented, and have been used nationally.	Excavation and treatment alternatives can be implemented, and have been used nationally.
Monitoring Requirements	Not Applicable.	Not Applicable.	Not Applicable.	Not Applicable.
Availability of Equipment and Specialists	Equipment and specialists are available for the implementation of all of these technologies.			
Ability to Obtain Approvals and Coordinate with Other Agencies	Ability to obtain approvals and coordinate with other agencies assumed to be possible.			
(7) Cost Effectiveness				
Cost	**$5,974,000**	**$4,208,000**	**$41,721,000**	**$23,557,000**
(8) Land Use				
	Unrestricted	Unrestricted	Unrestricted	Unrestricted
(9) Community Accepta				
	TBD	TBD	TBD	TBD

TABLE 6-2 ALTERNATIVE EVALUATION SUMMARY

OPERABLE UNIT 2: SEDIMENT						
	Alternative 1A	**Alternative 1B**	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 5**
	No Action	**Site Management**	**Multi-Media Sub-Aqueous Capping**	**In Situ Sediment Amendment**	**Complete Removal with Disposal**	**Partial Removal with Multi-Media Sub-Aqueous Capping**
(1) Overall Protection of the Public Health and the Environment						
	There is no reduction of risk with this alternative. The soil pathways would continue to pose unacceptable risk to all receptors.	Implementation of this alternative would serve to prevent ingestion or direct contact with contaminated sediment and surface water.	Capping reduces potential for an exposure pathway via surface contact. Continued potential risk of movement of contaminants through sediment bed mobility and surface water if sediment chemistry becomes acidic.	Will reduce risk of exposure through bonding contaminants into stable, non-leaching forms. Will reduce risk of transport of contaminants offsite or through surface water or sediment transport.	Removal of source reduces potential migration of contaminants to surface water or through surface contact. Subsequent capping will reduce potential for an exposure pathway via surface contact.	Removal reduces potential migration of contaminants to surface water or through surface contact. Capping reduces potential for an exposure pathway via surface contact. Continued potential risk of movement of remaining underlying contaminated sediment constituents through surface water if sediment chemistry becomes acidic.
(2) Standards, Criteria and Guidance (SCGs)						
	Does not meet SCG criterion.	Does not meet SCG criterion	Will meet SCG criteria.	Will meet SCG criteria.	Will meet SCG criteria.	Will meet SCG criteria.
(3) Long-Term Effectiveness and Permanence						
	This alternative will not provide long-term effectiveness or permanence. This alternative offers no controls.	This alternative would effectively address RAOs if implemented in conjunction with another alternative. As a stand-alone alternative, it is only moderately effective, as contamination will remain in place and no physical barriers would prevent contact or ingestion of sediment or surface water.	Cap would need to be maintained against breach through dredging, tree falls, burrowing animals. Site management and perimeter controls are required.	When designed and implemented properly, effectively eliminates exposure and prevents transport, permanently removes some habitat , RAOs are achieved in short time frame.	When designed and implemented properly, effectively reduces exposure and prevents transport, permanently removes some habitat , RAOs are achieved in short time frame.	When designed and implemented properly, effectively eliminates exposure and prevents transport. Permanently removes some habitat. RAOs are achieved in short time frame. Cap would need to be maintained against breach through excavation, tree falls, and burrowing animals. Site management and perimeter controls are required.
(4) Reduction of Toxicity, Mobility, or Volume of Contamination						
Amount of Hazardous Materials Destroyed, Treated, or Removed	None	None	None	Amendment will remove most bio-available contamination and reduce overall exposure risks.	Dredging will remove sediment exceeding allowable risks at the impacted area.	Dredging and capping will remove sediment exceeding allowable risks at the impacted area and reduce surface exposure risks.
Degree of Expected Reductions in Toxicity, Mobility, or Volume	None	None	Reduced mobility due to surface exposure. Potential risk remains with surface water and sediment bed mobility transport.	Significant reductions of mobility of contaminants expected.	Contaminated sediment will be disposed of on-site using stabilization amendments to reduce or eliminate the risk of toxic mobility.	Contaminated sediment will be disposed of on-site using stabilization amendments to reduce or eliminate the risk of toxic mobility.
Irreversible Treatment?	No	No	No	Yes	Yes	Yes
Residuals Remaining After Treatment	Yes	Yes	Yes.	Yes, particularly if impropper amounts of amendments are utilized or impropper mixing.	Trace residuals may remain after dredging is complete. Contaminated sediment will remain when landfilled on-site.	Residual contamination present below cap. Contaminated sediment will also remain when landfilled on-site.
(5) Short-Term Impact and Effectiveness						
Community Protection	There is no action and therefore, no additional risk to the community.	There is no physical action and therefore, no additional risk to the community.	As no material will leave the site, only risks due to constuction access, dust, etc are present. No risks to public from contaminted materials.	Increased short-term risks to the public during transport of equipment and materials to and from site. Dust/residuals will be produced during amendment activities. These can be mitigated through standard construction practices. Some adjacent habitats will be temporarily disturbed.	Increased short-term risks to the public during dredging activities and transport of equipment and materials to site. Dust/residuals will be produced during dredging/amendment activities. These can be mitigated through standard construction practices. Some adjacent habitats will be temporarily disturbed.	Increased short-term risks to the public during dredging activities and transport of equipment and materials to and from site. Dust/residuals will be produced during dredging/amendment activities. These can be mitigated through standard construction practices. Some adjacent habitats will be temporarily disturbed.
Worker Protection	There is no action and therefore no workers will be present on site.	There is no physical action and therefore, no workers will be present at the site	Work around heavy equipment carries potential risk to workers. Risks can be minimized by implementing health and safety controls.	Workers can potentially be exposed to contaminated media during amendment activities. Work around heavy equipment carries potential risk to workers. Risks can be minimized by implementing health and safety controls.	Workers can potentially be exposed to contaminated media during dredging activities. Work around heavy equipment carries potential risk to workers. Risks can be minimized by implementing health and safety controls.	Workers can potentially be exposed to contaminated media during dredging activities. Work around heavy equipment carries potential risk to workers. Risks can be minimized by implementing health and safety controls.
Environmental Impacts	There are no short-term impacts associated with this alternative.	There are no short-term impacts associated with this alternative.	Wastes produced will include contaminated PPE. Wastes will be managed in compliance with ARARs. Limited short term environmental impacts associated with implementation and air emissions. Significant impacts to stream, wetland and riparian habitats expected.	Wastes produced will include contaminated PPE. Wastes will be managed in compliance with ARARs. Limited short term environmental impacts associated with implementation and air emissions. Significant impacts to stream, wetland and riparian habitats expected.	Wastes produced will include contaminated PPE. Wastes will be managed in compliance with ARARs. Limited short term environmental impacts associated with implementation and air emissions. Significant impacts to stream, wetland and riparian habitats expected.	Wastes produced will include contaminated PPE. Wastes will be managed in compliance with ARARs. Limited short term environmental impacts associated with implementation and air emissions. Significant impacts to stream, wetland and riparian habitats expected.
Time Until Action Complete (Field Construction Time)	No action taken	Approximately 2 months for the deed restriction to be in effect.	Approximately 24 Months	Approximately 24 Months	Approximately 12 Months	Approximately 12 Months
(6) Implementability						
Ability to Construct and Operate	Not Applicable.	Institutional controls can be implemented, and have been used nationally.	Capping in riparian / stream or floodplain areas must be designed to resist transport. Able to be implemnted with specialty contractors and appropriate equipment.	Amendments are utilized nationally and proven effective.	Dredging and landfilling alternatives can be implemented, and have been used nationally.	Dredging, capping and landfilling are proven alternatives and utilized nationally.
Monitoring Requirements	Not Applicable.	Not Applicable.	Perimeter monitoring and initial characterization recommended. Cap must be monitored for stability.	Sediment shall be sampled and analyzed to confirm reduction of available contaminants.	Sediment shall be sampled and analyzed to confirm removal of impacted area.	Perimeter monitoring and initial characterization recommended. Cap must be monitored for stability.
Availability of Equipment and Specialists	Not Applicable.	Specialists are available for the implementation of institutional controls.	Equipment and specialists are available for the implementation of all of these technologies.			
Ability to Obtain Approvals and Coordinate with Other Agencies	Not Applicable.	Ability to obtain approvals and coordinate with other agencies assumed to be possible.	Ability to obtain approvals and coordinate with other agencies assumed to be possible.			
(7) Cost Effectiveness						
Cost	**$0**	**$87,000**	**$2,889,000**	**$2,334,000**	**$4,638,000**	**$3,887,000**
(8) Land Use						
	NA	Restricted	Unrestricted	Unrestricted	Unrestricted	Unrestricted
(9) Community Acceptance						
	TBD	TBD	TBD	TBD	TBD	TBD

APPENDIX A

TECHNOLOGY SCREENING LETTER AND COMMENTS

New York State Department of Environmental Conservation
Division of Environmental Remediation, Region 9
270 Michigan Avenue, Buffalo, New York 14203-2915
Phone: (716) 851-7220 • **Fax:** (716) 851-7226
Website: www.dec.ny.gov

Joe Martens
Commissioner

July 13, 2011

Mr. Robert Casey
6712 Brooklawn Parkway - Suite 104
Syracuse, New York 13211-2158

Dear Mr. Casey:

Remedial Action Objectives and Feasibility Study
Technology Screening
Old Upper Mountain Road Site, Site No. 932112
Lockport (C), Niagara County

The New York State Departments of Environmental Conservation (NYSDEC) and Health (NYSDOH) have completed a detailed review of the draft Remedial Action Objectives and Feasibility Study Technology Screening letter submitted to the NYSDEC via e-mail on June 21, 2011. This letter summarizes the results of the Remedial Investigation (RI) and Supplemental RI for the three operable units of the site, discusses the remedial action objectives for each contaminated media identified, and presents the initial screening of remedial alternatives. The initial screening of alternatives, and the alternatives retained for evaluation in the Feasibility Study (FS), appears reasonably given the physical constraints of the site. The Departments, however, have a number of comments concerning the Technology Screening Matrix tables. These comments are summarized as follows:

1. **Table 2, Soil/Fill, Monitored Natural Attenuation, Page 1:** This technology is generally associated with volatile organic compounds. For soil/fill at the Old Upper Mountain Road Site, is this technology being evaluated for metals?

2. **Table 2, Groundwater, Page 2:** If MNA was evaluated and retained for soil/fill and sediment, should it be evaluated and retained for groundwater?

3. **Table 2, Sediment, Page 3:**

   A. **Monitored Natural Attenuation:** For sediment at the Old Upper Mountain Road Site, is this technology being evaluated for metals?

B. **Containment:** It is not clear from the information given why some of the containment options were not retained for evaluation. For example, a multi-media cap was retained while a thin layer cap was not. From the description given, it appears to us that a thin layer cap would be easier and less disruptive to construct than a multi-media cap.

C. **Removal:** For the Eighteenmile Creek Corridor Site, the selected ROD remedy for creek sediment included excavation following creek diversion. This alternative was selected, in part, due to the difficulties in dredging a shallow, rocky creek. A similar alternative should be evaluated for Gulf Creek sediment.

D. **Dredged Material Handling and Treatment:** It is not clear from the information given why ex-situ chemical treatment was not retained for evaluation.

4. **Table 3:** The text for Alternative 4 on page 1 and Alternative 2 on page 2 is cut-off.

Should you have any questions regarding any of the above, please feel free to contact me at (716) 851-7220.

Sincerely yours,

Glenn M May

Glenn M. May, CPG
Environmental Geologist II

GMM:sz

ec: Mr. Gregory Sutton, NYSDEC, Region 9
Mr. Matthew Forcucci, NYSDOH, Buffalo

APPENDIX B

COST ESTIMATES

OU1

Option		Total NPV Cost	Capital Cost	Lifetime Monitoring	Lifetime O&M	Time to Complete	
1B	Site Management	$160,000	$99,000	$61,490	NA	2	months
2	Complete Removal (Excavation) and Disposal Off-site (Commercial)	$43,609,000	$43,609,000	NA	NA	40	months
3	Ex situ Stabilization and Disposal Off-site	$40,509,000	$40,509,000	NA	NA	40	months
4	Partial Removal, Landfill Capping with a Part 360 Cap, and Groundwater Monitoring	$26,975,000	$26,552,000	423300	NA	21	months
5	Re-grading, Landfill Capping with a Part 360 Cap, and Groundwater Monitoring	$5,974,000	$5,693,000	$280,600	NA	9	months
6	Re-grading, Landfill Capping with a Soil Cap, and Groundwater Monitoring	$4,208,000	$3,927,000	$280,600	NA	9	months
7	Partial Removal (Deeper Fill) and Off-site Disposal, with In Situ Stabilization (Shallow Fill 0-14 ft Depth)	$41,721,000	$41,500,000	$221,100	NA	34	months
8	Partial Removal (Deeper Fill) with Ex Situ Stabilization and On-site Disposal, with In Situ Stabilization (Shallow Fill 0-14 ft Depth)	$23,557,000	$23,336,000	$221,100	NA	43	months

REMEDIAL ALTERNATIVE	LOCATION	MEDIA	Estimated Cost to Implement	$160,000
Soil/Fill Material Alternative 1B **Site Management**	**Old Upper Mountain Road** **Lockport, NY**	**Soil/Fill - OU1**	**Construction Time:** **Operation Time:** **Post Remediation Monitoring**	**2** months **-** months **0** years

Description	Data Source (Means[1] or Other)	Quantity Amount	Quantity Unit	Material Unit Cost	Material Total Cost	Labor Unit Cost	Labor Total Cost	Equipment Unit Cost	Equipment Total Cost	Combined Unit Costs Unit Cost	Option Total Cost
REMEDIAL ACTION		**TOTAL CAPITAL COST (totals rounded to nearest thousand)**									**$99,000**
Site Management Activities		**1**			**$0**		**$0**		**$0**	**$114,199**	**$ 84,199**
Surveyor- monument installation		1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 10,000	$ 10,000
Lawyer		1	ls				$ -		$ -	$ 15,000	$ 15,000
Fence, chain link, 9 ga. Wire, in concrete, 6' H	*32 31 13.20 0200*	2,100	lf	$ 19.64	$ 41,244	$ 4.55	$ 9,555	$ 0.99	$ 2,079	$ -	$ 52,878
Double swing gates, 6' H, 12' open, in concrete	*32 31 13.20 5060*	2	Opng	$ 245.25	$ 491	$ 341.36	$ 683	$ 74.03	$ 148	$ -	$ 1,321
Signage, assume small signs attached to perimeter fencing		1.00	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,000	$ 5,000
Professional/Technical Services											**$ 14,314**
5% Project Management										$84,199	$ 4,210
6% Remedial Design											$ 5,052
6% Construction Management											$ 5,052
LONG TERM ANNUAL MONITORING AND MAINTENANCE								**ANNUAL LTM COST (YRS 1-30)**			**$ 4,000**
								LIFETIME LTM (NPV)			**$61,490**
Monitoring and Maintenance											
Site Monitoring											**$ 4,398**
Groundwater sampling for 1 event - Includes collection of field parameters		5	well	$ -	$ -	$ 340	$ 1,700.00	$ 92	$ 458.13	$ -	$ 2,158
Materials		1	event	$ 50	$ 50	$ -	$ -	$ -	$ -	$ -	$ 50
Mobilization/Demobilization of Inspector		1	event	$ -	$ -	$ -	$ -	$ -	$ -	$ 680.00	$ 680
Reporting		6	hr	$0	$ -	$ 85	$ 510.00	$ -	$ -	$ -	$ 510
Maintenance- Fence Maintenance											
Repair fence	*Estimate*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,000.00	$ 1,000
Lifetime Long Term Monitoring (Net Present Value)											
30 Years of Semi-Annual Monitoring											
5% Discount Factor (per NYSDEC)											

TOTAL ESTIMATED NPV TECHNOLOGY COST (Capital + Lifetime O&M + Post Remediation Monitoring) **$160,000**

Assumptions:

Labor

Cost per hr	**$85**	
Weighted Average of city cost index (Buffalo, NY)	**101.4%**	
Inflation	**3%**	
Hours per working day	**10**	
workers per event	**2**	
hours travel per event	**5**	
for materials (gloves, notebooks, etc.)	**$50**	
	2	hrs/GW sample
	0.5	hrs/SW sample

Typical Rental Rates - Includes G&A and 10% Profit

Truck/SUV (1/2 ton or smaller)	**$70.74**	per day
Water Quality Analyzer	**$159.00**	per day
Water Level Meter	**$31.80**	per day
Submersible Pump	**$113.91**	per day
Generators: 220 Volt	**$82.68**	per day
Multi-gas meter	**$75.00**	

Analytical Costs

Metals	**$75.00**	per sample
VOCs	**$90.00**	per sample
	$85	Labor cost per hr

2	hrs/GW sample
0.5	hrs/SW sample
2	workers per event
5	hours travel per event
$50	for materials (gloves, notebooks, etc.)

REMEDIAL ALTERNATIVE	LOCATION	MEDIA	Estimated Cost to Implement	$43,609,000	
Soil/Fill Material Alternative 2 Complete Removal (Excavation) and Disposal Off-site (Commercial)	Old Upper Mountain Road Lockport, NY	Soil/Fill - OU1	Construction Time:	40	months
			Operation Time:	-	months
			Post Remediation Monitoring	0	years

		Quantities		Cost Breakdown (if available)						Combined Unit Costs	
Description	Data Source (Means[1] or Other)	Quantity Amount	Quantity Unit	Material Unit Cost	Material Total Cost	Labor Unit Cost	Labor Total Cost	Equipment Unit Cost	Equipment Total Cost	Unit Cost	Option Total Cost
REMEDIAL ACTION		**TOTAL CAPITAL COST (totals rounded to nearest thousand)**									**$43,609,000**
Construction Activities		**1**			**$767,619**		**$326,044**		**$234,326**	**$889,795**	**$32,592,606**
Pre-Design Characterization Study											
Driller											
Mob/Demob	*quote- SJB*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 874	$ 874
Geoprobe/Crew for Soil Borings	*quote- SJB*	41	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,273	$ 52,196
Sample Collection		410	hr	$ -	$ -	$ 85.00	$ 34,850	$ -	$ -		$ 34,850
Sample Analysis for TCLP Lead and Zinc	*Life Science Laboratories*	418	sample	$ -	$ -	$ -	$ -	$ -	$ -	$ 593	$ 248,075
Reporting	*Engineer's Estimate*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 20,000	$ 20,000
Site Preparation											
Utility Locator (based on recent bids)	*recent quote*	0.5	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,475	$ 1,238
Erosion & Sediment Control Plan		1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 30,000	$ 30,000
Stabilization Measures for Erosion and Sedimentation Control											
Silt Fence, 3' high, adverse conditions	*31 25 14.16 1000*	2,500	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.68	$ 1,700
Sewer Relocation											
Excavating Trench to install sewer pipe, 10' to 14' deep, 1.5 CY excavator, wit	*31 23 16.13 1000*	2,785	bcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 8.96	$ 24,958
PVC sewer pipe, 13' lengths, 18" diameter	*33 31 13.25 2300*	1,400	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 28.74	$ 40,236
Install manholes- concrete, precast, 4' ID, 10' deep	*33 49 13.10 0600 and 0700*	4	ea	$ 1,358.94	$ 5,436	$ 2,636.87	$ 10,547	$ 139.74	$ 559	$ -	$ 16,542
Supply and Transportation of NYS Certified Clean Back Fill Material	*Recent quote- ESG from Seven Springs*	2,698	cy	$ 28	$ 74,184	$ -	$ -	$ -	$ -	$ -	$ 74,184
Haul Road Upgrades											
Haul Road Upgrades, Roads. 8" gravel (From ravine to upper staging area)	*01 55 23.50 0100*	917	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 13.86	$ 12,705
Install Guard Rails along Haul Road, corr steel, steel box beam	*34 71 13.26 1120*	350	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 69.74	$ 24,409
Monitoring Well Abandonment	*recent quote- EnviroTrac*	276	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 22	$ 6,072
Cut and chip medium, trees to 12" dia.	*31 11 10.10 0200*	6	acre		$ -	$ 3,323	$ 19,939	$ 2,295	$ 13,769	$ -	$ 33,707
Stockpile Pad Construction											
Silt Fence	*31 25 13.10 1000*	1,000	lf	$ 0.23	$ 230	$ 0.45	$ 450	$ -	$ -	$ -	$ 680
30 mil HDPE Liner	*33 47 13.53 1100*	80,000	sf	$ 0.30	$ 24,000	$ 0.85	$ 68,000	$ -	$ -	$ -	$ 92,000
3/4" Gravel Fill (9")	*ECHOS 17 03 0300*	2,222	cy	$ 26.26	$ 58,349	$ 3.63	$ 8,066	$ 1.28	$ 2,839	$ -	$ 69,255
Sheetpiling Along RR Tracks (40' deep, drive, extract and salvage)	*31 41 16.10 1000*	509	ton	$ 551.66	$ 280,905	$ 263.83	$ 134,342	$ 305.97	$ 155,800	$ -	$ 571,047
Sheetpiling Along OUMR (20' deep, drive, extract and salvage)	*31 41 16.10 1600*	7,220	sf	$ 8.07	$ 58,265	$ 6.65	$ 48,013	$ 7.70	$ 55,594	$ -	$ 161,872
Excavation											
Community Air Monitoring (Dust)	*recent quote - Pine Environmental*	4	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 15,097.50	$ 60,390
Dust Control, Heavy, assume 10 days per month	*31 23 23.20 2510*	400	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,734.40	$ 693,760
Grading of embankment, by dozer	*31 23 23.20 2300*	228,850	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.82	$ 416,507
Soil-Excavator, hydraulic, crawler mtd. 3.5 CY cap = 350 CY/hr	*31 23 16.42 5500*	199,000	bcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.16	$ 230,840
34 CY off-road 20 min. wait 2,000 ft cycle	*31 23 23.20 6300*	228,850	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 3.22	$ 736,897
Haul Road Maintenance	*31 23 23.20 2600*	400	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,141.04	$ 456,416
Maintain Stockpile, 700HP Dozer, 50ft Haul	*31 23 16.46 6010*	199,000	bcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.68	$ 334,320
Excavator Loadout, 4.5 CY bucket, 80% fill factor	*31 23 16.43 4700*	228,850	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.14	$ 260,889
Spotter at Loadout	*31 23 23.20 2310*	4,000	hrs	$ -	$ -	$ -	$ -	$ -	$ -	$ 45.96	$ 183,840
Confirmation Soil Sampling											
Grab Samples- 12 per acre plus 20% QA/QC		86	sample	$ -	$ 50	$ 21	$ 1,836	$ 67	$ 5,765	$ -	$ 7,651
Lab Analyses - TAL Metals	*Life Science Laboratories*	86	sample	$ -	$ -	$ -	$ -	$ -	$ -	$ 82.50	$ 7,128
Hazardous Soil Disposal											
Soil Characterization Sampling (1 sample per 500 CY, per CWM)	*Life Science Laboratories*	398	sample	$ -	$ -	$ -	$ -	$ -	$ -	$593.48	$ 236,205
Hazardous Soil Disposal	*CWM*	119,400	ton	$ -	$ -	$ -	$ -	$ -	$ -	$ 140.00	$ 16,716,000
Transportation using dumps	*CWM*	119,400	ton	$ -	$ -	$ -	$ -	$ -	$ -	$ 19.50	$ 2,328,300
Demurrage (assume 1 hour per week of loading)	*CWM*	109	hour	$ -	$ -	$ -	$ -	$ -	$ -	$ 85.00	$ 9,226
Fuel Surcharge- 36% of Transportation	*CWM*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 838,188.00	$ 838,188
Non-Hazardous Soil Disposal											
Soil transportation and disposal	*Recent quote- ESG plus 10%*	179,100	ton	$ -	$ -	$ -	$ -	$ -	$ -	$ 37.68	$ 6,747,593
Backfill and Compaction											
Supply and Transportation of NYS Certified Clean Back Fill Material	*Recent quote- ESG from Seven Springs*	9,680	lcy	$ 28	$ 266,200	$ -	$ -	$ -	$ -	$ -	$ 266,200
Backfill 300HP Dozer, 150' haul	*31 23 23.14 5220*	9,680	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.20	$ 11,616
Finishing grading slopes, steep	*31 22 16.10 3310*	29,040	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.21	$ 6,098
Compacting backfill, 12" lift, 2 passes w/ vibrating roller	*31 23 23.23 5060*	8,417	ecy	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.20	$ 1,683
Site Restoration											
Topsoil	*Recent quote- ESG from Seven Springs*	9,680	cy	$ 45	$ 430,760	$ -	$ -	$ -	$ -	$ -	$ 430,760
Finishing grading slopes, gentle	*31 22 16.10 3300*	44,000	sy	$ -	$ -	$ 0.09	$ 3,960	$ 0.08	$ 3,520	$ -	$ 7,480
Utility mix, 7#/M.S.F., Hydro or air seeding, with mulch and fertilizer	*32 92 19.14 5400*	396	msf	$ 68.11	$ 26,972	$ 8.90	$ 3,524	$ 8.39	$ 3,322	$ -	$ 33,818
Fence, chain link, 9 ga. Wire, in concrete, 6' H	*32 31 13.20 0200*	2,100	lf	$ 19.64	$ 41,244	$ 4.55	$ 9,555	$ 0.99	$ 2,079	$ -	$ 52,878
Double swing gates, 6' H, 12' open, in concrete	*32 31 13.20 5060*	2	Opng	$ 245.25	$ 491	$ 341.36	$ 683	$ 74.03	$ 148	$ -	$ 1,321
Mobilization and Demobilization											**$ 509,872**
5% of Total Costs of Site Work, Treatment										$ 10,197,438	$ 509,872
Contingency											**$ 4,965,372**
15% of Total Construction Activities										$ 33,102,478	$ 4,965,372
Professional/Technical Services											**$ 5,540,743**
5% Project Management										$ 32,592,606	$ 1,629,630
6% Remedial Design											$ 1,955,556
6% Construction Management											$ 1,955,556
TOTAL ESTIMATED NPV TECHNOLOGY COST (Capital + Lifetime O&M + Post Remediation Monitoring)											**$43,609,000**

Assumptions:

Working condition is Safety Level: **D** **(Labor productivity: 82% ; Equipment productivity: 100%)**
Weighted Average of city cost index (Buffalo, NY) **101.4%** **(not applicable for costs derived from vendor quotes).**
Costs are loaded with a profit factor **10%**
Inflation **3%** per year
Estimated number of soil samples **72** samples; **1** times sampled; **20%** added for QA/QC samples; **0.25** hrs/sample; **1** worker sampling; Labor **$85** Cost per hr

Characterization Cost — Table A (per CWM) — **$593.48** per sample
Analytical cost — TAL Metals — **$75.00** per sample
For each sampling event, assumed: **$50** for materials (gloves, notebooks, etc.)

Disposal

Lead contaminated soil as a "listed" waste- incineration **$275** per ton; **119,400** tons soil hazardous (assume 43% hazardous)
22 tons per load; **5,427** loads for haz disposal
Lead contaminated soil as non-haz **$39.87** per ton; **179,100** tons soil for non-haz disposal; **8,141** loads for non-haz disposal

Concrete **3,300** lbs per cy; **-** tons concrete for disposal

Typical Rental Rates - Includes G&A and 10% Profit

Mini-Rae Survey Mode PID **$96.08** per day
Truck/SUV (1/2 ton or smaller) **$70.74** per day

Work day consists of: **10** hrs

20 loads per day
20 working days per month
10 hours per working day
3 months for pre-design characterization
3 months for site prep/restoration
34 months to completion
150 ft/day drilling

Excavation With Concrete and Asphalt:

Concrete and Asphalt: **0.0%** % of excavation volume
Excavation Area: **261,360** sf
Excavation Volume: **199,000** cy **228,850** lcy
Excavated Weight: **298,500** tons
Roll-off dumpster can hold approximately: **12** tons

Notes

sy	square yard	mo	month
cy	cubic yard	ls	lump sum
lcy	loose cubic yard	O&M	Operation and maintenance
bcy	bank cubic yard	H&S	Health and Safety
lf	linear feet		
sf	square feet		
msf	1,000 square feet		

REMEDIAL ALTERNATIVE	LOCATION	MEDIA	Estimated Cost to Implement	$40,509,000
Soil/Fill Material Alternative 3 **Ex situ Stabilization and Disposal Off-site**	**Old Upper Mountain Road** **Lockport, NY**	**Soil/Fill - OU1**	**Construction Time:** **Operation Time:** **Post Remediation Monitoring**	**40** months **-** months **0** years

Description	Data Source (Means[1] or Other)	Quantities: Quantity Amount	Quantities: Quantity Unit	Cost Breakdown (if available): Material Unit Cost	Material Total Cost	Labor Unit Cost	Labor Total Cost	Equipment Unit Cost	Equipment Total Cost	Combined Unit Costs: Unit Cost	Option Total Cost
REMEDIAL ACTION		**TOTAL CAPITAL COST (totals rounded to nearest thousand)**									**$40,509,000**
Construction Activities		**1**			**$767,799**		**$743,683**		**$425,854**	**$35,709**	**$30,645,843**
Pre-Design Pilot Study											
Pilot Study Treatment	*MT2 Estimate*	5	ton							$ 33.24	$ 166
Sample analysis	*MT2 Estimate*	1	sample							$ 550.00	$ 550
Site Preparation											
Utility Locator (based on recent bids)	*recent quote*	0.5	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,475.00	$ 1,238
Erosion & Sediment Control Plan	*Engineer's Estimate*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 30,000	$ 30,000
Stabilization Measures for Erosion and Sedimentation Control											
Silt Fence, 3' high, adverse conditions	*31 25 14.16 1000*	1,200	lf	$ 0.21	$ 252	$ 0.47	$ 564	$ -	$ -	$ -	$ 816
Sewer Relocation											
Excavating Trench to remove sewer pipe, 10' to 14' deep, 1.5 CY excavator	*31 23 16.13 1000*	2,113	bcy	$ -	$ -	$ 1.59	$ 3,360	$ 1.93	$ 4,079	$ -	$ 7,439
Pipe removal, sewer, no excavation, 18" diameter	*02 41 13.33 2930*	1,019	lf	$ -	$ -	$ 8.16	$ 8,315	$ 11.94	$ 12,167	$ -	$ 20,482
Remove existing manhole	*02 41 13.33 0020*	4	ea	$ -	$ -	$ 297.07	$ 1,188	$ 90.80	$ 363	$ -	$ 1,551
Excavating Trench to install sewer pipe, 10' to 14' deep, 1.5 CY excavator, with t	*31 23 16.13 1000*	2,785	bcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 8.96	$ 24,958
PVC sewer pipe, 13' lengths, 18" diameter	*33 31 13.25 2300*	1,400	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 28.74	$ 40,236
Install manholes- concrete, precast, 4' ID, 10' deep	*33 49 13.10 0600 and 0700*	4	ea	$ 1,358.94	$ 5,436	$ 2,636.87	$ 10,547	$ 9,742.50	$ 38,970	$ -	$ 54,953
Supply and Transportation of NYS Certified Clean Back Fill Material	*Recent quote- ESG from Seven Springs*	2,698	cy	$ 28	$ 74,184	$ -	$ -	$ -	$ -	$ -	$ 74,184
Stockpile Pad Construction											
Silt Fence	*31 25 13.10 1000*	1,000	lf	$ 0.23	$ 230	$ 0.45	$ 450	$ -	$ -	$ -	$ 680
30 mil HDPE Liner	*33 47 13.53 1100*	80,000	sf	$ 0.30	$ 24,000	$ 0.85	$ 68,000	$ -	$ -	$ -	$ 92,000
3/4" Gravel Fill (9")	*ECHOS 17 03 0300*	2,222	cy	$ 26.26	$ 58,349	$ 3.63	$ 8,066	$ 1.28	$ 2,839	$ -	$ 69,255
Haul Road Upgrades											
Haul Road Upgrades, Roads. 8" gravel (From ravine to upper staging area)	*01 55 23.50 0100*	917	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 13.86	$ 12,705
Install Guard Rails along Haul Road, corr steel, steel box beam	*34 71 13.26 1120*	350	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 69.74	$ 24,409
Monitoring Well Abandonment	*recent quote- EnviroTrac*	276	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 22.00	$ 6,072
Cut and chip medium, trees to 12" dia.	*31 11 10.10 0200*	6	acre	$ -	$ -	$ 3,323	$ 19,939	$ 2,295	$ 13,769	$ -	$ 33,707
Sheetpiling Along RR Tracks (40' deep, drive, extract and salvage)	*31 41 16.10 1000*	509	ton	$ 551.66	$ 280,905	$ 263.83	$ 134,342	$ 305.97	$ 155,800	$ -	$ 571,047
Sheetpiling Along OUMR (20' deep, drive, extract and salvage)	*31 41 16.10 1600*	7,220	sf	$ 8.06	$ 58,193	$ 6.65	$ 48,013	$ 7.70	$ 55,594	$ -	$ 161,800
Excavation											
Community Air Monitoring (Dust)	*recent quote - Pine Environmental*	40	mo	$ -	$ -	$ 55	$ 439,061	$ 3,420	$ 136,508		$ 575,569
Dust Control, Heavy	*31 23 23.20 2510*	399.15	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,734.40	$ 692,280
Grading of embankment, by dozer	*31 23 23.20 2300*	228,850	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.82	$ 416,507
Soil-Excavator, hydraulic, crawler mtd. 3.5 CY cap = 350 CY/hr	*31 23 16.42 5500*	199,000	bcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.16	$ 230,840
34CY off-road 20min. Wait 2,000ft cycle	*31 23 23.20 6300*	228,850	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 3.22	$ 736,897
Haul Road Maintenance	*31 23 23.20 2600*	399	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,141.04	$ 455,442
Maintain Stockpile, 700HP Dozer, 50ft Haul	*31 23 16.46 6010*	199,000	bcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.68	$ 334,320
Excavator Loadout, 4.5 CY bucket, 80% fill factor	*31 23 16.43 4700*	228,850	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.14	$ 260,889
Spotter at Loadout	*31 23 23.20 2310*	3,991	hrs	$ -	$ -	$ -	$ -	$ -	$ -	$ 45.96	$ 183,448
Confirmation Soil Sampling											
Grab Samples- 12 per acre plus 20% QA/QC		86	sample	$ -	$ 50	$ 21	$ 1,836	$ 67	$ 5,765	$ -	$ 7,651
Lab Analyses - TAL Metals	*Life Science Laboratories*	86	sample	$ -	$ -	$ -	$ -	$ -	$ -	$ 82.50	$ 7,128
EcoBond Treat											
Treat w/ EcoBond, load and dispose off-site	*MT2 est*	324,849	ton							$ 76.05	$ 24,704,766
Backfill and Compaction											
Supply and Transportation of NYS Certified Clean Back Fill Material	*Recent quote- ESG from Seven Springs*	9,680	lcy	$ 28	$ 266,200	$ -	$ -	$ -	$ -	$ -	$ 266,200
Backfill 300HP Dozer, 150' haul	*31 23 23.14 5220*	9,680	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.20	$ 11,616
Finishing grading slopes, steep	*31 22 16.10 3310*	29,040	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.21	$ 6,098
Compacting backfill, 12" lift, 2 passes w/ vibrating roller	*31 23 23.23 5060*	8,417	ecy	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.20	$ 1,683
Site Restoration											
Topsoil	*Recent quote- ESG from Seven Springs*	9,680	cy	$ 45	$ 430,760	$ -	$ -	$ -	$ -	$ -	$ 430,760
Finishing grading slopes, gentle	*31 22 16.10 3300*	44,000	sy	$ -	$ -	$ 0.09	$ 3,960	$ 0.08	$ 3,520	$ -	$ 7,480
Utility mix, 7#/M.S.F., Hydro or air seeding, with mulch and fertilizer	*32 92 19.14 5400*	396	msf	$ 68.11	$ 26,972	$ 8.90	$ 3,524	$ 8.39	$ 3,322	$ -	$ 33,818
Fence, chain link, 9 ga. Wire, in concrete, 6' H	*32 31 13.20 0200*	2,100	lf	$ 19.64	$ 41,244	$ 4.55	$ 9,555	$ 0.99	$ 2,079	$ -	$ 52,878
Double swing gates, 6' H, 12' open, in concrete	*32 31 13.20 5060*	2	Opng	$ 245.25	$ 491	$ 341.36	$ 683	$ 74.03	$ 148	$ -	$ 1,321
Mobilization and Demobilization											**$ 49,288**
5% of Total Costs of Site Work, Treatment										$985,769	$ 49,288
Contingency											**$ 4,604,270**
15% of Total Construction Activities										$30,695,131	$ 4,604,270
Professional/Technical Services											**$ 5,209,793**
5% Project Management										$30,645,843	$ 1,532,292
6% Remedial Design											$ 1,838,751
6% Construction Management											$ 1,838,751

TOTAL ESTIMATED NPV TECHNOLOGY COST (Capital + Lifetime O&M + Post Remediation Monitoring) **$40,509,000**

Assumptions:

Working condition is Safety Level:	**D**	**(Labor productivity:**	**82%**	**; Equipment productivity:**	**100%**	**)**	
Weighted Average of city cost index (Buffalo, NY)	**101.4%**	**(not applicable for costs derived from vendor quotes).**					
Costs are loaded with a profit factor	**10%**						
Inflation	**3%**	per year					Labor
Estimated number of soil samples	**72**	samples	**1**	times sampled	**0.25**	hrs/sample	**$85** Cost per hr
			20%	added for QA/QC samples	**1**	worker sampling	
Characterization Cost (Table A (per CWM))	**$593.48**	per sample					
Analytical cost (TCLP Metals)	**$75.00**	per sample					
For each sampling event, assumed:	**$50**	for materials (gloves, notebooks, etc.)					
Disposal							
Lead contaminated soil	**$275**	per ton	**119,400**	tons soil hazardous (assume 43% hazardous)			
			22	tons per load			
Lead contaminated soil as non-haz	**$39.87**	per ton	**179,100**	tons soil for non-haz disposal	**14,766**	loads for disposal	
					324,849	tons for treatment and disposal	
Concrete	**3,300**	lbs per cy	**-**	tons concrete for disposal			
Typical Rental Rates - Includes G&A and 10% Profit					1000	tons per day for treatment	
Mini-Rae Survey Mode PID	**$96.08**	per day			20	loads per day	
Truck/SUV (1/2 ton or smaller)	**$70.74**	per day			20	working days per month	
					10	hours per working day	
Work day consists of:	**10**	hrs			3	months for site prep/restoration	
					37	months to completion	

Excavation With Concrete and Asphalt:

Concrete and Asphalt:	**0.0%**	% of excavation volume		
Excavation Area:	**261,360**	sf		
Excavation Volume:	**199,000**	cy	**228,850**	lcy
Excavated Weight:	**298,500**	tons		
Roll-off dumpster can hold approximately:	**12**	tons		

Notes

sy	square yard	mo	month
cy	cubic yard	ls	lump sum
lcy	loose cubic yard	O&M	Operation and maintenance
bcy	bank cubic yard	H&S	Health and Safety
lf	linear feet		
sf	square feet		
msf	1,000 square feet		

REMEDIAL ALTERNATIVE	LOCATION	MEDIA	Estimated Cost to Implement	$26,975,000	
Soil/Fill Material Alternative 4 Partial Removal, Landfill Capping with a Part 360 Cap, and Groundwater Monitoring	Old Upper Mountain Road Lockport, NY	Soil/Fill - OU1	Construction Time:	21	months
			Operation Time:	-	months
			Post Remediation Monitoring	30	years

Description	Data Source (Means[1] or Other)	Quantities: Quantity Amount	Quantity Unit	Cost Breakdown (if available): Material Unit Cost	Material Total Cost	Labor Unit Cost	Labor Total Cost	Equipment Unit Cost	Equipment Total Cost	Combined Unit Costs: Unit Cost	Option Total Cost
REMEDIAL ACTION		**TOTAL CAPITAL COST (totals rounded to nearest thousand)**									**$26,552,000**
Construction Activities		**1**			**$947,482**		**$350,716**		**$166,740**	**$473,433**	**$ 19,387,715**
Pre-Design Characterization Study											
Driller											
Mob/Demob	*quote- SJB*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 800	$ 800
Geoprobe/Crew for Soil Borings	*quote- SJB*	21	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,200	$ 25,200
Sample Collection		210	hr	$ -	$ -	$85	$ 17,850	$ -	$ -	$0	$ 17,850
Sample Analysis for TCLP Lead and Zinc	*Life Science Laboratories*	209	sample	$ -	$ -	$ -	$ -	$ -	$ -	$ 330	$ 68,970
Reporting	*Engineer's Estimate*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 15,000	$ 15,000
Site Preparation				$ -	$ -	$ -	$ -	$ -	$ -	$0	$ -
Utility Locator (based on recent bids)	*recent quote*	0.5	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,475.00	$ 1,238
Erosion & Sediment Control Plan		1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 30,000	$ 30,000
Stabilization Measures for Erosion and Sedimentation Control											
Silt Fence, 3' high, adverse conditions	*31 25 14.16 1000*	1,200	lf	$ 0.21	$ 252	$ 0.47	$ 564	$ -	$ -	$ -	$ 816
Sewer Relocation											
Excavating Trench to remove sewer pipe, 10' to 14' deep, 1.5 CY excavator	*31 23 16.13 1000*	2,113	bcy	$ -	$ -	$ 1.59	$ 3,360	$ 1.93	$ 4,079	$ -	$ 7,439
Pipe removal, sewer, no excavation, 18" diameter	*02 41 13.33 2930*	1,019	lf	$ -	$ -	$ 8.16	$ 8,315	$ 11.94	$ 12,167	$ -	$ 20,482
Remove existing manhole	*02 41 13.33 0020*	4	ea	$ -	$ -	$ 297.07	$ 1,188	$ 90.80	$ 363	$ -	$ 1,551
Excavating Trench to install sewer pipe, 10' to 14' deep, 1.5 CY excavator, with t	*31 23 16.13 1000*	2,785	bcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 8.96	$ 24,958
PVC sewer pipe, 13' lengths, 18" diameter	*33 31 13.25 2300*	1,400	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 28.74	$ 40,236
Install manholes- concrete, precast, 4' ID, 10' deep	*33 49 13.10 0600 and 0700*	4	ea	$ 1,358.94	$ 5,436	$ 2,636.87	$ 10,547	$ 14,938.50	$ 59,754	$ -	$ 75,737
Supply and Transportation of NYS Certified Clean Back Fill Material	*Recent quote- ESG from Seven Springs*	2,698	cy	$ 28	$ 74,184	$ -	$ -	$ -	$ -	$ -	$ 74,184
Haul Road Upgrades											
Haul Road Upgrades, Roads. 8" gravel (From ravine to upper staging area)	*01 55 23.50 0100*	917	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 13.86	$ 12,705
Install Guard Rails along Haul Road, corr steel, steel box beam	*34 71 13.26 1120*	350	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 69.74	$ 24,409
Monitoring Well Abandonment	*recent quote- EnviroTrac*	240	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 22.00	$ 5,280
Stockpile Pad Construction											
Silt Fence	*31 25 13.10 1000*	1,000	lf	$ 0.23	$ 230	$ 0.45	$ 450	$ -	$ -	$ -	$ 680
30 mil HDPE Liner	*33 47 13.53 1100*	80,000	sf	$ 0.30	$ 24,000	$ 0.85	$ 68,000	$ -	$ -	$ -	$ 92,000
3/4" Gravel Fill (9")	*ECHOS 17 03 0300*	2,222	cy	$ 26.26	$ 58,349	$ 3.63	$ 8,066	$ 1.28	$ 2,839	$ -	$ 69,255
Excavation											
Community Air Monitoring (Dust)	*recent quote - Pine Environmental*	21	mo	$ -	$ -	$ 55	$ 226,750	$ 3,420	$ 70,499	$ -	$ 297,249
Dust Control, Heavy, assumes 10 days per working month	*31 23 23.20 2510*	206	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,734.40	$ 357,523
Grading of embankment, by dozer	*31 23 23.20 2300*	190,133	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.82	$ 346,043
Soil-Excavator, hydraulic, crawler mtd. 3.5 CY cap = 350 CY/hr	*31 23 16.42 5500*	165,333	bcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.16	$ 191,787
34CY off-road 20min. Wait 2,000ft cycle	*31 23 23.20 6300*	190,133	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 3.22	$ 612,229
Haul Road Maintenance	*31 23 23.20 2600*	206	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,141.04	$ 235,210
Maintain Stockpile, 700HP Dozer, 50ft Haul	*31 23 16.46 6010*	103,333	bcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.68	$ 173,600
Excavator Loadout, 4.5 CY bucket, 80% fill factor	*31 23 16.43 4700*	118,833	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.14	$ 135,470
Spotter at Loadout	*31 23 23.20 2310*	2,061.36	hrs	$ -	$ -	$ -	$ -	$ -	$ -	$ 45.96	$ 94,740
Hazardous Soil Disposal											
Soil Characterization Sampling (1 sample per 500 CY, per CWM)	*Life Science Laboratories*	83	sample	$ -	$ -	$ -	$ -	$ -	$ -	$ 593.48	$ 49,061
Hazardous Soil Disposal	*CWM*	62,000	ton	$ -	$ -	$ -	$ -	$ -	$ -	$ 140.00	$ 8,680,000
Transportation using dumps	*CWM*	62,000	ton	$ -	$ -	$ -	$ -	$ -	$ -	$ 19.50	$ 1,209,000
Demurrage (assume 1 hour per week of loading)	*CWM*	56	hour	$ -	$ -	$ -	$ -	$ -	$ -	$ 85.00	$ 4,791
Fuel Surcharge- 36% of Transportation	*CWM*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 435,240.00	$ 435,240
Non-Hazardous Soil Disposal											
Soil transportation and disposal	*Recent quote- ESG plus 10%*	93,000	ton	$ -	$ -	$ -	$ -	$ -	$ -	$37.68	$ 3,503,775
Capping 3:1 Side Slope (Ravine)											
Finishing grading slopes, steep	*31 22 16.10 3310*	17,000	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.21	$ 3,570
Polymeric Liner Anchor Trench 3'x1.5' (level B)	*ECHOS 2006 33 08 0503*	2,300	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.87	$ 4,299
Deploy 10oz/sy mil Nonwoven Geotextile (level C)	*ECHOS 2006 33 08 0533*	17,000	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 2.40	$ 40,766
60 mil HDPE Liner (level C)	*ECHOS 2006 33 08 0572*	153,000	sf	$ -	$ -	$ -	$ -	$ -	$ -	$ 4.02	$ 615,094
Drainage Netting, Geotextile Fabric Heat Bonded (2 sides) (level E)	*ECHOS 2006 33 08 0513*	153,000	sf	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.67	$ 102,516
Supply and Transportation of NYS Certified Clean Back Fill Material	*Recent quote- ESG from Seven Springs*	11,333	cy	$ 28	$ 311,667	$ -	$ -	$ -	$ -	$ -	$ 311,667
Spreading and Compaction of General Fill	*ECHOS 2006 17 03 0422*	11,333	cy	$ -	$ -	$ -	$ -	$ -	$ -	$ 9.12	$ 103,382
Topsoil	*Recent quote- ESG from Seven Springs*	2,833	cy	$ 45	$ 126,083	$ -	$ -	$ -	$ -	$ -	$ 126,083
Spreading Topsoil 6" Lifts	*ECHOS 2006 18 05 0301*	2,833	cy		$ -	$ -	$ -	$ -	$ -	$ 9.43	$ 26,711
Utility mix, 7#/M.S.F., Hydro or air seeding, with mulch and fertilizer	*32 92 19.14 5400*	153	msf	$ 68.11	$ 10,421	$ 8.90	$ 1,362	$ 8.39	$ 1,284	$ -	$ 13,066
Capping											
Finishing grading slopes, gentle	*31 22 16.10 3300*	12,778	sy	$ -	$ -	$ 0.09	$ 1,150	$ 0.08	$ 1,022	$ -	$ 2,172
Deploy 10oz/sy mil Nonwoven Geotextile (level C)	*ECHOS 2006 33 08 0533*	12,778	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 2.40	$ 30,641
60 mil HDPE Liner (level C)	*ECHOS 2006 33 08 0572*	115,000	sf	$ -	$ -	$ -	$ -	$ -	$ -	$ 4.02	$ 462,326
Drainage Netting, Geotextile Fabric Heat Bonded (2 sides) (level E)	*ECHOS 2006 33 08 0513*	115,000	sf	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.67	$ 77,054
Gas Vents	*Recent quote- Modern Environmental*	7	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,715.58	$ 12,009
Supply and Transportation of NYS Certified Clean Back Fill Material	*Recent quote- ESG from Seven Springs*	8,519	cy	$ 28	$ 234,259	$ -	$ -	$ -	$ -	$ -	$ 234,259
Spreading and Compaction of General Fill	*ECHOS 2006 17 03 0422*	8,519	cy	$ -	$ -	$ -	$ -	$ -	$ -	$ 9.12	$ 77,705
Topsoil	*Recent quote- ESG from Seven Springs*	2,130	cy	$ 45	$ 94,769	$ -	$ -	$ -	$ -	$ -	$ 94,769
Spreading Topsoil 6" Lifts	*ECHOS 2006 18 05 0301*	2,130	cy		$ -	$ -	$ -	$ -	$ -	$ 9.43	$ 20,077
Utility mix, 7#/M.S.F., Hydro or air seeding, with mulch and fertilizer	*32 92 19.14 5400*	115	msf	$ 68.11	$ 7,833	$ 8.90	$ 1,024	$ 8.39	$ 965	$ -	$ 9,821
											$ -
Site Restoration											$ -
Fence, chain link, 9 ga. Wire, in concrete, 6' H	*32 31 13.20 0200*	2,100	lf	$ 19.64	$ 41,244	$ 4.55	$ 9,555	$ 0.99	$ 2,079	$ -	$ 52,878
Double swing gates, 6' H, 12' open, in concrete	*32 31 13.20 5060*	2	Opng	$ 245.25	$ 491	$ 341.36	$ 683	$ 74.03	$ 148	$ -	$ 1,321
Monitoring Well Installation	*recent quote- EnviroTrac*	330	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 94.00	$ 31,020
Mobilization and Demobilization											**$ 834,918**
5% of Total Costs of Site Work, Treatment										$16,698,365	$ 834,918
Contingency											**$ 3,033,395**
15% of Total Construction Activities										$20,222,633	$ 3,033,395
Professional/Technical Services											**$ 3,295,912**
5% Project Management										$19,387,715	$ 969,386
6% Remedial Design											$ 1,163,263
6% Construction Management											$ 1,163,263

REMEDIAL ALTERNATIVE	LOCATION	MEDIA	Estimated Cost to Implement	$26,975,000
Soil/Fill Material Alternative 4 **Partial Removal, Landfill Capping with a Part 360 Cap, and Groundwater Monitoring**	**Old Upper Mountain Road** **Lockport, NY**	**Soil/Fill - OU1**	**Construction Time:**	21 months
			Operation Time:	- months
			Post Remediation Monitoring	30 years

Description	Data Source (Means[1] or Other)	Quantities: Quantity Amount	Quantity Unit	Cost Breakdown (if available): Material Unit Cost	Material Total Cost	Labor Unit Cost	Labor Total Cost	Equipment Unit Cost	Equipment Total Cost	Combined Unit Costs: Unit Cost	Option Total Cost
LONG TERM ANNUAL MONITORING AND MAINTENANCE									**ANNUAL LTM COST (YRS 1-5)**		**$34,000**
									ANNUAL LTM COST (YRS 6-30)		**$25,000**
									LIFETIME LTM (NPV)		**$423,300**
Monitoring, Sampling, Testing and Analysis (Per Event)											
Assume 80% of combined sampling event for OU1 and OU3											$8,947
Site Monitoring											
Groundwater sampling for 1 event - Includes collection of field parameters		5	well	$ -	$ -	$ 340	$ 1,700.00	$ 92	$ 458.13	$ -	$2,158
Surface water sampling for 1 event		4	samples			$ 85	$ 340.00	$ -	$ -	$ -	$340
Materials		1	event	$ 40	$ 40	$ -	$ -	$ -	$ -	$ -	$40
Mobilization/Demobilization of Field Sampling Crew		1	event	$ -	$ -	$ -	$ -	$ -	$ -	$ 680.00	$680
Reporting		40	hr	$85	$ 3,400.00	$ -	$ -	$ -	$ -	$ -	$3,400
monitoring event		1	ea	$ -	$ -	$340	$ 340.00	$75.00	$ 75.00	$ -	$415
Laboratory analysis											
Metals and VOCs, plus 20% QA/QC	*Life Science Laboratories*	11	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 174.00	$1,914
Maintenance- Cap Maintenance											
Mowing brush, tractor with rotary mower, Medium density 2x per year	*32 01 90.19 1670*	153	msf	$ -	$ -	$ 28.51	$ 4,362	$ 24.74	$ 3,786	$ -	$8,147
Lifetime Long Term Monitoring (Net Present Value)											
5 Years of Semi-Annual Monitoring											
25 Years of Annual Monitoring											
5% Discount Factor (per NYSDEC)											

TOTAL ESTIMATED NPV TECHNOLOGY COST (Capital + Lifetime O&M + Post Remediation Monitoring) **$26,975,000**

Assumptions:

- Working condition is Safety Level: **D** **(Labor productivity: 82% ; Equipment productivity: 100%)**
- Weighted Average of city cost index (Buffalo, NY) **101.4%** **(not applicable for costs derived from vendor quotes).**
- Costs are loaded with a profit factor **10%**
- Inflation **3%** per year

Estimated number of soil samples **72** samples; **1** times sampled; **20%** added for QA/QC samples; **0.25** hrs/sample; **1** worker sampling; Labor **$85** Cost per hr

- Characterization Cost — Table A (per CWM) — **$593.48** per sample
- Analytical cost — TCLP Metals — **$75.00** per sample
- For each sampling event, assumed: **$50** for materials (gloves, notebooks, etc.)

Disposal

- Lead contaminated soil as a "listed" waste- incineration **$275** per ton; **62,000** tons soil hazardous (assume 43% hazardous); **22** tons per load; **2,818** loads for haz disposal
- Lead contaminated soil as non-haz **$39.87** per ton; **93,000** tons soil for non-haz disposal; **4,227** loads for non-haz disposal
- Concrete **3,300** lbs per cy; **-** tons concrete for disposal

Typical Rental Rates - Includes G&A and 10% Profit **180** lb/cf iron filings

- Mini-Rae Survey Mode PID **$96.08** per day
- Truck/SUV (1/2 ton or smaller) **$70.74** per day

Iron Filings change-out Assumptions

- 400 cy/day iron filings changeout
- #REF! days for iron filing removal
- 3 workers for iron filing removal

Disposal Assumptions

- 20 loads per day
- 20 working days per month
- 10 hours per working day
- 3 months for site prep/restoration
- 18 months to completion
- 150 ft/day

Work day consists of: **10** hrs

Excavation:

- Concrete and Asphalt: **0.0%** % of excavation volume
- Excavation Area: **261,360** sf
- Excavation Volume: **165,333** cy; **190,133** lcy
- Excavated Weight: **248,000** tons
- Roll-off dumpster can hold approximately: **12** tons
- Volume fill remaining onsite **62,000** cy

Groundwater Monitoring

Typical Rental Rates - Includes G&A and 10% Profit

- Truck/SUV (1/2 ton or smaller) **$70.74** per day
- Water Quality Analyzer **$159.00** per day
- Water Level Meter **$31.80** per day
- Submersible Pump **$113.91** per day
- Generators: 220 Volt **$82.68** per day
- Multi-gas meter **$75.00**

Analytical Costs

- Metals **$75.00** per sample
- VOCs **$90.00** per sample
- **2** hrs/GW sample; **$85** Labor cost per hr
- **0.5** hrs/SW sample
- **2** workers per event
- **5** hours travel per event
- **$50** for materials (gloves, notebooks, etc.)

Notes

sy	square yard	mo	month
cy	cubic yard	ls	lump sum
lcy	loose cubic yard	O&M	Operation and maintenance
bcy	bank cubic yard	H&S	Health and Safety
lf	linear feet		
sf	square feet		
msf	1,000 square feet		

REMEDIAL ALTERNATIVE	LOCATION	MEDIA	Estimated Cost to Implement	$5,974,000
Soil/Fill Material Alternative 5 **Re-grading, Landfill Capping with a Part 360 Cap, and Groundwater Monitoring**	**Old Upper Mountain Road** **Lockport, NY**	**Soil/Fill - OU1**	Construction Time: 9 months Operation Time: - months Post Remediation Monitoring: 30 years	

Description	Data Source (Means[1] or Other)	Quantity Amount	Quantity Unit	Material Unit Cost	Material Total Cost	Labor Unit Cost	Labor Total Cost	Equipment Unit Cost	Equipment Total Cost	Combined Unit Costs: Unit Cost	Option Total Cost
REMEDIAL ACTION		**TOTAL CAPITAL COST (totals rounded to nearest thousand)**									**$5,693,000**
Construction Activities		**1**			**$983,371**		**$292,189**		**$147,220**	**$37,311**	**$ 4,256,899**
Site Preparation				$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Utility Locator (based on recent bids)	*recent quote*	0.5	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,475.00	$ 1,238
Erosion & Sediment Control Plan		1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 30,000	$ 30,000
Stabilization Measures for Erosion and Sedimentation Control											
Silt Fence, 3' high, adverse conditions	*31 25 14.16 1000*	1,200	lf	$ 0.21	$ 252	$ 0.47	$ 564	$ -	$ -	$ -	$ 816
Sewer Relocation											
Excavating Trench to remove sewer pipe, 10' to 14' deep, 1.5 CY excavator	*31 23 16.13 1000*	2,113	bcy	$ -	$ -	$ 1.59	$ 3,360	$ 1.93	$ 4,079	$ -	$ 7,439
Pipe removal, sewer, no excavation, 18" diameter	*02 41 13.33 2930*	1,019	lf	$ -	$ -	$ 8.16	$ 8,315	$ 11.94	$ 12,167	$ -	$ 20,482
Remove existing manhole	*02 41 13.33 0020*	4	ea	$ -	$ -	$ 297.07	$ 1,188	$ 90.80	$ 363	$ -	$ 1,551
Excavating Trench to install sewer pipe, 10' to 14' deep, 1.5 CY excavator, with t	*31 23 16.13 1000*	2,785	bcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 8.96	$ 24,958
PVC sewer pipe, 13' lengths, 18" diameter	*33 31 13.25 2300*	1,400	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 28.74	$ 40,236
Install manholes- concrete, precast, 4' ID, 10' deep	*33 49 13.10 0600 and 0700*	4	ea	$ 1,358.94	$ 5,436	$ 2,636.87	$ 10,547	$ 14,938.50	$ 59,754	$ -	$ 75,737
Supply and Transportation of NYS Certified Clean Back Fill Material	*Recent quote- ESG from Seven Springs*	2,698	cy	$ 28	$ 74,184	$ -	$ -	$ -	$ -	$ -	$ 74,184
Haul Road Upgrades											
Haul Road Upgrades, Roads. 8" gravel (From ravine to upper staging area)	*01 55 23.50 0100*	917	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 13.86	$ 12,705
Install Guard Rails along Haul Road, corr steel, steel box beam	*34 71 13.26 1120*	350	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 69.74	$ 24,409
Monitoring Well Abandonment	*recent quote- EnviroTrac*	240	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 22.00	$ 5,280
Stockpile Pad Construction											
Silt Fence	*31 25 13.10 1000*	1,000	lf	$ 0.23	$ 230	$ 0.45	$ 450	$ -	$ -	$ -	$ 680
30 mil HDPE Liner	*33 47 13.53 1100*	80,000	sf	$ 0.30	$ 24,000	$ 0.85	$ 68,000	$ -	$ -	$ -	$ 92,000
3/4" Gravel Fill (9")	*ECHOS 17 03 0300*	2,222	cy	$ 26.26	$ 58,349	$ 3.63	$ 8,066	$ 1.28	$ 2,839	$ -	$ 69,255
Cut and chip medium, trees to 12" dia.	*31 11 10.10 0200*	6	acre	$ -	$ -	$ 3,323	$ 19,939	$ 2,295	$ 13,769	$ -	$ 33,707
Landfill Base Drainage Layer											
Removal of Sediment in Drainage Layer Area											
Soil-Excavator, hydraulic, crawler mtd. 2 CY cap = 165 CY/hr	*31 23 16.42 0260*	4,222.22	bcy	$ -	$ -	$ 0.65	$ 2,744	$ 1.03	$ 4,349	$ -	$ 7,093
12 CY truck, 15 mph average, cycle 2 miles, 10 min wait/ld/unld	*31 23 23.20 1218*	4,855.56	lcy	$ -	$ -	$ 1.83	$ 8,886	$ 3.11	$ 15,101		$ 23,986
Supply 6" perf pipe (used PVC cost)	*Recent quote*	1,125.00	lf		$ -		$ -	$ -	$ -	$ 14.54	$ 16,358
Supply and transport gravel for drainage layer, 13 cy load, 2 hr haul	*Engineer's Estimate*	4,222.22	cy	$ 8.50	$ 35,889	$ 13.07	$ 55,184	$ -	$ -	$ -	$ 91,073
Placement of gravel for drainage layer, 24" thickness	*Engineer's Estimate*	4,222.22	cy		$ -		$ -		$ -	$ 18.24	$ 77,013
Deploy 10oz/sy mil Nonwoven Geotextile (Level C)	*ECHOS 2006 33 08 0533*	6,333.33	sy		$ -		$ -		$ -	$ 2.40	$ 15,200
Excavation											
Community Air Monitoring (Dust)	*recent quote - Pine Environmental*	9	mo	$ -	$ -	$ 55	$ 101,409	$ 3,420	$ 31,529	$ -	$ 132,937
Dust Control, Heavy, assumes 10 days per working month	*31 23 23.20 2510*	92.19	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,734.40	$ 159,894
Grading of embankment, by dozer	*31 23 23.20 2300*	58,650	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.82	$ 106,743
Soil-Excavator, hydraulic, crawler mtd. 3.5 CY cap = 350 CY/hr	*31 23 16.42 5500*	51,000	bcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.16	$ 59,160
34CY off-road 20min. Wait 2,000ft cycle	*31 23 23.20 6300*	58,650	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 3.22	$ 188,853
Haul Road Maintenance	*31 23 23.20 2600*	92	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,141.04	$ 105,192
Maintain Stockpile, 700HP Dozer, 50ft Haul	*31 23 16.46 6010*	14,663	bcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.68	$ 24,633
Landfill Placement											
Excavator Loadout, 4.5 CY bucket, 80% fill factor	*31 23 16.43 4700*	58,650	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.14	$ 66,861
12 CY truck, 15 mph average, cycle 1 mile, 15 min wait/ld/unld	*31 23 23.20 1016*	58,650	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 3.38	$ 198,237
Compaction, riding, vibrating roller, 2 passes, 12" lifts	*31 23 23.23 5060*	51,000	ecy	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.26	$ 13,260
Finishing grading slopes, steep	*31 22 16.10 3310*	12,000	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.21	$ 2,520
Capping 3:1 Side Slope (Ravine)											
Finishing grading slopes, steep	*31 22 16.10 3310*	17,000	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.21	$ 3,570
Polymeric Liner Anchor Trench 3'x1.5' (level B)	*ECHOS 2006 33 08 0503*	2,300	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.87	$ 4,299
Deploy 10oz/sy mil Nonwoven Geotextile (level C)	*ECHOS 2006 33 08 0533*	17,000	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 2.40	$ 40,766
60 mil HDPE Liner (level C)	*ECHOS 2006 33 08 0572*	153,000	sf	$ -	$ -	$ -	$ -	$ -	$ -	$ 4.02	$ 615,094
Drainage Netting, Geotextile Fabric Heat Bonded (2 sides) (level E)	*ECHOS 2006 33 08 0513*	153,000	sf	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.67	$ 102,516
Supply and Transportation of NYS Certified Clean Back Fill Material	*Recent quote- ESG from Seven Springs*	11,333	cy	$ 28	$ 311,667	$ -	$ -	$ -	$ -	$ -	$ 311,667
Spreading and Compaction of General Fill	*ECHOS 2006 17 03 0422*	11,333	cy	$ -	$ -	$ -	$ -	$ -	$ -	$ 9.12	$ 103,382
Topsoil	*Recent quote- ESG from Seven Springs*	2,833	cy	$ 45	$ 126,083	$ -	$ -	$ -	$ -	$ -	$ 126,083
Spreading Topsoil 6" Lifts	*ECHOS 2006 18 05 0301*	2,833	cy		$ -	$ -	$ -	$ -	$ -	$ 9.43	$ 26,711
Utility mix, 7#/M.S.F., Hydro or air seeding, with mulch and fertilizer	*32 92 19.14 5400*	153	msf	$ 68.11	$ 10,421	$ 8.90	$ 1,362	$ 8.39	$ 1,284	$ -	$ 13,066
Capping											
Finishing grading slopes, gentle	*31 22 16.10 3300*	12,778	sy	$ -	$ -	$ 0.09	$ 1,150	$ 0.08	$ 1,022	$ -	$ 2,172
Deploy 10oz/sy mil Nonwoven Geotextile (level C)	*ECHOS 2006 33 08 0533*	12,778	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 2.40	$ 30,641
60 mil HDPE Liner (level C)	*ECHOS 2006 33 08 0572*	115,000	sf	$ -	$ -	$ -	$ -	$ -	$ -	$ 4.02	$ 462,326
Drainage Netting, Geotextile Fabric Heat Bonded (2 sides) (level E)	*ECHOS 2006 33 08 0513*	115,000	sf	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.67	$ 77,054
Gas Vents	*Recent quote- Modern Environmental*	7	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,715.58	$ 12,009
Supply and Transportation of NYS Certified Clean Back Fill Material	*Recent quote- ESG from Seven Springs*	8,519	cy	$ 28	$ 234,259	$ -	$ -	$ -	$ -	$ -	$ 234,259
Spreading and Compaction of General Fill	*ECHOS 2006 17 03 0422*	8,519	cy	$ -	$ -	$ -	$ -	$ -	$ -	$ 9.12	$ 77,705
Topsoil	*Recent quote- ESG from Seven Springs*	2,130	cy	$ 45	$ 94,769	$ -	$ -	$ -	$ -	$ -	$ 94,769
Spreading Topsoil 6" Lifts	*ECHOS 2006 18 05 0301*	2,130	cy		$ -	$ -	$ -	$ -	$ -	$ 9.43	$ 20,077
Utility mix, 7#/M.S.F., Hydro or air seeding, with mulch and fertilizer	*32 92 19.14 5400*	115	msf	$ 68.11	$ 7,833	$ 8.90	$ 1,024	$ 8.39	$ 965	$ -	$ 9,821
											$ -
Site Restoration											$ -
Fence, chain link, 9 ga. Wire, in concrete, 6' H	*32 31 13.20 0200*	2,100	lf	$ 19.64	$ 41,244	$ 4.55	$ 9,555	$ 0.99	$ 2,079	$ -	$ 52,878
Double swing gates, 6' H, 12' open, in concrete	*32 31 13.20 5060*	2	Opng	$ 245.25	$ 491	$ 341.36	$ 683	$ 74.03	$ 148	$ -	$ 1,321
Monitoring Well Installation	*recent quote- EnviroTrac*	330	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 94.00	$ 31,020
Mobilization and Demobilization											**$ 64,367**
5% of Total Costs of Site Work, Treatment										$1,287,344	$ 64,367
Contingency											**$ 648,190**
15% of Total Construction Activities										$4,321,266	$ 648,190
Professional/Technical Services											**$ 723,673**
5% Project Management										$4,256,899	$ 212,845
6% Remedial Design											$ 255,414
6% Construction Management											$ 255,414

REMEDIAL ALTERNATIVE	LOCATION	MEDIA	Estimated Cost to Implement	$5,974,000
Soil/Fill Material Alternative 5 Re-grading, Landfill Capping with a Part 360 Cap, and Groundwater Monitoring	Old Upper Mountain Road Lockport, NY	Soil/Fill - OU1	Construction Time: Operation Time: Post Remediation Monitoring	9 months - months 30 years

Description	Data Source (Means[1] or Other)	Quantities: Quantity Amount	Quantity Unit	Cost Breakdown (if available): Material Unit Cost	Material Total Cost	Labor Unit Cost	Labor Total Cost	Equipment Unit Cost	Equipment Total Cost	Combined Unit Costs: Unit Cost	Option Total Cost
LONG TERM ANNUAL MONITORING AND MAINTENANCE										ANNUAL LTM COST (YRS 1-5)	$24,000
										ANNUAL LTM COST (YRS 6-30)	$16,000
										LIFETIME LTM (NPV)	$280,600
Monitoring, Sampling, Testing and Analysis (Per Event)											
Assume 80% of combined sampling event for OU1 and OU2											$8,085
Site Monitoring											
Groundwater sampling for 1 event - Includes collection of field parameters		5	well	$ -	$ -	$ 340	$ 1,700.00	$ 92	$ 458.13	$ -	$2,158
Materials		1	event	$ 40	$ 40	$ -	$ -	$ -	$ -	$ -	$40
Mobilization/Demobilization of Field Sampling Crew		1	event	$ -	$ -	$ -	$ -	$ -	$ -	$ 680.00	$680
Reporting		40	hr	$85	$ 3,400.00	$ -	$ -	$ -	$ -	$ -	$3,400
Landfill Cap Inspection, 4 hrs each event, mob/demob with monitoring event		1	ea	$ -	$ -	$340	$ 340.00	$75.00	$ 75.00	$ -	$415
Laboratory analysis											
Metals and VOCs, plus 20% QA/QC	*Life Science Laboratories*	8	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 174.00	$1,392
Maintenance- Cap Maintenance											
Mowing brush, tractor with rotary mower, Medium density 1x per year	*32 01 90.19 1670*	153	msf	$ -	$ -	$ 28.51	$ 4,362	$ 24.74	$ 3,786	$ -	$8,147
Lifetime Long Term Monitoring (Net Present Value)											
5 Years of Semi-Annual Monitoring											
25 Years of Annual Monitoring											
5% Discount Factor (per NYSDEC)											

TOTAL ESTIMATED NPV TECHNOLOGY COST (Capital + Lifetime O&M + Post Remediation Monitoring) $5,974,000

Assumptions:

Working condition is Safety Level: D (Labor productivity: 82%; Equipment productivity: 100%)
Weighted Average of city cost index (Buffalo, NY) 101.4% (not applicable for costs derived from vendor quotes).
Costs are loaded with a profit factor 10%
Inflation 3% per year

Estimated number of soil samples 72 samples; 1 times sampled; 20% added for QA/QC samples; 0.25 hrs/sample; 1 worker sampling; $85 Labor Cost per hr

Characterization Cost — Table A (per CWM) — $593.48 per sample
Analytical cost — TCLP Metals — $75.00 per sample
For each sampling event, assumed: $50 for materials (gloves, notebooks, etc.)

Disposal

Lead contaminated soil as a "listed" waste- incineration $275 per ton
Lead contaminated soil as non-haz $39.87 per ton
Concrete 3,300 lbs per cy; - tons concrete for disposal

Disposal Assumptions
20 loads per day
20 working days per month
10 hours per working day
3 months for site prep/restoration
6 months to completion
150 ft/day

Typical Rental Rates - Includes G&A and 10% Profit
Mini-Rae Survey Mode PID $96.08 per day
Truck/SUV (1/2 ton or smaller) $70.74 per day

Iron Filings change-out Assumptions
400 cy/day iron filings changeout
#REF! days for iron filing removal
3 workers for iron filing removal

Work day consists of: 10 hrs

Excavation:
Concrete and Asphalt: 0.0% % of excavation volume
Excavation Area: 261,360 sf
Excavation Volume: 51,000 cy; 58,650 lcy
Excavated Weight: 76,500 tons
Roll-off dumpster can hold approximately: 12 tons
Volume fill remaining onsite 51,000 cy

Groundwater Monitoring
Typical Rental Rates - Includes G&A and 10% Profit
Truck/SUV (1/2 ton or smaller) $70.74 per day
Water Quality Analyzer $159.00 per day
Water Level Meter $31.80 per day
Submersible Pump $113.91 per day
Generators: 220 Volt $82.68 per day
Multi-gas meter $75.00

Analytical Costs
Metals $75.00 per sample
VOCs $90.00 per sample
2 hrs/GW sample; $85 Labor cost per hr
0.5 hrs/SW sample
2 workers per event
5 hours travel per event
$50 for materials (gloves, notebooks, etc.)

Notes

sy	square yard	mo	month
cy	cubic yard	ls	lump sum
lcy	loose cubic yard	O&M	Operation and maintenance
bcy	bank cubic yard	H&S	Health and Safety
lf	linear feet		
sf	square feet		
msf	1,000 square feet		

REMEDIAL ALTERNATIVE	LOCATION	MEDIA	Estimated Cost to Implement	$4,208,000
Soil/Fill Material Alternative 6 Partial Removal, Landfill Capping with a Soil Cap, and Groundwater Monitoring	Old Upper Mountain Road Lockport, NY	Soil/Fill - OU1	Construction Time: Operation Time: Post Remediation Monitoring	9 months - months 30 years

Description	Data Source (Means[1] or Other)	Quantities: Quantity Amount	Quantity Unit	Cost Breakdown (if available): Material Unit Cost	Material Total Cost	Labor Unit Cost	Labor Total Cost	Equipment Unit Cost	Equipment Total Cost	Combined Unit Costs: Unit Cost	Option Total Cost
REMEDIAL ACTION		**TOTAL CAPITAL COST (totals rounded to nearest thousand)**									**$3,927,000**
Construction Activities		**1**			**$1,025,105**		**$302,426**		**$149,447**	**$1,204,080**	**$ 2,924,203**
Site Preparation											
Utility Locator (based on recent bids)	*recent quote*	0.5	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,475.00	$ 1,238
Erosion & Sediment Control Plan		1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 30,000	$ 30,000
Stabilization Measures for Erosion and Sedimentation Control											
Silt Fence, 3' high, adverse conditions	*31 25 14.16 1000*	1,200	lf	$ 0.21	$ 252	$ 0.47	$ 564	$ -	$ -	$ -	$ 816
Sewer Relocation											
Excavating Trench to remove sewer pipe, 10' to 14' deep, 1.5 CY excavator	*31 23 16.13 1000*	2,113	bcy	$ -	$ -	$ 1.59	$ 3,360	$ 1.93	$ 4,079	$ -	$ 7,439
Pipe removal, sewer, no excavation, 18" diameter	*02 41 13.33 2930*	1,019	lf	$ -	$ -	$ 8.16	$ 8,315	$ 11.94	$ 12,167	$ -	$ 20,482
Remove existing manhole	*02 41 13.33 0020*	4	ea	$ -	$ -	$ 297.07	$ 1,188	$ 90.80	$ 363	$ -	$ 1,551
Excavating Trench to install sewer pipe, 10' to 14' deep, 1.5 CY excavator, wit	*31 23 16.13 1000*	2,785	bcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 8.96	$ 24,958
PVC sewer pipe, 13' lengths, 18" diameter	*33 31 13.25 2300*	1,400	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 28.74	$ 40,236
Install manholes- concrete, precast, 4' ID, 10' deep	*33 49 13.10 0600 and 0700*	4	ea	$ 1,358.94	$ 5,436	$ 2,636.87	$ 10,547	$ 14,938.50	$ 59,754	$ -	$ 75,737
Supply and Transportation of NYS Certified Clean Back Fill Material	*Recent quote- ESG from Seven Springs*	2,698	cy	$ 28	$ 74,184	$ -	$ -	$ -	$ -	$ -	$ 74,184
Haul Road Upgrades											
Haul Road Upgrades, Roads. 8" gravel (From ravine to upper staging area)	*01 55 23.50 0100*	917	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 13.86	$ 12,705
Install Guard Rails along Haul Road, corr steel, steel box beam	*34 71 13.26 1120*	350	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 69.74	$ 24,409
Monitoring Well Abandonment	*recent quote- EnviroTrac*	240	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 22.00	$ 5,280
Stockpile Pad Construction											
Silt Fence	*31 25 13.10 1000*	1,000	lf	$ 0.23	$ 230	$ 0.45	$ 450	$ -	$ -	$ -	$ 680
30 mil HDPE Liner	*33 47 13.53 1100*	80,000	sf	$ 0.30	$ 24,000	$ 0.85	$ 68,000	$ -	$ -	$ -	$ 92,000
3/4" Gravel Fill (9")	*ECHOS 17 03 0300*	2,222	cy	$ 26.26	$ 58,349	$ 3.63	$ 8,066	$ 1.28	$ 2,839	$ -	$ 69,255
Cut and chip medium, trees to 12" dia.	*31 11 10.10 0200*	6	acre	$ -	$ -	$ 3,323	$ 19,939	$ 2,295	$ 13,769	$ -	$ 33,707
Landfill Base Drainage Layer											
Removal of Sediment in Drainage Layer Area											
Soil-Excavator, hydraulic, crawler mtd. 2 CY cap = 165 CY/hr	*31 23 16.42 0260*	4,222	bcy	$ -	$ -	$ 0.65	$ 2,744	$ 1.03	$ 4,349	$ -	$ 7,093
12 CY truck, 15 mph average, cycle 2 miles, 10 min wait/ld/unld	*31 23 23.20 1218*	4,856	lcy	$ -	$ -	$ 1.83	$ 8,886	$ 3.11	$ 15,101		$ 23,986
Supply 6" perf pipe (used PVC cost)	*Recent quote*	1,125	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 14.54	$ 16,358
Supply and transport gravel for drainage layer, 13 cy load, 2 hr haul	*Engineer's Estimate*	4,222	cy	$ 8.50	$ 35,889	$ 13.07	$ 55,184	$ -	$ -	$ -	$ 91,073
Placement of gravel for drainage layer, 24" thickness	*Engineer's Estimate*	4,222	cy		$ -		$ -		$ -	$ 18.24	$ 77,013
Deploy 10oz/sy mil Nonwoven Geotextile (Level C)	*ECHOS 2006 33 08 0533*	6,333	sy		$ -		$ -		$ -	$ 2.40	$ 15,200
Excavation											
Community Air Monitoring (Dust)	*recent quote - Pine Environmental*	9	mo	$ -	$ -	$ 55	$ 101,409	$ 3,420	$ 31,529	$ -	$ 132,937
Dust Control, Heavy, assumes 10 days per working month	*31 23 23.20 2510*	92.19	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,734.40	$ 159,894
Grading of embankment, by dozer	*31 23 23.20 2300*	58,650	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.82	$ 106,743
Soil-Excavator, hydraulic, crawler mtd. 3.5 CY cap = 350 CY/hr	*31 23 16.42 5500*	51,000	bcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.16	$ 59,160
34CY off-road 20min. Wait 2,000ft cycle	*31 23 23.20 6300*	58,650	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 3.22	$ 188,853
Haul Road Maintenance	*31 23 23.20 2600*	92	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,141.04	$ 105,192
Maintain Stockpile, 700HP Dozer, 50ft Haul	*31 23 16.46 6010*	14,663	bcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.68	$ 24,634
Landfill Placement											
Excavator Loadout, 4.5 CY bucket, 80% fill factor	*31 23 16.43 4700*	58,650	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.14	$ 66,861
12 CY truck, 15 mph average, cycle 1 mile, 15 min wait/ld/unld	*31 23 23.20 1016*	58,650	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 3.38	$ 198,237
Compaction, riding, vibrating roller, 2 passes, 12" lifts	*31 23 23.23 5060*	51,000	ecy	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.26	$ 13,260
Finishing grading slopes, steep	*31 22 16.10 3310*	12,000	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.21	$ 2,520
Capping 3:1 Side Slope (Ravine)											
Finishing grading slopes, steep	*31 22 16.10 3310*	17,000	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.21	$ 3,570
Supply and Transportation of NYS Certified Clean Back Fill Material	*Recent quote- ESG from Seven Springs*	11,333	cy	$ 28	$ 311,667	$ -	$ -	$ -	$ -	$ -	$ 311,667
Spreading and Compaction of General Fill	*ECHOS 2006 17 03 0422*	11,333	cy	$ -	$ -	$ -	$ -	$ -	$ -	$ 9.12	$ 103,382
Topsoil	*Recent quote- ESG from Seven Springs*	2,833	cy	$ 45	$ 126,083	$ -	$ -	$ -	$ -	$ -	$ 126,083
Spreading Topsoil 6" Lifts	*ECHOS 2006 18 05 0301*	2,833	cy		$ -	$ -	$ -	$ -	$ -	$ 9.43	$ 26,711
Utility mix, 7#/M.S.F., Hydro or air seeding, with mulch and fertilizer	*32 92 19.14 5400*	153	msf	$ 68.11	$ 10,421	$ 8.90	$ 1,362	$ 8.39	$ 1,284	$ -	$ 13,066
Capping											
Finishing grading slopes, gentle	*31 22 16.10 3300*	12,778	sy	$ -	$ -	$ 0.09	$ 1,150	$ 0.08	$ 1,022	$ -	$ 2,172
Gas Vents	*Recent quote- Modern Environmental*	7	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,715.58	$ 12,009
Supply and Transportation of NYS Certified Clean Back Fill Material	*Recent quote- ESG from Seven Springs*	8,519	cy	$ 28	$ 234,259	$ -	$ -	$ -	$ -	$ -	$ 234,259
Spreading and Compaction of General Fill	*ECHOS 2006 17 03 0422*	8,519	cy	$ -	$ -	$ -	$ -	$ -	$ -	$ 9.12	$ 77,705
Topsoil	*Recent quote- ESG from Seven Springs*	2,130	cy	$ 45	$ 94,769	$ -	$ -	$ -	$ -	$ -	$ 94,769
Spreading Topsoil 6" Lifts	*ECHOS 2006 18 05 0301*	2,130	cy		$ -	$ -	$ -	$ -	$ -	$ 9.43	$ 20,077
Utility mix, 7#/M.S.F., Hydro or air seeding, with mulch and fertilizer	*32 92 19.14 5400*	115	msf	$ 68.11	$ 7,833	$ 8.90	$ 1,024	$ 8.39	$ 965	$ -	$ 9,821
											$ -
Site Restoration											$ -
Fence, chain link, 9 ga. Wire, in concrete, 6' H	*32 31 13.20 0200*	2,100	lf	$ 19.64	$ 41,244	$ 4.55	$ 9,555	$ 0.99	$ 2,079	$ -	$ 52,878
Double swing gates, 6' H, 12' open, in concrete	*32 31 13.20 5060*	2	Opng	$ 245.25	$ 491	$ 341.36	$ 683	$ 74.03	$ 148	$ -	$ 1,321
Monitoring Well Installation	*recent quote- EnviroTrac*	330	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 94.00	$ 31,020
Mobilization and Demobilization											**$ 58,335**
5% of Total Costs of Site Work, Treatment										$1,166,691	$ 58,335
Contingency											**$ 447,381**
15% of Total Construction Activities										$2,982,537	$ 447,381
Professional/Technical Services											**$ 497,114**
5% Project Management										$2,924,203	$ 146,210
6% Remedial Design											$ 175,452
6% Construction Management											$ 175,452

REMEDIAL ALTERNATIVE	LOCATION	MEDIA	Estimated Cost to Implement	$4,208,000	
Soil/Fill Material Alternative 6 **Partial Removal, Landfill Capping with a Soil Cap, and Groundwater Monitoring**	**Old Upper Mountain Road** **Lockport, NY**	**Soil/Fill - OU1**	**Construction Time:**	9	months
			Operation Time:	-	months
			Post Remediation Monitoring	30	years

Description	Data Source (Means[1] or Other)	Quantities: Quantity Amount	Quantity Unit	Cost Breakdown (if available): Material Unit Cost	Material Total Cost	Labor Unit Cost	Labor Total Cost	Equipment Unit Cost	Equipment Total Cost	Combined Unit Costs: Unit Cost	Option Total Cost
LONG TERM ANNUAL MONITORING AND MAINTENANCE									**ANNUAL LTM COST (YRS 1-5)**		**$24,000**
									ANNUAL LTM COST (YRS 6-30)		**$16,000**
									LIFETIME LTM (NPV)		**$280,600**
Monitoring, Sampling, Testing and Analysis (Per Event)											
Assume 80% of combined sampling event for OU1 and OU2											$8,013
Site Monitoring											
Groundwater sampling for 1 event - Includes collection of field parameters		5	well	$ -	$ -	$ 340	$ 1,700.00	$ 92	$ 458.15	$ -	$2,158
Materials		1	event	$ 40	$ 40	$ -	$ -	$ -	$ -	$ -	$40
Mobilization/Demobilization of Field Sampling Crew		1	event	$ -	$ -	$ -	$ -	$ -	$ -	$ 680.00	$680
Reporting		40	hr	$85	$ 3,400.00	$ -	$ -	$ -	$ -	$ -	$3,400
Landfill Cap Inspection, 4 per year, 4 hrs each event, mob/demob witl monitoring event		1	ea	$ -	$ -	$340	$ 340.00	$75.00	$ 75.00	$ -	$415
Laboratory analysis											
Metals and VOCs, plus 20% QA/QC	*Life Science Laboratories*	8	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 165.00	$1,320
Maintenance- Cap Maintenance											
Mowing brush, tractor with rotary mower, Medium density 1x per year	*32 01 90.19 1670*	153	msf	$ -	$ -	$ 28.51	$ 4,362	$ 24.74	$ 3,786	$ -	$8,147
Lifetime Long Term Monitoring (Net Present Value)											
5 Years of Semi-Annual Monitoring											
25 Years of Annual Monitoring											
5% Discount Factor (per NYSDEC)											
TOTAL ESTIMATED NPV TECHNOLOGY COST (Capital + Lifetime O&M + Post Remediation Monitoring)											**$4,208,000**

Assumptions:

Working condition is Safety Level: **D** **(Labor productivity: 82% ; Equipment productivity: 100%)**
Weighted Average of city cost index (Buffalo, NY) **101.4%** **(not applicable for costs derived from vendor quotes).**
Costs are loaded with a profit factor **10%**
Inflation **3%** per year

Estimated number of soil samples **72** samples; **1** times sampled; **20%** added for QA/QC samples; **0.25** hrs/sample; **1** worker sampling; **$85** Labor Cost per hr

Characterization Cost	Table A (per CWM)	$593.48	per sample
Analytical cost	TCLP Metals	$75.00	per sample
For each sampling event, assumed:		$50	for materials (gloves, notebooks, etc.)

Disposal

Lead contaminated soil as a "listed" waste- incineration	$275	per ton
Lead contaminated soil as non-haz	$39.87	per ton
Concrete	3,300	lbs per cy

- tons concrete for disposal
180 lb/cf iron filings

Typical Rental Rates - Includes G&A and 10% Profit

Mini-Rae Survey Mode PID	$96.08	per day
Truck/SUV (1/2 ton or smaller)	$70.74	per day

Iron Filings change-out Assumptions

400 cy/day iron filings changeout
#REF! days for iron filing removal
3 workers for iron filing removal

Disposal Assumptions

20 loads per day
20 working days per month
10 hours per working day
3 months for site prep/restoration
6 months to completion
150 ft/day

Work day consists of: **10** hrs

Excavation:

Concrete and Asphalt:	0.0%	% of excavation volume		
Excavation Area:	261,360	sf		
Excavation Volume:	165,333	cy	190,133	lcy
Excavated Weight:	248,000	tons		
Roll-off dumpster can hold approximately:	12	tons		
Volume fill remaining onsite	62,000	cy		

Groundwater Monitoring

Typical Rental Rates - Includes G&A and 10% Profit

Truck/SUV (1/2 ton or smaller)	$70.74	per day
Water Quality Analyzer	$159.00	per day
Water Level Meter	$31.80	per day
Submersible Pump	$113.91	per day
Generators: 220 Volt	$82.68	per day
Multi-gas meter	$75.00	

Analytical Costs

Metals	$75.00	per sample
VOCs	$90.00	per sample

$85 Labor cost per hr

2	hrs/GW sample
0.5	hrs/SW sample
2	workers per event
5	hours travel per event
$50	for materials (gloves, notebooks, etc.)

Notes

sy	square yard	mo	month
cy	cubic yard	ls	lump sum
lcy	loose cubic yard	O&M	Operation and maintenance
bcy	bank cubic yard	H&S	Health and Safety
lf	linear feet		
sf	square feet		
msf	1,000 square feet		

REMEDIAL ALTERNATIVE	LOCATION	MEDIA	Estimated Cost to Implement	$41,721,000	
Soil/Fill Material Alternative 7 Partial Removal (Deeper Fill) and Off-site Disposal, with In Situ Stabilization (Shallow Fill 0-14 ft Depth)	Old Upper Mountain Road Lockport, NY	Soil/Fill - OU1	Construction Time:	34	months
			Operation Time:	-	months
			Post Remediation Monitoring	30	years

Description	Data Source (Means[1] or Other)	Quantities: Quantity Amount	Quantity Unit	Cost Breakdown (if available): Material Unit Cost	Material Total Cost	Labor Unit Cost	Labor Total Cost	Equipment Unit Cost	Equipment Total Cost	Combined Unit Costs: Unit Cost	Option Total Cost
REMEDIAL ACTION		**TOTAL CAPITAL COST (totals rounded to nearest thousand)**									**$41,500,000**
Construction Activities		**1**			**$288,229**		**$536,265**		**$201,473**	**$725,750**	**$ 30,615,329**
Pre-Design Pilot Study											
Pilot Study Treatment	*MT2 Estimate*	5	ton	$ -	$ -	$ -	$ -	$ -	$ -	$ 33.24	$ 166
Sample analysis	*MT2 Estimate*	1	sample	$ -	$ -	$ -	$ -	$ -	$ -	$ 550.00	$ 550
Pre-Design Characterization Study											
Driller											
Mob/Demob	*quote- SJB*	1	ls							$ 800	$ 800
Geoprobe/Crew for Soil Borings	*quote- SJB*	21	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,273	$ 26,735
Sample Collection		210	hr	$ -	$ -	$ 85.00	$ 17,850	$ -	$ -	$ -	$ 17,850
Sample Analysis for TCLP Lead and Zinc	*Life Science Laboratories*	161	sample	$ -	$ -	$ -	$ -	$ -	$ -	$ 593	$ 95,550
Reporting	*Engineer's Estimate*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 15,000	$ 15,000
											$ -
Site Preparation											$ -
Utility Locator (based on recent bids)	*recent quote*	0.5	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,475.00	$ 1,238
Erosion & Sediment Control Plan	*Engineer's Estimate*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 30,000	$ 30,000
Stabilization Measures for Erosion and Sedimentation Control											
Silt Fence, 3' high, adverse conditions	*31 25 14.16 1000*	1,200	lf	$ 0.21	$ 252	$ 0.47	$ 564	$ -	$ -	$ -	$ 816
Sewer Relocation											
Excavating Trench to install sewer pipe, 10' to 14' deep, 1.5 CY excavator, with	*31 23 16.13 1000*	2,785	bcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 8.96	$ 24,958
PVC sewer pipe, 13' lengths, 18" diameter	*33 31 13.25 2300*	1,400	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 28.74	$ 40,236
Install manholes- concrete, precast, 4' ID, 10' deep	*33 49 13.10 0600 and 0700*	4	ea	$ 1,358.94	$ 5,436	$ 2,636.87	$ 10,547	$ 129.90	$ 520	$ -	$ 16,503
Supply and Transportation of NYS Certified Clean Back Fill Material	*Recent quote- ESG from Seven Springs*	2,698	cy	$ 28	$ 74,184	$ -	$ -	$ -	$ -	$ -	$ 74,184
Haul Road Upgrades											
Haul Road Upgrades, Roads. 8" gravel (From ravine to upper staging area)	*01 55 23.50 0100*	917	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 13.86	$ 12,705
Install Guard Rails along Haul Road, corr steel, steel box beam	*34 71 13.26 1120*	350	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 69.74	$ 24,409
Monitoring Well Abandonment	*recent quote- EnviroTrac*	240	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 22.00	$ 5,280
Monitoring Well Installation	*recent quote- EnviroTrac*	330	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 94.00	$ 31,020
Cut and chip medium, trees to 12" dia.	*31 11 10.10 0200*	6	acre	$ -	$ -	$ 3,323	$ 19,939	$ 2,295	$ 13,769	$ -	$ 33,707
Stockpile Pad Construction											
Silt Fence	*31 25 13.10 1000*	1,000	lf	$ 0.23	$ 230	$ 0.45	$ 450	$ -	$ -	$ -	$ 680
30 mil HDPE Liner	*33 47 13.53 1100*	80,000	sf	$ 0.30	$ 24,000	$ 0.85	$ 68,000	$ -	$ -	$ -	$ 92,000
3/4" Gravel Fill (9")	*ECHOS 17 03 0300*	2,222	cy	$ 26.26	$ 58,349	$ 3.63	$ 8,066	$ 1.28	$ 2,839	$ -	$ 69,255
Sheetpiling Along RR Tracks (40' deep, drive, extract and salvage)	*31 41 16.10 1000*	228	ton	$ 551.66	$ 125,778	$ 263.83	$ 60,153	$ 305.97	$ 69,761	$ -	$ 255,693
Excavation											
Community Air Monitoring (Dust)	*recent quote - Pine Environmental*	34	mo	$ -	$ -	$ 55	$ 368,545	$ 3,420	$ 114,584		$ 483,130
Dust Control, Heavy	*31 23 23.20 2510*	335	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,734.40	$ 581,096
Grading of embankment, by dozer	*31 23 23.20 2300*	175,041	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.82	$ 318,575
Soil-Excavator, hydraulic, crawler mtd. 3.5 CY cap = 350 CY/hr	*31 23 16.42 5500*	152,210	bcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.16	$ 176,564
34CY off-road 20min. Wait 2,000ft cycle	*31 23 23.20 6300*	175,041	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 3.22	$ 563,633
Haul Road Maintenance	*31 23 23.20 2600*	335	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,141.04	$ 382,296
Maintain Stockpile, 700HP Dozer, 50ft Haul	*31 23 16.46 6010*	152,210	bcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.68	$ 255,713
Excavator Loadout, 4.5 CY bucket, 80% fill factor	*31 23 16.43 4700*	175,041	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.14	$ 199,547
Spotter at Loadout	*31 23 23.20 2310*	3,350	hrs	$ -	$ -	$ -	$ -	$ -	$ -	$ 45.96	$ 153,985
Hazardous Soil Disposal											
Soil Characterization Sampling (1 sample per 500 CY, per CWM)	*Life Science Laboratories*	398	sample	$ -	$ -	$ -	$ -	$ -	$ -	$593.48	$ 236,205
Hazardous Soil Disposal	*CWM*	98,175	ton	$ -	$ -	$ -	$ -	$ -	$ -	$ 140.00	$ 13,744,556
Transportation using dumps	*CWM*	98,175	ton	$ -	$ -	$ -	$ -	$ -	$ -	$ 19.50	$ 1,914,420
Demurrage (assume 1 hour per week of loading)	*CWM*	89	hour	$ -	$ -	$ -	$ -	$ -	$ -	$ 85.00	$ 7,586
Fuel Surcharge- 36% of Transportation	*CWM*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 689,191.32	$ 689,191
Non-Hazardous Soil Disposal											
Soil transportation and disposal	*Recent quote- ESG plus 10%*	130,139	ton	$ -	$ -	$ -	$ -	$ -	$ -	$37.68	$ 4,903,005
Stabilization with Ecobond											
Treat w/ EcoBond, 5% volume added	*MT2 est*	70,185	ton	$ -	$ -	$ -	$ -	$ -	$ -	$ 39.93	$ 2,802,491
Site Restoration											
Supply and Transportation of NYS Certified Clean Back Fill Material	*Recent quote- ESG from Seven Springs*	76,105	lcy	$ 27.50	$ 2,092,886	$ -	$ -	$ -	$ -	$ -	$ 2,092,886
Soil-Excavator, 3.5 CY cap, earthwork of clean backfill	*31 23 16.42 5500*	76,105	bcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.16	$ 88,282
Finishing grading slopes, steep (Treated fill)	*31 22 16.10 3310*	11,516	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.21	$ 2,418
Topsoil	*Recent quote- ESG from Seven Springs*	1,919	cy	$ 45	$ 85,407	$ -	$ -	$ -	$ -	$ -	$ 85,407
Finishing grading slopes, gentle	*31 22 16.10 3300*	11,516	sy	$ -	$ -	$ 0.09	$ 1,036	$ 0.08	$ 921	$ -	$ 1,958
Utility mix, 7#/M.S.F., Hydro or air seeding, with mulch and fertilizer	*32 92 19.14 5400*	104	msf	$ 68.11	$ 7,059	$ 8.90	$ 922	$ 8.39	$ 870	$ -	$ 8,851
Fence, chain link, 9 ga. Wire, in concrete, 6' H	*32 31 13.20 0200*	2,100	lf	$ 19.64	$ 41,244	$ 4.55	$ 9,555	$ 0.99	$ 2,079	$ -	$ 52,878
Double swing gates, 6' H, 12' open, in concrete	*32 31 13.20 5060*	2	Opng	$ 245.25	$ 491	$ 341.36	$ 683	$ 74.03	$ 148	$ -	$ 1,321
Mobilization and Demobilization											**$ 946,200**
5% of Total Costs of Site Work, Treatment										$ 18,923,996	$ 946,200
Contingency											**$ 4,734,229**
15% of Total Construction Activities										$ 31,561,529	$ 4,734,229
Professional/Technical Services											**$ 5,204,606**
5% Project Management										$ 30,615,329	$ 1,530,766
6% Remedial Design											$ 1,836,920
6% Construction Management											$ 1,836,920
LONG TERM ANNUAL MONITORING AND MAINTENANCE								**ANNUAL LTM COST (YRS 1-5)**			**$23,000**
								ANNUAL LTM COST (YRS 6-30)			**$11,000**
								LIFETIME LTM (NPV)			**$221,100**
Monitoring, Sampling, Testing and Analysis (Per Event)											
Assume 80% of combined sampling event for OU1 and OU3											$11,388
Site Monitoring											
Groundwater sampling for 1 event - includes collection of field parameters		8	well	$ -	$ -	$ 340	$ 2,720.00	$ 92	$ 733.01	$ -	$3,453
Surface water sampling for 1 event		4	samples			$ 340	$ 1,360.00	$ 92	$ 366.50	$ -	$1,727
Materials		1	event	$ 40							$40
Mobilization/Demobilization of Field Sampling Crew		1	event	$ -	$ -	$ -	$ -	$ -	$ -	$ 680.00	$680
Reporting		40	hr	$85	$ 3,400.00	$ -	$ -	$ -	$ -	$ -	$3,400
Laboratory analysis											
Metals and VOCs, plus 20% QA/QC	*Life Science Laboratories*	12	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 174.00	$2,088
Lifetime Long Term Monitoring (Net Present Value)											
5 Years of Semi-Annual Monitoring											
25 Years of Annual Monitoring											
5% Discount Factor (per NYSDEC)											
TOTAL ESTIMATED NPV TECHNOLOGY COST (Capital + Lifetime O&M + Post Remediation Monitoring)											**$41,721,000**

REMEDIAL ALTERNATIVE		LOCATION		MEDIA		Estimated Cost to Implement		$41,721,000	
Soil/Fill Material Alternative 7 Partial Removal (Deeper Fill) and Off-site Disposal, with In Situ Stabilization (Shallow Fill 0-14 ft Depth)		Old Upper Mountain Road Lockport, NY		Soil/Fill - OU1		Construction Time: Operation Time: Post Remediation Monitoring		34 - 30	months months years
		Quantities		Cost Breakdown (if available)				Combined Unit Costs	
Description	Data Source (Means[1] or Other)	Quantity Amount	Quantity Unit	Material Unit Cost	Material Total Cost	Labor Unit Cost	Labor Total Cost	Equipment Unit Cost	Equipment Total Cost	Unit Cost	Option Total Cost

Assumptions:

Working condition is Safety Level:		D	(Labor productivity:		82%	; Equipment productivity:		100%	)		
Weighted Average of city cost index (Buffalo, NY)		101.4%	(not applicable for costs derived from vendor quotes).								
Costs are loaded with a profit factor		10%									
Inflation		3%	per year								Labor
Estimated number of soil samples		0	samples	1	times sampled		0.25	hrs/sample		$85	Cost per hr
				20%	added for QA/QC samples		1	worker sampling			
Characterization Cost	Table A (per CWM)	$593.48	per sample								
Analytical cost	TAL Metals	$75.00	per sample								
For each sampling event, assumed:		$50	for materials (gloves, notebooks, etc.)								
Disposal											
Lead contaminated soil as a "listed" waste- incineration		$275	per ton		98,175	tons soil hazardous (assume 43% hazardous)					
					22	tons per load		4,463	loads for haz disposal		
Lead contaminated soil as non-haz		$39.87	per ton		130,139	tons soil for non-haz disposal		5,915	loads for non-haz disposal		
								70,185	tons for treatment		
Concrete		3,300	lbs per cy								
Typical Rental Rates - Includes G&A and 10% Profit							150 ft/day drilling		1000 tons per day for treatment		
Mini-Rae Survey Mode PID		$96.08	per day						20 loads per day		
Truck/SUV (1/2 ton or smaller)		$70.74	per day						20 working days per month		
									10 hours per working day		
Work day consists of:		10	hrs						1 months for pre-design activities		
									3 months for site prep/restoration		
Excavation With Concrete and Asphalt:									29 months of construction		
Concrete and Asphalt:	0.0%	% of excavation volume									
Excavation Area:	0	sf									
Excavation Volume:	152,210	cy	175,041	lcy							
Excavated Weight:	228,315	tons									
Roll-off dumpster can hold approximately:	12	tons									

Notes

sy	square yard	mo	month
cy	cubic yard	ls	lump sum
lcy	loose cubic yard	O&M	Operation and maintenance
bcy	bank cubic yard	H&S	Health and Safety
lf	linear feet		
sf	square feet		
msf	1,000 square feet		

REMEDIAL ALTERNATIVE		LOCATION		MEDIA		Estimated Cost to Implement				$23,557,000	
Soil/Fill Material Alternative 8 **Partial Removal (Deeper Fill) with Ex Situ Stabilization and On-site Disposal, with In Situ Stabilization (Shallow Fill 0-14 ft Depth)**		**Old Upper Mountain Road** **Lockport, NY**		**Soil/Fill - OU1**					Construction Time: Operation Time: Post Remediation Monitoring	43 - 30	months months years
		Quantities		**Cost Breakdown (if available)**						**Combined Unit Costs**	
Description	Data Source (Means[1] or Other)	Quantity Amount	Quantity Unit	Material Unit Cost	Material Total Cost	Labor Unit Cost	Labor Total Cost	Equipment Unit Cost	Equipment Total Cost	Unit Cost	Option Total Cost
REMEDIAL ACTION		**TOTAL CAPITAL COST (totals rounded to nearest thousand)**									**$23,336,000**
Construction Activities		**1**			**$558,377**		**$710,752**		**$253,454**	**$37,333**	**$ 17,667,109**
Pre-Design Pilot Study											
Pilot Study Treatment	*MT2 Estimate*	5	ton	$ -	$ -	$ -	$ -	$ -	$ -	$ 33.24	$ 166
Sample analysis	*MT2 Estimate*	1	sample	$ -	$ -	$ -	$ -	$ -	$ -	$ 550.00	$ 550
Site Preparation											$ -
Utility Locator (based on recent bids)	*recent quote*	0.5	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,475.00	$ 1,238
Erosion & Sediment Control Plan	*Engineer's Estimate*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 30,000	$ 30,000
Stabilization Measures for Erosion and Sedimentation Control											
Silt Fence, 3' high, adverse conditions	*31 25 14.16 1000*	1,200	lf	$ 0.21	$ 252	$ 0.47	$ 564	$ -	$ -	$ -	$ 816
Sewer Relocation											
Excavating Trench to install sewer pipe, 10' to 14' deep, 1.5 CY excavator, with	*31 23 16.13 1000*	2,785	bcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 8.96	$ 24,958
PVC sewer pipe, 13' lengths, 18" diameter	*33 31 13.25 2300*	1,400	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 28.74	$ 40,236
Install manholes- concrete, precast, 4' ID, 10' deep	*33 49 13.10 0600 and 0700*	4	ea	$ 1,358.94	$ 5,436	$ 2,636.87	$ 10,547	$ 129.90	$ 520	$ -	$ 16,503
Supply and Transportation of NYS Certified Clean Back Fill Material	*Recent quote- ESG from Seven Springs*	2,698	cy	$ 28	$ 74,184	$ -	$ -	$ -	$ -	$ -	$ 74,184
Haul Road Upgrades											
Haul Road Upgrades, Roads. 8" gravel (From ravine to upper staging area)	*01 55 23.50 0100*	917	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 13.86	$ 12,705
Install Guard Rails along Haul Road, corr steel, steel box beam	*34 71 13.26 1120*	350	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 69.74	$ 24,409
Monitoring Well Abandonment	*recent quote- EnviroTrac*	240	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 22.00	$ 5,280
Monitoring Well Installation	*recent quote- EnviroTrac*	330	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 94.00	$ 31,020
Cut and chip medium, trees to 12" dia.	*31 11 10.10 0200*	6	acre	$ -	$ -	$ 3,323	$ 19,939	$ 2,295	$ 13,769	$ -	$ 33,707
Stockpile Pad Construction											
Silt Fence	*31 25 13.10 1000*	1,000	lf	$ 0.23	$ 230	$ 0.45	$ 450	$ -	$ -	$ -	$ 680
30 mil HDPE Liner	*33 47 13.53 1100*	80,000	sf	$ 0.30	$ 24,000	$ 0.85	$ 68,000	$ -	$ -	$ -	$ 92,000
3/4" Gravel Fill (9")	*ECHOS 17 03 0300*	2,222	cy	$ 26.26	$ 58,349	$ 3.63	$ 8,066	$ 1.28	$ 2,839	$ -	$ 69,255
Sheetpiling Along RR Tracks (40' deep, drive, extract and salvage)	*31 41 16.10 1000*	228	ton	$ 551.66	$ 125,778	$ 263.83	$ 60,153	$ 305.97	$ 69,761	$ -	$ 255,693
Excavation											
Community Air Monitoring (Dust)	*recent quote - Pine Environmental*	43	mo	$ -	$ -	$ 55	$ 476,227	$ 3,420	$ 148,063		$ 624,290
Dust Control, Heavy	*31 23 23.20 2510*	433	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,734.40	$ 750,879
Grading of embankment, by dozer	*31 23 23.20 2300*	175,041	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.82	$ 318,575
Soil-Excavator, hydraulic, crawler mtd. 3.5 CY cap = 350 CY/hr	*31 23 16.42 5500*	152,210	bcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.16	$ 176,564
34CY off-road 20min. Wait 2,000ft cycle	*31 23 23.20 6300*	175,041	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 3.22	$ 563,633
Haul Road Maintenance	*31 23 23.20 2600*	433	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,141.04	$ 493,994
Maintain Stockpile, 700HP Dozer, 50ft Haul	*31 23 16.46 6010*	152,210	bcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.68	$ 255,713
Excavator Loadout, 4.5 CY bucket, 80% fill factor	*31 23 16.43 4700*	175,041	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.14	$ 199,547
Spotter at Loadout	*31 23 23.20 2310*	4,329	hrs	$ -	$ -	$ -	$ -	$ -	$ -	$ 45.96	$ 198,976
Stabilization with Ecobond											
Treat w/ EcoBond In Situ, 5% volume added	*MT2 est*	70,185	ton	$ -	$ -	$ -	$ -	$ -	$ -	$ 39.93	$ 2,802,491
Treat w/ EcoBond Ex Situ, 5% volume added	*MT2 est*	228,315	ton	$ -	$ -	$ -	$ -	$ -	$ -	$ 39.93	$ 9,116,614
Landfill Base Drainage Layer											
Removal of Sediment in Drainage Layer Area											
Soil-Excavator, hydraulic, crawler mtd. 2 CY cap = 165 CY/hr	*31 23 16.42 0260*	4,222.22	bcy	$ -	$ -	$ 0.65	$ 2,744	$ 1.03	$ 4,349	$ -	$ 7,093
12 CY truck, 15 mph average, cycle 2 miles, 10 min wait/ld/unld	*31 23 23.20 1218*	4,222.22	lcy	$ -	$ -	$ 1.83	$ 7,727	$ 3.11	$ 13,131		$ 20,858
Supply 6" perf pipe (used PVC cost)	*Recent quote*	1,125.00	lf		$ -		$ -	$ -	$ -	$ 14.54	$ 16,358
Supply and transport gravel for drainage layer, 13 cy load, 2 hr haul	*Engineer's Estimate*	4,222.22	cy	$ 8.50	$ 35,889	$ 13.07	$ 55,184	$ -	$ -	$ -	$ 91,073
Placement of gravel for drainage layer, 24" thickness	*Engineer's Estimate*	4,222.22	cy		$ -		$ -		$ -	$ 18.24	$ 77,013
Deploy 10oz/sy mil Nonwoven Geotextile (Level C)	*ECHOS 2006 33 08 0533*	6,333.33	sy		$ -		$ -		$ -	$ 2.40	$ 15,200
Treated Soil Placement											
Excavator Loadout, 4.5 CY bucket, 80% fill factor	*31 23 16.43 4700*	175,041	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.14	$ 199,547
12 CY truck, 15 mph average, cycle 1 mile, 15 min wait/ld/unld	*31 23 23.20 1016*	175,041	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 3.38	$ 591,640
Compaction, riding, vibrating roller, 2 passes, 12" lifts	*31 23 23.23 5060*	152,210	ecy	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.26	$ 39,575
Finishing grading slopes, steep	*31 22 16.10 3310*	12,000	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.21	$ 2,520
Capping											
Finishing grading slopes, gentle	*31 22 16.10 3300*	12,778	sy	$ -	$ -	$ 0.09	$ 1,150	$ 0.08	$ 1,022	$ -	$ 2,172
Gas Vents	*Recent quote- Modern Environmental*	3	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,570.00	$ 4,710
Supply and Transportation of NYS Certified Clean Back Fill Material	*Recent quote- ESG from Seven Springs*	8,519	cy	$ 28	$ 234,259	$ -	$ -	$ -	$ -	$ -	$ 234,259
Spreading and Compaction of General Fill	*ECHOS 2006 17 03 0422*	8,519	cy	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Site Restoration											
Topsoil	*Recent quote- ESG from Seven Springs*	1,919	cy	$ 45	$ 85,407	$ -	$ -	$ -	$ -	$ -	$ 85,407
Finishing grading slopes, gentle	*31 22 16.10 3300*	11,516	sy	$ -	$ -	$ 0.09	$ 1,036	$ 0.08	$ 921	$ -	$ 1,958
Utility mix, 7#/M.S.F., Hydro or air seeding, with mulch and fertilizer	*32 92 19.14 5400*	104	msf	$ 68.11	$ 7,059	$ 8.90	$ 922	$ 8.39	$ 870	$ -	$ 8,851
Fence, chain link, 9 ga. Wire, in concrete, 6' H	*32 31 13.20 0200*	2,100	lf	$ 19.64	$ 41,244	$ 4.55	$ 9,555	$ 0.99	$ 2,079	$ -	$ 52,878
Double swing gates, 6' H, 12' open, in concrete	*32 31 13.20 5060*	2	Opng	$ 245.25	$ 491	$ 341.36	$ 683	$ 74.03	$ 148	$ -	$ 1,321
Mobilization and Demobilization											**$ 13,701**
5% of Total Costs of Site Work, Treatment										$ 274,017	$ 13,701
Contingency											**$ 2,652,121**
15% of Total Construction Activities										$ 17,680,810	$ 2,652,121
Professional/Technical Services											**$ 3,003,409**
5% Project Management										$ 17,667,109	$ 883,355
6% Remedial Design											$ 1,060,027
6% Construction Management											$ 1,060,027
LONG TERM ANNUAL MONITORING AND MAINTENANCE								**ANNUAL LTM COST (YRS 1-5)** **ANNUAL LTM COST (YRS 6-30)** **LIFETIME LTM (NPV)**			**$23,000** **$11,000** **$221,100**
Monitoring, Sampling, Testing and Analysis (Per Event)											
Assume 80% of combined sampling event for OU1 and OU2											$11,388
Site Monitoring											
Groundwater sampling for 1 event - Includes collection of field parameters		8	well	$ -	$ -	$ 340	$ 2,720.00	$ 92	$ 733.01	$ -	$3,453
Surface water sampling for 1 event		4	samples			$ 340	$ 1,360.00	$ 92	$ 366.50	$ -	$1,727
Materials		1	event	$ 40							$40
Mobilization/Demobilization of Field Sampling Crew		1	event	$ -	$ -	$ -	$ -	$ -	$ -	$ 680.00	$680
Reporting		40	hr	$85	$ 3,400.00	$ -	$ -	$ -	$ -	$ -	$3,400
Laboratory analysis											
Metals and VOCs, plus 20% QA/QC	*Life Science Laboratories*	12	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 174.00	$2,088
Lifetime Long Term Monitoring (Net Present Value)											
5 Years of Semi-Annual Monitoring											
25 Years of Annual Monitoring											
5% Discount Factor (per NYSDEC)											

REMEDIAL ALTERNATIVE	LOCATION	MEDIA	Estimated Cost to Implement	$23,557,000	
Soil/Fill Material Alternative 8 **Partial Removal (Deeper Fill) with Ex Situ Stabilization and On-site Disposal, with In Situ Stabilization (Shallow Fill 0-14 ft Depth)**	**Old Upper Mountain Road** **Lockport, NY**	**Soil/Fill - OU1**	**Construction Time:** **Operation Time:** **Post Remediation Monitoring**	43 - 30	months months years

		Quantities		Cost Breakdown (if available)						Combined Unit Costs	
Description	Data Source (Means[1] or Other)	Quantity Amount	Quantity Unit	Material Unit Cost	Material Total Cost	Labor Unit Cost	Labor Total Cost	Equipment Unit Cost	Equipment Total Cost	Unit Cost	Option Total Cost
TOTAL ESTIMATED NPV TECHNOLOGY COST (Capital + Lifetime O&M + Post Remediation Monitoring)											**$23,557,000**
Assumptions:											
Working condition is Safety Level:		D	**(Labor productivity:**		82%	**; Equipment productivity:**		100%	)		
Weighted Average of city cost index (Buffalo, NY)		101.4%	**(not applicable for costs derived from vendor quotes).**								
Costs are loaded with a profit factor		10%									
Inflation		3%	per year								Labor
Estimated number of soil samples		0	samples	1	times sampled		0.25	hrs/sample		$85	Cost per hr
				20%	added for QA/QC samples		1	worker sampling			
Characterization Cost	Table A (per CWM)	$593.48	per sample								
Analytical cost	TAL Metals	$75.00	per sample								
For each sampling event, assumed:		$50	for materials (gloves, notebooks, etc.)								
Disposal											
Lead contaminated soil as a "listed" waste- incineration		$275	per ton		228,315	tos soil treated ex situ for onsite disposal					
					22	tons per load		10,378	loads for haz disposal		
Lead contaminated soil as non-haz		$39.87	per ton		130,139	tons soil for non-haz disposal		5,915	loads for non-haz disposal		
								70,185	tons for in situ treatment		
Concrete		3,300	lbs per cy					600	CY per day for excavation		
Typical Rental Rates - Includes G&A and 10% Profit						150	ft/day drilling	1000	tons per day for treatment		
Mini-Rae Survey Mode PID		$96.08	per day					20	loads per day		
Truck/SUV (1/2 ton or smaller)		$70.74	per day					20	working days per month		
								10	hours per working day		
Work day consists of:		10	hrs								
								3	months for site prep/restoration		
Excavation With Concrete and Asphalt:								40	months of construction		
Concrete and Asphalt:	0.0%	% of excavation volume									
Excavation Area:	0	sf									
Excavation Volume:	152,210	cy	175,041	lcy							
Excavated Weight:	228,315	tons									
Roll-off dumpster can hold approximately:	12	tons									

Notes

sy	square yard	mo	month
cy	cubic yard	ls	lump sum
lcy	loose cubic yard	O&M	Operation and maintenance
bcy	bank cubic yard	H&S	Health and Safety
lf	linear feet		
sf	square feet		
msf	1,000 square feet		

OU2

Option		Total NPV Cost	Capital Cost	Lifetime Monitoring	Lifetime O&M	Time to Complete	
1B	Site Management	$87,000	$41,000	$46,117	NA	2	months
2	In situ Multi-media Sub-aqueous Capping	$2,889,000	$2,775,000	$113,900	NA	24	months
3	In Situ Sediment Amendment	$2,334,000	$2,295,000	$39,400	NA	24	months
4	Complete Removal Dredging (Mechanical) with Dewatering and On-site Disposal	$4,638,000	$4,638,000	NA	NA	12	months
5	Mass Removal Dredging with On-site Disposal and Multi-Media Residual Capping	$3,887,000	$3,875,000	NA	NA	12	months

REMEDIAL ALTERNATIVE	LOCATION	MEDIA	Estimated Cost to Implement	$87,000
OU 2 Alternative 1B Site Management	Old Upper Mountain Road Lockport, NY	Sediment - OU2	Construction Time: Operation Time: Post Remediation Monitoring	2 months - months 30 years

Description	Data Source (Means[1] or Other)	Quantities: Quantity Amount	Quantity Unit	Cost Breakdown (if available): Material Unit Cost	Material Total Cost	Labor Unit Cost	Labor Total Cost	Equipment Unit Cost	Equipment Total Cost	Combined Unit Costs: Unit Cost	Option Total Cost
REMEDIAL ACTION		**TOTAL CAPITAL COST (totals rounded to nearest thousand)**									**$41,000**
Site Management Activities		**1**			**$0**		**$0**		**$0**	**$65,433**	**$ 35,433**
Surveyor- monument installation		1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 10,000	$ 10,000
Lawyer		1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 15,000	$ 15,000
Fence, chain link, 9 ga. Wire, in concrete, 6' H	*32 31 13.20 0200*	200	lf	$ 15.92	$ 3,184	$ 3.53	$ 706	$ 1.11	$ 222	$ -	$ 4,112
Double swing gates, 6' H, 12' open, in concrete	*32 31 13.20 5060*	2	Opng	$ 245.25	$ 491	$ 341.36	$ 683	$ 74.03	$ 148	$ -	$ 1,321
Signage, assume small signs attached to perimeter fencing		1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,000	$ 5,000
Professional/Technical Services											**$ 6,024**
5% Project Management										$35,433	$ 1,772
6% Remedial Design											$ 2,126
6% Construction Management											$ 2,126
LONG TERM ANNUAL MONITORING AND MAINTENANCE								**ANNUAL LTM COST (YRS 1-30)** **LIFETIME LTM (NPV)**			**$3,000** **$46,117**
Monitoring and Maintenance											
Site Monitoring											**$ 2,766**
Mobilization/Demobilization of Inspector		1	event	$ -	$ -	$ -	$ -	$ -	$ -	$ 340	$ 340
Surface water sampling for 1 event		4	samples	$ -	$ -	$ 42.50	$ 170	$ -	$ -	$ -	$ 170
Materials		1	event	$ 50.00	$ -	$ -	$ -	$ -	$ -	$ -	$ 50
Reporting		6	hr	$ -	$ -	$ 85.00	$ 510	$ -	$ -	$ -	$ 510
Laboratory analysis											
Metals and VOCs, plus 20% QA/QC	*Life Science Laboratories*	4	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 174	$ 696
Maintenance- Fence Maintenance											
Repair fence	*32 01 90.19 1670*	1	ls	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,000	$ 1,000
Lifetime Long Term Monitoring (Net Present Value)											
30 Years of Annual Monitoring											
5% Discount Factor (per NYSDEC)											
TOTAL ESTIMATED NPV TECHNOLOGY COST (Capital + Lifetime O&M + Post Remediation Monitoring)											**$87,000**

Assumptions:

Labor Cost per hr	**$85**		
Weighted Average of city cost index (Buffalo, NY)	**101.4%**	**Analytical Costs**	
Inflation	**3%**	Metals	**$75.00** per sample
		VOCs	**$90.00** per sample
workers per event	**1**		
hours travel per event	**5**		
for materials (gloves, notebooks, etc.)	**$50**		
	0.5 hrs/SW sample		

REMEDIAL ALTERNATIVE	LOCATION	MEDIA	Estimated Cost to Implement	$2,889,000	
OU 2 Alternative 2 In situ Multi-media Sub-aqueous Capping	Old Upper Mountain Road Lockport, NY	Sediment - OU2	Construction Time:	24	months
			Operation Time:	-	months
			Post Remediation Monitoring	30	years

		Quantities		Cost Breakdown (if available)						Combined Unit Costs	
Description	Data Source (Means[1] or Other)	Quantity Amount	Quantity Unit	Material Unit Cost	Material Total Cost	Labor Unit Cost	Labor Total Cost	Equipment Unit Cost	Equipment Total Cost	Unit Cost	Option Total Cost
REMEDIAL ACTION		**TOTAL CAPITAL COST (totals rounded to nearest thousand)**									**$2,775,000**
Construction Activities		**1**			**$51,912**		**$45,019**		**$13,032**	**$62,744**	**$ 2,023,017**
Pre-Construction											
Apply for wetland permits	*Engineer's Estimate*	1	LS	$ -	$ -	$ -	$ 15,000	$ -	$ -	$ -	$ 15,000
Hydrology and Hydraulics study, no FEMA LOMR	*Engineer's Estimate*	1	LS	$ -	$ -	$ -	$ 40,000	$ -	$ -	$ -	$ 40,000
Fluvial Geomorph Investigation	*Engineer's Estimate*	1	LS	$ -	$ -	$ -	$ 10,000	$ -	$ -	$ -	$ 10,000
Site Preparation											
Utility Locator (based on recent bids)	*recent quote*	0.5	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,475.00	$ 1,238
Survey 1-foot contours	*Recent bids*	10.0	acres	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,400.00	$ 44,000
Cut and chip medium, trees to 12" dia.	*31 11 10.10 0200*	9.5	acre	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,617.88	$ 53,370
Haul Road Upgrades, Roads. 8" gravel (From ravine to upper staging area)	*01 55 23.50 0100*	917	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 13.86	$ 12,705
Install Guard Rails along Haul Road, corr steel, steel box beam	*34 71 13.26 1120*	350	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 69.74	$ 24,409
2 laborers, 2 hrs per day, 10 days for controlled release of beaver dams	*Means labor costs p 481*	40	hrs	$ -	$ -	$ 52.67	$ 2,107	$ -	$ -	$ -	$ 2,107
Dewatering											
Installation of gravity pipe (2x18"corr metal pipe)	*31 23 19.20 1400*	3,600	lf	$ 14.42	$ 51,912	$ 11.92	$ 42,912	$ 3.62	$ 13,032	$ -	$ 107,856
Outlet protection (Class II rip-rap for slope and channel protection)	*Recent Bids*	20	cy	$ -	$ -	$ -	$ -	$ -	$ -	$ 78.75	$ 1,575
Misc erosion and sediment control (silt fences, stockpiles, etc)	*Engineer's Estimate*	1	LS	$ -	$ -	$ -	$ -	$ -	$ -	$ 50,000.00	$ 50,000
Capping											
Deploy 10oz/sy mil Nonwoven Geotextile (Level C)	*ECHOS 2006 33 08 0533*	28,848	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 2.40	$ 69,178
Supply and Transportation of Clean Sand to Site - Triaxel 13CY.load, 85/HR truc	*Recent Bids*	9,616	cy	$ 8.50	$ -	$ 13.07	$ -	$ -	$ -	$ 23.73	$ 228,159
Supply and Transportation Clean Graded Armor Stone	*Recent Bids*	9,616	cy	$ 27.50	$ -	$ 13.07	$ -	$ -	$ -	$ 44.63	$ 429,133
Spreading and Compaction of Sand 1' thick		9,616	cy	$ -	$ -	$ -	$ -	$ -	$ -	$ 9.12	$ 87,716
Spreading and Compaction of Stone 1' thick		9,616	cy	$ -	$ -	$ -	$ -	$ -	$ -	$ 9.12	$ 87,716
Haul Road Maintenance	*31 23 23.20 2600*	104	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,141.04	$118,668
Restoration											
Topsoil 6"	*Recent quote- ESG from Seven Springs*	4,808	cy	$ 44.50	$ -	$ -	$ -	$ -	$ -	$ 44.50	$ 213,956
Spreading Topsoil 6" Lifts	*ECHOS 2006 18 05 0301*	4,808	cy	$ -	$ -	$ -	$ -	$ -	$ -	$ 9.43	$ 45,328
Wetland Seeding by hydroseeder with feritilizer and lime	*32 92 19.14 5800 with adjustment for native species*	260	msf	$ 61.30	$ 15,914	$ 8.90	$ 2,311	$ 8.39	$ 2,178	$ -	$ 20,403
Riffle Grade Controls for Cap Stability and Habitat Restoration	*Recent Bids*	5	EA	$ -	$ -	$ -	$ -	$ -	$ -	$ 20,740.00	$ 103,700
Grade Stream Channel Through Cap	*Recent Bids*	3,300	LF	$ -	$ -	$ -	$ -	$ -	$ -	$ 21.00	$ 69,300
Sod and Log Structures to maintain stream pattern	*Recent Bids*	25	EA	$ -	$ -	$ -	$ -	$ -	$ -	$ 7,500.00	$ 187,500
Mobilization and Demobilization											**$ 91,178**
5% of Total Costs of Site Work, Treatment										$ 1,823,559	$ 91,178
Contingency											**$ 317,129**
15% of Total Construction Activities										$ 2,114,195	$ 317,129
Professional/Technical Services											**$ 343,913**
5% Project Management										$ 2,023,017	$ 101,151
6% Remedial Design											$ 121,381
6% Construction Management											$ 121,381
LONG TERM MONITORING								**ANNUAL LTM COST (YRS 1-5)**			**$ 11,000**
								ANNUAL LTM COST (YRS 6-30)			**$ 6,000**
								LIFETIME LTM (NPV)			**$113,900**
Monitoring, Sampling, Testing and Analysis (Per Event)											
Assume 20% of combined sampling event for OU1 and OU2											$ 5,507
Site Monitoring											
Surface water sampling for 1 event		4	samples	$ -	$ -	$ 22.91	$ 92	$ -	$ -	$ -	$ 92
Materials		1	event	$ 50	$ 50	$ -	$ -	$ -	$ -	$ -	$ 50
Mobilization/Demobilization of Field Sampling Crew		1	event	$ -	$ -	$ -	$ -	$ -	$ -	$ 680.00	$ 680
Reporting		40	hr	$ 85.00	$ 3,400	$ -	$ -	$ -	$ -	$ -	$ 3,400
Cap Inspection, 4 hrs each event, mob/demob with monitoring event		1	ea	$ -	$ -	$340	$ 340.00	$75.00	$ 75.00	$ -	$ 415
Laboratory analysis											
Metals and VOCs, plus 20% QA/QC	*Life Science Laboratories*	5	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 174.00	$ 870
Lifetime Long Term Monitoring (Net Present Value)											
5 Years of Semi-Annual Monitoring											
25 Years of Annual Monitoring											
5% Discount Factor (per NYSDEC)											

TOTAL ESTIMATED NPV TECHNOLOGY COST (Capital + Lifetime O&M + Post Remediation Monitoring) **$2,889,000**

Assumptions:

Working condition is Safety Level: **D** **(Labor productivity:** **82%** **; Equipment productivity:** **100%**)

Weighted Average of city cost index (Buffalo, NY) **101.4%** **(not applicable for costs derived from vendor quotes).**

Costs are loaded with a profit factor **10%**

Inflation **3%** per year

Estimated number of soil samples **38** samples; **1** times sampled; **20%** added for QA/QC samples; **0.25** hrs/sample; **1** worker sampling; Labor **$85** Cost per hr

Characterization Cost — Table A (per CWM) — **$507.00** per sample

Analytical cost — TCLP Metals — **$75.00** per sample

For each sampling event, assumed: **$50** for materials (gloves, notebooks, etc.)

Disposal

Lead contaminated sediment as a "listed" waste- incineration **$275** per ton; **-** tons soil hazardous (assume 43% hazardous)

22 tons per load; **0** loads for haz disposal

Lead contaminated sediment as non-haz **$39.87** per ton; **-** tons soil for non-haz disposal; **0** loads for non-haz disposal

Concrete **3,300** lbs per cy; **-** tons concrete for disposal

Typical Rental Rates - Includes G&A and 10% Profit

Mini-Rae Survey Mode PID **$96.08** per day

Truck/SUV (1/2 ton or smaller) **$70.74** per day

Work day consists of: **10** hrs

Disposal Assumptions

20 loads per day
20 working days per month
10 hours per working day
2 months for site prep/restoration
22 months to completion

Excavation:

Concrete and Asphalt: **0.0%** % of excavation volume

Excavation Area: **138,294** sf

Excavation Volume: **0** cy; **0** lcy

Excavated Weight: **0** tons

Roll-off dumpster can hold approximately: **12** tons

Groundwater Monitoring

Typical Rental Rates - Includes G&A and 10% Profit

Truck/SUV (1/2 ton or smaller)	**$70.74**	per day
Water Quality Analyzer	**$159.00**	per day
Water Level Meter	**$31.80**	per day
Submersible Pump	**$113.91**	per day
Generators: 220 Volt	**$82.68**	per day

Analytical Costs

Metals	**$75.00**	per sample
VOCs	**$90.00**	per sample

2 hrs/GW sample; **$85** Labor cost per hr
0.5 hrs/SW sample
2 workers per event
5 hours travel per event
$50 for materials (gloves, notebooks, etc.)

Notes

sy	square yard	mo	month
cy	cubic yard	ls	lump sum
lcy	loose cubic yard	O&M	Operation and maintenance
bcy	bank cubic yard	H&S	Health and Safety
lf	linear feet		
sf	square feet		
msf	1,000 square feet		

REMEDIAL ALTERNATIVE	LOCATION	MEDIA	Estimated Cost to Implement	$2,334,000	
OU 2 Alternative 3 In Situ Sediment Amendment	Old Upper Mountain Road Lockport, NY	Sediment - OU2	Construction Time:	24	months
			Operation Time:	-	months
			Post Remediation Monitoring	30	years

Description	Data Source (Means[1] or Other)	Quantities: Quantity Amount	Quantity Unit	Cost Breakdown (if available): Material Unit Cost	Material Total Cost	Labor Unit Cost	Labor Total Cost	Equipment Unit Cost	Equipment Total Cost	Combined Unit Costs: Unit Cost	Option Total Cost
REMEDIAL ACTION		**TOTAL CAPITAL COST (totals rounded to nearest thousand)**									**$2,295,000**
Construction Activities		**1**			**$51,912**		**$46,312**		**$13,032**	**$67,735**	**$ 1,692,432**
Pre-Construction											
Apply for wetland permits	*Engineer's Estimate*	1	LS	$ -	$ -	$ -	$ 5,000	$ -	$ -	$ -	$ 5,000
Hydrology and Hydraulics study, no FEMA LOMR	*Engineer's Estimate*	1	LS	$ -	$ -	$ -	$ 40,000	$ -	$ -	$ -	$ 40,000
Fluvial Geomorph Investigation	*Engineer's Estimate*	1	LS	$ -	$ -	$ -	$ 10,000	$ -	$ -	$ -	$ 10,000
Bench-scale and Pilot Study Amendment Testing	*Engineer's Estimate*	1	LS	$ -	$ 15,000	$ -	$ 20,000	$ -	$ -	$ -	$ 35,000
Site Preparation											
Utility Locator (based on recent bids)	*recent quote*	0.5	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,475.00	$ 1,238
Survey 1-foot contours	*Recent bids*	10.0	acres	$ -	$ -		$ -	$ -	$ -	$ 4,400.00	$ 44,000
Cut and chip medium, trees to 12" dia.	*31 11 10.10 0200*	9.5	acre	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,617.88	$ 53,370
Haul Road Upgrades, Roads. 8" gravel (From ravine to upper staging area)	*01 55 23.50 0100*	917	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 13.86	$ 12,705
Install Guard Rails along Haul Road, corr steel, steel box beam	*34 71 13.26 1120*	350	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 69.74	$ 24,409
2 laborers, 2 hrs per day, 10 days for controlled release of beaver dams		20	hrs	$ -	$ -	$170	$ 3,400	$ -	$ -	$ -	$ 3,400
Dewatering											
Installation of gravity pipe (2x18"corr metal pipe)	*31 23 19.20 1400*	3,600	lf	$ 14.42	$ 51,912	$ 11.92	$ 42,912	$ 3.62	$ 13,032	$ -	$ 107,856
Outlet protection (Class II rip-rap for slope and channel protection)	*Recent Bids*	20	cy	$ -	$ -	$ -	$ -	$ -	$ -	$ 78.75	$ 1,575
Misc erosion and sediment control (silt fences, stockpiles, etc)	*Engineer's Estimate*	1	LS	$ -	$ -	$ -	$ -	$ -	$ -	$ 50,000.00	$ 50,000
Amendment											
Eco-Bond® or similar Gypsum/Apetite Amendment	*Engineer's Estimate - Recent Bids*	25,905	ton	$ -	$ -	$ -	$ -	$ -	$ -	$ 29.95	$ 775,783
Spread amendment (via hydroseeder and mulch)		260	msf	$ -	$ -	$ -	$ -	$ -	$ -	$ 49.50	$ 12,852
Chisel plow/rip ammendment into soil, 4 passes, assume a cubic yard per square yard depth	*Ripping, adverse conditions, 31 23 16.32 2800 till, boulder and clay*	28,848	SY	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.37	$ 10,674
Subgrade preparation (muddy or otherwise inaccessable areas)	*Allowance*	1	LS	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,000.00	$ 5,000
Haul Road Maintenance	*31 23 23.20 2600*	104	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,141.04	$ 118,668
Stabilization of Site											
Wetland Seeding by hydroseeder with feritilizer and lime	*32 92 19.14 5800 with adjustment for native species*	260	msf	$ 61.30	$ 15,914	$ 8.90	$ 2,311	$ 8.39	$ 2,178	$ -	$ 20,403
Riffle Grade Controls for Stability and Habitat Restoration	*Recent Bids*	5	EA	$ -	$ -	$ -	$ -	$ -	$ -	$ 20,740	$ 103,700
Grade Stream Channel Through Cap	*Recent Bids*	3,300	LF	$ -	$ -	$ -	$ -	$ -	$ -	$ 21.00	$ 69,300
Sod and Log Structures to maintain stream pattern	*Recent Bids*	25	EA	$ -	$ -	$ -	$ -	$ -	$ -	$ 7,500.00	$ 187,500
Mobilization and Demobilization											**$ 53,055**
5% of Total Costs of Site Work, Treatment										$1,061,108	$ 53,055
Contingency											**$ 261,823**
15% of Total Construction Activities										$1,745,487	$ 261,823
Professional/Technical Services											**$ 287,713**
5% Project Management										$1,692,432	$ 84,622
6% Remedial Design											$ 101,546
6% Construction Management											$ 101,546
LONG TERM MONITORING								**ANNUAL LTM COST (YRS 1-5)**			**$4,000**
								ANNUAL LTM COST (YRS 6-30)			**$2,000**
								LIFETIME LTM (NPV)			**$39,400**
Monitoring, Sampling, Testing and Analysis (Per Event)											
Assume 20% of combined sampling event for OU1 and OU2											$1,804
Site Monitoring											
Surface water sampling for 1 event		4	samples	$ -	$ -	$ -	$ -	$ 22.91	$ 91.63	$ -	$92
Materials		1	event	$ 10	$ -	$ -	$ -	$ -	$ -	$ -	$10
Mobilization/Demobilization of Field Sampling Crew		1	event	$ -	$ -	$ -	$ -	$ -	$ -	$ 17.00	$17
Reporting		10	hr	$ 85.00	$ 850	$ -	$ -	$ -	$ -	$ -	$850
Laboratory analysis											
Metals and VOCs	*Life Science Laboratories*	5	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 174.00	$835
Lifetime Long Term Monitoring (Net Present Value)											
5 Years of Semi-Annual Monitoring											
25 Years of Annual Monitoring											
5% Discount Factor (per NYSDEC)											
TOTAL ESTIMATED NPV TECHNOLOGY COST (Capital + Lifetime O&M + Post Remediation Monitoring)											**$2,334,000**

Assumptions:

Working condition is Safety Level:		**D**	**(Labor productivity:**	**82%**	**; Equipment productivity:**	**100%**	**)**
Weighted Average of city cost index (Buffalo, NY)		**101.4%**	**(not applicable for costs derived from vendor quotes).**				
Costs are loaded with a profit factor		**10%**					
Inflation		**3%**	per year				Labor
Estimated number of soil samples		**13**	samples	**-** times sampled	**0.25** hrs/sample	**$85**	Cost per hr
				20% added for QA/QC samples	**1** worker sampling		
Characterization Cost	Table A (per CWM)	**$507.00**	per sample				
Analytical cost	TAL Metals	**$75.00**	per sample				
For each sampling event, assumed:		**$50**	for materials (gloves, notebooks, etc.)				
Disposal							
Lead contaminated soil as a "listed" waste- incineration		**$275**	per ton	**-**	tons soil hazardous (assume 43% hazardous)		
				22	tons per load	**0**	loads for haz disposal
Lead contaminated soil as non-haz		**$39.87**	per ton	**-**	tons soil for non-haz disposal	**0**	loads for non-haz disposal
Concrete		**3,300**	lbs per cy	**-**	tons concrete for disposal		
Typical Rental Rates - Includes G&A and 10% Profit							
Mini-Rae Survey Mode PID		**$96.08**	per day			20	loads per day
Truck/SUV (1/2 ton or smaller)		**$70.74**	per day			20	working days per month
						10	hours per working day
Work day consists of:		**10**	hrs			1	months for site prep/restoration
						1	months to completion

Excavation With Concrete and Asphalt:

Concrete and Asphalt:	**0.0%**	% of excavation volume			
Excavation Area:	**47,997**	sf			
Excavation Volume:	**889**	cy	**1,022**	lcy	
Excavated Weight:	**1,333**	tons			
Roll-off dumpster can hold approximately:	**12**	tons			

Groundwater Monitoring

Typical Rental Rates - Includes G&A and 10% Profit

Truck/SUV (1/2 ton or smaller)	**$70.74**	per day
Water Quality Analyzer	**$159.00**	per day
Water Level Meter	**$31.80**	per day
Submersible Pump	**$113.91**	per day
Generators: 220 Volt	**$82.68**	per day

Analytical Costs

Metals	**$75.00**	per sample
VOCs	**$90.00**	per sample
0.5 hrs/ SW sample	**$85**	Labor cost per hr
2 workers per event		
5 hours travel per event		
$50 for materials (gloves, notebooks, etc.)		

Notes

sy	square yard	mo	month
cy	cubic yard	ls	lump sum
lcy	loose cubic yard	O&M	Operation and maintenance
bcy	bank cubic yard	H&S	Health and Safety
lf	linear feet		
sf	square feet		
msf	1,000 square feet		

REMEDIAL ALTERNATIVE	LOCATION	MEDIA	Estimated Cost to Implement	$4,638,000
			Estimated Cost for Off-Site Disposal	$5,239,000
OU 2 Alternative 4 Complete Removal Dredging (Mechanical) with Dewatering and On-site Disposal	Old Upper Mountain Road Lockport, NY	Sediment - OU2	Construction Time:	12 months
			Operation Time:	- months
			Post Remediation Monitoring	0 years

Description	Data Source (Means[1] or Other)	Quantities: Quantity Amount	Quantity Unit	Cost Breakdown (if available): Material Unit Cost	Material Total Cost	Labor Unit Cost	Labor Total Cost	Equipment Unit Cost	Equipment Total Cost	Combined Unit Costs: Unit Cost	Option Total Cost
REMEDIAL ACTION		**TOTAL CAPITAL COST (totals rounded to nearest thousand)**									**$4,638,000**
Construction Activities		**1**			**$1,571,652**		**$209,826**		**$133,765**	**$80,430**	**$ 3,482,346**
Pre-Construction											
Apply for wetland permits	*Engineer's Estimate*	1	LS	$ -	$ -	$ -	$ 5,000	$ -	$ -	$ -	$ 5,000
Hydrology and Hydraulics study, no FEMA LOMR	*Engineer's Estimate*	1	LS	$ -	$ -	$ -	$ 40,000	$ -	$ -	$ -	$ 40,000
Fluvial Geomorph Investigation	*Engineer's Estimate*	1	LS	$ -	$ -	$ -	$ 10,000	$ -	$ -	$ -	$ 10,000
Apply for discharge permits		1	LS	$ -	$ -	$ -	$ 25,000	$ -	$ -	$ -	$ 25,000
Site Preparation											
Survey 1-foot contours	*Recent bids*	10.0	acres	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,400.00	$ 44,000
Utility Locator (based on recent bids)	*recent quote*	0.5	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,475.00	$ 1,238
Grub stumps, trees to 12" diameter along creek for dredging	*31 11 10.10 0200*	10	acre	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,617.88	$ 53,370
Cut and chip light trees to 6" dia. Along road and in staging area	*31 11 10.10 0020*	1	acre	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,945.16	$ 3,945
Debris Removal by excavator (2 cy)- separation into trash and woody debris	*ECHOS Crew CODE1*	40	hours	$ -	$ -	$ 46	$ 1,845	$ 139	$ 5,567	$ -	$ 7,412
Haul Road Upgrades, Roads. 8" gravel (From ravine to upper staging area)	*01 55 23.50 0100*	917	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 13.86	$ 12,705
Install Guard Rails along Haul Road, corr steel, steel box beam	*34 71 13.26 1120*	350	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 69.74	$ 24,409
Beaver Trapping and Relocation		20	hours	$ -	$ -	$ 85	$ 1,700	$ -	$ -	$ -	$ 1,700
Controlled release of beaver dams by hand		20	hours	$ -	$ -	$ 85	$ 1,700	$ -	$ -	$ -	$ 1,700
Preparation of streamside staging area (50' x 50')											
Silt Fence	*31 25 13.10 1000*	200	lf	$ 0.23	$ 46	$ 0.45	$ 90	$ -	$ -	$ -	$ 136
30 mil HDPE Liner	*33 47 13.53 1100*	2,500	sf	$ 0.30	$ 750	$ 0.85	$ 2,125	$ -	$ -	$ -	$ 2,875
3/4" Gravel Fill	*ECHOS 17 03 0300*	46	cy	$ 26.26	$ 1,216	$ 3.63	$ 168	$ 1.28	$ 59	$ -	$ 1,443
Downstream Silt Curtain	*www.silt-barriers.com, labor from 31 25 13.10 1000*	250	lf	$ 6.50	$ 1,625	$ 0.45	$ 113	$ -	$ -	$ -	$ 1,738
Stream Dewatering											
Installation of gravity pipe (2x18"corr metal pipe)	*31 23 19.20 1400*	3,600	lf	$ 14	$ 51,912	$ 11.92	$ 42,912	$ 3.62	$ 13,032		$ 107,856
Outlet protection (Class II rip-rap for slope and channel protection)	*Recent Bids*	20	cy	$ -	$ -	$ -	$ -	$ -	$ -	$ 78.75	$ 1,575
Misc erosion and sediment control (silt fences, stockpiles, etc)	*Engineer's Estimate*	1	LS	$ -	$ -	$ -	$ -	$ -	$ -	$ 50,000.00	$ 50,000
Dredging											
Haul Road Upgrades (During sediment dredging, where possible)	*01 55 23.50 0100*	2,222	sy	$ 8.61	$ 19,124	$ 2.93	$ 6,502	$ 0.59	$ 1,315	$ -	$ 26,942
Crane mats (for narrow lower reach) 4- 20' mats	*Hanes Supply*	4	ea	$ -	$ -	$ -	$ -	$ -	$ -	$ 850.00	$ 3,400
Track excavator loadout into dumps											
Soil-Excavator, hydraulic, crawler mtd. 2 CY cap = 165 CY/hr	*31 23 16.42 0260*	18,133	bcy	$ -	$ -	$ 0.65	$ 18,677.32	$ 1.03	$ 18,677.32	$ -	$ 37,355
12 CY truck, 15 mph average, cycle 2 miles, 10 min wait/ld/unld	*31 23 23.20 1218*	20,853	lcy	$ -	$ -	$ 1.83	$ 38,162	$ 3.11	$ 64,854	$ -	$ 103,015
Addition of stabilizer/dewatering agent	*32 01 16.71 5400, 03 05 13.30 0240*	18,133	cy	$ 78	$ 1,414,399	$ 0.09	$ 1,632	$ 0.07	$ 1,269	$ -	$ 1,417,301
Haul Road Maintenance	*31 23 23.20 2600*	119	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,141.04	$ 135,784
Sediment Stockpiling for Dewatering											
Stockpile Pad with Sump - 40,000 SF											
Silt Fence	*31 25 13.10 1000*	1,000	lf	$ 0.23	$ 230	$ 0.45	$ 450	$ -	$ -	$ -	$ 680
30 mil HDPE Liner	*33 47 13.53 1100*	80,000	sf	$ 0.30	$ 24,000	$ 0.85	$ 68,000	$ -	$ -	$ -	$ 92,000
3/4" Gravel Fill (9")	*ECHOS 17 03 0300*	2,222	cy	$ 26.26	$ 58,349	$ 3.63	$ 8,066	$ 1.28	$ 2,839	$ -	$ 69,255
Pumping, 8 hr., attended 2 hrs. per day, including 20 lf of suction hose and 100 lf discharge hose, 4" diaphragm pump	*31 23 19.20 0650*	79	day	$ -	$ -	$ 119.18	$ 9,415	$ 33.56	$ 2,651	$ -	$ 12,066
2- 20,000 gallon tanks	*rain4rent*	79	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 92.00	$ 7,268
Water Treatment facility	*Engineer's Estimate*	4	month	$ -	$ -	$ -	$ -	$ -	$ -	$1,250	$ 4,938
Water Treatment facility- mob/demob	*Engineer's Estimate*	1	ea	$ -	$ -	$ -	$ -	$ -	$ -	$10,000	$ 10,000
Carbon	*Engineer's Estimate*	15,000	lbs	$ -	$ -	$ -	$ -	$ -	$ -	$1.00	$ 15,000
Bag filter housing	*Grainger*	3	ea	$ -	$ -	$ -	$ -	$ -	$ -	$275	$ 825
Bag filters, pack of 20	*Grainger*	8	ea	$ -	$ -		$ -	$ -	$ -	$175	$ 1,396
Maintain Stockpile, 700HP Dozer, 50ft Haul	*31 23 16.46 6010*	10,880	bcy	$ -	$ -	$ 0.16	$ 1,740.80	$ 1.52	$ 16,537.59	$ -	$ 18,278
FEL, wheel mount, 2 1/4 CY cap. loadout into dumps from stockpiles	*31 23 16.42 1600*	10,880	bcy	$ -	$ -	$ 0.60	$ 6,528	$ 0.64	$ 6,963	$ -	$ 13,491
Spotter at Loadout	*31 23 23.20 2310*	500	hrs	$ -	$ -	$ -	$ -	$ -	$ -	$ 45.96	$ 22,980
Landfill Placement and Sediment Stabilization											
Excavator Loadout, 4.5 CY bucket, 80% fill factor	*31 23 16.43 4700*	12,512	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.14	$ 14,264
12 CY truck, 15 mph average, cycle 1 mile, 15 min wait/ld/unld	*31 23 23.20 1016*	12,512	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 3.35	$ 41,915
Portland Cement, for sediment stabilization prior to compaction	*03 05 13.30 0300*	41,164	Cwt	$ -	$ -	$ -	$ -	$ -	$ -	$ 9.01	$ 370,892
Mixing material in windrow, 180 H.P. grader, including added 15% for portland cement	*32 01 16.71 5400*	14,389	cy							$ 0.16	$ 2,302
Compaction, riding, vibrating roller, 2 passes, 12" lifts	*31 23 23.23 5060*	12,512	ecy							$ 0.55	$ 6,882
Finishing grading slopes, steep	*31 22 16.10 3310*	12,000	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.21	$ 2,520
Confirmation Sediment Sampling											
Grab Samples- 12 per acre plus 20% QA/QC		86	sample	$ -	$ 50	$ 21	$ 1,824	$ 67	$ 5,727	$ -	$ 7,601
Lab Analyses - TAL Metals	*Life Science Laboratories*	86	sample	$ -	$ -	$ -	$ -	$ -	$ -	$ 82.50	$ 7,081
Stabilization of Site											
Topsoil 6"	*Recent quote- ESG from Seven Springs*	4,808	CY	$ 45.00	$ 216,360	$ -	$ -	$ -	$ -	$ -	$ 216,360
Spreading Topsoil 6" Lifts	*ECHOS 2006 18 05 0301*	4,808	CY	$ -	$ -	$ -	$ -	$ -	$ -	$ 9.43	$ 45,339
Wetland Seeding by hydroseeder with feritilizer and lime	*32 92 19.14 5800 with adjustment for native species*	237	msf	$ 61.30	$ 14,520	$ 8.90	$ 2,108	$ 8.39	$ 1,987	$ -	$ 18,615
Riffle Grade Controls for Stability and Habitat Restoration	*Recent Bids*	5	EA	$ -	$ -	$ -	$ -	$ -	$ -	$ 20,740	$ 103,700
Grade Stream Channel Through Cap	*Recent Bids*	3,300	LF	$ -	$ -	$ -	$ -	$ -	$ -	$ 21.00	$ 69,300
Sod and Log Structures to maintain stream pattern	*Recent Bids*	25	EA	$ -	$ -	$ -	$ -	$ -	$ -	$ 7,500.00	$ 187,500
Mobilization and Demobilization											**$ 36,338**
5% of Total Costs of Site Work, Treatment										$726,765	$ 36,338
Contingency											**$ 527,803**
15% of Total Construction Activities										$3,518,684	$ 527,803
Professional/Technical Services											**$ 591,999**
5% Project Management										$3,482,346	$ 174,117
6% Remedial Design											$ 208,941
6% Construction Management											$ 208,941

REMEDIAL ALTERNATIVE	LOCATION	MEDIA	Estimated Cost to Implement	$4,638,000	
			Estimated Cost for Off-Site Disposal	$5,239,000	
OU 2 Alternative 4 Complete Removal Dredging (Mechanical) with Dewatering and On-site Disposal	Old Upper Mountain Road Lockport, NY	Sediment - OU2	Construction Time:	12	months
			Operation Time:	-	months
			Post Remediation Monitoring	0	years

Description	Data Source (Means[1] or Other)	Quantities: Quantity Amount	Quantity Unit	Cost Breakdown (if available): Material Unit Cost	Material Total Cost	Labor Unit Cost	Labor Total Cost	Equipment Unit Cost	Equipment Total Cost	Combined Unit Costs: Unit Cost	Option Total Cost
TOTAL ESTIMATED NPV TECHNOLOGY COST (Capital + Lifetime O&M + Post Remediation Monitoring)											**$4,638,000**

Assumptions:

- Working condition is Safety Level: **D** **(Labor productivity: 82% ; Equipment productivity: 100%)**
- Weighted Average of city cost index (Buffalo, NY) **101.4%** **(not applicable for costs derived from vendor quotes).**
- Costs are loaded with a profit factor **10%**
- Inflation **3%** per year

Estimated number of sediment samples **72** samples; **1** times sampled; **20%** added for QA/QC samples; **0.25** hrs/sample; **1** worker sampling; Labor **$85** Cost per hr

- Characterization Cost — Table A (per CWM) — **$507.00** per sample
- Analytical cost — TAL Metals — **$75.00** per sample
- For each sampling event, assumed: **$50** for materials (gloves, notebooks, etc.)

Disposal

- Lead contaminated sediment as a "listed" waste- incineration **$275** per ton; **1,387** tons soil hazardous (assume 43% hazardous); **22** tons per load; **63** loads for haz disposal
- Lead contaminated sediment as non-haz **$39.87** per ton; **12,485** tons soil for non-haz disposal; **599** loads for non-haz disposal; **691** tons debris for non-haz disposal

Typical Rental Rates - Includes G&A and 10% Profit

- Mini-Rae Survey Mode PID **$96.08** per day
- Truck/SUV (1/2 ton or smaller) **$70.74** per day

Work day consists of: **10** hrs

Dredging Area

- Excavation Area: **259,632** sf
- Excavation Volume: **17,270** cy; **19,860** lcy
- Excavated Weight: **25,905** tons
- Roll-off dumpster can hold approximately: **22** tons

15 loads per day
20 working days per month
10 hours per working day
3 months for site prep/restoration
11 months to completion
79 Days sediment loadout for dewatering
40 Days sediment loadout for disposal
10 Days debris loadout for diposal

Notes

sy	square yard	mo	month
cy	cubic yard	ls	lump sum
lcy	loose cubic yard	O&M	Operation and maintenance
bcy	bank cubic yard	H&S	Health and Safety
lf	linear feet		
sf	square feet		
msf	1,000 square feet		

REMEDIAL ALTERNATIVE	LOCATION	MEDIA	Estimated Cost to Implement	$3,887,000
			Estimated Cost for Off-Site Disposal	$4,603,000
OU 2 Alternative 5 **Mass Removal Dredging with On-site Disposal and Multi-Media Residual Capping**	**Old Upper Mountain Road** **Lockport, NY**	**Sediment - OU2**	Construction Time:	12 months
			Operation Time:	- months
			Post Remediation Monitoring	0 years

Description	Data Source (Means[1] or Other)	Quantities: Quantity Amount	Quantity Unit	Cost Breakdown (if available): Material Unit Cost	Material Total Cost	Labor Unit Cost	Labor Total Cost	Equipment Unit Cost	Equipment Total Cost	Combined Unit Costs: Unit Cost	Option Total Cost
REMEDIAL ACTION		**TOTAL CAPITAL COST (totals rounded to nearest thousand)**									**$3,875,000**
Construction Activities		**1**			**$1,433,875**		**$152,574**		**$105,467**	**$13,076**	**$ 2,908,058**
Pre-Construction											
Apply for wetland permits	*Engineer's Estimate*	1	LS	$ -	$ -	$ -	$ 5,000	$ -	$ -	$ -	$ 5,000
Hydrology and Hydraulics study, no FEMA LOMR	*Engineer's Estimate*	1	LS	$ -	$ -	$ -	$ 40,000	$ -	$ -	$ -	$ 40,000
Fluvial Geomorph Investigation	*Engineer's Estimate*	1	LS	$ -	$ -	$ -	$ 10,000	$ -	$ -	$ -	$ 10,000
Apply for discharge permits	*Engineer's Estimate*	1	LS	$ -	$ -	$ -	$ 2,500	$ -	$ -	$ -	$ 2,500
Site Preparation											
Survey 1-foot contours	*Recent bids*	10.0	acres	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,400.00	$ 44,000
Utility Locator (based on recent bids)	*recent quote*	0.5	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,475.00	$ 1,238
Grub stumps, trees to 12" diameter along creek for dredging	*31 11 10.10 0200*	10	acre	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,617.88	$ 56,179
Cut and chip light trees to 6" dia. Along road and in staging area	*31 11 10.10 0020*	1	acre	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,945.16	$ 3,945
Debris Removal by excavator (2 cy)- separation into trash and woody debris	*ECHOS Crew CODE1*	40	hours	$ -	$ -	$ 46	$ 1,845	$ 139	$ 5,567	$ -	$ 7,412
Haul Road Upgrades, Roads. 8" gravel (From ravine to upper staging area)	*01 55 23.50 0100*	917	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 13.86	$ 12,705
Install Guard Rails along Haul Road, corr steel, steel box beam	*34 71 13.26 1120*	350	lf	$ -	$ -	$ -	$ -	$ -	$ -	$ 69.74	$ 24,409
Beaver Trapping and Relocation		20	hours	$ -	$ -	$ 85	$ 1,700	$ -	$ -	$ -	$ 1,700
Controlled release of beaver dams by hand		20	hours	$ -	$ -	$ 85	$ 1,700	$ -	$ -	$ -	$ 1,700
Preparation of streamside staging area (50' x 50')											
Silt Fence	*31 25 13.10 1000*	200	lf	$ 0.23	$ 46	$ 0.45	$ 90	$ -	$ -	$ -	$ 136
30 mil HDPE Liner	*33 47 13.53 1100*	2,500	sf	$ 0.30	$ 750	$ 0.85	$ 2,125	$ -	$ -	$ -	$ 2,875
3/4" Gravel Fill	*ECHOS 17 03 0300*	46	cy	$ 26.26	$ 1,216	$ 3.63	$ 168	$ 1.28	$ 59	$ -	$ 1,443
Downstream Silt Curtain	*www.silt-barriers.com, labor from 31 25 13.10 1000*	250	lf	$ 6.50	$ 1,625	$ 0.45	$ 113	$ -	$ -	$ -	$ 1,738
Stream Dewatering											
Installation of gravity pipe (2x18"corr metal pipe)	*31 23 19.20 1400*	1,700	lf	$ 14	$ 24,514	$ 11.92	$ 20,264	$ 3.62	$ 6,154		$ 50,932
Outlet protection (Class II rip-rap for slope and channel protection)	*Recent Bids*	20	cy	$ -	$ -	$ -	$ -	$ -	$ -	$ 78.75	$ 1,575
Misc erosion and sediment control (silt fences, stockpiles, etc)	*Engineer's Estimate*	1	LS	$ -	$ -	$ -	$ -	$ -	$ -	$ 50,000.00	$ 50,000
Dredging											
Haul Road Upgrades (During sediment dredging, where possible)	*01 44 23.50 0100*	2,222	sy	$ 8.61	$ 19,124	$ 2.93	$ 6,502	$ 0.59	$ 1,315	$ -	$ 26,942
Track excavator loadout into dumps											
Soil-Excavator, hydraulic, crawler mtd. 2 CY cap = 165 CY/hr	*31 23 16.42 0260*	17,200	bcy	$ -	$ -	$ 0.65	$ 17,716.05	$ 1.03	$ 17,716.05	$ -	$ 35,432
12 CY truck, 15 mph average, cycle 2 miles, 10 min wait/ld/unld	*31 23 23.20 1218*	19,780	lcy	$ -	$ -	$ 1.83	$ 36,198	$ 3.11	$ 61,516	$ -	$ 97,713
Addition of stabilizer/dewatering agent	*32 01 16.71 5400, 03 05 13.30 0240*	17,200		$ 78	$ 1,341,604	$ 0.09	$ 1,548	$ 0.07	$ 1,204	$ -	$ 1,344,356
Haul Road Maintenance	*31 23 23.20 2600*	75	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,141.04	$ 85,578
Sediment Stockpiling for Dewatering											
Stockpile Pad with Sump - 40,000 SF											
Silt Fence	*31 25 13.10 1000*	1,000	lf	$ 0.23	$ 230	$ 0.45	$ 450	$ -	$ -	$ -	$ 680
30 mil HDPE Liner	*33 47 13.53 1100*	80,000	sf	$ 0.30	$ 24,000	$ 0.85	$ 68,000	$ -	$ -	$ -	$ 92,000
3/4" Gravel Fill (9")	*ECHOS 17 03 0300*	2,222	cy	$ 21.99	$ 48,867	$ 3.04	$ 6,756	$ 1.07	$ 2,378	$ -	$ 58,000
Pumping, 8 hr., attended 2 hrs. per day, including 20 lf of suction hose and 100 lf discharge hose, 4" diaphragm pump	*31 23 19.20 0650*	75	day	$ -	$ -	$ 119.18	$ 8,939	$ 33.56	$ 2,517	$ -	$ 11,456
2- 20,000 gallon tanks	*rain4rent*	75	day	$ -	$ -	$ -	$ -	$ -	$ -	$ 92.00	$ 6,900
Water Treatment facility	*Engineer's Estimate*	4	month	$ -	$ -	$ -	$ -	$ -	$ -	$1,250	$ 4,688
Water Treatment facility- mob/demob	*Engineer's Estimate*	1	ea	$ -	$ -	$ -	$ -	$ -	$ -	$10,000	$ 10,000
Carbon	*Engineer's Estimate*	15,000	lbs	$ -	$ -	$ -	$ -	$ -	$ -	$1	$ 15,000
Bag filter housing	*Grainger*	3	ea	$ -	$ -	$ -	$ -	$ -	$ -	$275	$ 825
Bag filters, pack of 20	*Grainger*	8	ea	$ -	$ -	$ -	$ -	$ -	$ -	$175	$ 1,396
Maintain Stockpile, 700HP Dozer, 50ft Haul	*31 23 16.46 6010*	6,552	bcy	$ -	$ -	$ 0.16	$ 1,048.38	$ 1.52	$ 9,959.65	$ -	$ 11,008
FEL, wheel mount, 2 1/4 CY cap. loadout into dumps from stockpiles	*31 23 16.42 1600*	6,552	bcy	$ -	$ -	$ 0.60	$ 3,931	$ 0.64	$ 4,194	$ -	$ 8,125
Spotter at Loadout	*31 23 23.20 2310*	500	hrs	$ -	$ -	$ -	$ -	$ -	$ -	$ 45.96	$ 22,980
Landfill Placement and Sediment Stabilization											
Excavator Loadout, 4.5 CY bucket, 80% fill factor	*31 23 16.43 4700*	7,535	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.14	$ 8,590
12 CY truck, 15 mph average, cycle 1 mile, 15 min wait/ld/unld	*31 23 23.20 1016*	7,535	lcy	$ -	$ -	$ -	$ -	$ -	$ -	$ 3.35	$ 25,243
Portland Cement, for sediment stabilization prior to compaction	*03 05 13.30 0300*	24,791	Cwt	$ -	$ -	$ -	$ -	$ -	$ -	$ 9.01	$ 223,367
Mixing material in windrow, 180 H.P. grader, including added 15% for portland cement	*32 01 16.71 5400*	8,666	cy							$ 0.16	$ 1,386
Compaction, riding, vibrating roller, 2 passes, 12" lifts	*31 23 23.23 5060*	7,535	ecy							$ 0.55	$ 4,144
Finishing grading slopes, steep	*31 22 16.10 3310*	12,000	sy	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.21	$ 2,520
Confirmation Soil Sampling											
Grab Samples- 12 per acre plus 20% QA/QC		70	sample	$ -	$ 50	$ 21	$ 1,487	66.73	$ 4,668	$ -	$ 6,205
Lab Analyses - TAL Metals	*Life Science Laboratories*	70	sample	$ -	$ -	$ -	$ -	$ -	$ -	$ 82.50	$ 5,772
Site Restoration											
Topsoil	*Recent quote- ESG from Seven Springs*	889	cy	$ 45	$ 39,554	$ -	$ -	$ -	$ -	$ -	$ 39,554
Residuals Cap											
3" Sand Layer	*Recent bids*	444	cy	$ 9	$ 3,778	$ 13	$ 5,809	$ -	$ -	$ -	$ 9,586
3" Gravel Layer	*Recent bids*	444	cy	$ 28	$ 12,222	$ 13	$ 5,809	$ -	$ -	$ -	$ 18,030
Excavator for cap placement- assume three full weeks	*ECHOS Crew CODE1*	120	hours	$ -	$ -	$ 46	$ 5,536	$ 139	$ 16,701	$ -	$ 22,237
Laborer for grade stake placement	*ECHOS Crew COELD*	40	hours	$ -	$ -	$ 33	$ 1,327	$ -	$ -	$ -	$ 1,327
12 CY truck, 15 mph average, cycle 2 miles, 10 min wait/ld/unld	*31 23 23.20 1218*	1,067	lcy	$ -	$ -	$ 1.83	$ 1,952	$ 4.94	$ 5,269	$ -	$ 7,221
Maintain Stockpile, 700HP Dozer, 50ft Haul	*31 23 16.46 6010*	711	bcy	$ -	$ -	$ 0.16	$ 113.77	$ 1.52	$ 1,080.84	$ -	$ 1,195
Stabilization of Site											
Wetland Seeding by hydroseeder with feritilizer and lime	*32 92 19.14 5800 with adjustment for native species*	237	msf	$ 61	$ 14,520	$ 9	$ 2,108.23	$ 8	$ 1,987.42	$ -	$ 18,615
Riffle Grade Controls for Cap Stability and Habitat Restoration	*Recent Bids*	5	EA	$ -	$ -	$ -	$ -	$ -	$ -	$ 20,740	$ 103,700
Grade Stream Channel Through Cap	*Recent Bids*	3,300	LF	$ -	$ -	$ -	$ -	$ -	$ -	$ 21.00	$ 69,300
Sod and Log Structures to maintain stream pattern	*Recent Bids*	25	EA	$ -	$ -	$ -	$ -	$ -	$ -	$ 7,500.00	$ 187,500
Mobilization and Demobilization											**$ 31,310**
5% of Total Costs of Site Work, Treatment										$626,200	$ 31,310
Contingency											**$ 440,905**
15% of Total Construction Activities										$2,939,368	$ 440,905
Professional/Technical Services											**$ 494,370**
5% Project Management										$2,908,058	$ 145,403
6% Remedial Design											$ 174,483
6% Construction Management											$ 174,483
LONG TERM MONITORING								**ANNUAL LTM COST (YRS 1-30)**			**$760**
								LIFETIME LTM (NPV)			**$11,700**
Cap Inspection, 4 per year, 4 hrs each event, mob/demob with monitoring event		1	ea	$ -	$ -	$340	$ 340.00	$75.00	$ 75.00	$ -	$415
Mobilization/Demobilization of Field Sampling Crew		1	event	$ -	$ -	$ -	$ -	$ -	$ -	$ 340.00	$ 340
Lifetime Long Term Monitoring (Net Present Value)											
25 Years of Annual Monitoring											
5% Discount Factor (per NYSDEC)											

REMEDIAL ALTERNATIVE	LOCATION	MEDIA	Estimated Cost to Implement	$3,887,000
			Estimated Cost for Off-Site Disposal	$4,603,000
OU 2 Alternative 5 Mass Removal Dredging with On-site Disposal and Multi-Media Residual Capping	Old Upper Mountain Road Lockport, NY	Sediment - OU2	Construction Time:	12 months
			Operation Time:	- months
			Post Remediation Monitoring	0 years

Description	Data Source (Means[1] or Other)	Quantities: Quantity Amount	Quantity Unit	Cost Breakdown (if available): Material Unit Cost	Material Total Cost	Labor Unit Cost	Labor Total Cost	Equipment Unit Cost	Equipment Total Cost	Combined Unit Costs: Unit Cost	Option Total Cost

TOTAL ESTIMATED NPV TECHNOLOGY COST (Capital + Lifetime O&M + Post Remediation Monitoring) $3,887,000

Assumptions:

Working condition is Safety Level:		D	(Labor productivity:	82%	; Equipment productivity:	100%	)	
Weighted Average of city cost index (Buffalo, NY)		101.4%	(not applicable for costs derived from vendor quotes).					
Costs are loaded with a profit factor		10%						
Inflation		3%	per year					Labor
Estimated number of soil samples		58	samples	1	times sampled	0.25	hrs/sample	$85 Cost per hr
				20%	added for QA/QC samples	1	worker sampling	
Characterization Cost	Table A (per CWM)	$507.00	per sample					
Analytical cost	TAL Metals	$75.00	per sample					
For each sampling event, assumed:		$50	for materials (gloves, notebooks, etc.)					
Disposal								
Lead contaminated soil as a "listed" waste- incineration		$275	per ton	1,316	tons soil hazardous (assume 43% hazardous)			
				22	tons per load	60	loads for haz disposal	
Lead contaminated soil as non-haz		$39.87	per ton	11,842	tons soil for non-haz disposal	568	loads for non-haz disposal	
Concrete		3,300	lbs per cy	655	tons debris for non-haz disposal			
Typical Rental Rates - Includes G&A and 10% Profit								
Mini-Rae Survey Mode PID		$96.08	per day			15	loads per day	
Truck/SUV (1/2 ton or smaller)		$70.74	per day			20	working days per month	
						10	hours per working day	
Work day consists of:		10	hrs			2	months for site prep/restoration	
						9	months to completion	
Excavation With Concrete and Asphalt:				**Backfill 2:1 Slopes**		75	Days sediment loadout for dewatering	
Concrete and Asphalt:	0.0%	% of excavation volume		0	cy	40	Days sediment loadout for disposal	
Excavation Area:	211,635	sf		0	lcy	10	Days debris loadout for disposal	
Excavation Volume:	16,381	cy	18,838	lcy				
Excavated Weight:	24,572	tons						
Roll-off dumpster can hold approximately:	22	tons						

Notes

sy	square yard	mo	month
cy	cubic yard	ls	lump sum
lcy	loose cubic yard	O&M	Operation and maintenance
bcy	bank cubic yard	H&S	Health and Safety
lf	linear feet		
sf	square feet		
msf	1,000 square feet		