Revised Corrective Measures Study Report

Prepared for:
Hercules Incorporated/Dyno Nobel
Port Ewen, New York Facility
Site No. 356001

Prepared by:

EHS Support
consider it done

January 2014

I, Kristin A. VanLandingham, P.E., certify that I am currently a NYS-registered professional engineer and that this *Revised Corrective Measures Study Report* for the Dyno Nobel, Port Ewen Site dated January 2014 was prepared in accordance with all applicable statutes and regulations, and in substantial conformance with the DER *Technical Guidance for Site Investigation and Remediation* (DER-10).

Kristin A. VanLandingham, P.E.
NYS License No. 089610

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ACRONYMS

AOC	Area of Concern
bgs	below ground surface
CEC	cation exchange capacity
CFR	Code of Federal Regulation
cis-1,2-DCE	cis-1,2-Dichloroethene
CMS	Corrective Measure Study
cm/s	centimeters per second
CMI	Corrective Measure Implementation
COPC	Constituent of Potential Concern
CSM	Conceptual Site Model
CY	cubic yard
DDNP	Secondary Explosive (Diazodinitrophenol)
DOC	dissolved organic carbon
DNAPL	dissolved non-aqueous phase liquid
Dyno Nobel	Dyno Nobel Inc.
ECSM	Ecological Conceptual Site Model
EPH	Extractable Petroleum Hydrocarbon
ft	feet
ft/day	feet per day
FWIA	Fish and Wildlife Impact Analysis
GRA	General Response Action
GWQS	Groundwater Quality Standard
HASP	Health and Safety Plan
Hercules	Hercules Incorporated
Hg	mercury
HHRA	Human Health Risk Assessment
HMSD	Heavy Metal Surface Deposition
HMX	Secondary Explosive (cyclotetramethylene tetranetramine)
HRS	Hazard Ranking System
ICM	Interim Corrective Measures
lbs	pounds
LCSB	Liquid Chemical Storage Building
LDR	Land Disposal Restriction
LEL	Lower Effects Level
MDL	method detection limit
mg/kg	milligram per kilogram
mg/L	milligrams per liter
NAPL	non-aqueous phase liquid
NFA	no further action
NGVD	National Geodetic Vertical Datum
NYCRR	New York Codes, Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDOT	New York State Department of Transportation
O&M	operation and maintenance
OSHA	Occupational Safety and Health Administration
PBX	Polymer Bound Explosive (RDX and plasticizer)
PETN	Secondary Explosive (Pentaerythritol tetranitrate)
PID	Photo-ionization Detector

ppbv	parts per billion by volume
ppm	part per million
PQL	practical quantitation limit
PR	Preliminary Review
PRG	Proposed Remediation Goal
QA/QC	Quality Assurance/Quality Control
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RD/RA	Remedial Design/Remedial Action
RDX	Secondary Explosive (cyclotrimethylene trinitramine)
ROD	Record of Decision
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
SCG	Standards, Criteria and Guidelines
SCO	Soil Cleanup Objective
SEL	Severe Effects Level
SF	square foot
Site	Dyno Nobel Port Ewen, NY Facility
SMP	Site Management Plan
SPLP	Synthetic Precipitation Leaching Procedures
SQT	Sediment Quality Triad
SV	Sampling Visit
SVOC	semi-volatile organic compound
SWMU	Solid Waste Management Unit
SWQS	Surface Water Quality Standard
TAGM	Technical Administrative Guidance Memorandum
TAL	target analyte list
TCE	Trichloroethylene
TCL	target compound list
TCLP	Toxicity Characteristic Leaching Procedure
TDS	total dissolved solids
TOGS	Technical and Operational Series
TSD	Technical Support Document
VSI	Visual Site Inspection
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
$\mu g/m^3$	micrograms per cubic meter
USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency
UST	underground storage tank
VOCs	volatile organic compounds

STATEMENT OF LIMITATIONS

This report is intended for the sole use of Hercules Incorporated and Dyno Nobel (the Clients). The scope of services performed during this investigation may not be appropriate to satisfy the needs of other users, and any use or re-use of this document or of the findings, conclusions, or recommendations presented herein is at the sole risk of said user.

Background information, design bases, and other data have been furnished to EHS Support LLC (EHS Support) by the Clients and/or third parties, which EHS Support has used in preparing this report. EHS Support has relied on this information as furnished, and is neither responsible for nor has confirmed the accuracy of this information.

Opinions presented herein apply to the existing and reasonably foreseeable Site conditions at the time of our assessment. They cannot apply to Site changes of which EHS Support is unaware and has not had the opportunity to review. Changes in the condition of this property may occur with time due to natural processes or works of man at the Site or on adjacent properties. Changes in applicable standards may also occur as a result of legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated, wholly or in part, by changes beyond our control.

EXECUTIVE SUMMARY

This Revised Corrective Measures Study (CMS) Report has been prepared for the Dyno Nobel, Inc. (Dyno Nobel) Port Ewen, New York facility (the Site) pursuant to the requirements of the Part 373 Permit and detailed discussions with the New York State Department of Environmental Conservation (NYSDEC) during the May 17, 2011 meeting. The Site is located approximately one mile south of the Village of Port Ewen in Ulster County, New York and is the location of an active manufacturing facility that currently produces electric detonators. Various explosives, primers, igniters and related materials have been manufactured and stored at the Site since 1912. Of the approximately 350 acres within the property boundaries, development was limited to approximately 100 acres.

This Revised CMS supersedes all previous CMS documents prepared for the Site. The purpose of this Revised CMS is to:

- Consolidate the data from the 2000 CMS (Eckenfelder, 2000) with its subsequent addendums (Brown and Caldwell, 2003; HydroQual, 2005; HydroQual, 2006);
- Include data from subsequent investigations of groundwater, indoor air, sediment and ecological indicators;
- Re-evaluate and supplement the existing corrective measures alternatives for the Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) which previously required a CMS based on more recent Site-specific data;
- Evaluate potential corrective measures for impacted sediment within the on-site surface drainage features and off-site wetlands, and
- Evaluate potential corrective measures for indoor air.

The reevaluation of corrective measures alternatives in this Revised CMS includes:

- Assessment of impacted soil in comparison to the New York State promulgated standards for commercial and industrial use and proposed remediation options for impacted soil;
- Assessment of the recent Fish and Wildlife Impact Analysis (FWIA) data and proposed remediation options for the Wetlands Complex; and
- Assessment of indoor air data and management options.

Based on the extensive investigations conducted at the Site to date, the nature and impacts can be summarized as follows:

<u>Soil</u>

- With the exception of the Shell Plant, the Site impacts are related to inorganics (metals and selenium). VOCs are only present in the immediate area of the Shell Plant (SWMUs 24, 30, and 37).
- Soil impacts are generally limited to the upper 1 foot, but extend to depths ranging from 2 to 8 feet at several SWMUs/AOCs
- The majority of mercury impacts in Site soils were identified at the following locations:
    - o the western central portion of the Active Plant Area in the vicinity of the former mercury fulminate tanks area (SWMUs 9, 10, 11, 29, and 33);
    - o the northeastern portion of the Active Plant Area which was formerly the Burnable Waste Satellite Accumulation Area (SWMU 26G), Open Detonation Pit (AOC C), and Detonation Test Building (AOC D);
    - o the southeastern portion of the Active Plant Area at SWMU 13 (Waste Powder Catch Basins for the Lead Azide Building);

  - SWMU 52 Former Commercial Lab Shooting Area, which is transected be the northern drainage way; and
  - SWMU 54 (Former Historical Production Area) which is transected by the southern drainage way.
- Arsenic, barium, cadmium, copper, and lead are predominantly present in the northern and southern portions of the Active Plant Area.
  - The highest concentrations of arsenic (at least 8 times the industrial use SCO of 16 mg/kg) were detected at SWMU 52 and AOC H.
  - The highest concentrations of barium (at least 1.5 times the industrial use SCO of 10,000 mg/kg) were at SWMUs 7, 8, and AOC B.
  - The highest concentrations of cadmium (at least 15 times the industrial use SCO of 60 mg/kg) were at SWMUs 3 and 5.
  - The highest concentrations of copper (at least 10 times the industrial use SCO of 10,000 mg/kg) were at SWMUs 3 and 5.
  - The highest concentrations of lead (at least 10 times the industrial use SCO of 3,900 mg/kg) were at SWMU 52.
- The highest concentrations of mercury are found at SWMU 33, SWMU 26, AOC C, and AOC D at approximately 30-40 times the industrial standard of 220 mg/kg.
- The majority of selenium impacts in Site soils were identified in the northern portion of the Site in and around the former open burning pads (SWMUs 6, 7, 8, and AOC B) and the burnable waste satellite accumulation areas (SWMU 26G, AOC C, and AOC D). These areas are consistent with the ecological exposure evaluation performed in the Active Plant Area, which identified exposure to selenium in N1 and N3 areas as the greatest potential risk to wildlife receptors that potentially forage on at the margins of the facility.
- SWMUs 22, 23, 32, and 35 are locations that were previously used for on-site disposal of various wastes. These landfills/dumps are no longer active. Because of the potential presence of energetic materials within these SWMUs, investigative activities were restricted to the perimeter and adjacent areas.
- The total volume of soil impacts exceeding the commercial use SCO in the Active Plant Area is 16,936 CY. The total volume of soil impacts exceeding the industrial use SCO in the Active Plant Area is 8,424 CY. The majority of volume of Active Plant Area impacts are located in the northeastern portion near SWMUs 3, 4, 5, 6, 7, 8, and AOC B and at SMWU 54 the former production area.

<u>Sediment</u>

- The primary COPCs detected in the wetland complex comprise of mercury, selenium, lead, cadmium, copper, mercury and zinc. The total volume of sediment impacts in the Wetlands Complex and associated drainage ways is approximately 17,829 CY, which is more than three times the volume of the soil exceeding the industrial use SCO.
- Concentrations of arsenic, copper, lead, mercury, and zinc in the sediments present in the drainage way traversing the northern portion of the Site exceeded their respective SELs.
- The results of the downstream sediment sampling indicated concentrations of copper and mercury exceeding their respective SELs. Concentrations of inorganics at PE-DNS-SD-01 and PE-DNS-SD-02 were generally consistent with concentrations observed in the surface interval at station SQT-08. Concentrations of inorganics, particularly copper and mercury were substantially lower in sediments at downstream stations PE-DNS-SD-03 and PEDNS-SD-04 relative to upstream stations.

Surface Water
- Analyses from filtered surface water samples are below the SWQS and support that chronic exposure to inorganics concentrations in surface water within the Wetland Complex are not likely to result in adverse effects to aquatic life.
- Corrective measures for surface water are not required and are not considered for evaluation as part of the CMS.

Groundwater
- Elevated inorganic constituent concentrations in groundwater were localized near the SWMUs/AOCs.
- The VOC groundwater plume appears to be stable and the majority of the VOC impacts are limited to the shallow groundwater zone.
- The low permeability silty clay and clay deposits significantly limit migration of VOCs and inorganic constituents in groundwater.

Indoor Air
- Potential impacts to indoor air quality are limited to the Shell Plant. However, results of annual indoor air monitoring continue to show that concentrations remain well below the guidance value of 5 $\mu g/m^3$ and there is no immediate threat to human health.

Impacts to soil, sediment, surface water, and groundwater in excess of SCGs are or have historically been reported at the Site. Of the four mechanisms identified as being the most significant contributors to the transport of organics and inorganics, the following conclusions can be made:
- Inorganic constituents are strongly sorbed to silt and clay sized particles in the soil. The high cation exchange capacity (CEC) of Site soils has limited the vertical and lateral distribution of soil impacts.
- The transports of COPCs adsorbed to soil particles are believed to have contributed to the presence of inorganics impacts to sediments within the Wetlands Complex. However, due to the adsorptive soils, revegetation of the disposal areas and drainage ways, and low energy of water moving across the Site, the future transport of soil impacts is believed to be minimal.
- The dissolution and leaching of inorganic constituents from soil and sediment into groundwater or surface water at the Site is expected to be limited. This reflects the strong CEC of the soils and the organic rich nature of the sediments. Historical impacts to groundwater and surface water may have occurred but these are most likely associated with the more acidic and alkaline waste streams that would have been generated by the plant. As these source areas became neutralized by the natural buffering capacity of Site soils, sediment and water, the historic mobility of these constituents have reduced such that they are now considered immobile in the environment.
- Although VOC impacts at high concentrations are present near the Shell Plant area and extend to the base of the unconsolidated material, these impacts do not extend laterally away from the Shell Plant. The transport of dissolved VOC impacts is likely limited by the high adsorption potential of the VOCs to the silt and clay soils extending down to near the top of the bedrock surface in the Active Plant Area.
- The transport of VOC vapors within the soil gas and into indoor air is expected to continue under steady state conditions. However, the indoor air VOC concentrations are well below cleanup levels and are not expected to increase over time. Annual indoor air monitoring will be conducted to confirm this.

Although each of these transport mechanisms has potentially contributed to current impacts on- and off-site, the potential for further transport by these mechanisms is minimized due to 1) the characteristics of the Site soil and wetlands sediments which strongly adsorb organic and inorganic impacts, 2) the vegetation across the Site limiting the potential to mobilize soil particles, and 3) the low energy of water as it moves across Site.

The RAOs developed for the Site are presented below, and further discussed in the following subsections.

Media	Constituent/Material of Potential Concern	Remedial Action Objectives
Soil	Inorganics (metals and selenium)	Public Health Protection - Prevent ingestion/direct contact with impacted soil. - Prevent the migration of impacted soil into waterways and drainage features
		Environmental Protection - Prevent the migration of COPCs that would result in exceedances of groundwater and surface water and sediment criteria. - Prevent, to the extent practicable, the potential risks to terrestrial wildlife associated with exposure to selenium consumed in earthworms and small mammals.
	Energetic Materials	Public Health Protection - Minimize risk/safety hazard to workers and Site personnel during corrective measures implementation
Sediment	Inorganics (metals and selenium)	Public Health Protection - Prevent ingestion/direct contact with impacted sediment.
		Environmental Protection - Prevent the migration of COPCs that would result in exceedances of surface water criteria. - Prevent direct contact with impacted sediments by benthic invertebrates - Prevent potential risks to wildlife exposed to target inorganics.
Groundwater	VOCs Inorganics (metals and selenium)	Public Health Protection - Prevent ingestion of groundwater with COPC levels exceeding the Class GA water quality standards. - Prevent contact with impacted groundwater
		Environmental Protection - Restore the groundwater aquifer to meet ambient groundwater quality criteria, to the extent feasible.
Indoor Air	VOCs	Public Health Protection - Address exposures to the public and workers related to soil vapor intrusion into buildings.
		Environmental Protection - Eliminate, to the extent practicable, the impact of COPCs in soil or groundwater to soil vapor.

This CMS evaluates a range of corrective measure alternatives, and their ability to fulfill the objectives listed above at the Site. Based on the RAOs, the following Site-specific GRAs were established for Site media:

- No Further Action
- Containment
- In-Situ Treatment
- Removal
- Off-Site Treatment and/or Disposal
- Institutional/Engineering Controls

Within each of these GRAs, remedial technology types were identified for each impacted medium and screened with respect to effectiveness, implementability, and cost. The screened technologies were then used to develop corrective measures alternatives for the Site. The potential corrective measures alternatives are identified below for each impacted Site media.

Soil Corrective Measures Alternatives

The following four remedial alternatives have been identified to address the RAOs for the impacted soils at the Site:

- Alternative SOIL1: No Further Action
- Alternative SOIL2: Cover
- Alternative SOIL3: Excavation, On-Site Consolidation & Capping
- Alternative SOIL4: Excavation and Off-Site Disposal

Sediment Corrective Measures Alternatives

The following four remedial alternatives have been identified to address the RAOs for the impacted sediment at the Site:

- Alternative SED1: No Further Action
- Alternative SED2: Cover with Institutional Controls
- Alternative SED3: Excavation, On-Site Consolidation & Capping with Institutional Controls
- Alternative SED4: Excavation and Off-Site Disposal

Groundwater Corrective Measures Alternatives

The following two remedial alternatives have been identified to address the RAOs for the impacted groundwater at the Site:

- Alternative GW1: No Further Action
- Alternative GW2: Monitored Natural Attenuation with Institutional Controls

Indoor Air Corrective Measures Alternatives

As described in **Section 4**, the following corrective measures alternatives have previously been selected and approved by the Department to address the RAOs for the soil vapor impacts at the Site.

- Shell Plant Corrective Measures Alternative: Annual indoor air quality monitoring

Therefore, no further evaluation of indoor air quality corrective measures alternatives will be conducted.

RECOMMENDED CORRECTIVE ACTION ALTERNATIVES

These remedial alternatives were evaluated with respect to the criteria specified in 6 NYCRR 375-1.8(f) and DER-10 (NYSDEC, 2010). Based on the results of the comparative analysis, the following corrective measures alternatives were selected for Site soil, sediment, groundwater, and indoor air.

Soil

Based on a comparison of COPC concentrations with the SCOs, SWMUs 26E, 39, 42, 46, 47, and 56 were determined to require no further action due to no exceedances of the commercial use SCOs.

Excavation of impacted soils has always been the preferred remedy at the Site where implementable. Therefore, Alternative SOIL3 – Excavation, On-Site Consolidation, and Capping was selected for non-energetic and sensitive units because it is equally protective of human health and the environmental over the long-term as alternative SOIL4 – Excavation and Off-Site Disposal. Excavation of all soils exceeding the industrial use SCOs pursuant to 6 NYCRR 375 is proposed for this selected alternative.

Direct exposure, fugitive dust inhalation, and future erosion and transport of the Site CPOCs in storm water runoff is eliminated by removing the impacted soils and managing them at one consolidation unit designed to eliminate these potential risks. The additional actions under alternative SOIL4 of transportation of impacted soils to an off-site disposal facility would have the implementability concerns and short-term impacts to surrounding community to the surrounding community, which would not be experienced with alternative SOIL3:

- The anticipated risks to workers and the general public associated with transportation from the Site to the treatment/disposal facility. A key concern is the potential for spills and releases of contaminated soils on public roads and within residential neighborhoods.
- Traffic resulting from the transportation of approximately 8,424 CY of soil exceeding the industrial use SCO for off-site disposal. This would involve approximately 648 roundtrip truckloads through the community and increase the potential for road accidents in the narrow roads and streets around the area. Further, many of the land use abutting the Site and surrounding the County's highways are sensitive to high volumes of traffic with noise, odor, dust, and exhaust emissions from heavy traffic likely to pose concerns for the community.
- Throughout Ulster County, physical constraints or impediments exist on County and State highways that hinder the flow of traffic, especially truck traffic. These include steep grades, aging or low bridges, awkward intersection geometry, and narrow or curving roadways.
- Further, this truck traffic will results in wear and tear to the local road system due to 648 roundtrip truckloads of soil sent off-site for disposal.
- Generation of nearly 736 metric tons of carbon dioxide (CO_2) associated with combustion of approximately 71,978 gallons of diesel fuel (assumes 648 loads at 722 miles per roundtrip). Greenhouse gas emissions calculations are provided in **Appendix G.**

In addition, alternative SOIL3 is equally or more protective that alternative SOIL4 while costing approximately $1,500,000 less.

Alternative SOIL2 – Cover was selected for the remaining SWMUs due to the potential presence of energetic materials within these SWMUs. A cover will be the safest remedy for limiting interaction with potentially energetic materials and protecting the health and safety of Site workers while eliminating direct contact, fugitive dust inhalation, and future erosion and transport of COPCs within these SWMUs to the Site drainage ways and Wetlands Complex. In addition, federal regulations may prohibit the transportation of potential energetic materials that may exist in the former landfills as discussed in **Section 3.4.2**. As discussed in **Section 5**, the leaching of inorganic COPCs to the groundwater is not evidenced at the Site and the low permeability soil proposed for the cover will further limit water infiltration and leaching.

Alternative SOIL4 is only proposed for any excavated soil, which is determined to be hazardous based on TCLP analyses.

<u>Sediment</u>

Alternative SED3 – Excavation, On-Site Consolidation, and Capping has been selected for impacted sediment in the Wetlands Complex, which also includes the two drainage ways that transverse the Site. Under SED3, sediments will be excavated using a mass removal technique, which proposes the removal of approximately 1 foot of sediment in the Site drainage ways and the Wetlands Complex based on documented change in stream geomorphology, and sedimentation that is coincident with a precipitous decrease in concentrations. The Wetlands Complex is underlain by a competent clay layer, approximately one foot in thickness that would act as a natural excavation boundary. This remedial approach is the most conservative as it effectively removes all impacted sediments from the SWMU 1/22 Wetlands Complex. In addition, it eliminates cost and schedule delays associated with confirmation sampling, using a similar strategy as was approved by the NYSDEC to address the drainage ditches from the operational portion of the facility. The NYSDEC DFWMR has stated that a minimum of 22 additional SQT samples would be required to develop Site-specific PRGs and there is no guarantee that this additional sampling will satisfy their concerns about sufficient sample density. Delineation of impacted sediments using the SELs as delineation criteria will require additional delineation and confirmatory sampling to ensure that all sediments above the SELs have been removed.

Future impacts to benthic invertebrate communities; potential risks to wildlife, exposed to target inorganics, that forage exclusively within the Wetlands Complex; and future transport of impacted sediments off-site in storm water are eliminated by removing the impacted sediment and managing them at one consolidation unit designed to eliminate these potential risks. Transportation of impacted sediment to an off-site disposal facility (SED4) was not selected primarily due to implementability concerns. These include:

- The physical nature of the sediment increases the potential for releases during transportation that could expose the surrounding community.
- The excavated sediment would pose a risk while on-site and during transportation from the Site to the treatment/disposal facility since it would be more accessible to ecological exposure.
- Traffic resulting from the transportation of approximately 17,829 CY of impacted sediment for off-site disposal (approximately 1,372 roundtrip truckloads for sediment removal) would pose a potential nuisance to the community and increase the risk for accidents and spills.
- The excavated sediments would need to be dewatered prior to transportation off-site and have the potential to drip or leak from trucks during transportation.
- Many land uses surrounding the County's highways are especially sensitive to high volumes of truck traffic. Residents typically do not enjoy the noise trucks produce in their neighborhoods, especially at night.
- Throughout Ulster County, physical constraints or impediments exist on County and State highways that hinder the flow of traffic, especially truck traffic. These include steep grades, aging or low bridges, awkward intersection geometry, and narrow or curving roadways. They exist due to Ulster County's natural landscape and an aging highway network designed primarily for passenger vehicles.
- Further, this truck traffic will result in wear and tear to the local road system due to 1,372 roundtrip truckloads of sediment sent off-site for disposal.

- Generation of nearly 1,558 metric tons of CO_2 associated with combustion of approximately 152,398 gallons of diesel fuel (assumes 1,372 loads at 722 miles per roundtrip). Greenhouse gas emissions calculations are provided in **Appendix G.**

In addition, alternative SED3 is equally or more protective that alternative SED4 while costing approximately $2,000,000 less.

Alternative SED2 – Permeable Cover has been selected for SWMU 1 – Shooting Pond due primarily to the potential presence of energetic materials. In addition, federal regulations may prohibit the transportation of potential energetic materials that may exist in the former landfill. The pond will be dewatered and filled with excavated sediment/soil or clean backfill and capped as part of the on-site consolidation unit.

Groundwater

Alternative G2: Monitored Natural Attenuation with Institutional Controls is protective of human health and the environment. The most recent groundwater results, in October 2012, detected VOCs above their respective Class GA GWQS near the Shell Plant and SWMUs 24, 30, and 37 and inorganics in the immediate vicinity of some of the SMWUs within the Active Plant Area. However, based on the HHRA discussed in **Section 6**, the potential exposure pathway from direct exposure to impacted groundwater is incomplete based on the following:

- The low permeability silty clay and clay deposits, significantly limit migration of VOCs and inorganic constituents, as evidenced by water quality data collected during the Groundwater Investigation and subsequent semi-annual groundwater sampling program.
- The Wetlands Complex is a local discharge point for groundwater flow from the Active Plant Area local discharge point for groundwater flow, both in the shallow and deep overburden deposits. As a result, groundwater from the Site does not migrate east of the wetlands.
- Data collected during the Groundwater Investigation (Eckenfelder, 1996) indicate that potential groundwater receptors (i.e., properties located downgradient of the facility) are served by public water (Port Ewen Water Supply).
- The closest residences are approximately 2,700 ft from the facility and are located on the opposite side of the wetlands. Groundwater beneath the facility discharges to the Wetlands Complex prior to reaching these off-site locations
- The groundwater users nearest the facility (i.e., those not served by public water) are located approximately 3,000 ft upgradient of the Site and thus, are not subject to potential groundwater impacts from the Site.

Based on the fate and transport discussions, VOC impacts are not believed to be transported laterally away from the source area, and VOC impacts have not been detected in surface water samples in the Wetland Complex (which is the local discharge point for shallow groundwater beneath the Site); therefore, the discharge of VOC-impacted groundwater to surface water is not expected to be an active transport pathway.

The land use restriction proposed under the preferred soil corrective measure alternative(s) will be expanded to notify future property owners of the presence of COPCs in groundwater and prohibit groundwater use. The SMP proposed under the preferred soil corrective measures alternative(s) will be expanded to include the necessary elements to address groundwater.

Indoor Air

Based on prior approval from NYSDEC, the following corrective measures alternative were previously selected to address potential impacts to indoor air quality at the Shell Plant and the LCSB. Indoor air quality monitoring will continue to be performed on an annual basis until the Shell Plant is demolished or rendered uninhabitable. The LCSB has been demolished so future risk of impacts to indoor air in this building no longer exist.

1.0 INTRODUCTION

This Revised Corrective Measures Study (CMS) Report has been prepared for the Dyno Nobel, Inc. (Dyno Nobel) Port Ewen, New York facility (the Site) pursuant to the requirements of the Part 373 Permit and detailed discussions with the New York State Department of Environmental Conservation (NYSDEC) during the May 17, 2011 meeting. The Site location is shown on **Figure 1-1**. This Revised CMS supersedes all previous CMS documents prepared for the Site. The purpose of this Revised CMS is to:

- Consolidate the data from the 2000 CMS (Eckenfelder, 2000) with its subsequent addendums (Brown and Caldwell, 2003; HydroQual, 2005; HydroQual, 2006);
- Include data from subsequent investigations of groundwater, indoor air, sediment and ecological indicators;
- Re-evaluate and supplement the existing corrective measures alternatives for the Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) which previously required a CMS based on more recent Site-specific data;
- Evaluate potential corrective measures for impacted sediment within the on-site surface drainage features and off-site wetlands, and
- Evaluate potential corrective measures for indoor air.

The reevaluation of corrective measures alternatives in this Revised CMS includes:

- Assessment of impacted soil in comparison to the New York State promulgated standards for commercial and industrial use and proposed remediation options for impacted soil;
- Assessment of the recent Fish and Wildlife Impact Analysis (FWIA) data and proposed remediation options for the Wetlands Complex; and
- Assessment of indoor air data and management options.

This Revised CMS Report is comprised of twelve sections, which are as follows:

- **Section 1 - Introduction -** This section describes the scope of this report.
- **Section 2 - Site Setting and History-** Describes the Site features location, surrounding area and other historical Site information, as well as a summary of previous investigations, corrective measures, and corrective measures studies.
- **Section 3 – Identification of Standards, Criteria, and Guidelines** – Identifies the standards, criteria, and guidelines (SCGs) to be considered in the identification of remedial action objectives (RAOs) and corrective measures alternatives.
- **Section 4 – Nature and Extent of Impacts -** Identifies the constituents of potential concern and the extent of impacts in soil, sediment, groundwater, surface water, and indoor air at the Site.
- **Section 5 – Conceptual Site Model and Fate and Transport –** Presents a brief description of how historical Site operations resulted in current impacts to Site media, evaluates the mechanisms which govern the transport of impacts from the source area(s), and evaluates whether these mechanisms were significant historically or have the potential to be significant in the future.
- **Section 6 – Risk Assessment Summary –** Identifies potential routes of migration for Site constituents of potential concern (COPCs), potential exposure pathways for COPC impacts, and discusses those potential impacts on sensitive receptors at the Site.
- **Section 7 – Remedial Action Objectives and General Response Actions** – Develops and presents RAOs based on previous investigations and applicable SCGs as well as describes the general types of corrective measures that were evaluated for this Site.
- **Section 8 – Identification and Screening of Technologies and Development of Corrective Measures Alternatives** – Identifies and presents screening results for GRAs and remedial

technology types and processes. An assembled list of potential corrective measures alternatives for meeting the RAOs for the Site is presented in this section based on the results of the screening.

- **Section 9 – Corrective Measures Alternatives Evaluation** – Describes the NYSDEC criteria used to evaluate the corrective measures alternatives, and presents a detailed analysis of each corrective measures alternative for each media.
- **Section 10** – **Selection and Justification of Preferred Corrective Measures Alternatives** – Identifies the preferred corrective measures alternatives and presents justification for the selections.
- **Section 11** – **Conceptual Approach to Corrective Measures Implementation -** Presents the conceptual approach to implementation of the preferred corrective measures alternatives at the Site.
- **Section 12 - References**

2.0 SITE SETTING AND HISTORY

This section presents relevant background information used to define the nature and extent of impacts and to develop and evaluate the corrective measures alternatives for the Site. This includes a description of the physical location and operational history, the physical setting and future land use, and a summary of the historical remedial investigations and studies, and corrective measures completed at the Site.

2.1 Site Description and Setting

The Site is located approximately one mile south of the Village of Port Ewen in Ulster County, New York. The Site layout and property boundaries are shown on **Figure 2-1**.

The Site setting is shown on **Figure 2-2.** The Dyno Nobel property encompasses approximately 350 acres with the developed portion of the Site consists of approximately 100 acres. For the purposes of this CMS, the developed areas of the Site include the active or formerly active portions of the facility approximately delineated (in red) as the Site boundary on **Figure 2-2**. Most of the remaining 250 acres are naturally vegetated with cover types ranging from old fields to forested areas.

The Site is located in a small valley bordered on the west by Hussey Hill and on the east by a low ridge adjacent to the Hudson River. Hussey Hill rises to an elevation in excess of 900 feet (ft) (above the National Geodetic Vertical Datum of 1929 [NGVD]) and drops steeply to the western edge of the developed portion of the Site to an elevation of approximately 200 ft NGVD. The developed or active portion of the Site then grades gently to the valley floor, with the elevation of the Site dropping 50 ft (to an elevation of approximately 150 ft NGVD) over a distance of approximately 1,600 ft,. The land east of the Site then gently rises again to the ridge overlooking the Hudson River, which sits at an elevation of approximately 250 ft NGVD. The Hudson River is located approximately 1.5 miles east of the Site, at an elevation of approximately 5 ft NGVD. Esopus Lake, another major local feature, is located approximately one mile east of the Site at an elevation of 185 ft NGVD.

A stream and wetlands exists in the center of the valley with the drainage occurring to the north to an unnamed tributary of Plantasie Creek. The wetlands dominate the low-lying areas of the valley and are located to the east, northeast, and southeast of the developed portion of the Site, at an elevation of approximately 145 ft NGVD. There is an active rail line running north to south, which bisects the developed area of the Site (**Figure 2-2**) and separates the currently operational areas of the facility from the Wetlands Complex. Only parking and storage areas are located east of the rail line.

As previously stated, the developed areas of the Site include the active or formerly active portions of the facility used for industrial operations. The developed areas of the Site are further divided based on predominant cover types (i.e., typical vegetative species and their abundance, distribution, and density) (**Figure 2-3)**. Areas to the west of the railroad tracks are highly disturbed by active Site operations and are characterized exclusively by an industrial cover type. For purposes of this CMS, this area is referred to as the Active Plant Area. In a smaller portion of the developed Site to the east of the railroad tracks, there is a mix of cover types that include pavement, palustrine wetlands, and deciduous and successional forest. For purposes of this CMS, this area is referred to as the Wetlands Complex (**Figure 2-3)**.

2.2 Operational History

The Site is an active manufacturing facility that currently produces electric detonators. Various explosives, primers, igniters and related materials have been manufactured and stored at the Site since 1912. Of the approximately 350 acres within the property boundaries, development was limited to approximately 100 acres.

Brewster Explosives Company originally built the facility near the turn of the 20th Century. Aetna Explosives Company purchased the facility in 1915, sold it to Hercules Incorporated (Hercules) in 1922, who subsequently sold the company to IRECO Incorporated in 1985. In July 1993, IRECO was renamed Dyno Nobel Incorporated, the current property owner and facility operator. In 2009, Ashland Inc. (Ashland) acquired Hercules, and assumed the historical liability Hercules retained at the Site.

Manufacturing processes that have been or are currently used at the Site include activities associated with metals treatment and processing (including annealing, degreasing, extrusion, heat treatment, caustic and/or acid baths), metals cutting, machining, grinding, and pressing (Brown and Caldwell, 2003)

Brown and Caldwell (2003) present a description of the energetic materials that have been used on Site. A summary of the chemicals used in the energetic material is included below.

- Low energetic materials
  - black powder
  - nitrocellulose
  - double-base propellant
- Primary high energetic materials
  - lead azide
  - lead styphanate
  - mercury fulminate
  - tetrazene, diazodinitrophenol (DDNP)
- Secondary high energetic materials
  - cyclotrimethylene trinitramine (RDX)
  - cyclotetramethylene tetranetramine (HMX)
  - tetryl
  - pentaerythritol tetranitrate (PETN)
  - polymer bound explosive (PBX)

Degradation products of energetic materials that are the primary concern at the Site are lead and inorganic salts of mercury. A description of specific degradation products of the primary and secondary energetic material is included in the 2003 Addendum (Brown and Caldwell, 2003).

Wastes generated on Site include process waters, wastewaters, sludge, off-specification products, energetics-impacted packaging, spent degreasing solvents, and general garbage (Eckenfelder, 1994). The on-site annealing process resulted in the production of acidic wastewater that was disposed of on-site until 1980. Since 1980, this wastewater has been discharged to the Wastewater Treatment Facility (Brown and Caldwell, 2003).

Past practices allowed for the discharge of liquid wastes directly into drainage sumps on-site while potentially energetic materials were neutralized via open burning and detonation. Spent and waste energetic materials were washed into waste powder catch basins. Steam condensate was collected and treated using gravity filtration to recover energetic materials and then discharged to the ground. Water from catch basins, collection tanks, and treated steam condensate was routinely discharged to the ground in the past. Sludge collected in the catch basins, tank sumps, and production collection containers was historically disposed of on Site (Brown and Caldwell, 2003). A summary of historical on-site disposal and treatment areas is included in **Table 2-1.**

2.2.1 Future Land Use

The Site is currently an active manufacturing facility and zoned as Heavy Industrial (HI). In the Comprehensive Plan for the Town of Ulster, the Town plans to create a HI district, which would prohibit residential land uses to avoid adverse impacts from the industries in these districts. The presence of energetic materials in some Site areas will govern future use of the Site. Dyno Nobel, as part of the corrective measures for the Site, has filed a Declaration of Restrictions (2004) which includes industrial use restrictions on the property to limit future use of the Site to industrial operations.

2.2.2 Ecological Setting

URS (2009) evaluated cover type, habitat value, probability of receptor use, and frequency of disturbance in both the Active Plant Area and the Wetlands Complex.

The following sub-sections provide a brief description of the ecological setting of these two areas. Further detail regarding fish and wildlife resources in these areas was provided in the Step IIB Report (URS, 2009).

2.2.2.1 Active Plant Area

The Active Plant Area is primarily characterized as an industrial cover type. This portion of the Site provides limited overall habitat value due to the regular disturbance by Site activities from facility operations to the regular maintenance (mowing) of vegetation. Potential ecological exposure is likely associated with wildlife that may occasionally move into the margins of the industrial cover type to forage from adjacent habitats. Drainage from the Active Plant Area of the Site is generally from west to east through drainage ways originating at the base of the slope of Hussey Hill along the western side of the Site and traversing the active portion of the Site towards the Wetland Complex.

2.2.2.2 Wetlands Complex

The Wetlands Complex is a wetland and successional forest area. This area is dominated by a common reedgrass (*Phragmites australis*) marsh on the eastern side of the railroad tracks that intersect the Site. This Wetlands Complex drains generally to the north to an unnamed tributary Plantasie Creek and eventually to Rondout Creek. Near the downstream extent of the Site, hydrology in the wetlands has been altered by beaver activity. An open water area is located within the wetlands (SWMU 1); the open water area was used as a shooting pond during plant operations for underwater detonation of off-specification explosives and energetic process waste.

Portions of the Wetlands Complex have the potential to support permanent aquatic communities. Perennial water is likely to exist in normal years north of the Site access road and is capable of supporting benthic invertebrate communities and limited warm water fish communities. Fish and wildlife resources likely forage within the wetlands system. The hydrological connectivity of this area to downstream fish and wildlife resources such as Rondout Creek increases its habitat value. Limiting factors associated with the habitat value of the Wetlands Complex include the dominance of the invasive species *Phragmites*, which provides poor habitat for wildlife relative to wetlands with more diverse vegetative communities.

2.2.3 Drainage Basin Conditions

Although the Site is surrounded by steep hills, the active area of the Site is located in a topographic low with limited relief across the Site. Annual precipitation in this area averages approximately 47 inches per year. As can be seen from the graph below, average rainfall is usually greater in the summer months.

Average Monthly Rainfall for Port Ewen, NY (Source: Weatherzone.com)

Water entering the Active Plant Area of the Site comes from direct precipitation and runoff from Hussey Hill. The majority of the water is expected to come from Hussey Hill since the generally flat topography of the Site and vegetation covering much of the Area limits the amount of overland flow in this area.

Surface water flows across the Site primarily through the two drainage ways crossing the Site from west to east. A third drainage way runs across the southern edge of the Active Plant Area. **Figure 2-4** shows the catchment area, which contributes to surface water or overland flow on to the Active Plant Area. This catchment area, determined from an interpolation of ground surface contours, includes both the Active Plant Area and the adjacent area of Hussey Hill. The total catchment area is estimated at approximately 241 acres, with the Active Plant Area making up approximately 41% of the total area.

The drainage ways flow across the Site from west to east and enters the Wetlands Complex through culverts below the railway. The combination of the shallow topographic gradient across the active area of the Site and the vegetation within the drainage ways limits the velocity of water flowing through the channels into the Wetlands Complex. The narrow and poorly incised nature of the drainage channels as well as the vegetation within the drainage channels lends evidence to the low flow velocity of water through the drainage channels. During high flow events, the culvert beneath the railway can also control the velocity of water flowing across the Site by limiting the discharge into the Wetlands Complex, causing water to back-up and pond on the Active Plant Area. The low energy of storm water drainage through the Site has caused the deposition of sediment at the culverts prior to them exiting the property with the largest amount of deposition occurring at the northernmost drainage feature.

Surface water flows into the Wetlands Complex from both the Active Plant Area (through the culverts described above) and from intermittent and perennial tributaries which feed the Wetlands Complex from the south. The catchment area for the Wetlands Complex is shown separately in **Figure 2-4**. The shallow topographic gradient and the presence of wetland vegetation limits the surface water flow velocity into the Wetlands Complex from the south. The outlet from the Wetlands Complex is a perennial stream with a low hydraulic gradient that discharges to an unnamed tributary of Plantasie Creek. This tributary and others of Plantasie Creek flow northward into Rondout Creek approximately two miles north of the Site. Rondout Creek discharges into the Hudson River north of Port Ewen, New York (**Figure 1-1**).

2.2.4 Geologic and Hydrogeologic Conditions

The Site geology and hydrogeology have been previously described in the Groundwater Investigation Report (Eckenfelder, 1996) and in the RFI (Brown and Caldwell, 1999). The following presents a summary of the information presented in these previously submitted reports.

2.2.4.1 Site Geology

During the groundwater investigation performed on Site (Eckenfelder, 1996), bedrock was encountered at depths ranging between 1.5 ft below ground surface (bgs) (MW-1) and 85.1 ft bgs (MW-12D) (**Figure 2-5**). Bedrock elevations across the Site range from approximately 224 ft NGVD near monitoring well MW-1, where bedrock outcrops in adjacent areas, to 80 ft NGVD near the center of the Site at MW-12D. Moving eastward, the bedrock then rises again beneath the Wetlands Complex to an elevation of approximately 130 ft NGVD near MW-17S. The structural contour map of the top of the bedrock surface, presented in **Figure 2-6**, indicates that the bedrock surface forms a buried valley oriented in a northeastward direction and located beneath the Active Plant Area of the Site. The bedrock valley is offset to the western side of the topographic valley represented by the Wetlands Complex. The bedrock beneath the Site consists of the Austin Glen Formation of the Normanskill Unit and is composed of greywacke that grades upward to shale.

The overburden deposits beneath the Site consist of a shallow silt and clay deposits underlain by a deep sand and gravel layer. The silt and clay deposits are defined by two separate intervals. The upper interval, usually present in the top 15 ft, can generally be described as a moist, brown, silty clay with trace of fine sand. This then grades to a wet, gray, silty clay to clay, which ranges in thickness from 3.5 ft at MW-17S to 66.8 ft thick in MW-12D.

Underlying the silty clay is a sand and gravel layer identified in 22 borings across the Site. The sand and gravel layer ranges from 3.5 ft bgs at MW-17S to 66.8 ft bgs in MW-12D. The sand and gravel layer is not present in the northwest portion of the Site near MW-1 and, where its thickness could be determined, ranges in thickness from approximately 1 ft (HP-10) to greater than 23 ft (MW-11D) on the southern portion of the Site (**Figure 2-7**).

An isopach map depicting the thickness of the overburden material is presented **Figure 2-7**. The thickness contours are consistent with the contours presented in **Figure 2-6** for the bedrock, and exhibit a similar northeast orientation. The overburden deposits are thin along the western edge of the Site bordering Hussey Hill, thickening in the center of the bedrock valley (i.e., the central portion of the Site), before thinning in the eastern portion of the facility in the vicinity of the Wetlands Complex.

2.2.4.2 Site Hydrogeology

Groundwater beneath the Site is present in the shallow and deep portion of the overburden, and within the bedrock beneath the overburden (Brown and Caldwell, 1999). Groundwater flow beneath the Site is believed to be primarily through the sand and gravel layer under confined conditions in the deep portion of the overburden. Single well response tests to measure the hydraulic conductivity (K) within the sand and gravel zone yielded measurements of 1.9 x 10^{-2} to 2.3 x 10^{-4} centimeters per second (cm/s) with a geometric mean of 2.6 x 10^{-3} cm/s. Groundwater flow in the upper portion of the overburden is limited by the presence of silt and clay. Single well response tests to measure the hydraulic conductivity (K) within the Silty Clay zone yielded measurements of 8.1x 10^{-4} to 4.3 x 10^{-7} cm/s with a geometric mean of 1.6 x 10^{-5} cm/s.

Potentiometric surface maps include the shallow and deep overburden, which are presented in **Figure 2-8** and **Figure 2-9**. Groundwater within the overburden generally flows from Hussey Hill on the western portion of the Site, toward the wetland complex on the eastern portion of the Site. Brown and Caldwell (1999) determined that based on the downward hydraulic gradients within the central portion of the Site and the generally upward gradient toward the perimeters of the Site, coupled with the low permeability silt and clay unit overlying the higher permeability sand and gravel deposit, groundwater flow within the shallow overburden is anticipated to be predominantly vertical, while flow in the deep overburden is anticipated to be predominantly horizontal. Brown and Caldwell (1999) estimated the vertical seepage velocity in the silt and clay portion of the overburden at approximately 1.7 x 10^{-3} feet per day (ft/day) (0.61 ft/year) and the horizontal seepage velocity through the sand and gravel portion of the overburden at 0.45 ft/day (163 ft/year).

The groundwater flow within the bedrock is not characterized as well. Brown and Caldwell (1999) reported that based on the data from three monitoring wells screened in the top portion of the bedrock near the Shell Plant, the sand and gravel deposits in the deep portion of the overburden and the shallow bedrock behave as one hydrostratigraphic unit. The hydraulic conductivity measurements from these wells ranged from 2.8 cm/s to 5.3 x 10^{-3} cm/s. The potentiometric surface and groundwater flow direction in the upper bedrock is shown on **Figure 2-10**.

Although there is limited vertical hydraulic gradient data within the wetland, based on the converging groundwater flow lines in the Wetlands Complex shown on **Figure 2-8** and **Figure 2-9**, Brown and Caldwell (1999) determined that groundwater from the overburden was likely discharging to the wetland area.

2.3 Site Investigation Summary

Site investigations to characterize the nature and extent of soil, sediment, groundwater, and surface water impacts were performed between 1983 and 2012. Previous investigations at the Site have been conducted under two independent programs: the Resource Conservation and Recovery Act (RCRA) Program and the New York State Superfund Program. This section provides a summary of the Site assessments and investigations performed to date at the Site. The reports generated from these investigations are listed in **Table 2-2**. A summary of the degree and extent of impacts based on the findings of these investigations is provided in **Section 4** of this report.

2.3.1 Initial Site Assessments and Investigations

Phase I and II Site investigations were completed under the New York State Superfund Program in 1983 and 1990, respectively. The purpose of these investigations was to collect information necessary to classify the Site for further action and to develop a final Hazard Ranking System (HRS) score. The preliminary investigation (Phase I) was completed by EA Science and Technology and the final report for this work was issued in December 1983. Gibbs & Hill, Inc. completed a Phase II investigation and the final report for this investigation was issued in July 1990. The Phase II investigation built upon the information obtained from the Phase I preliminary investigation and consisted of the installation of twelve (12) monitoring wells, installed in groups of three, at four locations at the Site. The four locations included SWMUs 6 and 7 (Open Burning Pad Area), SWMU 30 (Drainage Ditch downgradient of Bldg 2036), SWMU 23 (Old Dump Area), and SWMU 1 (Shooting Pond).

A RCRA Facility Assessment (RFA) was conducted under the RCRA Program and consisted of a Preliminary Review (PR) of available relevant documents and a Visual Site Inspection (VSI). A.T. Kearney, Inc., completed the PR and VSI under contract to the United States Environmental Protection Agency (USEPA). The results of the PR and VSI were documented in the RFA Report (A.T. Kearney, 1993). At the request of NYSDEC, this report was revised by Eckenfelder in August 1994 (Eckenfelder, 1994), on behalf of Hercules and Dyno Nobel, to correct factual errors. The RFA identified 46 SWMUs and 4 AOCs.

Eckenfelder (1994) evaluated the SWMUs/AOCs from the RFA for one of the following recommendations:

- No further action (NFA)
- RFA Sampling Visit (RFA-SV)
- RCRA Facility Investigation (RFI)April
- Interim Corrective Measure (ICM)

Based on the RFA recommendations, 17 SWMUs/AOCs required an ICM to be implemented on an expedited basis to facilitate investigation as part of the RFI. Two additional SWMUs (47 and 48) were identified and added after the RFA was completed. The RFA also recommended confirmatory sampling for 19 SWMUs/AOCs as part of the RFA-SV. Based on the results of the RFA-SV, 10 SWMUs/AOCs were recommended for further investigation under the RFI.

Dyno Nobel entered into an Order on Consent with NYSDEC on April 15, 1996, which stipulated that 25 SWMUs/AOCs be the subject of a RFI. Additionally, 10 SWMUs/AOCs required further investigation as part of a RFI, based on the RFA-SV report (Eckenfelder, 1997b) and one SWMU (SWMU 12) was eliminated from further investigation due to building construction which make this area inaccessible (Eckenfelder, 1997b).

The RFI Work Plan (Eckenfelder, 1997b) was approved by NYSDEC for the investigation of 34 SWMUs and 4 AOCs. The RFI Report (Brown and Caldwell, 1999) was submitted in December 1999, and recommended no further action for six (6) SWMUs and further evaluation in a CMS for those areas containing constituent concentrations above the established screening criteria. The results of the RFI are discussed in more detail in **Section 4** of this report.

2.3.2 Groundwater Investigation

A groundwater investigation (Eckenfelder, 1996) was conducted at the Site as a precursor to the RFA-SV, ICM, and RFI. The purpose of completing this investigation first was to better develop the investigation strategy for the RFI by:

- obtaining a better understanding of the Site hydrogeology (including groundwater flow direction, hydraulic conductivity, and vertical and horizontal gradients);
- estimating the horizontal extent of groundwater impacts in the vicinity of the Shell Plant;
- recommending the location of monitoring wells associated with the Shell Plant based on data obtained from the investigation;
- evaluating the potential for off-site migration of constituents that may be associated with the detonation (shooting) pond; and
- determining groundwater use near the Site (including the use and location of private wells, as well as the availability of public water supplies).

The results of this investigation were reported in the Groundwater Investigation Report (Eckenfelder, 1996).

Water quality data collected from wells located throughout the facility yielded highly variable concentrations of inorganics. The variability in inorganics results was attributed to the turbidity of water samples collected from the low permeability silty clay and clay deposits. As discussed in the Groundwater Investigation Report (Eckenfelder, 1996), the unfiltered samples were turbid even when low flow purging techniques were used to collect the samples. The turbidity of samples resulted in elevated inorganics results, which exceed groundwater standards throughout the facility but are not considered representative of groundwater. As a result, typically filtered samples are used to define the metal concentrations in groundwater at the Site. The filtered samples indicate limited exceedances for several inorganic COPCs, including selenium and barium, at a few locations within the immediate vicinity of individual SWMUs.

The organic analytical data confirm the presence of trichloroethylene (TCE) and its degradation products near the Shell Plant (SWMUs 24, 30, and 37) at concentrations above Class GA Groundwater Quality Standards (GWQS). However, volatile organic compounds (VOCs) were not detected in wells and HydroPunch® samples located downgradient of these SWMUs, indicating that the extent of groundwater impacts is limited to the vicinity of the Shell Plant. Although, VOCs were detected at a few locations scattered across the facility, the reported values were estimates below both their respective Practical Quantitation Limits (PQLs) and GWQS.

Semi-annual groundwater monitoring from select monitoring wells has been performed at the Site since Spring 2001. The monitoring well network includes monitoring wells located in the vicinity of the Shell Plant (MW-3, MW-4A, MW-4B, MW-21R, MW-21D, MW-22R, MW-22D, and MW-25S), which are monitored for VOCs and monitoring wells located downgradient of SWMUs/AOCs located in the northern Active Plant Area (MW-2B, MW-15S, MW-15D, MW-16S, MW-24S, MW-24D, MW-26S, and MW-26D) which are monitored for inorganics. Monitoring well locations are provided on **Figure 2-5**. Results of this routine monitoring are discussed in **Section 4**.

2.3.3 Indoor Air Quality Investigations

This section summarizes the indoor air quality investigations performed at the Shell Plant and the Liquid Chemical Storage Building (LCSB).

2.3.3.1 Shell Plant Indoor Air Quality Investigation

On July 5, 2001, NYSDEC requested that Dyno Nobel conduct an indoor air quality assessment in the area of the former Shell Plant. The concerns associated with vapor intrusion were identified by NYSDEC based on the detection of high concentrations of chlorinated VOCs in groundwater.

The Shell Plant was historically used to form detonator casings from aluminum cups, and mold phenolic plugs. The building is not an active manufacturing area but contained machining equipment that used lubricating oils.

Four sub-slab soil gas samples and one ambient outdoor air sample were collected on July 12, 2002 and analyzed for VOCs in accordance with USEPA Method TO-14A. Sample results were compared to target concentrations published in the *Supplemental Guidance Document for Evaluating the Vapor Intrusion to Indoor Air Pathway, Table 2* (USEPA, 2001). At that time, all of the sub-slab vapor results were below the published criteria; and it was concluded that the vapor intrusion pathway was incomplete, and no further work was required.

However, the screening criteria for TCE was lowered and the detected TCE concentration in sample SG-4 (35 parts per billion by volume [ppbv] or 188 microgram per cubic meter [$\mu g/m^3$]) is now above the USEPA screening value of 22 $\mu g/m^3$ and within the range of 50 to 250 $\mu g/m^3$, published in the New York State final *Guidance for Evaluating Vapor Intrusion in the State of New York* (NYSDOH, 2006). Sample SG-4 was the only location at which TCE, or any other VOC, was detected above the current screening level.

Based on this screening exceedance, NYSDEC requested additional sub-slab and indoor air sampling at the Shell Plant. In response to NYSDEC request, a sub-slab sample was collected on March 29, 2007 near the southern end of the Shell Plant building within the hallway leading to the locker room. This represents the same area from which the original SG-4 sample was collected. In addition to the sub-slab sample, an indoor air sample (IA-1) was collected from the hallway at the same location and an outdoor, ambient air sample (OA-1) was collected at an upwind location.

The results of the air sampling indicate that the detected concentrations of TCE and cis-1,2- DCE in indoor air are, at least in part, most likely attributable to underlying soil gas. However, the reported concentration of TCE in indoor air (0.75 $\mu g/m^3$) is well below the TCE guidance value of 5 $\mu g/m^3$ identified in Table 3-1 of the final *Guidance for Evaluating Soil Vapor Intrusion in the State of New York*, (NYSDOH, 2006). Therefore, it was concluded that there is no immediate threat to human health. This is especially true given that this is an industrial building and an industrial setting at which TCE was used in the past. A guidance value for cis-1,2-dichloroethene (cis-1,2-DCE) is not published; however, the risk based criteria for cis-1,2-DCE is typically higher than that for TCE.

The NYSDEC, in an August 8, 2007 letter, agreed that the reported concentration of TCE in indoor air at the Shell Plant facility did not warrant further action. However, given the sub-slab sample results, NYSDEC recommended one of the following three options:

- Sample the Shell Plant indoor air once per year; or
- Install a vapor mitigation system; or

- Render the building uninhabitable.

Dyno Nobel has elected to collect an annual indoor air sample at the Shell Plant. Results of the investigation are discussed in **Section 4**.

2.3.3.2 LCSB Investigation

The LCSB was located in the southeast portion of the Active Plant Area near the railroad tracks as Shown on **Figure 2-1**. The LCSB was historically used to store liquid chemicals and liquid chemical wastes (e.g. solvents, acids, caustics, and oils) in New York State Department of Transportation (NYSDOT)-approved containers (i.e., 55-gallon drums or less). The LCSB's design storage capacity was 3,000 gallons and the building was approximately 12 ft by 20 ft in dimension. The building was constructed of un-insulated fiberglass panel siding over a wood frame, with a corrugated metal roof. The building was constructed on a concrete slab at grade, which was poured around an integral blind steel center sump. Pre-cast concrete collection troughs extended in the north and south directions from the sump. The containment area was rehabilitated in 2001 to seal joints around the sump and troughs and apply a chemical resistant coating to the base of the containment area. In accordance with the Facility's Hazardous Waste Management Permit and the Closure Plan prepared as a requirement of the Permit, the LCSB was decontaminated, sampled, and certified by a New York State Professional Engineer as closed in accordance with the specifications of the Closure Plan on January 20, 2012.

Prior to closure and due to a concern regarding the potential for undiscovered spills at the LCSB before its floor was epoxy coated in 2001, the NYSDEC required that two soil borings be completed on an angle under each end of the blind sump in the floor of the building, with a sub-slab soil vapor and soil sample to be collected from each soil boring during the RCRA closure. In response to this request, one shallow soil sample and one deeper soil sample were collected from each of the two borings completed during the RCRA closure sampling to represent a range of possible depths at which releases could potentially have occurred. The soil samples were analyzed for VOCs and semi-volatile organic compounds (SVOCs). Vapor sampling wells (i.e. one-inch diameter screened wells with a sand pack and bentonite seal at the top) were installed at the soil borings.

During the completion of the borings, continuous Geoprobe® core samples were retrieved from the borings, and the field geologist noted no discolorations, stains, odors, or photoionization detector readings in the soil samples. The laboratory analyses of the soil samples reported no VOC or SVOC constituents at concentrations above the method detection limits (MDLs) in any of the five soil samples collected from the two soil borings completed at the LCSB on May 11, 2011. The potential vapor intrusion exposure pathway was addressed when the LCSB was demolished in 2012. Additional details on the closure are provided in **Section 4.5.2**.

2.3.4 Fish and Wildlife Impact Analysis (FWIA) Investigation

Investigations to assess potential ecological impacts for the establishment of Site remedial objectives and the ultimate remedial actions were performed as part of the FWIA conducted for the Site. The FWIA investigations were conducted in accordance with the *NYSDEC Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites* guidance document (NYSDEC, 1994).

The FWIA process was initiated in 2007 to address potential ecological exposures to Site-related constituents, which had not been included as part of the previous remedial investigations or the CMS and its subsequent addendums. FWIA Steps I and II objectives were to (1) identify fish and wildlife resources that presently exist and existed before contaminant introduction and provide information necessary for the design of a remedial investigation, and (2) identify actual or potential impacts to fish and wildlife resources from Site COPCs. The results of the FWIA Step I (Site Description) and components of Step II, Part A were submitted as part of an *Ecological Evaluation Site Description Report* (URS, 2007). Supplemental information and responses to comments from NYSDEC were provided to allow agreement on February 17, 2009 to submit a FWIA Step II, Part B report.

The results of FWIA Step IIB (Criteria-Specific Analysis) (URS, 2009) indicated that the maximum concentrations of several inorganics in surficial soil from SWMUs or AOCs within the Active Plant Area exceeded contaminant-specific criteria, and further evaluation of potential exposure in the Wetlands Complex (SWMU 1/22) was warranted (**Figure 2-1)**. Recommendations for investigations to evaluate potential impacts in the Wetlands Complex (SWMU 1/22) were provided to NYSDEC in the *Fish and Wildlife Impact Analysis Step IIC Investigation Work Plan* (URS, 2010).

Subsequently, a FWIA Step IIC investigation was conducted to collect adequate and representative data to assess potential ecological impacts and support the establishment of Site remedial objectives for consideration in the CMS. Ecological investigations were conducted for two separate exposure areas: SWMU 1/22 Wetlands Complex and Active Plant Area. The scope of the Step IIC investigation was reported in the *Fish and Wildlife Impact Analysis Step IIC Investigation Report* (URS, 2011b) and are summarized below:

2.3.4.1 SWMU 1/22 Wetlands Complex

SWMU 1/22 Wetlands Complex investigations were conducted to evaluate potential ecological impacts associated with Site-related inorganics in surface water, sediment, and biological tissues, including sediment quality triad (SQT) investigation, surface water characterization, fish community evaluation, and biological tissue sampling. Sample locations are shown on **Figure 2-11.**

In general, greater concentrations of target inorganics were observed at SQT stations in close proximity to SWMU 22 (SQT-03 through SQT-06) relative to stations with increasing distance from SWMU 22. Maximum concentrations of target inorganics were associated with SQT-03 (selenium), SQT-05 (lead), or SQT-06 (cadmium, copper, mercury, and zinc). Concentrations of cadmium, copper, and zinc, were generally lower at stations upstream of SWMU 1 (SQT-01 and SQT-02) when compared to stations downstream of SWMU 22 (SQT-06 through SQT-08); concentrations of lead, mercury, and selenium at upstream stations were generally comparable to or greater than concentrations at downstream stations.

2.3.4.2 Active Plant Area

Active Plant Area investigations were conducted to evaluate potential terrestrial bioaccumulation and wildlife ingestions pathways for Site-related inorganics in soils. Co-located biological tissue samples (small mammal and earthworm) and soil samples were analyzed to evaluate potential ingestion pathways for terrestrial wildlife foraging at the margins of the Active Plant Area. Sample locations are shown on **Figure 2-12.** The findings of the exposure evaluation support the following conclusions regarding exposure to terrestrial wildlife:

- The greatest potential risks to terrestrial wildlife are associated with exposure to selenium consumed in earthworms and small mammals;
- Potential risks associated with selenium exposure to wildlife are greatest in the northern grids N1 and N3, which are associated with former burning areas used to combust off-specification and waste materials;

- Excluding the elevated tissue concentrations in grids N1 and N3, potential risks to top-tier, long-ranging receptors foraging throughout the Site are negligible; and
- Selenium bioaccumulation is highly variable and uncertain based on non-depurated earthworm tissue and total selenium analyses in soil; bioaccumulation relationships derived from Site-specific data are not reliable for developing preliminary remedial goals for soil.

2.3.4.3 Additional Areas of Investigation

Additional Site characterizations were conducted for Site-related inorganics in soil and sediments from SWMU 35 Perimeter Soil and Site Drainage Sediments. Sample locations are shown on **Figure 2-13.** The results of soil sampling at the perimeter of SWMU 35 indicate that inorganics are not migrating downgradient of the landfill. Based on the low concentrations of inorganics relative to screening soil criteria, it is not likely that the SWMU 35 landfill is a source of inorganics to downgradient surface soils.

The results of the FWIA are discussed in detail in **Section 4** and **Section 6.2**.

2.4 Interim Corrective Measures Summary

Interim corrective measures for explosives were undertaken during the period July 24, through October 7, 1996. This work was conducted to address health and safety concerns associated with areas of the Site, which may contain explosives at reactive concentrations. UXB International Inc. screened 17 SWMUs for primary and secondary explosives. Two locations were found to contain explosive quantities of both primary and secondary explosives:

- SWMU 41: Detonator Production Building Condensate Collection Sumps
- SWMU 48: Mercury Fulminate Area

Explosive material was removed from these areas until subsequent sampling indicated that explosive quantities were no longer present.

Three locations were found to contain numerous caps and related debris, which was collected in five-gallon pails for disposal:

- SWMU 1: Shooting Pond
- SWMU 38S: Suspected Grenade Disposal Areas South
- SWMU 38N: Suspected Grenade Disposal Areas North

These activities are documented in the report entitled *Documentation of Interim Corrective Measures (ICM) for Explosives, Dyno Nobel Facility, Port Ewen, New York* (Eckenfelder, 1997a). The objectives of the ICM for explosives were met and the screened areas were deemed safe for further investigation in the RFA-SV and RFI.

Due to the presence of potential energetic materials, NYSDEC requested, in a letter dated August 21, 2000, that Dyno Nobel install a fence around SWMUs 1, 22 and 35. A proposed fence design was submitted to the NYSDEC and approved in a letter dated August 30, 2000 and approximately 4,300 linear ft of chain-link fence was installed around the three SWMUs.

2.5 Previous Corrective Measure Study (CMS) Submittals

The CMS process initially began in 2000 based on the findings of the RFA and RFI. Subsequent revisions and addendums to the CMS have been developed as data gaps have been identified and supplemental investigations and evaluations have been performed. A summary of the CMS documents are presented below.

2.5.1 2000 CMS

The initial CMS (2000 CMS) (Eckenfelder, 2000) was prepared for the Site pursuant to a letter from the NYSDEC, dated July 11, 2000, and the requirements of the Part 373 Permit to evaluate and recommend corrective measures alternatives for 32 SWMUs and four AOCs. For evaluation purposes, the SWMUs and/or AOCs were grouped together based on information that resulted from the RFA, RFI, and subsequent investigations, such as the maximum depth of soil in which constituents were detected above the screening criteria and the nature of the material deposited within each SWMU and/or AOC. The following groups were established:

- **Heavy Metal Surface Deposition (HMSD)**
  The SWMUs and AOCs in this group contain soils with elevated concentration of one or more heavy metals and selenium. The HMSD group was further subdivided into three groups based on either physical location or COPC type.
  - HMSD Group 1: SWMUs 2-8, 32 and AOCs A and B
  - HMSD Group 2: SWMUs 10, 26G, 33 and AOCs C and D
  - HMSD Group 3: SWMUs 21, 26D, and 40
- **Landfills**
  The SWMUs and/or AOCs in the Landfill group (SWMUs 22, 23, 32, 35, and 48) are locations that were previously used for on-Site disposal of various wastes. These landfills/dumps are no longer active. Because of the potential presence of energetic materials within these SWMUs, investigative activities were restricted to the perimeter and adjacent areas.
- **Shooting Pond**
  SWMU 1, referred to as the shooting pond, is located in the Wetlands Complex. Undetonated energetics are potentially present within the pond sediments.
- **Wetlands**
  The Wetlands Complex (SWMU 1/22) refers to the wetlands surrounding SWMUs 1, 22, and 35 collectively.
- **Groundwater**
  The SWMUs and/or AOCs that are included in this group (SWMUs 24, 30, and 37) are proximal to groundwater monitoring wells, in which sample results exceed the groundwater protection standards.

Based on the technical, human health, and environmental evaluation presented in the 2000 CMS (Eckenfelder, 2000), the recommended management alternative for the groups mentioned above were as follows:

- HMSD Group 1 – Permeable cover
- HMSD Group 2 – Excavation and off-site disposal
- HMSD Group 3 – Excavation, on-site consolidation and capping
- Landfills – Permeable Cover
- Shooting Pond – Permeable cover
- Wetlands – Excavation, on-site consolidation and capping
- Groundwater – Monitored Natural Attenuation

2.5.2 2003 Addendum to CMS

An addendum to the 2000 CMS was prepared for the Site pursuant to a letter from the NYSDEC, dated January 6, 2003. The objective of addendum was to conduct a due diligence review of the history of Site operations to determine the potential for areas of environmental concern, if any, not adequately identified in prior Site investigations.

The *Addendum to the Corrective Measures Study* (2003 Addendum) (Brown and Caldwell, 2003) provided an overview of the historical elements, including a review of the Site's history, manufacturing processes, raw materials used, waste products, and waste disposal processes.

Historical information such as historical Site maps, aerial photographs, employee questionnaires, and review of public records including building and demolitions permits, fire and police department records, newspaper archives, Sanborn fire insurance maps, and corporate records were reviewed to develop a historical timeline of the Site's development. The findings of the historical review are consistent with previously identified and investigated SWMUs/AOCs, including that no new waste disposal areas or industrial practices were identified.

An outcome of the 2003 Addendum was the need for further evaluation at several areas across the Site, including:

- The area north of the Site fence line: stored ammonium nitrate fuel oil and possibly demolition debris disposal;
- Former production area: contained facilities using similar processes to those associated with SWMUs/AOCs; and
- Former dry houses in the southern area of the property: similar to existing AOCs G and H.

SWMUs/AOCs identified for further evaluation were presented in the Supplement to Corrective Measures Study (Hydroqual, 2005), which is discussed in the following section.

2.5.3 2005 Supplement to CMS

Pursuant to a meeting with NYSDEC, New York State Department of Health (NYSDOH), Hercules, Dyno Nobel, and HydroQual Inc. (HydroQual) representatives on July 28, 2005, a *Supplement to Corrective Measure Study* (2005 Supplement) (HydroQual, 2005) was submitted to NYSDEC. The 2005 Supplement addressed the eight SWMUs (SWMUs 49 through 56) and 11 AOCs (AOCs E through O) identified and investigated since the 2000 CMS. A determination of no further action was made for SWMUs 49, 50, 51, 53, and 55 and AOCs E, F, K and L.

Additional soil investigations were conducted for SWMUs 52, 54 and 56 and AOCs G, H, I, J, M, N, and O. Analytical data from the additional soil investigations were compared to screening criteria and with the exception of SWMU 56 (NFA was proposed); the additional SWMUs/AOCs were categorized into the HMSD groups, as initially presented in the 2000 CMS (Eckenfelder, 2000).

2.5.4 2006 Revision to CMS Soil Screening Criteria

In a July 7, 2006 meeting attended by representatives of NYSDEC, NYSDOH, Hercules Inc., Dyno Nobel, and HydroQual, discussions were held regarding the Unrestricted Use and Industrial Use Soil Screening Criteria used in the 2000 CMS (Eckenfelder, 2000). Based on these discussions, the NYSDOH indicated that the applicable cleanup criteria for arsenic, lead, and mercury would be as follows:

- Arsenic – 16 parts per million (ppm)
- Lead – 1,000 ppm
- Mercury – 220 ppm

The NYSDOH indicated that these criteria would remain applicable only to the extent that a deed notice is in place and use of the facility remains for manufacturing (i.e., industrial). The remaining Unrestricted Use and Industrial Use Soil Screening Criteria proposed in the 2000 CMS (Eckenfelder, 2000) were acceptable to NYSDEC.

Based on the revision to the Industrial Use Soil Screening Criteria for arsenic, lead, and mercury, the figures presented in both the 2000 CMS (Eckenfelder, 2000) and the 2005 Supplement (HydroQual, 2005) were revised to reflect the new criteria. These figures were submitted to NYSDEC in a letter report dated September 1, 2006 (HydroQual, 2006).

2.6 Summary of SWMUs/AOCs and COPCs

Over the course of the investigations on Site, a total of 78 SWMUs and AOCs have been identified. Of these SWMUs and AOCs, 46 was considered in the previous CMS reports and associated updates. The remaining SWMUs and AOCs were assigned as NFA and not considered within the previous CMS documents. The scope of this CMS as agreed with NYSDEC is to consider only the SWMUs and AOCs that have been considered in previous CMS reports and any new SWMUs/AOCs identified since the most recent CMS. **Table 2-3** lists all of the Site SWMUs and AOCs, which are considered in this document. **Figure 2-14** depicts the location of these SWMUs and AOCs.

The investigations completed at the Site to date have primarily been focused on the presence of inorganic (metals and selenium) and VOC impacts to Site media including soil, sediment, surface water, groundwater, and indoor air. The following section (**Section 3**) establishes the standards, criteria, and guidelines (SCGs) used to determine the COPCs and their allowable concentrations in different Site media. **Section 4** of this report then applies the SCGs to the Site media to determine the nature and extent of impacts above the applicable SCGs. The Site media with COPCs above the relevant SCGs will be considered for corrective measures in the subsequent sections of this report.

3.0 IDENTIFICATION OF STANDARDS, CRITERIA, AND GUIDELINES

One component involved in identifying, evaluating, and selecting remedial alternatives is a review of SCGs that may be applicable to the Site and/or contemplated remedial alternatives. Understanding federal, state, and local SCGs assists in identifying remedial objectives for the Site, the type of remedial alternatives that may be appropriate, and the scope and extent to which each retained alternative would be designed and implemented.

The SCGs that have been identified for the Site are presented in this section.

3.1 Definition of SCGs

"Standards and criteria" are cleanup standards, standards of control, and other substantive environmental requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance.

"Guidelines" are non-promulgated criteria, advisories and/or guidance that are not legal requirements and do not have the same status as "standards and criteria"; however, remedial alternatives should consider guidance documents that, based on professional judgment, may be applicable to the Site.

It is important to consider SCGs in the CMS. Doing so allows for the development of each corrective measures alternative to a reasonably accurate level of detail and provides for a common basis for comparison among alternatives.

3.2 Mercury Speciation

As established in **Section 2** of this report, based on the operational history and the results of the investigations performed on Site, the impacts present in Site media are generally limited to inorganics and VOCs. During previous investigations, mercury has been identified in media across the Site. Mercury (Hg) can exist in different forms in the environment. The toxicity of the mercury is related to the form in which it exists in the environment. As a result, in order to evaluate SCGs for mercury, it is important to determine if the total mercury concentrations reported in soil samples collected from the Site represent, in whole or in part, concentrations of elemental mercury.

This distinction is significant with respect to determining the clean-up criteria for mercury as it relates to the protection of human health and as documented in 6 New York Codes, Rules and Regulations (NYCRR) Part 375 "Brownfield" Regulations. Specifically, Table 375-6.8(b), which lists the Restricted Use Soil Cleanup Objectives, references the soil cleanup objectives (SCOs) for mercury as "Total Mercury". However, the concentrations for the protection of human health are tagged with a "J" footnote, which states, "This SCO is the lower of the values for mercury (elemental) or mercury (inorganic salts). See TSD Table 5.6-1." Table 5.6-1 of the Technical Support Document (TSD) is titled "Final Human Health Based Soil Cleanup Objectives" and lists Industrial Use SCO for both Mercury (Elemental) at the bottom of page 252 of the table and Mercury (inorganic) at the top of page 253. The stated final soil cleanup objective for inorganic mercury for industrial sites is 220 milligrams per kilogram (mg/kg) and elemental mercury SCOs at 5.7 mg/kg.

Based on the Site's operational history, the presence of mercury at the Site is attributed to the historical use of mercury fulminate [mercury (II) Hg(ONC)2] as a primary explosive at the facility from 1912 until the 1950s. No historical use of elemental mercury or equipment associated with elemental mercury (switches, etc.) has occurred at the Site. Therefore – the above information would support the conclusion that the mercury in the Site soils is in the form of a salt/ inorganic complex Hg (II).

In 2009, NYSDEC requested an evaluation of analytical methods that would provide data to differentiate between elemental and inorganic salts of mercury at the Site. The analytical results obtained from a mercury speciation study performed by Cornerstone Environmental Group, LLC (Cornerstone, 2009) support that the mercury in the Site soils is in the form of a salt/ inorganic complex Hg (II) through multiple lines of evidence as summarized below:

- Visible beads of mercury have not been observed in soil samples collected from the Site
- Elemental mercury (i.e. volatile mercury) was not detected in the F_O fraction
- The mercury species present at the Site are found within the F_3 and F_4 fractions, indicating that mercury is present as strongly bound inorganic mercury species
- Methyl mercury concentrations in Site soils are similar to those in background areas

The historical use of mercury salts at the Site (i.e. mercury fulminate) and the supporting analytical evidence provided by the Cornerstone study concludes that the mercury present at the Site is in the form of inorganic Hg(II) complexes that are strongly bound to the soil. Accordingly, the applicable industrial use SCO, as measured by the total mercury concentration in soil, is represented by the inorganic mercury criteria of 220 mg/kg.

3.3 Selenium Classification

Selenium is the only non-metal inorganic COPC at the Site. Selenium forms oxyanions, which strongly bind to iron and manganese in soils. The soils and subsurface geology (lacustrine clays) at the Site are manganese and iron rich and do not contain elevated levels of sulfate or phosphates that would compete for binding sites or displace selenium, which effectively limits the mobility of selenium in Site soils and groundwater.

The likely source of selenium in Site soils is the burning of coal or industrial materials such as semi-conductors and pigments. Selenium in soils, as an area of concern, is limited to the areas on the northern portion of the Site identified as N1 and N3 during the Step II FWIA evaluation (**Figure 2-12**). Groundwater immediately downgradient of the historic burn areas (SWMUs 6, 7, 8, 26G and AOCs B, C, and D) has been impacted by selenium. However, the elevated constituent concentrations appear to be localized near the SWMUs.

3.4 Types of SCGs

SCGs have been categorized into the following classifications:

- Chemical-Specific SCGs – These SCGs are typically health- or risk-based numerical values that establish allowable concentrations for constituents associated with the impacted media (soil, groundwater, etc.).
- Action-Specific SCGs – These SCGs are typically technology- or activity-based requirements related to the performance of remediation activities. These types of SCGs typically influence the implementation aspects of a given alternative.
- Location-Specific SCGs – These SCGs include regulations related to activities conducted in floodplains, wetlands, and navigable waters. Location-specific SCGs also include local requirements such as noise mitigation requirements, building permit conditions for permanent or semi-permanent facilities constructed during the remedial activities (if any), sewer discharge requirements, street closing policy, etc.

3.4.1 Chemical-Specific SCGs

3.4.1.1 Soil

As part of the RFI at the Site, NYSDEC approved the screening criteria for determining whether a CMS was required for each SWMU/AOC. These screening criteria were based on USEPA, New Jersey, and NYSDEC Technical Administrative Guidance Memorandum (TAGM) standards and were used as the unrestricted use target cleanup levels (TCLs) in previous versions of the CMS. The industrial use TCLs established in the 2000 CMS (Eckenfelder, 2000) were based on USEPA Region IX risk-based criteria. However, since the previous CMS document submittals, New York State promulgated state-specific SCOs in NYCRR Part 375 on December 14, 2006. Therefore, the chemical-specific SCGs have been updated for this revision of the CMS to include those SCOs established in NYCRR Part 375.

Because the existing and anticipated future use of the Site is industrial, the industrial use SCOs pursuant to NYCRR part 375-6.8(b) are applicable for chemical COPC-impacted soils in SWMUs and AOCs located on-site. However, pursuant to the direction of NYSDEC, this CMS also considers the commercial use SCOs in the evaluation of corrective measures alternatives. The commercial and industrial use SCOs for COPCs are provided in **Table 3-1.**

3.4.1.2 Sediment

Based on discussions with NYSDEC, this CMS evaluates the impacted sediments and proposed sediment excavation relative to the following three criteria:

- Severe Effects Levels (SELs)
- Proposed Remediation Goals (PRGs)
- Mass Removal

These criteria apply to sediments in the Wetlands Complex and drainage channels leading from the Active Plant Area to the Wetlands Complex.

<u>SELs</u>

The SELs for the Site COPCs are provided in **Table 3-1** and established in NYSDEC's *Technical Guidance for Screening Contaminated Sediments* (NYSDEC, 1999). The sediment criteria for metals are based upon procedures and data developed by the Ministry of Ontario (Persaud et al., 1992), and the National Oceanic and Atmospheric Agency (NOAA) (Long and Morgan, 1990). The SEL indicates the concentration at which pronounced disturbance of the sediment dwelling community can be expected (Persaud et al., 1992). The NYSDEC SEL for each metal is the lowest of either the Persaud et al. (1192) SEL or the Long and Morgan (1990) Effect Range-Moderate.

<u>PRGs</u>

The Site-specific PRGs are the minimum concentration of the invertebrate PRG or the wildlife PRG for each target metal provided in **Table 3-1** and were developed based on the data collected during the FWIA. The Site investigations did not collect enough data to develop NYSDEC-approved PRGs but this sediment delineation option has been retained for comparison and evaluation purposes only.

Mass Removal

The Wetlands Complex limit of the proposed mass removal scenario for sediments will be the NYSDEC-approved wetlands boundary, which is to be determined. In addition, all visible sediment will be removed from the site drainage features that transect the Active Plant Area (**Figure 4-1**). The downstream limit of the proposed mass removal scenario for sediments is based on observed sediment depositional patterns and analytical sediment data collected in Plantasie Creek downstream of the SWMU 1/22 Wetland Complex. As detailed in the technical memorandum titled *Summary of Downstream Sampling Results* (URS, 2011a), sediment samples were collected in October-November 2010 from sediment depositional features downstream of the SWMU 1/22 Wetland Complex. Sediment samples were analyzed for the site-related target metals (cadmium, copper, lead, mercury, selenium, and zinc) investigated as part of the Fish and Wildlife Impact Analysis (FWIA) Step IIC investigation (URS, 2011b).

Analytical results of downstream sediment sampling indicate that elevated concentrations of target metals are most associated with a zone of deposition immediately downstream of the SWMU 1/22 Wetland Complex. As discussed in the *Summary of Downstream Sampling Results*, the results of downstream sediment sampling indicate elevated concentrations of target metals, particularly copper and mercury, in the surface interval (0 – 1 foot) at the first two stations (PE-DNS-SD-01 and PE-DNS-SD-02) downstream of the SWMU 1/22 Wetland Complex (Figure 4-3). Sediment metals concentrations at these stations were generally consistent with elevated concentrations observed in the surface interval at station SQT-08, near the downstream extent of the SWMU 1/22 Wetland Complex. However, concentrations of target metals in sediment, particularly copper and mercury, at downstream stations PE-DNS-SD-03 and PE-DNS-SD-04 were substantially lower relative to upstream stations.

The distribution of target metals in sediment depositional areas downstream of the SWMU 1/22 Wetland Complex is generally consistent with channel morphology and flow conditions. As illustrated in Photographs 1 and 2 of the photographic log included as **Appendix A**, the reach from SQT-08 downstream to PE-DNS-SD-02 (approximately 1200 feet) is characterized by a broad channel with limited stream velocity and impeded stream flow. As a result, this reach represents a sediment depositional zone where fine-grained sediments potentially mobilized from the SWMU 1/22 Wetland Complex have accumulated. As illustrated in Photos 3 and 4, the stream channel becomes narrower and the stream banks become more defined at downstream stations PE-DNS-SD-03 and PE-DNS-SD-04, respectively. Channel features in this downstream reach become more variable, with small riffle complexes becoming evident. Consistent with this change in channel features, sediment depositional areas at stations PE-DNS-SD-03 and PE-DNS-SD-04 are largely limited to the channel margins; the thickness of sediment depositional features is also reduced at these stations relative to upstream stations. Greater concentrations of metals observed at upstream stations PE-DNS-SD-01 and PE-DNS-SD-02 are consistent with a more extensive zone of sediment deposition immediately downstream of the SWMU 1/22 Wetland Complex; lower metals concentrations at stations PE-DNS-SD-03 and PE-DNS-SD-04 are consistent with more limited downstream sediment transport and deposition from the SWMU 1/22 Wetland Complex. At downstream stations PE-DNS-SD-03 and PE-DNS-SD-04, only copper and mercury exceed Class C freshwater sediment guidance values (SGV; NYSDEC, 2013); however the ratios of the measured concentrations to the Class C SGVs is substantially lower (< 2 for copper and between 1 and 3 for mercury) than upstream stations.

In summary, the proposed downstream limit of the mass removal scenario for sediments is proposed at the downstream extent of the depositional area between PE-DNS-SD-02 and PE-DNS-SD-03 (**Figure 4-3**). This sediment depositional area provides a sink for fine-grained sediment potentially mobilized from the SWMU 1/22 Wetland Complex. The substantial reduction in the volume of sediment deposits and corresponding reductions in the concentrations of metals in sediment downstream of the depositional areas support this extent as the downstream limit of the mass removal of sediment potentially mobilized from the SWMU 1/22 Wetland Complex.

3.4.1.3 Groundwater

The applicable standards for Site groundwater are the NYSDEC Class GA GWQS as established in NYSDEC's Division of Water, Technical and Operational Guidance Series (TOGS) Groundwater Effluent Limitations (TOGS 1.1.1), which are derived from NYSDEC, 6 NYCRR Part 703, Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations. This criterion applies to the groundwater beneath the Site.

3.4.1.4 Indoor Air

The guidance value for TCE is 5 $\mu g/m^3$ as identified in Table 3-1 of *the Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York*, (NYSDOH, 2006). A guidance value for cis-1,2-DCEis not published, however the risk based criteria for cis-1,2-DCE is typically higher than that for TCE. This criterion applies to the indoor air at the Shell Plant.

3.4.1.5 Surface Water

The applicable standards for Site surface water are the NYSDEC Class C Surface Water Quality Standards (SWQS) as established in NYSDEC's Division of Water, Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations (TOGS 1.1.1), which are derived from NYSDEC, 6 NYCRR Part 703, Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations. These standards are only applicable to filtered surface water samples.

3.4.1.6 Waste

Another set of chemical-specific SCGs that potentially apply to Site soil and sediment, if the soil and/or sediment is to be excavated (and then considered under RCRA to be a "waste" that is generated) are the RCRA-regulated levels for Toxicity Characteristic Leaching Procedure (TCLP) constituents, as outlined in Title 40 of the Code of Federal Regulations (40 CFR) Part 261 and 6 NYCRR Part 371. The TCLP constituent levels are a set of numerical criteria at which solid waste subject to disposition is considered a hazardous waste by the characteristic of toxicity. In addition, the hazardous characteristics of ignitability, reactivity, and corrosivity also may apply depending on the results of waste characterization activities.

3.4.2 Action-Specific SCGs

Action-specific SCGs include topics such as general health and safety requirements and handling and disposing of hazardous waste (including permitting, manifesting, transportation and disposal, and treatment and disposal facility operations).

Remedial actions conducted at the Site would need to comply with applicable requirements established by the Occupational Safety and Health Administration (OSHA). General industry standards, which specify training requirements for workers involved with hazardous waste operations and time-weighted average concentrations for worker exposure to various compounds, are outlined under OSHA (29 CFR 1910). The types of safety equipment and procedures to be followed during Site remediation are specified under 29 CFR 1926, and recordkeeping and reporting-related regulations are outlined under 29 CFR 1904. Trenching and excavation requirements are outlined under 29 CFR 1926 (Parts 650-652). In addition to the requirements outlined under OSHA, the preparedness and prevention procedures, contingency plan, and emergency procedures outlined under RCRA (40 CFR 264) are potentially relevant and appropriate to those remedial alternatives that include the generation, treatment, or storing of hazardous wastes.

Another set of action-specific SCGs are land disposal restrictions (LDRs), which regulate land disposal of hazardous wastes. The LDRs are applicable to alternatives involving the disposal of hazardous waste (if any).

The United States Department of Transportation (USDOT) and New York State rules for the transport of hazardous materials are provided under 49 CFR Parts 107 and 171.1 through 172.558 and 6 NYCRR 372.3. These rules include procedures for packaging, labeling, manifesting, and transporting of hazardous materials and would potentially be applicable to the transport of hazardous materials under any remedial alternative. New York State requirements for waste transporter permits are included in 6 NYCRR Part 364, along with standards for the collection, transport, and delivery of regulated wastes within New York. The transport of waste materials off-site would need to be properly permitted.

Given the possibility of encountering energetic materials at the Site, as discussed in Section 2.2, 49 CFR 172.101 Hazardous Materials Table will apply. This regulation indicates that a material for which the entry in this column is "Forbidden" may not be offered for transportation or be transported. This prohibition does not apply if the material is diluted, stabilized or incorporated in a device and it is classed in accordance with the definitions of hazardous materials contained in part 173 of this subchapter. The option to dilute, stabilize, or incorporate into a device to allow shipment is not a blanket exception and does not apply to these specially noted forbidden materials unless indicated in 49 CFR 173.21. Energetic materials that may be encountered at the Site which are included in this list of "Forbidden Materials" are as follows:

- Lead azide
- Lead styphanate
- Mercury fulminate
- DDNP
- HMX
- PETN

3.4.3 Location-Specific SCGs

Location-specific SCGs include local requirements such as building permit conditions for permanent or semi-permanent facilities constructed during the remedial activities (if any), weight restrictions on local roads, local noise restrictions, floodplain and wetland regulations, and restrictions promulgated under the National Historic Preservation Act, Endangered Species Act, and other federal acts.

The Code of the Town of Esopus, New York (§ 123-16), which is the municipality for Port Ewen, indicates that the maximum sound pressure level radiated by any use of a facility (other than transportation facilities) at the property line shall not exceed the values tolerable in a residential neighborhood, except by specific review and approval by the Planning Board. According to the Esopus Highway Department, there may be some bridge restrictions (weight and height) on Highway 9W from Kingston and there is a 5-ton weight limit on Mountain View Road. As indicated in the *Fish and Wildlife Impact Analysis Report* (URS, 2009), a review of the NYSDEC Freshwater Wetlands Maps and National Wetland Inventory Maps and a field reconnaissance conducted as part of the FWIA confirmed the presence of NYSDEC-regulated wetlands within the Site boundaries. In addition, the FWIA indicated that rare, threatened, and endangered species have not been documented on or within 0.5 mile of the Site.

4.0 NATURE AND EXTENT OF IMPACTS

As discussed in **Section 2**, the SWMUs and/or AOCs requiring a CMS were grouped together in previous versions of the CMS based on contaminant type (e.g., inorganics), geographic area (e.g., wetlands), and media (e.g., groundwater). This revision of the CMS generally groups the SWMUs and AOCs by media type as follows:

- Soil
- Sediment
- Surface Water
- Groundwater
- Indoor Air

Grouping by media type will allow a more streamlined evaluation process. **Table 4-1** lists the SWMUs and AOCs that are categorized under each group listed above, as well as their prior grouping as reference. **Figure 2-14** depicts the location of these SWMUs and AOCs. A description of these SWMUs and AOCs is provided in **Appendix B**.

In general, the constituents detected in soil at the Active Plant Area are consistent with the sediment impacts detected within on-site drainage features and the Wetlands Complex sourced from runoff from the facility. Groundwater impacts at the facility include a combination of Site inorganics and chlorinated solvents. These chlorinated solvents have not been detected in site soils, sediment or surface water.

The remainder of this section evaluates the nature and extent of impacts on Site by each media type and provides an evaluation of the key attributes of the impacted media to be considered when evaluating corrective measures.

4.1 Soil

The SWMUs and/or AOCs in this group contain soils with concentrations of one or more inorganics above the applicable SCOs. Within this group of SWMUs and/or AOCs there are key attributes that need to be taken into account when evaluating corrective measure alternatives, such as:

- Location of impacts within the Site (active vs. remote area)
- Vicinity to drainage ways
- Topographic relief that could be difficult for corrective measures implementation
- Potential presence of energetic materials
- COPCs and the degree to which they exceed SCGs
- Vertical extent and volume of soil exceeding the SCOs

A summary of these key attributes for each SWMU/AOC in this group is provided in **Table 4-1**. Figures delineating each SWMU/AOC in this group to the commercial and industrial use SCOs are provided in **Appendices C and D**. In the **Appendix C** figures, each SWMU was delineated horizontally to the mid-point between an impacted sampling point and sampling point below the standard according to industry practice. This is the most likely scenario but will require additional pre-remedial sampling to confirm. In the **Appendix D** figures, each SMWU was delineated horizontally to a sample location below the applicable commercial and industrial SCOs where available. Additional pre-remedial or confirmation sampling may be required where no sample location below the commercial or industrial SCO exists.

With the exception of the Shell Plant, the Site impacts are related to inorganics (metals and selenium). VOCs are only present in the immediate area of the Shell Plant (SWMUs 24, 30, and 37). Arsenic, barium, cadmium, copper, lead, mercury, and selenium were identified as the primary COPCs in the Active Plant Area exceeding the commercial and industrial use SCOs. Arsenic, barium, cadmium, copper, and lead are predominantly present in the northern and southern portions of the Active Plant Area as shown in **Table 4-1**.

Arsenic was detected in soils at concentrations exceeding the commercial use SCO in the following units:

- SWMU 2 and AOC A
- SWMUs 3 and 5
- SWMU 4
- SWMU 26G and AOCs C & D
- SWMU 52
- AOCs G, H, J, M, N, and O

Barium was detected in soils at concentrations exceeding the commercial use SCO in the following units:
- SWMUs 6, 7, 8, and AOC B
- SWMU 21
- SWMU 52

Cadmium was detected in soils at concentrations exceeding the commercial use SCO in the following units:
- SWMU 2 and AOC A
- SWMUs 3 and 5
- SWMU 4

Copper was detected in soils at concentrations exceeding the commercial use SCO in the following units:
- SWMU 2 and AOC A
- SWMUs 3 and 5
- SWMU 4
- SWMU 21
- SWMU 26D
- SWMU 26G and AOCs C & D
- SWMU 48
- SWMU 52
- AOCs G, H, J, N, and O

Lead was detected in soils at concentrations exceeding the commercial use SCO in the following units:
- SWMU 2 and AOC A
- SWMUs 3 and 5
- SWMUs 6, 7, 8, and AOC B
- SWMU 21
- SWMU 26D
- SWMU 40
- SWMU 52
- AOCs H, I, J, M, N, and O

Selenium is isolated to the northern portion of the Active Plant area in the following units:

- SWMUs 6, 7, 8, and AOC B
- SWMU 26G and AOCs C & D
- SWMU 52
- N1/N3

Mercury is most predominant in SWMU 54, which is transected by the southern drainage way and near the former mercury fulminate tanks (SWMUs 9, 10, 11, 13, 29, and 33).

The majority of soil impacts are limited to a depth of 0-2 ft bgs in the Active Plant Area. However, as summarized in **Table 4**-1, impacts at greater depths were identified as follows

- 4 ft bgs at SWMUs 4, 6, 7, 8, 26D, and AOC B;
- 6 ft bgs at SWMUs 2, 3, 5, and AOC A; and
- 8 ft bgs at SWMU 52

In general, concentrations of COPCs in soil decrease with depth.

The total volume of soil impacts exceeding the commercial use SCO in the Active Plant Area is 16,936 cubic yards (CY). The total volume of soil impacts exceeding the industrial use SCO in the Active Plant Area is 8,424 CY.

The units that have the largest areal extent of impacts are SWMU 52 (27,593 square feet [SF]), SWMU 54 (19,313 SF), SWMU 2 and AOC A (15,988 SF), SWMUs 6, 7, 8, and AOC B (15,590 SF), and SWMUs 3 and 5 (13,753 SF).

Based on a comparison of COPC concentrations with the SCOs, SWMUs 26E, 39, 42, 46, 47, and 56 were determined to require no further action due to no exceedances of the commercial use SCOs.

4.1.1 Location of Impacts within the Site (active vs. remote)

The majority of SWMUs and AOCs located on the Active Plant Area of the Site are located in remote areas. However, there are a handful of SWMUs/AOCs (**Table 4-1**) which are located in active areas, which will require consideration of impacts on Site operations and hazards, and health and safety concerns for operational personnel.

4.1.2 Vicinity to Drainage Ways

SWMUs 52 and 54 are transected by the two Site drainage ways. Care will need to be taken when implementing corrective measures in these areas to prevent further transport of impacted soils to the Wetlands Complex via the drainage ways (e.g., silt fencing). In addition, elevated concentrations of inorganic CPOCs are present at SMWUs 2, 3, 4, 5, 9, and 33, which are located proximal to these Site drainage ways and could historically or in the future act as sources to surface water and downstream Wetlands Complex.

4.1.3 Topographic Relief

The topographic relief at portions of the Site could make remedy implementation difficult. The majority of the Active Plant Area is relatively flat with the exception of the northeastern portion, which is at the toe of Hussey Hill (i.e., SWMUs 2, 3, 4, 5, 6, 7, 8, 32 and AOCs A and B).

4.1.4 Potential Presence of Energetic Materials

SWMUs 22, 23, 32, and 35 are locations that were previously used for on-site disposal of various wastes. These landfills/dumps are no longer active. The presence of potentially reactive materials at the landfill was identified by Brown and Caldwell (2002) as a safety concern if excavation was proposed. Brown and Caldwell (2002) indicated that the SWMUs do not present a significant hazard *in situ*. Rather, the hazards are associated with conducting intrusive activities or handling/processing such materials which subjects the materials to potential ignition sources such as friction, heat, shock or static electricity, without which there is no potential for explosion. This risk was acknowledged in the RFI Work Plan (Eckenfelder, 1997b) and soil sampling was restricted to the perimeter of the landfill SWMUs.

Very little information is available regarding the operating procedures and practices associated with the landfills, as presented in the RFA Report (A.T. Kearney, 1993). The RFA Report notes that the SWMU 22 landfill was potentially in operation since 1912; the landfill received hazardous and non-hazardous wastes including ash, flashed debris, and general building debris; open burning was conducted at the landfill; and no additional details concerning the operating procedures were available. It is also noted that an unplanned detonation involving ammonium nitrate fuel oil occurred in 1969. Fewer specifics are available for SWMUs 12, 32 and 35. The RFA Report indicates that disposal of unknown materials occurred and no other information about the operating procedures and practices was known.

Further investigation would be necessary to characterize the landfill materials prior to excavation. Field screening procedures, such as colorimetric and immunoassay, could be used in conjunction with laboratory analysis. In *Field Sampling and Selecting On-Site Analytical Methods for Explosives in Soil* (USEPA, 1996) it is noted that, “Characterization of explosives contaminated sites is particularly difficult because of the very heterogeneous distribution of contamination in the environment and within samples.” It is further noted that, “Often 70 to 90 percent of the samples analyzed during an explosives site investigation do not contain detectable levels of contamination.” Accordingly, extensive investigation would be needed to characterize the landfill materials to attain a reasonable level of confidence that excavation could be performed without unacceptable safety hazard. The investigation itself would pose a safety hazard to the workers collecting and analyzing samples.

While methods and procedures are available to minimize the safety hazards associated with excavating potentially energetic materials, the hazard cannot be eliminated and should be given due consideration in the evaluation of corrective measure alternatives. In addition, federal regulations may prohibit the transportation of potential energetic materials that may exist in the former landfills as discussed in **Section 3.4.2**.

4.2 Sediment

The Wetlands Complex (SWMU 1/22) generally refers to the wetlands surrounding SWMUs 1, 22, and 35. This section looks at the nature and extent of sediment and surface water impacts within the Wetlands Complex.

The sediment impacts within the Wetlands Complex are primarily associated with historic waste management practices in and adjacent to the Wetlands Complex. In addition, historic operations at the Site located within and immediately adjacent to the Site drainage ways have led to soil impacts which have migrated into the drainage ways and into the Wetlands Complex.

Within the Wetlands Complex, the small catchment and the large and heavily vegetated nature of the wetland has resulted in very low flow velocities and sediment deposition. The presence of thick vegetation and the absence of channeling within the Wetlands Complex has resulted in very low flow enhancing the deposition process. Due to these characteristics the majority of impacted sediment have been deposited in the Wetlands Complex, with the concentrations of impacted sediments rapidly declining downstream of the Wetlands Complex. The presence of impacted sediment within the stream downstream of the wetlands is not considered to be due to ongoing discharges from the Wetlands Complex but rather from historic discharges. No evidence of erosion of sediment or mobilization from the Wetlands Complex has been observed. Further discuss of surface water quality is provided in **Section 4.3**.

The primary COPCs detected in the Wetlands Complex comprise of mercury, selenium, lead, cadmium, copper, mercury and zinc. These constituents have been detected in elevated concentrations within the landfills in and adjacent to the Wetlands Complex. Elevated concentrations of copper, lead, mercury, selenium, silver and zinc have also been detected in the drainage ways leading to the Wetlands Complex.

In general, the constituents detected within the Wetlands Complex are consistent with those detected on the Active Plant Area. The similarity in constituents and concentrations between the Wetlands Complex and areas Active Plant Area reflect both historic practices (transfer of wastes from the manufacturing area to the SWMU 22 landfill) and historic surface water runoff and impacted sediment discharges from the facility to the wetlands.

A discussion of the impacts within the Wetlands Complex and other areas where the chemical-specific SCGs for sediment have been applied are discussed further in the sections below.

4.2.1 SWMU 1: Shooting Pond

SWMU 1 managed off-specification PETN, DDNP, HMX, PBX, RDX, lead azide, lead styphnate, detonation caps and devices, and sump powder wastes. ICMs at this SWMU did not find energetics at reactive quantities. The results of the RFI indicate that the sediments in the pond contain concentrations of inorganics above the unrestricted use cleanup criteria established in previous CMS documents to depths of twelve feet or greater (**Appendices B and C - Figure 3-1**). Since SWMU 1 was previously used as a shooting pond, energetic materials are potentially present within the pond sediments. The pond covers approximately 3,000 SF and has a maximum depth of about 20 ft at its center. The pond has a native clay lining, is surrounded by marsh reed on three sides, and appears to be contiguous to the neighboring wetlands to the north and east.

Based on the sampling results, copper, lead, and mercury exceed the Severe Effects Levels (SELs) established in NYSDEC's *Technical Guidance for Screening Contaminated Sediments* (NYSDEC, 1999). The approximate extent of the area containing inorganic constituents above the SELs is illustrated in

Appendices B and C - Figure 17. The area of SWMU 1, to be remediated is approximately 11,158 SF. Impacted sediments outside of SWMU 1 are addressed as part of the Wetlands Complex discussed in **Section 4.2.3**.

4.2.2 Site Drainage Ways

At the request of NYSDEC, sediment samples were collected on June 23 and 28, 2010 from two Site drainage ways that traverse the Active Plant Area and discharge to the Wetlands Complex (**Figure 4-1**). The results of the Site drainage sediment characterization are illustrated on **Figure 4-1**. In the drainage way traversing the northern portion of the Site, concentrations of inorganics did not indicate a distinct trend along the flow path or with sampling depth. The maximum concentration of mercury in the surface sampling interval (0 – 0.5 ft bgs) was observed at the farthest upstream sampling station (PE-DRN-SD-01); concentrations of mercury varied by station and depth in the remaining samples. At the station near the discharge to the SWMU 1/22 Wetland Complex (PE-DRN-SD-05), concentrations of copper, mercury, selenium, silver, and zinc were elevated in the surficial 0-0.5 ft bgs sample. Concentrations of arsenic, copper, lead, mercury, and zinc in the sediments present in the drainage way traversing the northern portion of the Site exceeded their respective SELs. These same COPCs were also elevated at one or more of the SWMUs or AOCs located topographically upgradient of the drainage way such as SWMUs 2, 3, 4, 6, 9, 11, and 33 and in SWMU 52 which is actually transected by the drainage way, indicating that soils from these SMWUs were transported via erosion/storm water runoff to this drainage way.

In the drainage way traversing the southern portion of the Site, greater concentrations of inorganics were observed at stations downgradient (east) of the railroad tracks relative to stations on the Active Plant (**Figure 4-1**). The greatest concentrations were observed at the two stations near the discharge to the wetlands, PE-DRN-SD-07 and PE-DRN-SD-06. Sediments at these stations generally had the greatest concentrations of copper, lead, mercury and zinc at all depths when compared to other stations within the drainage ditch. These same COPCs can be found at elevated concentrations in the soils at SWMU 52, which is located topographically, upgradient of sampling points PE-DRN-SD-06 and PE-DRN-SD-07, and the Wetlands Complex.

In total, these results indicate that the two drainage ways that traverse the Site may represent historic migration pathways of Site-related inorganics.

4.2.3 Wetlands Complex (SWMU 1/22)

The following sections summarize the results of the SQT studies conducted in the Wetland Complex and reference wetland. The results of bulk sediment analyses of target inorganics at SQT stations are presented on **Figure 4-2**. For reference, sample results are presented relative to NYSDEC sediment criteria for inorganics (NYSDEC, 1999). Sample results exceeding the lowest effect level (LEL) are presented in bold; results exceeding the SEL are shaded and bold.

In general, greater concentrations of target inorganics were observed at SQT stations in close proximity to SWMU 22 (SQT-03 through SQT-06). Concentrations of copper, lead, and mercury exceeded their respective SELs in sediment at all eight SQT stations. Cadmium concentrations exceeded the LEL in SQT-06 and zinc exceeded its LEL at stations SQT-04, SQT-06, SQT-07, and SQT-08. Concentrations of cadmium, copper, and zinc, were generally lower at stations upstream of SWMU 1 (SQT-01 and SQT-02) when compared to stations downstream of SWMU 22 (SQT-06 through SQT-08); concentrations of lead, mercury, and selenium at upstream stations were generally comparable to or greater than concentrations at downstream stations.

Analyses of non-target metal constituents in sediments from reference SQT stations did not indicate the presence of chemical stressors at concentrations that are likely to impact benthic invertebrate communities. Five pesticides, three VOCs, and five semi-volatile organic compounds (SVOCs) were detected in sediments from at least one of the reference SQT stations; 13 additional naturally occurring TAL inorganics were also detected in reference wetland sediments. Comparisons of these detected constituents to available sediment screening criteria (NYSDEC, 1999), indicated only two slight exceedances for arsenic and manganese. The concentrations of detected organic constituents were all below available criteria. Based on these results, impacts to benthic invertebrate communities in the reference wetland due to chemical stressors are not likely.

Due to the observation of organics in the sample collected at SQT-03, an additional characterization of chemical constituents in sediments was conducted during the June 2010 sampling event. The results of these analyses indicated minor detections of VOCs and no detections of SVOCs in sample PE-SD-SQT-03; however, the presence of other petroleum hydrocarbon compounds was confirmed by the EPH analysis. Carbon disulfide, 1,2,4- trichlorobenzene, and toluene were detected at low concentrations relative to the reporting limit. These concentrations were all below the sediment criteria for non-polar organic contaminants (NYSDEC, 1999). No SVOC compounds were detected in the sample; however, elevated detection limits (650 micrograms per kilogram [µg/kg] to 17,000 µg/kg) were noted in the test. EPH analyses indicated elevated concentrations of aromatic and aliphatic compounds, with the presence of aromatic compounds indicating that these compounds are likely petrogenic in nature. C11- C22 aromatics (comprising of polycyclic aromatic hydrocarbons and other undefined ring structures) were detected at a combined concentration of 2,600 mg/kg. Heavy end aliphatic compounds were also detected at an elevated concentration of 13,000 mg/kg. The results of these analyses confirm the presence of non-metal stressors near PE-SD-SQT-03.

4.2.4 Downstream Sediment

Based on the results of the June 2010 bulk sediment analyses, additional characterization of target inorganics in sediment downstream of the SWMU 1/22 Wetlands Complex was conducted on October 28, 2010 and November 11, 2010. This additional sediment sampling was directed by NYSDEC to further characterize the concentrations of inorganics, particularly mercury, that were elevated in sediments at station SQT-08, the farthest downstream SQT station (**Figure 4-3**).

Analytical results of the downstream sediment sampling are provided on **Figure 4-3**. For reference, sample results are presented relative to NYSDEC sediment criteria for inorganics (NYSDEC, 1999). Sample results exceeding the LEL are presented in bold; results exceeding the SEL are shaded and bold.

The results of the downstream sediment sampling indicated concentrations of copper and mercury exceeding their respective SELs at stations PE-DNS-SD-01 and PE-DNS-SD-02 and copper exceeding its SEL in PE-DNS-SD-04 as well. The highest concentrations of inorganics, particularly copper and mercury, are in the surface interval at the first two downstream stations (PE-DNS-SD-01 and PE-DNS-SD-02). The deeper sediment interval at PE-DNS-SD-01 generally contained comparable concentrations to the surface interval for most inorganics, with the exception of mercury, which was elevated in the deeper interval relative to the surface interval. Concentrations of inorganics at PE-DNS-SD-01 and PE-DNS-SD-02 were generally consistent with concentrations observed in the surface interval at station SQT-08. Concentrations of inorganics, particularly copper and mercury, were substantially lower in sediments at downstream stations PE-DNS-SD-03 and PEDNS-SD-04 relative to upstream stations.

The distribution of sediment inorganics in depositional areas downstream of the SWMU 1/22 Wetland Complex is generally consistent with channel morphology and flow conditions. The reach from SQT-08 to PE-DNS-SD-02 is characterized by a broad channel with limited stream velocity that is consistent with past beaver activity that impeded stream flow. Because of limited flow, this reach represents a sediment depositional zone where fine-grained sediments have accumulated over time; the distribution of inorganics in sediments is typically associated with finer-grained sediments. The stream channel becomes narrower and the stream banks become more defined at downstream stations PE-DNS-SD-03 and PE-DNS-SD-04. Channel morphology in this downstream reach becomes more variable, with small riffle complexes becoming evident. Due to the change in channel morphology, sediment depositional areas at stations PE-DNS-SD-03 and PE-DNS-SD-04 are limited to the channel margins; the thickness of sediment depositional features is also reduced at these stations relative to the thickness of sediment deposition at upstream stations PE-DNS-SD-01 and PE-DNS-SD-02. Greater concentrations of inorganics observed at upstream stations PE-DNS-SD-01 and PE-DNS-SD02 are consistent with a more extensive zone of sediment deposition immediately downstream of the SWMU 1/22 Wetland Complex; lower inorganics concentrations at stations PE-DNS-SD-03 and PE-DNS-SD-04 are consistent with more limited sediment deposition downstream.

4.3 Surface Water

Surface water sampling was conducted within the SWMU 1/22 Wetlands Complex and at reference stations concurrent with SQT sampling (**Figure 2-10)** and the results are summarized in **Table 4-2**. Four out of six target inorganics were detected in filtered and unfiltered samples collected within the SWMU 1/22 Wetland Complex. Detected inorganics included copper, lead, selenium, and zinc; concentrations of cadmium and mercury were below detection in all filtered and unfiltered samples.

Based on the results of the surface water analyses, target inorganics are not detected at concentrations likely to result in adverse chronic effects to aquatic life. Filtered surface water results for detected constituents were evaluated relative to hardness-adjusted chronic NYSDEC SWQS. SWQS values for hardness-dependent inorganics (cadmium, copper, lead, zinc, etc.) were based on the lowest and most conservative hardness value from the SWMU 1/22 Wetland Complex (127 milligrams per liter [mg/L]). Concentrations of inorganics in filtered samples did not exceed NYSDEC SWQS. These findings indicate that chronic exposure to inorganics concentrations in surface water within the SWMU 1/22 Wetlands Complex are not likely to result in adverse effects to aquatic life.

A surface water sample is also collected on a semi-annual basis from the stream channel running through the wetlands, at the northern property boundary (**Figure 2-1**). Results of this routine surface water sampling are provided in **Table 4-3** and show historically elevated concentrations of aluminum and iron in unfiltered samples. However, when comparing the results of the filtered samples with the NYSDEC Class C SWQS (which are protective for fish propagation in fresh waters and only applicable to filtered samples) it can be seen that aluminum and iron are below their respective Class C SWQS in surface water at this location. This further supports that chronic exposure to inorganics concentrations in surface water within the Wetlands Complex are not likely to result in adverse effects to aquatic life. Based on historical and routine results, corrective measures for surface water are not required and are not considered for evaluation as part of the CMS.

4.4 Groundwater

Groundwater beneath the Site has been subject to previous investigations (Eckenfelder Inc., 1996) and sub-divided into a shallow groundwater zone (dominated by silts and clays) and a deeper groundwater zone (comprising gravels and sands). The groundwater flow direction across the Site differs between the monitoring boreholes completed in the shallow and deeper overburden sediments. Groundwater flow in the shallow sediments is influenced principally by the elevated topography to the west and the Hudson River to the east. The groundwater flow direction is mainly towards the east with localized convergence of surface water and groundwater to form wetland areas (**Figure 2-7**). Nested boreholes (MW-11, MW12, MW-13, MW-14, MW-15 and M-16) indicate that both discharge and recharge flow exists within the Site area as evidenced by the changes in vertical flow components between the shallow and deeper overburden (Eckenfelder Inc., 1996 and Brown and Caldwell, 1999). These vertical hydraulic gradients may change throughout the year depending on the magnitude of precipitation within the watershed area. The groundwater flow within the deeper overburden appears to be strongly aligned to the intermittent stream feature, which flows from the south-west to the northeast across the southern end of the Site (**Figure 2-8**). It is more likely, however, that the deeper groundwater flow direction is influenced by buried palaeo features related to the development of the Hudson River watershed. The borehole logs for the majority of the wells installed through the full thickness of the overburden deposits indicate a fining upward sequence typical of alluvial deposits. These consist of channel floor gravels grading up through point bar sand and silt deposits to overbank floodplain clays and organic material.

The SWMUs and/or AOCs that are included in this group included SWMUs 24, 30, and 37. SWMU 24 (Former Wastewater Treatment Facility) managed acidic wastewaters and waste degreaser solvents, and potentially energetic-containing process waters and energetic-containing waste oils. SWMU 30 (Drainage Ditch downgradient of Building 2036) managed acidic process wastewaters potentially containing energetic material and waste degreaser solvents. SWMU 37 (Former Shell Plant Drum Storage Area) managed waste degreaser solvents, including TCE and Freon, in drums stored directly on the ground. Historical and routine groundwater monitoring results since 2000 for VOCs and inorganics are presented in **Tables 4-4** and **4-5,** respectively. Monitoring well locations are identified on **Figure 2-10**.

The data indicates that while GWQSs are exceeded in groundwater adjacent to the Shell Plant (MW-3, MW-4A, MW-4B, MW-21R, and MW-21D); concentrations appear to be stable and/or decreasing as seen on **Figure 4-4**.

In addition, the aqueous-phase VOCs in groundwater do not appear to be migrating hydraulically down-gradient at an advective rate that exceeds the attenuation capacity of the aquifer material. This is evidenced by there being only random detectable levels of TCE and other VOCs hydraulically down-gradient of the SWMUs and east of the railroad tracks in monitoring wells MW-22R, MW-22D and MW-25S. Based on the results from nested wells MW-4A/MW-4B and MW-21R/MW-21D, the majority of the VOC impacts also appear to be limited to the lower permeability shallow groundwater zone.

Monitoring wells located adjacent and hydraulically downgradient of other SWMUs/AOCs (MW-2B, MW-15S, MW-15D, and MW-16S) indicated elevated concentrations of inorganic constituents. However, the elevated constituent concentrations were localized near the SWMUs/AOCs.

Further discussion related to the distribution of dissolved and aqueous phase COPCs is presented in **Section 5.2.3**.

4.5 Indoor Air

Potential for impacts to indoor air quality from soil vapor and subsequent investigations were limited to the Shell Plant and the LCSB. It should be noted that the LCSB was demolished and as a result vapor intrusion is now not a concern in this area. However, for completeness, the results are still discussed below.

4.5.1 Shell Plant Indoor Air Quality

Dyno Nobel has elected to collect an annual indoor air sample in the Shell Plant. The sample is collected during the heating season each year and the historical results of the indoor air monitoring effort are presented in **Table 4-6.** The results continue to show that concentrations remain well below the guidance value for TCE of 5 $\mu g/m^3$ and that there is no immediate threat to human health.

4.5.2 Liquid Chemical Storage Building (LCSB)

The laboratory analysis of the soil vapor samples collected in May 2011 reported the presence of several chemical constituents. These constituents included the petroleum hydrocarbons benzene, ethylbenzene, hexane, trimethylbenzene, toluene, and xylene. The chlorinated compounds 1,1,1-trichloroethane and trichloroethene, which have also been detected in groundwater at monitoring wells associated with the Shell Plant nearby and upgradient from the LCSB, were also detected in the May 2011 soil vapor samples. Alcohols and ketones, including acetone at concentrations one to two orders of magnitude higher than any other compound detected during the RCRA closure sampling were also reported in the soil vapor samples. These latter results were inconsistent with the soil sample data from these locations, which did not detect the presence of acetone. It was determined from interviews of the Facility personnel that acetone was not used at the Facility in any appreciable quantities. Although acetone is a common laboratory contaminant, a Quality Assurance/Quality Control (QA/QC) review of the data did not reveal any QA/QC issues that would discount the data.

In response to the detection of petroleum hydrocarbons, chlorinated compounds, and in particular acetone, a second set of soil vapor samples were collected from these same vapor sample wells on October 26, 2011. In summary, the October 2011 soil vapor sample results confirmed the identification of compounds detected in the May 2010 soil vapor samples. The concentrations of most of the compounds detected in these samples were significantly (i.e. up to 100 times) lower than the May 2011 sample results. The soil vapor and indoor air sample results collected during October 2011 were also consistent with the conclusions made based on review of the soil data, i.e.:

1) There were no identifiable sources of fugitive VOCs beneath the LCSB,
2) Low levels of VOCs are detectable in soil vapor due to transport in groundwater from the adjacent Shell Plant, and:
3) Low levels of petroleum VOCs detected in soil vapor may infiltrate from the ambient air, which generally contains higher concentrations of these compounds than the soil vapor.

In early October 2012, Dyno Nobel personnel demolished the LCSB super structure and placed the building's demolition debris in a roll-off container for disposal by Waste Management Corporation. A contractor then used a track-mounted excavator to break up and remove the building's concrete slab on October 11, 2012. This concrete (demonstrated to be clean fill) was then used to fill an underground storage tank (UST) excavation being completed simultaneous to the LCSB demolition project. Additional detail on the certified RCRA Closure of LCSB is contained in the *Revised Certification Report: Magazines A, B, C, F and Liquid Chemical Storage Building RCRA Unit Decontamination and Closure* (AECOM, 2012). On the basis that the building has been removed from this area, there are no remaining vapor intrusion concerns in this area.

4.6 Summary of Impacts

Based on the extensive investigations conducted at the Site to date, the nature and impacts can be summarized as follows:

Soil

- With the exception of the Shell Plant, the Site impacts are related to inorganics (metals and selenium). VOCs are only present in the immediate area of the Shell Plant (SWMUs 24, 30, and 37).
- Soil impacts are generally limited to the upper 1 foot, but extend to depths ranging from 2 to 8 feet at several SWMUs/AOCs
- The majority of mercury impacts in Site soils were identified at the following locations:
    - the western central portion of the Active Plant Area in the vicinity of the former mercury fulminate tanks area (SWMUs 9, 10, 11, 29, and 33);
    - the northeastern portion of the Active Plant Area which was formerly the Burnable Waste Satellite Accumulation Area (SWMU 26G), Open Detonation Pit (AOC C), and Detonation Test Building (AOC D);
    - the southeastern portion of the Active Plant Area at SWMU 13 (Waste Powder Catch Basins for the Lead Azide Building);
    - SWMU 52 Former Commercial Lab Shooting Area, which is transected be the northern drainage way; and
    - SWMU 54 (Former Historical Production Area) which is transected by the southern drainage way.
- Arsenic, barium, cadmium, copper, and lead are predominantly present in the northern and southern portions of the Active Plant Area.
    - The highest concentrations of arsenic (at least 8 times the industrial use SCO of 16 mg/kg) were detected at SWMU 52 and AOC H.
    - The highest concentrations of barium (at least 1.5 times the industrial use SCO of 10,000 mg/kg) were at SWMUs 7, 8, and AOC B.
    - The highest concentrations of cadmium (at least 15 times the industrial use SCO of 60 mg/kg) were at SWMUs 3 and 5.
    - The highest concentrations of copper (at least 10 times the industrial use SCO of 10,000 mg/kg) were at SWMUs 3 and 5.
    - The highest concentrations of lead (at least 10 times the industrial use SCO of 3,900 mg/kg) were at SWMU 52.
- The highest concentrations of mercury are found at SWMU 33, SWMU 26, AOC C, and AOC D at approximately 30-40 times the industrial standard of 220 mg/kg.
- The majority of selenium impacts in Site soils were identified in the northern portion of the Site in and around the former open burning pads (SWMUs 6, 7, 8, and AOC B) and the burnable waste satellite accumulation areas (SWMU 26G, AOC C, and AOC D). These areas are consistent with the ecological exposure evaluation performed in the Active Plant Area, which identified exposure to selenium in N1 and N3 areas as the greatest potential risk to wildlife receptors that potentially forage on at the margins of the facility.
- SWMUs 22, 23, 32, and 35 are locations that were previously used for on-site disposal of various wastes. These landfills/dumps are no longer active. Because of the potential presence of energetic materials within these SWMUs, investigative activities were restricted to the perimeter and adjacent areas.
- The total volume of soil impacts exceeding the commercial use SCO in the Active Plant Area is 16,936 CY. The total volume of soil impacts exceeding the industrial use SCO in the Active Plant Area is 8,424 CY. The majority of volume of Active Plant Area impacts are located in the

northeastern portion near SWMUs 3, 4, 5, 6, 7, 8, and AOC B and at SMWU 54 the former production area.

Sediment

- The primary COPCs detected in the Wetlands Complex comprise of mercury, selenium, lead, cadmium, copper, and zinc. The total volume of sediment impacts in the Wetlands Complex and associated drainage ways is approximately 17,829 CY, which is more than three times the volume of the soil exceeding the industrial use SCO.
- Concentrations of arsenic, copper, lead, mercury, and zinc in the sediments present in the drainage way traversing the northern portion of the Site exceeded their respective SELs.
- The results of the downstream sediment sampling indicated concentrations of copper and mercury exceeding their respective SELs. Concentrations of inorganics at PE-DNS-SD-01 and PE-DNS-SD-02 were generally consistent with concentrations observed in the surface interval at station SQT-08. Concentrations of inorganics, particularly copper and mercury, were substantially lower in sediments at downstream stations PE-DNS-SD-03 and PEDNS-SD-04 relative to upstream stations.

Surface Water

- Analyses from filtered surface water samples are below the SWQS and support that chronic exposure to inorganics concentrations in surface water within the Wetlands Complex are not likely to result in adverse effects to aquatic life.
- Corrective measures for surface water are not required and are not considered for evaluation as part of the CMS.

Groundwater

- Elevated inorganic constituent concentrations in groundwater were localized near the SWMUs/AOCs.
- The VOC groundwater plume appears to be stable and the majority of the VOC impacts are limited to the shallow groundwater zone.
- The low permeability silty clay and clay deposits significantly limit migration of VOCs and inorganic constituents in groundwater.

Indoor Air

- Potential impacts to indoor air quality are limited to the Shell Plant. However, results of annual indoor air monitoring continue to show that concentrations remain well below the guidance value for TCE of 5 $\mu g/m^3$ and that there is no immediate threat to human health.

5.0 CONCEPTUAL SITE MODEL AND FATE AND TRANSPORT

The fate and transport of organic and inorganic impacts in Site media is discussed in this section. An understanding of how Site media have been impacted and the mechanisms controlling the future fate and transport of these impacts within Site media is critical to the development of corrective measures. In this section, the fate and transport of impacts are discussed to better understand the genesis and stability of impacts in multiple media and the effectiveness of corrective measures for the various impacted media at the Site. The first subsection below presents a brief description of how historical Site operations resulted in current impacts to Site media. The second subsection evaluates the mechanisms, which govern the transport of impacts from the source area, and evaluates whether these mechanisms were significant historically or have the potential to be significant in the future.

5.1 Historical Operations and Current Site Impacts

Industrial manufacturing process at the Site included activities associated with the production of primers and explosives and metals treatment and processing, such as annealing, degreasing, extrusion, heat treatment, caustic and/or acid baths; and metals cutting, machining, grinding, and pressing. Primary waste streams consist of residual energetic material, waste production materials, off-specification products, wastewater, and waste degreaser solvents. Much of these wastes were managed on-site. Because of historical operations, multiple SWMUs and AOCs across the Site currently have impacted media in excess of SCGs. A detailed discussion of the nature and extend of impacts at the Site was previously discussed in **Section 4**.

Current impacts to Site media at concentrations above SCGs are generally located around operational portions of the Active Plant Area (burning areas, detonation areas, drying houses, landfills, and the Shell Plant area) and the Wetlands Complex (shooting pond and landfills). The impacts on-site can be grouped by media type and are summarized in the following subsections.

5.1.1 Soil

The primary impact to soils includes inorganics in excess of SCOs in the Active Plant Area and Wetland Complex SWMUs and AOCs. Energetics were generally burnt at the Site and organic residues are not present in soils. Soil impacts, with few exceptions, are generally limited laterally to the operational area where the impacts were initially deposited and vertically to the upper two feet of soil. Most soil impacts in the SWMU and AOC areas do not extend a significant distance away from these locations. The limited extent of soil impacts away from both the operational areas and vertically into the underlying soil reflects how strongly the inorganics are bound to the silt and clay particles in the soil. Impacts detected in soil are limited to arsenic, barium, cadmium, copper, lead, mercury, selenium, and zinc.

5.1.2 Sediment

Sediment is present in on-site drainage ways on the western side of the Site in the Active Plant Area and much of the area in the Wetlands Complex on the eastern side of the Site. The primary impacts to sediments include inorganics with detected concentrations of cadmium, copper, lead, mercury, selenium, and zinc. There is widespread distribution of inorganics in the Wetlands Complex but at concentrations generally decreasing with distance away from the SWMUs and AOCs.

5.1.3 Surface Water

In general, organic and inorganic compounds are not present in surface water samples at concentrations exceeding SWQSs.

5.1.4 Groundwater

Impacts to groundwater include minor GWQS exceedances of inorganics in the northern portion of the Active Plant Area and Wetlands Complex and VOC impacts near the Shell Plant.

As described earlier the turbidity of groundwater samples from wells collected within the upper finer grained units has required the assessment of only dissolved phase inorganics in groundwater. In general, the metal concentrations detected in groundwater are consistent with the background conditions observed in other wells at the Site.

VOC impacts have been detected in groundwater samples collected from wells near the Shell Plant. The VOC-impacted groundwater is generally limited to the area in the immediate vicinity of the Shell Plant, with hydraulically cross gradient and down-gradient monitoring wells indicating that the VOCs do not extend an appreciable distance away from the Active Plant Area.

5.1.5 Indoor Air

VOC impacts to indoor air are present in the Shell Plant and correspond to the area with VOC-impacted groundwater. Because the groundwater VOC impacts are limited to the area in the immediate vicinity of the Shell Plant, the corresponding soil vapor impacts are not expected to extend beyond this area.

Although organic and/or inorganic impacts are present at concentrations above SCGs in soil, sediment, groundwater, and indoor air, the distribution of impacts is generally in close proximity to the areas of historical use or disposal.

5.2 Potential Fate and Transport Mechanisms on Site

Inorganic and organic impacts can migrate from media within source areas to hydraulically down-gradient media through several different mechanisms. Four potential transport mechanisms are considered most relevant for the Site. These mechanisms include:

- Transport of COPCs adsorbed to soil/sediment particles via surface water erosion/runoff;
- Dissolution of COPCs from soil and sediment into groundwater and surface water;
- Transport of dissolved COPCs in groundwater off-site; and
- Partitioning of VOCs from groundwater into soil gas.

Each of these transport mechanisms are evaluated below with respect to fate and transport of COPCs, whether these processes have occurred historical, and whether future contaminant transport is possible. The first two mechanisms involve the mobilization and transport of soil or sediment impacts. Since there are no documented VOC impacts to Site soil or sediment, the discussion of the first two mechanisms is focused on the transport of inorganic impacts. The third mechanism includes an evaluation of metals and selenium (inorganics), and VOCs (organics) since both are present in Site groundwater above their GWQSs. Other mechanisms, such as vapor-phase VOC impacts partitioning into groundwater, are not expected to be significant contributions to contaminant mass flux within the Site and are, therefore, not included in the discussion.

5.2.1 Transport of COPCs Sorbed to Soil/Sediment Particles via Surface Water Erosion/Runoff

Under this transport mechanism, impacted soil particles are physically transported from one location to another. The degree of transport is generally governed by the grain size of the soil, the degree of vegetative cover holding the soil in place, and the energy of the water moving across or through the soil.

Metals tend to be preferentially bound to silt and clay sized particles, which exhibit higher CEC. These smaller grain size materials are also more readily transportable than larger grain size material, with both lower entrainment and deposition velocities. Based on the lower depositional velocities, impacted clay-sized particles can stay suspended in a water column for long periods of time and can therefore be transported large distances.

Selenium is the only non-metal inorganic COPC at the Site. Selenium forms oxy-anions, which strongly bind to iron and manganese in soils. The soils and subsurface geology (lacustrine clays) at the Site are manganese and iron rich and do not contain elevated levels of sulfate or phosphates that would compete for binding sites or displace selenium, which effectively limits the mobility of selenium in Site soils and groundwater.

In general, steeper unpaved and unvegetated areas have the greatest potential for erosion and to be a source of sediment in streams and wetlands. The velocity of water flow over the land surface is directly related to the Site topography, with higher velocities observed in steeper terrain.

Disturbed soil with no vegetative cover is more prone to erosion than vegetated areas. Vegetative cover provides the benefits of dissipating the velocity of water flowing over the ground and its associated erosion potential. In addition, both vegetative matter and root systems help keep the soil in place.

The presence of inorganics-impacted sediment within the Wetland Complex (at distances away from the SWMUs) and in the downstream sediment is likely attributed to the historical transport of inorganics-impacted soil and sediment from upstream locations. These impacts are most likely attributed to the transport of inorganics-impacted soil and sediment impacts from the SWMU 1/22 area (which is located within the Wetlands Complex), and potentially from the transport of inorganics-impacted soil from the Active Plant Area SWMUs and AOCs via the Site drainage ways. The detection of impacted sediments within the drainage ways and within the Wetlands Complex downgradient from the Active Plant Area supports the historic transport of impacted soil and sediment from the Site.

Based on the current vegetated nature of the Site, the impacts are believed to have been transported during periods when the source areas were disturbed, likely during or immediately after impacts were deposited in the SWMU/AOCs, or when process waste streams were being generated and discharged at the Site. The termination of specific operations (mercury fulminate production) and modifications to waste water treatment has reduced the flux of constituents. In addition, the transport of sediment off-site is reduced due to the following:

1. As on-site disposal was discontinued and the disposal areas became vegetated, the inorganics-impacted soils have been less available for erosion and transportation.
2. The decommissioning of some buildings and infrastructure has reduced the amount of impermeable surfaces (buildings and hardstand) that directed runoff to Site drainage ways. As a consequence, the flow of storm water through the Site is less concentrated reducing the potential for erosion and transportation of impacted sediment
3. The activities of both beavers in the area and the growth of invasive reedgrass and vegetation within the drainage ways and Wetlands Complex has slowed the flow of water from the Site and into the Wetlands Complex. As described above, water from the Active Plant Area commonly ponds on-site with the restriction of flow through the culvert under the rail line. In addition, the heavy growth within the Wetlands Complex has resulted in water flow through the wetlands being poorly channeled with water spread out over a large area. Because of these low energies, sediments have been shown to accumulate within the wetland area.
4. The catchment area upstream of the Wetlands Complex is small and the areas are heavily vegetated. This reduces the volume of water flowing through the wetlands and the magnitude of any storm

flows. In combination with the flat topography in the wetland area and heavy vegetation, flows through the Wetlands Complex during storm events are likely to be slow and generally insufficient to mobilize impacted sediment.

The stability of sediment impacts within the Wetlands Complex is supported by water sampling conducted downstream of the wetland. To date, Site-related inorganics have not been detected in unfiltered surface water samples from the stream, which exits the impacted wetland complex.

5.2.2 Dissolution of COPCs from Soil and Sediment and Leaching into Groundwater or Surface Water

Under this potential transport mechanism, impacts adsorbed to soil or sediment dissolve into water and infiltrate into the soil below. The impacted water then potentially migrates vertically and laterally and subsequently impacts groundwater or surface water. The dissolution is generally governed by the physical and chemical properties of the soil, the type of contaminant present, and the geochemistry of the leaching liquid (water).

Small particle size soils such as silts and clays generally have high organic carbon contents and CEC. These attributes contribute to the soil's ability to adsorb or bind on to organic and inorganic COPCs. Organic impacts such as VOCs tend to adsorb to organic carbon in soils. CEC determines a soil's ability to attract and bind cations, including many of the inorganic impacts present on Site. Acidified water can change the adsorptive capacity of the soils and mobilize organic and inorganic compounds from the soil. However, under normal conditions, the pH of rainwater (the primary water source for this mechanism of transport) is not low enough to mobilize the organic and inorganic compounds bound to the soil. Considering the attributes, which govern the dissolution from soils and sediments and transport of COPCs, the potential for contaminant dissolution and transport at the Site, is evaluated below.

The surface soils at the Site generally consist of silt and clay deposits, while the Wetlands Complex contains organic rich soils and vegetative debris. The organic and inorganic (including selenium) impacts in the SWMUs and AOCs are readily adsorbed to these soil particles. Soil samples collected on Site indicate that, with few exceptions, inorganics impacts above SCOs are generally limited to the upper two feet of soils and generally do not extend beyond the immediate vicinity of the SWMU. This suggests that although inorganics concentrations in the upper two feet of soil exceed SCOs, these impacts are immobilized in the soils with limited to no leaching of constituents.

During previous investigations on Site (Eckenfelder, 2000), soil samples from 11 SWMU/AOC areas across the Site were collected to assess the leachability of the inorganics. The samples were subjected to the TCLP and/or the synthetic precipitation leaching procedure (SPLP). The extracts were analyzed for selected inorganics. The results indicate that, at most locations, the inorganics exhibit a low degree of leachability in comparison to the total metal content of the samples. In the few samples where the leached concentrations were above the limit for characteristically hazardous waste, the soil sample corresponding to the elevated TCLP or SPLP analysis was usually associated with the highest concentration measured, and often an order of magnitude higher than other soil samples. While in a limited number of samples pore fluids contained inorganics, these constituents would rapidly be complexed in underlying soils with available absorption sites. The nature of extraction used for the TCLP and SPLP are designed to maximize the solubility of metals for analysis. Acidic extraction solutions are used during the procedure that may not necessarily be comparable to pore waters from where the sample was collected. Preparation of the sample for analysis also involves particle reduction and agitation of the sample and extraction solution for a specified period of time. The result of this procedure is a conservative estimate of the leachability of a metal, which is not a reasonable estimate of metal solubility and mobility within groundwater at this Site.

Although some of the data suggests that historically inorganics in soil may have dissolved and been transported into Site surface water and groundwater, the degree and extent of these impacts to surface and groundwater are generally localized. The Shell Plant annealing process generated acidic wastewater in the distant past; however, the soil buffering capacity has neutralized the acid quickly, subsequently limiting further migration of inorganics, with the inorganics bound within soil and sediment considered immobile. The potential transport of dissolved COPCs in surface water and groundwater is discussed below.

5.2.3 Transport of Dissolved COPCs

Once COPCs are dissolved in water, they can be transported by advection, dispersion and diffusion. This section evaluates the potential transport of dissolved organic and inorganic impacts in surface water and groundwater separately.

5.2.3.1 Surface Water

COPCs dissolved in surface water may be transported downstream and (1) remain in surface water, (2) adsorb to soil or sediment in the stream channel, or (3) migrate to groundwater. During each of these processes, organic and inorganic COPCs can become attenuated, diluted, and/or form complexes with other organic and inorganic material. Because no organic impacts have been reported in surface waters on-site, this discussion is limited to the transport of inorganics in surface water.

Only limited dissolved inorganics impacts have been detected in surface water samples on-site. Concentrations of aluminum and iron in excess of the SWQSs are likely attributed to background concentrations of these metals. Although elevated concentrations of mercury have been detected in surface water samples collected at SW-1, located near the northern property boundary of the Wetlands Complex, this detection is suspected to be attributed to the presence of sediment within turbid water samples. Two subsequent sampling events at this location did not show elevated concentrations of mercury.

The lack of dissolved metals in surface water is likely attributed to the limited desorption of metals from sediments as discussed above. If dissolved metals were to desorb from soil or sediments and be transported in surface water, it is likely they would quickly become re-adsorbed to downstream sediments. The lack of selenium in surface water is likely attributed to localized impacts in the northern portion of the Site (N1/N3 areas), the abundance of iron and manganese in surface water which selenium complexes, and incomplete migration pathway from the selenium-impacted areas to the Site drainage ways and ultimately the Wetlands Complex.

Since the Wetlands Complex on-site acts as the local discharge for groundwater, no transport of surface water to groundwater is expected to occur.

5.2.3.2 Groundwater

COPCs within groundwater may (1) continue to migrate in groundwater and are subject to dilution, dispersion and diffusion processes, (2) become sorbed to aquifer solids, (3) be degraded/transformed on aquifer solids or groundwater through biotic or abiotic processes (organics only) or (4) be discharged to surface water (and have the same fate as the surface water impacts described above). A discussion of the fate and transport of inorganics and organics is provided below.

Inorganics

Current impacts to groundwater include minor GWQS exceedances of inorganics in the northern portion of the Active Plant Area and Wetlands Complex and VOC impacts near the Shell Plant. Many of the inorganics impacts have been attributed to naturally occurring metals in the clay rich overburden deposits. When evaluating the attenuation potential of a soil or aquifer material in relation to an inorganic metal or compound, a variety of methods or mechanisms can be explored. Although metals cannot be degraded, the risk associated with their potential mobility can be reduced by (1) immobilization by sorption or (2) dilution. The transport of metals (as cations or metal complexes) in groundwater is expected to be limited by the potentially elevated CEC and the organic-rich nature of the lacustrine sediments. Overall, sorption is described as the distribution of a contaminant between the solid phase (aquifer material) and the solution phase (groundwater). To quantify sorption, a distribution ratio or K_d is derived. The distribution ratio encapsulates a range of mechanisms including CEC. The CEC of a material is a function of the mineralogy but may change with time as geochemical conditions change within the aquifer. Both K_d and CEC will vary but the values are mainly dependent on the concentration of the contaminant, the type of aquifer material and the field conditions (dissolved oxygen, temperature, redox and pH). The borehole logs available for the groundwater monitoring well installation locations indicate that soils in the unsaturated zone (above the water table) are oxygen rich as demonstrated by the brown silts and clays. However, on encountering saturated conditions the silts and clays were recorded as gray in color, which is indicative of more reducing conditions within groundwater.

Heavy metals (such as Pb, Cu and Cd) have low solubilities with strongly reducing conditions (-100 mV to -500 mV) resulting in the precipitation of heavy metal phases. Barium is also likely to precipitate out as the insoluble carbonate or sulfate phase (USEPA, 2007a). Precipitation of zinc sulfate (USEPA, 2005) is also predicted to be the dominant mechanism for the retardation of zinc in groundwater due to the anticipated anaerobic conditions within the saturated zone. Arsenic has a complex environmental migration behavior and is usually retarded at a shallow depth within the oxidizing unsaturated zone. In groundwater, arsenic is present as both the arsenate and the arsenite form. The oxidized arsenate form is strongly sorbed to iron oxides, whereas arsenite is sorbed to a lesser extent. This does depend on the pH of groundwater, however, in the majority of groundwater (pH 5-7), the dominant arsenate species are negatively charged and arsenite species are negatively charged. Within this pH range, iron oxides have a positive surface charge, which accounts for the sorption of negatively charged species. The arsenite species is still expected to be weakly adsorped, just not as strongly as arsenate (USEPA, 2007b).

Selenium is the only non-metal inorganic COPC at the Site. Electrical conductivity, pH and dissolved oxygen concentrations can affect the adsorption potential of selenium oxy anions to iron and manganese (oxy)hydroxides and therefore may differ across the site. Selenite oxy anion is more common under slightly acidic reducing conditions and more readily adsorbs than the selenite anion, which favors alkaline and oxidizing conditions

In summary, dissolved metal migration is expected to be limited by a combination of adsorption, CEC and precipitation reactions due to the presence of exchange surfaces on clays, silts and sands, the presence of elevated organic carbon (particularly in the wetlands), iron, manganese ,carbonate and sulfate anions.

Organics

In general, elevated VOC concentrations indicative of DNAPL presence have been detected in the Shell Plant Area. However, groundwater monitoring downstream of this area confirms VOCs do not extend laterally away from the Shell Plant. Strong evidence of VOC attenuation is observed in the groundwater monitoring data for the Active Plant Area. The presence of 1,1-DCE and *cis*-1,2-DCE as a daughter degradation product of TCE supports the presence of microbially mediated degradation and the organic-rich clays and silts provide sorption material. Further, VOC impacts have not been detected in surface water samples in the Wetlands Complex (which is the local discharge point for shallow groundwater beneath the Site) and as a result, the discharge of VOC-impacted groundwater to surface water is not an active transport mechanism

VOC impacts to groundwater near the Shell Plant extend down to the bottom of the unconsolidated material, which overlie the bedrock beneath the site. VOC concentrations are indicative of a dissolved non-aqueous phase liquid (DNAPL) source as the concentrations exceed the 1% solubility 'rule of thumb' (USEPA, 1992). It is unclear how the VOC impacts migrated through the thick deposits of silt and clay to reach the bottom of the unconsolidated material above the bedrock. However, if the silt and clay deposits are not laterally continuous and sand horizons are intermittently present, non-aqueous phase DNAPL may migrate vertically down through the material. There is also the possibility that cross-contamination occurred during the drilling and installation of the groundwater monitoring wells, near the Shell Plant.

When a DNAPL (dissolved or free-phase) is exposed to clay materials, physical and chemical interactions can take place. The contaminant can sorb to organic matter or mineral surfaces within the clay or enter the internal structure of the clay material. The degree of sorption is strongly dependent on the contaminant and the aquifer solids. Silt, clay and/organic rich material generally exhibit a high potential for sorption in comparison to sands and gravels. DNAPL enters the clay material either through physical apertures or via displacement of water from pores spaces, the head pressure of the DNAPL is sufficient to overcome the interfacial tension within the clay. Once a DNAPL or non-aqueous solution of DNAPL has penetrated a clay pore or fracture, it can become residualized and immobile. This process can be enhanced by the properties of the DNAPL (it lower dielectric constant) which cause the clay layers to shrink, with a resulting decrease in permeability. This effect generally only seen in the source areas and is negligible if the DNAPL is at or below its solubility limit (approximately 2 mg/L for TCE).

These combined processes lead to the residualization of DNAPL constituents within the soil, with mass lost through dissolution, abiotic and biotic degradation mechanisms and solute transport attenuated through sorption and a combination of abiotic and biotic degradation.

When a chlorinated hydrocarbon such as TCE is degraded, it can be sequentially broken down from 1,2-DCE, to VC and eventually to ethene. Most reactions (whether chemical or microbially facilitated) are more amenable under anaerobic conditions (e.g. TCE dechlorination). However, some are more easily degraded under aerobic conditions, e.g. 1,1,1-TCA and VC. Therefore, in an aquifer where dissolved oxygen levels are low, degradation of the more highly chlorinated hydrocarbons is a more favorable reaction, which can lead to an accumulation of degradation products such as VC. Where dissolved oxygen levels are higher, degradation rates are higher for VC but TCE degradation is more recalcitrant.

The borehole logs near the Shell Plant area indicate that soils in the unsaturated zone (above the water table) are oxygen rich as demonstrated by the brown silts and clays. However, on encountering saturated conditions the silts and clays, which extend to the underlying shale, were recorded as gray in color, which is indicative of more reducing conditions within groundwater. The groundwater quality monitoring data indicates that the measurable concentrations of *cis*-1,2-DCE and more noticeably VC are low in comparison to TCE and the potential concentrations that could result from the complete breakdown of TCE. For example, 1 mg of TCE degrades to 0.5 mg of VC, which is not supported by the monitoring data presented in **Table 4-4**.

There is evidence that microbially facilitated degradation of TCE is occurring as the *cis*- isomer of 1,2-DCE is detected, which is only produced because of microbial respiration. Although *cis*-1,2-DCE is not present at the concentrations expected from the complete degradation of TCE. In theory, 1 mg of TCE degrades to 0.7 mg of *cis*-1,2-DCE, however, trans-1,2-DCE and 1,1-DCE can also be formed. The production of 1,1-DCE from TCE degradation also appears to be occurring as it has been detected at elevated concentrations. As mentioned earlier, there are no detectable concentrations of VC within **Table 4-4**. Although VC is usually present as a product of DCE degradation, its absence does not mean that the degradation of DCE is not occurring. Microbial metabolism under Mn(IV) reducing conditions can reduce DCE directly to carbon dioxide according to the following reaction:

$$C_2H_2Cl_2 + 2MnO_2 + 4e^- \rightarrow 2Mn^{2+} + 2CO_2 + 2Cl^- + 2H^+$$

Fe(III) reduction can also facilitate degradation of DCE to CO_2 by microbial respiration.

Groundwater quality within a selection of wells in the Shell Plant area has been monitored since 2000 (MW-21D/R and MW-22D/R) and 2002 (MW-3, MW-4A and MW-25S) for a range of VOCs. The dissolved temporal concentrations of TCE detected in groundwater sampled near wells: MW-3; MW-4A; MW-4B; and MW-21R, are presented in **Figure 4-4**. MW-3 and MW-4A/B are screened within the shallow silty clays (approximately 15-20 feet below ground surface). MW21R is screened within the upper fractured portion of the shale bedrock. TCE has been selected as a representative constituent of the possible presence of DNAPL in groundwater and is known to have been stored in the Shell Plant area. The concentrations of TCE within MW-3 appear to be of a magnitude that is indicative of the presence of DNAPL or a residualized DNAPL source. Concentrations have fluctuated between (approximately) 20-50 mg/L since 2001. The dissolution flux of the DNAPL source mass appears to be constant, resulting in stable TCE groundwater concentrations at this location.

MW-4A/B lies hydraulically downgradient of MW-3. Concentrations of TCE within MW-4A are an order of magnitude higher than MW-3 and MW-4B. However, both MW-4A and MW-4B show declining trends in TCE concentration over the majority of the monitoring period. Based on the decreases in TCE over time, the half-life of TCE in groundwater has been calculated at 4.5 years while in MW-4B the half-life has varied between approximately 3.5 years (2002-2006) and 2 years (2009-2012). These half-lives are indicative of robust TCE degradation rates in anaerobic groundwater (Howard, 1991).

TCE was detected for the first time (apart from a solitary detection in 2003 of 16 μg/L) in MW-21R during 2010 (1.5 μg/L) and peaked in 2011 (6.1 μg/L). Concentrations have since declined and are similar to those initially detected (2.1 μg/L). This well is screened within the shale bedrock and is beneath a significant thickness of silts and clays. Advective transport is likely to be slow through the clays and silts, however, vertical gradients are predominantly downwards. MW-21R is located to the north of MW-3 and across hydraulic gradient but down-hydraulic gradient from MW-22R. The mechanism responsible for the elevated concentrations of TCE (potentially indicative of DNAPL) within MW-22R is not known, however, cross-contamination during well installation is a possibility. A review of the boring logs for the area indicate that any DNAPL migration is ultimately controlled by the topography of the upper contacts of the bedrock. A topographic low point is observed within the vicinity of MW-21D/R, which will ultimately act to contain any potential DNAPL at the site.

5.2.4 Mercury Transport

Mercury is a metal with a complicated chemistry that warrants a separate discussion. Mercury can cycle between various environmental media, including air, land, water, and biota, through deposition, volatilization, and other fate and transport processes (USEPA, 2006). Mercury can transform between different chemical species, including elemental mercury liquid and vapor, inorganic salts, and organic forms (e.g. methylmercury) through a series of complex chemical and physical transformations. As previously described in **Section 3**, extensive testing has been conducted to confirm that the mercury forms present at the Site are inorganic in nature.

Although mercury in soil and surface water can exist in the mercuric (Hg+2) and the mercurous (Hg-1) form in a number of complex ions with a range of water solubilities (ASTDR, 1999), the historic use of mercury salts at the Site (i.e. mercury fulminate), and the supporting evidence described previously in **Section 3.2**, concludes that the mercury present at the Site is in the form of inorganic mercury (II) complexes.

The degree of sorption of inorganic mercury to soil or sediment is related to the organic carbon content. Mercury is strongly sorbed to and creates complexes with humic materials and sesquioxides in soil at a pH higher than 4 (Blume and Brummer, 1991). The formation of the complexes is due to the affinity of inorganic mercuric and its inorganic compounds for sulfur-containing functional groups. As a result, inorganic mercury sorbed to particulate material is not readily desorbed (ATSDR, 1999) and, hence, not mobilized. Therefore, freshwater and marine sediments are important repositories for inorganic forms of mercury, and leaching is a relatively insignificant transport process in soils.

Because of the large proportion of mercury bound to bulk organic matter, the primary mechanism of release and transport is through surface water runoff and the erosion and transportation of impacted sediment. A secondary release mechanism is associated with inorganic mercuric absorbed onto dissolvable organic ligands and other forms of dissolved organic carbon (DOC), which may then partition to surface water runoff in the dissolved phase. Overall, the amount of mercury partitioning to surface water runoff is considered a small fraction of the amount of mercury stored in soil (USEPA, 1997) and is generally not considered an important transport mechanism.

5.2.5 Partitioning of Volatile Constituents from Groundwater into Soil Gas

Volatile constituents dissolved in groundwater partition into the unsaturated soil in the vadose zone above the water table, under this transport mechanism. Once in the vapor phase, the transport of volatile constituents is governed by Fick's law of diffusion, which is largely controlled by the concentration gradient within the media. In soil gas, it follows that higher VOC concentrations will be present close to water table (from where the VOCs partition) and from there, diffuse toward areas of lower concentrations within the unsaturated zone and potentially into buildings sitting above the impacted area.

As discussed previously in this report, although sub-slab TCE vapor impacts are present above USEPA screening levels in the samples collected from beneath the Shell Plant, the corresponding TCE concentration in the indoor air within the Shell Plant is below applicable screening levels. Due to the duration that the VOC impacts have been present in the groundwater (and soil vapor in the vadose zone), the flux of VOCs partitioning from the aqueous phase into the gas phase and then diffusing through the gas phase is expected to be in steady state. As a result, concentrations of TCE (or other VOC) in the indoor air are not expected to change appreciably over time.

5.3 Summary

Impacts to soil, sediment, surface water, and groundwater in excess of SCGs are or have historically been reported at the Site. Of the four mechanisms identified as being the most significant contributors to the transport of organics and inorganics, the following conclusions are made:

- Inorganic constituents are strongly sorbed to silt and clay sized particles in the soil. The high CEC of Site soils has limited the vertical and lateral distribution of soil impacts.

- The transport of COPCs adsorbed to soil particles is believed to have contributed to the presence of inorganics impacts to sediments within the Wetland Complex. However, due to the adsorptive soils, revegetation of the disposal areas and drainage ways, and low energy of water moving across the Site, the future transport of soil impacts from the is believed to be minimal.
- The dissolution and leaching of inorganic constituents from soil and sediment into groundwater or surface water at the Site is expected to be limited. This reflects the strong CEC of the soils and the organic rich nature of the sediments. Historical impacts to groundwater and surface water may have occurred but these are most likely associated with the more acidic and alkaline waste streams that would have been generated at the Shell Plant. As these source areas became neutralized by the natural buffering capacity of Site soils, sediment and water, the historic mobility of these constituents have reduced such that they are now considered immobile in the environment.
- Although VOC impacts at high concentrations are present near the Shell Plant area and extend to the base of the unconsolidated material, these impacts do not extend laterally away from the Shell Plant. The transport of dissolved VOC impacts is likely limited by the high adsorption potential of the VOCs to the silt and clay soils extending down to near the top of the bedrock surface in the Active Plant Area.
- The transport of VOC vapors within the soil gas and into indoor air is expected to continue under steady state conditions. However, the indoor air VOC concentrations are well below cleanup levels and are not expected to increase over time. Annual indoor air monitoring will continue to be conducted to confirm this.

Although each of these transport mechanisms has potentially contributed to current impacts on- and off-site, the potential for further transport by these mechanisms is minimized due to 1) the characteristics of the Site soil and wetlands sediments which strongly adsorb organic and inorganic impacts, 2) the vegetation across the Site limiting the potential to mobilize soil particles, and 3) the low energy of water as it moves across Site.

6.0 RISK ASSESSMENT SUMMARY

This section identifies potential routes of migration for Site COPCs, potential exposure pathways for COPC impacts, and discusses those potential impacts on sensitive receptors at the Site. Potential COPCs in Site media associated with the SWMUs and AOCs are primarily associated with elevated concentrations of inorganic (metal) constituents. Previous environmental investigations of Site media indicate that mercury, arsenic, and lead are the primary inorganics of concern associated with the Site. Other inorganics evaluated in previous investigations include aluminum, antimony, barium, cadmium, chromium, cobalt, copper, selenium, silver, and zinc. Potential COPCs in Site groundwater are VOCs, predominantly TCE and its associated breakdown products.

6.1 Human Health Risk Assessment (HHRA)

6.1.1 Potential Routes of COC Migration

Identifying the potential routes of migration of Site inorganics and VOCs is key to understanding how Site COPCs are currently affecting potential receptors and/or how they may potentially affect such receptors in the future. The main mechanisms identified for transport of inorganics and VOCs from the Site to receptors are as follows:

- Surface movement of soil particles to which inorganics are bound
- VOC non-aqueous phase liquid (NAPL) migrating through subsurface soil into groundwater
- Migration of VOC-impacted groundwater
- VOC-impacted soil vapor migration to indoor air

6.1.1.1 Surface Movement of Soil Particles to which Inorganics are Bound

Inorganic COPCs may be transported via surface erosion. One potential migration pathway is storm water transport of particle-sorbed inorganics from SWMUs within the Active Plant Area to other areas of the Active Plant and to the downgradient Wetlands Complex via two intermittent drainage ditches. A second migration pathway is likely surface erosion and transport of Site-related inorganics from SWMUs within the Wetlands Complex. Inorganics may be sorbed to particles transported by storm water and deposited in wetland sediments; disturbance of these sediments may subsequently re-suspend inorganics into surface water and re-deposit sediments locally in other areas of the wetland.

A described above, the Wetlands Complex is a low energy environment that facilitates the deposition of sediment. While historically, impacted sediment has migrated through the wetland complex into downstream areas, under the current setting the impacted sediments are effectively trapped within the Wetlands Complex.

6.1.1.2 COCs Migrating through Subsurface Soil into Groundwater

Historical groundwater data show limited impacts by Site COPCs and the low permeability silty clay and clay deposits as evidenced by this data significantly limit migration.

6.1.1.3 Migration of VOC-Impacted Groundwater

Historical groundwater data shows that the low permeability silty clay and clay deposits significantly limit migration. The wetland area located to the east of the active portion of the facility is the local discharge point for groundwater flow, both in the shallow and deep overburden deposits. As a result, groundwater that may be impacted from Site activities does not migrate east of the wetlands, which represent the headwaters to an unnamed tributary of Plantasie Creek.

6.1.1.4 VOC-impacted Soil Vapor Migration to Indoor Air

The vapor intrusion pathway is a potential issue because of the presence of elevated TCE in groundwater immediately north and west of the Shell Plant building (NYSDEC, 2007). The NYSDEC, in an August 8, 2007 letter, agreed that the reported concentration of TCE in indoor air of 0.75 $\mu g/m^3$ at the facility Shell Plant did not warrant further action. However, given the sub-slab sample result of 190 μ/m^3, NYSDEC recommended one of the following three options:

- Sample the Shell Plant indoor air once per year
- Install a vapor mitigation system
- Render the building uninhabitable

Based on the monitoring, this pathway is considered incomplete and no further assessment is provided.

6.1.2 Potential Human Health Exposure Pathways

Potential human health exposure pathways at the Site are as follows:
- Dermal contact with and ingestion of contaminated soil, sediment and surface water;
- Inhalation of the fugitive dust from contaminated surface soils;
- Ingestion of surface water and groundwater; and
- Ingestion of contaminated fish in wetlands

As described in the sections below, the only potentially complete exposure pathways are associated with dermal contact with impacted soil and sediment and inhalation of dust.

6.1.2.1 Dermal Contact with and Ingestion of Contaminated Soil, Sediment and Surface Water

Many Site COPCs exceed their respective screening levels and cleanup level in Site soil. Even though the area is industrial and not frequented by the public, the potential exposure pathway from dermal contact with and ingestion of impacted surface soils to Site workers is complete.

Further, many Site COPCs exceed their respective screening levels in Site sediment associated with the drainage ways, the Wetlands Complex, and the downgradient stream. Even though the area is industrial and not frequented by the public, the potential exposure pathway from dermal contact with and ingestion of impacted surface sediments to Site workers, trespassers, and downgradient landowners is complete.

Concentrations of filtered surface water samples within the Wetlands Complex did not exceed NYSDEC SWQS. Therefore, the potential exposure pathway from dermal contact with and ingestion of impacted surface water to Site workers or the public is incomplete.

6.1.2.2 Inhalation of Fugitive Dust from Contaminated Surface Soils

Many Site COPCs exceed their respective screening levels and cleanup levels in Site soil. The area is industrial and not frequented by the public. However, the potential exposure pathway from inhalation of fugitive dust from impacted surface soils to Site workers is complete.

6.1.2.3 Ingestion of Groundwater and Surface Water

The most recent groundwater results, in October 2011, detected VOCs above their respective Class GA GWQS near the Shell Plant and SWMUs 24, 30, and 37 and inorganics in the immediate vicinity of some of the SMWUs within the Active Plant Area. However, the potential exposure pathway from direct exposure to impacted groundwater is incomplete based on the following:

- Migration of VOCs and inorganic constituents, as evidenced by water quality data collected during the Groundwater Investigation and subsequent semi-annual groundwater sampling program, is significantly limited by the low permeability silty clay and clay deposits.
- The SWMU 1/22 is a local discharge point for groundwater flow from the Active Plant, both in the shallow and deep overburden deposits. As a result, groundwater from the Site does not migrate east of the wetlands.
- Data collected during the Groundwater Investigation (Eckenfelder, 1996) indicate that potential groundwater receptors (i.e., properties located downgradient of the facility) are served by public water (Port Ewen Water Supply).
- The closest residences are approximately 2,700 ft from the facility and are located on the opposite side of the wetlands. Groundwater beneath the facility discharges to the Wetlands Complex prior to reaching these off-site locations
- The groundwater users nearest the facility (i.e., those not served by public water) are located approximately 3,000 ft upgradient of the Site and thus, are not subject to potential groundwater impacts from the Site.

Concentrations of filtered surface water samples within the Wetlands Complex did not exceed NYSDEC SWQS. Therefore, the potential exposure pathway from ingestion of impacted surface water is incomplete.

6.1.2.4 Ingestion of Contaminated Fish in Wetlands

As concluded in the FWIA, limited aquatic resources are available to support fish or other permanent aquatic communities within the developed portions of the Site. Therefore, the potential exposure pathway from ingestion of contaminated fish in the wetlands is incomplete.

6.2 Ecological Risk Assessment

An ecological conceptual site model (ECSM) was developed in the FWIA Step IIB Report (URS, 2009) to identify potentially complete exposure pathways and potential receptors that may warrant further ecological evaluation. The ECSM was further refined based on comments received from NYSDEC on the Step IIB report (comment letter dated December 10, 2009 in **Appendix B**) and observations made during the implementation of FWIA Step IIC investigations.

The Step IIB Report and subsequent Work Plan identified the following target inorganics for investigation in the two ecological exposure areas:

- SWMU 1/22 Wetlands Complex: cadmium, copper, lead, mercury (total and methyl), selenium, and zinc; and
- Active Plant Area: antimony, arsenic, barium, cadmium, chromium, cobalt, copper, lead, mercury, selenium, silver, zinc.

6.2.1 SWMU 1/22 Wetlands Complex

The Wetlands Complex investigations were conducted to evaluate potential ecological impacts associated with Site-related inorganics in surface water, sediment, and biological tissues, including SQT investigation, surface water characterization, fish community evaluation, and biological tissue sampling. The ECSM developed for the SWMU 1/22 Wetlands Complex is illustrated on **Figure 6-1** and described in the following sections.

6.2.1.1 Contaminant Sources and Migration Pathways

The primary sources of impacts to the Wetlands Complex are the SWMUs (SWMUs 1 and 22) located within and adjacent to the wetland (**Figure 2-14)**.

As illustrated in the ECSM presented on **Figure 6-1**, COPCs may migrate from potential source areas to the Wetlands Complex through one or more of the following potential pathways and associated release and transport mechanisms:

- Transport via surface water erosion/runoff;
- Dissolution and leaching into groundwater;
- Migration of dissolved COPCs in shallow groundwater to sediment and surface water in adjacent wetlands and/or surface water bodies; and
- Trophic transfer of COPCs incorporated in the aquatic food chain.

The primary migration pathway is likely surface erosion and transport of Site-related inorganics from SWMUs within the Wetlands Complex. A second potential migration pathway to the Wetlands Complex is storm water transport of particle-sorbed inorganics from the Active Plant Area to the downgradient wetlands areas via two intermittent drainage ditches. Inorganics may be sorbed to particles transported by storm water and deposited in wetland sediments; disturbance of these sediments may subsequently re-suspend inorganics into surface water and re-deposit sediments locally in other areas of the wetland.

Groundwater also represents a potential migration pathway to the Wetlands Complex; however, groundwater transport is expected to be minimal. The evaluation of the leachability of soil samples from multiple SWMUs indicated that inorganics exhibited a low degree of leachability from soils at most locations (Eckenfelder, 2000). Furthermore, groundwater investigations at the Site concluded that the migration of inorganics from the active portion of the Site is limited by low permeability silty clays and clay deposits (Eckenfelder, 2000).

Trophic transfer is also a potential migration pathway for COPCs within the Wetlands Complex. COPCs may bioaccumulate in the tissues of biota in direct contact with potentially impacted exposure media. COPCs in the tissues of lower trophic organisms may be transferred to upper trophic consumers through ingestion pathways.

6.2.1.2 Ecological Exposure Pathways

Pathways by which ecological receptors using the Wetlands Complex may be exposed to COPCs are illustrated on **Figure 6-1**. Potential ecological receptors and routes of exposure are described below.

Potential Ecological Receptors

Because the FWIA cannot specifically evaluate the potential for adverse effects to each species that may be present and potentially exposed in the Wetlands Complex, receptors were selected to represent broader groups of organisms and those that are of high ecological value.

The Wetlands Complex potentially supports several categories of ecological receptors (with representative species provided in brackets) including:

- Emergent vegetation;
- Benthic macroinvertebrate community;
- Fish community;
- Omnivorous mammals: raccoon (*Procyon lotor*);
- Aerial insectivorous mammals: Indiana bat (*Myotis sodalis*);
- Piscivorous mammals: mink (*Mustela vison*);
- Invertivorous birds: mallard duck (*Anas platyrhynchos*);
- Semi-aquatic insectivorous birds: tree swallow (*Tachycineta bicolor*);
- Semi-aquatic insectivorous birds: Kentucky warbler (*Oporonis formosus*); and
- Piscivorous birds: great blue heron (*Ardea herodias*).

Potential Exposure Routes

The routes by which receptors may be exposed to COPCs in the Wetlands Complex are illustrated in the ECSM (**Figure 6-1**). Primary exposure pathways that will be quantitatively evaluated are illustrated by solid circles in the ECSM and described below for each receptor category:

- Benthic invertebrates: direct contact;
- Fish community: direct contact;
- Invertivorous wildlife: direct ingestion of surface water and contaminated biota and incidental ingestion of sediment (mallard only);
- Aerial insectivorous wildlife: direct ingestion of contaminated biota (Indiana bat and tree swallow only);
- Piscivorous wildlife: direct ingestion of surface water and contaminated biota (mink, belted kingfisher, and great blue heron only); and
- Omnivorous wildlife: direct ingestion of contaminated surface water and contaminated biota and incidental ingestion of sediment (raccoon only).

Emergent vegetation was not quantitatively evaluated in the FWIA Step IIC Investigation. As described in the *FWIA Step IIC Report* (URS, 2011b), the SWMU 1/22 Wetlands Complex is characterized as a monotypic stand of *Phragmites*. The dominance of *Phragmites* within the wetland is consistent with the physical disturbance of the wetland area associated with the creation of the SWMU 22 landfill and SWMU 1 Shooting Pond.

6.2.1.3 Wetlands Complex Exposure Assessment Results

The results of the FWIA Step IIC investigations (URS, 2011b) indicated the following:

- The SQT weight-of-evidence evaluation indicated that impacts to benthic invertebrate communities occurred at stations adjacent to SWMU 22 that contained the greatest concentrations of target inorganics in sediments; impacts to benthic invertebrate communities decreased with increasing distance from SWMU 22;
- The incidence of significant lethal and sublethal effects on benthic test organisms in sediment toxicity tests were most consistent with concentration gradients of selenium and lead;
- Levels of target inorganics in surface water were generally below surface water criteria; therefore, exposure of fish and other aquatic life to target inorganics in surface water is not likely to result in adverse community-level effects; and
- Potential risks to wildlife exposed to target inorganics were limited to receptors that forage exclusively within the exposure area; the potential for adverse effects was greatest for tree swallow, however, the estimation of the dose to tree swallow was highly uncertain.

6.2.2 Active Plant Area

The ECSM developed for the Active Plant Area system is illustrated in **Figure 6-1** and described in the following sections.

6.2.2.1 Contaminant Sources and Migration Pathways

The primary sources of COPCs within the Active Plant Area are the SWMUs and AOCs identified in the CMS (Eckenfelder, 2000; HydroQual, 2005; HydroQual, 2006). As illustrated in the ECSM (**Figure 6-1**), COPCs may migrate from these potential source areas to adjacent soils primarily via surface migration. Bioaccumulation of inorganics in wildlife through consumption of food/prey (i.e., plants and soil invertebrates) exposed to inorganics in site media is also a potential migration pathway.

6.2.2.2 Ecological Exposure Pathways

As described in the Step IIB Report, ecological exposure pathways within the Active Plant Area are limited by the poor to low habitat value associated with SWMUs and AOCs (URS, 2009). However, potential wildlife exposure pathways were included as part the FWIA Step IIC investigations to address NYSDEC concerns regarding potential ecological exposure to wildlife that may occasionally forage at the margins of the Active Plant Area.

Pathways by which ecological receptors using the margins of the Active Plant Area may be exposed to COPCs are illustrated in **Figure 6-1**. Potential ecological receptors and routes of exposure are described below.

<u>Potential Ecological Receptors</u>

In the Active Plant Area, ecological receptors were selected to evaluate potential exposure to wildlife that may forage at the margins of the facility. Receptor categories were selected to represent low-level secondary consumers and top-tier predators to provide a range of potential wildlife exposure. Low-level secondary consumers were represented by invertivorous birds and mammals that forage primarily on earthworms:

- Small invertivorous mammals: Short-tailed shrew (*Blarina brevicauda*); and
- Invertivorous birds: American robin (*Turdus migratorius*).

Top-tier predators were represented by carnivorous birds and mammals that forage primarily on low-level secondary consumers:

- Carnivorous birds: Red-tailed hawk (*Buteo jamaicensis*); and
- Carnivorous mammals: Red fox (*Vulpes vulpes*).

<u>Potential Exposure Routes</u>

The routes by which ecological receptors may be exposed to COPCs in the Active Plant Area are illustrated in the ECSM (**Figure 6-1**). Primary exposure pathways were quantitatively evaluated in the FWIA are illustrated by solid circles in the ECSM and described below for each receptor category:

- Invertivorous wildlife: direct ingestion of contaminated biota and incidental ingestion of soil;
- Carnivorous mammals: direct ingestion of contaminated biota and incidental ingestion of soil; and
- Carnivorous birds: direct ingestion of contaminated biota.

6.2.2.3 Active Plant Exposure Assessment Results

The exposure evaluation in the Active Plant Area focused on risks to wildlife receptors that potentially forage on the margins of the facility. The findings of the exposure evaluation support the following conclusions regarding exposure to terrestrial wildlife:

- The greatest potential risks to terrestrial wildlife are associated with exposure to selenium consumed in earthworms and small mammals;
- Potential risks associated with selenium exposure to wildlife are greatest in the northern grids N1 and N3 (**Figure 2-11**), which are associated with burning areas used to combust off-specification and waste materials;
- Excluding the elevated tissue concentrations in N1 and N3 (**Figure 2-11**), potential risks to top-tier, long-ranging receptors foraging throughout the Site are negligible; and
- Selenium bioaccumulation is highly variable and uncertain based on non-depurated earthworm tissue and total selenium analyses in soil; bioaccumulation relationships derived from Site-specific data are not reliable for developing preliminary remedial goals for soil.
- Given the frequent disturbance of plant activities in the Active Plant Area, risk management decision-making for terrestrial wildlife exposure to selenium should focus primarily on the protection of top-tier, long-ranging receptors, e.g., red fox and red hawk.

7.0 REMEDIAL ACTION OBJECTIVES AND GENERAL RESPONSE ACTIONS

This section presents the RAOs and GRAs that have been developed for the Site.

7.1 Remedial Action Objectives

Based on considerations specific to the Site (e.g., COPCs, Site use, and potential exposure pathways), RAOs are identified to maintain and/or achieve conditions that are protective of human health and the environment. The RAOs that have been developed for the Site are consistent with the remedy selection process described in NYCRR Part 375 and guidance presented in DER-10 *Technical Guidance for Site Investigation and Remediation* (NYSDEC, 2010). The RAOs are based on the completed investigations, the SCGs previously presented in **Section 3**, and the conclusions drawn from the HHRA and FWIA. The RAOs were used to identify the remedial alternatives presented in **Section 8**. The RAOs developed for the Site are presented below, and further discussed in the following subsections.

Table 7-1: Remedial Action Objectives

Media	Constituent/Material of Potential Concern	Remedial Action Objectives
Soil	Inorganics (metals and selenium)	<u>Public Health Protection</u> - Prevent ingestion/direct contact with impacted soil. - Prevent the migration of impacted soil into waterways and drainage features
		<u>Environmental Protection</u> - Prevent the migration of COPCs that would result in exceedances of groundwater and surface water and sediment criteria. - Prevent, to the extent practicable, the potential risks to terrestrial wildlife associated with exposure to selenium consumed in earthworms and small mammals.
	Energetic Materials	<u>Public Health Protection</u> - Minimize risk/safety hazard to workers and Site personnel during corrective measures implementation
Sediment	Inorganics (metals and selenium)	<u>Public Health Protection</u> - Prevent ingestion/direct contact with impacted sediment.
		<u>Environmental Protection</u> - Prevent the migration of COPCs that would result in exceedances of surface water criteria. - Prevent direct contact with impacted sediments by benthic invertebrates - Prevent potential risks to wildlife exposed to target inorganics.

Table 7-1: Remedial Action Objectives (continued)

Media	Constituent/Material of Potential Concern	Remedial Action Objectives
Groundwater	VOCs Inorganics (metals and selenium)	Public Health Protection - Prevent ingestion of groundwater with COPC levels exceeding the Class GA water quality standards. - Prevent contact with impacted groundwater
		Environmental Protection - Restore the groundwater aquifer to meet ambient groundwater quality criteria, to the extent feasible.
Indoor Air	VOCs	Public Health Protection - Address exposures to the public and workers related to soil vapor intrusion into buildings.
		Environmental Protection - Eliminate, to the extent practicable, the impact of COPCs in soil or groundwater to soil vapor.

This CMS evaluates a range of corrective measure alternatives, and their ability to fulfill the objectives listed above at the Site.

7.2 General Response Actions

Based on the RAOs identified in Section 7.1, the following Site-specific GRAs were established for Site media:

- NFA
- Containment
- In-Situ Treatment
- Removal
- Off-Site Treatment and/or Disposal
- Institutional/Engineering Controls

Within each of these GRAs, remedial technology types were identified for each impacted medium as and are presented in **Table 7-2**.

8.0 IDENTIFICATION AND SCREENING OF TECHNOLOGIES AND DEVELOPMENT OF CORRECTIVE MEASURES ALTERNATIVES

This section presents potentially applicable technologies and the results of the screening evaluation conducted to determine which technologies could be successfully implemented at the Site. The technologies were evaluated based on Site-specific conditions, implementability, effectiveness (i.e., whether the RAOs can be attained), and cost.

8.1 Technology Identification and Screening

The remedial technology types associated with each of the GRAs identified in **Section 7.2**, typically considered for the cleanup of inorganic and VOC-contaminated media were developed from experience on other hazardous waste sites, knowledge of developing and emerging technologies, and the professional judgment of engineers and remediation practitioners performing the CMS. Technology identification and screening involved the following steps:

- Assessment of technical issues posed by the Site and COPCs
- Identification of potentially applicable technologies
- Preliminary screening of the technologies with respect to effectiveness, implementability, and cost.

8.1.1 Site-Specific Technical Issues

Site data have been reviewed to identify characteristics that may limit or promote the use of certain corrective measures technologies. Technologies limited by these Site-specific characteristics will be eliminated from further consideration in this section of the CMS.

The technical issues affecting the implementability and effectiveness of potentially applicable technologies at the Site include the following:

- Potential exposure to energetic materials
- Characteristics of the Site media
- Characteristics of the COPCs

Each of the Site-specific technical issues are discussed in further detail in the following paragraphs.

The Site is an active manufacturing facility that currently produces electric detonators. Various explosives, primers, igniters and related materials have been manufactured and stored at the Site since 1912. Therefore, any technologies that utilize heat or electricity will be eliminated for SWMU/AOC groups due to the presence of sensitive operations involving explosive materials at the plant and the safety hazards posed by such technologies. In addition, intrusive technologies (including excavation) will be eliminated for the landfills due to the potential presence of energetic materials.

The characteristics of the impacted Site media (soils and groundwater) need to be determined and considered in selection of the remedial technologies used in formulation of a remedial alternative. Different types of soils are amenable to different types of treatment technologies. For example, in considering in-situ treatment technologies, coarse grain and granular soils are more suitable for soil vapor extraction, thermal conductivity heating (with vapor recovery) or chemical oxidation where the flow rate of either air or liquid is critical for optimal treatment effectiveness. Clay or silt type soils, on the other hand, would be more amenable to electrical resistance heating, for which this technology relies on the electrical resistance in the soil created during operation.

The characteristics of the COPCs were considered in the CMS. The COPCs may be present in several phases, (i.e., liquid, solid or vapor). The phase of the COPCs may affect the implementability or treatability of the material; therefore, this is also considered during the remedial technology selection process.

The technologies retained for the preliminary screening include consideration of the technical issues discussed above. Site data have been reviewed to identify conditions that may limit or promote the use of certain technologies. Technologies whose use is clearly precluded by Site characteristics will be eliminated from further consideration in this section of the CMS.

8.1.2 Potentially Applicable Technologies

Potentially applicable corrective measure technologies were originally identified in the RFI Task II Report (Eckenfelder, 1996). These technologies, along with several additional technologies, were screened as part of the 2000 CMS (Eckenfelder, 2000) and the 2005 Supplement to CMS (Hydroqual, 2005). The potentially applicable technologies identified were screened to eliminate those that may prove unreliable, unsatisfactory, infeasible to implement, or unable to achieve the corrective measures objectives within a reasonable time frame. The screening process has taken into account Site characteristics and impacts previously discussed in **Sections 2** and **4**, as well as technological limitations. The previous screening was utilized for the purposes of this revision to the CMS.

8.1.3 Preliminary Technology Screening

The technologies were evaluated based on effectiveness, implementability, and cost. **Table 8-1** presents a screening evaluation of the technologies for each of the GRAs as discussed in **Section 7.2**. A brief summary of the screening effort is provided below. The technologies that were not considered implementable or effective were not retained for further evaluation.

The technologies screened were categorized into five groups:

- NFA
- Containment
- In-situ Treatment
- Removal/Ex-situ Treatment/Disposal
- Institutional/Engineering Controls

NFA was retained for all impacted media as required by DER-10 (NYSDEC, 2010). Technologies that are dependent upon the transport of fluids (liquids or gases) through soil were not retained for any of the SWMUs/AOCs or media because of the low permeability soil (K_h ranging from $1x10^{-5}$ to $1x10^{-7}$ cm/sec) at the Site which would render these technologies ineffective. These technologies include groundwater extraction, air sparging, bioremediation, and chemical treatment among others. Groundwater extraction depends upon being able to move groundwater through the formation such that containment and effective mass removal can be achieved. Further, the stability of impacts and the absence of off-site migration does not warrant implementation of hydraulic containment.

Air sparging, bioremediation and chemical treatment depend upon delivering air and amendments to the subsurface so they encounter the subsurface impacts. Due to the low permeability soils at the Site, the number of injection wells necessary to achieve this would be cost prohibitive with no guarantee for success. Technologies that use heat or electricity were eliminated for all SMWUs/AOCs and media due the presence of sensitive operations involving explosive materials at the plant and the safety hazard posed by these technologies. Intrusive technologies were not retained for the landfills (SWMUs 22, 23, 32, and 35) and the Shooting Pond (SWMU 1) for the same reason sampling was not performed within these SWMUs (i.e., potential presence of energetic materials). Institutional/engineering controls were only retained in combination with other technologies.

8.2 Development of Corrective Measures Alternatives

This section uses the screened technologies presented in Section 8.1 to develop corrective measures alternatives for the Site. The potential corrective measures alternatives are identified below and detailed descriptions are presented in **Section 9**.

8.2.1 Soil Corrective Measures Alternatives

The following four remedial alternatives have been identified to address the RAOs for the impacted soils at the Site:

- Alternative SOIL1: NFA
- Alternative SOIL2: Cover
- Alternative SOIL3: Excavation, On-Site Consolidation & Capping
- Alternative SOIL4: Excavation and Off-Site Disposal

8.2.2 Sediment Corrective Measures Alternatives

The following four remedial alternatives have been identified to address the RAOs for the impacted sediment at the Site:

- Alternative SED1: NFA
- Alternative SED2: Cover with Institutional Controls
- Alternative SED3: Excavation, On-Site Consolidation & Capping with Institutional Controls
- Alternative SED4: Excavation and Off-Site Disposal

8.2.3 Groundwater Corrective Measures Alternatives

The following two remedial alternatives have been identified to address the RAOs for the impacted groundwater at the Site:

- Alternative GW1: NFA
- Alternative GW2: Monitored Natural Attenuation with Institutional Controls

8.2.4 Indoor Air Corrective Measures Alternatives

As described in **Section 4**, the following corrective measures alternatives have previously been selected and approved by the Department to address the RAOs for the soil vapor impacts at the Site.

- Shell Plant Corrective Measures Alternative: Annual indoor air quality monitoring

Therefore, no further evaluation of indoor air quality corrective measures alternatives will be conducted.

9.0 CORRECTIVE MEASURES ALTERNATIVES EVALUATION

This section evaluates the corrective measures alternatives identified in **Section 8**. These remedial alternatives were evaluated with respect to the criteria specified in 6 NYCRR 375-1.8(f) and DER-10 (NYSDEC, 2010). The detailed evaluation of each corrective measures alternative presented in this section consists of an assessment of the following seven criteria.

- Conformance with SCGs
- Overall Protectiveness of the Public Health and the Environment
- Short-Term Impact and Effectiveness
- Long-Term Effectiveness and Permanence
- Reduction of Toxicity, Mobility, or Volume
- Implementability
- Cost Effectiveness

As indicated in 6 NYCRR Part 375-1.8(f), other criteria to be considered when evaluating potential remedial alternatives are land use and community acceptance. Land use may be considered provided there is reasonable certainty associated with such land use. The community acceptance assessment will be completed by the NYSDEC after community comments on the remedy selection process are received. The results of the evaluation are typically considered when the NYSDEC selects a preferred remedial alternative and are typically presented in a Responsiveness Summary completed by the NYSDEC. The Responsiveness Summary is part of the Record of Decision (ROD) for the project and responds to all comments and questions raised during a public meeting associated with the remedy selection process, as well as comments received during the associated public comment period.

9.1 Description of Evaluation Criteria

A brief description of each of the seven evaluation criteria is presented in the following subsections.

9.1.1 Conformance with SCGs

This criterion evaluates each corrective measures alternative with respect to the SCGs that were identified in **Section 3**. Compliance with the following types of SCGs are considered:

- Chemical-specific
- Action-specific
- Location-specific

9.1.2 Overall Protectiveness of the Public Health and the Environment

This criterion assesses of the ability of each alternative or the remedy to protect public health and the environment. The assessment of overall protectiveness draws on the analysis of other criteria evaluated for each alternative (specifically short- and long-term effectiveness and compliance with SCGs). It also considers the manner in which the alternative achieves protection over time, the degree to which Site risks would be reduced, and the manner in which each source of impacts would be eliminated, reduced, or controlled.

9.1.3 Short-Term Impact and Effectiveness

This criterion is an evaluation of the potential short-term adverse environmental impacts and human exposures during the construction and/or implementation of an alternative or remedy. This evaluation will:

- Identify the potential human exposures, adverse environmental impacts and nuisance conditions, at the Site and to the surrounding community resulting from the implementation of the remedy or alternative. Identify how they would be controlled and the effectiveness of the controls. The potential short-term impacts to be evaluated include, nuisance conditions or potential exposures resulting from increased traffic, including truck trips, detours or loss of the use of access to property; odors; vapors; dust; habitat disturbance; run off from the Site and noise.
- Provide a discussion of engineering controls that would be used to mitigate the short-term impacts (i.e. dust control measures) should be included.
- Estimate the length of time needed to implement the remedy or alternative including time to achieve the remedial objectives should be estimated.

9.1.4 Long-Term Effectiveness and Permanence

This criterion is an evaluation of the long-term effectiveness and permanence of an alternative or remedy after implementation. If contamination will remain on- or off-site after the selected remedy has been implemented, this evaluation will assess the impact of the remaining contamination on any of the following:

- human exposures;
- ecological receptors; or
- impacts to the environment.

This evaluation will also address the adequacy and reliability of controls (if any) that would be used to manage contamination that will remain on-site; the risks remaining at the completion of the corrective measure implementation; and the ability of the alternative to meet the RAOs established for the Site.

9.1.5 Reduction of Toxicity, Mobility or Volume of Contamination

This criterion is an evaluation of the ability of an alternative or remedy to reduce the toxicity, mobility and volume of Site contamination. Preference should be given to remedies that permanently or significantly reduce the toxicity, mobility or volume of the contamination at the Site. The evaluation focuses on the following factors:

- the process the corrective measure would employ and the amount of materials that would be treated
- the anticipated ability of the remedy to reduce toxicity, mobility, or volume of impacts present in the Site media.
- the nature and quantity of residuals that would remain after corrective measures implementation.

9.1.6 Implementability

This criterion is an evaluation of the technical and administrative feasibility of implementing an alternative or remedy. Technical feasibility includes the difficulties associated with construction and the ability to monitor the effectiveness of an alternative or remedy. Administrative feasibility is evaluated, which includes:

- the availability of the necessary personnel and material; and
- potential difficulties in obtaining specific operating approvals, access for construction, etc.

This criterion also includes the evaluation of the reliability and viability of implementation of the institutional or engineering controls necessary for a remedy.

9.1.7 Cost Effectiveness

This criterion is an evaluation of the overall cost effectiveness of an alternative or remedy. The total cost of each alternative, on the basis of present worth analysis, represents the sum of the direct capital costs (e.g., materials, equipment, and labor), indirect capital costs (e.g., engineering, licenses or permits, and contingency allowances), and operation and maintenance (O&M) costs (e.g., operating labor, energy, sampling and analyses). Because detailed remedial design activities have not been performed, a 20 percent contingency has been included to each alternative to account for potential changes in scope (and costs) that may be identified during the design and implementation activities. Present value costs are calculated for alternatives expected to last more than two years. In accordance with USEPA guidance, a 7 percent discount rate (before taxes and after inflation) was used to calculate present worth.

9.2 Detailed Evaluation of Alternatives

9.2.1 Soil

Four corrective measures alternatives for soil were developed for detailed analysis:

- Alternative SOIL1: NFA
- Alternative SOIL2: Cover
- Alternative SOIL3: Excavation, On-Site Consolidation & Capping
- Alternative SOIL4: Excavation and Off-Site Disposal

These corrective measures alternatives apply to the impacted soils present in the SWMUs/AOCs at the Site. A description of the conceptual approach for each alternative is provided in the following subsections. A side-by-side comparison of the soil corrective measures alternatives is provided in **Table 9-1**. This comparison rates the alternatives (poor, fair, and good) for each of the evaluation criteria identified in **Section 9.1**. The total estimated cost for implementation of each of these four alternative at each SWMU/AOC is provided in **Table 9-2.** Detailed breakdowns of the estimated costs for this alternative for each SWMU/AOC delineated to the mid-point and to the NYSDEC-requested point below the applicable SCO are provided in **Appendices E and F,** respectively**.**

9.2.1.1 Conceptual Approach to Soil Corrective Measures Alternatives

Alternative SOIL1: NFA

Alternative SOIL1 involves NFA at the Site. This alternative serves as the baseline for comparison of the overall effectiveness of the other corrective measures alternatives. The Site would be allowed to remain in its current condition. The existing cover material (i.e., grass/vegetation, asphalt, concrete slabs, etc.) and fencing would be maintained.

Alternative SOIL2: Cover

Alternative SOIL2 would involve constructing a cover over the areas that exceed the applicable SCOs and would be applicable for all SWMUs/AOCs within the HMSD Group. The purpose of the cover would be to restrict direct contact with the underlying soil. The cover could consist of soil, asphalt, gravel or other suitable materials however in general clay and silt soils (native to the area) are preferred. The soil cover would be comprised of six to 18 inches of subsoil and six inches of topsoil over a geotextile. The geotextile would be placed upon the existing ground surface to identify the bottom of the cover, with the subsoil comprising clay material obtained from an on-site borrow either pit or off-site source.

The silts and clays from the area are characterized by their low permeability with slug tests (Eckenfelder) indicating lateral hydraulic conductivities in the silts and clays of less than 1×10^{-6} cm/sec and vertical conductivities likely less than 1×10^{-7} cm/sec. These low hydraulic conductivities will limit the infiltration into capped materials and the potential further leaching of impacts to groundwater. On completion of the capping, the topsoil will be seeded to establish a vegetative cover.

Where an asphalt is selected, the cover would consist of a binder or wearing course of asphaltic concrete (typically three inches) over a base course of gravel (typically four to six inches). A gravel cover would consist of 12 to 24 inches of coarse gravel. A cover would require inspection and maintenance to ensure that it continues to function as a barrier restricting direct contact with the underlying soil.

This alternative includes implementation of a land use restriction (in the form of a deed restriction or environmental easement), preparation of a SMP, and maintenance of the fencing surrounding the facility.

Alternative SOIL3: Excavation, On-Site Consolidation & Capping

Alternative SOIL3 would consist of excavating the soil in the SWMUs/AOCs that exceeds the applicable SCOs, transporting the soil to a designated area within the Site (e.g., one of the existing landfill areas), constructing an aboveground consolidation unit (i.e., earthen berm walls), grading and compacting the soil within the designated area, and constructing a cover atop the consolidated material. Total concentrations and the "20 times" rule-of-thumb will be utilized to determine whether the excavated soil must be managed as hazardous waste. If the hazardous waste criteria is exceeded then TCLP analyses will be conducted for final characterization and transport for off-site disposal. After excavation, the SWMUs/AOCs would be backfilled with clean fill and restored to its original appearance. The cover would be constructed as described for Alternative SOIL2. The cover and earthen berms would require inspection and maintenance to ensure that it continues to function as a barrier restricting direct contact with the contained soil.

This alternative includes implementation of a land use restriction (in the form of a deed restriction or environmental easement), preparation of a SMP, and maintenance of the fencing surrounding the consolidation unit. This alternative is applicable for all SMWUs/AOCs, except those with the potential to contain energetic materials (e.g., landfills).

Alternative SOIL4: Excavation and Off-Site Disposal

Alternative SOIL4 would consist of excavating the soil in the SWMUs/AOCs that exceeds the applicable SCOs, and transporting the soil to an off-site facility for disposal. Total concentrations and the "20 times" rule-of-thumb will be utilized to determine whether the excavated soil must be managed as hazardous waste. If the hazardous waste criteria is exceeded then TCLP analyses will be conducted for final characterization and transport for off-site disposal. After excavation, the SWMUs/AOCs would be backfilled with clean fill and restored to their original appearance.

This alternative includes implementation of a land use restriction (in the form of a deed restriction or environmental easement). This alternative is applicable for all SMWUs/AOCs with impacted soil, except those with the potential to contain energetic materials (e.g., landfills).

9.2.1.2 Soil Corrective Measures Alternatives Evaluation Results

As indicated in **Table 9-1**, the evaluation resulted in the following recommendations:

- Alternative SOIL1: NFA was not retained
- Alternative SOIL2: Cover was retained in areas where energetic materials are likely to remain and excavation poses a significant health and safety risk or in the Active Plant Area near sensitive operations.
- Alternative SOIL3: Excavation, On-Site Consolidation, and Capping was retained for non-energetic and sensitive SWMUs because it is equally or nearly equally protective over human health and the environment over the long-term as alternative SOIL4 – Excavation and Off-Site

Disposal. Direct exposure, fugitive dust inhalation, and future erosion and transport of the Site CPOCs in storm water runoff is eliminated by removing the impacted soils and managing them at one consolidation unit designed to eliminate these potential risks. The net environmental benefit recognized by this option and through avoidance of the risk issues identified with alternative SOIL4 distinguishes this remedy as the option of choice

- Alternative SOIL4: Excavation and Off-Site Disposal was not retained because the net benefits of this approach do not outweigh the potential risks as follows:
  - The excavated soil would pose a risk while on-site and during transportation from the Site to the treatment/disposal facility since it would be more accessible to human exposure.
  - Traffic resulting from the transportation of approximately 8,424 CY of impacted soil for off-site disposal (approximately 648 roundtrip truckloads for soil) would pose a potential nuisance to the community and increase the risk for accidents and spills. This potentially would be combined with traffic associated with off-site disposal of impacted sediment (
  - Many land uses surrounding the County's highways are especially sensitive to high volumes of truck traffic. Residents typically do not enjoy the noise trucks produce in their neighborhoods, especially at night.
  - Throughout Ulster County, physical constraints or impediments exist on County and State highways that hinder the flow of traffic, especially truck traffic. These include steep grades, aging or low bridges, awkward intersection geometry, and narrow or curving roadways. They exist due to Ulster County's natural landscape and an aging highway network designed primarily for passenger vehicles.
  - Wear and tear to the local road system due to 648 roundtrip truckloads of soil sent off-site for disposal and potentially additional traffic for sediment as described below.
  - Generation of nearly 736 metric tons of CO_2 associated with combustion of approximately 71,978 gallons of diesel fuel (assumes 648 loads at 722 miles per roundtrip). Greenhouse gas emissions calculations are provided in **Appendix G.**

In addition, alternative SOIL3 is equally or more protective that alternative SOIL4 while costing approximately $1,500,000 less depending upon the SCO used for cleanup.

9.2.2 Sediment

Four corrective measures alternatives for soil were developed for detailed analysis:

- Alternative SED1: NFA
- Alternative SED2: Cover
- Alternative SED3: Excavation, On-Site Consolidation & Capping
- Alternative SED4: Excavation and Off-Site Disposal

These corrective measures alternatives apply to the impacted sediment present in the Wetlands Complex, the drainage ways bisecting the Active Plant area, which drain into the Wetlands Complex, and the area downstream (off-site) of the Wetlands Complex. A description of the conceptual approach for each alternative is provided in the following subsections. A side-by-side comparison of the sediment corrective measures alternatives is provided in **Table 9-3**. This comparison rates the alternatives (poor, fair, and good) for each of the evaluation criteria identified in **Section 9.1**.

Limits of corrective measures will be determined by one of the following:

- Comparison with the SELs (approximately 447,043 SF or 16,557 CY as shown on **Figure 9-1**)
- Comparison to PRGs (after further sampling and development) (approximately 380,741 SF or 14,102 CY as shown on **Figure 9-2**)
- Mass removal based on the documented change in stream geomorphology and sedimentation that is coincident with a precipitous decrease in concentrations (approximately 481,378 SF or 17,829 CY as shown on **Figure 9-3**).

The total estimated cost for implementation of each of these four alternative at each SWMU/AOC is provided in **Table 9-4.** A detailed breakdown of the estimated costs for the sediment corrective measures alternative is provided in **Appendix H.**

9.2.2.1 Conceptual Approach to Sediment Corrective Measures Alternatives

<u>Alternative SED1: NFA</u>

Alternative SED1 involves NFA at the Site. This alternative serves as the baseline for comparison of the overall effectiveness of the other corrective measures alternatives. The Site would be allowed to remain in its current condition. The existing cover material (i.e., grass/vegetation, asphalt, concrete slabs, etc.) and fencing would be maintained.

<u>Alternative SED2: Cover</u>

The purpose of the cover would be to restrict direct contact with the underlying soil. The cover may consist of soil, asphalt, gravel or other suitable materials. In general, a soil cover would be comprised of six to 18 inches of subsoil and six inches of topsoil over a geotextile. The geotextile would be placed upon the existing ground surface to identify the bottom of the cover. The subsoil would consist of approximately 18 inches of clay material obtained from an on-site borrow pit. Based on the slug tests performed at the Site during the groundwater investigation (Eckenfelder, 1996), hydraulic conductivities of the shallow overburden soils at the Site range from 8.1×10^{-4} cm/sec to 4.3×10^{-7} cm/sec. Given these values, the vertical conductivities of the shallow overburden soil is likely to be 1×10^{-7} cm/sec or less. These hydraulic conductivities are consistent with low permeability soil, which is sufficient to restrict direct contact with the underlying consolidated material and limit leaching of water through the underlying consolidated material. The topsoil would be seeded to establish a vegetative cover. An asphalt cover would consist of a binder or wearing course of asphaltic concrete (typically three inches) over a base course of gravel (typically four to six inches). A gravel cover would consist of 12 to 24 inches of coarse gravel.

In order to place a cover over the impacted sediments in the Wetlands Complex, the wetland would have to be dewatered, vegetation removed, and the creek rerouted around the cover area to prevent future erosion of the cover. The drainage ways bisecting the facility would need to be covered with riprap, or similar, to prevent erosion and future transport of impacted sediment to the wetlands complex. A cover would require inspection and maintenance to ensure that it continues to function as a barrier restricting direct contact with the underlying soil.

This alternative would lead to the loss of wetlands and the implementation of a land use restriction (in the form of a deed restriction or environmental easement), preparation of a SMP, and maintenance of the fencing surrounding the facility and Wetlands Complex. Due to the loss of wetlands, federal and state requirements will require offsets and wetlands reconstruction.

Alternative SED3: Excavation, On-Site Consolidation & Capping

Alternative SED3 would consist of temporary rerouting of surface water flow, dewatering the Wetlands Complex, excavating the impacted sediment in the Wetlands Complex, the drainage ways bisecting the Active Plant Area, and the area downstream (off-site) of the Wetlands Complex to the native clay layer, dewatering the sediment, transporting the sediment to a designated area within the Site (e.g., one of the existing landfill areas), constructing an aboveground consolidation unit (i.e., earthen berm walls), grading and compacting the sediment within the designated area, and constructing a cover atop the consolidated material. After excavation, the wetlands area would be restored in accordance with federal and/or state mitigation requirements. The cover atop the consolidation unit would be constructed as described for Alternative SED2. The cover and earthen berms would require inspection and maintenance to ensure that they continue to function as barriers restricting direct contact with the contained sediment.

This alternative includes implementation of a land use restriction (in the form of a deed restriction or environmental easement), preparation of a SMP, and maintenance of the fencing surrounding the consolidation unit.

Alternative SED4: Excavation and Off-Site Disposal

Alternative SED4 would consist of rerouting the wetlands stream, dewatering the Wetlands Complex, excavating the impacted sediment in the Wetlands Complex, the drainage ways bisecting the Active Plant Area, and the area downstream (off-site) of the Wetlands Complex to the native clay layer, and transporting the soil to an off-site facility for disposal. After excavation, the wetlands area would be restored in accordance with federal and/or state mitigation requirements.

9.2.2.2 Sediment Corrective Measures Alternatives Evaluation Results

As indicated in **Table 9-3**, the evaluation resulted in the following recommendations:

- Alternative SED1: NFA was not retained
- Alternative SED2: Cover was not retained because it is not implementable in the Wetlands Complex due to the future presence of flowing and standing water.
- Alternative SED3: Excavation, On-Site Consolidation and Capping was retained because it is equally protective over human health and the environment over the long-term as alternative SED4 – Excavation and Off-Site Disposal. Direct exposure, fugitive dust inhalation, and future erosion and transport of the Site CPOCs in storm water runoff is eliminated by removing the impacted sediments and managing them at one consolidation unit designed to eliminate these potential risks. The net environmental benefit recognized by this option and through avoidance of the risk issues identified with alternative SED4 distinguishes this remedy as the option of choice.
- Alternative SED4: Excavation and Off-Site Disposal was not retained because the net benefits of this approach do not outweigh the potential risks
    - The physical nature of the sediment increases the potential for releases during transportation that could expose the surrounding community.
    - The excavated sediment would pose a risk while on-site and during transportation from the Site to the treatment/disposal facility since it would be more accessible to ecological exposure.
    - The excavated sediment would pose a risk while on-site and during transportation from the Site to the treatment/disposal facility since it would be more accessible to human exposure.
    - Traffic resulting from the transportation of approximately 17,829 CY of impacted sediment for off-site disposal (approximately 1,372 roundtrip truckloads for soil removal and importing

clean fill materials) would pose a potential nuisance to the community and increase the risk for accidents and spills.

- o Many land uses surrounding the County's highways are especially sensitive to high volumes of truck traffic. Residents typically do not enjoy the noise trucks produce in their neighborhoods, especially at night.
- o Throughout Rockland County, physical constraints or impediments exist on County and State highways that hinder the flow of traffic, especially truck traffic. These include steep grades, aging or low bridges, awkward intersection geometry, and narrow or curving roadways. They exist due to Rockland County's natural landscape and an aging highway network designed primarily for passenger vehicles.
- o Wear and tear to the local road system due to 1,372 roundtrip truckloads of sediment sent off-site for disposal.
- o Generation of nearly 1,558 metric tons of CO_2 associated with combustion of approximately 152,398 gallons of diesel fuel (assumes 1,372 loads at 722 miles per roundtrip). Greenhouse gas emissions calculations are provided in **Appendix G**.

In addition, alternative SED3 is equally or more protective that alternative SED4 while costing approximately $2,000,000 less, depending upon the removal criteria.

9.2.3 Groundwater

Two corrective measures alternatives for soil were developed for detailed analysis:

- Alternative GW1: NFA
- Alternative GW2: Monitored Natural Attenuation with Institutional Controls

These corrective measures alternatives apply to the impacted groundwater at the Site. A description of the conceptual approach for each alternative is provided in the following subsections. A side-by-side comparison of the groundwater corrective measures alternatives is provided in **Table 9-5**. This comparison rates the alternatives (poor, fair, and good) for each of the evaluation criteria identified in **Section 9.1**. A detailed breakdown of the estimated costs for the groundwater corrective measures alternative is provided in **Appendix I.**

9.2.3.1 Conceptual Approach to Groundwater Corrective Measures Alternatives

<u>Alternative GW1: NFA</u>

Alternative GW1 involves NFA at the Site. This alternative serves as the baseline for comparison of the overall effectiveness of the other corrective measures alternatives for groundwater. This alternative would involve natural attenuation processes to reduce concentrations of COPCs in groundwater. However, no monitoring would be performed to evaluate the time and extent of natural degradation.

<u>Alternative GW2: Monitored Natural Attenuation with Institutional Controls</u>

Alternative GW2 consists of use restrictions on groundwater, natural attenuation processes to reduce concentrations of COPCs in groundwater, and long-term groundwater monitoring to evaluate changes in groundwater conditions. A land use restriction (e.g., in the form of a deed restriction or environmental easement) would notify future property owners of the presence of COPCs in groundwater at the Site, restrict the use of on-site groundwater, and notify the owners of the applicability of an SMP. Existing groundwater use laws [10 NYCRR 5-1.31(b)], which prohibit the installation of private wells where public supply is available (unless approval is expressly granted by the public water authority), would continue to minimize potential human exposure to constituents in groundwater at concentrations exceeding the groundwater quality standards/guidance values. The use restriction would apply to groundwater beneath the Site

A SMP would be prepared under this alternative to: (1) identify areas of impacted groundwater associated with the Site; and (2) address possible future intrusive activities that would result in the potential for contact with impacted groundwater (to minimize the performance of work below the water table and/or dewatering without appropriate controls and measures).

Long-term monitoring would be performed under this alternative to evaluate the effectiveness of natural attenuation over an extended period of time. Samples would be collected from selected existing monitoring wells and analyzed for COPCs. The results of the groundwater monitoring would be summarized and presented to the NYSDEC in annual reports. After a five-year period, an evaluation of the long-term monitoring would be made and presented to the NYSDEC. Based on the analytical results and trends in groundwater constituent concentrations, Dyno Nobel would propose modifications to the monitoring program. For the purposes of this revision to the CMS, it is assumed that annual sampling to document natural attenuation would be conducted for an additional 25 years (i.e., for a total of 30 years).

Current and future property owners would be required to complete and submit annual certification to the NYSDEC that administrative and engineering controls were put in place as part of the Site remedy, are still place, have not been altered, and are still effective.

9.2.3.2 Groundwater Corrective Measures Alternatives Evaluation Results

As indicated in **Table 9-5**, the evaluation resulted in the following recommendations:

- Alternative GW1: No Further Action was not retained.
- Alternative GW2: Monitored Natural Attenuation with Institutional Controls was retained because it may be effective over the long-term at reducing concentrations of VOCs in groundwater. Long-term monitoring would be performed to evaluate changes in groundwater conditions. Through the establishment of a land use restriction and SMP, this alternative would meet the groundwater RAOs related to potential direct contact, ingestion, and inhalation human health exposure pathways. The land use restriction and SMP would be kept in place, unchanged, unless Site conditions were to change and make these measures unnecessary. If changes were to occur that would require modifications to the land use restriction/SMP, such modifications would be presented to the NYSDEC for review and approval, as appropriate. Both the land use restriction and SMP would be apparent to possible future Site owners during comprehensive due diligence activities performed in connection with property transfer. Taken together, these institutional controls could be expected to adequately and reliably provide for the management of groundwater exhibiting constituents at concentrations exceeding standards.

10.0 SELECTION AND JUSTIFICATION FOR PREFERRED CORRECTIVE MEASURES ALTERNATIVES

This section presents the preferred corrective measures alternative for impacted media at the Site.

10.1 Preferred Soil Corrective Measures Alternatives

Based on the evaluation of the four soil alternatives presented in Section 9, the following alternatives have been selected for impacted soils at the Site:

Table 10-1: Preferred Soil Corrective Measures Alternatives

SWMU/AOC	Preferred Alternative
SWMU 22 – Former Landfill	SOIL2: Cover
SWMU 23 – Former Dump	
SWMU 32 – Old Dump (near water tower)	
SWMU 35 – Stone Fence Dump	
SWMU 2 – Burning Cage/Incinerator	SOIL3: Excavation, On-Site Consolidation and Capping
SWMU 3 – Copper Wire Burning Area	
SWMU 4 – Iron Wire Burning Area	
SWMU 5 – Wire Burning Area III	
SWMUs 6&7 – Open Burning Pads	
SWMU 8 – Former Burning Area	
SWMU 9 – Waste Powder Catch Basin – Bldg 2037	
SWMU 10 - Waste Powder Catch Basin – Bldg 2048	
SWMU 11 - Waste Powder Catch Basin – Bldg 2049	
SWMU 13 – Former Waste Powder Catch Basin – Lead Azide Bldg	
SWMU 21 – Lead Recycling Unit Area	
SWMUs 26D - Burnable Waste Satellite Accumulation Areas	
SWMU 29 – Drainage Ditch (downgradient of Bldg 2049)	
SWMU 33 – Mercury Fulminate Tanks Area	
SWMU 40 – Pilot Line Condensate Collection Sump	
SWMU 48 – Mercury Fulminate Area	
SWMU 52 – Former Commercial Lab Shooting Area	
SWMU 54 – Former Historical Production Area	
AOC A – Kerosene Tank Leak	
AOC B – Open Burning Pads Area	
AOC C – Open Detonation Pit	
AOC D – Detonation Test Building	
AOC G – Former Drying House	
AOC H – Former Drying House	
AOC I – Roof Drainage from Deto Building	
AOC J – Former Drying House	
AOC M – Former Drying House	
AOC N – Former Drying House	
AOC O – Former Drying House	

Based on a comparison of COPC concentrations with the SCOs, SWMUs 26E, 39, 42, 46, 47, and 56 were determined to require no further action due to no exceedances of the commercial use SCOs.

Excavation of impacted soils has always been the preferred remedy at the Site where implementable. Therefore, Alternative SOIL3 – Excavation, On-Site Consolidation, and Capping was selected for non-energetic and sensitive units because it is equally protective of human health and the environmental over the long-term as alternative SOIL4 – Excavation and Off-Site Disposal. Excavation of all soils exceeding the industrial use SCOs shown in **Table 3-1** is proposed for this selected alternative.

Direct exposure, fugitive dust inhalation, and future erosion and transport of the Site COPCs in storm water runoff is eliminated by removing the impacted soils and managing them at one consolidation unit designed to eliminate these potential risks. The additional actions under alternative SOIL4 of transportation of impacted soils to an off-site disposal facility would have the implementability concerns and short-term impacts to surrounding community, which would not be experienced with alternative SOIL3. The impacts, which would be avoided, include:

- The anticipated risks to workers and the general public associated with transportation from the Site to the treatment/disposal facility. A key concern is the potential for spills and releases of contaminated soils on public roads and within residential neighborhoods.
- Traffic resulting from the transportation of approximately 8,424 CY of soil exceeding the industrial use SCO for off-site disposal. This would involve approximately 648 roundtrip truckloads through the community and increase the potential for road accidents in the narrow roads and streets around the area. Further, many of the land use abutting the Site and surrounding the County's highways are sensitive to high volumes of traffic with noise, odor, dust, and exhaust emissions from heavy traffic likely to pose concerns for the community.
- Throughout Ulster County, physical constraints or impediments exist on County and State highways that hinder the flow of traffic, especially truck traffic. These include steep grades, aging or low bridges, awkward intersection geometry, and narrow or curving roadways.
- Further, this truck traffic will results in wear and tear to the local road system due to 648 roundtrip truckloads of soil sent off-site for disposal.
- Generation of nearly 736 metric tons of carbon dioxide (CO_2) associated with combustion of approximately 71,978 gallons of diesel fuel (assumes 648 loads at 722 miles per roundtrip). Greenhouse gas emissions calculations are provided in **Appendix G.**

In addition, alternative SOIL3 is equally or more protective that alternative SOIL4 while costing approximately $1,500,000 less depending upon the SCO used for cleanup.

Alternative SOIL2 – Cover was selected for the remaining SWMUs due to the potential presence of energetic materials within these SWMUs. A cover will be the safest remedy for limiting interaction with potentially energetic materials and protecting the health and safety of Site workers while eliminating direct contact, fugitive dust inhalation, and future erosion and transport of COPCs within these SWMUs to the Site drainage ways and Wetlands Complex. In addition, federal regulations may prohibit the transportation of potential energetic materials that may exist in the former landfills as discussed in **Section 3.4.2**. As discussed in **Section 5**, the leaching of inorganic COPCs to the groundwater is not evidenced at the Site; however, the low-permeability soil proposed for the cover will limit water infiltration and leaching through the consolidation unit.

Alternative SOIL4 is only proposed for any excavated soil, which is determined to be hazardous based on TCLP analyses.

10.2 Preferred Sediment Corrective Measures Alternatives

Based on the evaluation of the four sediment alternatives presented in Section 9, the following alternatives have been selected for impacted sediment at the Site:

Table 10-2: Preferred Sediment Corrective Measures Alternatives

SWMU/AOC	Group	Preferred Alternative
SWMU 1 – Shooting Pond	Shooting Pond	SED 2: Cover
SWMU 1/22 – Wetlands Complex	Wetlands	SED 3: Excavation, On-Site Consolidation, and Capping

Alternative SED3 – Excavation, On-Site Consolidation, and Capping has been selected for impacted sediment in the Wetlands Complex, which also includes the two drainage ways that transverse the Site, and the area downstream (off-site) of the Wetlands Complex. Under SED3, sediments will be excavated using a mass removal technique, which proposes the removal of sediment to the native (unimpacted) clay layer in the Site drainage ways, the Wetlands Complex, and the area downstream (off-site) of the Wetlands Complex. The clay, which underlies all of the wetland areas, is a natural impediment to vertical migration of impacts, with the clay extending to a depth of at least 50 feet below grade (based on borings from the adjacent facility). Runoff from the facility and historic landfills and associated deposition of sediment at surface is the sole contributor to impacts in this area.

This remedial approach is the most conservative as it effectively removes all impacted sediments from the SWMU 1/22 Wetlands Complex. In addition, it eliminates cost and schedule delays associated with confirmation sampling, using a similar strategy as was approved by the NYSDEC to address the drainage ditches from the operational portion of the facility. The NYSDEC DFWMR has stated that a minimum of 22 additional SQT samples would be required to develop Site-specific PRGs. However, there is no guarantee that this additional sampling will satisfy their concerns about sufficient sample density. Delineation of impacted sediments using the SELs as delineation criteria will require additional delineation and confirmatory sampling to ensure that all sediments above the SELs have been removed.

Future impacts to benthic invertebrate communities; potential risks to wildlife, exposed to target inorganics, that forage exclusively within the Wetlands Complex; and future transport of impacted sediments off-site in storm water are eliminated by removing the impacted sediment and managing them at one consolidation unit designed to eliminate these potential risks. Transportation of impacted sediment to an off-site disposal facility (SED4) was not selected primarily due to implementability concerns. These include:

- The physical nature of the sediment increases the potential for releases during transportation that could expose the surrounding community.
- The excavated sediment would pose a risk while on-site and during transportation from the Site to the treatment/disposal facility since it would be more accessible to ecological exposure.
- Traffic resulting from the transportation of approximately 17,829 CY of impacted sediment for off-site disposal (approximately 1,372 roundtrip truckloads for sediment removal) would pose a potential nuisance to the community and increase the risk for accidents and spills.
- The excavated sediments would need to be dewatered prior to transportation off-site and have the potential to drip or leak from trucks during transportation.
- Many land uses surrounding the County's highways are especially sensitive to high volumes of truck traffic. Residents typically do not enjoy the noise trucks produce in their neighborhoods, especially at night.
- Throughout Ulster County, physical constraints or impediments exist on County and State highways that hinder the flow of traffic, especially truck traffic. These include steep grades, aging

or low bridges, awkward intersection geometry, and narrow or curving roadways. They exist due to Ulster County's natural landscape and an aging highway network designed primarily for passenger vehicles.

- Further, this truck traffic will result in wear and tear to the local road system due to 1,372 roundtrip truckloads of sediment sent off-site for disposal.
- Generation of nearly 1,558 metric tons of CO_2 associated with combustion of approximately 152,398 gallons of diesel fuel (assumes 1,372 loads at 722 miles per roundtrip). Greenhouse gas emissions calculations are provided in **Appendix G.**

In addition, alternative SED3 is equally or more protective that alternative SED4 while costing approximately $2,000,000 less depending upon the removal method.

Alternative SED2 – Cover has been selected for SWMU 1 – Shooting Pond due primarily to the potential presence of energetic materials. In addition, federal regulations may prohibit the transportation of potential energetic materials that may exist in the former landfills as discussed in **Section 3.4.2**. The pond will be dewatered and filled with excavated sediment/soil or clean backfill and capped as part of the on-site consolidation unit.

10.3 Preferred Groundwater Corrective Measures Alternatives

Based on the evaluation of the two groundwater alternatives presented in Section 9, the following alternatives have been selected for impacted groundwater at the Site:

Table 10-3: Preferred Groundwater Corrective Measures Alternatives

SWMU/AOC	Group	Preferred Alternative
SWMU 24 – Former Wastewater Treatment Facility	Groundwater	GW2: Monitored Natural Attenuation with Institutional Controls
SWMU 30 - Drainage Ditch (downgradient of Bldg 2036)	Groundwater	
SWMU 37 – Former Shell Plant Drum Storage Area	Groundwater	

Alternative G2: Monitored Natural Attenuation with Institutional Controls is protective of human health and the environment. The most recent groundwater results, in October 2012, detected VOCs above their respective Class GA GWQS near the Shell Plant and SWMUs 24, 30, and 37 and inorganics in the immediate vicinity of some of the SMWUs within the Active Plant Area. However, based on the HHRA previously discussed in **Section 6**, the potential exposure pathway from direct exposure to impacted groundwater is incomplete based on the following:

- Migration of VOCs and inorganic constituents, as evidenced by water quality data collected during the Groundwater Investigation and subsequent semi-annual groundwater sampling program, is significantly limited by the low permeability silty clay and clay deposits.
- The Wetlands Complex is a local discharge point for groundwater flow from the Active Plant Area local discharge point for groundwater flow, both in the shallow and deep overburden deposits. As a result, groundwater from the Site does not migrate east of the wetlands.
- Data collected during the Groundwater Investigation (Eckenfelder, 1996) indicate that potential groundwater receptors (i.e., properties located downgradient of the facility) are served by public water (Port Ewen Water Supply).

- The closest residences are approximately 2,700 ft from the facility and are located on the opposite side of the wetlands. Groundwater beneath the facility discharges to the Wetlands Complex prior to reaching these off-site locations
- The groundwater users nearest the facility (i.e., those not served by public water) are located approximately 3,000 ft upgradient of the Site and thus, are not subject to potential groundwater impacts from the Site.

Based on the fate and transport discussions in **Section 5**, VOC impacts are not believed to be transported laterally away from the source area, and VOC impacts have not been detected in surface water samples in the Wetlands Complex (which is the local discharge point for shallow groundwater beneath the Site); therefore, the discharge of VOC-impacted groundwater to surface water is not expected to be an active transport pathway.

The land use restriction proposed under the preferred soil corrective measure alternative(s) will be expanded to notify future property owners of the presence of COPCs in groundwater and prohibit groundwater use. The SMP proposed under the preferred soil corrective measures alternative(s) will be expanded to include the necessary elements to address groundwater.

10.4 Preferred Indoor Air Corrective Measures Alternatives

Based on prior approval from NYSDEC, the following corrective measures alternative were previously selected to address potential impacts to indoor air quality at the Shell Plant and the LCSB. Indoor air quality monitoring will continue to be performed on an annual basis until the Shell Plant is demolished or rendered uninhabitable. The LCSB has been demolished so future risk of impacts to indoor air in this building no longer exist.

10.5 Corrective Measures Alternatives Cost Estimate

The following table summarizes the total estimated cost associated with the preferred corrective measures alternatives for impacted media at the Site.

Table 10-4: Cost Estimate Summary for Preferred Corrective Measures Alternatives

<table>
<tr><th>Alternative</th><th colspan="2">Estimated Total Cost</th></tr>
<tr><th>Soil</th><th>Industrial Use SCO (delineated to mid-point as shown in Appendix B)</th><th>Industrial Use SCO (delineated to below SCO as shown in Appendix C)</th></tr>
<tr><td>SOIL2</td><td>$255,406
(includes capping of SWMUs 23 & 32)</td><td>$255,406
(includes capping of SWMUs 23 & 32)</td></tr>
<tr><td>SOIL3</td><td>$2,116,638</td><td>$2,465,755</td></tr>
<tr><th>Sediment</th><th>Mass Removal (original estimate)</th><th>Mass Removal (including downstream areas)</th></tr>
<tr><td>SED3</td><td>$5,186,054
(Mass Removal; includes cost for capping SWMUs 22 & 35)</td><td>$5,480,145
(Mass Removal; includes cost for capping SWMUs 22 & 35)</td></tr>
<tr><th>Groundwater</th><th colspan="2"></th></tr>
<tr><td>GW2</td><td colspan="2">$252,367</td></tr>
<tr><th>Indoor Air</th><th colspan="2"></th></tr>
<tr><td>Indoor Air Monitoring</td><td colspan="2">$78,865</td></tr>
<tr><td>TOTAL</td><td>$7,889,330</td><td>$8,532,538</td></tr>
</table>

11.0 OVERVIEW OF THE SELECTED REMEDY

The remedial approach and specific corrective measures alternatives were selected as the most protective of human health and the environment through source removal and control, and groundwater protection and restoration. The selected remedies provide a sustainable approach to remediation, balancing social environmental and economic outcomes for the community. In assessing the sustainability of the proposed approach, an analysis of DER 13 Green Remediation policy (NYSDEC, 2010) was completed with the following key outcomes and observations:

- Areas of energetic waste disposal will be addressed through a cover (Alternative SOIL2) to eliminate the risks to workers and the public associated with excavation, handling and transport of these materials, and to limit the infiltration of water through the material left in place. In addition, federal regulations may prohibit the transportation of potential energetic materials that may exist in the former landfills as discussed in **Section 3.4.2**.
- Alternatives SOIL3 and SED3 (Excavation, On-Site Consolidation, and Capping) were selected for soil and sediment in non-energetic and sensitive SWMUs because they are-protective of human health and the environment with the potential impacts and risks associated with Excavation and Off-Site Disposal (SOIL4 and SED4). Excavation and offsite disposal introduces a number of potential impacts and risk that affect the sustainability of the approach. These include:
    - The risks to worker and the general public associated with transportation from the Site to the treatment/disposal facility. A key concern is the potential for spills and releases (especially of the saturated sediments) of contaminated soils and sediments on public roads and within residential areas.
    - Traffic resulting from the transportation of approximately 8,424 CY of impacted soil and 17,829 CY of impacted sediment for off-site disposal. This would involve approximately 1,930-roundtrip truck and trailer loads through the community and increase the potential for road accidents in the narrow roads and streets around the area. Further many of the land use abutting the Site and surrounding the County's highways are sensitive to high volumes of traffic with noise, odor, dust and exhaust emissions from heavy traffic likely to pose concerns for the community. .
    - Throughout the county, physical constraints or impediments exist on County and State highways that hinder the flow of traffic, especially truck traffic. These include steep grades, aging or low bridges, awkward intersection geometry, and narrow or curving roadways. This extra heavy traffic and the addition wear and tear on the local road system will be a concern to the county.
    - Impacted soils excavated on the Active Plant will be used to stabilize the excavated sediments as they are placed in the on-site consolidation unit; this beneficial reuse reduces the need for off-site borrow or other stabilizing materials.
    - In addition, alternatives SOIL3 and SED3 are equally or more protective that alternatives SOIL4 and SED4 while costing approximately $3,500,000 less.
- Similarly, the groundwater remediation alternative selected (GW2) provides an alternative that is protective and sustainable. This alternative consists of use restrictions on groundwater, natural attenuation processes to reduce concentrations of COPCs in groundwater, and long-term groundwater monitoring to evaluate changes in groundwater conditions. Key components of the remedy comprise
    - A land use restriction (e.g., in the form of a deed restriction or environmental easement) would notify future property owners of the presence of COPCs in groundwater at the Site, restrict the use of on-site groundwater, and notify the owners of the applicability of an SMP. Existing groundwater use laws [10 NYCRR 5-1.31(b)], which prohibit the installation of private wells where public supply is available (unless approval is expressly granted by the public water authority), would continue to minimize potential human

exposure to constituents in groundwater at concentrations exceeding the groundwater quality standards/guidance values. The use restriction would apply to groundwater beneath the Site
  - A SMP would be prepared under this alternative to: (1) identify areas of impacted groundwater associated with the Site; and (2) address possible future intrusive activities that would result in the potential for contact with impacted groundwater (to minimize the performance of work below the water table and/or dewatering without appropriate controls and measures).
  - Long-term monitoring will be initiated to evaluate the effectiveness of the source area removal and capping and the natural attenuation groundwater remedy.

11.1 Conceptual Approach to Implementation

Impacted Site soil and sediment will be excavated and consolidated at SWMU 22 located in the Wetlands Complex. SWMU 22 was chosen for the location of the consolidation unit over other locations for the following reasons:

- Majority of impacted material is off-site in the Wetlands Complex (approximately two times more sediment than impacted soil)
- SWMU 22 already requires capping, which will require long-term management
- SWMU 22 has the largest surface area to be covered
- The constituents and concentrations of impact within the wetland area are consistent with the constituents and contaminant concentrations observed on the Site.
- There are major technical issues associated with the transportation of wet sediment back to the Active Plant Area for consolidation. These include:
  - continuous truck traffic through the security gate and across the rail lines which create logistical concerns
  - the volume of traffic through the active plant which creates impediments for operations and major safety concerns; and,
  - handling and transportation of wet sediment, which could result in spillage along the access road and within the main plant.
- Majority of soil excavated from Active Plant Area will be dry and readily transportable to SWMU 22 for consolidation

In order to implement remediation at the Site a phased program of works will have to be adopted, with this program likely to extend over two earthworks seasons. Further, it is anticipated that work with the wetlands and plant areas may be undertaken in parallel. The key components of this phased program of works is described below

Prior to corrective measures implementation, the wetlands area will be delineated. Within one month of wetlands delineation, a regional NYSDEC wetland biologist will verify the wetlands delineation boundaries. Upon receipt of NYSDEC approval of the wetlands delineation boundaries, corrective implementation will commence. The stream currently running through the Wetlands Complex will be re-routed around the west side of SWMU 22 and will temporarily discharge north of sample location SQT-8 as conceptualized in **Figure 11-1**. Rerouting of the stream, coupled with dewatering of the Wetlands Complex will facilitate the construction of the consolidation unit at SWMU 22 and for excavation of impacted sediments within the Wetlands Complex. After dewatering of the Wetlands Complex, inert fill will be imported to SWMU 22 to construct the containment cell for the consolidation unit (earthen berm). A typical cross-section of the conceptual containment cell is provided in **Figure 11-2**.

The containment cell (earthen berm) will be constructed of low permeability soils, which will be keyed into the underlying native low permeability clays. These low permeability clays underlie the landfill and the entire wetland area and in combination with the low permeability earthen berm will contain constituents within the consolidation unit. The low permeability earthen berm and underlying clays and a low permeability soil cover will reduce both infiltration and the potential for flux of constituents from the landfill into the wetland.

Given the presence of low permeability clays at the site, the construction of a low permeability consolidation unit wall will essentially act as a physical barrier to water flow much like a slurry wall or sheet pile wall. This wall will be as effective as slurry walls and sheet piles in containing constituents within the landfill and considering site conditions (clays near surface and activities already planned to remove impacted sediments to the clay) is the most practical option. Slurry walls and sheet piles are used for containment of deep impacts and by design are keyed into low permeability units. Construction of a slurry wall or sheet piles above grade and keyed into the shallow clays is not practical.

Following construction of the low permeability containment wall around the consolidation area, the outer wall of the consolidation unit will be protected with rock and/or rip rap. This riprap and the realignment of the creek will ensure the long-term stability of the unit, with water from the capped landfill shed directly to the wetland area.

Once the consolidation unit is constructed, implementation of corrective measures alternatives will commence with the construction of the covers recommended for the former landfills (SWMUs 23, 32, and 35). These SWMUs are located in isolated areas that will not be disturbed by excavation activities. The cover implementation will be performed prior to excavation of the rest of the SMWUs/AOCs on-site to prevent re-contamination of downgradient-excavated areas by impacted soil that could migrate from these units via storm water during a rain event.

Excavation of the proposed SWMUs/AOCs at the Active Plant Area will commence following the cover construction at SWMUs 23, 32, and 35. Silt fencing will be placed around and especially downgradient of all SWMUs/AOCs prior to beginning excavation to prevent the transport of impacted soil during a rain event. Impacted soil will be excavated and characterized prior to transport to the consolidation unit. Clean backfill will be imported to fill the excavated area and then the area will be seeded or covered with asphalt and/or concrete depending on its location and vicinity to facility traffic and operations. Excavation at the Active Plant Area will be performed prior to remediation of the drainage ways and Wetlands Complex to prevent their recontamination by impacted soil that could migrate from the Active Plant Area via storm water during a rain event.

Following remediation of the Active Plant Area, the two Site drainage ways, followed by the Wetlands Complex, and the downstream (off-site) area, will be excavated to the native clay layer to remove impacted sediment. Sand embankments and filter beds will be constructed within the wetland structure to facilitate the drainage of sediment and prevent the migration of impacted sediment from the work areas. Following drainage, the impacted sediments will be blended/stabilized with a combination of fly ash and excavated soil from the plant to allow for placement on the landfill. After consolidation of impacted soils and sediments within the SWMU 22 area, inert fill will be imported to develop a stable subgrade landform on which a cover can be placed over the consolidation unit above SWMU 22. The cover will consist of a geotextile to serve as a marker for the impacted soil/sediment, 18 inches of low permeability fill/clay, 6 inches of top soil, and a vegetative cover. Compaction of the consolidated soil and sediment and the cover will not be performed due to the risk of vibration and disturbance of potential energetic material in the SWMU 22 landfill. Therefore, settling and consolidation of the newly constructed unit may occur so in the short-term additional materials may be brought on-site for maintenance of the cover.

The fate and transport of COPCs from the consolidation unit has been considered and leaching of constituents from the landfill is not a concern.

The combination of the physical properties of the constituents (which are not mobile) and the design of the consolidation unit (underlain, contained and capped with low permeability silts and clays), flux of constituents from the unit to the wetland will not occur. As discussed in **Section 5**, the dissolution and leaching of inorganic constituents from soil and sediment into groundwater or surface water at the Site is limited. This reflects the strong CEC of the soils and the organic rich nature of the sediments. The incorporation of the low permeability native silts and clays, a silt/clay containment wall and a low permeability soil cover will further limit potential flux.

Once excavation, consolidation, and capping activities are complete, the consolidation unit area will be fenced and final stream and wetlands restoration will commence. The rerouted stream will be realigned to discharge near sample location SQT-6, the downgradient portion of the temporary stream bed will be regraded and stabilized, the excavated areas will be backfilled to design grade and vegetated with native plants and grasses.

Conservatively, it is estimated that approximately 10 acres of wetlands will be impacted by the Wetlands Complex remediation. This area is likely to decrease once the jurisdictional wetlands within SWMU 1/22 have been delineated and surveyed. Wetlands mitigation will replace the existing low-quality wetland with one that will strive to expand the ecological functions and societal benefits of those wetlands beyond the present conditions. Renderings providing a before and after remediation look at the Wetlands Complex are provided as **Figures 11-3** through **11-5**. Following the Wetlands Complex mitigation efforts, long-term groundwater monitoring of existing monitoring wells MW-8, MW-9, MW-10, MW-17S, and MW-18S (**Figure 2-5**) for inorganics will be performed on an annual basis to assess whether or not water traveling through the new consolidation unit and the SWMU 22 landfill below it affects the surrounding area. Additional monitoring wells may be proposed if the existing wells are damaged or abandoned during corrective measures implementation or if the routine groundwater data warrants. In addition, maintenance will be initiated to maintain the cover over the consolidation unit.

12.0 REFERENCES

AECOM, 2012. Revised Certification Report: Magazines A, B, C, F and Liquid Chemical Storage Building RCRA Unit Decontamination and Closure. January 20.

ASTDR, 1999. Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile for Mercury.

A.T. Kearney, 1993. RCRA Facility Assessment Report for IRECO/DYNO, Inc., Port Ewen Facility, Port Ewen, New York. October.

Blume and Brummer, 1991. Prediction of Heavy Metal Behavior in Soil by Means of Simple Field Tests. Ecotoxicol Environ Safety 22:164-174.

Brown and Caldwell, 1999. RCRA Facility Investigation (RFI) Report, Dyno Nobel Facility, Port Ewen, New York. December.

Brown and Caldwell, 2002. Memorandum to Paul Patel (NYSDEC) from Jeff Caputi, RE: Preliminary Evaluation of the CAMU Alternative, Dyno Nobel – Port Ewen, New York. March 13.

Brown and Caldwell, 2003. Addendum to the Corrective Measure Study (CMS), DYNO Port Ewen Plant, Port Ewen, New York. September 22.

Cornerstone, 2009. Mercury Cleanup Objectives, Corrective Measures Study (CMS), Dyno Nobel, Port Ewen. November 25.

Eckenfelder, 1994. RCRA Facility Investigation Report for the Ireco/Dyno, Inc. Port Ewen Facility, Port Ewen, New York, EPA I.D. NYD000799122. October.

Eckenfelder, 1996. Groundwater Investigation Report, Dyno-Nobel Inc. Site, Port Ewen, New York. January.

Eckenfelder, 1997. Documentation of Interim Corrective Measures (ICM) for Explosives, Dyno Nobel Facility, Port Ewen, New York. January.

Eckenfelder, 1997. RCRA Facility Investigation Work Plan, Dyno Nobel Facility, Port Ewen, New York. April.

Eckenfelder, 2000. Corrective Measures Study (CMS), DYNO Port Ewen Plant, Port Ewen, New York. December.

Howard, P.H. 1991. Handbook of environmental degradation rates Lewis Publishers

HydroQual, 2005. Supplement to Corrective Measure Study, Dyno Nobel Port Ewen. October 4.

HydroQual, 2006. Revision to CMS Soil Screening Criteria, Dyno Nobel Port Ewen. September 1.

Long, E.R., and L.G. Morgan, 1990. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National States and Trends Program. National Oceanic Atmospheric Administration (NOAA) Technical Memorandum No. 5, OMA52, NOAA National Ocean Service, Seattle, Washington.

NYSDEC, 1994. Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites. Division of Fish and Wildlife.

NYSDEC, 1999. Technical Guidance for Screening Contaminated Sediments, Division of Fish, Wildlife, and Marine Resources. January.

NYSDEC, 2007. Soil Vapor Investigation – Shell Plant, Dyno Nobel Port Ewen. July 2.

NYSDEC, 2010. Technical Guidance for Site Investigation and Remediation (DER-10). May.

NYSDOH, 2006. Guidance for Evaluating Vapor Intrusion in the State of New York, Center for Environmental Health, Bureau of Environmental Exposure Investigation.

Persaud, D., Jaagumagi, R., and A. Hayton, 1992. Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario. Ontario Ministry of the Environment, Queen's Printer for Ontario.

URS, 2007. Ecological Evaluation Site Description Report. Dyno Nobel Site, Port Ewen, New York. December 17.

URS, 2009. Fish and Wildlife Impact Analysis Report, Dyno Nobel Site, Port Ewen, New York. April 29.

URS, 2010. Fish and Wildlife Impact Analysis Step IIC Investigation Work Plan, Dyno Nobel Site, Port Ewen, New York. April 29.

URS. 2011a. Summary of Downstream Sampling Results. Dyno Nobel Port Ewen Facility. Port Ewen, New York. January 3, 2011.

URS, 2011b. Fish and Wildlife Impact Analysis Step IIC Investigation Report, Dyno Nobel Site, Port Ewen, New York. April 12.

USEPA, 1992. Estimating Potential for Occurrence of DNAPL at Superfund Sites OS-220W 9355.4-07FS

USEPA, 1996. Field Sampling and Selecting On-Site Analytical Methods for Explosives in Soil

USEPA, 1997. Mercury Study Report to Congress. Volume III: Fate and Transport of Mercury in the Environment. Office of Research and Development and Office of Air Quality Planning and Standards, Washington, DC.

USEPA, 2001. Supplemental Guidance Document for Evaluating the Vapor Intrusion to Indoor Air Pathway, Table 2. October 23.

USEPA, 2005 Toxicological Profile for Zinc Agency for Toxic Substances and Diseases Registry

USEPA, 2006. Mercury Transport and Fate through a Watershed. Office of Research and Development National Center for Environmental Research Washington, DC.

USEPA, 2007a Toxicological Profile for Barium Agency for Toxic Substances and Diseases Registry

USEPA, 2007b Toxicological Profile for Arsenic Agency for Toxic Substances and Diseases Registry

TABLES

TABLE 2-1
HISTORICAL ON-SITE DISPOSAL/TREATMENT AREAS

Dyno Nobel Site
Port Ewen, New York

Area	Management/Treatment Method	Materials Disposed/Treatment
Shooting Pond	Underwater Detonation	Off-specification energetics and process water
Burning Area	Open burning in fabricated cage and incinerator	Waste material contaminated with energetics and/or reactive raw materials
Copper Wire Burning Area	Open burning on concrete pad	Copper wire with energetics
Iron Wire Burning Area	Open burning on unlined soil pit	Iron wire with energetics
Wire Burning Area III	Open burning of unknown material	Burning of unknown materials
Open Burning Pads	Open burning on unlined soil	Off-specification caps and detonators, energetic contaminated packaging material, waste powder, used wipes, Q-tips and syringes
Former Burning Area	Open burning on unlined soil	Waste energetics
Open Detonation Pit	Detonation of blasting caps and devices for research and development	Blasting caps

TABLE 2-2
LIST OF INVESTIGATIONS, STUDIES AND CORRESPONDENCE

Dyno Nobel Site
Port Ewen, New York

Date	Title or Subject	Author
December 1983	Phase I Investigation	EA Science and
July 1990	Phase II Investigation	Gibbs and Hill, Inc.
October 1993	RCRA Facility Assessment (RFA)	A.T. Kearny
August 1994	Revised RFA	Eckenfelder, Inc.
February 1995	Work Plan for Interim Corrective Measures	UXB International Inc.
April 1995	Groundwater Investigation Work Plan, Dyno Nobel, Port Ewen, New York	Eckenfelder Inc.
May 1995	Sampling Visit Work Plan, Dyno Nobel Facility, Port Ewen, New York	Eckenfelder Inc.
January 1996	Groundwater Investigation Report, Dyno Nobel, Port Ewen, New York	Eckenfelder Inc.
March 1996	Work Plan for Interim Corrective Measures Related to Removal of Reactives Contaminated Soils and Remediation of Hand Grenade Disposal Sites, Dyno Nobel Inc., Port Ewen, New York	UXB International Inc.
April 23, 1996	Letter to NYSDEC - Bldg. 2073 Sampling Visit Work Plan	Eckenfelder Inc.
june 1996	Work Plan for Determination of Explosive Material in Detonation Pond	UXB International Inc.
June 28, 1996	Letter from NYSDEC - Approval of Bldg. 2073 Sampling Visit Work Plan	NYSDEC
August 1996	RFI Task II Report, Dyno Nobel Inc. Site, Port Ewen, New York	Eckenfelder Inc.
August 27, 1996	Letter from NYSDEC - Approval of UXB Work Plan for Detonation Pond	NYSDEC
September 5, 1996	Letter to NYSDEC - Acknowledge approval to proceed with UXB work	Dyno
January 1997	Documentation of Interim Corrective Measures (ICM) for Explosives, Dyno Nobel Facility, Port Ewen, New York	Eckenfelder Inc. and UXB International Inc.
February 27, 1997	Sampling Visit Report, Dyno Nobel Facility, Port Ewen, New York	Eckenfelder Inc.
April 1997	RCRA Facility Investigation Work Plan, Dyno Nobel Facility, Port Ewen, New York	Eckenfelder Inc.
May 2, 1997	DEC Approval letter of Sampling Visit Report	NYSDEC
June 17, 1997	Comments from NYSDEC on RFI Work Plan	NYSDEC
July 24, 1997	Response to NYSDEC comments on RFI Work Plan	Eckenfelder Inc.
August 8, 1997	NYSDEC Approval letter of Groundwater Investigation Report and RFI Work Plan	NYSDEC
January 6, 1998	Phase I Horizontal Delineation Analytical Results	Kirkpatrick to Aldrich
February 18, 1998	NYSDEC comments on Phase I Analytical Results and proposed Phase II Work	NYSDEC
March 6, 1998	Response to NYSDEC comments on Phase II Work	Eckenfelder Inc.
April 6, 1998	NYSDEC approval letter for Phase II Work	NYSDEC
July 31, 1998	Phase II Horizontal Delineation Analytical Results	Kirkpatrick to Aldrich
September 9, 1998	SWMU No. 1 Analytical Results	Kirkpatrick to Aldrich
September 23, 1998	NYSDEC approval letter for Phase III Work	NYSDEC
January 8, 1999	Phase III Horizontal Delineation Analytical Results	Kirkpatrick to Aldrich
March 24, 1999	NYSDEC approval letter for Phase IV Work	NYSDEC
April 30, 1999	Vertical Delineation Work Plan	Kirkpatrick to Aldrich
June 2, 1999	Meeting with NYSDEC to discuss Vertical Delineation Work Plan	
June 17, 1999	NYSDEC approval letter of Vertical Delineation Work Plan	NYSDEC
July 2, 1999	Phase IV Horizontal Delineation Analytical Results	Kirkpatrick to Aldrich
July 27, 1999	Teleconference with NYSDEC and confirming letter Re: Safety issues related to SWMUs 1 and 48	
October 25, 1999	Vertical Delineation results forwarded to Department	Brown and Caldwell
December 3, 1999	RCRA Facility Investigation (RFI) Report	Brown and Caldwell
December 8, 1999	Meeting with Department (present RFI, update new DEC staff to project)	
December 14, 1999	Letter to NYSDEC - Bldg. 2073/2075 Investigation Results	Brown and Caldwell
July 11, 2000	Meeting with Department (discuss CMS, use screening values for non-restricted)	
July 11, 2000	NYSDEC approval of RFI Report	NYSDEC
October 31, 2000	Teleconference with NYSDEC (Progress report on CMS)	
November 15, 2000	Groundwater results to NYSDEC	Brown and Caldwell
November 30, 2000	Teleconference with NYSDEC (Progress report on CMS)	
December 1, 2000	CMS Report	Brown and Caldwell
December 15, 2000	NYSDEC approval letter on fence construction	NYSDEC
January 18, 2001	Letter to NYSDEC - Results of Bldg. 2075 (SWMU 49) Investigation	Brown and Caldwell
March 14, 2001	SWMU 51/52 Work Plan letter	Brown and Caldwell
July 5, 2001	NYSDEC letter requesting soil gas or air sampling around Shell Plant	NYSDEC

TABLE 2-2
LIST OF INVESTIGATIONS, STUDIES AND CORRESPONDENCE

Dyno Nobel Site
Port Ewen, New York

Date	Title or Subject	Author
August 23, 2001	Work Plan for Soil Gas Sampling	Brown and Caldwell
August 29, 2001	E-Mail from NYSDEC requesting additional SWMU 51 samples and TCLP analysis	NYSDEC
November 1, 2001	Progress report with TCLP and additional sample analytical data attached	Brown and Caldwell
December 13, 2001	NYSDEC letter regarding additional sampling at SWMU 52, comparison criteria, etc.	NYSDEC
January 4, 2002	Response to NYSDEC 12/13/01 letter	Brown and Caldwell
January 4, 2002	NYSDEC letter - comments on Soil Gas Work Plan	NYSDEC
January 17, 2002	Letter to NYSDEC - Transmittal of SWMU 51/52 Analytical Data	Brown and Caldwell
February 22, 2002	Meeting with NYSDEC - Preliminary comments on CMS - Request for tech. memos	
March 4, 2002	Response to 1/4/04 comments from NYSDEC on Soil Gas Work Plan	Brown and Caldwell
March 13, 2002	Tech. Memo to NYSDEC - Additional monitoring wells for Selenium	Brown and Caldwell
March 13, 2002	Tech. Memo to NYSDEC - Preliminary evaluation of CAMU alternative	Brown and Caldwell
March 27, 2002	Tech. Memo to NYSDEC - Evaluation of excavation of TCE impacted area	Brown and Caldwell
March 27, 2002	Tech. Memo to NYSDEC - Alternative corrective measures for landfill/wetland areas	Brown and Caldwell
April 26, 2002	Letter to NYSDEC - Transmittal of final SWMU 51/52 Analytical Data	Brown and Caldwell
May 24, 2002	Letter from NYSDEC - Request for Soil Gas sampling under Shell Plant slab	NYSDEC
May 31, 2002	Letter from NYSDEC - Request for installation of additional monitoring wells	NYSDEC
June 12, 2002	Submitted revised Soil Gas Work Plan consistent with NYSDEC letter of 5/24/02	Brown and Caldwell
June 12, 2002	Transmittal of Spring 02 Semi-Annual Groundwater Sampling data	Brown and Caldwell
June 12, 2002	Letter from NYSDEC - Request for summary of site monitoring wells and data	NYSDEC
June 20, 2002	Letter to NYSDEC - Response to 5/31/02 letter - proposal for additional monitoring	Brown and Caldwell
July 9, 2002	Letter to NYSDEC - Response to 6/12/02 request for summary of monitoring well	Brown and Caldwell
July 17, 2002	Letter from NYSDEC - Comments on 6/20/02 proposal for additional wells - request additional wells downgradient of Shell Plant	NYSDEC
August 7, 2002	Letter to NYSDEC - Identification of new SWMU 53 and AOCs G and H	Brown and Caldwell
August 8, 2002	Letter from NYSDEC - Request for sampling plan for new SWMU and AOCs	NYSDEC
August 13, 2002	Letter to NYSDEC - Transmittal of soil gas sampling results	Brown and Caldwell
August 22, 2002	Summary of SWMU's and AOC's at the Dyno Nobel Port Ewen, New York Facility	Brown and Caldwell
August 28, 2002	Letter to NYSDEC - Work Plan for soil sampling at SWMU 53 and AOCs G and H	Brown and Caldwell
December 30, 2002	Letter to NYSDEC - Transmit Well construction logs MW-24 through MW-26	Brown and Caldwell
January 6, 2003	Letter from NYSDEC - Request for additional Historical Review/ID other	NYSDEC
April 4, 2003	Letter from NYSDEC - Request for notification and sampling plan for AOC I	NYSDEC
April 11, 2003	Letter to NYSDEC - Notification of new AOC I	Dyno
April 17, 2003	Letter to NYSDEC - Proposed Scope of Work for Historical Review	Brown and Caldwell
April 28, 2003	Letter from NYSDEC - Conditional approval of SWMU 53, AOC G and H Sampling	NYSDEC
April 29, 2003	Letter from NYSDEC - Approval of Scope and timeframe for Historical Review	NYSDEC
May 12, 2003	Letter to NYSDEC - Response to April 28 conditional approval letter	Brown and Caldwell
May 19, 2003	Letter to NYSDEC - Work Plan for soil sampling at AOC I	Brown and Caldwell
June 30, 2003	Letter to NYSDEC - Spring 2003 GW Sampling Results	Brown and Caldwell
September 22, 2003	Addendum to the Corrective Measures Study (CMS) AKA - Site History Report	Brown and Caldwell
October 1, 2003	Letter to NYSDEC - Notification of SWMUs 54, 55 and AOCs J,K,L,M,N,O	Dyno
October 14, 2003	Letter to NYSDEC - Ass. Rpt and Sampling Plan - SWMUs 54, 55 and AOCs	Brown and Caldwell
November 17, 2003	Letter to NYSDEC - Results from SWMU 53 and AOCs G, H, I	
February 13, 2004	Letter to NYSDEC - Results from SWMU 54 and 55, AOCs J,M,N,O	HydroQual
February 20, 2004	Letter to NYSDEC - Transmit 5 aerial photo stereo pairs	HydroQual
June 1, 2004	Letter from NYSDEC - Acceptance of Site History Report/request for additional	NYSDEC
June 14, 2004	E-Mails from NYSDEC requesting additional sampling associated with historical	NYSDEC
June 29, 2004	Letter to NYSDEC - Response to June 1 letter on History Report	Dyno
July 12, 2004	Letter to NYSDEC - Spring 2004 GW Sampling Results	
July 21, 2004	Letter from NYSDEC - Additional investigation of historical accidents not required	NYSDEC
July 21, 2004	Letter to NYSDEC - Submit data packages for SWMU 54, 55, AOCs J,M,N,O	
October 13, 2004	Letter from NYSDEC - Response to data/recommendations SWMU 54, AOC	
November 12, 2004	Letter to NYSDEC - Provide revised data packages for SWMUs 53 and 55	HydroQual
December 21, 2004	Letter to NYSDEC - Notification of SWMU 56	Dyno
January 21, 2005	Letter to NYSDEC - Fall 2004 GW Sampling Results	HydroQual
January 24, 2005	Letter to NYSDEC - Assessment Report/Sampling Plan for SWMU 56	HydroQual

TABLE 2-2
LIST OF INVESTIGATIONS, STUDIES AND CORRESPONDENCE

Dyno Nobel Site
Port Ewen, New York

Date	Title or Subject	Author
February 9, 2005	Letter to NYSDEC - Results from SWMU 54 and AOCs G, H, J, M, N, O	HydroQual
April 25, 2005	Letter from NYSDEC - Comments on Data from SWMU 54, AOCs G,H, I,J,M,N,O	NYSDEC
July 28, 2005	Meeting with NYSDEC - Status of CMS Review, Inv. Additional areas	
August 5, 2005	Letter to NYSDEC - Spring 2005 GW Sampling Results	
August 15, 2005	Letter to NYSDEC - Work Plan to investigate areas outside Main Plant area	HydroQual
October 5, 2005	Supplement to Corrective Measures Study (cover letter and supplement)	HydroQual
December 19, 2005	E-Mail from NYSDEC - Approval/Clarifications on Inv. Of areas outside Main Plant	NYSDEC
January 23, 2006	Letter to NYSDEC - Fall 2005 GW sampling results	HydroQual
March 2, 2006	Letter from NYSDEC - Comments on Supplement to CMS	NYSDEC
March 6, 2006	Letter to NYSDEC - Recommended changes to GW Sampling program	HydroQual
July 7, 2006	Meeting with NYSDEC/DOH - Revised cleanup criteria, additional SVI at Shell Plant	
July 24, 2006	Letter to NYSDEC - Spring 2006 GW Sampling Results	HydroQual
July 24, 2006	Letter to NYSDEC - Results of Inv. Of areas outside Main Plant area	HydroQual
September 1, 2006	Letter to NYSDEC - Revisions to CMS screening criteria for As, Pb, Hg	HydroQual
October 2, 2006	Letter to NYSDEC - Evaluate additional alternatives for Shell Plant TCE area	HydroQual
October 23, 2006	Letter to NYSDEC - Additional soil vapor investigation Work Plan at Shell Plant	HydroQual
December 19, 2006	Letter to NYSDEC - Fall 2006 GW sampling results	HydroQual
February 23, 2007	Letter from NYSDEC - Approval of Oct 23, 2006 SVI work plan at Shell Plant	NYSDEC
May 22, 2007	Letter from NYSDEC - Comment on Sept. 1, 2006 revisions to screening criteria	NYSDEC
July 2, 2007	Letter to NYSDEC - Report results of sub slab and indoor air sampling at Shell Plant	HydroQual
August 3, 2007	Letter to NYSDEC - Respond to May 22, 2007 NYSDEC letter on screening criteria	HydroQual
August 8, 2007	Letter from NYSDEC - Requirements for Shell Plant indoor air	NYSDEC
August 17, 2007	Letter from NYSDEC - Request clarification of selected responses in Aug. 3, 2007	NYSDEC
September 11, 2007	Letter to NYSDEC - Respond to Aug. 17, 2007 NYSDEC letter with clarifications	HydroQual
December 17, 2007	Ecological Evaluation Site Description	URS
February 5, 2008	Teleconference with DEC on Eco Evaluation Site Description	URS
February 13, 2008	Letter from NYSDEC - Comments on December 17, 2007 Eco Evaluation Site	NYSDEC
March 10, 2008	Letter to NYSDEC - Report results of indoor air sampling in Shell Plant	HydroQual
March 17, 2008	Supplemental Information for Eco Risk Site Description Report	URS
April 4, 2008	Memo from DOH (Crance) to DEC (Patel) - Review of March 17, 2008 Sup. Info on	NYSDEC
April 9, 2008	DEC representatives and URS tour site relative to Eco risk	URS
June 16, 2008	Letter from NYSDEC - Comments on Sup. Info for Eco Risk	NYSDEC
July 17, 2008	Letter to NYSDEC - Respond to NYSDEC June 16, 2008 letter on Eco Risk	URS
July 17, 2008	Letter to NYSDEC - Work Plan to quantify elemental vs. inorganic mercury	HydroQual
August 28, 2008	Email to NYSDEC providing details on sequential extraction and mercury speciation	HydroQual
September 23, 2008	Teleconference with DEC and lab on mercury speciation	HydroQual
October 31, 2008	Letter from NYSDEC - Rejection of July 17 response to Sup. Info on Eco Evaluation and reactive soils.	NYSDEC
November 25, 2009	Letter to NYSDEC - Corrective Measures Study Mercury Cleanup Objectives	Cornerstone
March 2, 2010	Memo to NYSDEC - Request for NYSDEC DFWMR Guidance Documents	URS
March 29, 2010	Letter to NYSDEC - Report results of indoor air sampling in Shell Plant	Cornerstone
April 29, 2010	FWIA Step IIC Investigation Work Plan	URS
April 12, 2011	FWIA Step IIC Investigation Report	URS
April 18, 2011	Letter to NYSDEC - Report results of indoor air sampling in Shell Plant	EHS Support
July 28, 2011	Spring 2011 Semi-Annual Groundwater Monitoring Event	Antea Group
August 18, 2011	Letter to NYSDEC - Conceptual Remedial Approach and Planning Level Estimates SWMU 1/22 Wetlands	EHS Support
October 10, 2011	Wetland Delineation Report	URS
December 22, 2011	Fall 2011 Semi-Annual Groundwater Monitoring Event	Antea Group
November 7, 2012	Spring 2012 Semi-Annual Groundwater Monitoring Event	Antea Group
May 3, 2012	Letter to NYSDEC - 2012 Shell Plant Indoor Air Sampling Results	EHS Support

TABLE 2-3
SOLID WASTE MANAGEMENT UNITS (SWMUs) AND AREAS OF CONCERN (AOCs) REQUIRING A CORRECTIVE MEASURES STUDY

Dyno Nobel Site
Port Ewen, New York

SWMU/AOC	Description
Solid Waste Management Units (SWMUs)	
1/22	Wetlands Complex
1	Shooting Pond
2	Burning Cage/Incinerator
3	Copper Wire Burning Area
4	Iron Wire Burning Area
5	Wire Burning Area III
6	Open Burning Pads
7	Open Burning Pads
8	Former Burning Area
9	Waste Powder Catch Basins - Building 2037
10	Waste Powder Catch Basins - Building 2048
11	Waste Powder Catch Basins - Building 2049
13	Former Waste Powder Catch Basins - Lead Azide Building
21	Lead Recycling Unit Area
22	Former Landfill
23	Former Dump
24	Former Wastewater Treatment Facility
26D	Burnable Waste Satellite Accumulation Area
26E	Burnable Waste Satellite Accumulation Area
26G	Burnable Waste Satellite Accumulation Area
29	Drainage Ditch (Downgrade of Building 2049)
30	Drainage Ditch (Downgrade of Building 2036)
32	Old Dump (near water tower)
33	Mercury Fulminate Tanks Area
35	Stone Fence Dump
37	Former Shell Plant Drum Storage Area
39	Former Washwater Discharge Area - Building 2009
40	Pilot Line Condensate Collection Sump
42	SAC Building Steam Collection Containers
46	Vacuum Line Condensate Collection Sump - Building 2059
47	Building 2058 Fuse Room
48	Mercury Fulminate Area
52	Former Commercial Lab Shooting Area
54	Former Historical Production Area
56	Vent System for Static Security Testing Chamber
Areas of Concern (AOCs)	
A	Kerosene Tank Leak
B	Open Burning Pads Area
C	Open Detonation Pit
D	Detonation Test Building
G	Former Drying House
H	Former Drying House
I	Roof Drainage from Deto Building
J	Former Drying House
K	Former Drying House
L	Former Drying House
M	Former Drying House
N	Former Drying House
O	Former Drying House
Additional Areas for Evaluation	
Shell Plant	Shell Plant
LCSB	Liquid Chemical Storage Building

TABLE 3-1
CONSTITUENTS OF POTENTIAL CONCERN (COPCs) AND THEIR APPLICABLE CHEMICAL-SPECIFIC STANDARDS, CRITERIA, AND GUIDELINES (SCGs)

Dyno Nobel Site
Port Ewen, New York

COPC	CAS Number	Soil		Groundwater	Surface Water	Sediment				Indoor Air	Waste
		Commercial Use SCO[1] (mg/kg)	Industrial Use SCO[1] (mg/kg)	Class GA GWQS[2] (µg/L)	Class C SWQS[2] (µg/L)	SEL[3] (µg/g)	Invertebrate PRG[4] (mg/kg)	Wildlife PRG_{lo}[4] (mg/kg)	Wildlife PRG_{hi}[4] (mg/kg)	Guidance Value[5] (µg/m³)	Toxicity Characteristic Criteria[6] (mg/L)
Metals											
Aluminum		NS		100	100	Not Applicable				Not Applicable	NS
Antimony		NS		3	NS	25	Not applicable				NS
Arsenic	7440-38-2	16	16	25	150	33					5
Barium	7440-39-3	400	10,000	1000	NS	Not Applicable					100
Cadmium	7440-43-9	9.3	60	5	+	9	3.3	60.3	127.2		1
Chromium, hexavalent [e]	18540-29-9	400	800	50	+	110	Not applicable				5
Chromium, trivalent [e]	16065-83-1	1,500	6,800			Not Applicable					5
Cobalt		NS		5	5						NS
Copper	7440-50-8	270	10,000	200	+	110	2,300	203	994		NS
Lead	7439-92-1	1,000	3,900	25	NS	110	251	5,949	15,290		5
Total Mercury		47	220	0.7	0.0007	1.3	24.8	16.3	27.2		0.2
Potassium		NS		NS	NS	Not Applicable					NS
Selenium	7782-49-2	1,500	6,800	10	4.6	NS	16.4	11	14		1
Silver	7440-22-4	1,500	6,800	50	0.1	2.2	Not applicable				5
Zinc	7440-66-6	10,000	10,000	2000	+	270	4.4	521.7	684.8		NS
VOCs											
Chloroform	67-66-3	Not Applicable		7	Not Applicable					Not Applicable	6
1,1,1-Trichloroethane	71-55-6			5							NS
1,1-Dichloroethane	75-34-3			5							NS
1,1-Dichloroethene	75-35-4			5							0.7
1,2-Dichloroethane	107-06-2			0.6							0.5
cis-1,2-Dichloroethene	156-59-2			5							NS
trans-1,2-Dichlorothene	156-59-2			5							NS
Tetrachloroethene	127-18-4			5							0.7
Trichloroethene	79-01-6			5						5	0.5
SVOCs											
TPH	NA	100	100	Not Applicable						Not Applicable	NS

Notes:

1. Pursuant to Title 6 of the New York Codes, Rules, and Regulations (6 NYCRR) Part 375-6.8(b)
2. Pursuant to NYCRR Part 703, Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations
3. Pursuant to the New York Department of Environmental Conservation (NYSDEC) *Technical Guidance for Screening Contaminated Sediments* (January 1999)
4. Site-specific PRGs developed by URS Corporation as part of the Fish & Wildlife Impact Analysis (URS, 2011)
5. Pursuant to Table 3-1 of NYSDEC's *Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (October 2006)
6. Title 40 of the Code of Federal Regulations (40 CFR) Part 261

GWQS = Groundwater Quality Standard
SWQS = Surface Water Quality Standard
SEL = Severe Effects Levels pursuant to Technical Guidance for Screening Contaminated Sediments (NYSDEC, 1999)
PRG = Proposed Remediation Goals

Invertebrate PRG = Maximum concentration for SQT-1 and SQT-8 except for Hg and Se (see notes).
Wildlife PRG_{lo} = based on apparent effects threshold (AET) toxicity reference values (TRV)

Wildlife PRG_{hi} = based on the lowest observable adverse effects level (LOAEL) TRV

mg/kg = milligram per kilogram
mg/L = microgram per liter
mg/g= microgram per gram or parts per million (ppm)
NS = No Standard
NA = Not Applicable

TABLE 4-1
KEY ATTRIBUTES OF SWMUs AND AOCs REQUIRING CORRECTIVE MEASURES

Dyno Nobel Site
Port Ewen, New York

SWMU/AOC	Description	Original CSM Classification	Current Classification	Proximity to ongoing operations (active/remote area)	Cover Type	Proximity to Site Drainage Features	Topographic Relief	Potential for Presence of Energetic Materials	Soil Impacts												Corrective Measures Proposed? (Yes/No)
											Mid-Point Delineation		Below SCO Delineation				Mid-Point Delineation		Below SCO Delineation		
									COPCs exceeding Commercial Use SCO	Depth of Exceedance (ft bgs)	Area of Exceedance (SF)	Volume of Exceedance (CY)	Area of Exceedance (SF)	Volume of Exceedance (CY)	COPCs exceeding Commercial Use SCO	Depth of Exceedance (ft bgs)	Area of Exceedance (SF)	Volume of Exceedance (CY)	Area of Exceedance (SF)	Volume of Exceedance (CY)	
2 and AOC A	Burning Cage Incinerator and Kerosene Tank Leak	HMSD 1	Soil	Remote	grass and small shrubs	300 ft upgradient of northern drainage way	Slight slope	No	As, Cd, Cu, Pb	6	15988	900	27328	1279	As, Cd, Cu	6	5144	447	7144	531	Yes
3 and 5	Copper Wire Burning Area and Wire Burning Area III	HMSD 1	Soil	Remote	concrete slab and gravel	450 ft upgradient of northern drainage way	Slight slope	No	As, Cd, Cu, Pb	6	13753	2038	18153	868	As, Cd, Cu, Pb	6	3842	356	8363	506	Yes
4	Iron Wire Burning Area	HMSD 1	Soil	Remote	grass	300 ft upgradient of northern drainage way	Slight slope	No	As, Cd, Cu	4	6827	1011	11029	523	As, Cd	1	2583	97	5244	194	Yes
6, 7, 8, and AOC B	Open Burning Pads Area	HMSD 1	Soil	Remote	grass, small shrubs, concrete and gravel	Not Applicable	Slight slope	No	Ba, Pb, Se	4	15590	2310	34943	1453	Ba, Pb, Se	4	9185	1457	21580	683	Yes
9	Waste Powder Catch Basins for Bldg 2037	HMSD 5	Soil		grass	Not Applicable	Flat	No	Hg	4	390	58	867	40	None	--	--	--	--	--	Dependent on cleanup standard selected
10	Waste Powder Catch Basins for Bldg 2048	HMSD 2	Soil	Active	grass and small shrubs	Not Applicable	Flat	No	Hg	1	6570	244	11732	434	Hg	1	3028	113	6705	249	Yes
11	Waste Powder Catch Basins for Bldg 2049	HMSD 2	Soil	Active	grass and small shrubs	Not Applicable	Flat	No	Hg	1	308	12	538	20	Hg	1	150	6	207	6	Yes
13	Waste Powder Catch Basins for Lead Azide Bldg	HMSD 5	Soil	Remote	grass	Not Applicable	Flat	No	Hg	1	8540	317	15534	575	None	--	--	--	--	--	Dependent on cleanup standard selected
21	Lead Recycling Unit Area	HMSD 3	Soil	Active	grass, asphalt drives and parking areas	Not Applicable	Flat	No	Ba, Cu, Pb	1	1859	69	8152	302	Ba, Pb	1	327	13	1154	43	Yes
22	Former Landfill	Landfill	Soil	Remote	large trees, shrubs, and grass	Within Wetland	Flat	Yes	No Samples Inside Landfill	--	60867	--	60867	--	No Samples Inside Landfill		60867	--	60867	--	Yes
23	Former Dump	Landfill	Soil	Remote	large trees, shrubs, and grass	100 ft upgradient of the southern drainage way	Flat	Yes	No Samples Inside Landfill	--	20358	--	20358	--	No Samples Inside Landfill		20358	--	20358	--	Yes
26D	Burnable Waste Satellite Accumulation Area	HMSD 3	Soil	Active	grass, gravel, and asphalt	Not Applicable	Flat	No	Cu, Pb	4	3995	280	7741	404	None	--	--	--	--	--	Dependent on cleanup standard selected
26E	Burnable Waste Satellite Accumulation Area	HMSD 5	Soil	Active	grass and asphalt drives	100 ft upgradient of the southern drainage way	Flat	No	None	--	--	--	--	--	None	--	--	--	--	--	No
26G, AOC C and D	Burnable Waste Satellite Accumulation Area, Open Detonation Pit, and Detonation Test Bldg	HMSD 1	Soil	Remote	grass, gravel, and sand	Not Applicable	Flat	No	As, Cu, Hg, Se	1	2109	78	21049	780	As, Cu, Hg	1	1609	60	21049	780	Yes
29	Drainage Ditch located downgradient of Bldg 2049	HMSD 5	Soil	Active	grass	SWMU is a drainage ditch which drains to the southern drainageway	Flat	No	Hg	1	809	30	4778	177	None	--	--	--	--	--	Dependent on cleanup standard selected
32	Old Dump near water tower	Landfill	Soil	Remote	large trees	Not Applicable	Steep slope	Yes	No Samples Inside Landfill	--	11556	--	11556	--	No Samples Inside Landfill	--	11556	--	11556	--	Yes
33	Mercury Fulminate Tanks Area	HMSD 2	Soil	Active	grasss	350 ft upgradient of SWMU 29 drainage ditch	Flat	No	Hg	1	6151	228	13501	500	Hg	1	1705	64	6404	237	Yes
35	Stone Fence Dump	Landfill	Soil	Remote	large trees, shrubs, and grass	Within Wetland	Flat	Unknown	No Samples Inside Landfill	--	10062	--	10062	--	No Samples Inside Landfill	--	10062	--	10062	--	Yes
39	Former Washwater Discharge Area at Bldg 2009	HMSD 5	Soil	Active	grass and small shrubs	Not Applicable	Flat	No	None	--	--	--	--	--	None	--	--	--	--	--	No
40	Pilot Line Condensate Collection Sump	HMSD 3	Soil	Remote	grass	Not Applicable	Flat	No	Pb	1	101	4	316	12	None	--	--	--	--	--	Dependent on cleanup standard selected
42	SAC Bldg Steam Collection Containers	HMSD 5	Soil	Active	grass	Not Applicable	Flat	No	None	--	--	--	--	--	None	--	--	--	--	--	No
46	Vacuum Line Condensate Collection Sump - Building 2059	Not classified	Soil	Active	grass	Not Applicable	Flat	No	None	--	--	--	--	--	None	--	--	--	--	--	No
47	Bldg 2058 Fuse Room	HMSD 5	Soil	Active	grass	Not Applicable	Flat	No	None	--	--	--	--	--	None	--	--	--	--	--	No
48	Mercury Fulminate Area	Landfill	Soil		grass and small shrubs	100 ft upgradient of northern drainage way	Flat	No	Cu	1	3026	112	6299	233	None	--	--	--	--	--	Dependent on cleanup standard selected
52	Former Commercial Shooting Lab Area	HMSD 1	Soil	Active	grass and small shrubs	Transected by northern drainageway	Flat	No	As, Ba, Cu, Pb, Se	8	27593	1022	20268	2559	As, Cu, Pb	8	13856	515	18121	1490	Yes
54	Former Historical Production Area	HMSD 2	Soil	Active	two buildings, asphalt drives and parking areas, and grass	Transected by southern drainageway	Flat	No	Hg	2	19313	1431	62216	4609	Hg	2	11649	863	29413	2179	Yes
56	Vent System for Static Security Testing Chamber	HMSD 5	Soil	Active	grass and gravel	Not Applicable	Flat	No	None	--	--	--	--	--	None	--	--	--	--	--	No
AOC G	Former Drying House	HMSD 4	Soil	Remote	large trees and shrubs	Not Applicable	Flat	No	As, Cu	2	756	56	1026	76	As	2	657	50	902	67	Yes
AOC H	Former Drying House	HMSD 4	Soil	Remote	large trees and shrubs	Not Applicable	Flat	No	As, Cu, Pb	2	1271	95	2079	159	As, Pb	2	329	25	914	68	Yes
AOC I	Roof Drainage from Deto Bldg	HMSD 3	Soil	Remote	grass	Not Applicable	Flat	No	Pb	2	670	50	867	65	None	--			--	--	Dependent on cleanup standard selected
AOC J	Former Drying House	HMSD 4	Soil	Remote	large trees and shrubs	Not Applicable	Flat	No	As, Cu, Pb	2	2011	149	3716	276	As, Cu	2	1054	78	2700	200	Yes
AOC M	Former Drying House	HMSD 4	Soil	Remote	large trees and shrubs	Not Applicable	Flat	No	As, Pb	2	4480	332	8204	608	As, Pb	2	3911	290	7435	551	Yes
AOC N	Former Drying House	HMSD 4	Soil	Remote	large trees and shrubs	Not Applicable	Flat	No	As, Cu, Pb	2	4912	364	8506	631	As, Pb	2	3320	246	5353	397	Yes
AOC O	Former Drying House	HMSD 4	Soil	Remote	large trees and shrubs	Not Applicable	Flat	No	As, Cu, Pb	2	2486	184	4759	353	As	2	1602	119	3277	243	Yes

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Notes:
SWMU = Solid Waste Management Unit
AOC = Area of Concern
SCO = Soil Cleanup Objective
ft bgs = feet below ground surface
SF= square feet
CY = cubic yard
HMSD = Heavy Metal Surface Deposition
As = Arsenic
Ba = Barium
Cd = Cadmium
Cu = Copper
Hg = Mercury
Pb = Lead
Se = Selenium

EHS Support

TABLE 4-2
WETLANDS COMPLEX (SWMU 1/22) SURFACE WATER ANALYTICAL RESULTS

Dyno Nobel Site
Port Ewen, New York

Analyte	Sample Type[1]	Units	Number of Samples	Number of Detections	Minimum Detected Concentration	Maximum Detected Concen tration	NYSDEC SWQS	SWMU 1/22 Wetland Complex Stations						Reference Stations		
								PE-SW-01	PE-SW-02	PE-SW-03	PE-SW-04	PE-SW-05	PE-SW-06	PE-SW-07	PE-SW-08	PE-SW-09
Inorganics																
Cadmium	U	µg/L	9	0	ND	ND	NA	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
	F	µg/L	9	0	ND	ND	2.52	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U
Copper	U	µg/L	9	9	0.33	19	NA	3.30	2.40	18.60	3.00	3.70	5.90	0.81 B'	1.30 B'	0.33 B'
	F	µg/L	9	6	1.90	12	14.1	2.00	1.90 B'	12.00	2.00	2.60	4.40	0.93 U (2.0)	1.50 U (2.0)	0.68 U (2.0)
1-ead	U	µg/L	9	9	0.072	0.96	NA	0.16 B'	0.15 B'	0.07 B'	0.96 B'	0.58 B'	0.40 B'	0.10 B'	0.46 B'	0.11 B'
	F	µg/L	9	9	0.04	0.26	4.9	0.06 B'	0.19 B'	0.04 B'	0.26 B'	0.25 B'	0.20 B'	0.11 B'	0.18 B'	0.14 B'
Mercury	U	µg/L	9	0	ND	ND	NA	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
	F	µg/L	9	0	ND	ND	0.77	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
Selenium	U	µg/L	9	1	0.49	0.49	NA	5.00 U	5.00 U	0.49 B'	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
	F	µg/L	9	3	0.5	1.4	4.6	5.00 U	0.86 B'	1.40 B'	0.50 B'	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U
Zinc	U	µg/L	9	9	1.3	7.2	NA	3.90 B'	2.70 B'	4.90 B'	7.20	1.70 B'	2.80 B'	2.20 B'	3.70 B'	1.30 B'
	F	µg/L	9	6	1.3	4.5	101.2	4.50 B'	1.90 B'	3.70 B'	2.60 B'	2.30 B'	4.50 B'	3.40 U (5.0)	3.00 U (5.0))	1.30 U (5.0))
Other Water Quality Parameters																
Total Suspended Solids	U	mg/L	9	3	2	4	4	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	2.00 B'	3.60 B'	2.00 B'
Hardness	U	mg/L	9	9	54.7	156	156	133.00	128.00	156.00	132.00	127.00	133.00	54.70	71.60	80.00

Notes:
If the result is > the reporting limit (RL), then [x] is non-detect at the sample concentration; if the result is < the RL, then [x] is non-detect at the RL.
U Result is a non-detect < the detection limit (DL)
B' Estimated result; less than the RL
J' Method blank contamination
1. U = unfiltered sample; F = Filtered (0.45 µm) sample
NYSDEC = New York State Department of Environmental Compliance
SWQS = Surface Water Quality Standards
ND = Analyte was not detected in any sample
NA = Not applicable; NYSDEC Surface Water Quality Standards (SWQS) are based on filtered surface water results.

TABLE 4-3
SUMMARY OF ROUTINE SURFACE WATER SAMPLE (SW-1) RESULTS

Dyno Nobel Site
Port Ewen, New York

Date Collected	NYSDEC Class C SWQS	8/15/2001				4/17/2002		4/30/2003				10/19/2004		10/20/2005		10/12/2006	
		Unfiltered		Filtered		Filtered		Unfiltered		Filtered		Unfiltered		Unfiltered		Filtered	
Total Inorganics (mg/L)																	
Aluminum	100	19	U	31.6	J	48	U	41.3	U	41.3	U	264	N	18.6	B	80	U
Antimony	NS	14	U	14	U	9.9	U	8.5	U	8.5	U	2.5	U	2.5	U	8.4	U
Arsenic	150	5	U	5	U	4.9	U	4.9	U	4.9	U	3.1	U	3.1	U	4	U
Barium	NS	39.7	J	41.6	J	59.3	J	42.9	J	41.8	J	35.9	B	35	B	37.3	
Beryllium	+	1.9	U	1.9	U	0.5	U	0.34	U	0.34	U	0.4	U	0.4	U	0.21	U
Cadmium	+	3.6	U	3.6	U	0.94	U	0.87	U	0.87	U	0.8	U	0.8	U	0.76	U
Calcium	NS	52000		46000		51500		40100		40800		36500		35100		41200	
Chromium	+	6.6	U	6.6	U	2	U	2.2	U	2.2	U	1.5	B	0.9	U	2	U
Cobalt	5	7.1	U	7.1	U	1.7	U	1.6	U	1.8	U	1.9	U	1.9	U	2.3	B
Copper	+	14.2	J	13.1	J	18.4	J	12.1	J	8.2	J	10.6	B	15.6	B	4	U
Iron	300	270		102		46	J	175		45.3	U	**787**	N	**490**		121	B
Lead	+	9.8	U	9.8	U	8.9	U	9.3	U	9.3	U	1.9	U	1.9	U	3	U
Magnesium	NS	5770		5450		6380		4990		5090		5440		4550	B	4700	
Manganese	NS	57.7		53.7		68.2	U	54.5		23.9		192		280		19.8	
Mercury	0.0007	0.048	U	0.048	U	0.079	U	0.16	U	0.16	U	0.2	U	0.16	U	0.07	U
Nickel	+	8.4	U	8.4	U	1.9	U	3.8	U	3.8	U	2.3	U	2.3	U	1.2	B
Potassium	NS	571		464	J	2050		1030		1250		3160	B	913	B	1540	
Selenium	4.6	3.5	U	3.5	U	4.8	U	4.7	U	4.7	U	1.8	B	3.9	U	7.5	U
Silver	0.1	3.6	U	3.6	U	1.4	U	1.8	U	1.8	U	1.1	U	**2.4**	BN	0.73	U
Sodium	NS	17100		16800		35500		21500		22800		13500	E	15300	E	15700	
Thallium	5	9.5	U	9.5	U	9.5	U	8.9	U	8.9	U	2.9	U	2.9	U	10.1	U
Vanadium	14	2.6	U	2.6	U	1.7	U	1.7	U	1.7		2	U	2	U	0.6	U
Zinc	+	8.6	U	12.4	J	10.2	J	28.2		17.2	J	5.5	B	3.4	B	10	U

Notes:
SWQS = Surface Water Quality Standard
mg/L = micrograms per liter

TABLE 4-3
SUMMARY OF ROUTINE SURFACE WATER SAMPLE (SW-1) RESULTS

Dyno Nobel Site
Port Ewen, New York

Date Collected	NYSDEC Class C SWQS	5/16/2007		10/25/2007		1/16/2008		4/15/2008		10/8/2008		4/21/2009		9/28/2009		4/29/2010	
		Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered	
		Total Inorganics (mg/L)															
Aluminum	100											83	J	15.8	J	**460**	
Antimony	NS																
Arsenic	150																
Barium	NS	38		53		29		37		51		35		45.1		120	
Beryllium	+																
Cadmium	+																
Calcium	NS	41600		53200		31200		37200		55800		37400		54400		33000	
Chromium	+																
Cobalt	5																
Copper	+	4.8	J	38		80.2	J	12		8.3	J	9.7		4.8	J		
Iron	300	**500**		120	J	140	J	**310**		**550**		**340**		**554**		**1100**	
Lead	+																
Magnesium	NS	4800		9000		4400		4300		7000		5200		6480		4600	
Manganese	NS	390		18		30		91		98		60		42.4		480	
Mercury	0.0007																
Nickel	+	0.85	J														
Potassium	NS	1200		630		770		760		500	J	1400		1770		970	J
Selenium	4.6			**12**	J												
Silver	0.1																
Sodium	NS	11700		55000		21300		14400		21900		22900		20400		3600	
Thallium	5																
Vanadium	14																
Zinc	+																

Notes:
SWQS = Surface Water Quality Standard
mg/L = micrograms per liter

EHS Support consider it done

TABLE 4-3
SUMMARY OF ROUTINE SURFACE WATER SAMPLE (SW-1) RESULTS

Dyno Nobel Site
Port Ewen, New York

Date Collected	NYSDEC Class C SWQS	11/3/2010		4/13/2011		10/11/2011		4/4/2012		8/8/2012				10/24/2012	
		Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered		Filtered		Unfiltered	
		Total Inorganics (mg/L)													
Aluminum	100	**930**		0.24		**1800**		**4000**		**1800**		200	U	200	U
Antimony	NS											20	U	20	U
Arsenic	150					6	J	8.2	J	20	U	20	U	20	U
Barium	NS	39		0.033		110		180		160		54		34	
Beryllium	+							0.26	J	4	U	4	U	4	U
Cadmium	+											5	U	5	U
Calcium	NS	43000		53		40000		46000		67000		6300		39000	
Chromium	+	1.8	J					5.4	J	2.3	J	10	U	10	U
Cobalt	5					4.3	J	4.2	J	1.6	J	10	U	10	U
Copper	+	2.5	J	0.0081	J	670	J	130		73		20	U	6.1	
Iron	300	**1500**		0.38		**7500**		**23000**		**7500**		100		250	
Lead	+					25		19		7.3	J	10	U	10	U
Magnesium	NS	7300		7.2		7000		6200		8000		7500		5400	
Manganese	NS	1700		0.06		3700		3400		4600		3000		64	
Mercury	0.0007	0.2	U	0.2	U	**0.11**	J	**1**		0.2	U	0.2	U	0.2	U
Nickel	+					7	J	5.4	J	3	J	40	U	40	U
Potassium	NS	1100		1.3		2200		1800		850	J	490	J	1800	
Selenium	4.6											20	U	20	U
Silver	0.1	,										10	U	10	U
Sodium	NS	5800		56		14000		17000		20000		20000		16000	
Thallium	5											25	U	25	U
Vanadium	14					6.1	J	9.2	J	4	J	10	U	10	U
Zinc	+					170		50		26		7.3	J	20	U

Notes:
SWQS = Surface Water Quality Standard
mg/L = micrograms per liter

EHS Support
consider it done

TABLE 4-4
VOCS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	**Water Quality Standards**	**MW-3**	**MW-3**	**MW-3**	**MW-3**	**MW-3**	**MW-3**	**MW-3**	**MW-3**	**MW-3**	**MW-3**
Date Collected:	**703.5****	**4/18/2002**	**10/17/2002**	**4/30/2003**	**10/14/2003**	**4/20/2004**	**10/8/2004**	**6/7/2005**	**10/17/2005**	**10/10/2006**	**5/17/2007**
Volatile Organic Compounds (µg/L)											
1,1,1-Trichloroethane	5	**43000**	**47000**	**29000**	**32000**	**33000** D	**27000**	**39000**	**43000** D	**31000**	**33000**
1,1,2,2-Tetrachloroethane	5	25 U	25 U	50 U	50 U		500 U	500 U	500 U	200 U	
1,1,2-Trichloroethane	1	20 U	20 U	40 U	40 U		500 U	500 U	500 U	300 U	
1,1-Dichloroethane	5	120 J	140	110 J	190 J	150 E	500 U	500 U	500 U	300 U	
1,1-Dichloroethene	5	**24000**	**23000**	**14000**	**18000**	**13000** E	**17000**	**26000**	**32000** D	**25000**	**31000**
1,2-Dichloroethane	0.6	87 J	110 J	83 J	81 J	86	500 U	500 U	500 U	300 U	
1,2-Dichloropropane	1	25 U	25 U	50 U	50 U		500 U	500 U	500 U	450 U	
2-Butanone (MEK)	5	75 U	75 U	150 U	150 U		500 U	500 U	500 U	600 U	
2-Hexanone	50	75 U	75 U	150 U	150 U		500 U	500 U	500 U	400 U	
4-Methyl-2-pentanone (MIBK)	5	75 U	75 U	150 U	150 U		500 U	500 U	500 U	350 U	
Acetone	50	150 U	150 U	300 U	300 U		500 U	320 JB	500 U	700 UB	
Benzene	1	15 J	14 J	25 U	25 U		500 U	500 U	500 U	200 U	
Bromodichloromethane	50	25 U	25 U	50 U	50 U		500 U	500 U	500 U	200 U	
Bromoform	50	25 U	25 U	50 U	50 U		500 U	500 U	500 U	400 U	
Bromomethane	5	25 U	25 U	50 U	50 U		500 U	500 U	500 U	600 U	
Carbon disulfide	5	25 U	25 U	50 U	50 U		500 U	500 U	500 U	450 U	
Carbon tetrachloride	5	25 U	25 U	50 U	50 U		500 U	500 U	500 U	500 U	
Chlorobenzene	5	20 U	20 U	40 U	40 U		500 U	500 U	500 U	200 U	
Chloroethane	5	25 U	25 U	50 U	50 U		500 U	500 U	500 U	400 U	
Chloroform	7	25 J	27 J	40 U	40 U		500 U	500 U	500 U	350 U	
Chloromethane	5	25 U	25 U	50 U	50 U		500 U	500 U	500 U	250 U	
cis-1,2-Dichloroethene	5	**280**	**280**	**240** J	**270**	**340** J	500 U	**360** J	**340** J	**390** J	**370** J
cis-1,3-Dichloropropene	0.4*	25 U	25 U	50 U	50 U		500 U	500 U	500 U	250 U	
Dibromochloromethane	50	25 U	25 U	50 U	50 U		500 U	500 U	500 U	250 U	
Ethylbenzene	5	20 U	20 U	40 U	40 U		500 U	500 U	500 U	500 U	
Methylene Chloride	5	50 U	50 U	100 U	100 U		500 U	500 U	500 U	**220** JB	
Styrene	5	25 U	25 U	50 U	50 U		500 U	500 U	500 U	250 U	
Tetrachloroethene	5	20 U	20 U	40 U	40 U		500 U	500 U	500 U	250 U	
Toluene	5	18 U	18 U	35 U	35 U		500 U	500 U	500 U	150 U	
trans-1,2-Dichloroethene	5	20 U	20 U	40 U	40 U		500 U	500 U	500 U	250 U	
trans-1,3-Dichloropropene	0.4*	25 U	25 U	50 U	50 U		500 U	500 U	500 U	400 U	
Trichloroethene	5	**43000**	**42000**	**23000**	**30000**	**34000**	**23000**	**35000**	**39000** D	**30000**	**46000**
Vinyl chloride	2	25 U	25 U	50 U	50 U		500 U	500 U	500 U	400 U	
Xylenes, Total	5	20 U	20 U	40 U	40 U		500 U	500 U	500 U	500 U	

Notes:
µg/L = micrograms per liter
J = indicates that the compound was analyzed for but not detected
D = indicates all compounds identified in an anaylsis at a secndary dilution factor
B =indicates that the analyte was found in both the sample and its associated laboratory blank
E = this qualifier indicates compounds whose concentrations exceed the calibration range of the instrument for the specific analysis
350 Exceeds NYSDEC Class GA Groundwater Standards

EHS Support consider it done

TABLE 4-4
VOCS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	Water Quality Standards	MW-3	MW-3	MW-3	MW-3	MW-3	MW-3	MW-3	MW-3	MW-3	MW-3	MW-3
Date Collected:	703.5**	10/25/2007	4/18/2008	10/8/2008	4/22/2009	9/29/2009	4/28/2010	11/2/2010	4/14/2011	10/11/2011	4/3/2012	10/24/2012
Volatile Organic Compounds (µg/L)												
1,1,1-Trichloroethane	5	**32000**	**26000**	**31000**	**29000**	**31000**	**22000**	**23000**	**28000**	**19000**	**22000**	**15000**
1,1,2,2-Tetrachloroethane	5								500 U	250 U	500 U	
1,1,2-Trichloroethane	1								500 U	250 U	500 U	
1,1-Dichloroethane	5						**140** J	**120** J	**140** J	**130** J	**160** J	**500** U
1,1-Dichloroethene	5	**2800**	**25000**	**31000**	**37000**	**43000**	**28000**	**30000**	**37000**	**22000**	**29000**	**23000**
1,2-Dichloroethane	0.6							**120** J	**150** J	**94** J	**130** J	**500** U
1,2-Dichloropropane	1								500 U	250 U	500 U	
2-Butanone (MEK)	5								500 U	250 U	500 U	
2-Hexanone	50								500 U	2500 U	5000 U	
4-Methyl-2-pentanone (MIBK)	5								500 U	250 U	500 U	
Acetone	50								12000 U	6300 U	13000 U	
Benzene	1								500 U	250 U	500 U	
Bromodichloromethane	50								500 U	250 U	500 U	
Bromoform	50								500 U	250 U	500 U	
Bromomethane	5								500 U	250 U	500 U	
Carbon disulfide	5								1000 U	500 U	500 U	
Carbon tetrachloride	5								500 U	250 U	500 U	
Chlorobenzene	5								500 U	250 U	500 U	
Chloroethane	5								500 U	250 U	500 U	
Chloroform	7								500 U	250 U	500 U	
Chloromethane	5								500 U	250 U	500 U	
cis-1,2-Dichloroethene	5	**550** J	**470** J	**430** J	**630** J	**500** J	**520**	**510**	**480** J	**340**	**720**	**400** J
cis-1,3-Dichloropropene	0.4*								500 U	250 U	500 U	
Dibromochloromethane	50						**100**		**86**	250 U	500 U	
Ethylbenzene	5								500 U	250 U	500 U	
Methylene Chloride	5			**260** J B					2500 U	250 U	2500 U	
Styrene	5								500 U	250 U	500 U	
Tetrachloroethene	5								500 U	77 J	500 U	
Toluene	5								500 U	250 U	500 U	
trans-1,2-Dichloroethene	5								500 U	250 U	500 U	
trans-1,3-Dichloropropene	0.4*								500 U	250 U	500 U	
Trichloroethene	5	**39000**	**38000** B	**34000**	**49000** B L	**40000**	**32000**	**37000**	**41000**	**24000**	**37000**	**23000**
Vinyl chloride	2								500 U	250 U	500 U	
Xylenes, Total	5								500 U	250 U	1000 U	

Notes:
µg/L = micrograms per liter
J = indicates that the compound was analyzed for bu
D = indicates all compounds identified in an anaylsi
B =indicates that the analyte was found in both the s
E = this qualifier indicates compounds whose conce
350 Exceeds NYSDEC

EHS Support consider it done

TABLE 4-4
VOCS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	Water Quality Standards	MW-4A	MW-4A	MW-4A	MW-4A	MW-4A	MW-4A	MW-4A	MW-4A	MW-4A	MW-4A	MW-4A	MW-4A
Date Collected:	**703.5****	**4/18/2002**	**10/17/2002**	**4/30/2003**	**10/23/2003**	**10/20/2004**	**6/8/2005**	**10/18/2005**	**10/10/2006**	**5/17/2007**	**10/26/2007**	**4/18/2008**	**10/8/2008**
Volatile Organic Compounds (µg/L)													
1,1,1-Trichloroethane	5	400 U	400 U	80 U	800 U	1000 U	10000 U		2000 U				
1,1,2,2-Tetrachloroethane	5	500 U	500 U	100 U	1000 U	1000 U	10000 U		2000 U				
1,1,2-Trichloroethane	1	400 U	400 U	80 U	800 U	1000 U	10000 U		3000 U				
1,1-Dichloroethane	5	500 U	500 U	100 U	1000 U	1000 U	10000 U		3000 U				
1,1-Dichloroethene	5	400 U	400 U	80 U	800 U	1000 U	10000 U		3500 U				
1,2-Dichloroethane	0.6	500 U	500 U	100 U	1000 U	1000 U	10000 U		3000 U				
1,2-Dichloropropane	1	500 U	500 U	100 U	1000 U	1000 U	10000 U		4500 U				
2-Butanone (MEK)	5	1500 U	1500 U	300 U	3000 U	1000 U	10000 U		6000 U				
2-Hexanone	50	1500 U	1500 U	300 U	3000 U	1000 U	10000 U		4000 U				
4-Methyl-2-pentanone (MIBK)	5	1500 U	1500 U	300 U	3000 U	1000 U	10000 U		3500 U				
Acetone	50	3000 U	3000 U	600 U	6000 U	1000 U	10000 U		**8000** JB			**17000** J S	
Benzene	1	250 U	250 U	50 U	500 U	1000 U	10000 U		2000 U				
Bromodichloromethane	50	500 U	500 U	100 U	1000 U	1000 U	10000 U		2000 U				
Bromoform	50	500 U	500 U	100 U	1000 U	1000 U	10000 U		4000 U				
Bromomethane	5	500 U	500 U	100 U	1000 U	1000 U	10000 U		6000 U				
Carbon disulfide	5	500 U	500 U	100 U	1000 U	1000 U	10000 U		4500 U				
Carbon tetrachloride	5	500 U	500 U	100 U	1000 U	1000 U	10000 U		5000 U				
Chlorobenzene	5	400 U	400 U	80 U	800 U	1000 U	10000 U		2000 U				
Chloroethane	5	500 U	500 U	100 U	1000 U	1000 U	10000 U		4000 U				
Chloroform	7	400 U	400 U	80 U	800 U	1000 U	10000 U		3500 U				
Chloromethane	5	500 U	500 U	100 U	1000 U	1000 U	10000 U		2500 U				
cis-1,2-Dichloroethene	5	400 U	400 U	210 J	800 U	1000 U	10000 U		3000 U				
cis-1,3-Dichloropropene	0.4*	500 U	500 U	100 U	1000 U	1000 U	10000 U		2500 U				
Dibromochloromethane	50	500 U	500 U	100 U	1000 U	1000 U	10000 U		2500 U				
Ethylbenzene	5	400 U	400 U	80 U	800 U	1000 U	10000 U		5000 U				
Methylene Chloride	5	1000 U	1000 U	200 U	2000 U	1000 U	10000 U		**2400** JB				**4300**
Styrene	5	500 U	500 U	100 U	1000 U	1000 U	10000 U		2500 U				
Tetrachloroethene	5	400 U	400 U	160 J	800 U	1000 U	10000 U		2500 U				
Toluene	5	350 U	350 U	70 U	700 U	1000 U	10000 U		1500 U				
trans-1,2-Dichloroethene	5	400 U	400 U	80 U	800 U	1000 U	10000 U		2500 U				
trans-1,3-Dichloropropene	0.4*	500 U	500 U	100 U	1000 U	1000 U	10000 U		4000 U				
Trichloroethene	5	**670000**	**600000**	**600000**	**610000**	**810000**	**780000**	**610000** D	**480000**	**500000**	**610000**	**530000** B L	**330000**
Vinyl chloride	2	500 U	500 U	100 U	1000 U	1000 U	10000 U		4000 U				
Xylenes, Total	5	400 U	400 U	80 U	800 U	1000 U	10000 U		5000 U				

Notes:
µg/L = micrograms per liter
U = indicates that the compound was analyzed for but not detected
J = indicates an estimated value
D = indicates all compounds identified in an analysis at a secondary dilution factor
B = indicates that the analyte was found in both the sample and its associated laboratory blank
L =
S =
350 Exceeds NYSDEC Class GA Groundwater Standards

EHS Support consider it done

TABLE 4-4
VOCS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	**Water Quality Standards**		**MW-4A**	**MW-4A**	**MW-4A**	**MW-4A**	**MW-4A**	**MW-4A**	**MW-4A**
Date Collected:	**703.5****		**4/22/2009**	**9/30/2009**	**11/2/2010**	**4/14/2011**	**10/11/2011**	**4/3/2012**	**10/24/2012**
1,1,1-Trichloroethane	5					5000 U	500 U	1300 U	
1,1,2,2-Tetrachloroethane	5					5000 U	500 U	1300 U	
1,1,2-Trichloroethane	1					5000 U	500 U	1300 U	
1,1-Dichloroethane	5					5000 U	500 U	1300 U	
1,1-Dichloroethene	5				**110** J	5000 U	500 U	1300 U	
1,2-Dichloroethane	0.6					5000 U	500 U	1300 U	
1,2-Dichloropropane	1					5000 U	500 U	1300 U	
2-Butanone (MEK)	5					5000 U	500 U	1300 U	
2-Hexanone	50					50000 U	5000 U	13000 U	
4-Methyl-2-pentanone (MIBK)	5					5000 U	500 U	1300 U	
Acetone	50					120000 U	13000 U	31000 U	
Benzene	1					5000 U	500 U	1300 U	
Bromodichloromethane	50					5000 U	500 U	1300 U	
Bromoform	50					5000 U	500 U	1300 U	
Bromomethane	5					5000 U	500 U	1300 U	
Carbon disulfide	5					10000 U	1000 U	1300 U	
Carbon tetrachloride	5					5000 U	500 U	1300 U	
Chlorobenzene	5					5000 U	500 U	1300 U	
Chloroethane	5					5000 U	500 U	1300 U	
Chloroform	7					5000 U	**160** J	1300 U	
Chloromethane	5					5000 U	500 U	1300 U	
cis-1,2-Dichloroethene	5				**240**	5000 U	500 U	1300 U	
cis-1,3-Dichloropropene	0.4*					5000 U	500 U	1300 U	
Dibromochloromethane	50					5000 U	500 U	1300 U	
Ethylbenzene	5					5000 U	500 U	1300 U	
Methylene Chloride	5	J B				25000 U	2500 U	6300 U	
Styrene	5					5000 U	500 U	1300 U	
Tetrachloroethene	5				**150** J	5000 U	500 U	1300 U	
Toluene	5					5000 U	500 U	1300 U	
trans-1,2-Dichloroethene	5					5000 U	500 U	1300 U	
trans-1,3-Dichloropropene	0.4*					5000 U	500 U	1300 U	
Trichloroethene	5		**410000** B L	**460000**	**350000** D	520000	**26000**	**97000**	**250000**
Vinyl chloride	2					5000 U	500 U	1300 U	
Xylenes, Total	5					10000 U	500 U	2500 U	

Notes:
µg/L = micrograms per liter
U = indicates that the compound was analyzed for I
J = indicates an estimated value
D = indicates all compounds identified in an analys
B = indicates that the analyte was found in both the
L =
S =

350	Exceeds NYSDEC

EHS Support consider it done

TABLE 4-4
VOCS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	**Water Quality Standards**	**MW-4B**	**MW-4B**	**MW-4B**	**MW-4B**	**MW-4B**	**MW-4B**	**MW-4B**	**MW-4B**	**MW-4B**
Date Collected:	**703.5****	**4/19/2002**	**10/17/2002**	**4/30/2003**	**10/14/2003**	**10/20/2004**	**10/18/2005**	**10/10/2006**	**5/17/2007**	**10/26/2007**
Volatile Organic Compounds (µg/L)										
1,1,1-Trichloroethane	5	0.8 U	20 U	0.8 U	40 U	500 U	0.6 J	100 U		
1,1,2,2-Tetrachloroethane	5	1 U	25 U	1 U	50 U	500 U	1 U	100 U		
1,1,2-Trichloroethane	1	0.8 U	20 U	0.8 U	40 U	500 U	1 J	150 U		
1,1-Dichloroethane	5		25 U	1 U	50 U	500 U	0.5 J	150 U		
1,1-Dichloroethene	5	30	20 U	**16**	40 U	500 U	**16**	180 U		
1,2-Dichloroethane	0.6	1 U	25 U	1 U	50 U	500 U	1 U	150 U		
1,2-Dichloropropane	1	1 U	25 U	1 U	50 U	500 U	1 U	220 U		
2-Butanone (MEK)	5	3 U	75 U	3 U	150 U	500 U	1 U	300 U		
2-Hexanone	50	3 U	75 U	3 U	150 U	500 U	1 U	200 U		
4-Methyl-2-pentanone (MIBK)	5	3 U	75 U	3 U	150 U	500 U	1 U	180 U		
Acetone	50	6 U	150 U	6 U	300 U	500 U	26	**520** JB		
Benzene	1	0.6 J	13 U	0.5 U	25 U	500 U	1 U	100 U		
Bromodichloromethane	50	1 U	25 U	1 U	50 U	500 U	1 U	100 U		
Bromoform	50	1 U	25 U	1 U	50 U	500 U	1 U	200 U		
Bromomethane	5	1 U	25 U	1 U	50 U	500 U	1 U	300 U		
Carbon disulfide	5	1 U	25 U	1 U	50 U	500 U	1 U	220 U		
Carbon tetrachloride	5	1 U	25 U	1 U	50 U	500 U	1 U	250 U		
Chlorobenzene	5	0.8 U	20 U	0.8 U	40 U	500 U	1 U	100 U		
Chloroethane	5	1 U	25 U	1 U	50 U	500 U	1 U	200 U		
Chloroform	7	0.8 U	20 U	0.8 U	40 U	500 U	1 U	180 U		
Chloromethane	5	1 U	25 U	1 U	50 U	500 U	1 U	120 U		
cis-1,2-Dichloroethene	5	**330**	**130**	**140**	**250**	500 U	**330** E	**210** J	**340** J	
cis-1,3-Dichloropropene	0.4*	1 U	25 U	1 U	50 U	500 U	1 U	120 U		
Dibromochloromethane	50	1 U	25 U	1 U	50 U	500 U	1 U	120 U		
Ethylbenzene	5	0.8 U	20 U	0.8 U	40 U	500 U	1 U	250 U		
Methylene Chloride	5	2 U	50 U	2 U	100 U	500 U	1 U	**140** JB		
Styrene	5	1 U	25 U	1 U	50 U	500 U	1 U	120 U		
Tetrachloroethene	5	0.8 U	20 U	0.8 U	40 U	500 U	1 U	120 U		
Toluene	5	0.7 U	18 U	0.7 U	35 U	500 U	1 U	75 U		
trans-1,2-Dichloroethene	5	**12**	20 U	**6**	40 U	500 U	**6.5**	120 U		
trans-1,3-Dichloropropene	0.4*	1 U	25 U	1 U	50 U	500 U	1 U	200 U		
Trichloroethene	5	**42000**	**31000**	**35000**	**34000**	**27000**	**25000** D	**15000**	**20000**	**27000**
Vinyl chloride	2	1 U	25 U	1 U	50 U	500 U	0.61 J	200 U		
Xylenes, Total	5	0.8 U	20 U	0.8 U	40 U	500 U	1 U	250 U		

Notes:
µg/L = micrograms per liter
U = indicates that the compound was analyzed for but not detected
J = indicates an estimated value
D = indicates all compounds identified in an analysis at a secondary dilution factor
B = indicates that the analyte was found in both the sample and its associated laboratory blank
E = this qualifier indicates compounds whose concentrations exceed the calibration range of the instrument for the specific analysis
L =
350 Exceeds NYSDEC Class GA Groundwater Standards

TABLE 4-4
VOCS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	Water Quality Standards	MW-4B	MW-4B	MW-4B	MW-4B	MW-4B	MW-4B	MW-4B	MW-4B
Date Collected:	**703.5****	**4/18/2008**	**10/8/2008**	**4/22/2009**	**9/30/2009**	**4/14/2011**	**10/11/2011**	**4/3/2012**	**10/24/2012**
Volatile Organic Compounds (µg/L)									
1,1,1-Trichloroethane	5					500 U	NS	500 U	
1,1,2,2-Tetrachloroethane	5					500 U	NS	500 U	
1,1,2-Trichloroethane	1					500 U	NS	500 U	
1,1-Dichloroethane	5					500 U	NS	500 U	
1,1-Dichloroethene	5	**18** J	**1400** J			500 U	NS	500 U	
1,2-Dichloroethane	0.6					500 U	NS	500 U	
1,2-Dichloropropane	1					500 U	NS	500 U	
2-Butanone (MEK)	5					500 U	NS	500 U	
2-Hexanone	50					5000 U	NS	5000 U	
4-Methyl-2-pentanone (MIBK)	5					500 U	NS	500 U	
Acetone	50					12000 U	NS	13000 U	
Benzene	1					500 U	NS	500 U	
Bromodichloromethane	50					500 U	NS	500 U	
Bromoform	50					500 U	NS	500 U	
Bromomethane	5					500 U	NS	500 U	
Carbon disulfide	5					1000 U	NS	1000 U	
Carbon tetrachloride	5					500 U	NS	500 U	
Chlorobenzene	5					500 U	NS	500 U	
Chloroethane	5					500 U	NS	500 U	
Chloroform	7					500 U	NS	500 U	
Chloromethane	5					500 U	NS	500 U	
cis-1,2-Dichloroethene	5	**310**			**500** J	**220** J	NS	**370** J	**150** J
cis-1,3-Dichloropropene	0.4*					500 U	NS	500 U	
Dibromochloromethane	50					**88**	NS	500 U	
Ethylbenzene	5					500 U	NS	500 U	
Methylene Chloride	5		**450** J B			2500 U	NS	2500 U	
Styrene	5					500 U	NS	500 U	
Tetrachloroethene	5					500 U	NS	500 U	
Toluene	5					500 U	NS	500 U	
trans-1,2-Dichloroethene	5					500 U	NS	500 U	
trans-1,3-Dichloropropene	0.4*					500 U	NS	500 U	
Trichloroethene	5	**40000** B L	**83000**	**74000** L	**79000**	**43000**	NS	**35000**	**7300**
Vinyl chloride	2					500 U	NS	500 U	
Xylenes, Total	5					1000 U	NS	1000 U	

Notes:
µg/L = micrograms per liter
U = indicates that the compound was analyzed for b
J = indicates an estimated value
D = indicates all compounds identified in an analysi
B = indicates that the analyte was found in both the
E = this qualifier indicates compounds whose conce
L =

350	Exceeds NYSDEC

TABLE 4-4
VOCS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	Water Quality Standards	MW-21D	MW-21D	MW-21D	MW-21D	MW-21D	MW-21D	MW-21D	MW-21D	MW-21D	MW-21D	MW-21D	MW-21D	MW-21D	MW-21D
Date Collected:	**703.5****	**8/15/2000**	**5/1/2001**	**4/17/2002**	**10/14/2002**	**4/30/2003**	**10/14/2003**	**10/18/2004**	**6/7/2005**	**10/17/2005**	**10/10/2006**	**11/2/2010**	**4/14/2011**	**10/11/2011**	**4/3/2012**
Volatile Organic Compounds (µg/L)															
1,1,1-Trichloroethane	5	1 U	1 U	0.8 U	0.8 U	0.8 U	0.8 U	1 U	1 U	1 U	0.4 U		1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	5	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	0.4 U		1 U	1 U	1 U
1,1,2-Trichloroethane	1	1 U	1 U	0.8 U	0.8 U	0.8 U	0.8 U	1 U	1 U	1 U	0.6 U		1 U	1 U	1 U
1,1-Dichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.6 U		1 U	1 U	1 U
1,1-Dichloroethene	5	1 U	1 U	0.8 U	0.8 U	0.8 U	0.8 U	1 U	1 U	1 U	0.7 U		0.19 J	1 U	1 U
1,2-Dichloroethane	0.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.6 U		1 U	1 U	1 U
1,2-Dichloropropane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.9 U		1 U	1 U	1 U
2-Butanone (MEK)	5	3 U	3 U	3 U	3 U	3 U	3 U	1 U	1 U	1 U	1.2 U		1 U	1 U	1 U
2-Hexanone	50	3 U	3 U	3 U	3 U	3 U	3 U	1 U	1 U	1 U	0.8 U		10 U	1 U	1 U
4-Methyl-2-pentanone (MIBK)	5	3 U	3 U	3 U	3 U	3 U	3 U	1 U	1 U	1 U	0.7 U		1 U	1 U	1 U
Acetone	50	6 U	6 U	6 U	25	6 U	6 U	1 U	1.4 B	1 U	2 JB		5.5 J	25 U	25 U
Benzene	1	1 U	1 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	1 U	0.4 U		1 U	1 U	1 U
Bromodichloromethane	50	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.4 U		1 U	1 U	1 U
Bromoform	50	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.8 U		1 U	1 U	1 U
Bromomethane	5	2 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.2 U		1 U	1 U	1 U
Carbon disulfide	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.9 U		2 U	2 U	2 U
Carbon tetrachloride	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U		1 U	1 U	1 U
Chlorobenzene	5	1 U	1 U	0.8 U	0.8 U	0.8 U	0.8 U	1 U	1 U	1 U	0.4 U		1 U	1 U	1 U
Chloroethane	5	2 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.8 U		1 U	1 U	1 U
Chloroform	7	1 U	1 U	0.8 U	0.8 U	0.8 U	0.8 U	1 U	1 U	1 U	0.7 U		1 U	1 U	1 U
Chloromethane	5	2 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U		1 U	1 U	1 U
cis-1,2-Dichloroethene	5	1 U	1 U	0.8 U	0.8 U	0.8 U	0.8 U	1 U	1 U	1 U	0.6 U		1 U	1 U	1 U
cis-1,3-Dichloropropene	0.4*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U		1 U	1 U	1 U
Dibromochloromethane	50	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U		1 U	1 U	1 U
Ethylbenzene	5	1 U	1 U	0.8 U	0.8 U	0.8 U	0.8 U	1 U	1 U	1 U	1 U		1 U	1 U	1 U
Methylene Chloride	5	2 U	2 U	2 U	2 U	2 U	2 U	1 U	0.9 J	1 U	0.41 JB		1 U	5 U	5 U
Styrene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U		1 U	1 U	1 U
Tetrachloroethene	5	1 U	1 U	0.8 U	0.8 U	0.8 U	0.8 U	1 U	1 U	1 U	0.4 U		1 U	1 U	1 U
Toluene	5	1 U	1 U	0.7 U	0.7 U	0.7 U	0.7 U	1 U	1 U	1 U	0.3 U		1 U	1 U	1 U
trans-1,2-Dichloroethene	5	1 U	1 U	0.8 U	0.8 U	0.8 U	0.8 U	1 U	1 U	1 U	0.5 U		1 U	1 U	1 U
trans-1,3-Dichloropropene	0.4*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.8 U		1 U	1 U	1 U
Trichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.7 U	0.51 J	0.46 J	0.2 J	1 U
Vinyl chloride	2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.8 U		1 U	1 U	1 U
Xylenes, Total	5	1 U	1 U	0.8 U	0.8 U	0.8 U	0.8 U	1 U	1 U	1 U	1 U		2 U	2 U	2 U

Notes:
µg/L = micrograms per liter
U = indicates that the compud was analyzed for but not detected
J = indicates an estimated value
B = indicates that the analyte was found in both the sample and its associated laboratory blank

350	Exceeds NYSDEC Class GA Groundwater Standards

EHS Support consider it done

TABLE 4-4
VOCS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	Water Quality Standards	MW-21R	MW-21R	MW-21R	MW-21R	MW-21R	MW-21R	MW-21R	MW-21R	MW-21R	MW-21R	MW-21R
Date Collected:	703.5**	8/15/2000	4/30/2003	10/14/2003	10/18/2004	6/7/2005	10/17/2005	10/10/2006	4/16/2008	10/7/2008	9/29/2009	4/28/2010
Volatile Organic Compounds (ug/L)												
1,1,1-Trichloroethane	5	1 J	**10**	0.8 U	1 U	1 U	1 U	0.4 U				
1,1,2,2-Tetrachloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	0.4 U				
1,1,2-Trichloroethane	1	1 U	0.8 U	0.8 U	1 U	1 U	1 U	0.6 U				
1,1-Dichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	0.6 U				
1,1-Dichloroethene	5	1 U	**7**	0.8 U	1 U	1 U	1 U	0.7 U				
1,2-Dichloroethane	0.6	1 U	1 U	1 U	1 U	1 U	1 U	0.6 U				
1,2-Dichloropropane	1	1 U	1 U	1 U	1 U	1 U	1 U	0.9 U				
2-Butanone (MEK)	5	3 U	3 U	3 U	1 U	1 U	1 U	1.2 U				
2-Hexanone	50	3 U	3 U	3 U	1 U	1 U	1 U	0.8 U				
4-Methyl-2-pentanone (MIBK)	5	3 U	3 U	3 U	1 U	1 U	1 U	0.7 U				
Acetone	50	18 J	6 U	6 U	1 U	2.1 B	1 U	1.7 JB		2.5 J		
Benzene	1	1 U	0.5 U	0.5 U	1 U	1 U	1 U	0.4 U				
Bromodichloromethane	50	1 U	1 U	1 U	1 U	1 U	1 U	0.4 U				
Bromoform	50	1 U	1 U	1 U	1 U	1 U	1 U	0.8 U				
Bromomethane	5	2 U	1 U	1 U	1 U	1 U	1 U	1.2 U				
Carbon disulfide	5	1 U	4 J	1 U	1 U	1 U	1 U	0.9 U				
Carbon tetrachloride	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U				
Chlorobenzene	5	1 U	0.8 U	0.8 U	1 U	1 U	1 U	0.4 U				
Chloroethane	5	2 U	1 U	1 U	1 U	1 U	1 U	0.8 U				
Chloroform	7	1 U	0.8 U	0.8 U	1 U	1 U	1 U	0.7 U				
Chloromethane	5	2 U	1 U	1 U	1 U	1 U	1 U	0.5 U				
cis-1,2-Dichloroethene	5	1 U	0.8 U	0.8 U	1 U	1 U	1 U	0.71 J	1.1 J	1.6 J	2.1 J	0.25 J
cis-1,3-Dichloropropene	0.4*	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U				
Dibromochloromethane	50	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U				
Ethylbenzene	5	1 U	0.8 U	0.8 U	1 U	1 U	1 U	1 U				
Methylene Chloride	5	2 U	2 U	2 U	1 U	1 U	1 U	0.4 UB				
Styrene	5	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U				
Tetrachloroethene	5	1 U	0.8 U	0.8 U	1 U	1 U	1 U	0.5 U				
Toluene	5	1 U	0.7 U	0.7 U	1 U	1 U	1 U	0.3 U				
trans-1,2-Dichloroethene	5	1 U	0.8 U	0.8 U	1 U	1 U	1 U	0.5 U				
trans-1,3-Dichloropropene	0.4*	1 U	1 U	1 U	1 U	1 U	1 U	0.8 U				
Trichloroethene	5	1 U	**16**	1 U	1 U	1 U	1 U	0.7 U	0.27 J	0.76 J		1.5
Vinyl chloride	2	1 U	1 U	1 U	1 U	1 U	1 U	0.8 U				
Xylenes, Total	5	1 U	0.8 U	0.8 U	1 U	1 U	1 U	1 U				

Notes:
µg/L = micrograms per liter
J = indicates an estimated value
B = indicates that the analyte was found in both the sample and its associated laboratory blank
350 Exceeds NYSDEC Class GA Groundwater Standards

EHS Support consider it done

TABLE 4-4
VOCS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	Water Quality Standards	MW-21R	MW-21R	MW-21R	MW-21R	MW-21R
Date Collected:	703.5**	11/2/2010	4/14/2011	10/11/2011	4/3/2012	10/24/2012
Volatile Organic Compounds (ug/L)						
1,1,1-Trichloroethane	5		1 U	1 U	1 U	
1,1,2,2-Tetrachloroethane	5		1 U	1 U	1 U	
1,1,2-Trichloroethane	1		1 U	1 U	1 U	
1,1-Dichloroethane	5		1 U	1 U	1 U	
1,1-Dichloroethene	5		1 U	1 U	1 U	
1,2-Dichloroethane	0.6		1 U	1 U	1 U	
1,2-Dichloropropane	1		1 U	1 U	1 U	
2-Butanone (MEK)	5		1 U	1 U	1 U	
2-Hexanone	50		1 U	1 U	1 U	
4-Methyl-2-pentanone (MIBK)	5		1 U	1 U	1 U	
Acetone	50		25 U	25 U	25 U	
Benzene	1		1 U	1 U	1 U	
Bromodichloromethane	50		1 U	1 U	1 U	
Bromoform	50		1 U	1 U	1 U	
Bromomethane	5		1 U	1 U	1 U	
Carbon disulfide	5		2 U	2 U	2 U	
Carbon tetrachloride	5		1 U	1 U	1 U	
Chlorobenzene	5		1 U	1 U	1 U	
Chloroethane	5		1 U	1 U	1 U	
Chloroform	7		1 U	1 U	1 U	
Chloromethane	5		1 U	U	1 U	
cis-1,2-Dichloroethene	5	0.42 J	0.63 J	1.1	0.59 J	0.43 J
cis-1,3-Dichloropropene	0.4*		1 U	1 U	1 U	
Dibromochloromethane	50		1 U	1 U	1 U	
Ethylbenzene	5		1 U	1 U	1 U	
Methylene Chloride	5		5 U	5 U	5 U	
Styrene	5		1 U	1 U	1 U	
Tetrachloroethene	5		1 U	1 U	1 U	
Toluene	5		1 U	1 U	1 U	
trans-1,2-Dichloroethene	5		1 U	0.23 J	1 U	
trans-1,3-Dichloropropene	0.4*		1 U	1 U	1 U	
Trichloroethene	5	1.6	**5**	**6.1**	2.3	2.1
Vinyl chloride	2		1 U	1 U	1 U	
Xylenes, Total	5		2 U	2 U	2 U	

Notes:
µg/L = micrograms per liter
J = indicates an estimated value
B = indicates that the analyte was found in both the
350 Exceeds NYSDEC

TABLE 4-4
VOCS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	Water Quality Standards	MW-22D	MW-22D	MW-22D	MW-22D	MW-22D	MW-22D	MW-22D	MW-22D	MW-22D	MW-22D	MW-22D
Date Collected:	703.5**	8/15/2000	4/16/2002	10/14/2002	4/28/2003	10/18/2004	6/7/2005	10/17/2005	10/12/2006	5/16/2007	4/28/2010	11/2/2010
Volatile Organic Compounds (µg/L)												
1,1,1-Trichloroethane	5	1 U	0.8 U	0.8 U	0.8 U		1 U	1 U	0.4 U		1.2	
1,1,2,2-Tetrachloroethane	5	1 U	1 U	1 U	1 U		1 U	1 U	0.4 U			
1,1,2-Trichloroethane	1	1 U	0.8 U	0.8 U	0.8 U		1 U	1 U	0.6 U			
1,1-Dichloroethane	5	1 U	1 U	1 U	1 U		1 U	1 U	0.6 U			
1,1-Dichloroethene	5	1 U	0.8 U	0.8 U	0.8 U		1 U	1 U	0.7 U		1.6	0.34 J
1,2-Dichloroethane	0.6	1 U	1 U	1 U	1 U		1 U	1 U	0.6 U			
1,2-Dichloropropane	1	1 U	1 U	1 U	1 U		1 U	1 U	0.5 U			
2-Butanone (MEK)	5	3 U	3 U	3 U	3 U		1 U	1 U	1.2 U			
2-Hexanone	50	3 U	3 U	3 U	3 U		1 U	1 U	0.8 U			
4-Methyl-2-pentanone (MIBK)	5	3 U	3 U	3 U	3 U		1 U	1 U	0.7 U			
Acetone	50	6 U	7 J	6 U	6 U		0.74 JB	1 U	1.4 UB			
Benzene	1	1 U	0.5 U	0.5 U	0.5 U		1 U	1 U	0.4 U			
Bromodichloromethane	50	1 U	1 U	1 U	1 U		1 U	1 U	0.4 U			
Bromoform	50	1 U	1 U	1 U	1 U		1 U	1 U	0.8 U			
Bromomethane	5	2 U	1 U	1 U	1 U		1 U	1 U	1.2 U			
Carbon disulfide	5	1 U	1 U	1 U	1 U		1 U	1 U	0.9 U			
Carbon tetrachloride	5	1 U	1 U	1 U	1 U		1 U	1 U	1 U			
Chlorobenzene	5	1 U	0.8 U	0.8 U	0.8 U		1 U	1 U	0.4 U			
Chloroethane	5	2 U	1 U	1 U	1 U		1 U	1 U	0.8 U			
Chloroform	7	1 U	0.8 U	0.8 U	0.8 U		1 U	1 U	0.7 U			
Chloromethane	5	2 U	1 U	1 U	1 U		1 U	1 U	0.5 U			
cis-1,2-Dichloroethene	5	1 U	0.8 U	0.8 U	0.8 U		1 U	1 U	0.6 U			
cis-1,3-Dichloropropene	0.4*	1 U	1 U	1 U	1 U		1 U	1 U	0.5 U			
Dibromochloromethane	50	1 U	1 U	1 U	1 U		1 U	1 U	0.5 U			
Ethylbenzene	5	1 U	0.8 U	0.8 U	0.8 U		1 U	1 U	1 U			
Methylene Chloride	5	2 U	2 U	2 U	2 U		0.66 J	1 U	0.4 UB			
Styrene	5	1 U	1 U	1 U	1 U		1 U	1 U	0.5 U	0.58 J		
Tetrachloroethene	5	1 U	0.8 U	0.8 U	0.8 U		1 U	1 U	0.5 U			
Toluene	5	1 U	0.7 U	0.7 U	0.7 U		1 U	1 U	0.3 U			
trans-1,2-Dichloroethene	5	1 U	0.8 U	0.8 U	0.8 U		1 U	1 U	0.5 U			
trans-1,3-Dichloropropene	0.4*	1 U	1 U	1 U	1 U		1 U	1 U	0.8 U			
Trichloroethene	5	1 U	1 U	1 U	1 U		1 U	1 U	0.7 U		2.5	1.9
Vinyl chloride	2	1 U	1 U	1 U	1 U		1 U	1 U	0.8 U			
Xylenes, Total	5	1 U	0.8 U	0.8 U	0.8 U		1 U	1 U	1 U			

Notes:
µg/L = micrograms per liter
U = indicates that the compound was analyzed for but not detected
J = indicates an estimated value
350 Exceeds NYSDEC Class GA Groundwater Standards

TABLE 4-4
VOCS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	Water Quality Standards	MW-22D	MW-22D	MW-22D	MW-22D
Date Collected:	703.5**	4/14/2011	10/11/2011	4/3/2012	10/24/2012
Volatile Organic Compounds (µg/L)					
1,1,1-Trichloroethane	5	1 U	1 U	1 U	
1,1,2,2-Tetrachloroethane	5	1 U	1 U	1 U	
1,1,2-Trichloroethane	1	1 U	1 U	1 U	
1,1-Dichloroethane	5	1 U	1 U	1 U	
1,1-Dichloroethene	5	0.2 J	1 U	1 U	
1,2-Dichloroethane	0.6	1 U	1 U	1 U	
1,2-Dichloropropane	1	1 U	1 U	1 U	
2-Butanone (MEK)	5	1 U	1 U	1 U	
2-Hexanone	50	10 U	10 U	1 U	
4-Methyl-2-pentanone (MIBK)	5	1 U	1 U	1 U	
Acetone	50	25 U	25 U	25 U	
Benzene	1	1 U	1 U	1 U	
Bromodichloromethane	50	1 U	1 U	1 U	
Bromoform	50	1 U	1 U	1 U	
Bromomethane	5	1 U	1 U	1 U	
Carbon disulfide	5	2 U	2 U	1 U	
Carbon tetrachloride	5	1 U	1 U	1 U	
Chlorobenzene	5	1 U	1 U	1 U	
Chloroethane	5	1 U	1 U	1 U	
Chloroform	7	1 U	1 U	1 U	
Chloromethane	5	1 U	1 U	1 U	
cis-1,2-Dichloroethene	5	1 U	1 U	1 U	
cis-1,3-Dichloropropene	0.4*	1 U	1 U	1 U	
Dibromochloromethane	50	1 U	1 U	1 U	
Ethylbenzene	5	1 U	1 U	1 U	
Methylene Chloride	5	5 U	5 U	5 U	
Styrene	5	1 U	1 U	1 U	
Tetrachloroethene	5	1 U	1 U	1 U	
Toluene	5	1 U	1 U	1 U	
trans-1,2-Dichloroethene	5	1 U	1 U	1 U	
trans-1,3-Dichloropropene	0.4*	1 U	1 U	1 U	
Trichloroethene	5	1	1 U	1 U	**1.14** J
Vinyl chloride	2	1 U	1 U	1 U	
Xylenes, Total	5	2 U	2 U	2 U	

Notes:
µg/L = micrograms per liter
U = indicates that the compound was analyzed for b
J = indicates an estimated value

350	Exceeds NYSDEC

TABLE 4-4
VOCS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	**Water Quality Standards**	**MW-22R**	**MW-22R**	**MW-22R**	**MW-22R**	**MW-22R**	**MW-22R**	**MW-22R**	**MW-22R**	**MW-22R**	**MW-22R**	**MW-22R**	**MW-22R**	**MW-22R**	**MW-22R**
Date Collected:	**703.5****	**8/15/2000**	**4/15/2002**	**10/14/2002**	**4/28/2003**	**10/13/2003**	**10/18/2004**	**6/7/2005**	**10/17/2005**	**10/12/2006**	**10/25/2007**	**11/2/2010**	**4/14/2011**	**10/11/2011**	**4/4/2012**
Volatile Organic Compounds (ug/L)															
1,1,1-Trichloroethane	5	1 J	0.8 U	0.8 U	0.8 U	0.8 U	1 U	1 U	1 U	0.4 U			1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.4 U			1 U	1 U	1 U
1,1,2-Trichloroethane	1	1 U	0.8 U	0.8 U	0.8 U	0.8 U	1 U	1 U	1 U	0.6 U			1 U	1 U	1 U
1,1-Dichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U			1 U	1 U	1 U
1,1-Dichloroethene	5	1 U	0.8 U	0.8 U	0.8 U	0.8 U	1 U	1 U	1 U	0.7 U			1 U	1 U	1 U
1,2-Dichloroethane	0.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.6 U			1 U	1 U	1 U
1,2-Dichloropropane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.9 U			1 U	1 U	1 U
2-Butanone (MEK)	5	3 U	3 U	3 U	3 U	3 U	1 U	1 U	1 U	1.2 U			1 U	1 U	1 U
2-Hexanone	50	3 U	3 U	3 U	3 U	3 U	1 U	1 U	1 U	0.8 U			10 U	1 U	1 U
4-Methyl-2-pentanone (MIBK)	5	3 U	3 U	3 U	3 U	3 U	1 U	1 U	1 U	0.7 U			1 U	1 U	1 U
Acetone	50	10 J	7 J	6 U	6 U	6 U	3.8 B	0.89 JB	1 U	1.4 UB			25 U	25 U	25 U
Benzene	1	1 U	0.5 U	0.5 U	0.5 U	0.5 U	1 U	1 U	1 U	0.4 U			1 U	1 U	1 U
Bromodichloromethane	50	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.4 U			1 U	1 U	1 U
Bromoform	50	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.8 U			1 U	1 U	1 U
Bromomethane	5	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.2 U			1 U	1 U	1 U
Carbon disulfide	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.9 U			2 U	2 U	2 U
Carbon tetrachloride	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U			1 U	1 U	1 U
Chlorobenzene	5	1 U	0.8 U	0.8 U	0.8 U	0.8 U	1 U	1 U	1 U	0.4 U			1 U	1 U	1 U
Chloroethane	5	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.8 U			1 U	1 U	1 U
Chloroform	7	1 U	0.8 U	0.8 U	0.8 U	0.8 U	1 U	1 U	1 U	0.7 U			1 U	1 U	1 U
Chloromethane	5	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U			1 U	1 U	1 U
cis-1,2-Dichloroethene	5	1 U	0.8 U	0.8 U	0.8 U	0.8 U	1 U	1 U	1 U	0.6 U			1 U	1 U	1 U
cis-1,3-Dichloropropene	0.4*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U			1 U	1 U	1 U
Dibromochloromethane	50	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U			1 U	1 U	1 U
Ethylbenzene	5	1 U	0.8 U	0.8 U	0.8 U	0.8 U	1 U	1 U	1 U	1 U			1 U	1 U	1 U
Methylene Chloride	5	2 U	2 U	2 U	2 U	2 U	1 U	0.58 J	1 U	0.4 UB			5 U	5 U	5 U
Styrene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U			1 U	1 U	1 U
Tetrachloroethene	5	1 U	0.8 U	0.8 U	0.8 U	0.8 U	1 U	1 U	1 U	0.5 U			1 U	1 U	1 U
Toluene	5	1 U	0.7 U	0.7 U	0.7 U	0.7 U	1 U	1 U	1 U	0.3 U			1 U	1 U	1 U
trans-1,2-Dichloroethene	5	1 U	0.8 U	0.8 U	0.8 U	0.8 U	1 U	1 U	1 U	0.5 U			1 U	1 U	1 U
trans-1,3-Dichloropropene	0.4*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.8 U			1 U	1 U	1 U
Trichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.7 U	**11** V	0.14 J	1 U	1 U	1 U
Vinyl chloride	2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.8 U			1 U	1 U	1 U
Xylenes, Total	5	1 U	0.8 U	0.8 U	0.8 U	0.8 U	1 U	1 U	1 U	1 U			2 U	2 U	2 U

Notes:
µg/L = micrograms per liter
U = indicates that the compound was analyzed for but not detected
J = indicates an estimated value
B = indicates that the analyte was found in both the sample and its associated laboratory blank
V =
350 Exceeds NYSDEC Class GA Groundwater Standards

TABLE 4-4
VOCS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	Water Quality Standards	MW-25S	MW-25S	MW-25S	MW-25S	MW-25S	MW-25S	MW-25S	MW-25S	MW-25S	MW-25S	MW-25S	MW-25S
Date Collected:	703.5**	10/14/2002	4/28/2003	10/13/2003	10/18/2004	6/7/2005	10/17/2005	10/12/2006	4/29/2010	11/2/2010	4/14/2011	10/11/2011	4/4/2012
Volatile Organic Compounds (ug/L)													
1,1,1-Trichloroethane	5	0.8 U	0.8 U	0.8 U	1 U	1 U	1 U	0.4 U			1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	0.4 U			1 U	1 U	1 U
1,1,2-Trichloroethane	1	0.8 U	0.8 U	0.8 U	1 U	1 U	1 U	0.6 U			1 U	1 U	1 U
1,1-Dichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	0.6 U			1 U	1 U	1 U
1,1-Dichloroethene	5	0.8 U	0.8 U	0.8 U	1 U	1 U	1 U	0.7 U			1 U	1 U	1 U
1,2-Dichloroethane	0.6	1 U	1 U	1 U	1 U	1 U	1 U	0.6 U			1 U	1 U	1 U
1,2-Dichloropropane	1	1 U	1 U	1 U	1 U	1 U	1 U	0.9 U			1 U	1 U	1 U
2-Butanone (MEK)	5	3 U	3 U	3 U	1 U	1 U	1 U	1.2 U			1 U	1 U	1 U
2-Hexanone	50	3 U	3 U	3 U	1 U	1 U	1 U	0.8 U			10 U	10 U	1 U
4-Methyl-2-pentanone (MIBK)	5	3 U	3 U	3 U	1 U	1 U	1 U	0.7 U			1 U	1 U	1 U
Acetone	50	6 U	16 J	6 U	1 U	2 B	1 U	1.4 UB			25 U	25 U	25 U
Benzene	1	0.5 U	0.5 U	0.5 U	1 U	1 U	1 U	0.4 U			1 U	1 U	1 U
Bromodichloromethane	50	1 U	1 U	1 U	1 U	1 U	1 U	0.4 U			1 U	1 U	1 U
Bromoform	50	1 U	1 U	1 U	1 U	1 U	1 U	0.8 U			1 U	1 U	1 U
Bromomethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1.2 U			1 U	1 U	1 U
Carbon disulfide	5	1 U	1 U	1 U	1.5	1 U	1 U	0.9 U			2 U	2 U	2 U
Carbon tetrachloride	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U			1 U	1 U	1 U
Chlorobenzene	5	0.8 U	0.8 U	0.8 U	1 U	1 U	1 U	0.4 U			1 U	1 U	1 U
Chloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	0.8 U			1 U	1 U	1 U
Chloroform	7	0.8 U	0.8 U	0.8 U	1 U	1 U	1 U	0.7 U			1 U	1 U	1 U
Chloromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U	0.33 J		1 U	1 U	1 U
cis-1,2-Dichloroethene	5	0.8 U	0.8 U	0.8 U	1 U	1 U	1 U	0.6 U			1 U	1 U	1 U
cis-1,3-Dichloropropene	0.4*	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U			1 U	1	1 U
Dibromochloromethane	50	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U			1 U	1	1 U
Ethylbenzene	5	0.8 U	0.8 U	0.8 U	1 U	1 U	1 U	1 U			1 U	1	1 U
Methylene Chloride	5	2 U	2 U	2 U	1 U	0.73 J	1 U	0.4 UB			5 U	5 U	5 U
Styrene	5	1 U	1 U	1 U	1 U	1 U	1 U	0.5 U			1 U	1 U	1 U
Tetrachloroethene	5	0.8 U	0.8 U	0.8 U	1 U	1 U	1 U	0.5 U			1 U	1 U	1 U
Toluene	5	0.7 U	0.7 U	0.7 U	1 U	1 U	1 U	0.3 U			1 U	1 U	1 U
trans-1,2-Dichloroethene	5	0.8 U	0.8 U	0.8 U	1 U	1 U	1 U	0.5 U			1 U	1 U	1 U
trans-1,3-Dichloropropene	0.4*	1 U	1 U	1 U	1 U	1 U	1 U	0.8 U			1 U	1 U	1 U
Trichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	0.7 U		2.1 J	1 U	0.67 J	1 U
Vinyl chloride	2	1 U	1 U	1 U	1 U	1 U	1 U	0.8 U			1 U	1 U	1 U
Xylenes, Total	5	0.8 U	0.8 U	0.8 U	1 U	1 U	1 U	1 U			2 U	2 U	2 U

Notes:
µg/L = micrograms per liter
J = Indicates an estimated value

350	Exceeds NYSDEC Class GA Groundwater Standards

TABLE 4-5
INORGANICS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	**Water Quality**	**MW-2B**	**MW-2B**	**MW-2B**	**MW-2B**	**MW-2B**	**MW-2B**	**MW-2B**	**MW-2B**	**MW-2B**	**MW-2B**	**MW-2B**
Date Collected:	**Standards 703.5****	**8/14/2000**	**4/30/2001**	**4/17/2002**	**10/15/2002**	**4/28/2003**	**10/20/2004**	**10/18/2005**	**10/11/2006**	**5/17/2007**	**10/24/2007**	**4/16/2008**
Total Metals (µg/L)												
Aluminum	100	**229**	**1720**	1270	2410	**275**	**3530** N	**983**	80 U	**1900**	**110** J	94 J
Antimony	3	14 U	5.9 U	9.9 U	9.9 U	8.5 U	2.5 U	2.5 U	8.4 U			
Arsenic	25	5 U	3.9 J	4.9 U	4.9 U	4.9 U	3.3 B	3.1 U	4 U			
Barium	1000	55.1 J	74.3 J	115	141	64.4 J	114 B	130 B	63.4	65	100	50
Beryllium	3	1.9 U	0.64 U	0.5 U	0.5 U	0.34 U	0.4 U	0.4 U	0.21 U			
Cadmium	5	3.6 U	0.64 U	0.94 U	0.94 U	0.87 U	0.8 U	0.8 U	0.76 U			
Calcium	NA	57600	73100	56800	58400	71400	54300	51600	51200	90900	66400	72100
Chromium	50	43.2	**62.6**	67.5	102	26 J	29.5	33.6	2 U	7.3 J		
Cobalt	5	38.6 J	1.8 U	1.7 U	57.3	4.8 J	4.6 B	1.9 B	2.3 B	3.4 J		
Copper	200	2.7 U	7.1 J	5.5 J	10.9 J	3.5 J	8.8 B	9.7 B	4 U	5.3 J		
Iron	300*	**866**	**4480**	2530	4650	**849**	**5980** N	**1510**	25.7 U	**4100**	**390**	210
Lead	25	9.8 U	8.8 U	8.9 U	8.9 U	9.3 U	3.5	1.9 U	3 U	3.6 J		
Magnesium	35000	7340	8930	8130	8940	7190	9230	7460	7070	10800	9500	7800
Manganese	300*	176	**634**	271	667	99.4	**486**	**486**	6.1 B	**540**	62	29
Mercury	0.7	0.048 U	0.026 U	0.079 U	0.1 J	0.16 U	0.2 U	0.16 U	0.07 U			
Nickel	100	30.9 J	42.6 J	47.4 J	75.4	20.9 J	18.5 B	36.8 B	6.4 B	7.7 J		
Potassium	NA	1400	1930	1940	2250	1220	2960 B	1910 BE	1270	1300	1500	1400
Selenium	10	**220**	**20.5**	92.4 U	180	**14.3**	**485**	**1470**	**334**	**25** J	**670**	**38**
Silver	50	3.6 U	1.3 U	1.4 U	1.4 U	1.8 U	1.1 UN	3.2 B	0.73 U			
Sodium	20000	7140	7180	7100	7760	6420	6430 E	7090	7990	7000	7700	4900
Thallium	0.5	9.5 U	8.8 U	9.5 U	9.5 U	8.9 U	2.9 U	2.9 U	10.1 U			
Vanadium	5	2.6 U	4.7 J	3.1 J	5.8 J	1.7 U	**7** B	2 B	0.6 U	4 J		
Zinc	2000	84.4	23.9 J	13.7 J	33.5	7.6 J	46.3	17.9 B	10 U	17 J		

TABLE 4-5
INORGANICS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	Water Quality	MW-2B	MW-2B	MW-2B	MW-2B	MW-2B	MW-2B	MW-2B	MW-2B	MW-2B	MW-2B	MW-2B
Date Collected:	**Standards 703.5****	**8/14/2000**	**4/30/2001**	**4/17/2002**	**10/15/2002**	**4/28/2003**	**10/20/2004**	**10/18/2005**	**10/11/2006**	**5/17/2007**	**10/24/2007**	**4/16/2008**
Dissolved Metals (µg/L)												
Aluminum	100	25.6 J	**105** J	48 U	47.7 U	41.3 U	10.4 U	10.4 U	80 U			
Antimony	3	14 U	5.9 U	9.9 U	9.9 U	8.5 U	2.5 U	2.5 U	8.4 U			
Arsenic	25	5 U	3.7 U	4.9 U	4.9 U	4.9 U	3.1 U	3.1 U	4 U			
Barium	1000	53.7 J	47.2 J	94.5 J	96.6 J	59 J	73.6 B	77.4 B	64.8	45	98	52
Beryllium	3	1.9 U	0.34 U	0.5 U	0.5 U	0.34 U	0.4 U	0.4 U	0.21 U			
Cadmium	5	3.6 U	0.64 U	0.94 U	0.94 U	0.87 U	0.8 U	0.8 U	0.76 U			
Calcium	NA	50600	71700	55300	56400	68700	54100	54500	52200	94100	65000	78400
Chromium	50	6.6 U	1.7 U	2 U	2 U	2.9 J	1.6 B	1.4 B	2 B			
Cobalt	5	9.2 J	1.8 U	1.7 U	48.3 J	2 J	1.9 U	4.6 B	2.2 B			
Copper	200	3 J	2.4 U	2.6 U	5.9 J	2.2 J	1.2 U	1.2 U	4 U			
Iron	300*	12.3 J	38 U	35 U	34.9 U	45.3 U	7.7 U	7.7 U	25.7 U			
Lead	25	9.8 U	8.8 U	8.9 U	8.9 U	9.3 U	1.9 UN	1.9 U	3 U			
Magnesium	35000	6900	8040	20 U	8090	7100	8360	7820	7190	10500	9100	8300
Manganese	300*	6.2 J	6.5 J	6.9 J	24.8	4.8 J	4.7 B	18.2	6.7 B			
Mercury	0.7	0.048 U	0.026 U	0.079 U	0.079 U	0.16 U	0.2 U	0.16 U	0.07 U			
Nickel	100	8.4 U	6.6 J	9.4 J	17.5 J	10.5 J	2.3 U	7.8 B	7.4 B	0.7 J		
Potassium	NA	1620	1580	1560	1380	1270	1870 B	1880 B	1300	990	1500	1400
Selenium	10	**226**	**21.9**	91.2	176	**14**	**532** N	**1550**	**341**	**27** J	**670**	**45**
Silver	50	3.6 U	1.3 U	1.4 U	1.4 U	1.8 U	1.1 U	1.1 U	0.73 U			
Sodium	20000	6980	6610	6920	7600	6140	5930 E	6900	8190	7200	7400	5200
Thallium	0.5	9.5 U	8.8 U	9.5 U	9.5 U	8.9 U	2.9 UN	**4.3** B	10.1 U			
Vanadium	5	2.6 U	1.6 U	1.7 U	1.7 U	1.7 U	2 U	2 U	0.6 U			
Zinc	2000	128	8 J	4.9 J	26 U	4.9 J	3.3 B	2.5 U	10 U			

Notes:

µg/L = micrograms per liter

U = indicates that the compound was analyzed for but not detected

J = indicates an estimated value

B = the reported value is less than the Contract Required Detection Limit (CRDL), but greater than the Instrument Detection Limit (IDL)

E = indicates an estimated value because of the presence of interference

N = spiked sample recovery not within control limits

350 Exceeds NYSDEC Class GA Groundwater Standards

TABLE 4-5
INORGANICS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	**Water Quality**	**MW-2B**	**MW-2B**	**MW-2B**	**MW-2B**	**MW-2B**	**MW-2B**	**MW-2B**	**MW-2B**
Date Collected:	**Standards 703.5****	**10/7/2008**	**4/22/2009**	**9/28/2009**	**4/28/2010**	**11/2/2010**	**4/14/2011**	**10/10/2011**	**4/3/2012**
Total Metals (µg/L)									
Aluminum	100	**160** J	**750**	62 J		**1100**	200 U	200 U	**120** J
Antimony	3						20 U	20 U	20 U
Arsenic	25						20 U	20 U	20 U
Barium	1000	100	52	44	40	110	45	65	40
Beryllium	3						4 U	4 U	4 U
Cadmium	5						5 U	5 U	5 U
Calcium	NA	68100	79900	51200	84000	65000	75000	87000	89000
Chromium	50		2.3 J			3.2 J	10 U	10 U	10 U
Cobalt	5		0.56 J			1.2 J	10 U	10 U	10 U
Copper	200		2.6 J			4.8 J	20 U	20 U	2 J
Iron	300*	280	**1500**	90.4 J	110	**1400**	100 U	100 U	220
Lead	25						10 U	10 U	10 U
Magnesium	35000	9400	10400	7160	9100	9200	8100	8700	11000
Manganese	300*	40	190	14.8	35	**360**	3.9 J	45	55
Mercury	0.7						0.2 U	0.2 U	0.2 U
Nickel	100		2.4 J			2.9 J	40 U	40 U	40 U
Potassium	NA	1800	1300	1680	980 J	2300	920 J	1600	990 J
Selenium	10	**700**	**25** J	**569**	**28**	**1100**	**40**	**350**	**14** J
Silver	50						10 U	10 U	10 U
Sodium	20000	9600	7100	8430	6400	8600	5200	6100	6300
Thallium	0.5						25 U	25 U	25 U
Vanadium	5						10 U	10 U	10 U
Zinc	2000		8.0 J			8.8 J	20 U	20 U	20 U

TABLE 4-5
INORGANICS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	**Water Quality**	**MW-2B**	**MW-2B**	**MW-2B**	**MW-2B**	**MW-2B**	**MW-2B**	**MW-2B**	**MW-2B**
Date Collected:	**Standards 703.5****	**10/7/2008**	**4/22/2009**	**9/28/2009**	**4/28/2010**	**11/2/2010**	**4/14/2011**	**10/10/2011**	**4/3/2012**
Dissolved Metals (µg/L)									
Aluminum	100		**240** J				200 U	200 U	200 U
Antimony	3						20 U	20 U	20 U
Arsenic	25						20 U	20 U	20 U
Barium	1000	100	47	42.5	39	94	47	63	39
Beryllium	3				0.1 J		4 U	4 U	4 U
Cadmium	5						5 U	5 U	5 U
Calcium	NA	69600	81500	50700	82000	64000	75000	88000	90000
Chromium	50		1.0 J				10 U	10 U	10 U
Cobalt	5	4.5 J	0.73 J	1.0 J			10 U	10 U	10 U
Copper	200						20 U	20 U	20 U
Iron	300*		**470**				50 U	50 U	24 J
Lead	25						10 U	10 U	10 U
Magnesium	35000	9600	10400	6980	9200	8900	8100	8900	11000
Manganese	300*	11 J	50	3.2 J	3.6 J		10 U	24	8.3 J
Mercury	0.7						0.2 U	0.2 U	0.2 U
Nickel	100						40 U	40 U	40 U
Potassium	NA	1800	1200	1620	1000	2000	940 J	1600	1000
Selenium	10	**730**	**23** J	**558**	**26**	**1100**	**42**	**320**	**17** J
Silver	50						10 U	10 U	10 U
Sodium	20000	9800	7200	8200	6400	8500	5600	6200	6300
Thallium	0.5						25 U	25 U	25 U
Vanadium	5						10 U	10 U	10 U
Zinc	2000						20 U	20 U	20 U

Notes:
µg/L = micrograms per liter
U = indicates that the compound was analyzed
J = indicates an estimated value
B = the reported value is less than the Contract
E = indicates an estimated value because of the
N = spiked sample recovery not within control

350	Exceeds NYSDEC Cla:

TABLE 4-5
INORGANICS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	**Water Quality**	**MW-15S**	**MW-15S**	**MW-15S**	**MW-15S**	**MW-15S**	**MW-15S**	**MW-15S**	**MW-15S**	**MW-15S**	**MW-15S**	**MW-15S**
Date Collected:	**Standards 703.5****	**8/14/2000**	**4/30/2001**	**4/16/2002**	**10/15/2002**	**4/29/2003**	**10/20/2004**	**10/20/2005**	**10/11/2006**	**5/17/2007**	**10/23/2007**	**4/15/2008**
Total Metals (µg/L)												
Aluminum	100	**625**	**509**	**1850**	**151** J	**807**	**7020** N	**358**	80 U	**170** J		**110** J
Antimony	3	14 U	5.9 U	9.9 U	9.9 U	8.5 U	2.5 U	2.5 UN	8.4 U			**7.5** J
Arsenic	25	5 U	3.7 U	4.9 U	4.9 U	4.9 U	4.8 B	3.1 U	4 U			
Barium	1000	70.7 J	63.2 J	50.7 J	42 J	49.3 J	95.8 B	37.1 B	42.8	36	31	32
Beryllium	3	1.9 U	0.64 U	0.5 U	0.5 U	0.34 U	0.4 U	0.4 U	0.21 U			
Cadmium	5	3.6 U	0.76 J	0.94 U	0.94 U	0.87 U	0.8 U	0.8 U	0.76 U			
Calcium	NA	136000	111000	90500	75400	96100	1030000	69300	73500	75200	62300	73700
Chromium	50	10.4 J	14.2 J	4.6 J	2.4 J	8.2 J	24.6	1.8 B	2 U			2.7 J
Cobalt	5	**26.9** J	1.8 U	1.7 U	12.9 J	2.3 J	**10.8** B	1.9 U	1.7 B B	1 J		
Copper	200	2.7 U	2.4 U	6.5 J	3.4 J	2.6 J	15.5 B	4.5 B	4 U			
Iron	300*	**1440**	**885**	**4130**	**310**	**1450**	**10400** N	**577**	25.7 U	200 J	210	280
Lead	25	9.8 U	8.8 U	8.9 U	8.9 U	9.3 U	7.5	1.9 U	3 U			
Magnesium	35000	**35100**	30200	19500	16900	25400	26500	16300	18800	20700	14600	20300
Manganese	300*	**1100**	**325**	**825**	**320**	**474**	**2160**	210	22.9	230	**800**	160
Mercury	0.7	0.048 U	0.026 U	0.079 U	0.079 U	0.16 U	0.2 U	0.16 UN	0.07 U			
Nickel	100	13.1 J	9.9 J	9.6 J	3.1 J	**8.2** J	**25.7** B	2.3 U	**1.7** B	**0.98** J	**2.8** J	
Potassium	NA	1400	792	1390	876	958	4180 B	1280 B	555	440	570	760
Selenium	10	61.9	73.1	137	99.4	**51.9**	**32**	**262** N	**40.2**	9.1 J	**410**	**25** J
Silver	50	3.6 U	1.3 U	1.4 U	1.4 U	1.8 U	1.1 UN	2.2 BN	0.73 U			
Sodium	20000	**90200**	**82100**	**35000**	**29700**	**71300**	**70400** E	**29900** E	**60300**	**74200**	**20700**	**67200**
Thallium	0.5	9.5 U	2.8 U	9.5 U	9.5 U	8.9 U	2.9 U	2.9 U	10.1 U			
Vanadium	5	2.6 U	1.6 U	4 J	1.7 U	1.7 U	**12.8** B	2 U	0.6 U			
Zinc	2000	64.9	8.7 J	17.7 J	9.9 J	13.6 J	76	11.7 B	10 U			

TABLE 4-5
INORGANICS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	Water Quality	MW-15S	MW-15S	MW-15S	MW-15S	MW-15S	MW-15S	MW-15S	MW-15S	MW-15S	MW-15S	MW-15S
Date Collected:	**Standards 703.5****	**8/14/2000**	**4/30/2001**	**4/16/2002**	**10/15/2002**	**4/29/2003**	**10/20/2004**	**10/20/2005**	**10/11/2006**	**5/17/2007**	**10/23/2007**	**4/15/2008**
Dissolved Metals (µg/L)												
Aluminum	100	20.5 J	82.5 J	48 U	47.7 U	41.3 U	31.3 B	10.4 U	80 U			
Antimony	3	14 U	5.9 U	9.9 U	9.9 U	8.5 U	2.5 U	2.5 UN	8.4 U			
Arsenic	25	5 U	3.7 U	4.9 U	4.9 U	5 J	3.1 U	3.1 U	4 U			
Barium	1000	64.5 J	53.8 J	37.4 J	39.2 J	39.9 J	40.8 B	34.7 B	42.3	35	22	28
Beryllium	3	1.9 U	0.64 U	0.5 U	0.5 U	0.34 U	0.4 U	0.4 U	0.21 U			
Cadmium	5	3.6 U	0.64 U	0.94 U	0.94 U	0.87 U	0.8 U	0.8 U	0.76 U			
Calcium	NA	125000	108000	78000	72800	90800	80400	66300	73300	78100	58900	66300
Chromium	50	6.6 U	1.7 U	2 U	2 U	2.2 U	1.4 B	0.9 U	2 U			
Cobalt	5	**12.7** J	1.8 U	1.7 U	4.5 J	1.6 U	1.9 U	**5.5** B	1.4 B			
Copper	200	2.7 U	2.4 U	2.6 U	183	2.4 J	1.2 U	5.5 B	4 U			
Iron	300*	27.3 J	40.4 J	35 U	34.9 U	45.3 U	15.7 B	40.1 B	25.7 U			
Lead	25	9.8 U	8.8 U	8.9 U	8.9 U	9.3 U	1.9 UN	1.9 U	3 U			
Magnesium	35000	33500	29900	17700	17000	25000	22300	15700	18700	21700	13600	18700
Manganese	300*	18.6	26.4	3.8 J	7.2 J	8.8 J	24.4	28.4	20.7	3.2 J		6.3 J
Mercury	0.7	0.048 U	0.026 U	0.079 U	0.079 U	0.16 U	0.2 U	0.16 UN	0.07 U			
Nickel	100	8.4 U	2.9 J	1.9 U	1.9 U	3.8 U	2.3 U	2.3 U	1.9 B			
Potassium	NA	776	679	850	809	750	921 B	1100 B	549	450	540	640
Selenium	10	**70.4**	79.1	**137**	101	**48.7**	**38.4** N	**243** N	**36.6**	**11** J	**390**	**28** J
Silver	50	3.6 U	1.3 U	1.4 U	1.4 U	1.8 U	1.1 U	1.7 BN	0.73 U			
Sodium	20000	97400	84900	34000	31600	**79500**	**68300** E	**28100** E	**60000**	**77900**	19500	**63100**
Thallium	0.5	9.5 U	8.8 U	9.5 U	9.5 U	8.9 U	2.9 UN	2.9 U	10.1 U			
Vanadium	5	2.6 U	1.6 U	1.7 U	1.7 U	1.7 U	2 U	2 U	0.6 U			
Zinc	2000	74.9	3.6 J	4.9 U	84.2	7.4 J	5.7 B	2.5 U	10 U			

Notes:
µg/L = micrograms per liter
U = indicates that the compound was analyzed for but not detected
J = indicates an estimated value
B = the reported value is less than the Contract Required Detection Limit (CRDL), but greater than the Instrument Detection Limit (IDL)
E = indicates an estimated value because of the presence of interference
N = spiked sample recovery not within control limits

350	Exceeds NYSDEC Class GA Groundwater Standards

TABLE 4-5
INORGANICS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	**Water Quality**	**MW-15S**	**MW-15S**	**MW-15S**	**MW-15S**	**MW-15S**	**MW-15S**	**MW-15S**	**MW-15S**
Date Collected:	**Standards 703.5****	**10/6/2008**	**4/21/2009**	**9/28/2009**	**4/28/2010**	**11/2/2010**	**4/13/2011**	**10/10/2011**	**4/3/2012**
Total Metals (µg/L)									
Aluminum	100	**210** J	89 J	74.1 J			200 U	200 U	**160** J
Antimony	3					**6.4** J	20 U	20 U	20 U
Arsenic	25						20 U	20 U	20 U
Barium	1000	43	27	36.9	27	30	22	28	26
Beryllium	3						4 U	4 U	4 U
Cadmium	5						5 U	5 U	5 U
Calcium	NA	73400	64900	72500	68000	65000	65000	70000	62000
Chromium	50						10 U	10 U	1.2 J
Cobalt	5						10 U	10 U	10 U
Copper	200	2.2 J	2.9 J			3.5 J	2 J	20 U	6.2 J
Iron	300*	**410**	140	94.6 J	130	210	94 J	54 U	260
Lead	25						10 U	10 U	10 U
Magnesium	35000	19000	19500	17900	19000	16000	19000	17000	18000
Manganese	300*	**390**	280	76	510	**490**	250	120	**910**
Mercury	0.7						0.2 U	0.2 U	0.2 U
Nickel	100	**2.0** J					40 U	40 U	4.7 J
Potassium	NA	740	360	659	260 J	420 J	290 J	310 J	340 J
Selenium	10	**29** J		**15.5** J		**120**	8 J	**10** J	6.9 J
Silver	50					1.4 J	10 U	10 U	10 U
Sodium	20000	**54200**	**76900**	**54100**		**48000**	**66000**	**67000**	**67000**
Thallium	0.5		4.9 J				25 U	25 U	25 U
Vanadium	5						10 U	10 U	10 U
Zinc	2000				**73000**		20 U	20 U	8.7 J

TABLE 4-5
INORGANICS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	**Water Quality**	**MW-15S**	**MW-15S**	**MW-15S**	**MW-15S**	**MW-15S**	**MW-15S**	**MW-15S**	**MW-15S**
Date Collected:	**Standards 703.5****	**10/6/2008**	**4/21/2009**	**9/28/2009**	**4/28/2010**	**11/2/2010**	**4/13/2011**	**10/10/2011**	**4/3/2012**
Dissolved Metals (µg/L)									
Aluminum	100						200 U	200 U	200 U
Antimony	3						20 U	20 U	**7.8** J
Arsenic	25						20 U	20 U	20 U
Barium	1000	35	24	36.3	22	25	20	23	20
Beryllium	3				0.12 J		4 U	4 U	4 U
Cadmium	5						5 U	5 U	5 U
Calcium	NA	72500	65700	72500	67000	64000	64000	70000	63000
Chromium	50						10 U	10 U	10 U
Cobalt	5	1.8 J	2.9 J	**5.0**			10 U	10 U	10 U
Copper	200	1.8 J					20 U	20 U	20 U
Iron	300*		17 J				50 U	59	50 U
Lead	25						10 U	10 U	10 U
Magnesium	35000	19000	19500	18100	20000	16000	18000	18000	18000
Manganese	300*	15 J	6.5 J	23.9			10 U	59	10 U
Mercury	0.7						0.2 U	0.2 U	0.2 U
Nickel	100						40 U	40 U	40 U
Potassium	NA	640	320	642	260 J	440 J	290 J	330 J	280 J
Selenium	10	**29** J		**17.4** J		120	9.2 J	9 J	20 U
Silver	50						10 U	10 U	10 U
Sodium	20000	**56000**	**76000**	**56000**		**49000**	**66000**	**68000**	**70000**
Thallium	0.5		**4.0** J				25 U	25 U	**9.7** J
Vanadium	5						10 U	10 U	10 U
Zinc	2000				**74000**		20 U	7.4 J	20 U

Notes:
µg/L = micrograms per liter
U = indicates that the compound was analyzed
J = indicates an estimated value
B = the reported value is less than the Contract
E = indicates an estimated value because of the
N = spiked sample recovery not within control

350	Exceeds NYSDEC Cla:

TABLE 4-5
INORGANICS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	**Water Quality**	**MW-15D**	**MW-15D**	**MW-15D**	**MW-15D**	**MW-15D**	**MW-15D**	**MW-15D**	**MW-15D**	**MW-15D**	**MW-15D**	**MW-15D**
Date Collected:	**Standards 703.5****	**8/14/2000**	**5/1/2001**	**4/16/2002**	**10/15/2002**	**4/29/2003**	**10/20/2004**	**10/20/2005**	**10/11/2006**	**5/17/2007**	**10/23/2007**	**4/15/2008**
Total Metals (µg/L)												
Aluminum	100	74.9 J	**241**	95.6 J	**2770**	66.1 J	**1290** N	**1560**	**570**	**170** J	**140** J	
Antimony	3	14 U	5.9 U	9.9 U	9.9 U	8.5 U	2.5 U	2.5 UN	8.4 U			
Arsenic	25	5 U	3.7 U	4.9 U	4.9 U	4.9 U	3.1 U	3.1 U	4 U			
Barium	1000	426	130	175	366	181	239	188 B	241	260	130	150
Beryllium	3	1.9 U	0.64 U	0.5 U	0.5 U	0.34 U	0.4 U	0.4 U	0.21 U			
Cadmium	5	3.6 U	0.64 U	0.94 U	0.94 U	0.87 U	0.8 U	0.8 U	0.76 U			
Calcium	NA	102000	72900	75500	107000	78100	98700	110000	127000	205000	62700	68800
Chromium	50	7.8 J	4.8 J	2 U	60.8	9.2 J	12.9	7.7 B	27.5	5.4 J		
Cobalt	5	7.1 U	1.8 U	1.7 U	18 J	1.6 U	3.1 B	3.5 B	2.4 B	1.3 J		
Copper	200	2.7 U	2.4 U	2.6 U	16.4 J	2.1 U	5.7 B	9.1 B	5.6 B			
Iron	300*	275	**508**	**323**	**6720**	186	**2360** N	**3030**	**1170**	47 J	230	70 J
Lead	25	9.8 U	8.8 U	8.9 U	8.9 U	9.3 U	1.9 U	2.8 B	3 U			
Magnesium	35000	15000	10500	9260	11200	9020	8200	14900	10600	620	6000	7300
Manganese	300*	18.9	35.6	30.8	**457**	16.8	129	**349**	84.8	5.9 J	17	6.0 J
Mercury	0.7	0.048 U	0.026 U	0.079 U	0.079 U	0.16 U	0.2 U	0.16 UN	0.07 U			
Nickel	100	8.4 U	3 J	2.1 J	40.8 J	7.2 J	4.8 B	4.1 B	19.6	1.3 J		
Potassium	NA	2740	4160	4480	6390	3050	5030	3700 B	3240	5700	4000	4300
Selenium	10	374	**374**	**290**	**171**	**219**	**406**	**598** N	**595**	**81**	**390**	**370**
Silver	50	3.6 U	1.3 U	1.4 U	1.4 U	1.8 U	1.1 UN	2.8 BN	0.73 U			
Sodium	20000	11600	10700	10200	12000	10400	9950 E	9080 E	12000	19800	10100	9900
Thallium	0.5	9.5 U	8.8 U	9.5 U	9.5 U	8.9 U	2.9 U	2.9 U	10.1 U			
Vanadium	5	2.6 U	1.6 U	1.7 U	5.8 J	1.7 U	**3.1** B	3.2 B	1.8 U	1.4 J		
Zinc	2000	8.6 U	3.5 J	4.9 U	24.8 J	4.1 U	10.4 B	24.3	10.6 B			

TABLE 4-5
INORGANICS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	**Water Quality**	**MW-15D**	**MW-15D**	**MW-15D**	**MW-15D**	**MW-15D**	**MW-15D**	**MW-15D**	**MW-15D**	**MW-15D**	**MW-15D**	**MW-15D**
Date Collected:	**Standards 703.5****	**8/14/2000**	**5/1/2001**	**4/16/2002**	**10/15/2002**	**4/29/2003**	**10/20/2004**	**10/20/2005**	**10/11/2006**	**5/17/2007**	**10/23/2007**	**4/15/2008**
Dissolved Metals (ug/L)												
Aluminum	100	33.1 J	41.8 J	48 U	47.7 U	41.3 U	42.8 B	10.4 U	80 U		**190** J	
Antimony	3	14 U	5.9 U	9.9 U	11.7 J	8.5 U	2.5 U	2.5 UN	8.4 U			
Arsenic	25	5 U	3.7 U	4.9 U	4.9 U	4.9 U	3.1 U	3.1 U	4 U			
Barium	1000	161	107	129	90.6 J	132	94.6 B	85.7 B	71.8	250	130	120
Beryllium	3	1.9 U	0.64 U	0.5 U	0.5 U	0.34 U	0.4 U	0.4 U	0.21 U			
Cadmium	5	3.6 U	0.64 U	0.94 U	0.94 U	0.87 U	0.8 U	0.8 U	0.76 U			
Calcium	NA	35800	73900	54000	23700	58900	47900	55600	49600	197000	64600	67500
Chromium	50	6.6 U	1.7 U	2 U	2 U	2.2 U	2.2 B	1.4 B	2 U	5 J	2 J	2.0 J
Cobalt	5	7.1 U	1.8 U	1.7 U	3.5 J	1.6 U	1.9 U	1.9 U	1.1 B	1.3 J		
Copper	200	2.7 U	2.4 U	2.6 U	3.6 J	3.2 J	1.2 U	1.3 B	4 U			
Iron	300*	6.9 J	38 U	35 U	64.6 J	45.3 U	7.7 U	7.7 U	25.7 U		280	
Lead	25	9.8 U	8.8 U	8.9 U	8.9 U	9.3 U	1.9 UN	1.9 U	3 U			
Magnesium	35000	9830	10400	9090	8020	8800	5600	7950	7350	52 J	5300	6300
Manganese	300*	2.5 U	5.6 J	4 J	3.8 J	1.4 J	2.1 U	2.1	1.9 B		19	
Mercury	0.7	0.048 U	0.026 U	0.079 U	0.079 U	0.16 U	0.2 U	0.16 UN	0.07 U			
Nickel	100	8.4 U	2.3 J	1.9 U	1.9 U	3.8 U	2.3 U	2.3 U	2.2 B	1.3 J		
Potassium	NA	3400	4750	4710	5340	3510	4300 B	4130 B	2610	6000	4000	4400
Selenium	10	**398**	**399**	**294**	**180**	**215**	**425** N	**564** N	**589**	**92**	**360**	**340**
Silver	50	3.6 U	1.3 U	1.4 U	3.9 J	1.8 U	1.1 U	1.1 U	0.73 U			
Sodium	20000	12000	11000	10400	12000	10500	8910 E	9300 E	10000	20500	10200	10600
Thallium	0.5	9.5 U	8.8 U	9.5 U	9.5 U	8.9 U	2.9 UN	2.9 U	10.1 U			
Vanadium	5	3.6 U	1.6 U	1.7 U	1.7 U	1.7 U	2 U	2 U	0.6 U	1.2 J		
Zinc	2000	8.6 U	17.1 J	95.6 J	7.8 J	4.1 U	2.5 U	4.2 B	10 U			

Notes:
µg/L = micrograms per liter
U = indicates that the compound was analyzed for but not detected
J = indicates an estimated value
B = the reported value is less than the Contract Required Detection Limit (CRDL), but greater than the Instrument Detection Limit (IDL)
E = indicates an estimated value because of the presence of interference
N = spiked sample recovery not within control limits
350 Exceeds NYSDEC Class GA Groundwater Standards

TABLE 4-5
INORGANICS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	**Water Quality**	**MW-15D**	**MW-15D**	**MW-15D**	**MW-15D**	**MW-15D**	**MW-15D**	**MW-15D**	**MW-15D**
Date Collected:	**Standards 703.5****	**10/6/2008**	**4/21/2009**	**9/28/2009**	**4/28/2010**	**11/2/2010**	**4/13/2011**	**10/10/2011**	**4/3/2012**
Total Metals (µg/L)									
Aluminum	100	67 J	78 J	27.3 J			200 U	200 U	**350**
Antimony	3						20 U	20 U	20 U
Arsenic	25						20 U	20 U	5.1 J
Barium	1000	120	240	106	160	130	130	140	170
Beryllium	3						4 U	4 U	4 U
Cadmium	5						5 U	5 U	5 U
Calcium	NA	62000	145000	58500	97000	35000	62000	53000	84000
Chromium	50		4.4 J	0.52 J	2.2 J	1.8 J	2.5 J	10 U	3.4 J
Cobalt	5						10 U	10 U	1.2 J
Copper	200	4.1 J				2.2 J	20 U	20 U	3.5 J
Iron	300*	180 J	98 J	26.8 J	66 J		100 U	54 J	**590**
Lead	25						10 U	10 U	10 U
Magnesium	35000	7600	900	8370	1500	420 J	840	4100	5300
Manganese	300*	28	5.8 J	3.6 J	3.8 J	2.6 J	10 U	7.9 J	50
Mercury	0.7						0.2 U	0.2 U	0.2 U
Nickel	100						40 U	40 U	40 U
Potassium	NA	4000	5500	3630	4900	4800	4900	4800 U	4500
Selenium	10	**420**	**150**	**460**	**190**	**210**	150	**310**	**330**
Silver	50						10 U	10 U	10 U
Sodium	20000	10700	16400	9140	12000	9900	12000	8900	9700
Thallium	0.5						25 U	25 U	25 U
Vanadium	5						10 U	10 U	10 U
Zinc	2000						20 U	20 U	20 U

TABLE 4-5
INORGANICS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	Water Quality	MW-15D	MW-15D	MW-15D	MW-15D	MW-15D	MW-15D	MW-15D	MW-15D
Date Collected:	Standards 703.5**	10/6/2008	4/21/2009	9/28/2009	4/28/2010	11/2/2010	4/13/2011	10/10/2011	4/3/2012
Dissolved Metals (ug/L)									
Aluminum	100			15.4 J			200 U	200 U	200 U
Antimony	3						20 U	20 U	**8** J
Arsenic	25						20 U	20 U	20 U
Barium	1000	90	180	99.2	150	110	120	100	99
Beryllium	3				0.13 J		4 U	4 U	4 U
Cadmium	5						5 U	5 U	5 U
Calcium	NA	54300	127000	57100	96000	26000	63000	34000	51000
Chromium	50		3.6 J	0.78 J	2.9 J		2.5 J	10 U	10 U
Cobalt	5			1.3 J			10 U	10 U	10 U
Copper	200	2.7 J					20 U	20 U	20 U
Iron	300*						50 U	50 U	50 U
Lead	25						10 U	10 U	10 U
Magnesium	35000	9000		7300	680	63 J	320 J	2100 J	5800
Manganese	300*	20		4.2 J			10 U	10 U	10 U
Mercury	0.7						0.2 U	0.2 U	0.2 U
Nickel	100						40 U	40 U	40 U
Potassium	NA	3000	5200	3740	5000	5200	4900	5100	4800
Selenium	10	**480**	**160**	**428**	**180**	**220**	**140**	**260**	**370**
Silver	50						10 U	10 U	10 U
Sodium	20000	8600	15600	9550	13000	11000	12000	9500 U	9400
Thallium	0.5						25 U	25 U	25 U
Vanadium	5						10 U	10 U	10 U
Zinc	2000						20 U	20 U	20 U

Notes:
µg/L = micrograms per liter
U = indicates that the compound was analyzed
J = indicates an estimated value
B = the reported value is less than the Contract
E = indicates an estimated value because of the
N = spiked sample recovery not within control

350	Exceeds NYSDEC Cla:

TABLE 4-5
INORGANICS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	Water Quality	MW-16S	MW-16S	MW-16S	MW-16S	MW-16S	MW-16S	MW-16S	MW-16S	MW-16S	MW-16S	MW-16S
Date Collected:	Standards 703.5**	8/14/2000	5/2/2001	10/10/2001	4/17/2002	10/16/2002	4/30/2003	10/19/2004	10/18/2005	10/12/2006	5/15/2007	10/26/2007
Total Metals (µg/L)												
Aluminum	100	**101** J	**2420**	**2530**	**940**	**1340**	**1090**	**6470** N	29.1 B	80 U	**160** J	**560**
Antimony	3	14 U	5.9 U	5.9 U	9.9 U	9.9 U	8.5 U	2.5 U	2.5 U	8.4 U		
Arsenic	25	5 U	4.6 J	10.2	4.9 U	4.9 U	6 J	6.6 B	3.1 U	4 U		
Barium	1000	152	213	265	155	163	118	156 B	160 B	106	130	190
Beryllium	3	1.9 U	0.64 U	0.64 U	0.5 U	0.5 U	0.34 U	0.4 U	0.4 U	0.21 U		
Cadmium	5	**41.4**	**12.1**	**16.5**	**9.1** J	**13.9**	**5.2** J	**5.5**	0.8 U	1.8 B	1.7 J	4.6 J
Calcium	NA	86300	90300	88500	122000	101000	92400	97400	83000	82900	83600	88400
Chromium	50	36.1	46.6	31	**50.9**	120	**52.9**	**129**	2 B	5.3 B	2.2 J	3.8 J
Cobalt	5	**21.9** J	**8.2** J	5 J	1.7 U	57.1	2.7 J	**9.4** B	3.8 B	**5.2** B	1.7 J	
Copper	200	13.6 J	64.3	72.2	24.6 J	58	21.2 J	31.1	3.2 B	4 U	10	70.2 J
Iron	300*	**3150**	**4750**	**6930**	**2110**	**3910**	**2200**	**12300** N	225	25.7 U	**610**	**1600**
Lead	25	9.8 U	**56.9**	**168**	23.9	60.3	21.9	**25.3**	1.9 U	3 U	5 J	70.2 J
Magnesium	35000	20800	24400	24700	32600	28300	26200	27300	24200	23400	24000	25500
Manganese	300*	**3880**	538	**1740**	249	**1050**	**354**	**1940**	264	185	**830**	**870**
Mercury	0.7	0.048 U	0.026 U	0.12 J	0.085 J	0.086 J	0.16 U	0.2 U	0.18 B	0.07 U		
Nickel	100	30.8 J	42.4 J	25.7 J	77.4	85.8	46.6 J	84.3	12.2 B	10.6	4.1 J	50.2 J
Potassium	NA	1360	1430	1480	1390	1680	1140	3040 B	1400 BE	805	810	1000
Selenium	10	3.5 U	5.8 J	6 J	4.8 U	4.8 U	4.7 U	2.1 B	3.9 U	7.5 U		
Silver	50	3.6 U	4.3 J	7.3 J	1.4 J	3.6 J	1.8 U	1.1 UN	2.5 B	0.73 U		
Sodium	20000	**25800**	**20900**	18800	**23200**	**22200**	17300	18500 E	16200	**21100**	19100	17200
Thallium	0.5	9.5 U	8.8 U	8.8 U	9.5 U	12.9 J	8.9 U	2.9 U	2.9 U	10.1 U		
Vanadium	5	206 U	**5.8** J	4.3 J	2.5 J	2.9 J	1.7 U	**10.6** B	2 U	0.6 U		
Zinc	2000	302	59.5	93.2	26.9	94.7	25.4	110	46	10 U	27 J	19 J

TABLE 4-5
INORGANICS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	**Water Quality**	**MW-16S**	**MW-16S**	**MW-16S**	**MW-16S**	**MW-16S**	**MW-16S**	**MW-16S**	**MW-16S**	**MW-16S**	**MW-16S**	**MW-16S**
Date Collected:	**Standards 703.5****	**8/14/2000**	**5/2/2001**	**10/10/2001**	**4/17/2002**	**10/16/2002**	**4/30/2003**	**10/19/2004**	**10/18/2005**	**10/12/2006**	**5/15/2007**	**10/26/2007**
Dissolved Metals (µg/L)												
Aluminum	100	**21.4** J	32 U	252	48	47.7 U	41.3 U	10.4 U	10.4 U	80 U		**500**
Antimony	3	14 U	5.9 U	6.5 J	9.9	9.9 U	8.5 U	2.5 U	2.5 U	8.4 U		
Arsenic	25	5 U	4.7 J	4.2 J	4.9	4.9 U	4.9 U	3.1 U	3.1 U	4 U		
Barium	1000	78.4 J	134	374	142	114	97.5 J	88.2 B	168 B	106	120	160
Beryllium	3	1.9 U	0.64 U	0.64 U	0.5	0.5 U	0.34 U	0.4 U	0.4 U	0.21 U		
Cadmium	5	**10.5**	1.3 J	4 J	**5.5** J	6.5 J	2.5 J	3.2 B	1.4 B	1.8 B		2 J
Calcium	NA	79900	83200	86500	119000	98200	87000	74800	84500	83900	85600	83300
Chromium	50	6.6 U	1.7 J	2.7 J	2 U	2 U	4.3 J	2.1 B	1.8 B	6 B		
Cobalt	5	7.1 U	1.8 U	1.8 U	1.7	67.8	1.6 U	1.9 U	3.2 B	**5.6** B	1.2 J	
Copper	200	2.7 U	2.4 U	5.3 J	4.5 J	4.5 J	2.1 U	1.2 U	1.2 U	4 U		
Iron	300*	38.5 J	38 U	762	**389**	69.3 J	58 J	29.1 B	184	25.7 U		
Lead	25	9.8 U	8.8 U	14.3 J	8.9	8.9 U	9.3 U	1.9 UN	1.9 U	3 U		
Magnesium	35000	20800	23600	24100	31800	27500	25200	21000	25300	23400	24900	24200
Manganese	300*	655	81.6 U	365	179	309	222	298	271	185	48	53
Mercury	0.7	0.048 U	0.026 U	0.026 U	0.079 J	0.079 U	0.16 U	0.2 U	0.16 U	0.07 U		
Nickel	100	11.8 J	3.9 J	3.2 J	35.2	25 J	5 J	2.3 U	12.8 B	10.9	0.88 J	
Potassium	NA	979	974	1040	1140	1570	1100	1180 B	1420 B	825	810	820
Selenium	10	3.5 U	4.3 U	5.3 J	4.8	4.8 U	4.7 U	1.6 U	3.9 U	7.5 U		
Silver	50	3.6 U	1.3 U	1.3 U	1.4	1.4 U	1.8 U	1.1 U	1.1 U	0.73 U		
Sodium	20000	26900	19500	19900	22200	22700	17700	16200 E	15900	**21300**	19600	16700
Thallium	0.5	9.5 U	8.8 U	8.8 U	**9.5**	9.5 U	8.9 U	2.9 UN	**4.2** B	10.1 U		
Vanadium	5	2.6 U	1.6 U	1.6 U	1.7	1.7 U	1.7 U	2 U	2 U	0.6 U		
Zinc	2000	144	8.2 J	84.1 U	12.8 J	46.3	10 J	33.1	2.5 U	10 U	13 J	

Notes:
µg/L = micrograms per liter
U = indicates that the compound was analyzed for but not detected
J = indicates an estimated value
B = the reported value is less than the Contract Required Detection Limit (CRDL), but greater than the Instrument Detection Limit (IDL)
350 Exceeds NYSDEC Class GA Groundwater Standards

TABLE 4-5
INORGANICS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	**Water Quality**	**MW-16S**	**MW-16S**	**MW-16S**	**MW-16S**	**MW-16S**	**MW-16S**	**MW-16S**	**MW-16S**	**MW-16S**
Date Collected:	**Standards 703.5****	**4/15/2008**	**10/6/2008**	**4/20/2009**	**9/28/2009**	**4/28/2010**	**11/3/2010**	**4/13/2011**	**10/10/2011**	**4/3/2012**
Total Metals (µg/L)										
Aluminum	100		80 J		48.4 J		**1000**	200 U	200 U	200 U
Antimony	3							20 U	20 U	20 U
Arsenic	25						7.5 J	20 U	6.3 J	20 U
Barium	1000	120	110	120	122	130	200	120	110	110
Beryllium	3							4 U	4 U	4 U
Cadmium	5						**5.5**	5 U	5 U	5 U
Calcium	NA	82800	79800	78400	79600	83000	110000	88000	88000	79000
Chromium	50		7.7 J				4.2 J	10 U	10 U	10 U
Cobalt	5						2.9 J	10 U	10 U	10 U
Copper	200	6.6 J	3.8 J				28	2.7 J	20 U	3.3 J
Iron	300*		**1800**	160	**336**	130	**3200**	160	180	210
Lead	25		4.6 J				22	10 U	10 U	10 U
Magnesium	35000	24200	23100	23400	23100	24000	26000	25000	23000	23000
Manganese	300*	78	**370**	200	**342**	150	**2100**	**420**	280	240
Mercury	0.7							0.2 U	0.2 U	0.2 U
Nickel	100		2.6 J				4.9 J	40 U	40 U	40 U
Potassium	NA	780	930	990	977	890 J	1200	940 J	970 J	920 J
Selenium	10							20 U	20 U	20 U
Silver	50							10 U	10 U	10 U
Sodium	20000	18600	19200	19100	19100	19000	17000	19000	18000	18000
Thallium	0.5							25 U	25 U	25 U
Vanadium	5							10 U	10 U	10 U
Zinc	2000		11 J	5.6 J	5.8 J		43	12 J	10 J	9.8 J

TABLE 4-5
INORGANICS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	**Water Quality**	**MW-16S**	**MW-16S**	**MW-16S**	**MW-16S**	**MW-16S**	**MW-16S**	**MW-16S**	**MW-16S**	**MW-16S**
Date Collected:	**Standards 703.5****	**4/15/2008**	**10/6/2008**	**4/20/2009**	**9/28/2009**	**4/28/2010**	**11/3/2010**	**4/13/2011**	**10/10/2011**	**4/3/2012**
Dissolved Metals (µg/L)										
Aluminum	100							200 U	200 U	200 U
Antimony	3							20 U	20 U	**11** J
Arsenic	25				4.1 J			20 U	20 U	20 U
Barium	1000	110	120	110	123	120	140	110	110	110
Beryllium	3					0.11 J		4 U	4 U	4 U
Cadmium	5							5 U	5 U	5 U
Calcium	NA	82500	82500	75800	79100	79000	79000	80000	92000	77000
Chromium	50							10 U	10 U	10 U
Cobalt	5			2.4 J	4.9 J			10 U	10 U	10 U
Copper	200							20 U	20 U	20 U
Iron	300*		150 J	140	273	24 J		50 U	110	35 J
Lead	25		3.8 J					10 U	10 U	10 U
Magnesium	35000	24200	24000	22700	23100	24000	23000	23000	24000	23000
Manganese	300*	29	200	160	**338**	8.5 J	30	21	180	32
Mercury	0.7							0.2 U	0.2 U	0.2 U
Nickel	100							40 U	40 U	40 U
Potassium	NA	780	910	950	964	890 J	980 J	870 J	1000	900 J
Selenium	10							20 U	20 U	20 U
Silver	50							10 U	10 U	10 U
Sodium	20000	18600	19400	18700	19000	18000	18000	18000	19000	18000
Thallium	0.5							25 U	25 U	**11** J
Vanadium	5							10 U	10 U	10 U
Zinc	2000		22 J	5.3 J	5.7 J	7.5 J		6.7 J	7.8 J	20 U

Notes:
µg/L = micrograms per liter
U = indicates that the compound was analyzed
J = indicates an estimated value
B = the reported value is less than the Contract

350	Exceeds NYSDEC Cla:

TABLE 4-5
INORGANICS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	**Water Quality**	**MW-24D**	**MW-24D**	**MW-24D**	**MW-24D**	**MW-24D**	**MW-24D**	**MW-24D**	**MW-24D**	**MW-24D**	**MW-24D**	**MW-24D**
Date Collected:	**Standards 703.5****			**10/15/2002**	**4/29/2003**	**10/19/2004**	**10/19/2005**	**10/11/2006**	**5/15/2007**	**10/30/2007**	**4/17/2008**	**10/7/2008**
Total Metals (µg/L)												
Aluminum	100			1380	41.3 U	**1280** N	**304**	**9560**	**160** J	**780**	**310** J	**190** J
Antimony	3			9.9 U	8.5 U	2.5 U	2.5 U	8.4 U				
Arsenic	25			4.9 U	4.9 U	3.1 U	3.1 U	6.6 B				
Barium	1000			99.8 J	75.7 J	115 B	99.5 B	244	88	98	98	95
Beryllium	3			0.5 U	0.34 U	0.4 U	0.4 U	0.35 BN				
Cadmium	5			0.94 U	0.87 U	0.8 U	0.8 U	1.2 B				
Calcium	NA			82200	78200	72200	76100	114000	76800	74800	73400	72400
Chromium	50			3.4 J	24 J	4.4 B	1.9 B	119				
Cobalt	5			4 J	**5.5** J	2.3 B	1.9 U	**13.8**				
Copper	200			4.7 J	2.1 J	4.1 B	3.8 B	40.9				
Iron	300*			2640	169	**1800** N	**657**	**22700**	**510**	**1600**	**820**	**490**
Lead	25			8.9 U	9.3 U	2.4 B	1.9 U	7.4 B				
Magnesium	35000			17000	20400	15200	15900	23200	15100	14700	14400	14300
Manganese	300*			241	149	206	181	**1240**	200	180	160	140
Mercury	0.7			0.079 U	0.16 U	0.2 U	0.16 UN	0.07 U				
Nickel	100			2.3 J	20.8 J	2.3 U	2.3 U	93.5	1.1 J			
Potassium	NA			2140	916	2660 B	2350 B	3540	1500	1500	1600	1700
Selenium	10			4.8 U	4.7 U	1.6 U	3.9 UN	7.5 U				
Silver	50			1.7 J	1.8 U	1.1 UN	2 BN	0.73 U				
Sodium	20000			7830	10800	6900 E	8860 E	9200	8300	6800	7400	8500
Thallium	0.5			9.5 U	8.9 U	2.9 U	2.9 U	10.1 U				
Vanadium	5			3.1 J	1.7 U	2.6 B	2 U	**16**		1.3 J		
Zinc	2000			10.3 J	7.9 J	7.4 B	2.5 U	65.4				

EHS Support consider it done

TABLE 4-5
INORGANICS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	**Water Quality**	**MW-24D**	**MW-24D**	**MW-24D**	**MW-24D**	**MW-24D**	**MW-24D**	**MW-24D**	**MW-24D**	**MW-24D**	**MW-24D**	**MW-24D**
Date Collected:	**Standards 703.5****			**10/15/2002**	**4/29/2003**	**10/19/2004**	**10/19/2005**	**10/11/2006**	**5/15/2007**	**10/30/2007**	**4/17/2008**	**10/7/2008**
Dissolved Metals (µg/L)												
Aluminum	100			47.7 U	41.3 U	38.4 B	10.4 U	80 U				
Antimony	3			9.9 U	8.5 U	2.5 U	2.5 U	8.4 U				
Arsenic	25			4.9 U	4.9 U	3.1 U	3.1 U	4 U				
Barium	1000			88.3 J	72.8 J	97.6 B	95.9 B	93.9	86	87	97	89
Beryllium	3			0.5 U	0.34 U	0.4 U	0.4 U	0.21 U				
Cadmium	5			0.94 U	0.87 U	0.8 U	0.8 U	0.76 U				
Calcium	NA			83700	77900	66400	72900	73000	77600	71500	75500	68500
Chromium	50			2 U	4.6 J	1.1 B	0.9 U	2 U				
Cobalt	5			1.7 U	3.5 J	1.9 U	**5.3** B	3.4 B				
Copper	200			2.6 U	2.5 J	1.2 U	1.3 B	4 U				
Iron	300*			218	68.7 J	121	113	79.6 B			140 J	120 J
Lead	25			8.9 U	9.3 U	1.9 UN	1.9 U	3 U				
Magnesium	35000			17100	20800	14000	15200	14400	15400	13900	14700	13500
Manganese	300*			138	137	119	142	122	2.9 J	110	130	120
Mercury	0.7			0.079 U	0.16 U	0.2 U	0.16 UN	0.07 U				
Nickel	100			1.9 U	16.6 J	2.3 U	2.3 U	2.6 B				
Potassium	NA			1690	980	2100 B	2140 B	1400	1500	1200	1500	1500
Selenium	10			4.8 U	4.7 U	1.6 UW	3.9 UN	7.5 U				
Silver	50			1.4 U	1.8 U	1.1 U	1.3 B	0.73 U				
Sodium	20000			8570	10700	6700 E	7760 E	8290	8400	6600	7600	8100
Thallium	0.5			9.5 U	8.9 U	2.9 UN	2.9 U	10.1 U				
Vanadium	5			1.7 U	1.7 U	2 U	2 U	0.6 U			1.1 J	
Zinc	2000			11.3 J	10.6 J	2.5 U	3.3 B	10 U			20 J	

Notes:
µg/L = micrograms per liter
J = indicates an estimated value
B = the reported value is less than the Contract Required Detection Limit (CRDL), but greater than the Instrument Detection Limit (IDL)
N = spiked sample recovery not within control limits
350 Exceeds NYSDEC Class GA Groundwater Standards

EHS Support *consider it done*

TABLE 4-5
INORGANICS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	**Water Quality**	**MW-24D**	**MW-24D**	**MW-24D**	**MW-24D**	**MW-24D**	**MW-24D**	**MW-24D**
Date Collected:	**Standards 703.5****	**4/20/2009**	**9/29/2009**	**4/29/2010**	**11/3/2010**	**4/13/2011**	**10/11/2011**	**4/3/2012**
Total Metals (µg/L)								
Aluminum	100	**360**	**293**	**390**	**369**	200 U	200 U	**380**
Antimony	3					20 U	20 U	20 U
Arsenic	25					20 U	20 U	20 U
Barium	1000	93	98.0	98	100	82	90	89
Beryllium	3					4 U	4 U	4 U
Cadmium	5					5 U	5 U	5 U
Calcium	NA	71000	69100	73000	70000	71000	75000	69000
Chromium	50	0.50 J	0.63 J			10 U	10 U	10 U
Cobalt	5					10 U	10 U	10 U
Copper	200		2.8 J		2.4 J	20 U	20 U	2.3 J
Iron	300*	**820**	**585**	**1200**	**1100**	100 U	**980**	**1100**
Lead	25					10 U	10 U	10 U
Magnesium	35000	14500	14200	15000	14000	14000	14000	14000
Manganese	300*	160	136	**360**	170	7.9 J	140	200
Mercury	0.7					0.2 U	0.2 U	0.2 U
Nickel	100					40 U	40 U	40 U
Potassium	NA	2000	1920	2000	1800	1800	1800	1900
Selenium	10					20 U	20 U	20 U
Silver	50					10 U	10 U	1 J
Sodium	20000	8700	8530	7800	7000	7300	6500	7200
Thallium	0.5					25 U	25 U	25 U
Vanadium	5					10 U	10 U	10 U
Zinc	2000					20 U	20 U	20 U

TABLE 4-5
INORGANICS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	Water Quality	MW-24D	MW-24D	MW-24D	MW-24D	MW-24D	MW-24D	MW-24D
Date Collected:	**Standards 703.5****	**4/20/2009**	**9/29/2009**	**4/29/2010**	**11/3/2010**	**4/13/2011**	**10/11/2011**	**4/3/2012**
Dissolved Metals (µg/L)								
Aluminum	100	**380**					200 U	200 U
Antimony	3						20 U	**6** J
Arsenic	25						20 U	20 U
Barium	1000	94	92.6	90	95	0.074	87	85
Beryllium	3			0.12 J			4 U	4 U
Cadmium	5						5 U	5 U
Calcium	NA	71900	67200	72000	68000	63	73000	70000
Chromium	50	1.3 J	5.0 J				10 U	10 U
Cobalt	5		0.94 J				10 U	10 U
Copper	200	2.0 J					20 U	20 U
Iron	300*	**1300**	102 J	90	170		220	50 U
Lead	25						10 U	10 U
Magnesium	35000	14600	13800	15000	13000	12	13000	14000
Manganese	300*	**430**	116	120	120	0.0055 J	120	10 U
Mercury	0.7						0.2 U	0.2 U
Nickel	100	1.4 J	1.4 J				40 U	40 U
Potassium	NA	2000	1780	1900	1700	1.6	1800	1900
Selenium	10						20 U	20 U
Silver	50						10 U	10 U
Sodium	20000	8800	8380	7800	7000	6.5	6600	7200
Thallium	0.5						25 U	25 U
Vanadium	5						10 U	10 U
Zinc	2000	10 J					20 U	20 U

Notes:
µg/L = micrograms per liter
J = indicates an estimated value
B = the reported value is less than the Contract
N = spiked sample recovery not within control
350 Exceeds NYSDEC Cla:

TABLE 4-5
INORGANICS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	Water Quality	MW-24S	MW-24S	MW-24S	MW-24S	MW-24S	MW-24S	MW-24S	MW-24S	MW-24S	MW-24S	MW-24S
Date Collected:	**Standards 703.5****			**10/15/2002**	**4/29/2003**	**10/19/2004**	**10/19/2005**	**10/11/2006**	**5/15/2007**	**10/30/2007**	**4/17/2008**	**10/7/2008**
Total Metals (µg/L)												
Aluminum	100			88.4 J	**538**	**215** N	10.4 U	80 U	**610**			**110** J
Antimony	3			9.9 U	8.5 U	2.5 U	2.5 U	8.4 U				
Arsenic	25			4.9 U	4.9 U	4.4 B	3.1 U	4 U	5 J		7.3 J	17 J
Barium	1000			90.1 J	102	69.6 B	78.6 B	64.4	87	75	53	90
Beryllium	3			0.5 U	0.34 U	0.4 U	0.4 U	0.21 U				
Cadmium	5			0.94 U	0.87 U	0.8 U	0.8 U	0.76 U	0.97 J			
Calcium	NA			70600	79700	69500	84300	78000	78500	66100	77100	69100
Chromium	50			5.2 J	24.9 J	9.3 B	4.6 B	17.9	4.5 J			
Cobalt	5			16 J	1.6 U	1.9 U	1.9 U	3.9 B	1.6 J			
Copper	200			2.9 J	4.2 J	2.6 B	2.5 B	4 U	5.2 J			2.2 J
Iron	300*			18.5	**1610**	**393** N	179	**309**	**1300**	120 J	**450**	**630**
Lead	25			8.9 U	9.3 U	1.9 U	1.9 U	3 U	4.7 J			
Magnesium	35000			18300	15400	19300	24200	20500	21900	14600	22500	14000
Manganese	300*			**335**	196	226	65	**302**	**730**	130	**420**	290
Mercury	0.7			0.079 U	0.16 U	0.2 U	0.16 UN	0.07 U				
Nickel	100			3.9 J	18.7 J	3.8 B	3 B	16.4	6 J			
Potassium	NA			2840	1710	813 B	1070 B	547	900	500	460	1100
Selenium	10			4.8 U	4.7 U	4.3 B	3.9 UN	7.5 U				4.5 J
Silver	50			1.4 U	1.8 U	1.1 UN	2.2 BN	0.73 U				
Sodium	20000			**24000**	9040	8220 E	13600 E	11500	15200	8900	10100	12000
Thallium	0.5			9.5 U	8.9 U	2.9 U	2.9 U	10.1 U				
Vanadium	5			1.7 U	1.7 U	2 U	2 U	0.6 U	1.4 J			
Zinc	2000			9.7 J	6.3 J	9.9 B	3.5 B	10 U	24 J			

TABLE 4-5
INORGANICS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	**Water Quality**	**MW-24S**	**MW-24S**	**MW-24S**	**MW-24S**	**MW-24S**	**MW-24S**	**MW-24S**	**MW-24S**	**MW-24S**	**MW-24S**	**MW-24S**
Date Collected:	**Standards 703.5****			**10/15/2002**	**4/29/2003**	**10/19/2004**	**10/19/2005**	**10/11/2006**	**5/15/2007**	**10/30/2007**	**4/17/2008**	**10/7/2008**
Dissolved Metals (µg/L)												
Aluminum	100			47.7 U	**294**	24.3 B	10.4 U	80 U				
Antimony	3			9.9 U	8.5 U	2.5 U	2.5 U	8.4 U				
Arsenic	25			5.2 J	6.9 J	3.5 B	3.1 U	4 U				18 J
Barium	1000			85.4 J	98.1 J	66.2 B	80.4 B	60.8	48	73	46	89
Beryllium	3			0.5 U	0.34 U	0.4 U	0.4 U	0.21 U				
Cadmium	5			0.94 U	8.7 U	0.8 U	0.8 U	0.76 U				
Calcium	NA			68300	77600	70100	88300	75000	79500	65500	70500	69500
Chromium	50			2 U	28.7 J	1.5 B	2.8 B	14.2				
Cobalt	5			22 J	1.6 U	1.9 U	**5.8** B	4.4 B				3.2 J
Copper	200			57.7	4.2 J	1.2 U	10.8 B	4 U			4.6 J	
Iron	300*			34.9 U	**1190**	79.4 B	32.4 B	174 B			81 J	**540**
Lead	25			8.9 U	9.3 U	1.9 UN	1.9 U	3 U				
Magnesium	35000			17000	15400	19300	25400	19900	21600	14500	20900	14200
Manganese	300*			318	173	179	54.7	237	16	150	9.2 J	**330**
Mercury	0.7			0.079 U	0.16 U	0.2 U	0.16 UN	0.07 U				
Nickel	100			1.9 U	22.3 J	2.3 U	5.2 B	13.5				
Potassium	NA			2410	1980	827 B	1100 B	538	600	520	400	1100
Selenium	10			4.8 U	4.7 U	1.6 U	3.9 UN	7.5 U				
Silver	50			1.4 U	1.8 U	1.1 U	3.1 BN	0.73 U				
Sodium	20000			18200	8940	7840 E	13900 E	11200	9800	8700	9400	12200
Thallium	0.5			9.5 U	8.9 U	2.9 UN	2.9 U	10.1 U				
Vanadium	5			1.7 U	1.7 U	2 U	2 U	0.6 U				
Zinc	2000			28.8	6.5 J	7.7 B	5.8 B	10 U			20 J	

Notes:
µg/L = micrograms per liter
J = indicates an estimated value
B = the reported value is less than the Contract Required Detection Limit (CRDL), but greater than the Instrument Detection Limit (IDL)
E = indicates an estimated value because of the presence of interference
N = spiked sample recovery not within control limits
350 Exceeds NYSDEC Class GA Groundwater Standards

TABLE 4-5
INORGANICS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	**Water Quality**	**MW-24S**	**MW-24S**	**MW-24S**	**MW-24S**	**MW-24S**	**MW-24S**	**MW-24S**
Date Collected:	**Standards 703.5****	**4/20/2009**	**9/29/2009**	**4/29/2010**	**11/3/2010**	**4/13/2011**	**10/11/2011**	**4/3/2012**
Total Metals (µg/L)								
Aluminum	100	**270**				200 U	200 U	200 U
Antimony	3					20 U	20 U	20 U
Arsenic	25	5.4 J	5.2 J		23	20 U	14 J	11 J
Barium	1000	57	70.9	44	89	44	45	36
Beryllium	3					4 U	4 U	4 U
Cadmium	5					5 U	5 U	5 U
Calcium	NA	73800	73800	82000	63000	80000	85000	77000
Chromium	50					10 U	10 U	10 U
Cobalt	5					10 U	10 U	10 U
Copper	200					20 U	20 U	20 U
Iron	300*	**650**	**501**	270	**660**	100 U	**930**	**870**
Lead	25					10 U	10 U	10 U
Magnesium	35000	21000	19300	23000	13000	23000	23000	24000
Manganese	300*	290	270	**520**	210	2.6 J	100	120
Mercury	0.7					0.2 U	0.2 U	0.2 U
Nickel	100	1.1 J				40 U	40 U	40 U
Potassium	NA	640	681	520 J	630 J	470 J	550 J	440 J
Selenium	10					20 U	20 U	20 U
Silver	50					10 U	10 U	10 U
Sodium	20000	11000	11500	10000	10000	12000	12000	13000
Thallium	0.5					25 U	25 U	25 U
Vanadium	5					10 U	10 U	10 U
Zinc	2000					20 U	20 U	20 U

TABLE 4-5
INORGANICS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	Water Quality	MW-24S	MW-24S	MW-24S	MW-24S	MW-24S	MW-24S	MW-24S
Date Collected:	**Standards 703.5****	**4/20/2009**	**9/29/2009**	**4/29/2010**	**11/3/2010**	**4/13/2011**	**10/11/2011**	**4/3/2012**
Dissolved Metals (µg/L)								
Aluminum	100					200 U	200 U	200 U
Antimony	3					20 U	20 U	20 U
Arsenic	25		5.5 J		23	20 U	20 U	20 U
Barium	1000	52	73.3	41	88	41	42	33
Beryllium	3			0.14 J		4 U	4 U	4 U
Cadmium	5					5 U	5 U	5 U
Calcium	NA	72300	73900	79000	64000	72000	85000	73000
Chromium	50					10 U	10 U	10 U
Cobalt	5	1.7 J				10 U	10 U	10 U
Copper	200					20 U	20 U	20 U
Iron	300*	23 J	**502**	26 J	**620**	50 U	150	50 U
Lead	25					10 U	10 U	10 U
Magnesium	35000	20900	19400	23000	13000	21000	24000	23000
Manganese	300*	22	270	**460**	210	10 U	79	10 U
Mercury	0.7					0.2 U	0.2 U	0.2 U
Nickel	100					40 U	40 U	40 U
Potassium	NA	590	691	500 J	640 J	440 J	570 J	450 J
Selenium	10					20 U	20 U	20 U
Silver	50					10 U	10 U	10 U
Sodium	20000	10900	11600	10000	10000	11000	13000	13000
Thallium	0.5					25 U	25 U	25 U
Vanadium	5					10 U	10 U	10 U
Zinc	2000					20 U	20 U	20 U

Notes:
µg/L = micrograms per liter
J = indicates an estimated value
B = the reported value is less than the Contract
E = indicates an estimated value because of the
N = spiked sample recovery not within control
350 Exceeds NYSDEC Cla:

TABLE 4-5
INORGANICS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	**Water Quality**	**MW-26D**	**MW-26D**	**MW-26D**	**MW-26D**	**MW-26D**	**MW-26D**	**MW-26D**	**MW-26D**	**MW-26D**	**MW-26D**	**MW-26D**
Date Collected:	**Standards 703.5****			**10/16/2002**	**4/28/2003**	**10/19/2004**	**10/19/2005**	**10/12/2006**	**5/15/2007**	**10/30/2007**	**4/16/2008**	**10/7/2008**
Total Metals (µg/L)												
Aluminum	100			7470	**908**	**34400** N	**6480**	80 U	**310** J		**2600**	**2000**
Antimony	3			9.9 U	8.5 U	2.5 U	2.5 UN	8.4 U				
Arsenic	25			6.2 J	7.6 J	**48.1**	20.4	10 B	24 J	8.7 J	15 J	22
Barium	1000			139	76.4 J	323	123 B	67.2	62	66	85	79
Beryllium	3			0.5 U	0.34 U	1.6 B	0.52 B	0.21 U				
Cadmium	5			0.94 U	0.87 U	0.8 U	0.8 U	0.76 U				
Calcium	NA			87300	77100	128000	1030000	64500	44600	74500	69400	79200
Chromium	50			28.5 J	3.1 J	**57.6**	11.2	2 U	3.2 J		3.5 J	3.9 J
Cobalt	5			16.4 J	1.7 J	**30.6** B	**7.2** B	1.7 B				
Copper	200			21.6 J	6 J	78.2	23.3 B	4 U			7.8 J	5.2 J
Iron	300*			**14900**	**2140**	**61300** N	**11700**	70.5 B	**620**	**470**	**4200**	**4500**
Lead	25			8.9 U	9.3 U	**30.5**	7.1	3 U				
Magnesium	35000			18600	14100	33000	20200	11800	7500	13900	13700	15100
Manganese	300*			746	**344**	**2460**	**1210**	188	90	240	**320**	**330**
Mercury	0.7			0.079 U	0.16 U	0.2 U	0.16 UN	0.073 B				
Nickel	100			21.2 J	4.5 J	63.4	8.4 B	1.9 B	2.6 J		4.8 J	3.6 J
Potassium	NA			4220	1480	10900	4430 B	939	630	1000	1800	2000
Selenium	10			4.8	4.7 U	3.1 B	3.9 UN	7.5 U				
Silver	50			1.4 U	1.8 U	1.1 BN	2.5 BN	0.73 U				
Sodium	20000			7420	7530	7710 E	8450 E	8980	10500	6700	8300	9400
Thallium	0.5			10.2 J	8.9 U	2.9 U	2.9 U	10.1 U				
Vanadium	5			13.3 J	1.7 U	**60.5**	**12.8** B	0.6 U	0.69 J		4.7 J	3.7 J
Zinc	2000			47.3	9.6 J	179	29	10 U	11 J		21 J	12 J

TABLE 4-5
INORGANICS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	Water Quality	MW-26D	MW-26D	MW-26D	MW-26D	MW-26D	MW-26D	MW-26D	MW-26D	MW-26D	MW-26D	MW-26D
Date Collected:	**Standards 703.5****			**10/16/2002**	**4/28/2003**	**10/19/2004**	**10/19/2005**	**10/12/2006**	**5/15/2007**	**10/30/2007**	**4/16/2008**	**10/7/2008**
Dissolved Metals (µg/L)												
Aluminum	100			47.7 U	41.3 U	40.9 B	10.4 U	80 U				
Antimony	3			9.9 U	8.5 U	2.5 U	2.5 UN	8.4 U				
Arsenic	25			4.9 U	7.4 J	5.4 B	3.1 U	9.2 B	23 J		8.8 J	20 U
Barium	1000			85.6 J	219	91.7 B	70.8 B	65.6	56	89	65	60
Beryllium	3			0.5 U	0.34 U	0.4 U	0.4 U	0.21 U				
Cadmium	5			0.94 U	0.87 U	0.8 U	0.8 U	0.76 U				
Calcium	NA			70100	71800	68800	73700	63000	44100	74100	65700	73000
Chromium	50			2 U	2.2 U	0.9 U	0.9 U	2 U				
Cobalt	5			5.5 J	1.6 U	1.9 U	**9.4** B	1.8 B				
Copper	200			2.6 U	3.3 J	1.2 U	2.8 B	4 U				2.5 J
Iron	300*			31.8	133	151	152	86.8 B			75 J	64 J
Lead	25			8.9 U	9.3 U	1.9 UN	1.9 U	3 U				
Magnesium	35000			13700	13700	14000	14900	11500	7400	14300	12200	13400
Manganese	300*			196	190	200	229	185		120	170	190
Mercury	0.7			0.079 U	0.16 U	0.2 U	0.16 UN					
Nickel	100			4.7 J	3.8 U	2.3 U	2.3 U	1.9 B				
Potassium	NA			2190	1360	1530 B	1810 B	912	570	1400	1000	1300
Selenium	10			4.8 U	4.7 U	1.6 U	3.9 UN	7.5 U				3.4 J
Silver	50			1.4 U	1.8 U	1.1 U	1.1 U	0.73 U				
Sodium	20000			7340	9480	6190 E	7210 E	8570	10500	6700	8000	8700
Thallium	0.5			9.5 U	8.9 U	2.9 UN	**3** B	10.1 U				
Vanadium	5			1.7 U	1.7 U	2 U	2 U	0.6 U				
Zinc	2000			184	129	2.5 U	2.5 U	10 U	12 J			

Notes:
µg/L = micrograms per liter
U = indicates that the compound was analyzed for but not detected
J = indicates an estimated value
B = the reported value is less than the Contract Required Detection Limit (CRDL), but greater than the Instrument Detection Limit (IDL)
E = indicates an estimated value because of the presence of interference
N = spiked sample recovery not within control limits
350 Exceeds NYSDEC Class GA Groundwater Standards

EHS Support consider it done

TABLE 4-5
INORGANICS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	**Water Quality**	**MW-26D**	**MW-26D**	**MW-26D**	**MW-26D**	**MW-26D**	**MW-26D**	**MW-26D**
Date Collected:	**Standards 703.5****	**4/21/2009**	**9/29/2009**	**4/29/2010**	**11/3/2010**	**4/13/2011**	**10/11/2011**	**4/3/2012**
Total Metals (µg/L)								
Aluminum	100	**760**	**621**	**140** J		200 U	200 U	200 U
Antimony	3					20 U	20 U	20 U
Arsenic	25	14 J	12.5 J	21	20	19 J	23	20 U
Barium	1000	68	64.8	59	56	53	50	49
Beryllium	3					4 U	4 U	4 U
Cadmium	5					5 U	5 U	5 U
Calcium	NA	62100	65500	39000	39000	40000	40000	37000
Chromium	50	1.4 J	0.65 J			10 U	10 U	10 U
Cobalt	5					10 U	10 U	10 U
Copper	200					20 U	20 U	20 U
Iron	300*	**1300**	**1490**	220	150	100 U	65 J	170
Lead	25					10 U	10 U	10 U
Magnesium	35000	11700	13200	6400	6200	6400	6100	6200
Manganese	300*	190	213	26	30	10 U	19	27
Mercury	0.7					0.2 U	0.2 U	0.2 U
Nickel	100	1.5 J				40 U	40 U	40 U
Potassium	NA	1500	1600	790 J	740 J	740 J	720 J	710 J
Selenium	10					20 U	20 U	20 U
Silver	50					10 U	10 U	10 U
Sodium	20000	10600	8740	19000	18000	19000	17000	18000
Thallium	0.5					25 U	25 U	25 U
Vanadium	5	1.4 J				10 U	10 U	10 U
Zinc	2000	5.1 J			14 J	20 U	20 U	20 U

TABLE 4-5
INORGANICS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	**Water Quality**	**MW-26D**	**MW-26D**	**MW-26D**	**MW-26D**	**MW-26D**	**MW-26D**	**MW-26D**
Date Collected:	**Standards 703.5****	**4/21/2009**	**9/29/2009**	**4/29/2010**	**11/3/2010**	**4/13/2011**	**10/11/2011**	**4/3/2012**
Dissolved Metals (µg/L)								
Aluminum	100	29 J					200 U	200 U
Antimony	3						20 U	**6.2** J
Arsenic	25	11 J	15 U	21	19 J	0.018 J	20	20
Barium	1000	61	59.8	57	52	0.051	48	52
Beryllium	3			0.13 J			4 U	4 U
Cadmium	5						5 U	5 U
Calcium	NA	54200	65500	39000	37000	37	40000	39000
Chromium	50						10 U	10 U
Cobalt	5	1.3 J	1.6 J				10 U	10 U
Copper	200						20 U	20 U
Iron	300*	99 J	98.4 J	50 U		0.027 J	50 U	50 U
Lead	25						10 U	10 U
Magnesium	35000	9900	13000	6500	6000	6	6100	6500
Manganese	300*	96	175				10 U	10 U
Mercury	0.7						0.2 U	0.2 U
Nickel	100						40 U	40 U
Potassium	NA	1100	1400	770 J	730 J	0.7 J	720 J	740 J
Selenium	10						20 U	20 U
Silver	50						10 U	10 U
Sodium	20000	11900	8730	**20000**	17000	17	17000	19000
Thallium	0.5						25 U	25 U
Vanadium	5						10 U	10 U
Zinc	2000				9.9 J	0.0073 J	6.8 J	20 U

Notes:
µg/L = micrograms per liter
U = indicates that the compound was analyzed
J = indicates an estimated value
B = the reported value is less than the Contract
E = indicates an estimated value because of the
N = spiked sample recovery not within control

350	Exceeds NYSDEC Cla:

EHS Support consider it done

TABLE 4-5
INORGANICS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	Water Quality	MW-26S	MW-26S	MW-26S	MW-26S	MW-26S	MW-26S	MW-26S	MW-26S	MW-26S	MW-26S	MW-26S
Date Collected:	**Standards 703.5****			**10/17/2002**	**4/29/2003**	**10/19/2004**	**10/19/2005**	**10/12/2006**	**5/15/2007**	**10/30/2007**	**4/16/2008**	**10/7/2008**
Total Metals (µg/L)												
Aluminum	100			2240	**231**	**2430** N	10.4 U	80 U	**1800**		**270** J	**720**
Antimony	3			9.9 U	8.5 U	2.5 U	2.5 UN	8.4 U				
Arsenic	25			4.9 U	4.9 U	3.1 U	3.1 U	4 U				
Barium	1000			170	83.9 J	81.4 B	203	42.2	61	79	46	44
Beryllium	3			0.5 U	0.34 U	0.4 U	0.4 U	0.21 U				
Cadmium	5			0.94 U	0.87 U	1.2 B	0.8 U	0.76 U				
Calcium	NA			76100	80800	71500	108000	75300	72700	82100	71100	77300
Chromium	50			12.6 J	2.2 U	8.8 B	7.6 B	2 U	4.3 J			1.9 J
Cobalt	5			10.7 J	1.6 U	3.1 B	1.9 U	2 B	2 J			
Copper	200			40.4	2.1 U	4.9 B	90.4	4 U	4 J			
Iron	300*			**5080**	**425**	**3090** N	**349**	25.7 U	**2500**	150 J	**450**	**870**
Lead	25			8.9 U	9.3 U	1.9 U	1.9 U	3 U	3.5 J			
Magnesium	35000			22600	28300	30200	**37400**	29900	29400	30500	28000	30300
Manganese	300*			664	266	143	36.6	15.4	170	130	48	65
Mercury	0.7			0.079 U	0.16 U	0.2 U	0.16 UN	0.07 U				
Nickel	100			14.2 J	3.8 U	4.2 B	20.3 B	3.3 B	4.5 J		2.3 J	
Potassium	NA			3450	1230	1790 B	13400	744	940	760	700	980
Selenium	10			4.8 U	4.7 U	5.1	3.9 UN	7.5 U				3.2 J
Silver	50			1.4 U	1.8 U	1.1 UN	2.1 BN	0.73 U				
Sodium	20000			**29200**	**36900**	**22700** E	**48000** E	**31800**	**29900**	**29800**	**28100**	**34200**
Thallium	0.5			9.5 U	8.9 U	2.9 U	2.9 U	10.1 U				
Vanadium	5			3.7 J	1.7 U	4.3 B	2 U	0.6 U	3.5 J			1.5 J
Zinc	2000			175	8.5 J	46.2	104	10 U	13 J			

TABLE 4-5
INORGANICS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	**Water Quality**	**MW-26S**	**MW-26S**	**MW-26S**	**MW-26S**	**MW-26S**	**MW-26S**	**MW-26S**	**MW-26S**	**MW-26S**	**MW-26S**	**MW-26S**
Date Collected:	**Standards 703.5****			**10/17/2002**	**4/29/2003**	**10/19/2004**	**10/19/2005**	**10/12/2006**	**5/15/2007**	**10/30/2007**	**4/16/2008**	**10/7/2008**
Dissolved Metals (µg/L)												
Aluminum	100			47.7 U	41.3 U	10.4 U	10.4 U	80 U		97 J		
Antimony	3			9.9 U	8.5 U	2.5 U	2.5 UN	8.4 U				
Arsenic	25			4.9 U	4.9 U	3.1 U	3.1 U	4 U				
Barium	1000			148	73.8 J	61.5 B	142 B	41.7	48	77	42	36
Beryllium	3			0.5 U	0.34 U	0.4 U	0.4 U	0.21 U				
Cadmium	5			0.94 U	0.87 U	0.8 U	0.8 U	0.76 U				
Calcium	NA			69600	77600	65700	83300	73000	71400	83500	68200	73100
Chromium	50			2 U	2.2 U	1 B	1.1 B	2 U				
Cobalt	5			4.1 J	1.6 U	1.9 U	**42.5** B	1.9 B				
Copper	200			22.6 J	11.8 J	1.2 U	1.4 B	4 U				4.0 J
Iron	300*			34.9 U	45.3 U	7.7 U	97.6 B	25.7 U				
Lead	25			8.9 U	9.3 U	1.9 UN	1.9 U	3 U				
Magnesium	35000			20300	28500	27500	29600	29000	28600	30800	27400	28900
Manganese	300*			514	249	44.2	172	14.8 B	1.7 J	17		9.5 J
Mercury	0.7			0.079 U	0.16 U	0.2 U	0.16 UN	0.07 U				
Nickel	100			8.3 J	3.8 U	2.3 U	21.1 B	3.8 B				
Potassium	NA			3060	1150	1020 B	1680 B	690	610	790	590	820
Selenium	10			4.8 U	4.7 U	1.6 U	3.9 UN	7.5 U				6.4 J
Silver	50			1.4 U	1.8 U	1.1 U	2.3 B	0.73 U				
Sodium	20000			**28600**	**35600**	**21300** E	**31200** E	**31000**	**29300**	**29900**	**27800**	**32900**
Thallium	0.5			9.5 U	8.9 U	2.9 UN	**4.7** B	10.1 U				
Vanadium	5			1.7 U	1.7 U	2 U	2 U	0.6 U				
Zinc	2000			78.5	90.6	5.9 B	4.8 B	10 U				

Notes:
µg/L = micrograms per liter
U = indicates that the compound was analyzed for but not detected
J = indicates an estimated value
B = the reported value is less than the Contract Required Detection Limit (CRDL), but greater than the Instrument Detection Limit (IDL)
E = indicates an estimated value because of the presence of interference
N = spiked sample recovery not within control limits
350 Exceeds NYSDEC Class GA Groundwater Standards

TABLE 4-5
INORGANICS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	**Water Quality**	**MW-26S**	**MW-26S**	**MW-26S**	**MW-26S**	**MW-26S**	**MW-26S**	**MW-26S**
Date Collected:	**Standards 703.5****	**4/21/2009**	**9/29/2009**	**4/29/2010**	**11/3/2010**	**4/13/2011**	**10/11/2011**	**4/3/2012**
Total Metals (µg/L)								
Aluminum	100	**1800**	**1170**	**150** J	**1000**	200 U	**350**	**280**
Antimony	3					20 U	20 U	20 U
Arsenic	25					20 U	20 U	20 U
Barium	1000	72	49.5	37	140	46	32	37
Beryllium	3					4 U	4 U	4 U
Cadmium	5					5 U	5 U	5 U
Calcium	NA	67100	64400	63000	73000	65000	70000	58000
Chromium	50	3.2 J	1.2 J		2.2 J	10 U	10 U	1.2 J
Cobalt	5	1.5 J	0.59 J			10 U	10 U	10 U
Copper	200	4.1 J	2.0 J		2.9 J	20 U	20 U	2.5 J
Iron	300*	**2700**	**1870**	150	**1200**	100 U	**800**	**320**
Lead	25					10 U	10 U	10 U
Magnesium	35000	27900	26400	25000	25000	26000	23000	22000
Manganese	300*	200	95.3	34	260	10 U	**310**	160
Mercury	0.7					0.2 U	0.2 U	0.2 U
Nickel	100	2.3 J	1.8 J			40 U	40 U	40 U
Potassium	NA	1000	1160	580 J	1100 J	600 J	560 J	550 J
Selenium	10					20 U	20 U	20 U
Silver	50					10 U	10 U	10 U
Sodium	20000	**29400**	**28300**	**29000**	**30000**	27000	**26000**	**27000**
Thallium	0.5	**3.9** J				25 U	25 U	25 U
Vanadium	5	3.9 J	1.9 J			10 U	10 U	10 U
Zinc	2000	12 J	5.9 J			20 U	9.9 J	20 U

EHS Support consider it done

TABLE 4-5
INORGANICS IN GROUNDWATER

Dyno Nobel Site
Port Ewen, New York

Sample ID:	**Water Quality**	**MW-26S**	**MW-26S**	**MW-26S**	**MW-26S**	**MW-26S**	**MW-26S**	**MW-26S**
Date Collected:	**Standards 703.5****	**4/21/2009**	**9/29/2009**	**4/29/2010**	**11/3/2010**	**4/13/2011**	**10/11/2011**	**4/3/2012**
Dissolved Metals (µg/L)								
Aluminum	100					200 U	200 U	200 U
Antimony	3					20 U	20 U	20 U
Arsenic	25					20 U	20 U	20 U
Barium	1000	59	44.4	38	120	50	24	34
Beryllium	3			0.1 J		4 U	4 U	4 U
Cadmium	5					5 U	5 U	5 U
Calcium	NA	66300	61800	63000	72000	70000	66000	58000
Chromium	50					10 U	10 U	10 U
Cobalt	5	0.67 J	1.4 J			10 U	10 U	10 U
Copper	200	2.3 J				20 U	20 U	20 U
Iron	300*				130	50 U	50 U	30 J
Lead	25					10 U	10 U	10 U
Magnesium	35000	27100	25300	26000	25000	27000	23000	22000
Manganese	300*	22	25.8		25	10 U	5.6 J	9.8 J
Mercury	0.7					0.2 U	0.2 U	0.2 U
Nickel	100					40 U	40 U	40 U
Potassium	NA	740	889	630 J	890 J	660 J	560 J	510 J
Selenium	10					20 U	20 U	20 U
Silver	50					10 U	10 U	10 U
Sodium	20000	**29400**	**27700**	**30000**	**30000**	**29000**	**27000**	**28000**
Thallium	0.5	**4.5** J				25 U	25 U	25 U
Vanadium	5	1.1 J				10 U	10 U	10 U
Zinc	2000					20 U	20 U	20 U

Notes:
µg/L = micrograms per liter
U = indicates that the compound was analyzed
J = indicates an estimated value
B = the reported value is less than the Contract
E = indicates an estimated value because of the
N = spiked sample recovery not within control

350	Exceeds NYSDEC Clas

TABLE 4-6
ANNUAL SHELL PLANT INDOOR AIR QUALITY RESULTS

Dyno Nobel Site
Port Ewen, New York

	NYSDOH Guidance Value[1] µg/m³	**IA-1 March 2007** µg/m³	**IA-1 February 2008** µg/m³	**IA-1 February 2009** µg/m³	**IA-1 February 2010** µg/m³	**IA-1 February 2011** µg/m³	**IA-1 February 2012** µg/m³
Compound							
Dichlorodifluoromethane	--	**2**	**1.9**	**3**	**2.5**	**2.5**	**2.1**
1,2-Dichloratetrafluoroethane	--	0.28 U	0.28 U	0.28 U	0.28 U	0.28 U	0.28 U
Vinyl Chloride	--	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,3-Butadiene	--	**0.22**	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U
Bromomethane	--	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U
Chloroethane	--	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U
Bromaethene	--	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U
Trichlorofluoromethane	--	**1.1**	**0.96**	**1.7**	**1.3**	**1.6**	**1.2**
1,1-Dichloroethene	--	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U
3-Chloropropene	--	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Methyl tert-Butyl Ether	--	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U
trans-1 ,2-Dichloroethene	--	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U
n-Hexane	--	**0.31**	**0.33**	0.28 U	0.28 U	**0.36**	**0.33**
1,1-Dichloroethane	--	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U
1,2-Dichloroethene (total)	--	**0.67**	0.16 U	**0.48**	**0.34**	**0.58**	**0.3**
cis-1,2-Dichloroethene	--	**0.71**	0.16 U	**0.75**	**0.34**	**0.58**	**0.3**
Chloroform	--	**0.23**	0.2 U	**0.68**	0.2 U	0.2 U	0.2 U
1,1,1-Trichloroethane	--	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U
Cyclohexane	--	0.14 U	0.14 U	0.14 U	0.14 U	**0.25**	**0.21**
Carbon Tetrachloride	--	**0.45**	**0.4**	**0.63**	**0.51**	**0.44**	**0.4**
2,2,4-Trimethylpentane	--	**0.22**	0.19 u U	0.19 U	0.19 U	0.19 U	0.19 U
Benzene	--	**0.51**	**0.45**	**0.45**	**0.58**	**0.47**	**0.59**
1 ,2-Dichloroethane	--	0.32 U	0.32 u U	0.32 U	0.32 U	0.32 U	0.32 U
n-Heptane	--	0.16 U	**0.23**	0.16 U	0.16 U	**0.27**	**0.24**
Trichloroethene	5	**0.75**	**0.24**	**0.64**	**0.27**	**0.49**	**0.39**
1,2-Dichloropropane	--	0.37 U	**0.4**	0.37 U	0.37 U	0.37 U	0.37 U
Bromodichloromethane	--	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U
cis-1,3-Dichloropropene	--	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U
Toluene	--	**0.68**	**0.53**	**0.41**	**1.4**	**1**	**0.71**
trans-1,3-Dichloropropene	--	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U
1,1,2-Trichloroethane	--	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U
Tetrachloroethene	100	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U
Dibromochloromethane	--	0.34 U	0.34 U	0.34 U	0.34 U	0.34 U	0.34 U
1,2-Dibromoethane	--	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U
Ethylbenzene	--	0.17 U	0.17 U	0.17 U	**0.2**	**0.22**	0.17 U
Xylene (m,p)	--	0.35 U	0.35 U	0.35 U	**0.61**	**0.71**	0.17 U
Xylene (o)	--	0.17 U	0.17 U	0.17 U	**0.24**	**0.23**	0.17 U
Xylene (total)	--	0.17 U	0.17 U	0.17 U	**0.87**	**0.94**	0.17 U
Bromoform	--	0.41 U	0.41 U	0.41 U	0.41 U	0.41 U	0.41 U
1,1,2,2-Tetrachloroethane	--	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U
4-Ethyltoluene	--	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,3,5-Trimethylbenzene	--	0.2 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U
Methylene Chloride	60	NA	NA	NA	NA	NA	1.4 U

Notes
1) Guidance value established Table 3.1 of *"Guidance for Evaluating Soil Vapor Intrusion in the State of New York"*, published by the New York State Department of Health (NYSDOH), October 2006

µg/m³: Micrograms per cubic meter
U: Sample not detected above laboratory method detection limit
Bold: indicates constituent detected above laboratory method detection limit
NA: Not analyzed

TABLE 7-2
APPLICABLE GENERAL RESPONSE ACTIONS

Dyno Nobel Site
Port Ewen, New York

	General Response Action and Potential Technology	Applicability Group/Media			
		Soil	Sediment	Groundwater	Indoor Air
I. No Further Action					
A.	No Further Action	X	X	X	X
II. Containment					
A.	Cutoff Walls	X	X		
B.	Caps				
	Permeable	X	X		
	Low Permeable	X	X		
C.	Vapor Barrier				X
III. In-Situ Treatment					
A.	Thermal				
	Vitrification	X	X		
	Six-phase Heating	X	X	X	
	Dynamic Underground Stripping	X	X		
	Steam Stripping	X	X		
B.	Chemical Treatment	X	X	X	
C.	Stabilization/Fixation				
	Phytostabilization	X	X		
	Portland Cement	X	X		
	Microencapsulation	X	X		
D.	Surfactant Flushing	X	X		
E.	Soil Vapor Extraction	X	X		X
F.	Phytoremediation	X	X	X	
G.	Biological Treatment	X	X	X	
H.	Passive/Reactive Walls			X	
I.	Air Sparging			X	
J.	Natural Attenuation			X	
IV. Removal/Ex-Situ Treatment/Disposal					
A.	Removal				
	Excavation	X	X		
	Groundwater Extraction			X	
B.	Ex-Situ Treatment				
	Stabilization/Fixation	X	X		
	Phytoremediation	X	X		
	Soil Washing	X	X		
	Biological Treatment	X	X	X	
	Chemical Treatment	X	X	X	
	Thermal				
	Steam Stripping	X	X		
	Incineration	X	X		
	Asphalt Incorporation	X	X		
	Soil Aeration/Bioventing	X	X		
C.	Disposal				
	Off-Site Landfill	X	X		
	On-Site Consolidation	X	X		
V. Institutional/Engineering Controls					
A.	Institutional Controls				
	Deed Restrictions	X	X		
	Site Management Plan	X	X	X	X
	Health and Safety Plan	X	X	X	
B.	Engineering Controls				
	Demolition of Structures				X
	Fencing	X	X	X	X
	Storm water/erosion Controls	X	X		

TABLE 8-1
TECHNOLOGY SCREENING SUMMARY

Dyno Nobel Site
Port Ewen, New York

	General Response Action & Screened Technology	Applicability Group/Media: Soil	Sediment	Groundwater	Indoor Air	Comment
I. No Further Action						
A.	No Further Action	X	X	X	X	Must evaluate pursuant to DER-10
II. Containment						
A.	Cutoff Walls					Generally used in conjunction with groundwater extraction
B.	Caps					
	Permeable	X	X			
	Low Permeable					Infiltration control is not an objective
C.	Vapor Barrier					Mitigation not required at this time
III. In-Situ Treatment						
A.	Thermal					
	Vitrification					Not recommended due to the potential existence of energetic materials
	Six-phase Heating					Not recommended due to the potential existence of energetic materials
	Dynamic Underground Stripping					Not recommended due to the potential existence of energetic materials
	Steam Stripping					Ineffective due to the fine grain, clayey soils and therefore low permeability
B.	Chemical Treatment					
C.	Stabilization/Fixation					Given the range of contaminants, additives may increase the mobility of some contaminants
	Phytostabilization					
	Portland Cement					
	Microencapsulation					
D.	Surfactant Flushing					Ineffective due to the fine grain, clayey soils and therefore low permeability
E.	Soil Vapor Extraction				X	Ineffective due to the fine grain, clayey soils and therefore low permeability
F.	Phytoremediation					Would be potential fire hazard at the active facility; planting would not be allowed in Wetlands Complex
G.	Biological Treatment					Ineffective due to the fine grain, clayey soils and therefore low permeability and inorganic constituents
H.	Passive/Reactive Walls					Ineffective due to the fine grain, clayey soils and therefore low permeability
I.	Air Sparging					Ineffective due to the fine grain, clayey soils and therefore low permeability
J.	Natural Attenuation			X		

TABLE 8-1
TECHNOLOGY SCREENING SUMMARY

Dyno Nobel Site
Port Ewen, New York

	General Response Action & Screened Technology	Applicability Group/Media				Comment
		Soil	Sediment	Groundwater	Indoor Air	
IV. Removal/Ex-Situ Treatment/Disposal						
A.	Removal					
	Excavation	X	X			
	Groundwater Extraction					Ineffective due to the fine grain, clayey soils
B.	Ex-Situ Treatment					
	Stabilization/Fixation					Given the range of contaminants, additives may increase the mobility of some contaminants
	Phytoremediation					In-situ application is generally more cost effective
	Soil Washing					Ineffective due to the fine grain, clayey soils
	Biological Treatment					Ineffective due to the majority of the constituents consisting of metals
	Chemical Treatment					Ineffective due to the fine grain, clayey soils
	Thermal					
	Stream Stripping					Ineffective due to the fine grain, clayey soils
	Incineration					Not recommended due to the potential existence of energetic materials
	Asphalt Incorporation					Ineffective due to the fine grain, clayey soils
	Soil Aeration/Bioventing					Ineffective due to the fine grain, clayey soils and therefore low permeability
C.	Disposal					
	Off-Site Landfill	X	X			
	On-Site Consolidation	X	X			
V. Institutional/Engineering Controls						
A.	Institutional Controls					
	Deed Restrictions	X	X			
	Site Management Plan	X	X	X	X	
	Health and Safety Plan	X	X	X		
B.	Engineering Controls					
	Demolition of Structures				X	
	Fencing	X	X	X	X	
	Storm water/erosion Controls	X	X			

TABLE 9-1
SOIL CORRECTIVE MEASURES ALTERNATIVES EVALUATION AND COMPARISON

Dyno Nobel Site
Port Ewen, New York

Evaluation Criteria	Soil Corrective Measures Alternatives			
	SOIL1: No Further Action	**SOIL2: Permeable Cover**	**SOIL3: Excavation, On-Site Consolidation, & Capping**	**SOIL4: Excavation & Off-Site Disposal**
Conformance with SCGs (Poor, Fair, Good)	Poor No action will be taken under this alternative and thus will not comply with SCGs	Poor Impacted soil will remain on-site under this alternative and thus will not comply with SCGs	Fair Impacted soil will be excavated, consolidated, and managed at one location on-site. However, the impacted soil will remain on-site and thus will not comply with SCGs at all locations.	Good Impacted soil above the chemical-specific SCGs will be removed from the Site.
Overall Protectiveness of the Public Health and the Environment (Poor, Fair, Good)	Poor Alternative will not provide protection for human health and the environment. • RAOs would not be achieved. • Human health and ecological risks associated with impacted soil would not be reduced or eliminated.	Good Alternative will provide protection for human health and the environment • RAOs for soil would be achieved • Human health and ecological risks associated with impacted soil would be reduced or eliminated	Good Alternative will provide protection for human health and the environment • RAOs for soil would be achieved • Human health and ecological risks associated with impacted soil would be reduced or eliminated	Good Alternative will provide protection for human health and the environment • RAOs for soil would be achieved • Human health and ecological risks associated with impacted soil would be reduced or eliminated
Short-term Impact and Effectiveness	Good No actions will be taken under this remedy	Good Potential risks and environmental impacts associated with this alternative are few.	Good Potential risks and environmental impacts associated with this alternative are few.	Poor There are several very significant potential risks associated with this alternative.
Risks to community, workers, and associated controls		Potential risks to the community would include increased levels of noise, dust, and traffic. Engineering controls and BMPs can mitigate potential risks: • Access to the active work and support zones would be prohibited. • Dust and noise levels would be monitored. Potential risks to workers include physical hazards associated with general construction, potential exposure to and direct contact with impacted soil, noise, and dust. These would be mitigated through: • Engineering controls and BMPs • Compliance with appropriate health and safety plans and SMP • Use of appropriate PPE	Potential risks to the community would include increased levels of noise, dust, and traffic. Engineering controls and BMPs can mitigate potential risks: • Access to the active work and support zones would be prohibited. • Dust and noise levels would be monitored. Potential risks to workers include physical hazards associated with general construction, potential exposure to and direct contact with impacted soil, noise, and dust. These would be mitigated through: • Engineering controls and BMPs • Compliance with appropriate health and safety plans and SMP • Use of appropriate PPE	Potential risks to the community would include increased levels of noise, dust, and traffic; and the increased risk of accidents and spills during waste transportation. Engineering controls and BMP, including the following, can mitigate potential risks associated with noise and dust: • Access to the active work and support zones would be prohibited. • Dust and noise levels would be monitored. Potential risks to workers include physical hazards associated with general construction, potential exposure to and direct contact with impacted soil, noise, and dust. These would be mitigated through: • Engineering controls and BMPs • Compliance with appropriate health and safety plans and SMP • Use of appropriate PPE Traffic resulting from the transportation of approximately 8,424 CY of soil exceeding the industrial use SCO for off-site disposal. This would involve approximately 648 roundtrip truckloads through the community and increase the potential for road accidents in the narrow roads and streets around the area. Further, many of the land use abutting the Site and surrounding the County's highways are sensitive to high volumes of traffic with noise, odor, dust, and exhaust emissions from heavy traffic likely to pose concerns for the community. • Increased potential for spills and releases of contaminated soil on public roads and within the residential community. • Throughout Ulster County, physical constraints or impediments exist on County and State highways that hinder the flow of traffic, especially truck traffic. These include steep grades, aging or low bridges, awkward intersection geometry, and narrow or curving roadways. • Wear and tear to the local road system due to 648 roundtrip truckloads of soil sent off-site for disposal. • Generation of nearly 736 metric tons of carbon dioxide (CO_2) associated with combustion of approximately 71,978 gallons of diesel fuel (assumes 648 loads at 722 miles per roundtrip). Greenhouse gas emissions calculations are provided in **Appendix G.**

TABLE 9-1
SOIL CORRECTIVE MEASURES ALTERNATIVES EVALUATION AND COMPARISON

Dyno Nobel Site
Port Ewen, New York

Evaluation Criteria	**Soil Corrective Measures Alternatives**			
	SOIL1: No Further Action	**SOIL2: Permeable Cover**	**SOIL3: Excavation, On-Site Consolidation, & Capping**	**SOIL4: Excavation & Off-Site Disposal**
Environmental impacts of remedy and controls		Short-term environmental effects during implementation may include the potential transport of impacted soil via storm water. Example control measures to mitigate these impacts include the following: • Erosion/storm water controls would be established prior to commencing with construction activities. • Construction will begin at SWMUs/AOCs located topographically upgradient to minimize recontamination of completed covers. • The duration of these potential releases would only occur during a rain event.	Short-term environmental effects during implementation may include the potential transport of impacted soil via storm water and the disturbance of ecological receptors during the construction of the consolidation unit within the wetlands area. Example control measures to mitigate these impacts include the following: • Erosion/storm water controls would be established prior to commencing with construction activities. • Excavation will begin at SWMUs/AOCs located topographically upgradient to minimize recontamination of excavated areas. • The Wetlands Complex will be mitigated/reconstructed to a higher quality than what currently exists. • The duration of these potential releases would only occur during a rain event.	Short-term environmental effects during implementation may include the potential transport of impacted soil via storm water and the disturbance of ecological receptors during the construction of the consolidation unit within the wetlands area. Example control measures to mitigate these impacts include the following: • Erosion/storm water controls would be established prior to commencing with construction activities. • Excavation will begin at SWMUs/AOCs located topographically upgradient to minimize recontamination of excavated areas. • The Wetlands Complex will be mitigated/reconstructed to a higher quality than what currently exists. • The duration of these potential releases would only occur during a rain event. Traffic resulting from the transportation of approximately 8,424 CY of impacted soil for off-site disposal will generate approximately 648 truck trips through the community and increase the risk for accidents and spills. • The 648 truck trips to the nearest Subtitle C landfill will require approximately 467,856 miles of travel, consuming an estimated 71,978 gallons of diesel fuel. This will create 736 tons of carbon dioxide emissions.
Duration of short-term risks		The duration of the short-term risks would be the time required for construction, which is estimated to be approximately two earthwork seasons.	The duration of the short-term risks would be the time required for construction, which is estimated to be approximately two earthwork seasons and the time for the wetlands to be mitigated/reconstructed and established which is estimated to be approximately two additional years or more.	The duration of the short-term risks would be the time required for construction, which is estimated to be approximately two earthwork seasons and the time for the wetlands to be mitigated/reconstructed and established which is estimated to be approximately two additional years or more..
Long-term Effectiveness and Permanence	Poor Alternative would not result in any significant change in the risks associated with impacted soil	Fair Alternative would provide a fair level of long-term effectiveness and permanence • Alternative would meet RAOs • Contact with or ingestion of impacted soil would be minimized by the cover • Cover materials would need to be periodically inspected and maintained • Potential exposures to future construction workers would be addressed in a SMP	Good Alternative would provide a good level of long-term effectiveness and permanence • Alternative would meet RAOs • Impacted soil would be excavated and consolidated in one location minimizing the potential for future exposure • Potential exposures to future construction workers would be addressed in a SMP • This alternative avoids the off-site disposal and landfilling of approximately 8,424 CY of impacted soil.	Good Alternative would provide a good level of long-term effectiveness and permanence • Alternative would meet RAOs • Impacted soil would be excavated and disposed of off-site eliminating the potential for future exposure
Magnitude and type of residual risk		Residual risk will consist of future exposure to the impacted soil which will remain in place.	Residual risk will consist of future exposure to the impacted soil placed in the consolidation unit.	No residual risk with this alternative
Adequacy and reliability of controls		Risks associated with the impacted soil which will remain in place will be managed as follows: • The cover will eliminate the risk of direct contact or ingestion of impacted soils as well as the transport of impacted soil via storm water. • Property use will be restricted to industrial • Risks to future construction workers will be managed using an SMP by the covers. The covers will be routinely inspected and maintained.	Risks associated with the impacted soil which will be placed in the consolidation unit will be managed as follows: • The cover will eliminate the risk of direct contact or ingestion of impacted materials as well as the transport of impacted materials via storm water. • Property use will be restricted to industrial • Risks to future construction workers will be managed using an SMP by the covers. The consolidation unit will be routinely inspected and maintained.	No residual risk with this alternative as long as the property is restricted to industrial use

TABLE 9-1
SOIL CORRECTIVE MEASURES ALTERNATIVES EVALUATION AND COMPARISON

Dyno Nobel Site
Port Ewen, New York

Evaluation Criteria	**Soil Corrective Measures Alternatives**			
	SOIL1: No Further Action	**SOIL2: Permeable Cover**	**SOIL3: Excavation, On-Site Consolidation, & Capping**	**SOIL4: Excavation & Off-Site Disposal**
Reduction of Toxicity, Mobility, or Volume	Poor	Fair	Good	Good
Reduction of Toxicity, Mobility, or Volume	Alternative does not include a treatment component and does not meet the statutory preference for treatment as a principal element of a remedy.	The overall reduction of COPC mobility in impacted soil is good because a cover will prevent the migration of impacted soil via storm water runoff. However, the toxicity and volume of impacted soil would not change with this alternative.	The overall reduction of COPC mobility in impacted soil is good because the impacted soil will be excavated, consolidated, and managed in on location which will prevent the migration of impacted soil via storm water runoff. However, the toxicity and volume of impacted soil would not change with this alternative.	Implementation of this alternative would reduce the toxicity, mobility and volume of impacted soil through excavation and off-site disposal.
Type and quantity of treatment residuals and associated risks		Treatment residuals will consist of the impacted soil which will remain in place. However, risks associated with this impacted soil will be managed as follows: • The cover will eliminate the risk of direct contact or ingestion of impacted soils as well as the transport of impacted soil via storm water. • Property use will be restricted to industrial • Risks to future construction workers will be managed using an SMP by the covers. The covers will be routinely inspected and maintained.	Residual risk will consist of future exposure to the impacted soil placed in the consolidation unit. Risks associated with the impacted soil which will be placed in the consolidation unit will be managed as follows: • The cover will eliminate the risk of direct contact or ingestion of impacted materials as well as the transport of impacted materials via storm water. • Property use will be restricted to industrial • Risks to future construction workers will be managed using an SMP by the covers. The consolidation unit will be routinely inspected and maintained.	No residual risk with this alternative as long as the property is restricted to industrial use
Implementability	Not applicable; no actions will be taken under this alternative	Good	Good	Good
Technical Feasibility		This alternative is technically feasible and is a proven technology for minimizing exposure from direct contact or ingestion.	This alternative is technically feasible and is a proven technology for minimizing exposure from direct contact or ingestion.	This alternative is technically feasible and is a proven technology for minimizing exposure from direct contact or ingestion.
Administrative Feasibility		The constructability at a number of locations may prove more difficult due to their proximity to sensitive operations.	• The excavation at a number of locations may prove more difficult due to their proximity to sensitive operations. • Design of the consolidation unit within the wetlands complex will require coordination between regulatory agencies (NYSDEC and USACE)	• The excavation at a number of locations may prove more difficult due to their proximity to sensitive operations. • The routing of truck traffic (962 trips) through the community could prove difficult • Land disposal restrictions for off-site disposal could apply depending on the concentrations and characteristics of the excavated soil.
Availability of services and materials		The materials and services needed to construct permeable covers are readily available	The materials and services needed to excavate impacted soils and construct the consolidation unit are readily available	The materials and services needed to excavate and transport impacted soils to an off-site disposal facility are readily available
Cost Effectiveness	$0	$33,569,611 (commercial use SCO) to $2,486,589 (industrial use SCO)	$3,870,089 (commercial use SCO) to $2,465,756(industrial use SCO);	$6,829,945 (commercial use SCO) to $3,941044 (industrial use SCO

EHS Support consider it done

TABLE 9-1
SOIL CORRECTIVE MEASURES ALTERNATIVES EVALUATION AND COMPARISON

Dyno Nobel Site
Port Ewen, New York

Evaluation Criteria	Soil Corrective Measures Alternatives			
	SOIL1: No Further Action	**SOIL2: Permeable Cover**	**SOIL3: Excavation, On-Site Consolidation, & Capping**	**SOIL4: Excavation & Off-Site Disposal**
Retained? (Yes/No)	No	Yes – in areas where energetic materials are likely to remain and excavation poses a significant health and safety risk or in the Active Plant Area near sensitive operations	Yes – Excavation, On-Site Consolidation, and Capping is selected for non-energetic and sensitive SWMUs because it is equally protective over human health and the environment over the long-term as alternative SOIL4 – Excavation and Off-Site Disposal. Direct exposure, fugitive dust inhalation, and future erosion and transport of the Site CPOCs in storm water runoff is eliminated by removing the impacted soils and managing them at one consolidation unit designed to eliminate these potential risks. The net environmental benefit recognized by this option and through avoidance of the risk issues identified with alternative SOIL4 distinguishes this remedy as the option of choice.	No – Net benefits of this approach do not outweigh the potential risks • Increased potential for spills and releases of contaminated soils on public roads and within the residential neighborhoods. • The excavated soil would pose a risk while on-site and during transportation from the Site to the treatment/disposal facility since it would be more accessible to human exposure. • Traffic resulting from the transportation of approximately 8,424 CY of impacted soil for off-site disposal (approximately 648 roundtrip truckloads for sediment) would pose a potential nuisance to the community and increase the risk for accidents and spills. • Many land uses surrounding the County's highways are especially sensitive to high volumes of truck traffic. Residents typically do not enjoy the noise trucks produce in their neighborhoods, especially at night. • Throughout Ulster County, physical constraints or impediments exist on County and State highways that hinder the flow of traffic, especially truck traffic. These include steep grades, aging or low bridges, awkward intersection geometry, and narrow or curving roadways. They exist due to Ulster County's natural landscape and an aging highway network designed primarily for passenger vehicles. • Wear and tear to the local road system due to 368 roundtrip truckloads of soil sent off-site for disposal. • Generation of nearly 736 metric tons of CO_2 associated with combustion of approximately 71,978 gallons of diesel fuel (assumes 648 loads at 722 miles per roundtrip)

Notes:
USACE = United States Army Corp of Engineers
BMP = Best Management Practices
CO_2 = Carbon Dioxide
COPC = Constituent of Potential Concern
NYSDEC = New York State Department of Environmental Conservation
RAO = Remedial Action Objective
SCG = Standards, Criteria, and Guidance
SCO = Soil Cleanup Objective
SMP = Site Management Plan

TABLE 9-2
COST ESTIMATE SUMMARY FOR SOIL CORRECTIVE MEASURES ALTERNATIVES

Dyno Nobel Site
Port Ewen, New York

SWMU/AOC	Description	Soil Corrective Measures Alternatives (Costs based on Below SCO Delineation)							Comment
		SOIL 1: No Further Action	SOIL2: Permeable Cover		SOIL3: Excavation, On-Site Consolidation & Capping		SOIL4: Excavation & Off-Site Disposal		
		No Applicable	Commercial Use SCO	Industrial Use SCO	Commercial Use SCO	Industrial Use SCO	Commercial Use SCO	Industrial Use SCO	
2 and AOC A	Burning Cage Incinerator and Kerosene Tank Leak	$0	$165,241	$115,754	$202,311	$157,581	$422,362	$250,214	
3 and 5	Copper Wire Burning Area and Wire Burning Area III	$0	$148,705	$108,118	$180,145	$145,242	$331,567	$233,514	
4	Iron Wire Burning Area	$0	$119,141	$100,515	$149,529	$125,308	$240,766	$159,151	
6, 7, 8, and AOC B	Open Burning Pads Area	$0	$194,872	$149,614	$220,671	$162,596	$474,147	$281,746	
9	Waste Powder Catch Basins for Bldg 2037	$0	$88,801	No exceedances	$114,681	No exceedances	$121,659	No exceedances	No COPCs exceeding the industrial use SCO
10	Waste Powder Catch Basins for Bldg 2048	$0	$124,836	$104,412	$146,583	$129,075	$222,294	$172,513	
11	Waste Powder Catch Basins for Bldg 2049	$0	$88,090	$86,929	$113,506	$112,405	$116,995	$113,800	
13	Waste Powder Catch Basins for Lead Azide Bldg	$0	$130,693	No exceedances	$153,061	No exceedances	$253,369	No exceedances	No COPCs exceeding the industrial use SCO
21	Lead Recycling Unit Area	$0	$107,787	$85,770	$132,226	$112,217	$184,909	$119,718	
22	Former Landfill	$0	$256,702		Not Applicable		Not Applicable		Intrusive alternatives cannot be employed due to the potential of unexploded ordinances within the SWMU
23	Former Dump	$0	$138,932		Not Applicable		Not Applicable		Intrusive alternatives cannot be employed due to the potential of unexploded ordinances within the SWMU
26D	Burnable Waste Satellite Accumulation Area	$0	$106,707	No exceedances	$138,795	No exceedances	$209,272	No exceedances	No COPCs exceeding the industrial use SCO
26E	Burnable Waste Satellite Accumulation Area	$0	No exceedances		No exceedances		No exceedances		No further action required
26G, AOC C and D	Burnable Waste Satellite Accumulation Area, Open Detonation Pit, and Detonation Test Bldg	$0	$144,394	$144,394	$166,102	$166,102	$302,173	$302,173	
29	Drainage Ditch located downgradient of Bldg 2049	$0	$98,730	No exceedances	$123,599	No exceedances	$154,477	No exceedances	No COPCs exceeding the industrial use SCO
32	Old Dump near water tower	$0	$116,474		Not Applicable		Not Applicable		Intrusive alternatives cannot be employed due to the potential of unexploded ordinances within the SWMU
33	Mercury Fulminate Tanks Area	$0	$121,514	$99,368	$135,711	$119,040	$231,382	$165,756	
35	Stone Fence Dump	$0	$112,697		Not Applicable		Not Applicable		Intrusive alternatives cannot be employed due to the potential of unexploded ordinances within the SWMU

TABLE 9-2
COST ESTIMATE SUMMARY FOR SOIL CORRECTIVE MEASURES ALTERNATIVES

Dyno Nobel Site
Port Ewen, New York

SWMU/AOC	Description	Soil Corrective Measures Alternatives (Costs based on Below SCO Delineation)							Comment
		SOIL 1: No Further Action	SOIL2: Permeable Cover		SOIL3: Excavation, On-Site Consolidation & Capping		SOIL4: Excavation & Off-Site Disposal		
		No Applicable	Commercial Use SCO	Industrial Use SCO	Commercial Use SCO	Industrial Use SCO	Commercial Use SCO	Industrial Use SCO	
39	Former Washwater Discharge Area at Bldg 2009	$0	No exceedances		No exceedances		No exceedances		No further action required
40	Pilot Line Condensate Collection Sump	$0	$87,286	No exceedances	$112,745	No exceedances	$114,838	No exceedances	No COPCs exceeding the industrial use SCO
42	SAC Bldg Steam Collection Containers	$0	No exceedances		No exceedances		No exceedances		No further action required
47	Bldg 2058 Fuse Room	$0	No exceedances		No exceedances		No exceedances		No further action required
48	Mercury Fulminate Area	$0	$103,061	No exceedances	$127,714	No exceedances	$168,361	No exceedances	No COPCs exceeding the industrial use SCO
52	Former Commercial Shooting Lab Area	$0	$142,339	$136,910	$281,300	$212,029	$727,717	$471,959	
54	Former Historical Production Area	$0	$290,241	$160,308	$443,912	$253,641	$1,247,952	$633,768	No COPCs exceeding the industrial use SCO
56	Vent System for Static Security Testing Chamber	$0	No exceedances		No exceedances		No exceedances		No further action required
AOC G	Former Drying House	$0	$89,324	$89,011	$117,135	$116,552	$130,393	$128,240	
AOC H	Former Drying House	$0	$92,067	$88,838	$122,595	$116,414	$150,332	$128,277	
AOC I	Roof Drainage from Deto Bldg	$0	$89,003	No exceedances	$116,503	No exceedances	$127,843	No exceedances	No COPCs exceeding the industrial use SCO
AOC J	Former Drying House	$0	$96,166	$89,699	$130,136	$122,410	$178,284	$157,300	
AOC M	Former Drying House	$0	$108,040	$106,095	$152,176	$148,482	$258,241	$244,604	
AOC N	Former Drying House	$0	$108,722	$100,750	$153,585	$138,422	$263,663	$207,679	
AOC O	Former Drying House	$0	$99,046	$95,299	$135,368	$128,240	$196,949	$170,632	
		TOTALS	**$3,569,611**	**$2,486,589**	**$3,870,089**	**$2,465,756**	**$6,829,945**	**$3,941,044**	

TABLE 9-3
SEDIMENT CORRECTIVE MEASURES ALTERNATIVES EVALUATION AND COMPARISON

Dyno Nobel Site
Port Ewen, New York

Evaluation Criteria	Sediment Corrective Measures Alternatives			
	SED1: No Further Action	**SED2: Permeable Cover**	**SED3: Excavation, On-Site Consolidation, & Capping**	**SED4: Excavation & Off-Site Disposal**
Conformance with SCGs (Poor, Fair, Good)	Poor No action will be taken under this alternative and thus will not comply with SCGs	Poor Impacted sediment will remain on-site under this alternative and thus will not comply with SCGs	Fair Impacted sediment will be excavated, consolidated, and managed at one location on-site. However, the impacted soil will remain on-site and thus will not comply with the SCGs at all locations.	Good Impacted sediment above the applicable criteria will be removed from the Site.
Overall Protectiveness of the Public Health and the Environment (Poor, Fair, Good)	Poor Alternative will not provide protection for human health and the environment. • RAOs would not be achieved. • Human health and ecological risks associated with impacted sediment would not be reduced or eliminated.	Good Alternative will provide protection for human health and the environment • RAOs for sediment would be achieved • Human health and ecological risks associated with impacted sediment would be reduced or eliminated	Good Alternative will provide protection for human health and the environment • RAOs for sediment would be achieved • Human health and ecological risks associated with impacted sediment would be reduced or eliminated	Good Alternative will provide protection for human health and the environment • RAOs for sediment would be achieved • Human health and ecological risks associated with impacted sediment would be reduced or eliminated
Short-term Impact and Effectiveness	Good No actions will be taken under this remedy	Fair Potential risks and environmental impacts associated with this alternative are few.	Good Potential risks and environmental impacts associated with this alternative are few.	Poor There are several very significant potential risks associated with this alternative.
Risks to community, workers, and associated controls		Potential risks to the community would include increased levels of noise, dust, and traffic. Engineering controls and BMPs can mitigate potential risks: • Access to the active work and support zones would be prohibited. • Dust and noise levels would be monitored. Potential risks to workers include physical hazards associated with general construction, potential exposure to and direct contact with impacted sediment, noise, and dust. These would be mitigated through: • Engineering controls and BMPs • Compliance with appropriate health and safety plans and SMP • Use of appropriate PPE	Potential risks to the community would include increased levels of noise, dust, and traffic. Engineering controls and BMPs can mitigate potential risks: • Access to the active work and support zones would be prohibited. • Dust and noise levels would be monitored. Potential risks to workers include physical hazards associated with general construction, potential exposure to and direct contact with impacted sediment, noise, and dust. These would be mitigated through: • Engineering controls and BMPs • Compliance with appropriate health and safety plans and SMP • Use of appropriate PPE	Potential risks to the community would include increased levels of noise, dust, and traffic; and the increased risk of accidents and spills during waste transportation. Engineering controls and BMP, including the following, can mitigate potential risks associated with noise and dust: • Access to the active work and support zones would be prohibited. • Dust and noise levels would be monitored. However, traffic resulting from the transportation of approximately 16,666 CY of impacted sediment for off-site disposal will generate approximately 1,282 truck trips through the community and increase the risk for accidents and spills and cause stress and wear and tear to the community roadways. Potential risks to workers include physical hazards associated with general construction, potential exposure to and direct contact with impacted sediment, noise, and dust. These would be mitigated through: • Engineering controls and BMPs • Compliance with appropriate health and safety plans and SMP • Use of appropriate PPE

TABLE 9-3
SEDIMENT CORRECTIVE MEASURES ALTERNATIVES EVALUATION AND COMPARISON

Dyno Nobel Site
Port Ewen, New York

Evaluation Criteria	Sediment Corrective Measures Alternatives			
	SED1: No Further Action	SED2: Permeable Cover	SED3: Excavation, On-Site Consolidation, & Capping	SED4: Excavation & Off-Site Disposal
Environmental impacts of remedy and controls		Short-term environmental effects during implementation may include the potential for migration of impacted sediment into surface water. Example control measures to mitigate these impacts include the following: • Erosion/storm water controls would be established prior to commencing with construction activities. • Construction will begin at SWMUs/AOCs located topographically upgradient to minimize recontamination of completed covers. The disturbance of ecological receptors within the wetlands area would be permanent because the wetland would have to be dewatered in order to maintain the cover.	Short-term environmental effects during implementation may include the potential transport of impacted sediment into surface water and the disturbance of ecological receptors within the wetlands area. Example control measures to mitigate these impacts include the following: • Erosion/storm water controls would be established prior to commencing with construction activities. • Excavation will begin at upstream locations to minimize recontamination of excavated areas. • The Wetlands Complex will be mitigated/reconstructed to a higher quality than what currently exists. • This alterative requires less movement of the impacted soils and therefore less energy , reducing carbon dioxide emissions over SED4: Excavation & Off-Site Disposal option by 1,558 tons	Short-term environmental effects during implementation may include the potential transport of impacted sediment via storm water and the disturbance of ecological receptors during the construction of the consolidation unit within the wetlands area. Example control measures to mitigate these impacts include the following: • Erosion/storm water controls would be established prior to commencing with construction activities. • Excavation will begin at SWMUs/AOCs located topographically upgradient to minimize recontamination of excavated areas. • The Wetlands Complex will be mitigated/reconstructed to a higher quality than what currently exists. • The duration of these potential releases would only occur during a rain event. Traffic resulting from the transportation of approximately 17,829 CY of impacted sediment for off-site disposal will generate approximately 1,372 truck trips through the community and increase the risk for accidents and spills. • The physical nature of the sediment increases the potential for releases during transportation that could expose the surrounding community. • The excavated sediment would pose a risk while on-site and during transportation from the Site to the treatment/disposal facility since it would be more accessible to ecological exposure. • The excavated sediments would need to be dewatered prior to transportation off-site and have the potential to drip or leak from trucks during transportation. • Many land uses surrounding the County's highways are especially sensitive to high volumes of truck traffic. Residents typically do not enjoy the noise trucks produce in their neighborhoods, especially at night. • Throughout Ulster County, physical constraints or impediments exist on County and State highways that hinder the flow of traffic, especially truck traffic. These include steep grades, aging or low bridges, awkward intersection geometry, and narrow or curving roadways. They exist due to Ulster County's natural landscape and an aging highway network designed primarily for passenger vehicles. • Further, this truck traffic will result in wear and tear to the local road system due to 1,372 roundtrip truckloads of sediment sent off-site for disposal. • The 1,372 truck trips to the nearest Subtitle C landfill will require approximately 990,584 miles of travel, consuming an estimated 152,398 gallons of diesel fuel. This will create 1,558 tons of carbon dioxide emissions.
Duration of short-term risks		The potential for migration of impacted sediment would always be a risk as long as water is present in the wetlands that could erode the cover. The disturbance of ecological receptors within the wetlands area would be permanent because the wetland would have to be dewatered in order to maintain the cover.	The duration of the short-term risks would be the time required for construction, which is estimated to be over two earthworks seasons and the time for the wetlands to be mitigated/reconstructed and established which is estimated to be approximately an additional two years or more.	The duration of the short-term risks would be the time required for construction, which is estimated to be over two earthworks seasons and the time for the wetlands to be mitigated/reconstructed and established which is estimated to be approximately an additional two years or more.

EHS Support consider it done

TABLE 9-3
SEDIMENT CORRECTIVE MEASURES ALTERNATIVES EVALUATION AND COMPARISON

Dyno Nobel Site
Port Ewen, New York

Evaluation Criteria	Sediment Corrective Measures Alternatives			
	SED1: No Further Action	**SED2: Permeable Cover**	**SED3: Excavation, On-Site Consolidation, & Capping**	**SED4: Excavation & Off-Site Disposal**
Long-term Effectiveness and Permanence	**Poor** Alternative would not result in any significant change in the risks associated with impacted sediment	**Poor** Alternative would provide a poor level of long-term effectiveness and permanence because the cover material would constantly erode due to the presence of water in the wetlands	**Good** Alternative would provide a good level of long-term effectiveness and permanence • Alternative would meet RAOs • Impacted sediment would be excavated and consolidated in one location minimizing the potential for future exposure • Potential exposures to future construction workers would be addressed in a SMP • This alternative avoids the off-site disposal and landfilling of approximately 17,829 CY of impacted sediment.	**Good** Alternative would provide a good level of long-term effectiveness and permanence • Alternative would meet RAOs • Impacted sediment would be excavated and disposed of off-site eliminating the potential for future exposure
Magnitude and type of residual risk		Residual risk will consist of future exposure to the impacted sediment which will remain in place.	Residual risk will consist of future exposure to the impacted sediment placed in the consolidation unit.	No residual risk with this alternative
Adequacy and reliability of controls		There is no way to effectively manage the continued erosion of the proposed cover due to the presence of water in the wetlands without rerouting water around this area which would destroy the wetlands.	Risks associated with the impacted sediment which will be placed in the consolidation unit will be managed as follows: • The cover will eliminate the risk of direct contact or ingestion of impacted materials as well as the transport of impacted materials via storm water. • Property use will be restricted to commercial/industrial • Risks to future construction workers will be managed using an SMP by the covers. The consolidation unit will be routinely inspected and maintained.	No residual risk with this alternative
Reduction of Toxicity, Mobility, or Volume	**Poor**	**Poor**	**Good**	**Good**
Reduction of Toxicity, Mobility, or Volume	Alternative does not include a treatment component and does not meet the statutory preference for treatment as a principal element of a remedy.	The overall reduction of COPC mobility in impacted sediment in the short-term is good because a cover will prevent the migration of impacted sediment into surface water. However, the long-term reduction in mobility is limited due to the risk of cover erosion due to the continued presence of water in the wetlands. Toxicity and volume of impacted sediment would not change with this alternative.	The overall reduction of COPC mobility in impacted sediment is good because the impacted sediment will be excavated, consolidated, contained, and managed in one location which will prevent the future migration of impacted sediment into surface water. However, the toxicity and volume of impacted sediment would not change with this alternative.	Implementation of this alternative would reduce the toxicity, mobility and volume of impacted sediment through excavation and off-site disposal.
Type and quantity of treatment residuals and associated risks		Treatment residuals will consist of the impacted sediment which will remain in place. There is no way to effectively manage the continued erosion of the proposed cover due to the presence of water in the wetlands without rerouting water around this area which would destroy the wetlands	Residual risk will consist of future exposure to the impacted sediment placed in the consolidation unit. Risks associated with the impacted sediment which will be placed in the consolidation unit will be managed as follows: • The cover will eliminate the risk of direct contact or ingestion of impacted materials as well as the transport of impacted sediment into surface water. • Property use will be restricted to commercial/industrial • Risks to future construction workers will be managed using an SMP by the covers. The consolidation unit will be routinely inspected and maintained.	No residual risk with this alternative

TABLE 9-3
SEDIMENT CORRECTIVE MEASURES ALTERNATIVES EVALUATION AND COMPARISON

Dyno Nobel Site
Port Ewen, New York

Evaluation Criteria	**Sediment Corrective Measures Alternatives**			
	SED1: No Further Action	**SED2: Permeable Cover**	**SED3: Excavation, On-Site Consolidation, & Capping**	**SED4: Excavation & Off-Site Disposal**
Implementability	Not applicable; no actions will be taken under this alternative	Poor	Good	Good
Technical Feasibility		This alternative is a proven technology for minimizing exposure from direct contact or ingestion. However, this alternative is not technically feasible for the remediation of sediments in the drainage ways and wetlands complex due to the continued presence of water which would erode the cover.	This alternative is technically feasible and is a proven technology for minimizing exposure from direct contact or ingestion. The most significant technical challenge will be the design of the consolidation unit. The stream currently running through the wetlands complex will be rerouted around the west side of SWMU 22 and will temporarily discharge north of sample location SQT-8 as conceptualized in **Figure 11-2**. Rerouting of the stream, coupled with dewatering of the wetlands complex will facilitate the construction of the consolidation unit at SWMU 22 and for excavation of impacted sediments within the wetlands complex. After dewatering of the wetlands complex, inert fill will be imported to SWMU 22 to construct the containment cell of the consolidation unit (earthen berm). After dewatering the impacted sediments will be excavated, stabilized (with native soils, fly ash or similar materials, if necessary), and consolidated in an engineered landfill constructed at SWMU 22 along with soil excavated from the operational portion of the plant which exceeds the Industrial SCOs. After consolidation of impacted soils and sediments, inert fill will be imported to develop a stable subgrade landform on which a permeable cover can be placed over SWMUs 1, 22, 35. The permeable cover will consist of a geotextile layer to serve as a marker for the impacted soil/sediment,18 inches of low permeability fill/clay, 6 inches of top soil, and a vegetative cover.	This alternative is technically feasible and is a proven technology for minimizing exposure from direct contact or ingestion.
Availability of services and materials		The materials and services needed to construct permeable covers are readily available	The materials and services needed to excavate impacted sediments and construct the consolidation unit are readily available	The materials and services needed to excavate and transport impacted sediments to an off-site disposal facility are readily available
Cost Effectiveness	$0	$0	SEL = $5,507,981 PRG = $5,337,868 Mass Removal = $5,480,145	SEL = $7,368,756 PRG = $6,946,959 Mass Removal = $7,313,493

TABLE 9-3
SEDIMENT CORRECTIVE MEASURES ALTERNATIVES EVALUATION AND COMPARISON

Dyno Nobel Site
Port Ewen, New York

Evaluation Criteria	Sediment Corrective Measures Alternatives			
	SED1: No Further Action	SED2: Permeable Cover	SED3: Excavation, On-Site Consolidation, & Capping	SED4: Excavation & Off-Site Disposal
Remedy Selected?	No	No – This alternative is no implementable in the Wetlands Complex due to the future presence of flowing and standing water.	Yes – Excavation, On-Site Consolidation, and Capping is selected impacted sediments because it is equally protective over human health and the environment over the long-term as alternative SED4 – Excavation and Off-Site Disposal. Direct exposure, fugitive dust inhalation, and future erosion and transport of the Site COPCs in storm water runoff is eliminated by removing the impacted sediments and managing them at one consolidation unit designed to eliminate these potential risks. The net environmental benefit recognized by this option and through avoidance of the risk issues identified with alternative SED4 distinguishes this remedy as the option of choice.	No – Net benefits of this approach do not outweigh the potential risks • The physical nature of the sediment increases the potential for releases during transportation that could expose the surrounding community. • The excavated sediment would pose a risk while on-site and during transportation from the Site to the treatment/disposal facility since it would be more accessible to ecological exposure. • The excavated soil would pose a risk while on-site and during transportation from the Site to the treatment/disposal facility since it would be more accessible to human exposure. • Traffic resulting from the transportation of approximately 17,829 CY of impacted sediment for off-site disposal (approximately 1,372 roundtrip truckloads for soil removal and importing clean fill materials) would pose a potential nuisance to the community and increase the risk for accidents and spills. • Many land uses surrounding the County's highways are especially sensitive to high volumes of truck traffic. Residents typically do not enjoy the noise trucks produce in their neighborhoods, especially at night. • Throughout Rockland County, physical constraints or impediments exist on County and State highways that hinder the flow of traffic, especially truck traffic. These include steep grades, aging or low bridges, awkward intersection geometry, and narrow or curving roadways. They exist due to Rockland County's natural landscape and an aging highway network designed primarily for passenger vehicles. • Wear and tear to the local road system due to 1,372 roundtrip truckloads of sediment sent off-site for disposal. • Generation of nearly 1,558 metric tons of CO2 associated with combustion of approximately 152,398 gallons of diesel fuel (assumes 1,558 loads at 722 miles per roundtrip)

Notes:
USACE = United States Army Corp of Engineers
BMP = Best Management Practices
CO_2 = Carbon Dioxide
COPC = Constituent of Potential Concern
NYSDEC = New York State Department of Environmental Conservation
RAO = Remedial Action Objective
SCG = Standards, Criteria, and Guidance
SMP = Site Management Plan

TABLE 9-4
COST ESTIMATE SUMMARY FOR SOIL CORRECTIVE MEASURES ALTERNATIVES

Dyno Nobel Site
Port Ewen, New York

SWMU/AOC	Sediment Corrective Measures Alternatives							
	SED1: No Further Action	SED2: Permeable Cover	SED3: Excavation, On-Site Consolidation & Capping			SED4: Excavation & Off-Site Disposal		
	No Applicable	Not Applicable	Cleanup to SEL	Cleanup to PRG	Mass Removal	Cleanup to SEL	Cleanup to PRG	Mass Removal
Wetlands Complex	$0	$0 (Not Implementable)	$5,507,981	$5,337,868	$5,480,145	$7,368,756	$6,946,959	$7,313,493

Note: The Wetlands Complex cost includes the Site drainage ways as well as the capping of SWMUs 1, 22, and 35 underneath the consolidation unit.

TABLE 9-5
GROUNDWATER CORRECTIVE MEASURES ALTERNATIVES EVALUATION AND COMPARISON

Dyno Nobel Site
Port Ewen, New York

Evaluation Criteria	GW1: No Further Action	GW2: Monitored Natural Attenuation with Institutional Controls
Conformance with SCGs (Poor, Fair, Good)	**Poor** No action will be taken under this alternative and thus will not comply with SCGs	**Fair** Natural attenuation processes may result in reduced concentrations of VOCs in groundwater, but it is likely to be a long-term process. .
Overall Protectiveness of the Public Health and the Environment (Poor, Fair, Good)	**Fair** This alternative would not address exposures to construction workers performing intrusive activities below the water table (such as activities to repair existing, or install new, subsurface utilities/facilities). Although there are constituents in groundwater at concentrations exceeding standards/guidance values, the mass flux evaluation demonstrated that concentrations of VOCs in groundwater flowing from the Active Plant area to the Wetlands Complex do not result in exceedances of applicable surface water quality standards. Natural attenuation processes over time may result in decreases in concentrations of COPCs in groundwater.	**Good** Alternative will provide protection for human health and the environment • Existing groundwater use laws would continue to minimize the potential human exposure to COPCs in groundwater. • SMP would address potential exposure to construction workers performing intrusive activities below the water table and identify requirements for use of PPE • The mass flux evaluation demonstrated that concentrations of COPCc in groundwater flowing from the Active Plant area to the Wetlands Complex do not result in exceedances of applicable surface water quality standards. • Natural attenuation processes over time may result in decreases in concentrations of constituents of interest in groundwater.
Short-term Impact and Effectiveness	**Good** No actions will be taken under this remedy	**Good**
Risks to community, workers, and associated controls		Monitoring would be the only field work performed pursuant to this alternative. Personnel performing groundwater monitoring would use PPE and follow requirements of a Site-specific HASP. There would be no short-term environmental impacts or risks to on-site workers or the community (or construction workers, because there would not be any construction) associated with implementation of this alternative.
Environmental impacts of remedy and controls		
Duration of short-term risks		The duration of the short-term risks would be for the next 30 years while routine monitoring is being performed.

TABLE 9-5
GROUNDWATER CORRECTIVE MEASURES ALTERNATIVES EVALUATION AND COMPARISON

Dyno Nobel Site
Port Ewen, New York

Evaluation Criteria	GW1: No Further Action	GW2: Monitored Natural Attenuation with Institutional Controls
Long-term Effectiveness and Permanence	**Poor** Alternative would not result in any significant change in the risks associated with impacted groundwater	**Good** Alternative would provide a good level of long-term effectiveness and permanence
Magnitude and type of residual risk		Natural attenuation processes may be effective over the long-term at reducing concentrations of VOCs in groundwater.
Adequacy and reliability of controls		Long-term monitoring would be performed to evaluate changes in groundwater conditions. Through the establishment of a land use restriction and SMP, this alternative would meet the groundwater RAOs related to potential direct contact, ingestion, and inhalation human health exposure pathways. The land use restriction and SMP would be kept in place, unchanged, unless Site conditions were to change and make these measures unnecessary. If changes were to occur that would require modifications to the land use restriction/SMP, such modifications would be presented to the NYSDEC for review and approval, as appropriate. Both the land use restriction and SMP would be apparent to possible future Site owners during comprehensive due diligence activities performed in connection with property transfer. Taken together, these institutional controls could be expected to adequately and reliably provide for the management of groundwater exhibiting constituents at concentrations exceeding standards.
Reduction of Toxicity, Mobility, or Volume	**Poor**	**Fair**
Reduction of Toxicity, Mobility, or Volume	COPC-impacted groundwater would not be actively treated (other than natural processes), recycled, or destroyed. Reduction of toxicity, mobility, and mass of the impacted groundwater would potentially occur over an extended period of time as a result of natural processes.	VOC-impacted groundwater would not be contained, removed, or actively treated (other than by natural processes). Reduction of the toxicity, mobility, and volume of impacted groundwater would likely be reduced over an extended period of time via natural attenuation processes.
Type and quantity of treatment residuals and associated risks		Same as above

Evaluation Criteria	

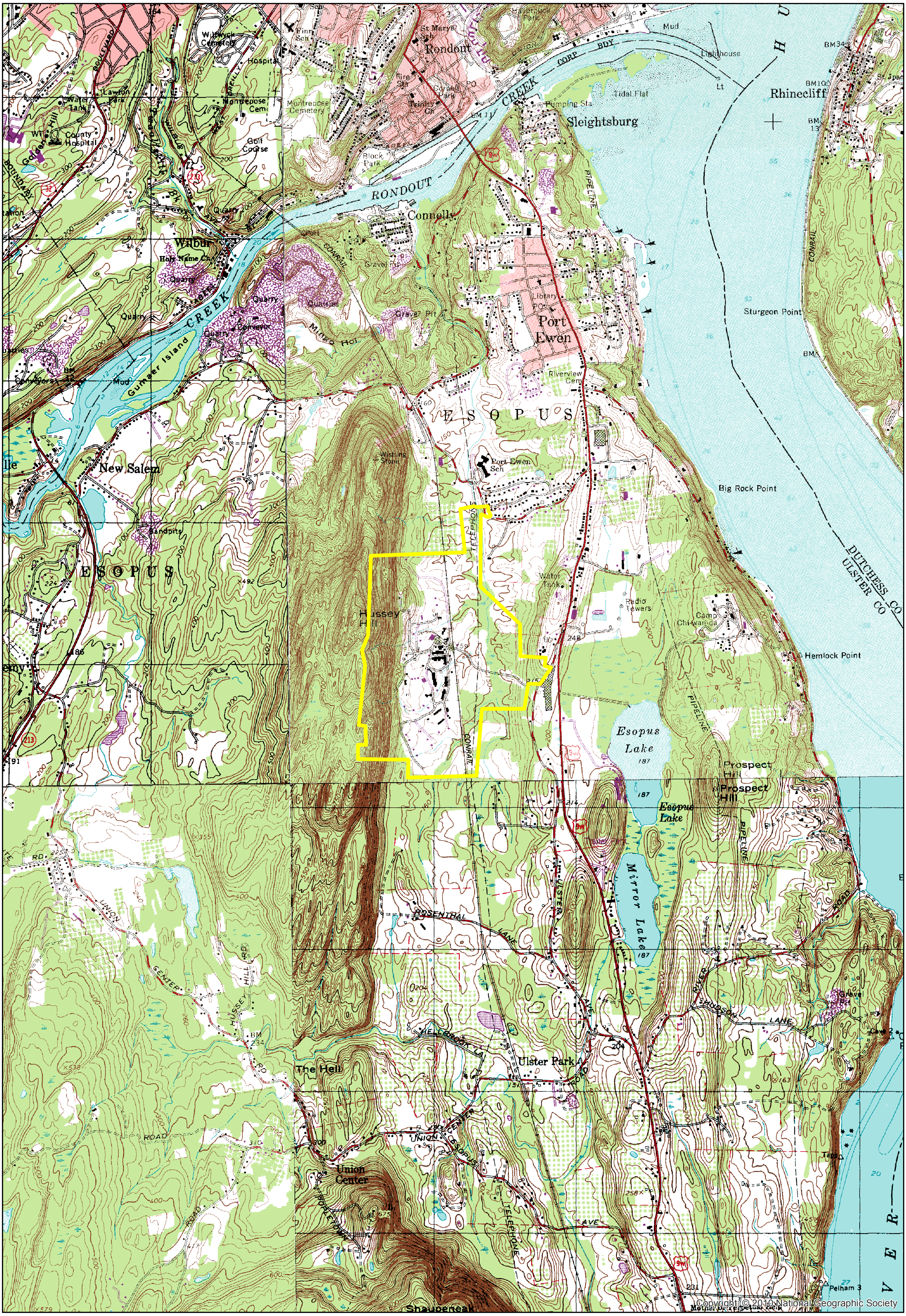
TABLE 9-5
GROUNDWATER CORRECTIVE MEASURES ALTERNATIVES EVALUATION AND COMPARISON

Dyno Nobel Site
Port Ewen, New York

	GW1: No Further Action	GW2: Monitored Natural Attenuation with Institutional Controls
Implementability	Not applicable; no actions will be taken under this alternative	Good
Technical Feasibility		This alternative is technically feasible and is a proven technology monitoring the long-term attenuation of VOCs in groundwater..
Availability of services and materials		The equipment, materials and services needed to monitor the groundwater at the Site are readily available
Cost Effectiveness	$0	$252,367
Remedy Selected?	No	Yes - Natural attenuation processes may be effective over the long-term at reducing concentrations of VOCs in groundwater. Long-term monitoring would be performed to evaluate changes in groundwater conditions. Through the establishment of a land use restriction and SMP, this alternative would meet the groundwater RAOs related to potential direct contact, ingestion, and inhalation human health exposure pathways. The land use restriction and SMP would be kept in place, unchanged, unless Site conditions were to change and make these measures unnecessary. If changes were to occur that would require modifications to the land use restriction/SMP, such modifications would be presented to the NYSDEC for review and approval, as appropriate. Both the land use restriction and SMP would be apparent to possible future Site owners during comprehensive due diligence activities performed in connection with property transfer. Taken together, these institutional controls could be expected to adequately and reliably provide for the management of groundwater exhibiting constituents at concentrations exceeding standards.

Notes:
COPC = Constituent of Potential Concern
NYSDEC = New York State Department of Environmental Conservation
SCG = Standards, Criteria, and Guidance
SMP = Site Management Plan
VOCs = Volatile Organic Compounds

FIGURES



Legend

APPROXIMATE PROPERTY BOUNDARY

0 1,000 2,000 4,000 Feet

N

FIGURE 1-1. SITE LOCATION MAP

DYNO NOBEL SITE

PORT EWEN, NEW YORK

Map Source:
USGS topographic maps: Kingston West (2000), Kingston East (1980), Rosendale (1980), Hyde Park (2000)
Boundaries: Site and property boundaries approximations were determined using available data from historical maps and CAD files.

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Legend

- APPROXIMATE SITE BOUNDARY
- APPROXIMATE PROPERTY BOUNDARY
- NYSDEC MAPPED CLASS 2 WETLANDS
- NYSDEC MAPPED CLASS 3 WETLANDS
- LAKE/POND
- SWAMP/MARSH
- SWMU 1/22 BOUNDARY
- RAILROAD
- PERENNIAL STREAM
- INTERMITTENT STREAM
- ARTIFICIAL PATH
- CONNECTOR

N

FIGURE 2-1
SITE LAYOUT
DYNO NOBEL SITE, PORT EWEN, NEW YORK

Map Source:
Fresh water wetlands: New York State Department of Environmental Conservation
Surface water: National Hydrography Dataset
Countours: United States Department of Agriculture/Natural Resource Conservation Service - National Cartography and Geospatial Center digital elevation models
Boundaries: Site and property boundaries approximations were determined using available data from historical maps and CAD files.

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Legend

APPROXIMATE SITE BOUNDARY	LAKE/POND
APPROXIMATE PROPERTY BOUNDARY	SWAMP/MARSH
NYSDEC MAPPED CLASS 2 WETLANDS	CONTOURS (5 meter intervals)
NYSDEC MAPPED CLASS 3 WETLANDS	RAILROAD
PERENNIAL STREAM	INTERMITTENT STREAM
ARTIFICIAL PATH	CONNECTOR

N

FIGURE 2-2 SITE SETTING

DYNO NOBEL SITE
PORT EWEN, NEW YORK

Map Source:
Fresh water wetlands: New York State Department of Environmental Conservation
Surface water: National Hydrography Dataset
Countours: United States Department of Agriculture/Natural Resource Conservation Service - National Cartography and Geospatial Center digital elevation models
Boundaries: Site and property boundaries approximations were determined using available data from historical maps and CAD files.

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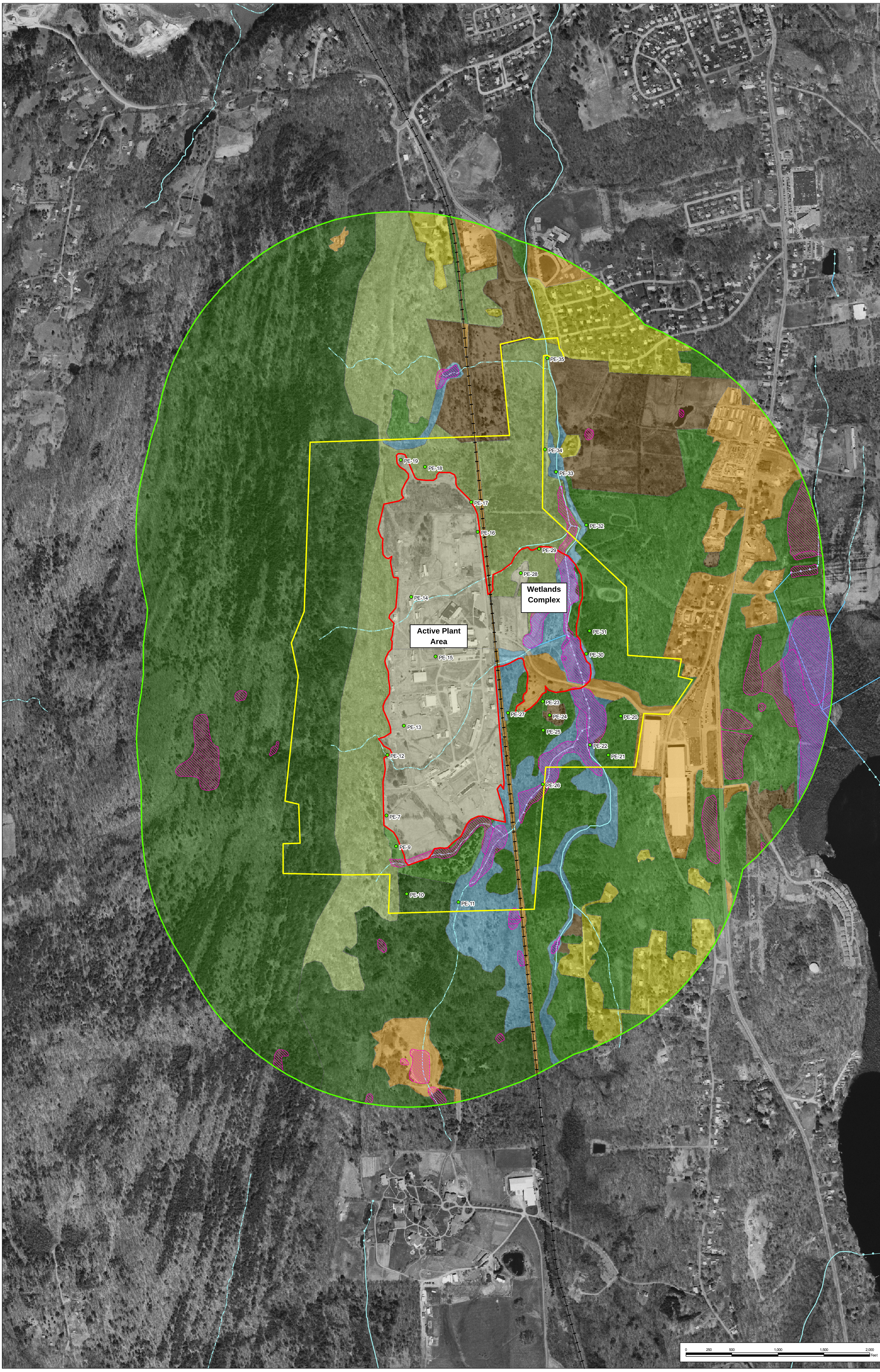
IM-C:\GIS\Port Ewen\Figures\Land_Cover_v2.mxd



Legend

APPROXIMATE SITE BOUNDARY
APPROXIMATE PROPERTY BOUNDARY
1/2 MILE RADIUS FROM SITE BOUNDARY
RECONNAISSANCE LOCATIONS
RAILROAD
PERENNIAL STREAM
INTERMITTENT STERAM
CONNECTOR
ARTIFICIAL PATH
NATIONAL WETLANDS INVENTORY
RESIDENTIAL
DEVELOPED
INDUSTRIAL
OLD FIELD
DECIDUOUS FOREST
SUCCESSIONAL FOREST
PINE OAK FOREST
PALUSTRINE WETLAND

N

FIGURE 2-3 COVER TYPE MAP

DYNO NOBEL SITE
PORT EWEN, NEW YORK

Map Source:
Image: NYSGIS (2004)
Land Cover: Derived from aerial photo interpretation and site visit (November 7, 2007)
National Wetlands Inventory: United States Fish & Wildlife Service (Lower 48 States)
Surface water: National Hydrography Dataset
Boundaries: Site and property boundaries approximations were determined using available data from historical maps and CAD files.

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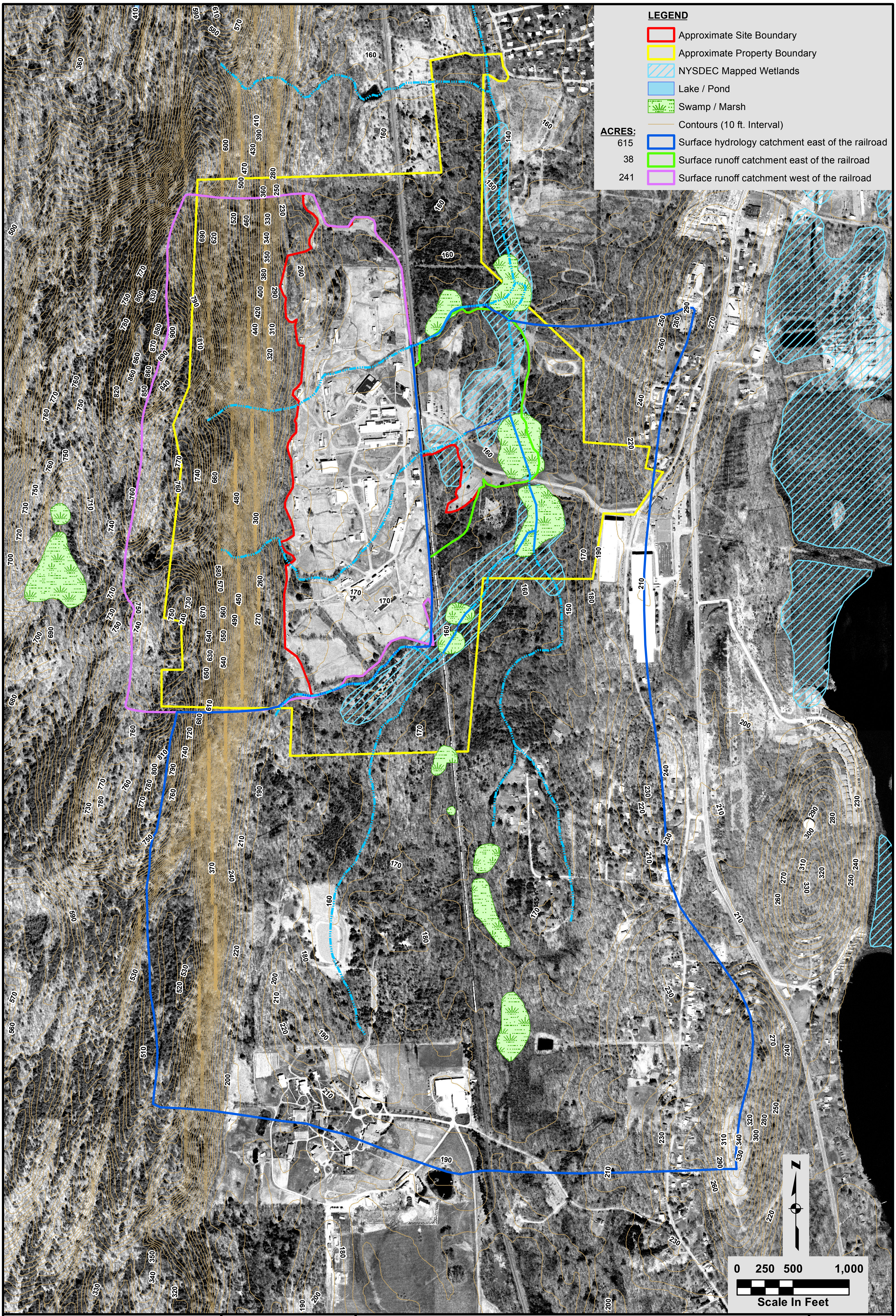

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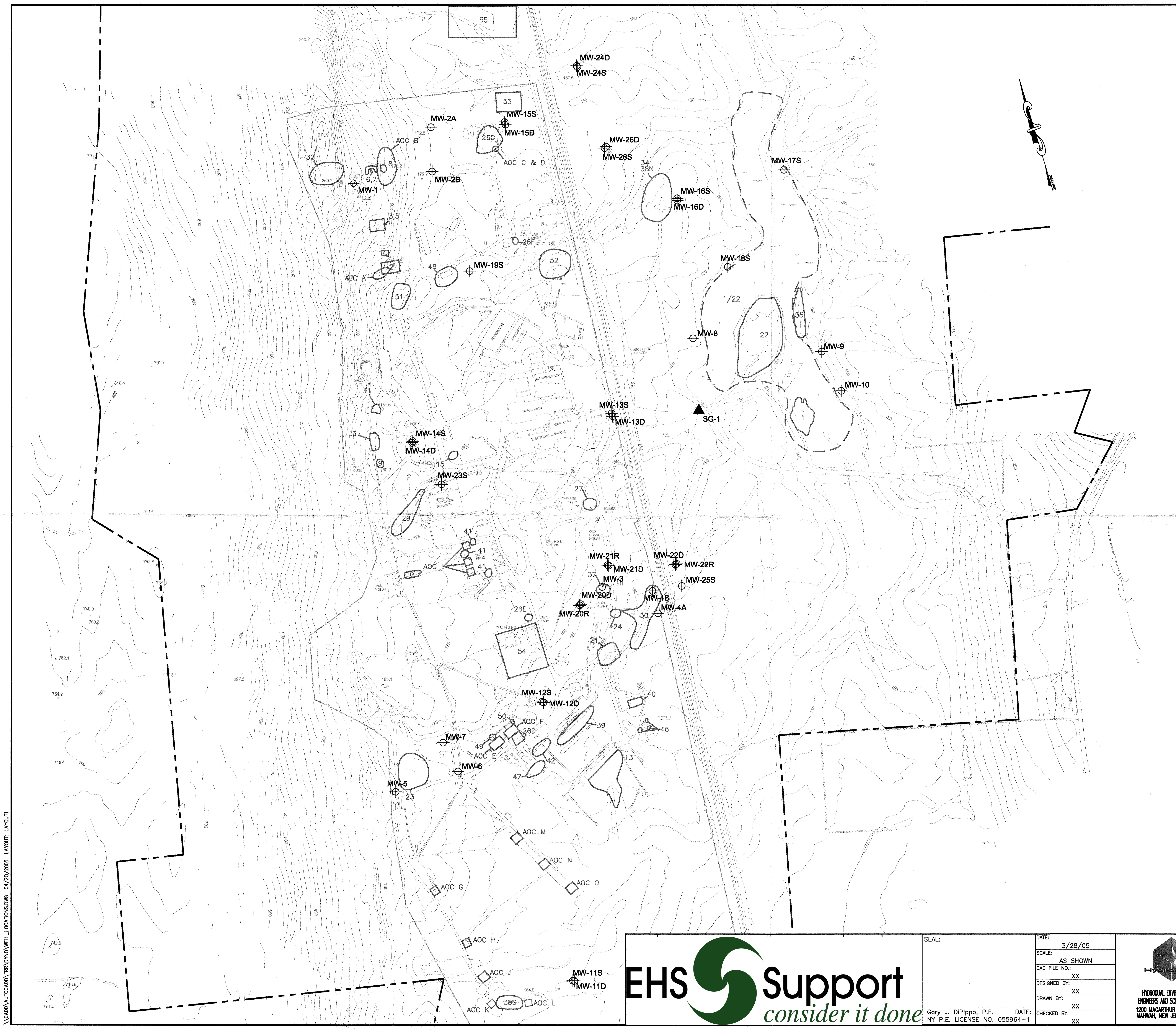
DYNO-NOBEL, INC.
PORT EWEN, NY.

SITE CATCHMENT AREA DELINEATION

FIGURE 2-4



SWMU

1. SHOOTING POND
2. BURNING CAGE/INCINERATOR
3. COPPER WIRE BURNING AREA
4. IRON WIRE BURNING AREA
5. WIRE BURNING AREA
6–7. OPEN BURNING PADS
8. FORMER BURNING AREA
9. WASTE POWDER CATCH BASINS–BUILDING 2037
10. WASTE POWDER CATCH BASINS–BUILDING 2048
11. WASTE POWDER CATCH BASINS–BUILDING 2049
13. FORMER WASTE POWDER CATCH BASINS–LEAD AZIDE BUILDING
15. WASTE POWDER MAGAZINE–BUILDING 9216
21. LEAD RECYCLING UNIT AREA
22. FORMER LANDFILL
23. FORMER DUMP
24. FORMER WASTEWATER TREATMENT FACILITY
26. BURNABLE WASTE SATELLITE ACCUMULATION AREAS
27. SANITARY SEWER SYSTEM (NOT ILLUSTRATED ON THIS DRAWING)
29. DRAINAGE DITCH (DOWNGRADE OF BUILDING 2049)
30. DRAINAGE DITCH (DOWNGRADE OF BUILDING 2036)
32. OLD DUMP (NEAR WATER TOWER)
33. MERCURY FULMINATE TANKS AREA
34. OLD WASTE BURNING GROUNDS (NEAR SHOOTING POND)
35. STONE FENCE DUMP
37. FORMER SHELL PLANT DRUM STORAGE AREA
38. GRENADE DISPOSAL AREA
39. FORMER WASTEWATER DISCHARGE AREA–BUILDING 2009
40. PILOT LINE CONDENSATE COLLECTION SUMP
41. DETONATOR PRODUCTION BUILDING CONDENSATE COLLECTION SUMPS
42. SAC BUILDING STEAM COLLECTION CONTAINERS
46. VACUUM LINE CONDENSATE COLLECTION SUMP (BUILDING 2059)
47. BUILDING 2058 AREA
48. MERCURY FULMINATE AREA
49. BUILDING 2073 SUMP
50. BUILDING 2075 SUMP
51. CONSTRUCTION STOCK PILES
52. FORMER COMMERCIAL LAB SHOOTING AREA
53. PACKAGE BURN TEST AREA
54. FORMER PRODUCTION AREA
55. FORMER ANFO AREA
56. VENT SYSTEM FOR STATIC SECURITY TESTING CHAMBER
1/22. COMBINED AREA FOR SWMU'S 1&22

A KEROSENE TANK LEAK
B OPEN BURNING PADS AREA
C OPEN DETONATION PIT
D DETONATION TEST BUILDING
E FORMER BUILDING 2073
F BUILDING 2075
G FORMER DRYING HOUSE
H FORMER DRYING HOUSE
I ROOF DRAINAGE FROM DETO BUILDING
J FORMER DRYING HOUSE
K FORMER DRYING HOUSE
L FORMER DRYING HOUSE
M FORMER DRYING HOUSE
N FORMER DRYING HOUSE
O FORMER DRYING HOUSE

LEGEND:

MW-12S MONITORING WELL LOCATION

SG-1 STAFF GAUGE

23 SOLID WASTE MANAGEMENT UNITS

APPROXIMATE PROPERTY BOUNDARIES

200 0 200 400
SCALE IN FEET

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SEAL:	DATE: 3/28/05		LOCATION OF SWMUS, AOCs, AND MONITORING WELLS	PROJECT NO. SEMD.004.002
	SCALE: AS SHOWN	HydroQual		DRAWING NO.
	CAD FILE NO.: XX			FIGURE 2-5
	DESIGNED BY: XX	HYDROQUAL ENVIRONMENTAL ENGINEERS AND SCIENTISTS, P.C.	DYNO NOBEL SITE	
	DRAWN BY: XX	1200 MACARTHUR BOULEVARD	PORT EWEN, NEW YORK	
Gary J. DiPippo, P.E. DATE: NY P.E. LICENSE NO. 055964-1	CHECKED BY: XX	MAHWAH, NEW JERSEY 07430		SHEET X OF X

\\CADD\AUTOCADD\TRR\DYNO\WELL_LOCATIONS.DWG 04/20/2005 LAYOUT: LAYOUT1


N
LEGEND:
MONITORING WELL LOCATION
HYDROPUNCH® BORING LOCATION
(46.6) THICKNESS OF OVERBUREN/FILL DEPOSITS (FEET)
—50— THICKNESS CONTOUR (FEET, DASHED WHERE INFERRED) CONTOUR INTERVAL = 5 FEET
200 0 200 400
scale feet
ECKENFELDER INC.
Nashville, Tennessee
Mahwah, New Jersey
SCALE: AS SHOWN
DRAWN BY JHM
DATE 1/96
CHECKED BY L.E.S.
APPROVED BY
NO.
REVISIONS
REV'D BY
DATE
APPRO'D BY
HERCULES INC./DYNO-NOBEL INC.
DYNO-NOBEL SITE
PORT EWEN, NEW YORK
GENERALIZED ISOPACHOUS MAP
OVERBURDEN/FILL DEPOSITS
DRAWING NUMBER
9596-03

Figure 2-6


N
MW-2A (155.8)
(153.8) MW-15S
MW-15D
MW-2B
MW-1
(137.2) MW-16S
MW-16D
MW-17S
MW-18S
MW-8 (139.0)
MW-9 (140.4)
MW-10 (140.1)
(153.5) MW-13S
MW-13D
(157.6) MW-14S
MW-14D
(156.8) MW-3
MW-4B (147.9)
(141.8) MW-4A
(160.4) MW-12S
MW-12D
MW-7
MW-6
MW-5
(154.4) MW-11S
MW-11D
SG-1
165
160
155
150
145
140
200 0 200 400
scale feet
LEGEND:
MW-12S MONITORING WELL LOCATION
(160.4) POTENTIOMETRIC SURFACE ELEVATION FEET, ABOVE N.G.V.D.
140 POTENTIOMETRIC SURFACE CONTOUR FEET, ABOVE N.G.V.D. (DASHED WHERE INFERRED)
CONTOUR INTERVAL = 5 FEET
GENERALIZED DIRECTION OF GROUNDWATER FLOW
NO. REVISIONS REV'D BY DATE APPRO'D BY
ECKENFELDER INC.
Nashville,Tennessee
Mahwah,New Jersey
HERCULES INC./DYNO-NOBEL INC.
DYNO-NOBEL SITE
PORT EWEN, NEW YORK
GENERALIZED POTENTIOMETRIC SURFACE MAP
SHALLOW OVERBURDEN WELLS
OCTOBER 4, 1995
SCALE: AS SHOWN
DRAWN BY JHM DATE 1/96
CHECKED BY L.E.S.
APPROVED BY -
DRAWING NUMBER 9596-04

Figure 2-7

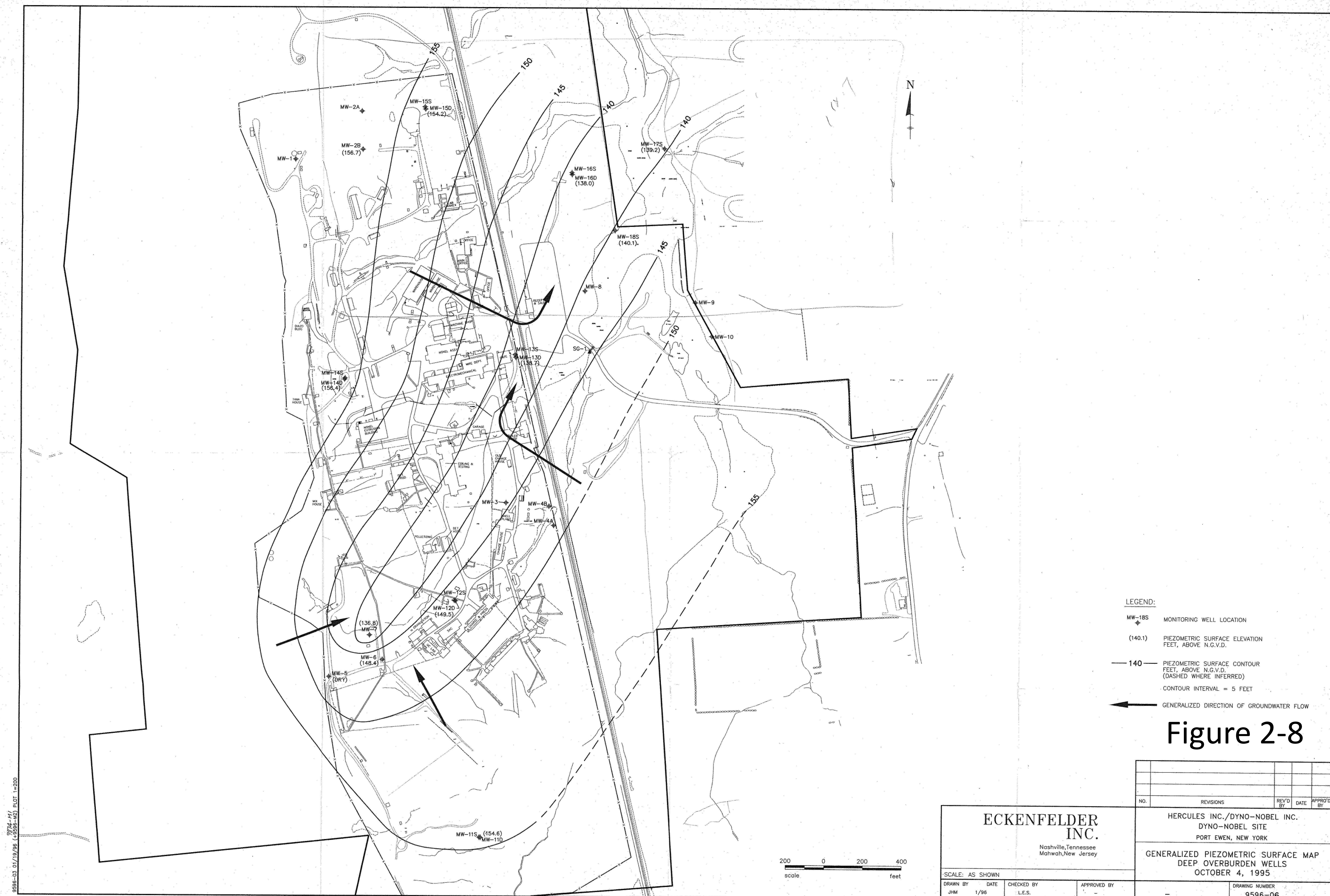
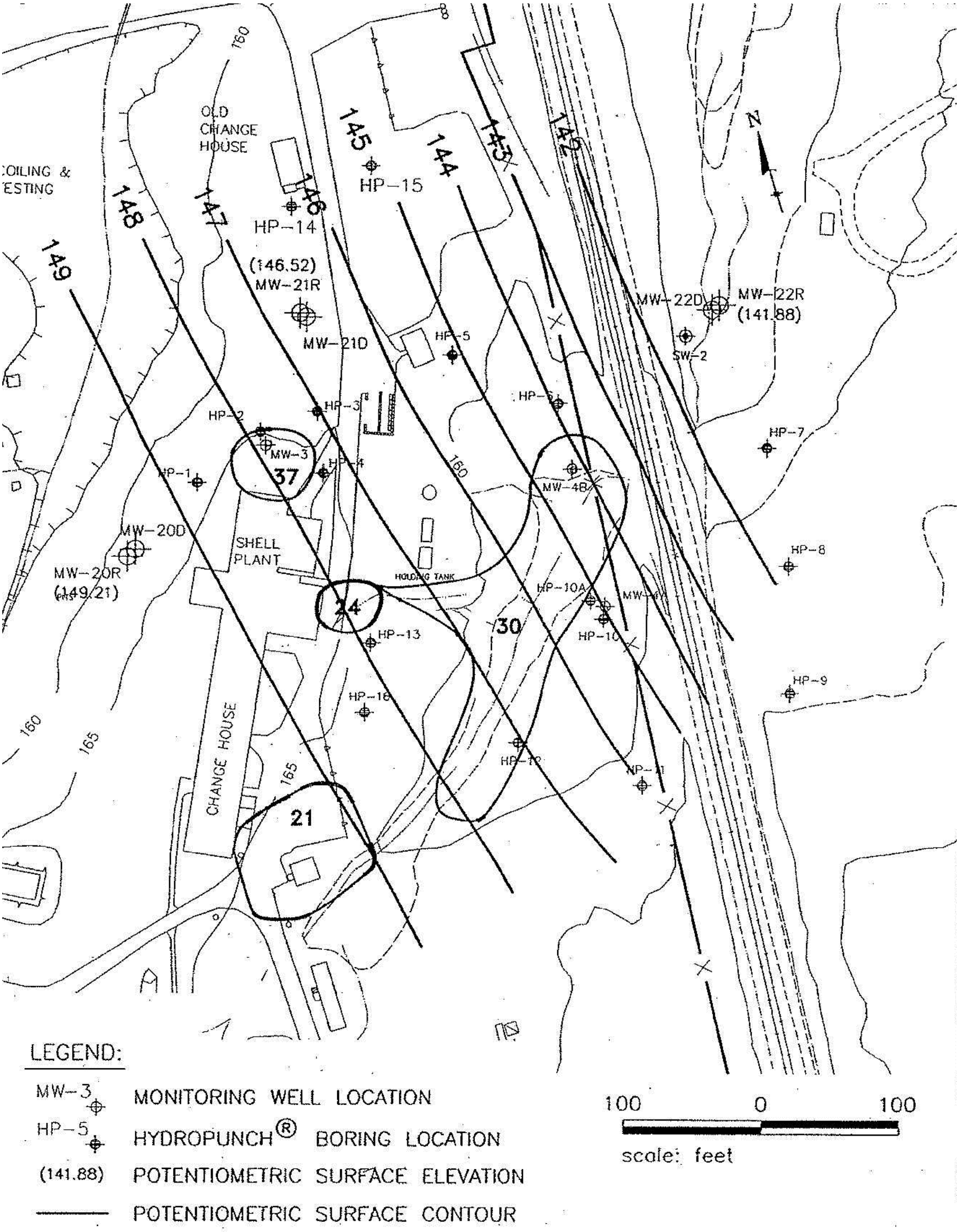

N
155
150
145
140
140
145
150
155
MW-2A
MW-15S
MW-15D
(154.2)
MW-2B
(156.7)
MW-1
MW-17S
(139.2)
MW-16S
MW-16D
(138.0)
MW-18S
(140.1)
MW-8
MW-9
MW-10
SG-1
MW-13S
MW-13D
(138.7)
MW-14S
MW-14D
(156.4)
MW-3
MW-4B
MW-4A
MW-12S
MW-12D
(149.5)
(136.8)
MW-7
MW-6
(148.4)
MW-5
(DRY)
MW-11S (154.6)
MW-11D
200 0 200 400
scale feet
LEGEND:
MW-18S MONITORING WELL LOCATION
(140.1) PIEZOMETRIC SURFACE ELEVATION FEET, ABOVE N.G.V.D.
140 PIEZOMETRIC SURFACE CONTOUR FEET, ABOVE N.G.V.D. (DASHED WHERE INFERRED)
CONTOUR INTERVAL = 5 FEET
GENERALIZED DIRECTION OF GROUNDWATER FLOW
NO. REVISIONS REV'D BY DATE APPRO'D BY
ECKENFELDER INC.
Nashville,Tennessee
Mahwah,New Jersey
SCALE: AS SHOWN
DRAWN BY JHM DATE 1/96
CHECKED BY L.E.S.
APPROVED BY –
HERCULES INC./DYNO-NOBEL INC.
DYNO-NOBEL SITE
PORT EWEN, NEW YORK
GENERALIZED PIEZOMETRIC SURFACE MAP
DEEP OVERBURDEN WELLS
OCTOBER 4, 1995
DRAWING NUMBER 9596-06
9596-03 01/19/96 (+9596-M2) PLOT 1=200

Figure 2-8

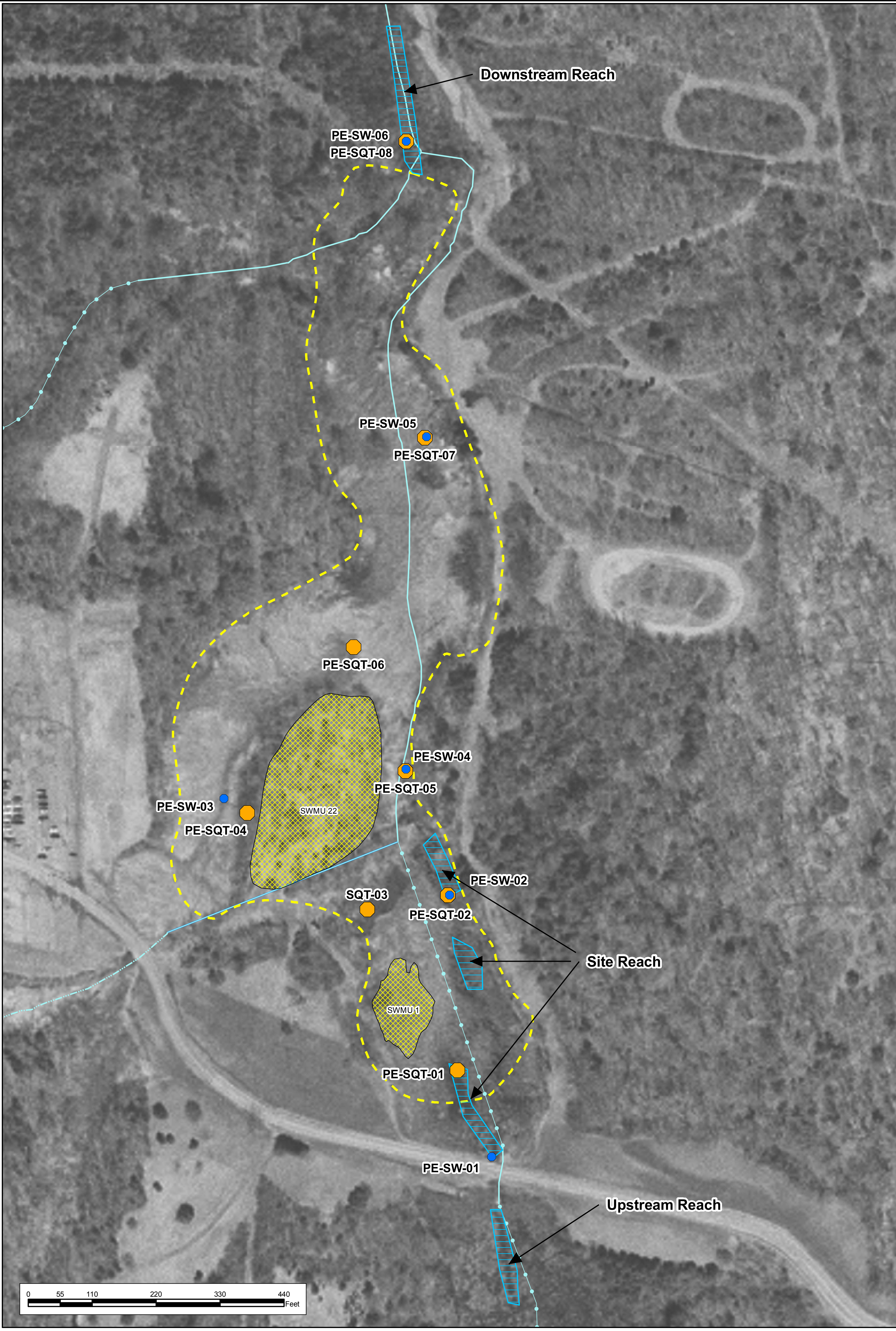

N
MW-1
(223.5)
MW-15S
MW-15D
(128.2)
MW-16S
MW-16D
(107.9)
MW-17S
(130.0)
MW-18S
(123.9)
MW-8
MW-9
MW-10
MW-13S
MW-13D (116.6)
(108.1)
MW-14S
MW-14D
MW-12S
MW-12D
(80.9)
MW-7
(125.2)
MW-6
MW-5
(155.7)
MW-11S
MW-11D
LEGEND:
MW-13D
MONITORING WELL LOCATION
HP-1
HYDROPUNCH® BORING LOCATION
(116.6)
ELEVATION OF TOP OF BEDROCK FEET, ABOVE N.G.V.D.
130
STRUCTURAL CONTOUR FEET, ABOVE N.G.V.D. (DASHED WHERE INFERRED)
CONTOUR INTERVAL = 5 FEET
200 0 200 400
scale feet
ECKENFELDER INC.
Nashville,Tennessee
Mahwah,New Jersey
SCALE: AS SHOWN
DRAWN BY JHM
DATE 1/96
CHECKED BY L.E.S.
APPROVED BY -
NO. REVISIONS REV'D BY DATE APPRO'D BY
HERCULES INC./DYNO-NOBEL INC.
DYNO-NOBEL SITE
PORT EWEN, NEW YORK
GENERALIZED STRUCTURAL CONTOUR MAP
TOP OF BEDROCK
DRAWING NUMBER
9596-02

Figure 2-9



Source: RCRA Facility Investigation Report
Brown & Caldwell, December 1999

EHS Support consider it done	**POTENTIOMETRIC SURFACE MAP – TOP OF BEDROCK SEPTEMBER 28, 1999 DYNO NOBEL SITE PORT EWEN, NEW YORK**	**FIGURE 2-10**



Legend

- SURFACE WATER SAMPLING STATION
- SQT SEDIMENT SAMPLING STATION
- FISH SAMPLING REACH
- APPROXIMATE SWMU/AOC BOUNDARY
- PERENNIAL STREAM
- INTERMITTENT STERAM
- CONNECTOR
- ARTIFICIAL PATH

N

FIGURE 2-11
SEDIMENT QUALITY TRIAD, SURFACE WATER, AND FISH SAMPLING LOCATIONS
SWMU 1/22 WETLAND COMPLEX
DYNO NOBEL SITE, PORT EWEN, NEW YORK

Map Source:
Image: NYSGIS (2004)
Boundaries: Site and property boundaries approximations were determined using available data from historical maps and CAD files.

EHS Support
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Legend

- ACTIVE PLANT SOIL
- EARTHWORM
- *Microtus pennsylvanicus*
- *Peromyscus leucopus*
- *Zapus hudsonius*
- SMALL MAMMAL TRANSECTS
- SMALL MAMMAL TRANSECT END POINTS
- RAILROAD
- SWMU 1/22 BOUNDARY
- BIOLOGICAL TISSUE AND SOIL SAMPLING GRID
- APPROXIMATE SWMU/AOC BOUNDARY
- APPROXIMATE PROPERTY BOUNDARY

N

FIGURE 2-12
ACTIVE PLANT AREA SAMPLING LOCATIONS
DYNO NOBEL SITE, PORT EWEN, NEW YORK

Map Source:
Fresh water wetlands: New York State Department of Environmental Conservation
Surface water: National Hydrography Dataset
Countours: United States Department of Agriculture/Natural Resource Conservation Service - National Cartography and Geospatial Center digital elevation models
Boundaries: Site and property boundaries approximations were determined using available data from historical maps and CAD files.

EHS Support
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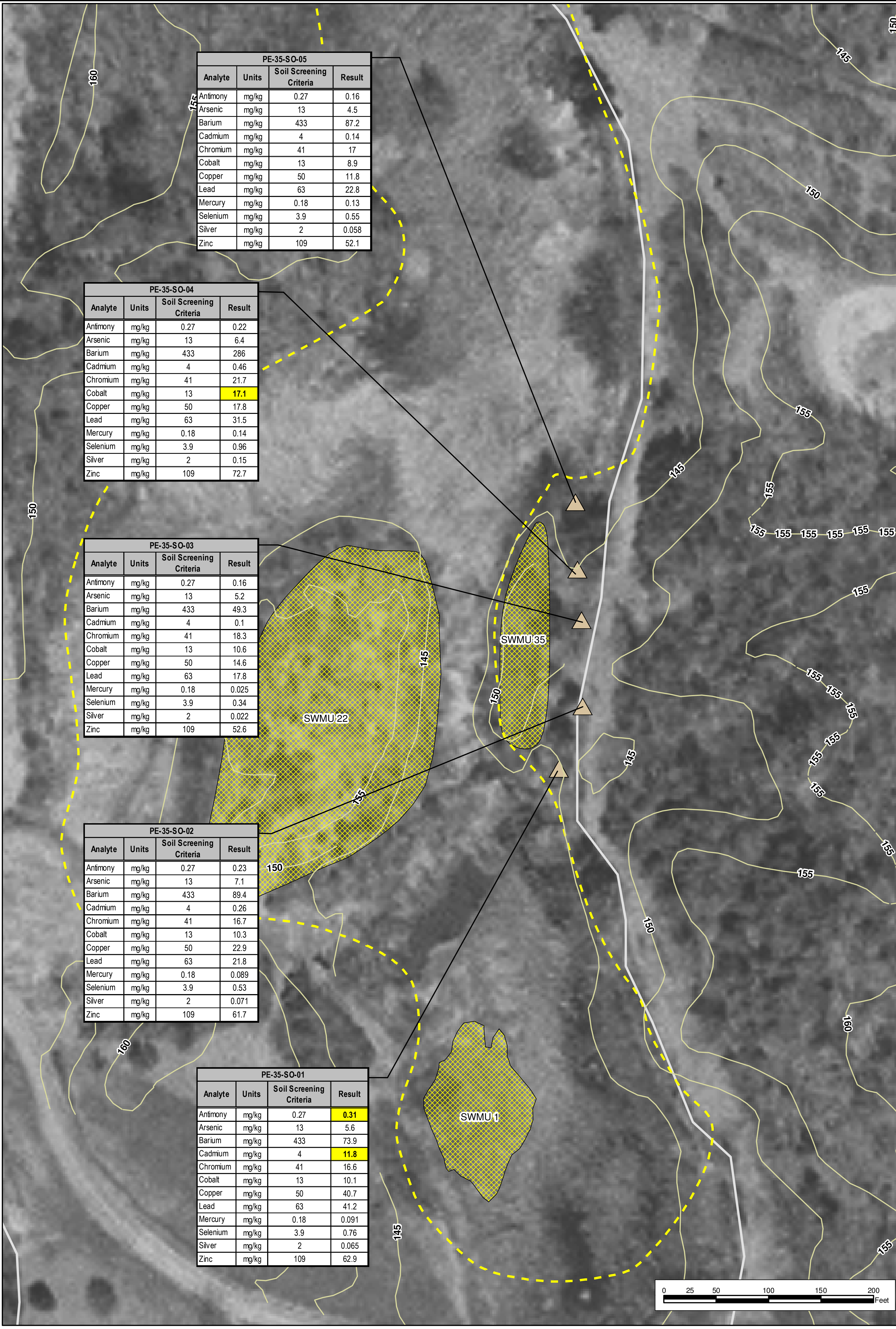

PE-35-SO-05			
Analyte	Units	Soil Screening Criteria	Result
Antimony	mg/kg	0.27	0.16
Arsenic	mg/kg	13	4.5
Barium	mg/kg	433	87.2
Cadmium	mg/kg	4	0.14
Chromium	mg/kg	41	17
Cobalt	mg/kg	13	8.9
Copper	mg/kg	50	11.8
Lead	mg/kg	63	22.8
Mercury	mg/kg	0.18	0.13
Selenium	mg/kg	3.9	0.55
Silver	mg/kg	2	0.058
Zinc	mg/kg	109	52.1

PE-35-SO-04			
Analyte	Units	Soil Screening Criteria	Result
Antimony	mg/kg	0.27	0.22
Arsenic	mg/kg	13	6.4
Barium	mg/kg	433	286
Cadmium	mg/kg	4	0.46
Chromium	mg/kg	41	21.7
Cobalt	mg/kg	13	17.1
Copper	mg/kg	50	17.8
Lead	mg/kg	63	31.5
Mercury	mg/kg	0.18	0.14
Selenium	mg/kg	3.9	0.96
Silver	mg/kg	2	0.15
Zinc	mg/kg	109	72.7

PE-35-SO-03			
Analyte	Units	Soil Screening Criteria	Result
Antimony	mg/kg	0.27	0.16
Arsenic	mg/kg	13	5.2
Barium	mg/kg	433	49.3
Cadmium	mg/kg	4	0.1
Chromium	mg/kg	41	18.3
Cobalt	mg/kg	13	10.6
Copper	mg/kg	50	14.6
Lead	mg/kg	63	17.8
Mercury	mg/kg	0.18	0.025
Selenium	mg/kg	3.9	0.34
Silver	mg/kg	2	0.022
Zinc	mg/kg	109	52.6

PE-35-SO-02			
Analyte	Units	Soil Screening Criteria	Result
Antimony	mg/kg	0.27	0.23
Arsenic	mg/kg	13	7.1
Barium	mg/kg	433	89.4
Cadmium	mg/kg	4	0.26
Chromium	mg/kg	41	16.7
Cobalt	mg/kg	13	10.3
Copper	mg/kg	50	22.9
Lead	mg/kg	63	21.8
Mercury	mg/kg	0.18	0.089
Selenium	mg/kg	3.9	0.53
Silver	mg/kg	2	0.071
Zinc	mg/kg	109	61.7

PE-35-SO-01			
Analyte	Units	Soil Screening Criteria	Result
Antimony	mg/kg	0.27	0.31
Arsenic	mg/kg	13	5.6
Barium	mg/kg	433	73.9
Cadmium	mg/kg	4	11.8
Chromium	mg/kg	41	16.6
Cobalt	mg/kg	13	10.1
Copper	mg/kg	50	40.7
Lead	mg/kg	63	41.2
Mercury	mg/kg	0.18	0.091
Selenium	mg/kg	3.9	0.76
Silver	mg/kg	2	0.065
Zinc	mg/kg	109	62.9

O:\GIS_Data\HERCULES\Projects\Figure 13 SWMU 35 Surficial Soil Sampling Locs.mxd

Legend

SWMU 35 SOIL SAMPLES

APPROXIMATE SWMU/AOC BOUNDARY

SWMU 1/22 BOUNDARY

APPROXIMATE SITE BOUNDARY

CONTOUR INTERVAL (5 Feet)

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FIGURE 2-13

SWMU 35 SURFICIAL SOIL SAMPLING LOCATIONS

FWIA STEP IIC INVESTIGATION
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Map Source:
Image: NYSGIS (2004)
Boundaries: Site and property boundaries approximations were determined using available data from historical maps and CAD files.

EHS Support
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Legend

APPROXIMATE SWMU/AOC BOUNDARY
APPROXIMATE SITE BOUNDARY
APPROXIMATE PROPERTY BOUNDARY
SWMU 1/22 BOUNDARY
LAKE/POND
SWAMP/MARSH
NYSDEC MAPPED CLASS 2 WETLANDS
NYSDEC MAPPED CLASS 3 WETLANDS
PERENNIAL STREAM
INTERMITTENT STREAM
ARTIFICIAL PATH
CONNECTOR
RAILROAD

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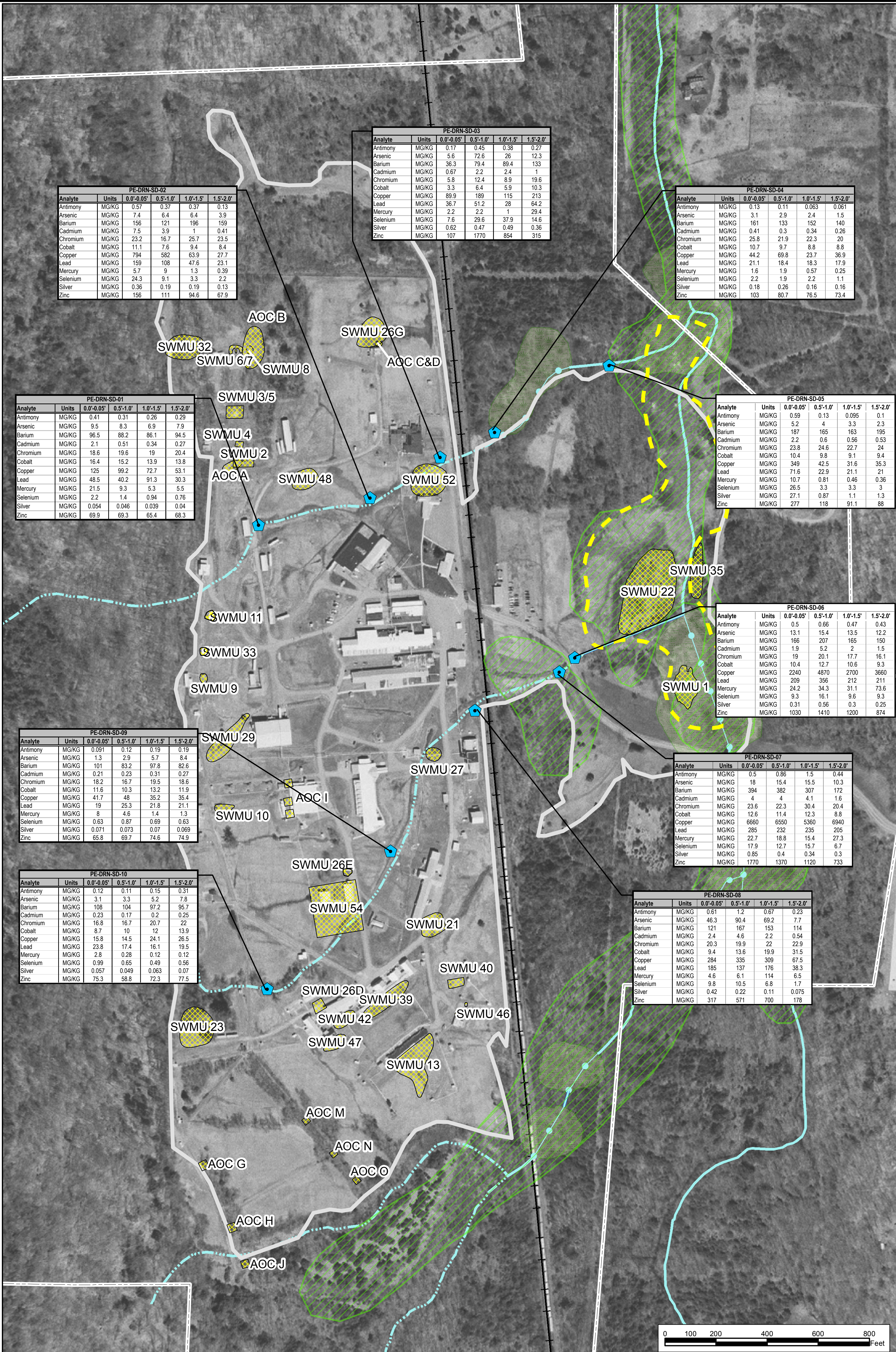
FIGURE 2-14. SWMUs & AOCs REQUIRING A CMS

DYNO NOBEL SITE
PORT EWEN, NEW YORK

Map Source:
Fresh water wetlands: New York State Department of Environmental Conservation
Surface water: National Hydrography Dataset
Countours: United States Department of Agriculture/Natural Resource Conservation Service
- National Cartography and Geospatial Center digital elevation models
Boundaries: Site and property boundaries approximations were determined using available data from historical maps and CAD files.

EHS Support
consider it done



PE-DRN-SD-01

Analyte	Units	0.0'-0.05'	0.5'-1.0'	1.0'-1.5'	1.5'-2.0'
Antimony	MG/KG	0.41	0.31	0.26	0.29
Arsenic	MG/KG	9.5	8.3	6.9	7.9
Barium	MG/KG	96.5	88.2	86.1	94.5
Cadmium	MG/KG	2.1	0.51	0.34	0.27
Chromium	MG/KG	18.6	19.6	19	20.4
Cobalt	MG/KG	16.4	15.2	13.9	13.8
Copper	MG/KG	125	99.2	72.7	53.1
Lead	MG/KG	48.5	40.2	91.3	30.3
Mercury	MG/KG	21.5	9.3	5.3	5.5
Selenium	MG/KG	2.2	1.4	0.94	0.76
Silver	MG/KG	0.054	0.046	0.039	0.04
Zinc	MG/KG	69.9	69.3	65.4	68.3

PE-DRN-SD-02

Analyte	Units	0.0'-0.05'	0.5'-1.0'	1.0'-1.5'	1.5'-2.0'
Antimony	MG/KG	0.57	0.37	0.37	0.13
Arsenic	MG/KG	7.4	6.4	6.4	3.9
Barium	MG/KG	156	121	196	159
Cadmium	MG/KG	7.5	3.9	1	0.41
Chromium	MG/KG	23.2	16.7	25.7	23.5
Cobalt	MG/KG	11.1	7.6	9.4	8.4
Copper	MG/KG	794	582	63.9	27.7
Lead	MG/KG	159	108	47.6	23.1
Mercury	MG/KG	5.7	9	1.3	0.39
Selenium	MG/KG	24.3	9.1	3.3	2.2
Silver	MG/KG	0.36	0.19	0.19	0.13
Zinc	MG/KG	156	111	94.6	67.9

PE-DRN-SD-03

Analyte	Units	0.0'-0.05'	0.5'-1.0'	1.0'-1.5'	1.5'-2.0'
Antimony	MG/KG	0.17	0.45	0.38	0.27
Arsenic	MG/KG	5.6	72.6	26	12.3
Barium	MG/KG	36.3	79.4	89.4	133
Cadmium	MG/KG	0.67	2.2	2.4	1
Chromium	MG/KG	5.8	12.4	8.9	19.6
Cobalt	MG/KG	3.3	6.4	5.9	10.3
Copper	MG/KG	89.9	189	115	213
Lead	MG/KG	36.7	51.2	28	64.2
Mercury	MG/KG	2.2	2.2	1	29.4
Selenium	MG/KG	7.6	29.6	37.9	14.6
Silver	MG/KG	0.62	0.47	0.49	0.36
Zinc	MG/KG	107	1770	854	315

PE-DRN-SD-04

Analyte	Units	0.0'-0.05'	0.5'-1.0'	1.0'-1.5'	1.5'-2.0'
Antimony	MG/KG	0.13	0.11	0.063	0.061
Arsenic	MG/KG	3.1	2.9	2.4	1.5
Barium	MG/KG	161	133	152	140
Cadmium	MG/KG	0.41	0.3	0.34	0.26
Chromium	MG/KG	25.8	21.9	22.3	20
Cobalt	MG/KG	10.7	9.7	8.8	8.8
Copper	MG/KG	44.2	69.8	23.7	36.9
Lead	MG/KG	21.1	18.4	18.3	17.9
Mercury	MG/KG	1.6	1.9	0.57	0.25
Selenium	MG/KG	2.2	1.9	2.2	1.1
Silver	MG/KG	0.18	0.26	0.16	0.16
Zinc	MG/KG	103	80.7	76.5	73.4

PE-DRN-SD-05

Analyte	Units	0.0'-0.05'	0.5'-1.0'	1.0'-1.5'	1.5'-2.0'
Antimony	MG/KG	0.59	0.13	0.095	0.1
Arsenic	MG/KG	5.2	4	3.3	2.3
Barium	MG/KG	187	165	163	195
Cadmium	MG/KG	2.2	0.6	0.56	0.53
Chromium	MG/KG	23.8	24.6	22.7	24
Cobalt	MG/KG	10.4	9.8	9.1	9.4
Copper	MG/KG	349	42.5	31.6	35.3
Lead	MG/KG	71.6	22.9	21.1	21
Mercury	MG/KG	10.7	0.81	0.46	0.36
Selenium	MG/KG	26.5	3.3	3.3	3
Silver	MG/KG	27.1	0.87	1.1	1.3
Zinc	MG/KG	277	118	91.1	88

PE-DRN-SD-06

Analyte	Units	0.0'-0.05'	0.5'-1.0'	1.0'-1.5'	1.5'-2.0'
Antimony	MG/KG	0.5	0.66	0.47	0.43
Arsenic	MG/KG	13.1	15.4	13.5	12.2
Barium	MG/KG	166	207	165	150
Cadmium	MG/KG	1.9	5.2	2	1.5
Chromium	MG/KG	19	20.1	17.7	16.1
Cobalt	MG/KG	10.4	12.7	10.6	9.3
Copper	MG/KG	2240	4870	2700	3660
Lead	MG/KG	209	356	212	211
Mercury	MG/KG	24.2	34.3	31.1	73.6
Selenium	MG/KG	9.3	16.1	9.6	9.3
Silver	MG/KG	0.31	0.56	0.3	0.25
Zinc	MG/KG	1030	1410	1200	874

PE-DRN-SD-07

Analyte	Units	0.0'-0.05'	0.5'-1.0'	1.0'-1.5'	1.5'-2.0'
Antimony	MG/KG	0.5	0.86	1.5	0.44
Arsenic	MG/KG	18	15.4	15.5	10.3
Barium	MG/KG	394	382	307	172
Cadmium	MG/KG	4	4	4.1	1.6
Chromium	MG/KG	23.6	22.3	30.4	20.4
Cobalt	MG/KG	12.6	11.4	12.3	8.8
Copper	MG/KG	6660	6550	5360	6940
Lead	MG/KG	285	232	235	205
Mercury	MG/KG	22.7	18.8	15.4	27.3
Selenium	MG/KG	17.9	12.7	15.7	6.7
Silver	MG/KG	0.85	0.4	0.34	0.3
Zinc	MG/KG	1770	1370	1120	733

PE-DRN-SD-08

Analyte	Units	0.0'-0.05'	0.5'-1.0'	1.0'-1.5'	1.5'-2.0'
Antimony	MG/KG	0.61	1.2	0.67	0.23
Arsenic	MG/KG	46.3	90.4	69.2	7.7
Barium	MG/KG	121	167	153	114
Cadmium	MG/KG	2.4	4.6	2.2	0.54
Chromium	MG/KG	20.3	19.9	22	22.9
Cobalt	MG/KG	9.4	13.6	19.9	31.5
Copper	MG/KG	284	335	309	67.5
Lead	MG/KG	185	137	176	38.3
Mercury	MG/KG	4.6	6.1	114	6.5
Selenium	MG/KG	9.8	10.5	6.8	1.7
Silver	MG/KG	0.42	0.22	0.11	0.075
Zinc	MG/KG	317	571	700	178

PE-DRN-SD-09

Analyte	Units	0.0'-0.05'	0.5'-1.0'	1.0'-1.5'	1.5'-2.0'
Antimony	MG/KG	0.091	0.12	0.19	0.19
Arsenic	MG/KG	1.3	2.9	5.7	8.4
Barium	MG/KG	101	83.2	97.8	82.6
Cadmium	MG/KG	0.21	0.23	0.31	0.27
Chromium	MG/KG	18.2	16.7	19.5	18.6
Cobalt	MG/KG	11.6	10.3	13.2	11.9
Copper	MG/KG	41.7	48	35.2	35.4
Lead	MG/KG	19	25.3	21.8	21.1
Mercury	MG/KG	8	4.6	1.4	1.3
Selenium	MG/KG	0.63	0.87	0.69	0.63
Silver	MG/KG	0.071	0.073	0.07	0.069
Zinc	MG/KG	65.8	69.7	74.6	74.9

PE-DRN-SD-10

Analyte	Units	0.0'-0.05'	0.5'-1.0'	1.0'-1.5'	1.5'-2.0'
Antimony	MG/KG	0.12	0.11	0.15	0.31
Arsenic	MG/KG	3.1	3.3	5.2	7.8
Barium	MG/KG	108	104	97.2	95.7
Cadmium	MG/KG	0.23	0.17	0.2	0.25
Chromium	MG/KG	16.8	16.7	20.7	22
Cobalt	MG/KG	8.7	10	12	13.9
Copper	MG/KG	15.8	14.5	24.1	26.5
Lead	MG/KG	23.8	17.4	16.1	19.5
Mercury	MG/KG	2.8	0.28	0.12	0.12
Selenium	MG/KG	0.99	0.65	0.49	0.56
Silver	MG/KG	0.057	0.049	0.063	0.07
Zinc	MG/KG	75.3	58.8	72.3	77.5

Legend

- SWMU 1/22 BOUNDARY
- APPROXIMATE SWMU/AOC BOUNDARY
- APPROXIMATE SITE BOUNDARY
- APPROXIMATE PROPERTY BOUNDARY
- NYSDEC MAPPED CLASS 2 WETLANDS
- NYSDEC MAPPED CLASS 3 WETLANDS
- SWAMP/MARSH
- SITE DRAINAGE SEDIMENT SAMPLES
- PERENNIAL STREAM
- INTERMITTENT STREAM
- ARTIFICIAL PATH
- CONNECTOR
- RAILROAD

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FIGURE 4-1 SITE DRAINAGE FEATURES SEDIMENT SAMPLING RESULTS

DYNO NOBEL SITE, PORT EWEN, NEW YORK

Map Source:
Fresh water wetlands: New York State Department of Environmental Conservation
Surface water: National Hydrography Dataset
Countours: United States Department of Agriculture/Natural Resource Conservation Service - National Cartography and Geospatial Center digital elevation models
Boundaries: Site and property boundaries approximations were determined using available data from historical maps and CAD files.

EHS Support
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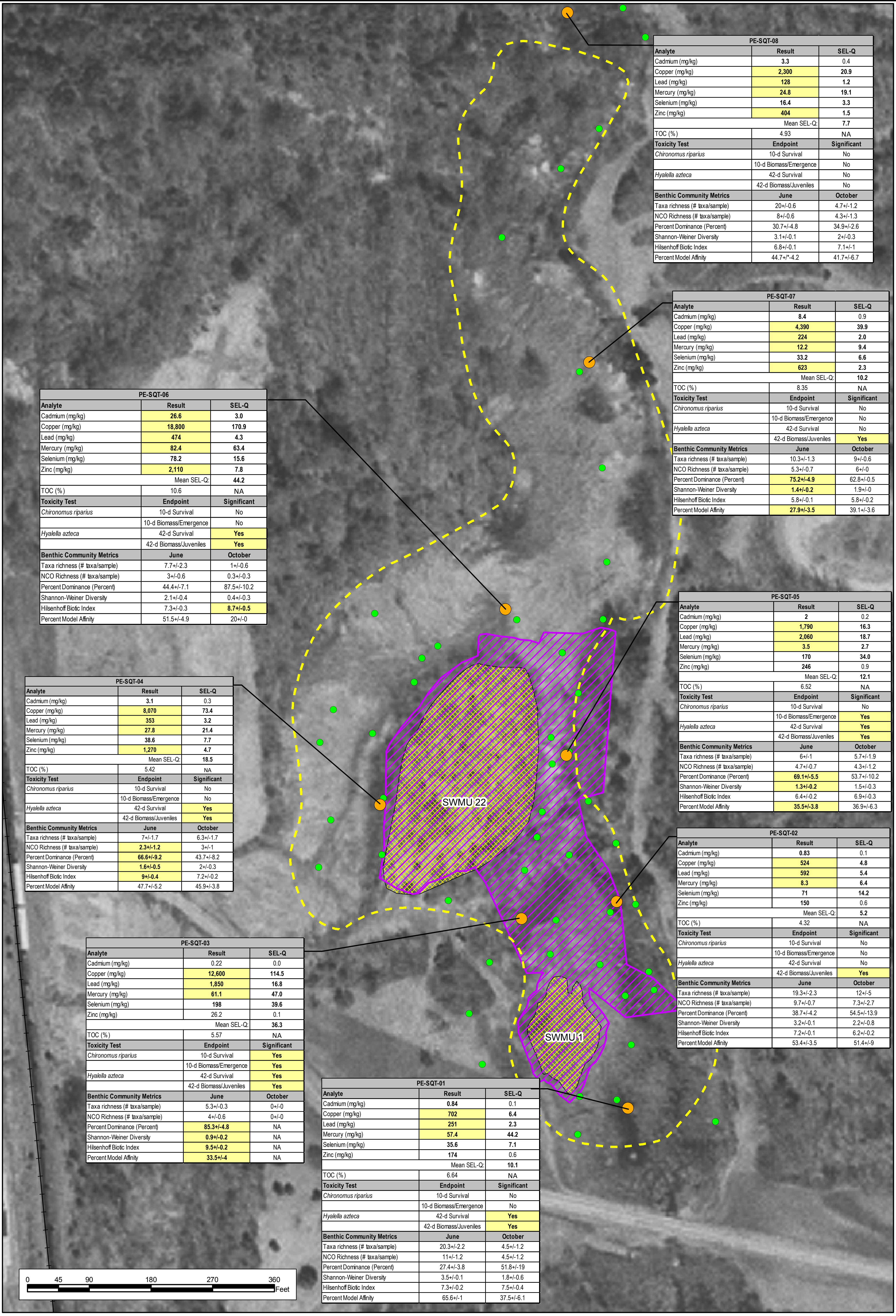


PE-SQT-08		
Analyte	**Result**	**SEL-Q**
Cadmium (mg/kg)	**3.3**	0.4
Copper (mg/kg)	**2,300**	**20.9**
Lead (mg/kg)	**128**	**1.2**
Mercury (mg/kg)	**24.8**	**19.1**
Selenium (mg/kg)	**16.4**	**3.3**
Zinc (mg/kg)	**404**	**1.5**
	Mean SEL-Q:	**7.7**
TOC (%)	4.93	NA
Toxicity Test	**Endpoint**	**Significant**
Chironomus riparius	10-d Survival	No
	10-d Biomass/Emergence	No
Hyalella azteca	42-d Survival	No
	42-d Biomass/Juveniles	No
Benthic Community Metrics	**June**	**October**
Taxa richness (# taxa/sample)	20+/-0.6	4.7+/-1.2
NCO Richness (# taxa/sample)	8+/-0.6	4.3+/-1.3
Percent Dominance (Percent)	30.7+/-4.8	34.9+/-2.6
Shannon-Weiner Diversity	3.1+/-0.1	2+/-0.3
Hilsenhoff Biotic Index	6.8+/-0.1	7.1+/-1
Percent Model Affinity	44.7+/*-4.2	41.7+/-6.7

PE-SQT-07		
Analyte	**Result**	**SEL-Q**
Cadmium (mg/kg)	**8.4**	0.9
Copper (mg/kg)	**4,390**	**39.9**
Lead (mg/kg)	**224**	**2.0**
Mercury (mg/kg)	**12.2**	**9.4**
Selenium (mg/kg)	**33.2**	**6.6**
Zinc (mg/kg)	**623**	**2.3**
	Mean SEL-Q:	**10.2**
TOC (%)	8.35	NA
Toxicity Test	**Endpoint**	**Significant**
Chironomus riparius	10-d Survival	No
	10-d Biomass/Emergence	No
Hyalella azteca	42-d Survival	No
	42-d Biomass/Juveniles	**Yes**
Benthic Community Metrics	**June**	**October**
Taxa richness (# taxa/sample)	10.3+/-1.3	9+/-0.6
NCO Richness (# taxa/sample)	5.3+/-0.7	6+/-0
Percent Dominance (Percent)	**75.2+/-4.9**	62.8+/-0.5
Shannon-Weiner Diversity	**1.4+/-0.2**	1.9+/-0
Hilsenhoff Biotic Index	5.8+/-0.1	5.8+/-0.2
Percent Model Affinity	**27.9+/-3.5**	39.1+/-3.6

PE-SQT-06		
Analyte	**Result**	**SEL-Q**
Cadmium (mg/kg)	**26.6**	**3.0**
Copper (mg/kg)	**18,800**	**170.9**
Lead (mg/kg)	**474**	**4.3**
Mercury (mg/kg)	**82.4**	**63.4**
Selenium (mg/kg)	**78.2**	**15.6**
Zinc (mg/kg)	**2,110**	**7.8**
	Mean SEL-Q:	**44.2**
TOC (%)	10.6	NA
Toxicity Test	**Endpoint**	**Significant**
Chironomus riparius	10-d Survival	No
	10-d Biomass/Emergence	No
Hyalella azteca	42-d Survival	**Yes**
	42-d Biomass/Juveniles	**Yes**
Benthic Community Metrics	**June**	**October**
Taxa richness (# taxa/sample)	7.7+/-2.3	1+/-0.6
NCO Richness (# taxa/sample)	3+/-0.6	0.3+/-0.3
Percent Dominance (Percent)	44.4+/-7.1	87.5+/-10.2
Shannon-Weiner Diversity	2.1+/-0.4	0.4+/-0.3
Hilsenhoff Biotic Index	7.3+/-0.3	**8.7+/-0.5**
Percent Model Affinity	51.5+/-4.9	20+/-0

PE-SQT-04		
Analyte	**Result**	**SEL-Q**
Cadmium (mg/kg)	**3.1**	0.3
Copper (mg/kg)	**8,070**	**73.4**
Lead (mg/kg)	**353**	**3.2**
Mercury (mg/kg)	**27.8**	**21.4**
Selenium (mg/kg)	**38.6**	**7.7**
Zinc (mg/kg)	**1,270**	**4.7**
	Mean SEL-Q:	**18.5**
TOC (%)	5.42	NA
Toxicity Test	**Endpoint**	**Significant**
Chironomus riparius	10-d Survival	No
	10-d Biomass/Emergence	No
Hyalella azteca	42-d Survival	**Yes**
	42-d Biomass/Juveniles	**Yes**
Benthic Community Metrics	**June**	**October**
Taxa richness (# taxa/sample)	7+/-1.7	6.3+/-1.7
NCO Richness (# taxa/sample)	**2.3+/-1.2**	3+/-1
Percent Dominance (Percent)	**66.6+/-9.2**	43.7+/-8.2
Shannon-Weiner Diversity	**1.6+/-0.5**	2+/-0.3
Hilsenhoff Biotic Index	**9+/-0.4**	7.2+/-0.2
Percent Model Affinity	47.7+/-5.2	45.9+/-3.8

PE-SQT-05		
Analyte	**Result**	**SEL-Q**
Cadmium (mg/kg)	**2**	0.2
Copper (mg/kg)	**1,790**	**16.3**
Lead (mg/kg)	**2,060**	**18.7**
Mercury (mg/kg)	**3.5**	**2.7**
Selenium (mg/kg)	**170**	**34.0**
Zinc (mg/kg)	**246**	0.9
	Mean SEL-Q:	**12.1**
TOC (%)	6.52	NA
Toxicity Test	**Endpoint**	**Significant**
Chironomus riparius	10-d Survival	No
	10-d Biomass/Emergence	**Yes**
Hyalella azteca	42-d Survival	**Yes**
	42-d Biomass/Juveniles	**Yes**
Benthic Community Metrics	**June**	**October**
Taxa richness (# taxa/sample)	6+/-1	5.7+/-1.9
NCO Richness (# taxa/sample)	4.7+/-0.7	4.3+/-1.2
Percent Dominance (Percent)	**69.1+/-5.5**	53.7+/-10.2
Shannon-Weiner Diversity	**1.3+/-0.2**	1.5+/-0.3
Hilsenhoff Biotic Index	6.4+/-0.2	6.9+/-0.3
Percent Model Affinity	**35.5+/-3.8**	36.9+/-6.3

PE-SQT-02		
Analyte	**Result**	**SEL-Q**
Cadmium (mg/kg)	**0.83**	0.1
Copper (mg/kg)	**524**	**4.8**
Lead (mg/kg)	**592**	**5.4**
Mercury (mg/kg)	**8.3**	**6.4**
Selenium (mg/kg)	**71**	**14.2**
Zinc (mg/kg)	**150**	0.6
	Mean SEL-Q:	**5.2**
TOC (%)	4.32	NA
Toxicity Test	**Endpoint**	**Significant**
Chironomus riparius	10-d Survival	No
	10-d Biomass/Emergence	No
Hyalella azteca	42-d Survival	No
	42-d Biomass/Juveniles	**Yes**
Benthic Community Metrics	**June**	**October**
Taxa richness (# taxa/sample)	19.3+/-2.3	12+/-5
NCO Richness (# taxa/sample)	9.7+/-0.7	7.3+/-2.7
Percent Dominance (Percent)	38.7+/-4.2	54.5+/-13.9
Shannon-Weiner Diversity	3.2+/-0.1	2.2+/-0.8
Hilsenhoff Biotic Index	7.2+/-0.1	6.2+/-0.2
Percent Model Affinity	53.4+/-3.5	51.4+/-9

PE-SQT-03		
Analyte	**Result**	**SEL-Q**
Cadmium (mg/kg)	0.22	0.0
Copper (mg/kg)	**12,600**	**114.5**
Lead (mg/kg)	**1,850**	**16.8**
Mercury (mg/kg)	**61.1**	**47.0**
Selenium (mg/kg)	**198**	**39.6**
Zinc (mg/kg)	26.2	0.1
	Mean SEL-Q:	**36.3**
TOC (%)	5.57	NA
Toxicity Test	**Endpoint**	**Significant**
Chironomus riparius	10-d Survival	**Yes**
	10-d Biomass/Emergence	**Yes**
Hyalella azteca	42-d Survival	**Yes**
	42-d Biomass/Juveniles	**Yes**
Benthic Community Metrics	**June**	**October**
Taxa richness (# taxa/sample)	5.3+/-0.3	0+/-0
NCO Richness (# taxa/sample)	4+/-0.6	0+/-0
Percent Dominance (Percent)	**85.3+/-4.8**	NA
Shannon-Weiner Diversity	**0.9+/-0.2**	NA
Hilsenhoff Biotic Index	**9.5+/-0.2**	NA
Percent Model Affinity	**33.5+/-4**	NA

PE-SQT-01		
Analyte	**Result**	**SEL-Q**
Cadmium (mg/kg)	**0.84**	0.1
Copper (mg/kg)	**702**	**6.4**
Lead (mg/kg)	**251**	**2.3**
Mercury (mg/kg)	**57.4**	**44.2**
Selenium (mg/kg)	**35.6**	**7.1**
Zinc (mg/kg)	**174**	0.6
	Mean SEL-Q:	**10.1**
TOC (%)	6.64	NA
Toxicity Test	**Endpoint**	**Significant**
Chironomus riparius	10-d Survival	No
	10-d Biomass/Emergence	No
Hyalella azteca	42-d Survival	**Yes**
	42-d Biomass/Juveniles	**Yes**
Benthic Community Metrics	**June**	**October**
Taxa richness (# taxa/sample)	20.3+/-2.2	4.5+/-1.2
NCO Richness (# taxa/sample)	11+/-1.2	4.5+/-1.2
Percent Dominance (Percent)	27.4+/-3.8	51.8+/-19
Shannon-Weiner Diversity	3.5+/-0.1	1.8+/-0.6
Hilsenhoff Biotic Index	7.3+/-0.2	7.5+/-0.4
Percent Model Affinity	65.6+/-1	37.5+/-6.1

Legend

SQT SEDIMENT SAMPLING STATION

HISTORIC SEDIMENT SAMPLE LOCATION

APPROXIMATE SWMU/AOC BOUNDARY

SWMU 1/22 BOUNDARY

APPROXIMATE EXTENT OF REMEDIAL BOUNDARY PROPOSED IN 2006 CMS

RAILROAD

N

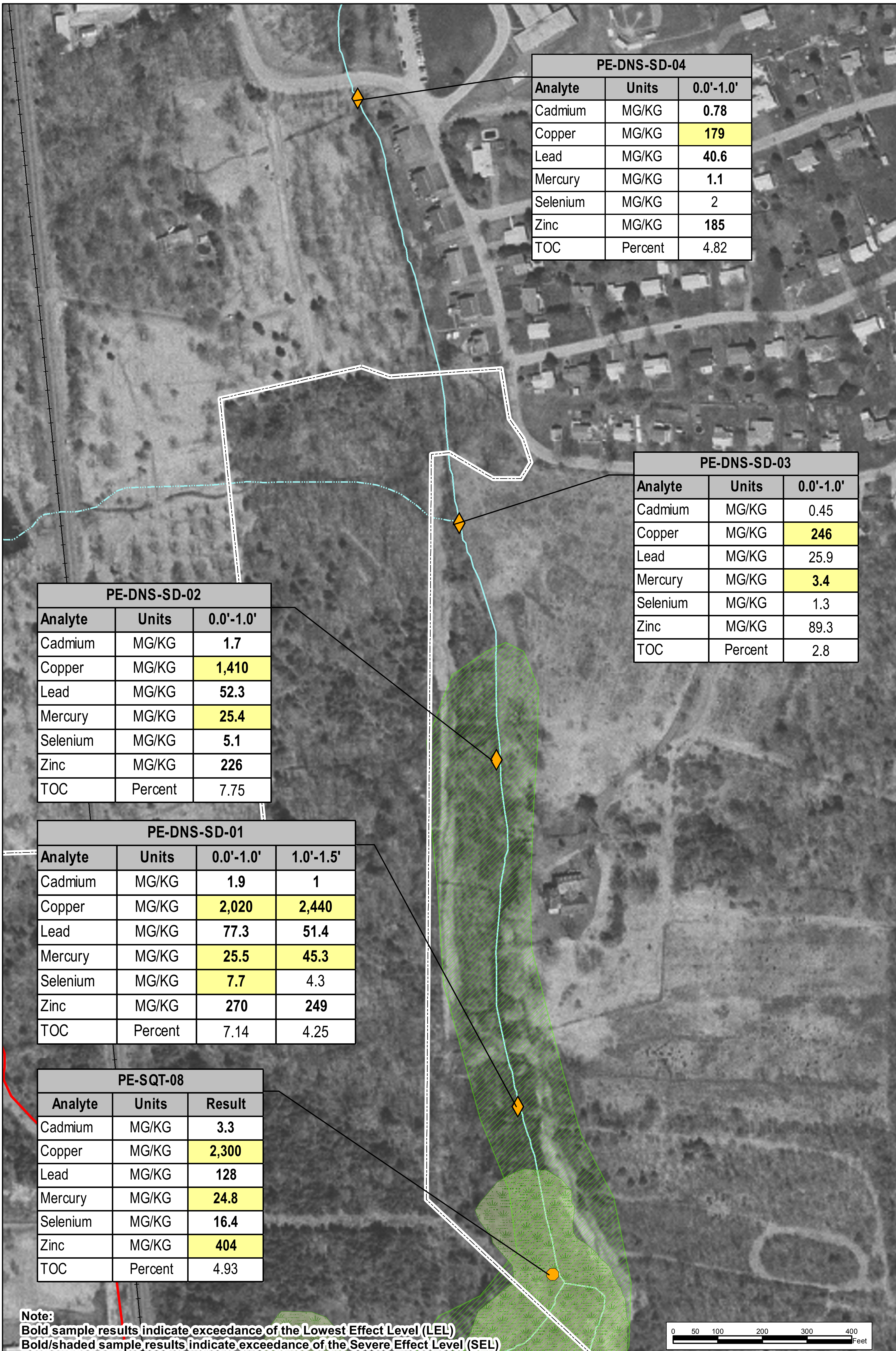
Note: All concentrations are represented as mg/kg. Bold sediment concentrations indicate an exceedance of the LEL; shaded concentrations indicate an exceedance of the SEL; Shaded sediment toxicity testing and benthic community results indicate statistical significance relevant to reference stations.

FIGURE 4-2. SEDIMENT QUALITY TRIAD SAMPLING LOCATIONS SWMU 1/22 WETLAND COMPLEX

DYNO NOBEL SITE, PORT EWEN, NEW YORK

Map Source:
Image: NYSGIS (2004)
Boundaries: Site and property boundaries approximations were determined using available data from historical maps and CAD files.

EHS Support
consider it done



PE-DNS-SD-04		
Analyte	**Units**	**0.0'-1.0'**
Cadmium	MG/KG	**0.78**
Copper	MG/KG	**179**
Lead	MG/KG	**40.6**
Mercury	MG/KG	**1.1**
Selenium	MG/KG	2
Zinc	MG/KG	**185**
TOC	Percent	4.82

PE-DNS-SD-03		
Analyte	**Units**	**0.0'-1.0'**
Cadmium	MG/KG	0.45
Copper	MG/KG	**246**
Lead	MG/KG	25.9
Mercury	MG/KG	**3.4**
Selenium	MG/KG	1.3
Zinc	MG/KG	89.3
TOC	Percent	2.8

PE-DNS-SD-02		
Analyte	**Units**	**0.0'-1.0'**
Cadmium	MG/KG	**1.7**
Copper	MG/KG	**1,410**
Lead	MG/KG	**52.3**
Mercury	MG/KG	**25.4**
Selenium	MG/KG	**5.1**
Zinc	MG/KG	**226**
TOC	Percent	7.75

PE-DNS-SD-01			
Analyte	**Units**	**0.0'-1.0'**	**1.0'-1.5'**
Cadmium	MG/KG	**1.9**	**1**
Copper	MG/KG	**2,020**	**2,440**
Lead	MG/KG	**77.3**	**51.4**
Mercury	MG/KG	**25.5**	**45.3**
Selenium	MG/KG	**7.7**	4.3
Zinc	MG/KG	**270**	**249**
TOC	Percent	7.14	4.25

PE-SQT-08		
Analyte	**Units**	**Result**
Cadmium	MG/KG	**3.3**
Copper	MG/KG	**2,300**
Lead	MG/KG	**128**
Mercury	MG/KG	**24.8**
Selenium	MG/KG	**16.4**
Zinc	MG/KG	**404**
TOC	Percent	4.93

Note:
Bold sample results indicate exceedance of the Lowest Effect Level (LEL)
Bold/shaded sample results indicate exceedance of the Severe Effect Level (SEL)

Legend

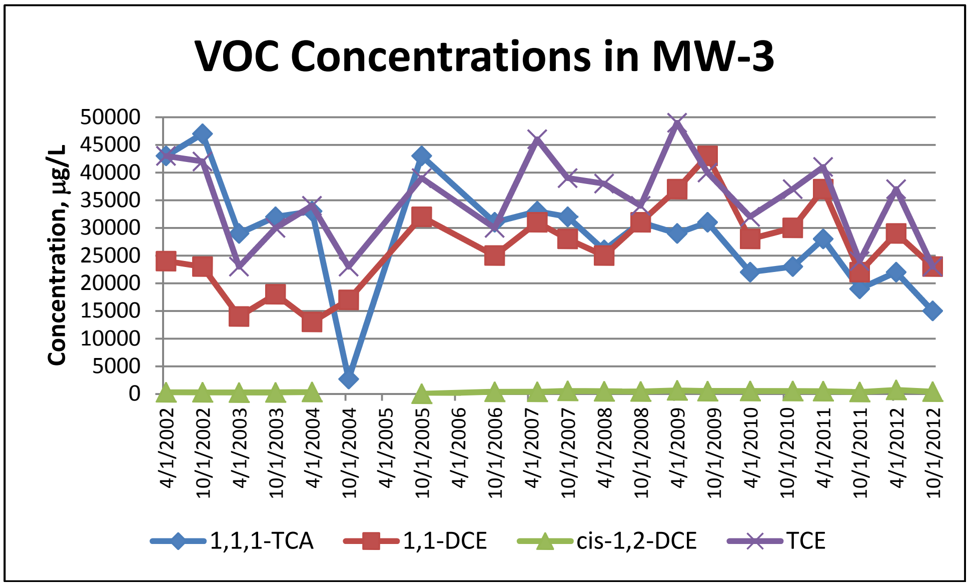
- New Sediment Sample Location
- SQT STATION
- APPROXIMATE PROPERTY BOUNDARY
- APPROXIMATE SITE BOUNDARY
- SWAMP/MARSH
- NYSDEC MAPPED CLASS 2 WETLANDS
- NYSDEC MAPPED CLASS 3 WETLANDS
- INTERMITTENT STREAM
- PERENNIAL STREAM
- RAILROAD

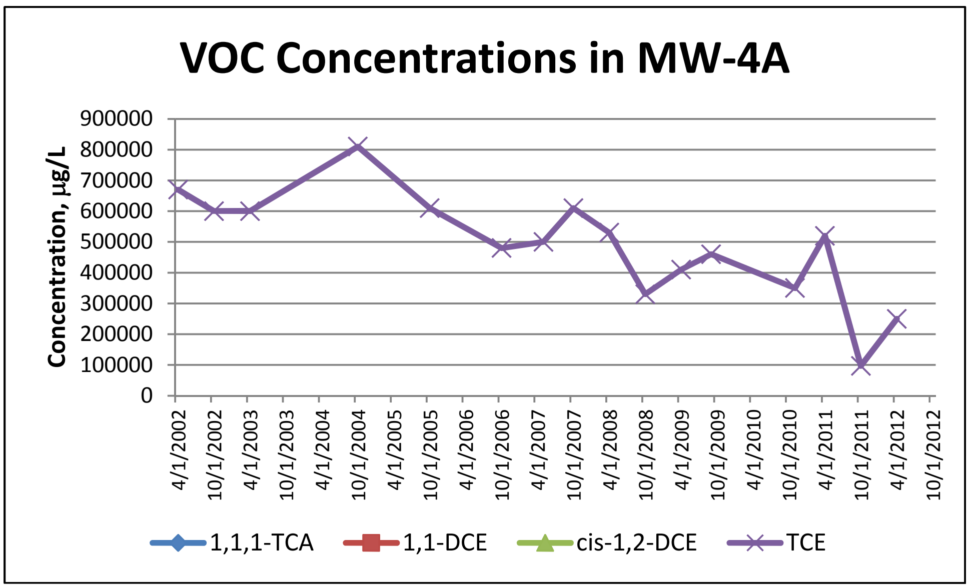
N

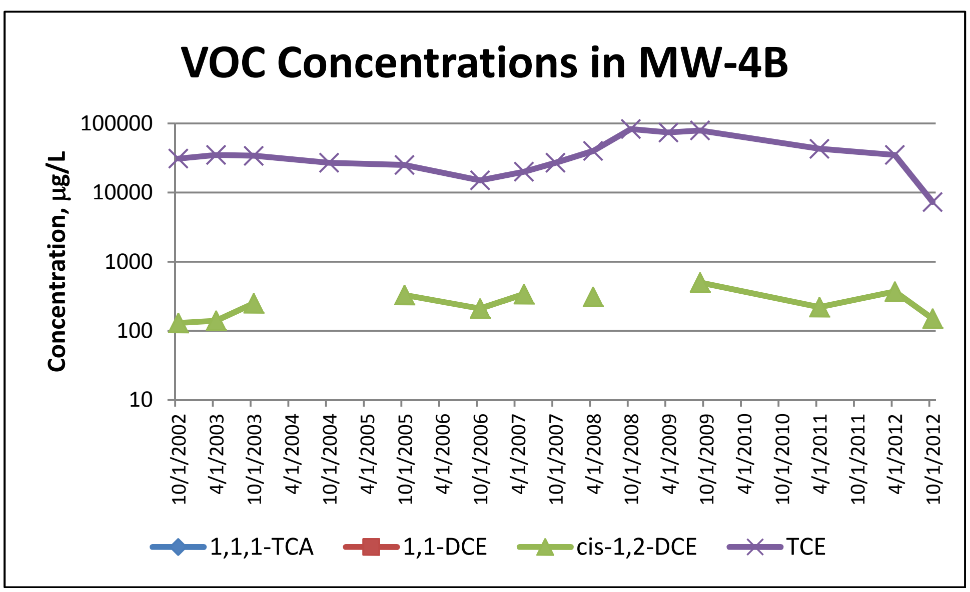
FIGURE 4-3. DOWNSTREAM SEDIMENT SAMPLING STATIONS
SWMU 1/22 WETLAND COMPLEX
DYNO NOBEL SITE, PORT EWEN, NEW YORK

Map Source:
Fresh water wetlands: New York State Department of Environmental Conservation
Surface water: National Hydrography Dataset
Countours: United States Department of Agriculture/Natural Resource Conservation Service - National Cartography and Geospatial Center digital elevation models
Boundaries: Site and property boundaries approximations were determined using available data from historical maps and CAD files.

EHS Support
consider it done







EHS Support
consider it done

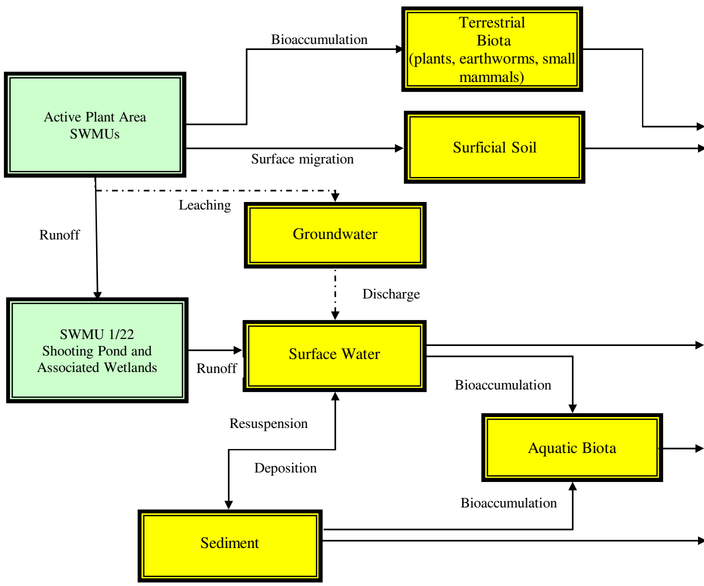
VOLATILE ORGANIC COMPOUND (VOC) TRENDS IN SHELL PLANT GROUNDWATER
DYNO NOBEL SITE
PORT EWEN, NEW YORK

FIGURE 4-4

FIGURE 6-1
ECOLOGICAL CONCEPTUAL SITE MODEL

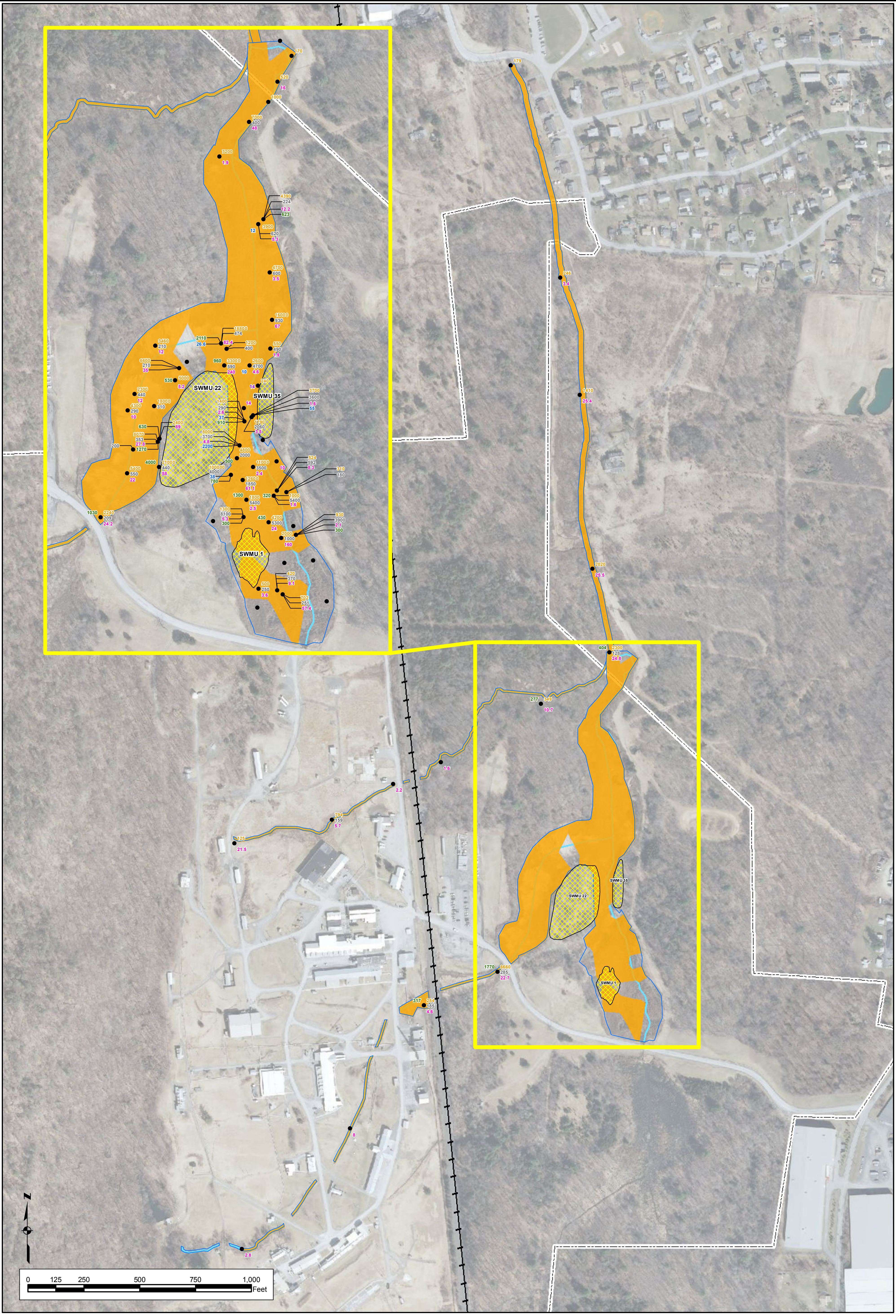
DYNO NOBEL SITE
PORT EWEN, NEW YORK

Areas of Concern | **Migration Pathways and Exposure Media** | **Potential Exposure Routes** | **Potential Ecological Receptors**



Potential Exposure Routes	Terrestrial: Active Plant Area				Wetland: SWMU 1/22 Wetland Complex									
	Invertivorous Mammal (e.g., Short-tailed shrew)	Invertivorous Bird (e.g., American robin)	Carnivorous Mammal (e.g., red fox)	Carnivorous Bird (e.g., red-tailed hawk)	Emergent Vegetation	Benthic Macroinvertebrates	Fish/Amphibians	Omnivorous Mammal (e.g., raccoon)	Aerial Insectivorous Mammal (e.g., Indiana bat)	Piscivorous Mammal (e.g., mink)	Invertivorous Bird (e.g., mallard)	Aerial Insectivorous Bird (e.g., tree swallow)	Semi-Aquatic Insectivorous Bird (e.g., Kentucky Warbler)	Piscivorous Bird (e.g., great blue heron)
Direct Contact/Absorption														
Direct Ingestion	●	●	●	●										
Incidental Ingestion	●	●	●	○										
Direct Contact/Absorption					○	○	●							
Direct Ingestion						○	○	●	●	●	●	●	●	●
Incidental Ingestion														
Direct Ingestion						○	○	●	●	●	●	●	●	●
Direct Contact/Absorption					○	●	○	--	--	--	--	--	--	--
Direct Ingestion														
Incidental Ingestion								●	--	--	●	--	●	●

Notes:
→ CONTAMINANT MIGRATION PATHWAY
⇢ LIMITED OR INSIGNIFICANT CONTAMINANT MIGRATION PATHWAY
● PRIMARY EXPOSURE PATHWAY: EVALUATED QUANTITATIVELY
○ SECONDARY EXPOSURE PATHWAY: EVALUATED QUALITATIVELY
-- EXPOSURE PATHWAY IS INSIGNIFICANT
BLANK = INCOMPLETE EXPOSURE PATHWAY



Legend

- ● SURFACE SEDIMENT SAMPLE
- SEL EXCEEDANCE (447,043.40 SqFt)
- SEDIMENT STUDY AREA
- APPROXIMATE SWMU/AOC BOUNDARY
- EST. SURFACE WATER
- SURFACE WATER
- APPROXIMATE PROPERTY BOUNDARY
- RAILROAD

Values represent concentrations of metals (mg/kg) exceeding the SEL, as indicated by the following colors:

Copper
Lead
Mercury
Cadmium
Zinc

FIGURE 9-1

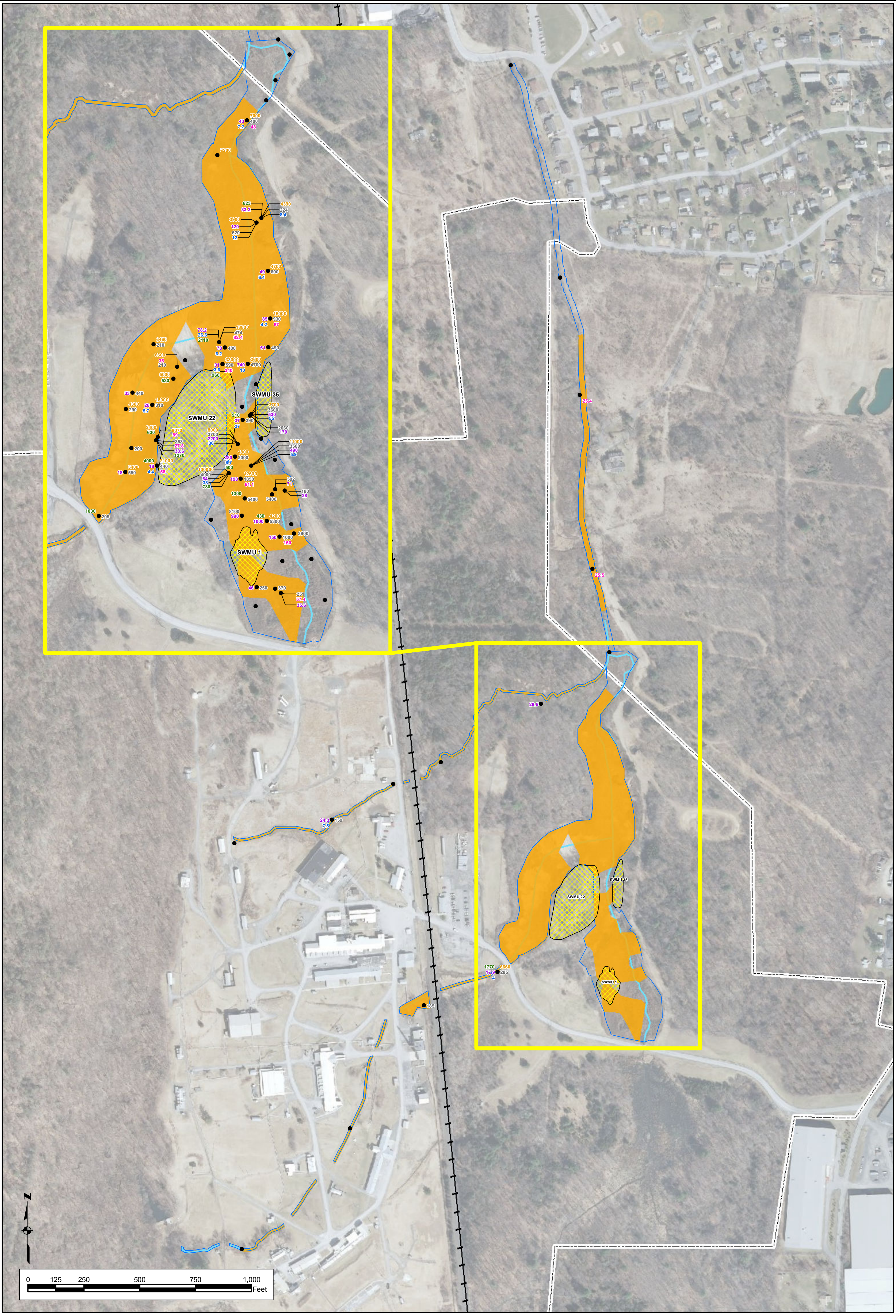
SEVERE EFFECTS LEVEL (SEL) EXCEEDANCES IN SURFACE SEDIMENT

DYNO NOBEL SITE

PORT EWEN, NEW YORK

Map Source:
Image: NYSGIS (2009)
Boundaries: Site and property boundaries approximations were determined using available data from historical maps and CAD files.

EHS Support *consider it done*



Legend

- SURFACE SEDIMENT SAMPLE
- PRG EXCEEDANCE (380,741.45 SqFt)
- SEDIMENT STUDY AREA
- APPROXIMATE SWMU/AOC BOUNDARY
- EST. SURFACE WATER
- SURFACE WATER
- APPROXIMATE PROPERTY BOUNDARY
- RAILROAD

Values represent concentrations of metals (mg/kg) exceeding the PRG, as indicated by the following colors:

Copper
Lead
Mercury
Cadmium
Selenium
Zinc

FIGURE 9-2

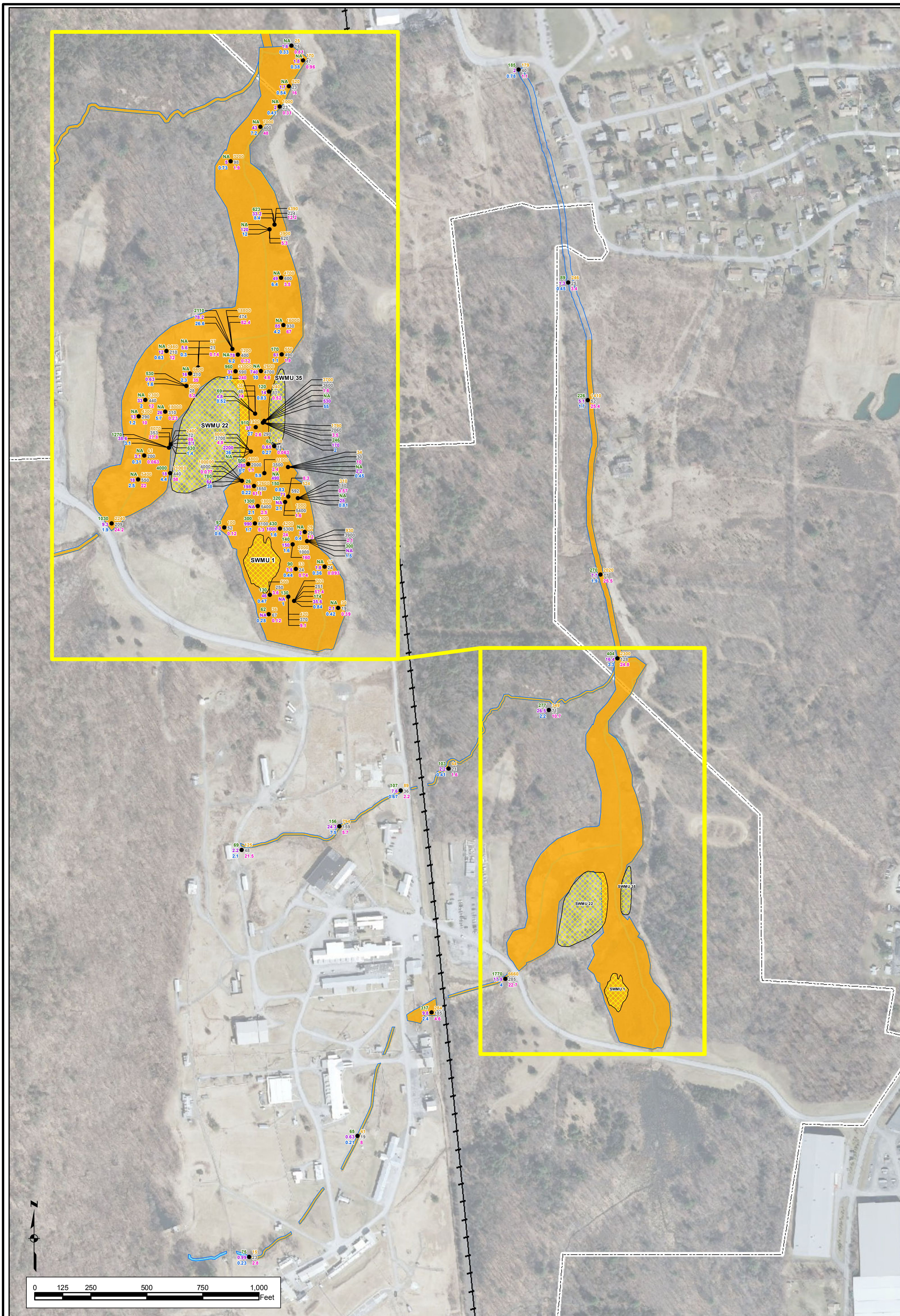
PROPOSED REMEDIATION GOASL (PRG) EXCEEDANCES IN SURFACE SEDIMENT

DYNO NOBEL SITE

PORT EWEN, NEW YORK

Map Source:
Image: NYSGIS (2009)
Boundaries: Site and property boundaries approximations were determined using available data from historical maps and CAD files.

EHS Support
consider it done



Legend

- ● SURFACE SEDIMENT SAMPLE
- MASS REMOVAL (481,378.34 SqFt)
- SEDIMENT STUDY AREA
- APPROXIMATE SWMU/AOC BOUNDARY
- EST. SURFACE WATER
- SURFACE WATER
- APPROXIMATE PROPERTY BOUNDARY
- RAILROAD

Values represent concentrations of metals (mg/kg), as indicated by the following colors:

Copper
Lead
Mercury
Cadmium
Selenium
Zinc
NA = Not Analyzed

FIGURE 9-3

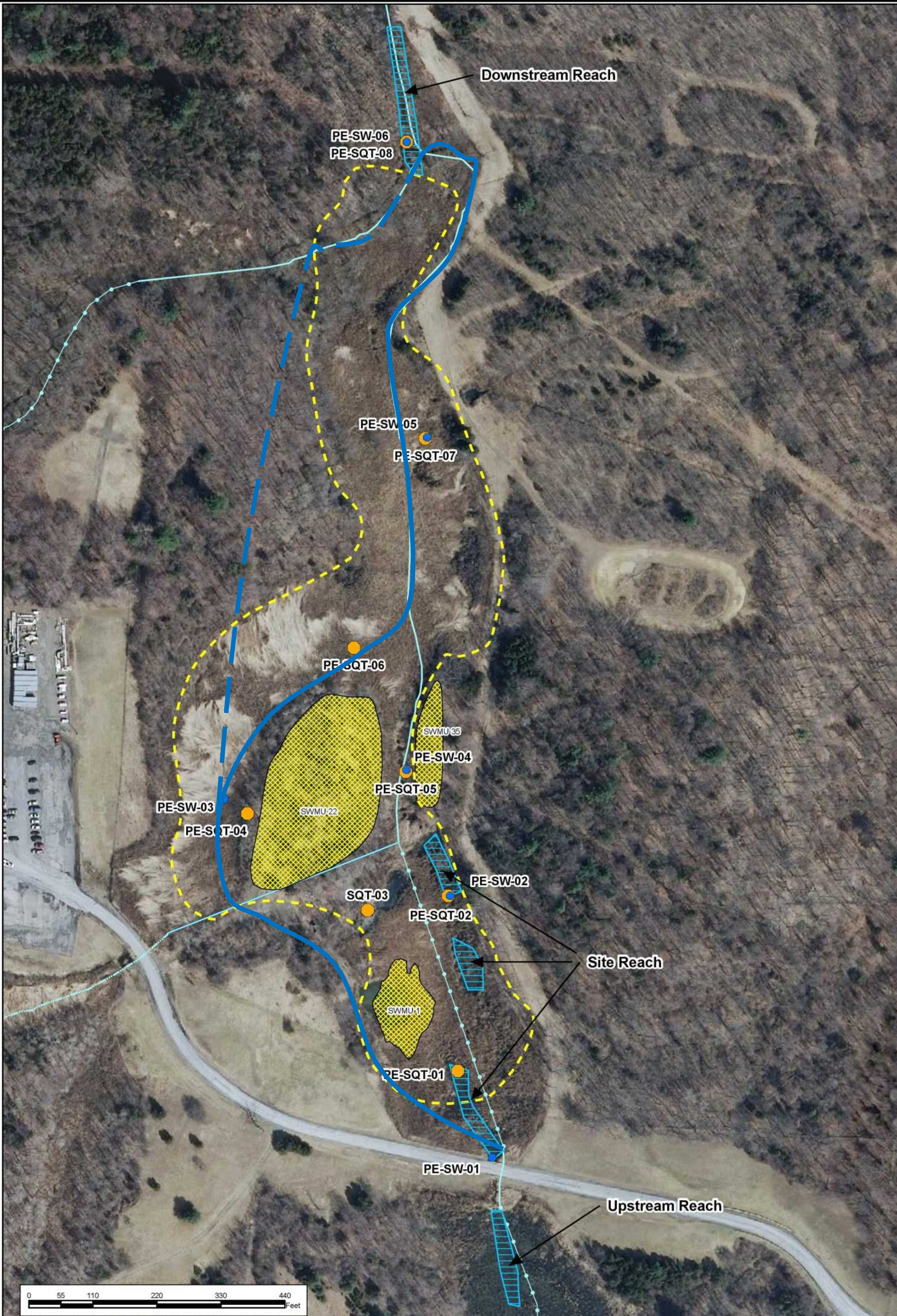
EXTENT OF IMPACTED SURFACE SEDIMENT BASED ON MASS REMOVAL

DYNO NOBEL SITE

PORT EWEN, NEW YORK

Map Source:
Image: NYSGIS (2009)
Boundaries: Site and property boundaries approximations were determined using available data from historical maps and CAD files.

EHS Support
consider it done



Q:\GIS_Data\HERCULES\Projects\Figure 3 Surface Water and Fish Sampling Locs.mxd

Legend

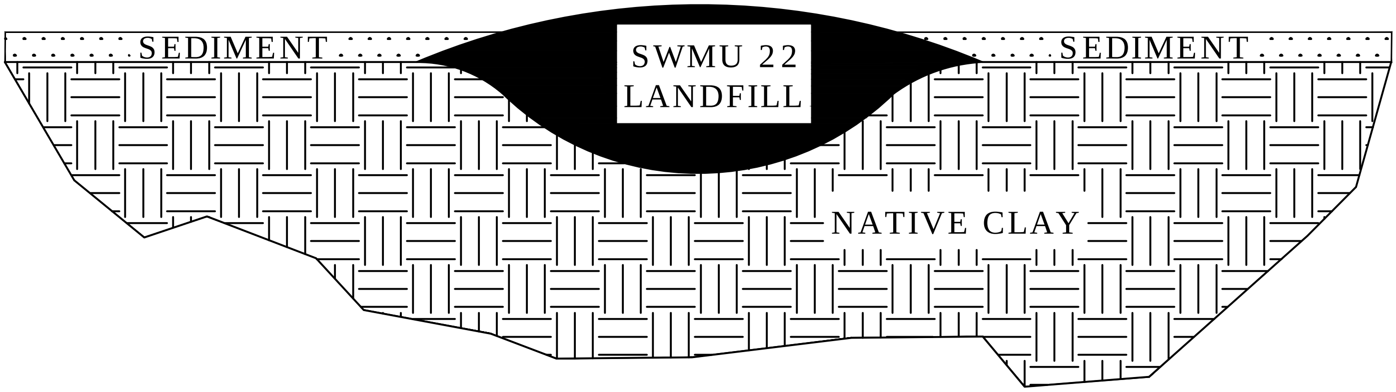
- SURFACE WATER SAMPLING STATION
- SQT SEDIMENT SAMPLING STATION
- SWMU 1/22 BOUNDARY
- PERMANENT REALIGNED STREAM
- FISH SAMPLING REACH
- APPROXIMATE SWMU/AOC BOUNDARY
- TEMPORARY STREAM
- PERENNIAL STREAM
- INTERMITTENT STREAM
- CONNECTOR
- ARTIFICIAL PATH

N

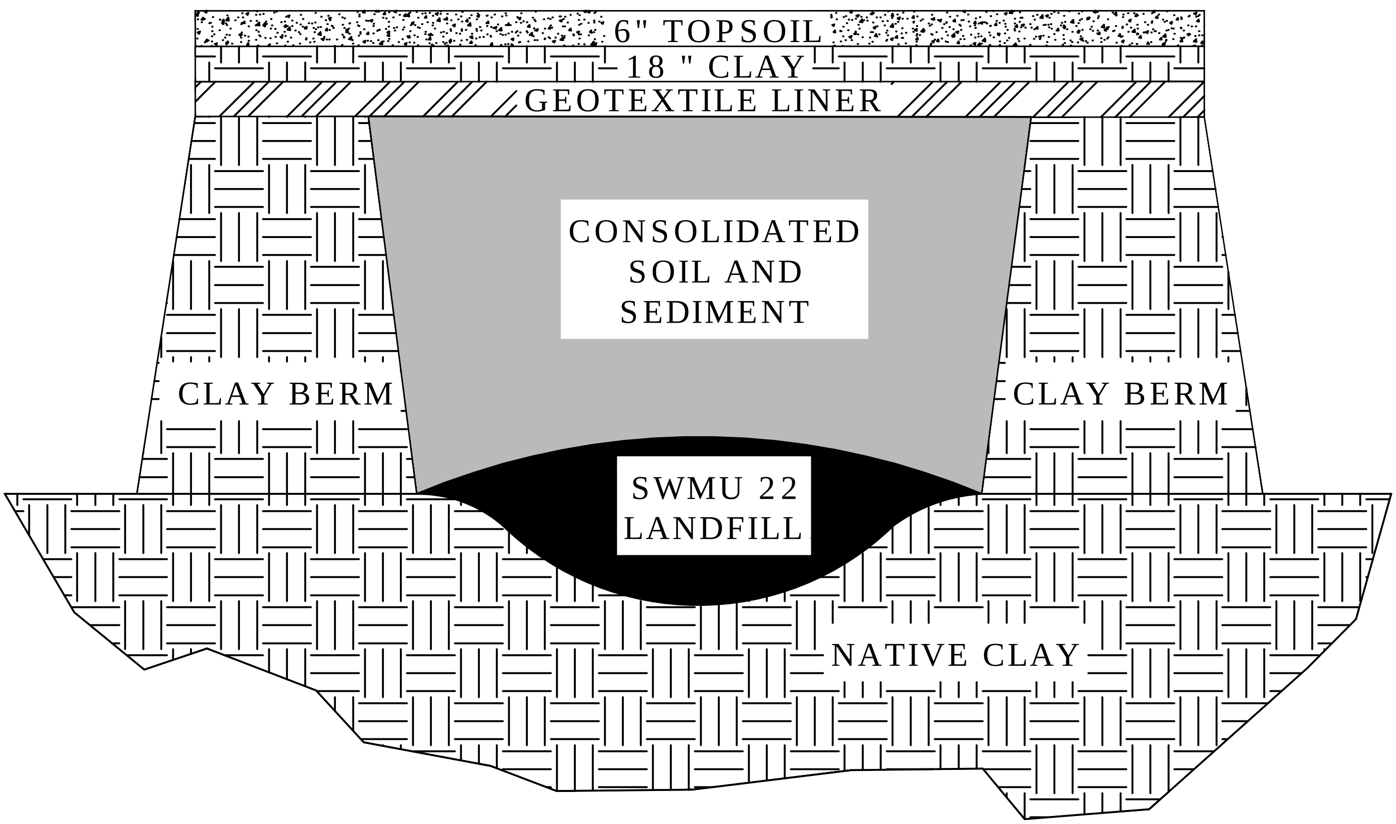
FIGURE 11-1
CONCEPTUAL STREAM REALIGNMENT
DYNO NOBEL PORT EWEN SITE
PORT EWEN, NEW YORK

Map Source:
Image: NYSGIS (2004)
Boundaries: Site and property boundaries approximations were determined using available data from historical maps and CAD files.

EHS Support
consider it done



EXISTING



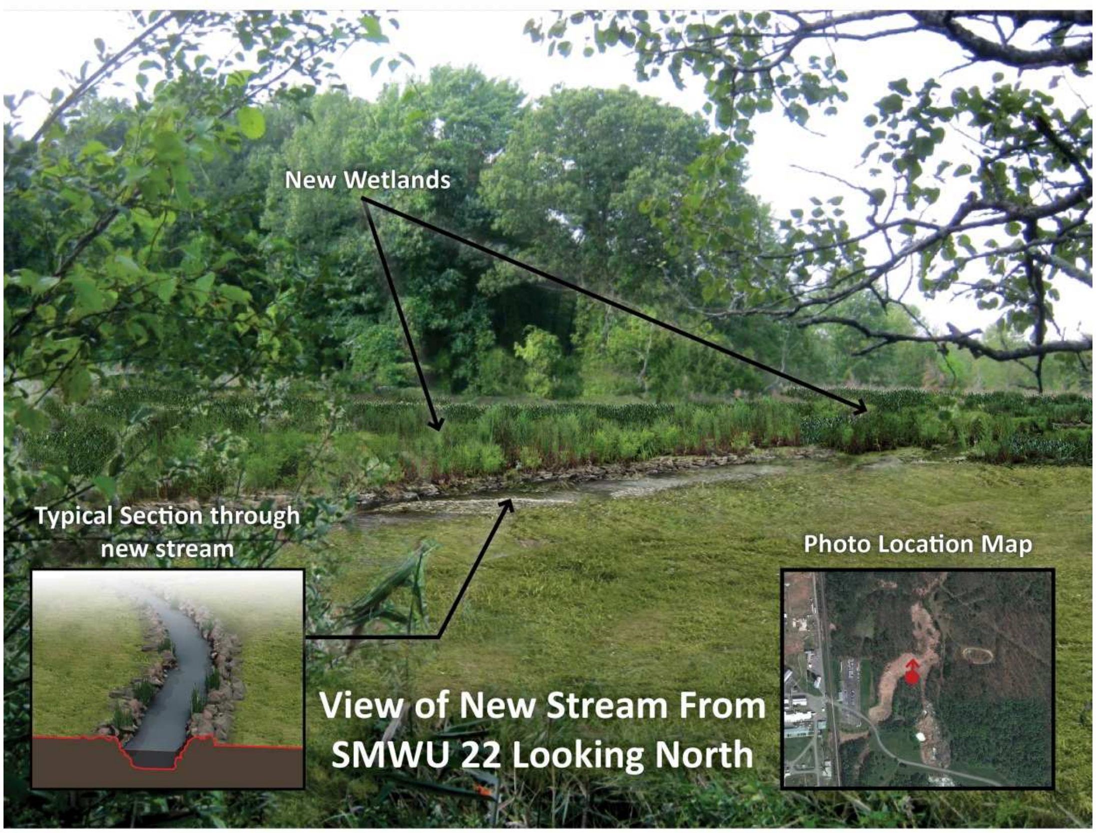
PROPOSED

EHS Support *consider it done*	DYNO-NOBEL, INC. PORT EWEN, NY.	**FIGURE 11-2** TYPICAL CROSS SECTION OF CONCEPTUAL CONSOLIDATION UNIT	Drawn By: BC	Date Drawn: 01/09/14
			Reviewed By: KV	Date Reviewed: 01/2014
			Scale: NTS	Plot Date: 01/2014
			Project Number.:	

EHS Support consider it done

CONCEPTUAL LOOK AT ON-SITE CONSOLIDATION UNIT
DYNO NOBEL SITE
PORT EWEN, NEW YORK

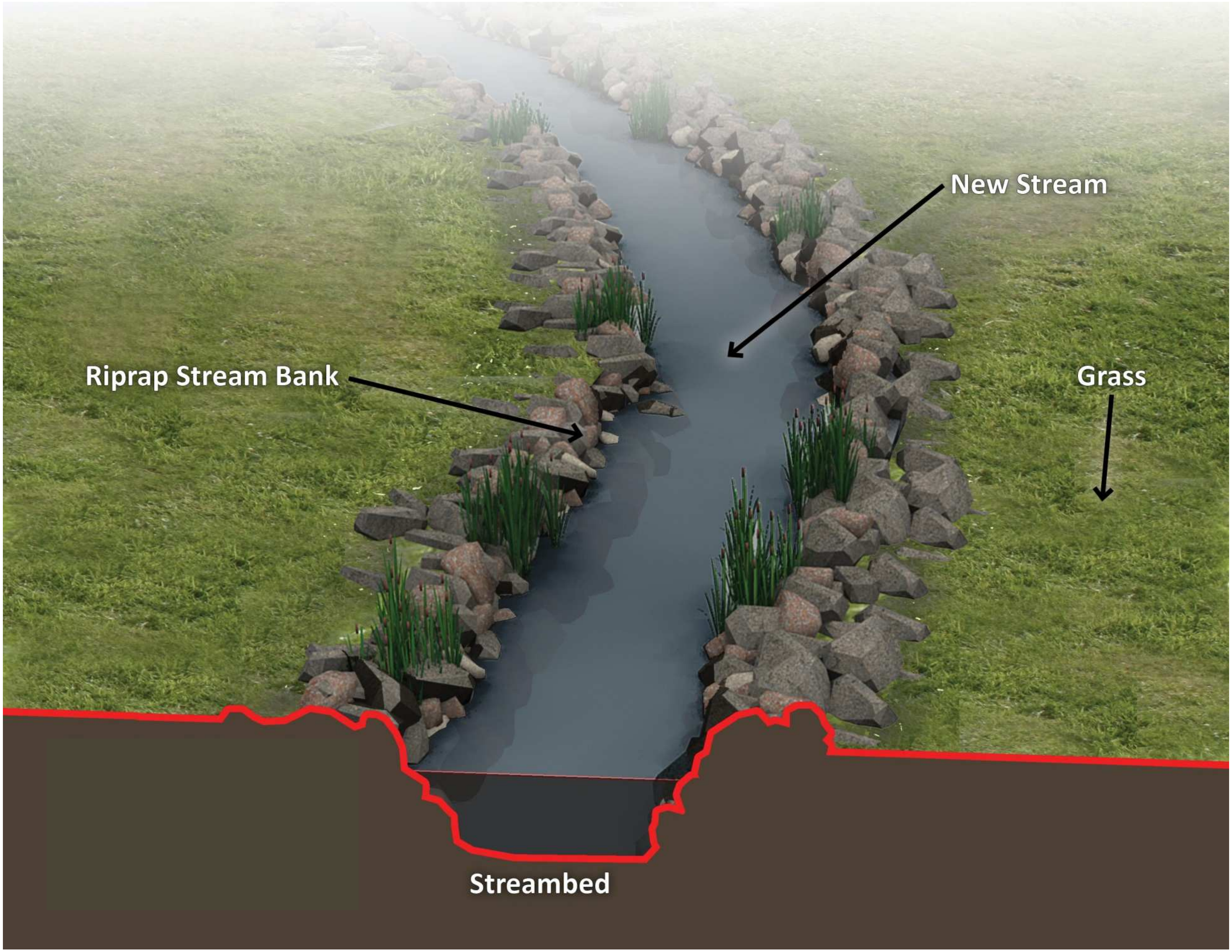
FIGURE 11-3



EHS Support
consider it done

CONCEPTUAL LOOK AT MITIGATED WETLANDS COMPLEX
DYNO NOBEL SITE
PORT EWEN, NEW YORK

FIGURE
11-4



EHS Support
consider it done

TYPICAL SECTION OF NEW STREAM
DYNO NOBEL SITE
PORT EWEN, NEW YORK

FIGURE
11-5

APPENDIX A

Photographic Log

URS	PHOTOGRAPHIC LOG	
Client Name: Dyno Nobel/Ashland	**Site Location:** Port Ewen, New York	**Project No.** 19998508.00002 19998509.00002

Photo No. 1	**Date:** 11/11/2010

Direction Photo Taken:

S

PE-DNS-SD-01

View: Looking upstream from sampling location PE-DNS-SD-01

PE-SQT-08 is approximately at far extent of view.

Photo No. 2	**Date:** 11/11/2010

Direction Photo Taken:

S

PE-DNS-SD-02

View: Looking upstream from sampling location PE-DNS-SD-02

URS

PHOTOGRAPHIC LOG

Client Name:	Site Location:	Project No.
Dyno Nobel/Ashland	Port Ewen, New York	19998508.00002 19998509.00002

Photo No.	Date:
3	11/11/2010

Direction Photo Taken:

S

PE-DNS-SD-03

View: Looking upstream from sampling location PE-DNS-SD-03

Photo No.	Date:
4	10/28/2010

Direction Photo Taken:

S

PE-DNS-SD-04

View: Looking upstream at sampling location from bridge at Mountain View Road

APPENDIX B

SWMU/AOC Descriptions

The SWMUs and AOCs to be addressed as part of this CMS revision are presented below. A description of the wastes handled at each unit is taken from the RFA.

SWMU No. 1: Shooting Pond - The unit managed off-specification PETN, DDNP, HMX, PBX, RDX, lead azide, lead styphnate, detonation caps and devices, and sump powder waste. Interim Corrective Measures at this unit did not find any explosives at reactive quantities. However, as reported in the Sampling Visit Report, metals concentrations were found in the pond sediment above the screening criteria.

SWMU No. 2: Burning Cage Incinerator - This unit managed approximately 1,200 to 2,500 pounds of explosive contaminated waste per burn with approximately 500 pounds of ash generated at each of two to four burns per week.

SWMU No. 3: Copper Wire Burning Area - This unit managed (burned) scrap copper wire covered with plastic insulation until July 1993. The waste usually included some blasting caps. The waste potentially contained, or has in the past contained, arsenic, copper, cadmium, lead, mercury, selenium, silver, and chromium.

SWMU No. 4: Iron Wire Burning Area - This unit managed (burned) scrap iron wire covered with plastic insulation. The waste usually included some blasting caps. The waste potentially contained arsenic, barium, cadmium, lead, mercury, selenium, silver, and chromium.

SWMU No. 5: Wire Burning Area III - Facility personnel were not able to identify what waste had been burned at the unit. The unit showed dark stains and was littered with bits of paper and wire.

SWMU Nos. 6 and 7: Open Burning Pads - These units managed up to 500 pounds at a time of reactive and ignitable wastes, which were not suitable for open detonation. The residual waste may have also contained arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver, or tellurium.

SWMU No. 8: Former Burning Area - This unit managed reactive and ignitable wastes, which were not suitable for open detonation. The residual waste may have contained arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver, or tellurium.

SWMU No. 9: Waste Powder Catch Basins - Building 2037 - This unit managed waste powder (unknown type) in water.

SWMU No. 10: Waste Powder Catch Basins - Building 2048 - This unit managed waste PETN, RDX, HMX, PBX, and DDNP powder in water.

SWMU No. 11: Waste Powder Catch Basins - Building 2049 - This unit managed waste DDNP powder (unknown type) in water.

SWMU No. 13: Former Waste Powder Catch Basins - Lead Azide Building - The unit managed waste lead azide powder in water (K046).

SWMU No. 21: Lead Recycling Unit Area - This unit managed waste ignition powders and blasting cap components containing lead and selenium.

SWMU No. 22: Former Landfill - Potentially hazardous and non-hazardous wastes, including ash, flashed debris, and general building debris are reported to have been disposed in this unit.

SWMU No. 23: Former Dump - This unit managed used equipment, and used 55-gallon drums. This unit may also have potentially managed PCB-containing transformers.

SWMU No. 24: Former Wastewater Treatment Facility - This unit is known to have managed acidic wastewaters and waste degreaser solvents, and potentially explosive-containing process waters and explosive-containing waste oils.

SWMU No. 26: Burnable Waste Satellite Areas - These units consisted of open-topped metal dumpsters, which managed waste packaging materials possibly contaminated with explosive materials.

SWMU No. 29: Drainage Ditch (Downgradient of Building 2049) - This unit managed process wastewaters containing potentially explosive material and may have managed waste degreaser solvents.

SWMU No. 30: Drainage Ditch (Downgradient of Building 2036) - This unit managed acidic process wastewaters potentially containing explosive material and waste degreaser solvents.

SWMU No. 32: Old Dump (near water tower) - The wastes managed by this unit are unknown. Miscellaneous metal debris and the remains of old drums were observed during the second VSI.

SWMU No. 33: Mercury Fulminate Tanks Area - This unit formally consisted of wooden tanks, which managed a protective water bath that may have contained trace amounts of mercury fulminate.

SWMU No. 35: Stone Fence Dump - The wastes managed by this unit include metal drums and debris. It could not be determined if other materials have also been managed at the unit.

SWMU No. 37: Former Shell Plant Drum Storage Area - This unit managed waste degreaser solvents, including TCE and Freon, in drums stored directly on the ground.

SWMU No. 39: Former Wash Water Discharge Area (Building 2009) - This unit managed PETN and DDNP powders in water.

SWMU No. 40: Pilot Line Condensate Collection Sump - This unit managed steam condensate that contained trace amounts of lead styphnate.

SWMU No. 42: SAC Building Steam Collection Canisters - This unit managed steam condensate containing fuse powders and DDNP.

SWMU No. 46: Vacuum Line Condensate Collection Sump - Building 2059 - This unit managed steam condensate that potentially contained trace amounts of antimony sulfide, barium salts, boron, HMX, RDX, dibutylphthalate,. diphenylamine, graphite, latex, lead azide, lead dioxide, lead styphnate, nitrocellulose, nitroglycerin, PETN, potassium nitrate, stearic acid, tetrazene, tetryl, viton, and zirconium.

SWMU No. 47: Building 2058 Fuse Room - This unit consisted of a wooden box which collected wash water with ignition and fuse powders containing lead and selenium.

SWMU No. 48: Mercury Fulminate Area - This unit consists of a fill area for construction and demolition debris from various projects throughout the facility. The presence of mercury fulminate has been documented in this area.

SWMU 52: Former Commercial Lab Shooting Area - This unit is located immediately adjacent to the training center. This unit currently consists of a vegetated area with obvious soil staining and evidence of shot debris and cap remnants. Available information indicates that this area was used for testing (shooting) commercial blasting caps for an unknown period of time ceasing in the early to mid-1990s. Additionally, shot debris accumulated in a water tank in the former commercial laboratory was spread on the grass and soil in this area.

SWMU 54: Former Historical Production Area – This unit is located in the central portion of the Site and consists of the north and south press areas, charge room and shell room. This area was in use when production began at the facility in 1912 and was phased out sometime before the mid-1930s.

SWMU 56 is identified as the Vent System for Static Security Testing Chamber

AOC A: Kerosene Tank Leak - This AOC contains soil stained with a small amount of kerosene, which has leaked from a storage tank.

AOC B: Open Burning Pads Area - This AOC is an area of soil to which waste explosive debris and kerosene has been released.

AOC C: Open Detonation Pit - This AOC consists of a metal-sided pit, which managed detonators and blasting caps produced at the facility.

AOC D: Detonation Test Building - This unit is used to test detonators and blasting caps produced at the facility.

AOC G: Former Drying House - All that remains of the original structure is debris consisting of bricks, concrete, piping, metal sheeting, and a section of boardwalk.

AOC H: Former Drying House – This unit is very similar to AOC G with regard to other types of debris present.

AOC I: Roof Drainage from Deto Building – This unit conveys shot debris from roof of Deto building (from permitted air emissions source) onto ground near down spout.

AOC J: Former Drying House - All that remains of the original structure is debris consisting of bricks, concrete, piping, and metal sheeting.

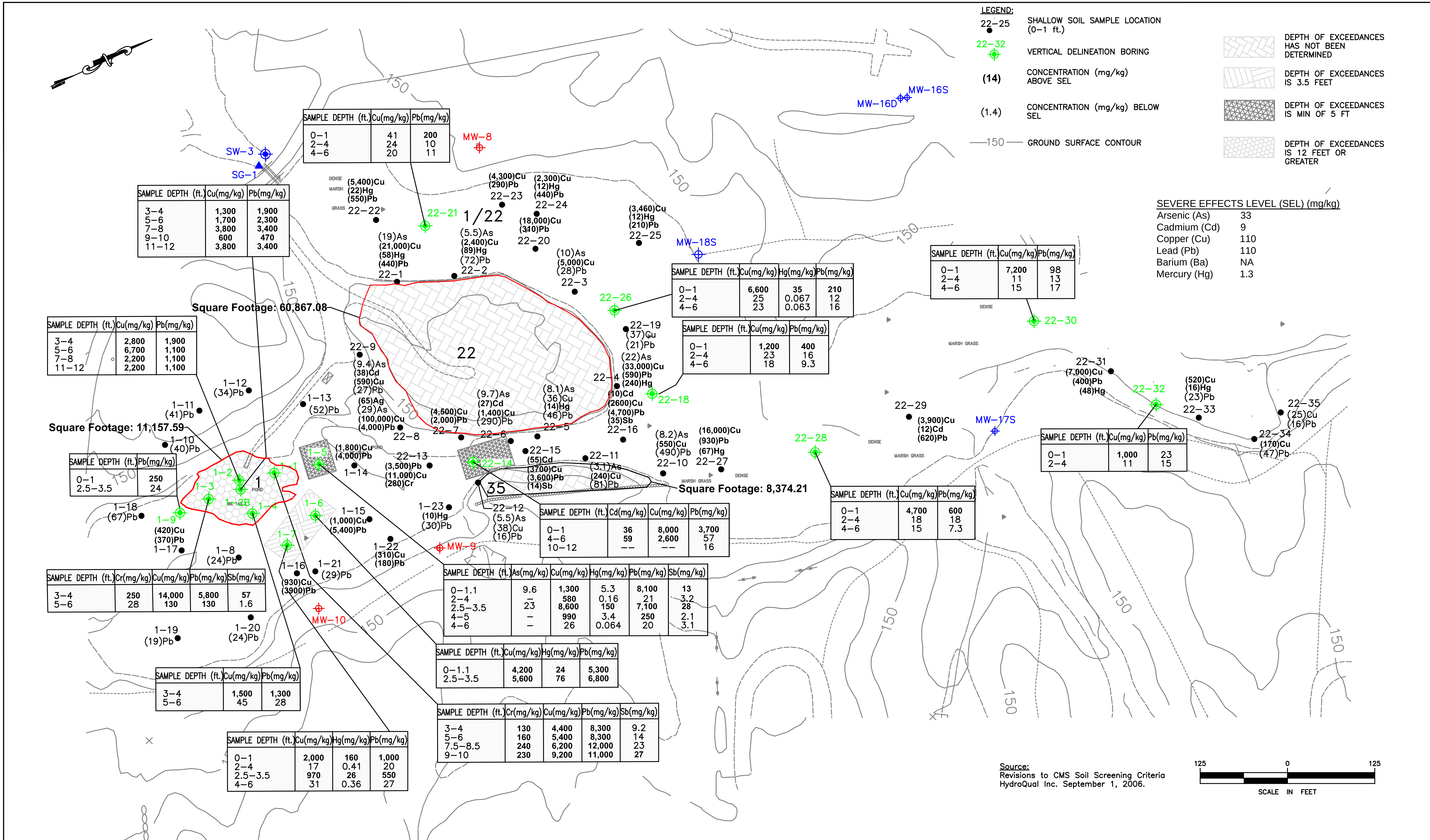
AOC M: Former Drying House - This unit is very similar to AOC G with regard to other types of debris present.

AOC N: Former Drying House - This unit is very similar to AOC G with regard to other types of debris present.

AOC O: Former Drying House - This unit is very similar to AOC G with regard to other types of debris present.

APPENDIX C

Mid-Point Delineation Figures



SAMPLE DEPTH (ft.)	Cu(mg/kg)	Pb(mg/kg)
0-1	41	200
2-4	24	10
4-6	20	11

SAMPLE DEPTH (ft.)	Cu(mg/kg)	Pb(mg/kg)
3-4	1,300	1,900
5-6	1,700	2,300
7-8	3,800	3,400
9-10	600	470
11-12	3,800	3,400

SAMPLE DEPTH (ft.)	Cu(mg/kg)	Pb(mg/kg)
3-4	2,800	1,900
5-6	6,700	1,100
7-8	2,200	1,100
11-12	2,200	1,100

SAMPLE DEPTH (ft.)	Pb(mg/kg)
0-1	250
2.5-3.5	24

SAMPLE DEPTH (ft.)	Cr(mg/kg)	Cu(mg/kg)	Pb(mg/kg)	Sb(mg/kg)
3-4	250	14,000	5,800	57
5-6	28	130	130	1.6

SAMPLE DEPTH (ft.)	Cu(mg/kg)	Pb(mg/kg)
3-4	1,500	1,300
5-6	45	28

SAMPLE DEPTH (ft.)	Cu(mg/kg)	Hg(mg/kg)	Pb(mg/kg)
0-1	2,000	160	1,000
2-4	17	0.41	20
2.5-3.5	970	26	550
4-6	31	0.36	27

SAMPLE DEPTH (ft.)	As(mg/kg)	Cu(mg/kg)	Hg(mg/kg)	Pb(mg/kg)	Sb(mg/kg)
0-1.1	9.6	1,300	5.3	8,100	13
2-4	—	580	0.16	21	3.2
2.5-3.5	23	8,600	150	7,100	28
4-5	—	990	3.4	250	2.1
4-6	—	26	0.064	20	3.1

SAMPLE DEPTH (ft.)	Cu(mg/kg)	Hg(mg/kg)	Pb(mg/kg)
0-1.1	4,200	24	5,300
2.5-3.5	5,600	76	6,800

SAMPLE DEPTH (ft.)	Cr(mg/kg)	Cu(mg/kg)	Pb(mg/kg)	Sb(mg/kg)
3-4	130	4,400	8,300	9.2
5-6	160	5,400	8,300	14
7.5-8.5	240	6,200	12,000	23
9-10	230	9,200	11,000	27

SAMPLE DEPTH (ft.)	Cd(mg/kg)	Cu(mg/kg)	Pb(mg/kg)
0-1	36	8,000	3,700
4-6	59	2,600	57
10-12	--	--	16

SAMPLE DEPTH (ft.)	Cu(mg/kg)	Hg(mg/kg)	Pb(mg/kg)
0-1	6,600	35	210
2-4	25	0.067	12
4-6	23	0.063	16

SAMPLE DEPTH (ft.)	Cu(mg/kg)	Pb(mg/kg)
0-1	1,200	400
2-4	23	16
4-6	18	9.3

SAMPLE DEPTH (ft.)	Cu(mg/kg)	Pb(mg/kg)
0-1	7,200	98
2-4	11	13
4-6	15	17

SAMPLE DEPTH (ft.)	Cu(mg/kg)	Pb(mg/kg)
0-1	1,000	23
2-4	11	15

SAMPLE DEPTH (ft.)	Cu(mg/kg)	Pb(mg/kg)
0-1	4,700	600
2-4	18	18
4-6	15	7.3

LEGEND:

22-25 SHALLOW SOIL SAMPLE LOCATION (0-1 ft.)

22-32 VERTICAL DELINEATION BORING

(14) CONCENTRATION (mg/kg) ABOVE SEL

(1.4) CONCENTRATION (mg/kg) BELOW SEL

150 GROUND SURFACE CONTOUR

DEPTH OF EXCEEDANCES HAS NOT BEEN DETERMINED

DEPTH OF EXCEEDANCES IS 3.5 FEET

DEPTH OF EXCEEDANCES IS MIN OF 5 FT

DEPTH OF EXCEEDANCES IS 12 FEET OR GREATER

SEVERE EFFECTS LEVEL (SEL) (mg/kg)

Arsenic (As)	33
Cadmium (Cd)	9
Copper (Cu)	110
Lead (Pb)	110
Barium (Ba)	NA
Mercury (Hg)	1.3

Source:
Revisions to CMS Soil Screening Criteria
HydroQual Inc. September 1, 2006.

125 0 125
SCALE IN FEET

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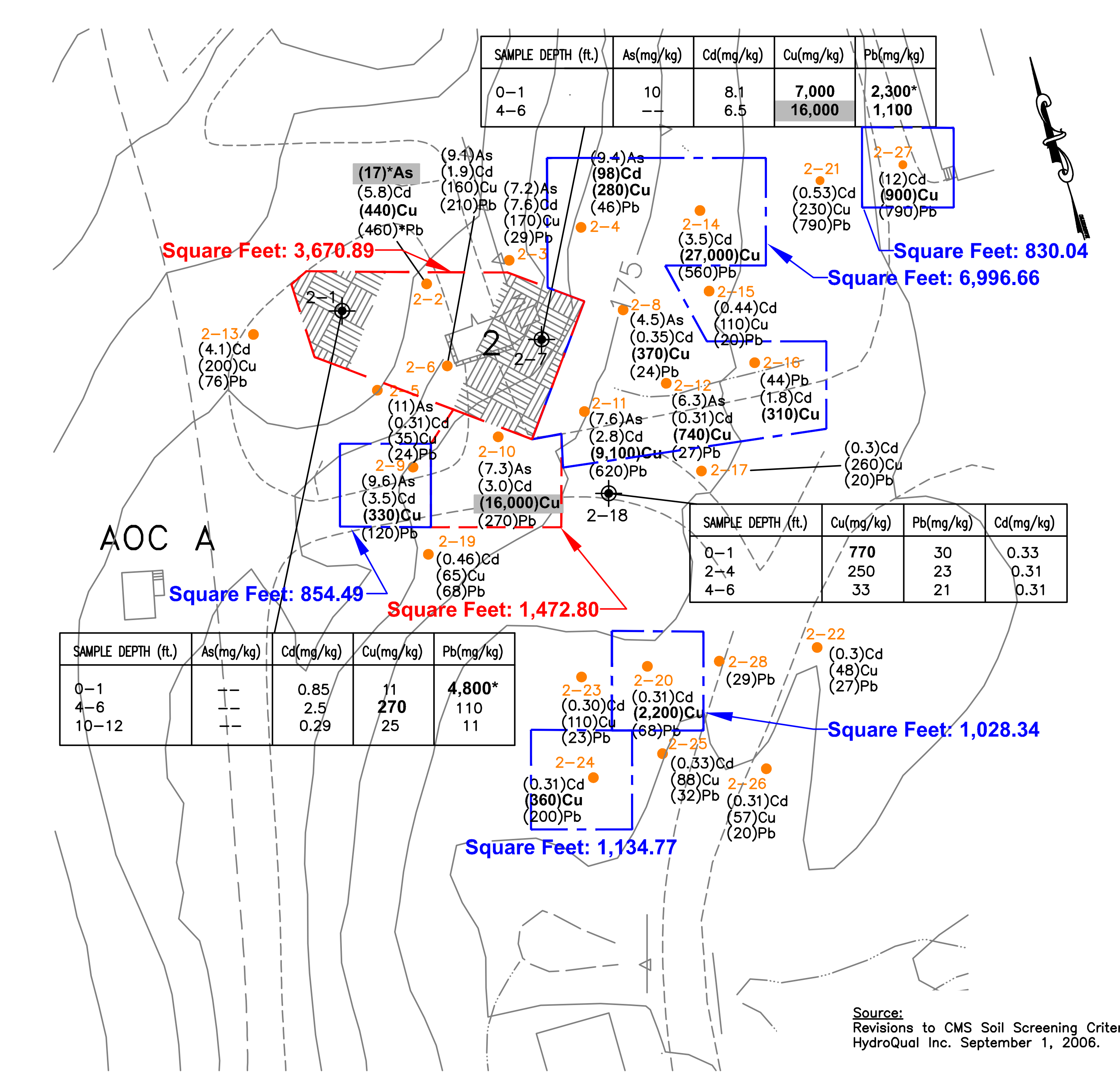
FIGURE 17
SEVERE EFFECTS LEVEL (SEL) DELINEATION
SWMUs 1 AND 22

Drawn By: BC	Date Drawn:
Reviewed By: KV	Date Reviewed:
Scale: 1" = 125'	Plot Date:
Project Number.:	



SAMPLE DEPTH (ft.)	As(mg/kg)	Cd(mg/kg)	Cu(mg/kg)	Pb(mg/kg)
0–1	10	8.1	**7,000**	**2,300***
4–6	--	6.5	**16,000**	1,100

SAMPLE DEPTH (ft.)	Cu(mg/kg)	Pb(mg/kg)	Cd(mg/kg)
0–1	**770**	30	0.33
2–4	250	23	0.31
4–6	33	21	0.31

SAMPLE DEPTH (ft.)	As(mg/kg)	Cd(mg/kg)	Cu(mg/kg)	Pb(mg/kg)
0–1	--	0.85	11	**4,800***
4–6	--	2.5	**270**	110
10–12	--	0.29	25	11

LEGEND:

2–3 SHALLOW SOIL SAMPLE LOCATION (0–1 ft.)

2–7 VERTICAL DELINEATION BORING

(12) CONCENTRATION (mg/kg) ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

(12) CONCENTRATION (mg/kg) ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE

(1.5) CONCENTRATION (mg/kg) BELOW COMMERCIAL USE SOIL CLEANUP OBJECTIVE

—175— GROUND SURFACE CONTOUR

APPROXIMATE AREA OF SOIL CONTAINING METALS CONCENTRATIONS ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

APPROXIMATE AREA OF SOIL CONTAINING METALS CONCENTRATIONS ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE

DEPTH OF EXCEEDANCES IS 6 FEET

* TWO SAMPLES WERE ANALYZED AT THIS SAMPLE LOCATION. THE CONCENTRATION SHOWN REPRESENTS THE GREATER OF THE TWO SAMPLING RESULTS.

NOTE:
1. THE INDUSTRIAL USE SOIL CLEANUP CRITERION FOR Pb IS 1,000 mg/kg.
2. THE INDUSTRICAL USE SOIL CLEANUP CRITERION FOR As IS 16 mg/kg.

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Arsenic (As)	16	16
Cadmium (Cd)	9.3	60
Copper (Cu)	270	10,000
Lead (Pb)	1,000	3,900

Source:
Revisions to CMS Soil Screening Criteria
HydroQual Inc. September 1, 2006.

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Rev.	By:	Date:

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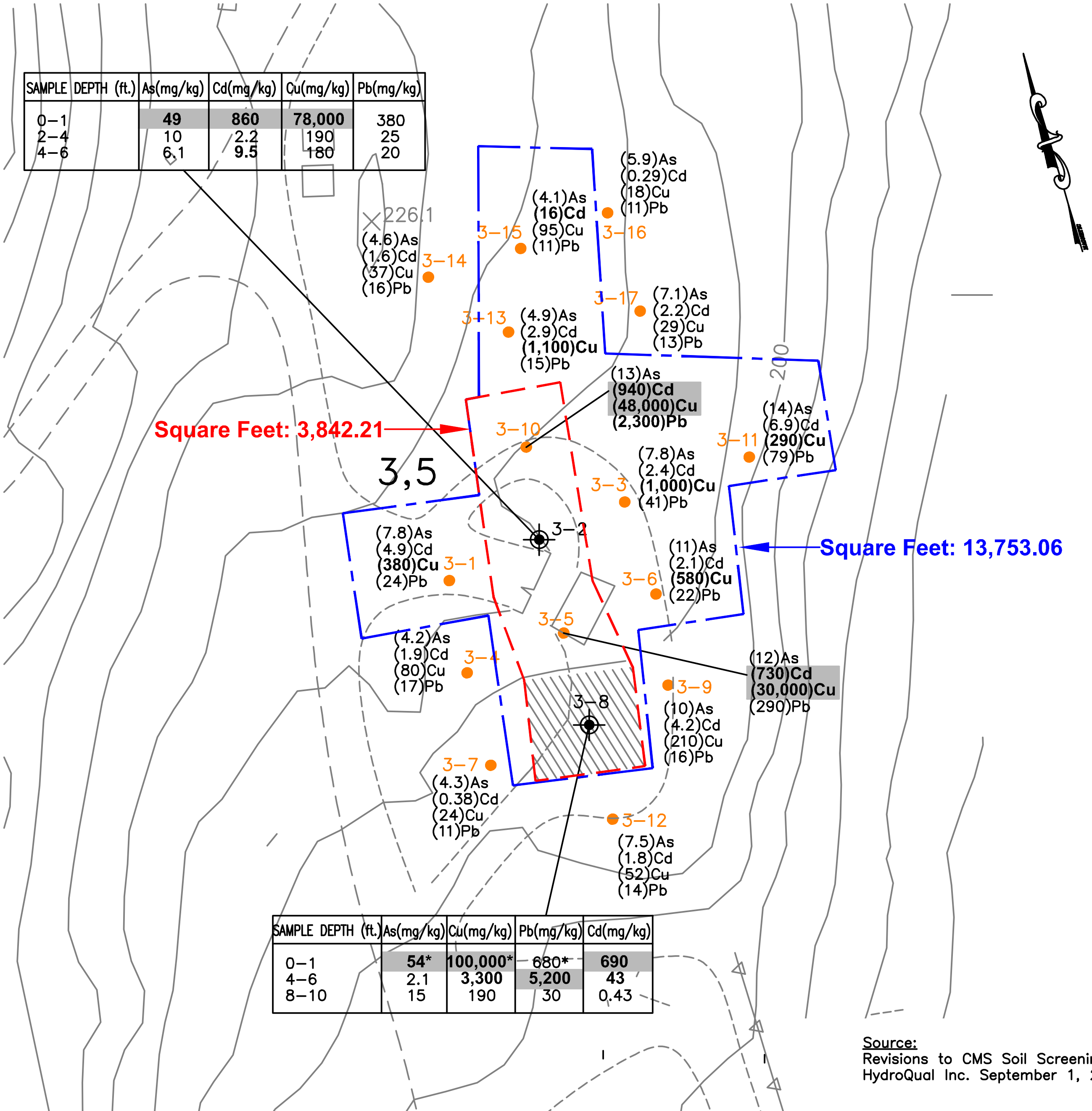
PORT EWEN, NY.

FIGURE 18
COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE DELINEATION
SWMU 2 AND AOC A

Drawn By:	MDO	Date Drawn:	11/16/2012
Reviewed By:	MS	Date Reviewed:	11/2012
Scale:	1" = 50'	Plot Date:	11/2012
Project Number.:			



SAMPLE DEPTH (ft.)	As(mg/kg)	Cd(mg/kg)	Cu(mg/kg)	Pb(mg/kg)
0–1	**49**	**860**	**78,000**	380
2–4	10	2.2	190	25
4–6	6.1	**9.5**	180	20

SAMPLE DEPTH (ft.)	As(mg/kg)	Cu(mg/kg)	Pb(mg/kg)	Cd(mg/kg)
0–1	**54***	**100,000***	680*	**690**
4–6	2.1	**3,300**	**5,200**	**43**
8–10	15	190	30	0.43

LEGEND:

3–16 SHALLOW SOIL SAMPLE LOCATION (0–1 ft.)

3–2 VERTICAL DELINEATION BORING

(16) CONCENTRATION (mg/kg) ABOVE INDUSTRIAL USE SOIL OBJECTIVE

(16) CONCENTRATION (mg/kg) ABOVE COMMERCIAL USE SOIL OBJECTIVE

(1.8) CONCENTRATION (mg/kg) BELOW COMMERCIAL USE SOIL OBJECTIVE

200 GROUND SURFACE CONTOUR

226.1 GROUND SURFACE ELEVATION

APPROXIMATE AREA OF SOIL CONTAINING METALS CONCENTRATIONS ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

APPROXIMATE AREA OF SOIL CONTAINING METALS CONCENTRATIONS ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE

* TWO SAMPLES WERE ANALYZED AT THIS SAMPLE LOCATION. THE CONCENTRATION SHOWN REPRESENTS THE GREATER OF THE TWO SAMPLING RESULTS.

DEPTH OF EXCEEDANCES IS 6 FEET MINIMUM

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Arsenic (As)	16	16
Cadmium (Cd)	9.3	60
Copper (Cu)	270	10,000
Lead (Pb)	1,000	3,900

Source:
Revisions to CMS Soil Screening Criteria
HydroQual Inc. September 1, 2006.

50 0 50
SCALE IN FEET

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Rev.		By:	Date:
Rev.		By:	Date:

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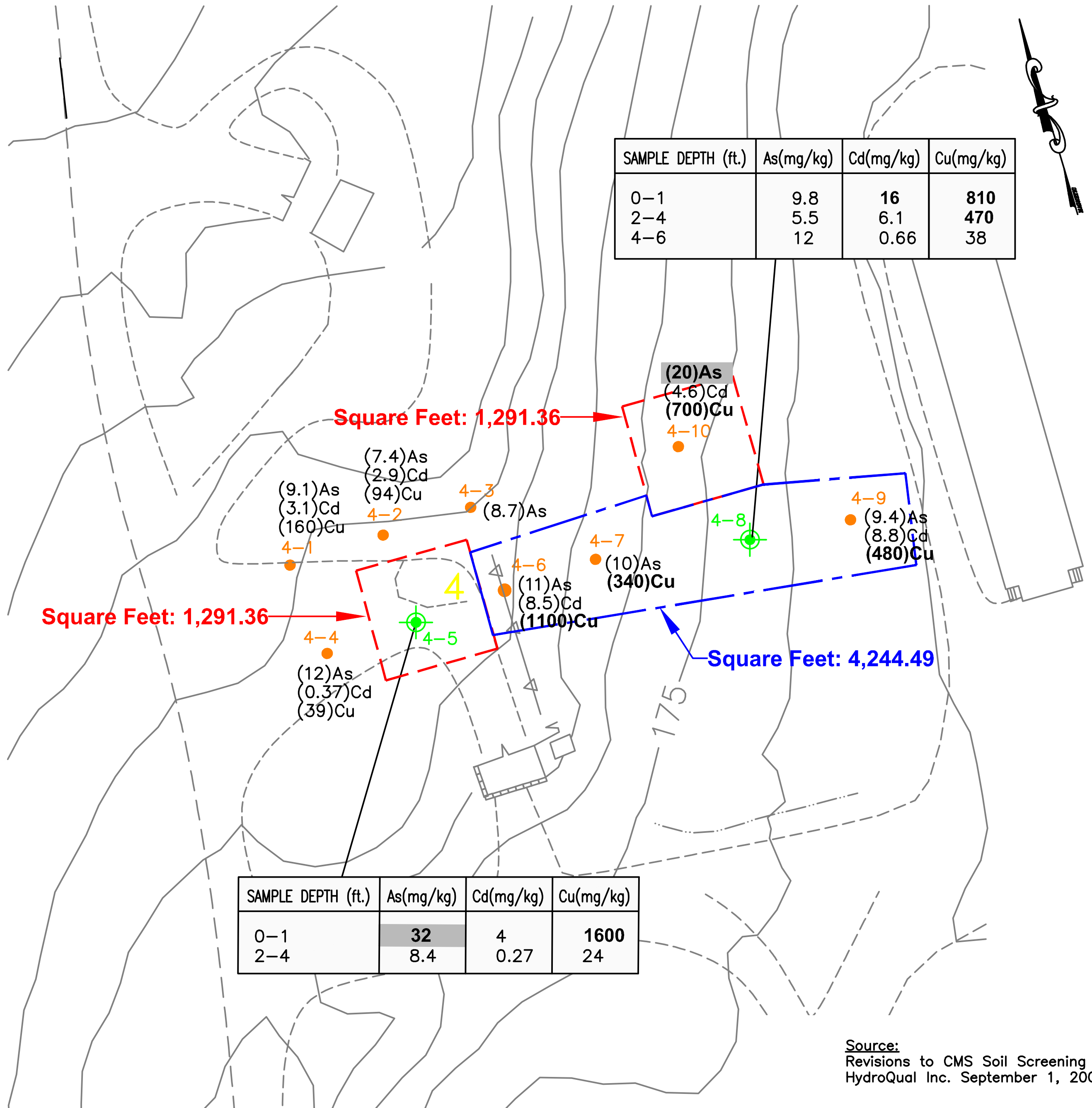
FIGURE 19
COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE DELINEATION:
SWMU 3 AND 5

Drawn By: MDO		Date Drawn:	11/07/2012
Reviewed By: MS		Date Reviewed:	11/2012
Scale: 1" = 50'		Plot Date:	11/2012
Project Number.:			



SAMPLE DEPTH (ft.)	As(mg/kg)	Cd(mg/kg)	Cu(mg/kg)
0-1	9.8	**16**	**810**
2-4	5.5	6.1	**470**
4-6	12	0.66	38

SAMPLE DEPTH (ft.)	As(mg/kg)	Cd(mg/kg)	Cu(mg/kg)
0-1	**32**	4	**1600**
2-4	8.4	0.27	24

LEGEND:

11-1 SHALLOW SOIL SAMPLE LOCATION

11-3 VERTICAL DELINEATION BORING

(12) CONCENTRATION (mg/kg) ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

(12) CONCENTRATION (mg/kg) ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE

(4.9) CONCENTRATION (mg/kg) BELOW COMMERCIAL USE SOIL CLEANUP OBJECTIVE

181.6 GROUND SURFACE ELEVATION

175 GROUND SURFACE CONTOUR

APPROXIMATE AREA OF SOIL CONTAINING METALS CONCENTRATIONS ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

APPROXIMATE AREA OF SOIL CONTAINING METALS CONCENTRATIONS ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Arsenic (As)	16	16
Cadmium (Cd)	9.3	60
Copper (Cu)	270	10,000

Source:
Revisions to CMS Soil Screening Criteria
HydroQual Inc. September 1, 2006.

50 0 50
SCALE IN FEET

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Rev.	By:	Date:
Rev.	By:	Date:

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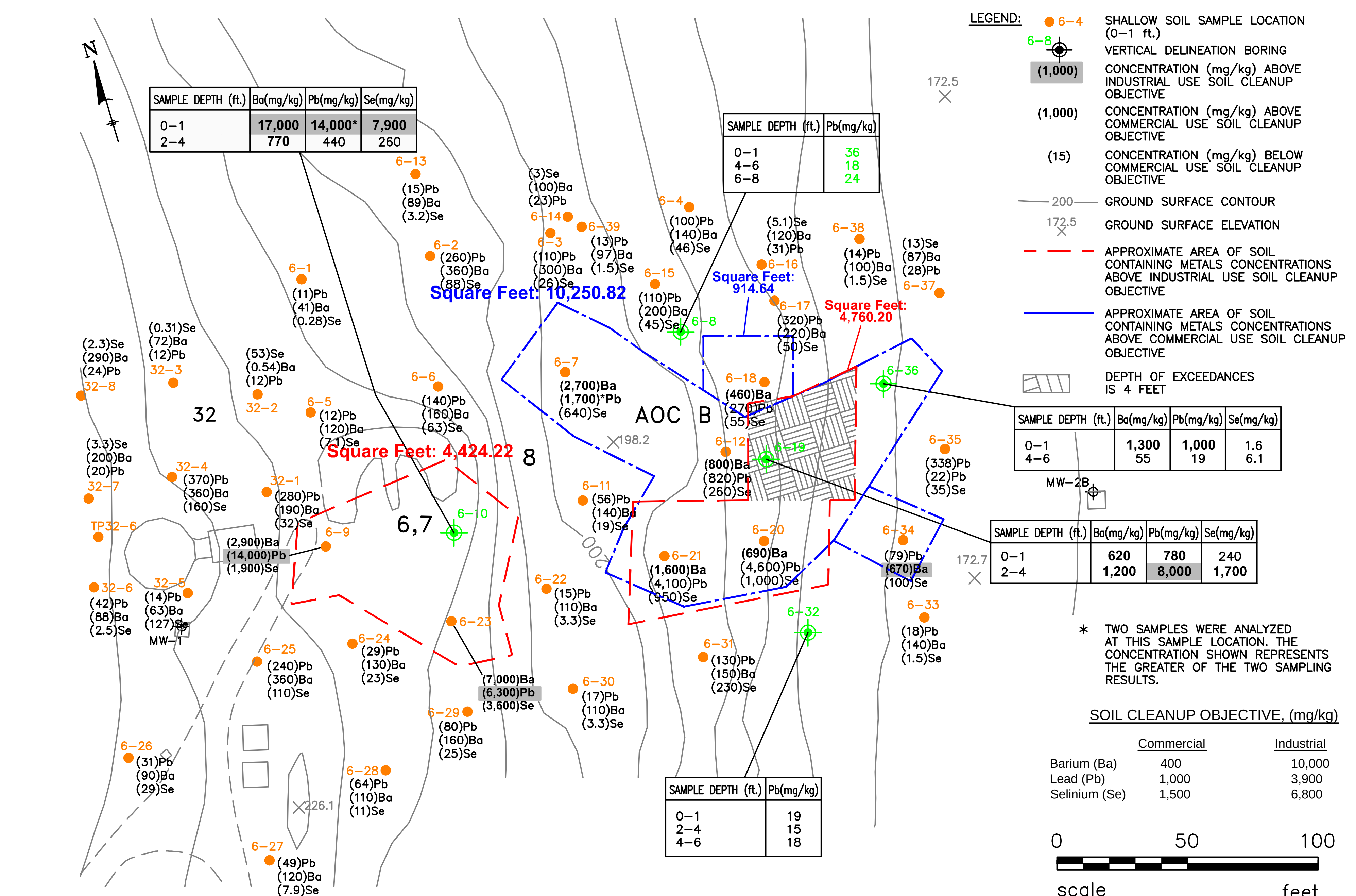
FIGURE 20
COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE DELINEATION
SWMU 4

Drawn By: MDO	Date Drawn: 11/16/2012
Reviewed By: MS	Date Reviewed: 11/2012
Scale: 1" = 50'	Plot Date: 11/2012
Project Number.:	



Source:
Revisions to CMS Soil Screening Criteria
HydroQual Inc. September 1, 2006.

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Rev.	By:	Date:

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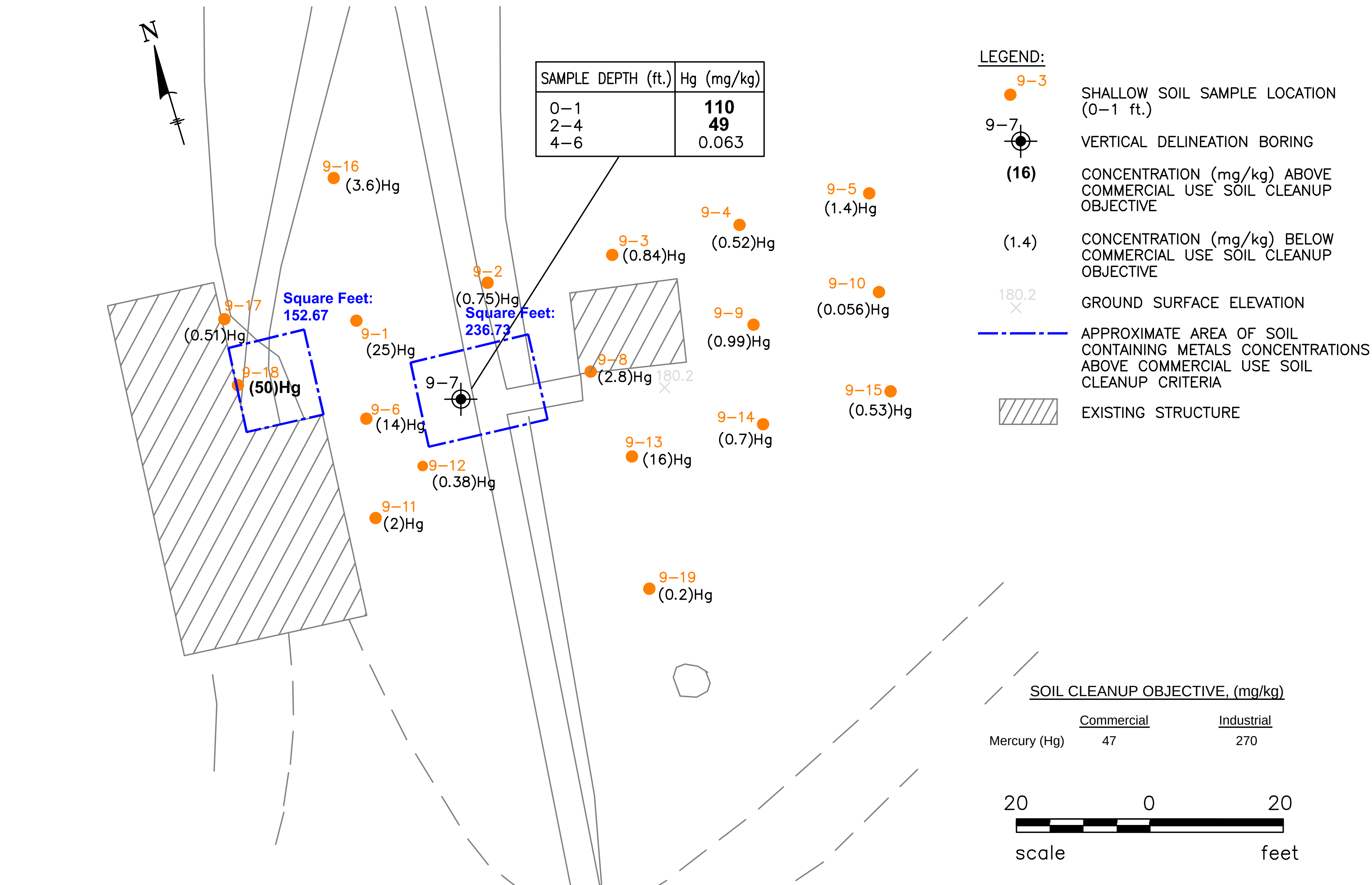
FIGURE 21
COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE DELINEATION
SWMU NOS. 6, 7, 8, 32 & AOC B

Drawn By: MDO	Date Drawn: 11/16/2012
Reviewed By: MS	Date Reviewed: 11/2012
Scale: 1" = 50'	Plot Date: 11/2012
Project Number.:	



Source:
Revisions to CMS Soil Screening Criteria
HydroQual Inc. September 1, 2006.

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Rev.	By:	Date:

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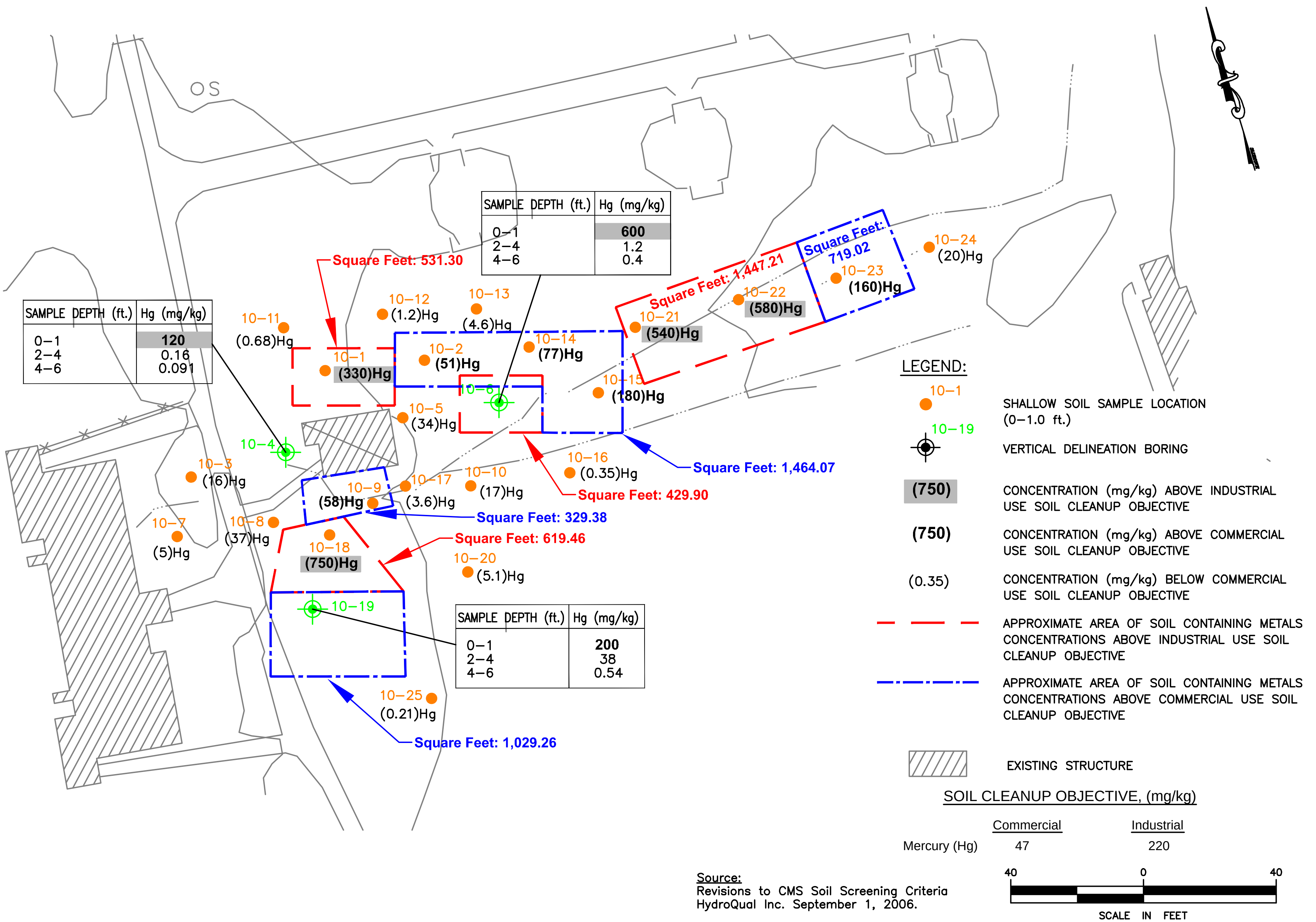
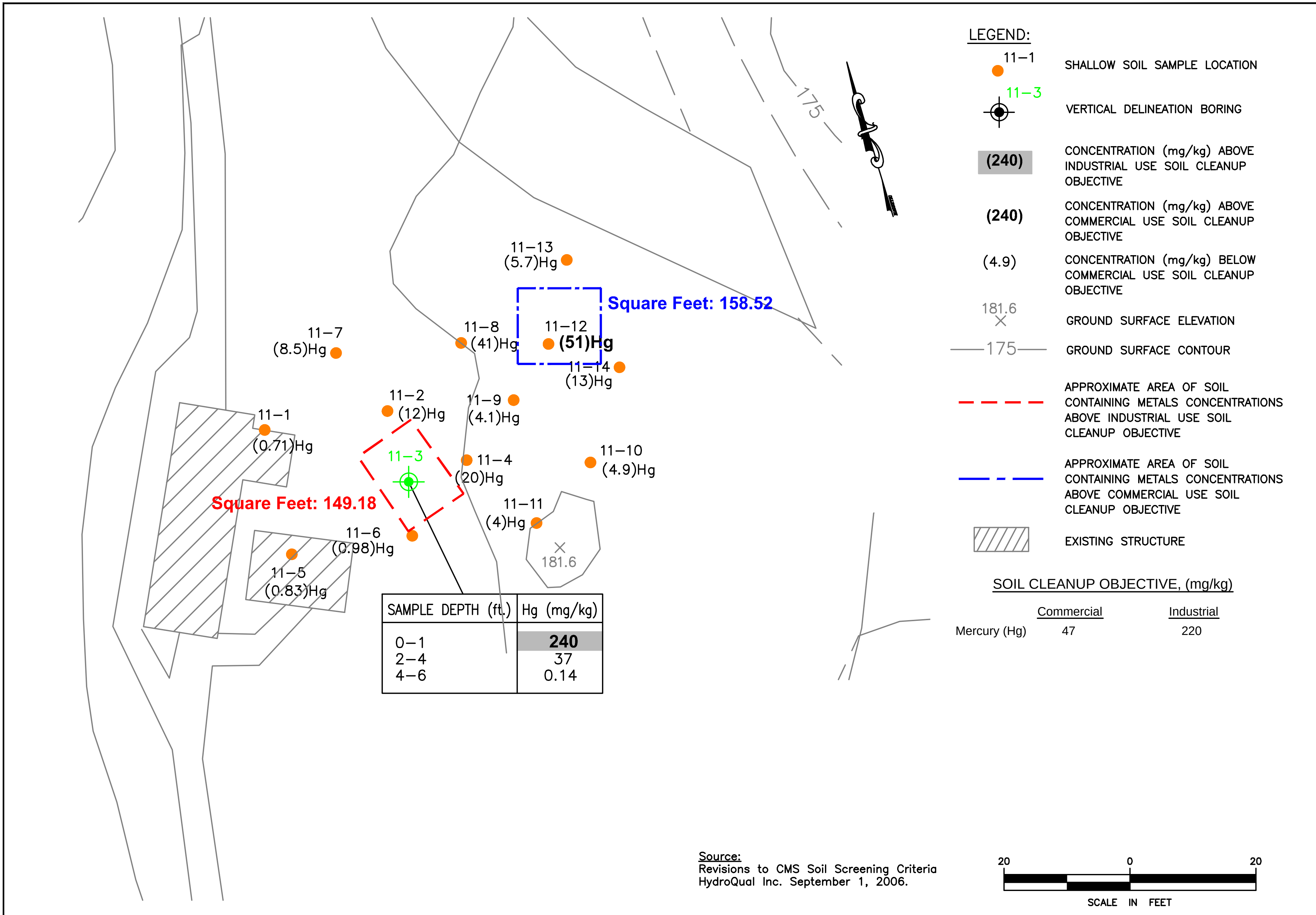
FIGURE 22
COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE DELINEATION:
SWMU 9

Drawn By:	MDO	Date Drawn:	11/16/2012
Reviewed By:	MS	Date Reviewed:	11/2012
Scale:	1" = 50'	Plot Date:	11/2012
Project Number.:			



EHS Support consider it done	REVISIONS	DYNO-NOBEL, INC. PORT EWEN, NY.	**FIGURE 23** COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE DELINEATION: SWMU 10	Drawn By: MDO	Date Drawn: 11/16/2012
	Rev. By: Date:			Reviewed By: MS	Date Reviewed: 11/2012
	Rev. By: Date:			Scale: 1" = 40'	Plot Date: 11/2012
	Rev. By: Date:			Project Number.:	
	Rev. By: Date:				



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Rev.	By:	Date:
Rev.	By:	Date:

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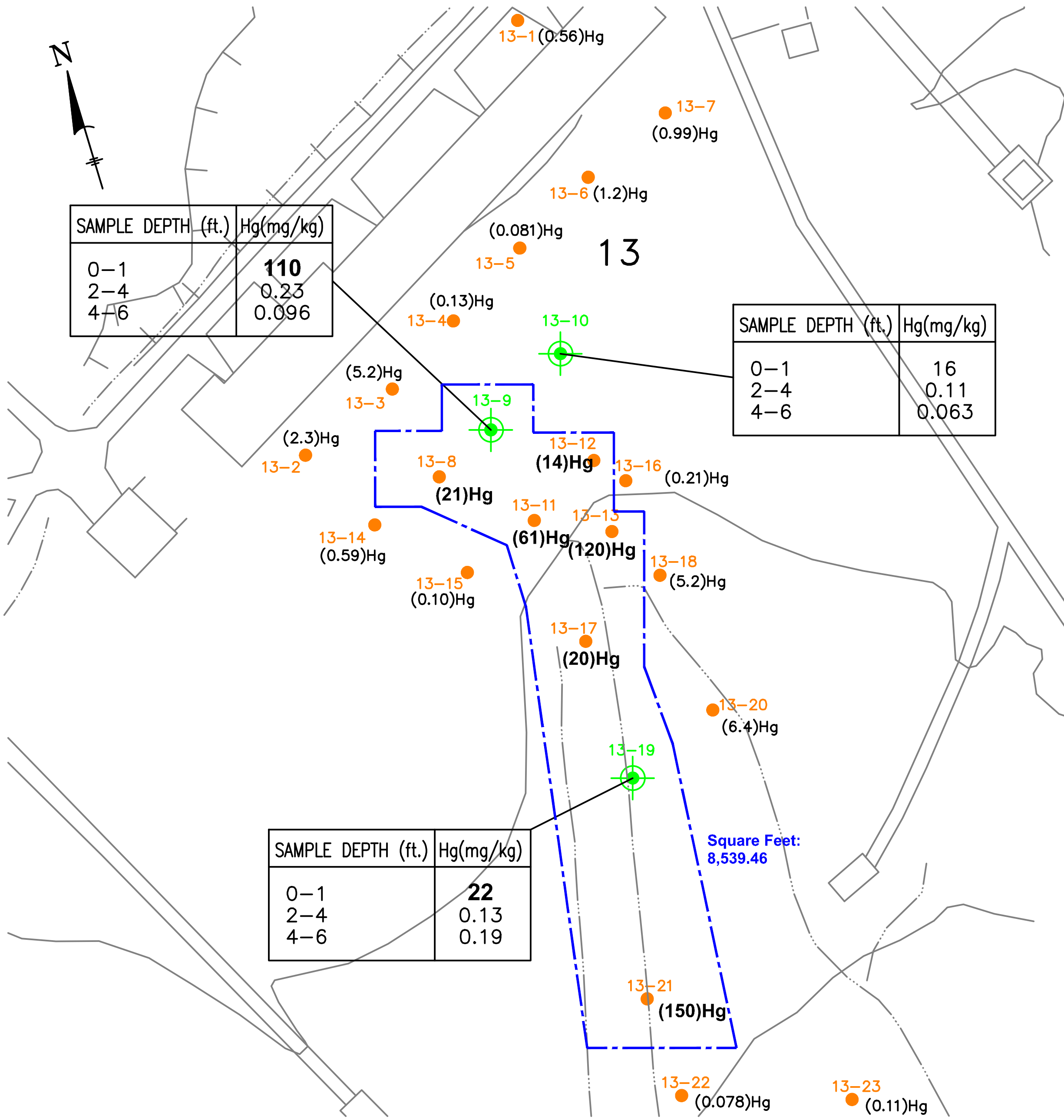
FIGURE 24
COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE DELINEATION: SWMU 11

Drawn By: MDO		Date Drawn:	11/16/2012
Reviewed By: MS		Date Reviewed:	11/2012
Scale: 1" = 20'		Plot Date:	11/2012
Project Number.:			



SAMPLE DEPTH (ft.)	Hg(mg/kg)
0–1	**110**
2–4	0.23
4–6	0.096

SAMPLE DEPTH (ft.)	Hg(mg/kg)
0–1	16
2–4	0.11
4–6	0.063

SAMPLE DEPTH (ft.)	Hg(mg/kg)
0–1	**22**
2–4	0.13
4–6	0.19

LEGEND:

- 13–3 ● SHALLOW SOIL SAMPLE LOCATION (0–1 ft.)
- 13–9 ⊕ VERTICAL DELINEATION BORING
- **(110)** CONCENTRATION (mg/kg) ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE
- (1.2) CONCENTRATION (mg/kg) BELOW COMMERCIAL USE SOIL CLEANUP OBJECTIVE
- — · — APPROXIMATE AREA OF SOIL CONTAINING METALS CONCENTRATIONS ABOVE COMMERCIAL USE SOIL CLEANUP CRITERIA

NOTE:

1. THE UNRESTRICTED USE SOIL CLEANUP CRITERION FOR Hg IS 10 mg/kg.

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Mercury (Hg)	47	270

Source:
Revisions to CMS Soil Screening Criteria
HydroQual Inc. September 1, 2006.

0 50 100
scale feet

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Rev.	By:	Date:

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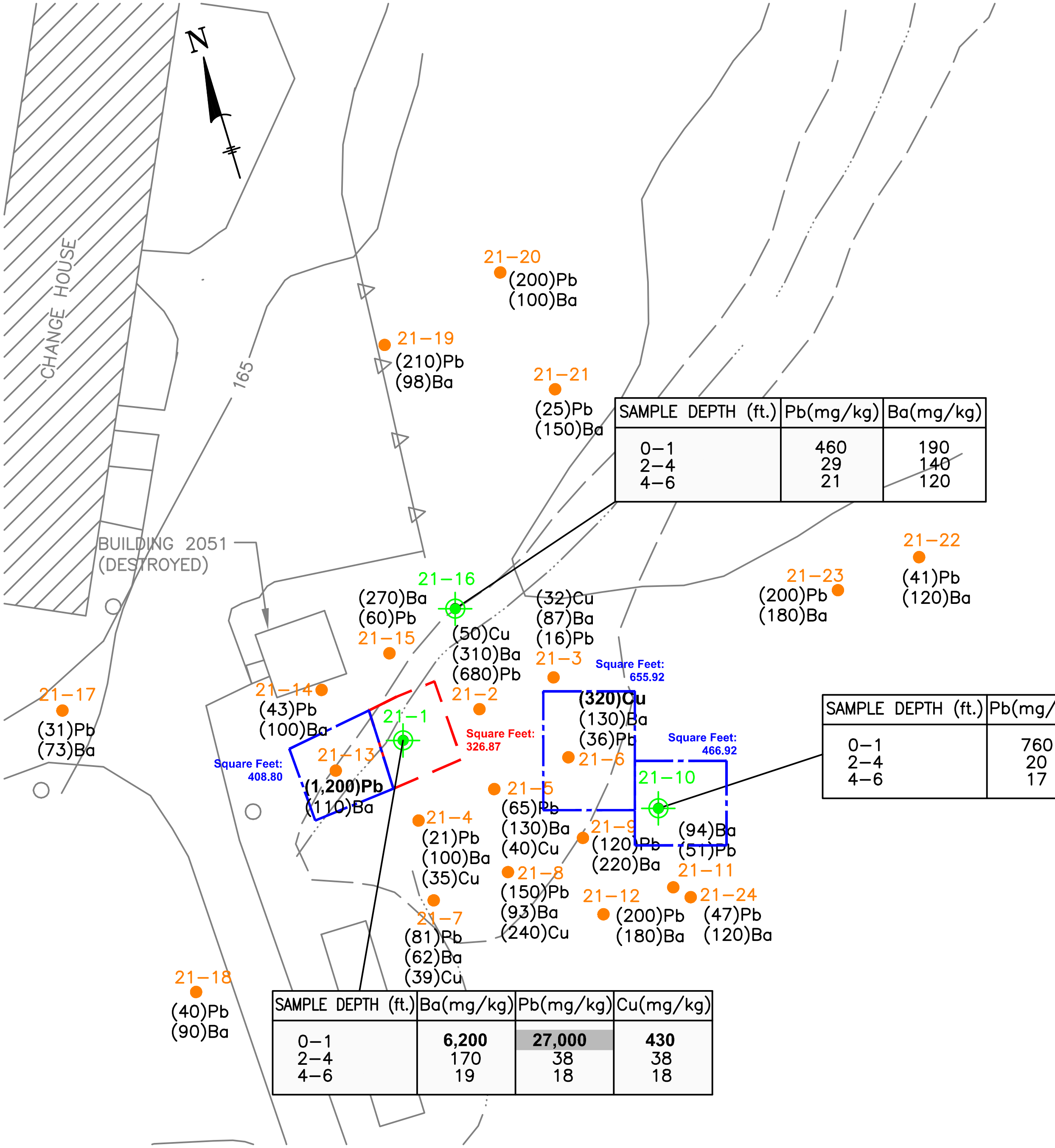
FIGURE 25
COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE DELINEATION: SWMU 13

Drawn By:	MDO	Date Drawn:	11/16/2012
Reviewed By:	MS	Date Reviewed:	11/2012
Scale:	1" = 50'	Plot Date:	11/2012
Project Number.:			



SAMPLE DEPTH (ft.)	Pb(mg/kg)	Ba(mg/kg)
0–1	460	190
2–4	29	140
4–6	21	120

SAMPLE DEPTH (ft.)	Pb(mg/kg)	Ba(mg/kg)
0–1	760	**680**
2–4	20	81
4–6	17	130

SAMPLE DEPTH (ft.)	Ba(mg/kg)	Pb(mg/kg)	Cu(mg/kg)
0–1	**6,200**	**27,000**	**430**
2–4	170	38	38
4–6	19	18	18

LEGEND:

21–21 SHALLOW SOIL SAMPLE LOCATION (0–1.0 ft.)

21–16 VERTICAL DELINEATION BORING

(2,700) CONCENTRATION (mg/kg) ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

(2,700) CONCENTRATION (mg/kg) ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE

(210) CONCENTRATION (mg/kg) BELOW COMMERCIAL USE SOIL CLEANUP OBJECTIVE

APPROXIMATE AREA OF SOIL CONTAINING METALS CONCENTRATIONS ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVES

APPROXIMATE AREA OF SOIL CONTAINING METALS CONCENTRATIONS ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVES

165 GROUND SURFACE CONTOUR

EXISTING STRUCTURE

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Barium (Ba)	400	10,000
Copper (Cu)	270	10,000
Lead (Pb)	1,000	3,900

Source:
Revisions to CMS Soil Screening Criteria
HydroQual Inc. September 1, 2006.

40 0 40
scale feet

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Rev.	By:	Date:

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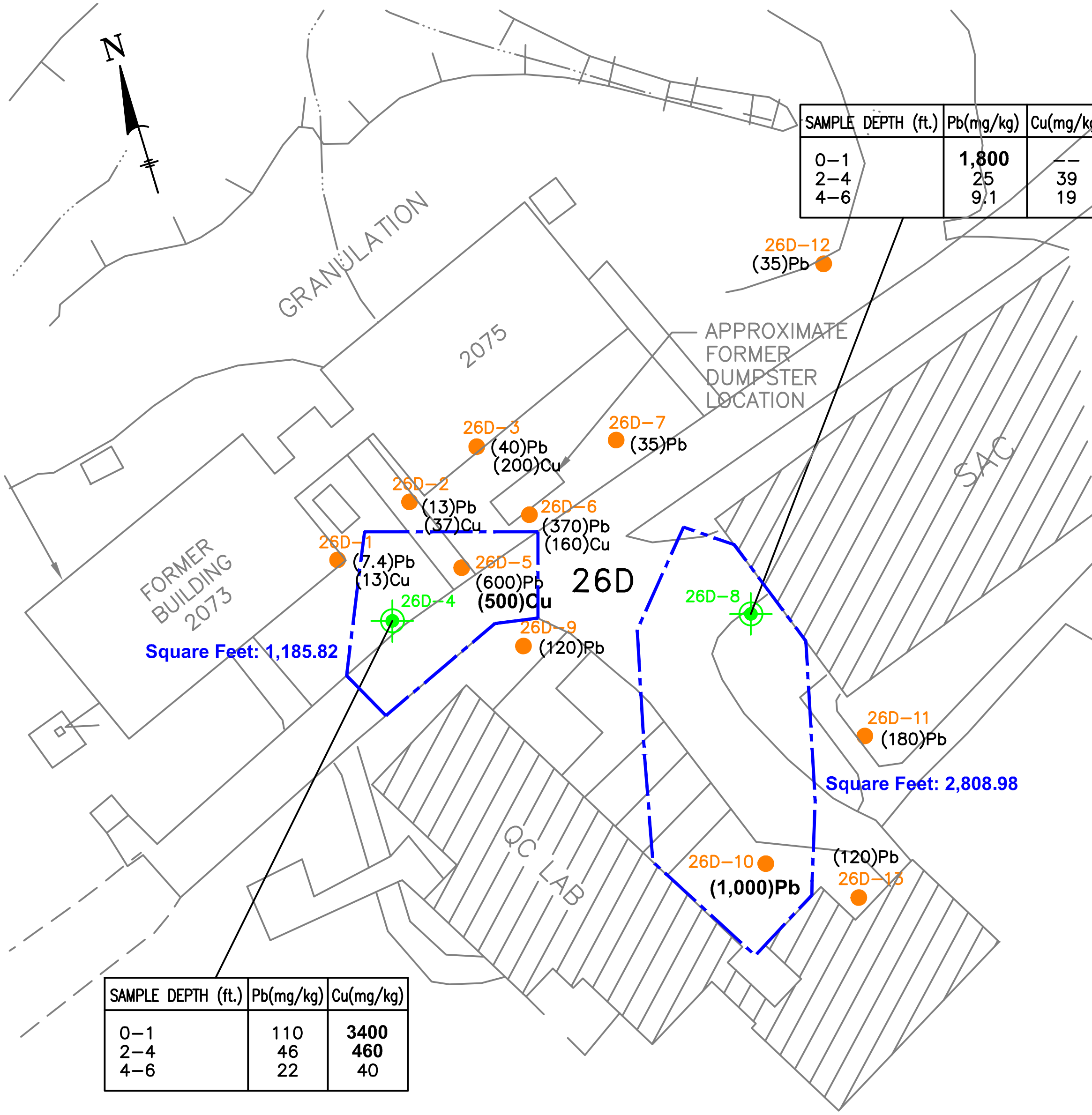
FIGURE 26
COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE DELINEATION: SWMU 21

Drawn By: MDO		Date Drawn:	11/16/2012
Reviewed By: MS		Date Reviewed:	11/2012
Scale:	1" = 40'	Plot Date:	11/2012
Project Number.:			



SAMPLE DEPTH (ft.)	Pb(mg/kg)	Cu(mg/kg)
0–1	**1,800**	--
2–4	25	39
4–6	9.1	19

SAMPLE DEPTH (ft.)	Pb(mg/kg)	Cu(mg/kg)
0–1	110	**3400**
2–4	46	**460**
4–6	22	40

LEGEND:

- 26D-12 — SHALLOW SOIL SAMPLE LOCATION (0–1 ft.)
- 26D-8 — VERTICAL DELINEATION BORING
- **(1,800)** — CONCENTRATION (mg/kg) ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE
- (7.4) — CONCENTRATION (mg/kg) BELOW COMMERCIAL USE SOIL CLEANUP OBJECTIVE
- APPROXIMATE AREA OF SOIL CONTAINING METALS CONCENTRATIONS ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE
- EXISTING STRUCTURE

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Lead (Pb)	1,000	3,900
Copper (Cu)	270	10,000

Source:
Revisions to CMS Soil Screening Criteria
HydroQual Inc. September 1, 2006.

40 0 40
scale feet

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Rev.	By:	Date:

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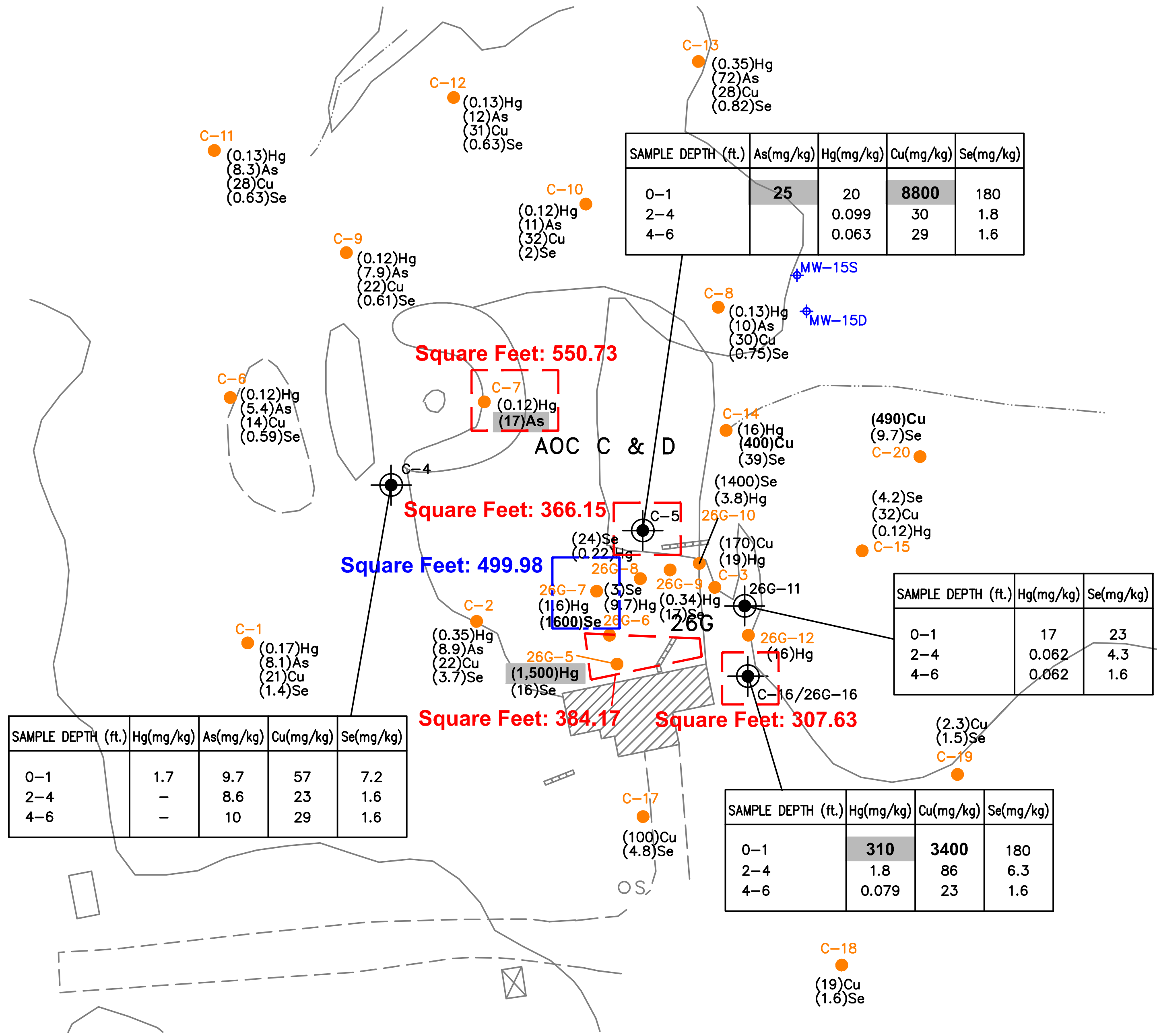
FIGURE 27
COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE DELINEATION:
SWMU 26D

Drawn By:	MDO	Date Drawn:	11/16/2012
Reviewed By:	MS	Date Reviewed:	11/2012
Scale:	1" = 40'	Plot Date:	11/2012
Project Number.:			



SAMPLE DEPTH (ft.)	As(mg/kg)	Hg(mg/kg)	Cu(mg/kg)	Se(mg/kg)
0–1	25	20	8800	180
2–4		0.099	30	1.8
4–6		0.063	29	1.6

SAMPLE DEPTH (ft.)	Hg(mg/kg)	Se(mg/kg)
0–1	17	23
2–4	0.062	4.3
4–6	0.062	1.6

SAMPLE DEPTH (ft.)	Hg(mg/kg)	As(mg/kg)	Cu(mg/kg)	Se(mg/kg)
0–1	1.7	9.7	57	7.2
2–4	–	8.6	23	1.6
4–6	–	10	29	1.6

SAMPLE DEPTH (ft.)	Hg(mg/kg)	Cu(mg/kg)	Se(mg/kg)
0–1	310	3400	180
2–4	1.8	86	6.3
4–6	0.079	23	1.6

LEGEND:

C-8 — SHALLOW SOIL SAMPLE LOCATION (0–1 ft.)

26G-11 — VERTICAL DELINEATION BORING

(15,000) — CONCENTRATION (mg/kg) ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

(15,000) — CONCENTRATION (mg/kg) ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE

(1.4) — CONCENTRATION (mg/kg) BELOW COMMERCIAL USE SOIL CLEANUP OBJECTIVE

APPROXIMATE AREA OF SOIL CONTAINING METALS CONCENTRATIONS ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

APPROXIMATE AREA OF SOIL CONTAINING METALS CONCENTRATIONS ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Copper (Cu)	270	10,000
Mercury (Hg)	47	220
Selenium (Se)	1,500	6,800
Arsenic (As)	16	16

Source:
Revisions to CMS Soil Screening Criteria
HydroQual Inc. September 1, 2006.

50 0 50
SCALE IN FEET

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Rev.	By:	Date:
Rev.	By:	Date:

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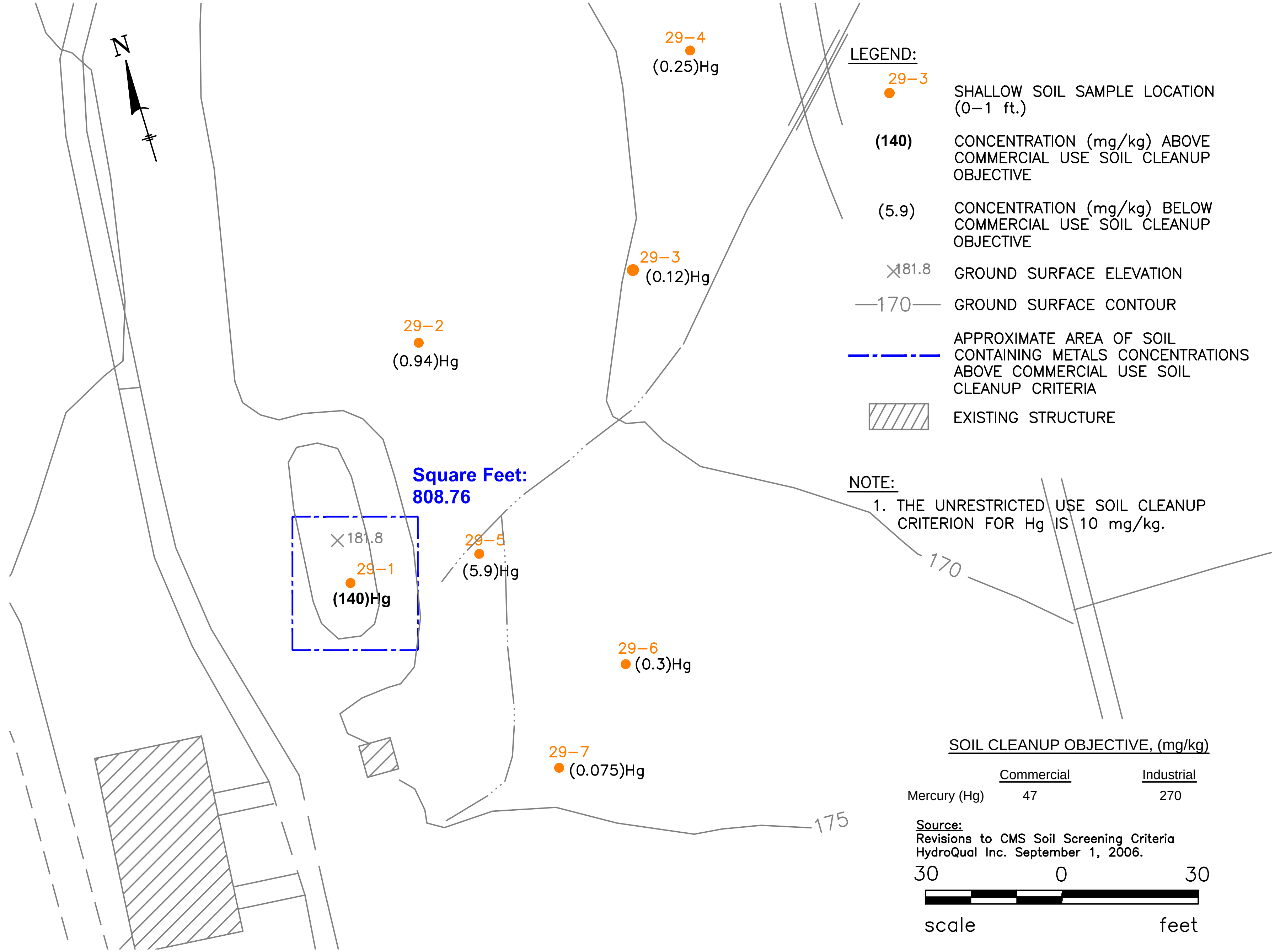
FIGURE 28
COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE DELINEATION
SWMU 26G AND AOC C AND D

Drawn By: MDO		Date Drawn:	11/16/2012
Reviewed By: MS		Date Reviewed:	11/2012
Scale:	1" = 50'	Plot Date:	11/2012
Project Number.:			



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Rev.		By:	Date:
Rev.		By:	Date:

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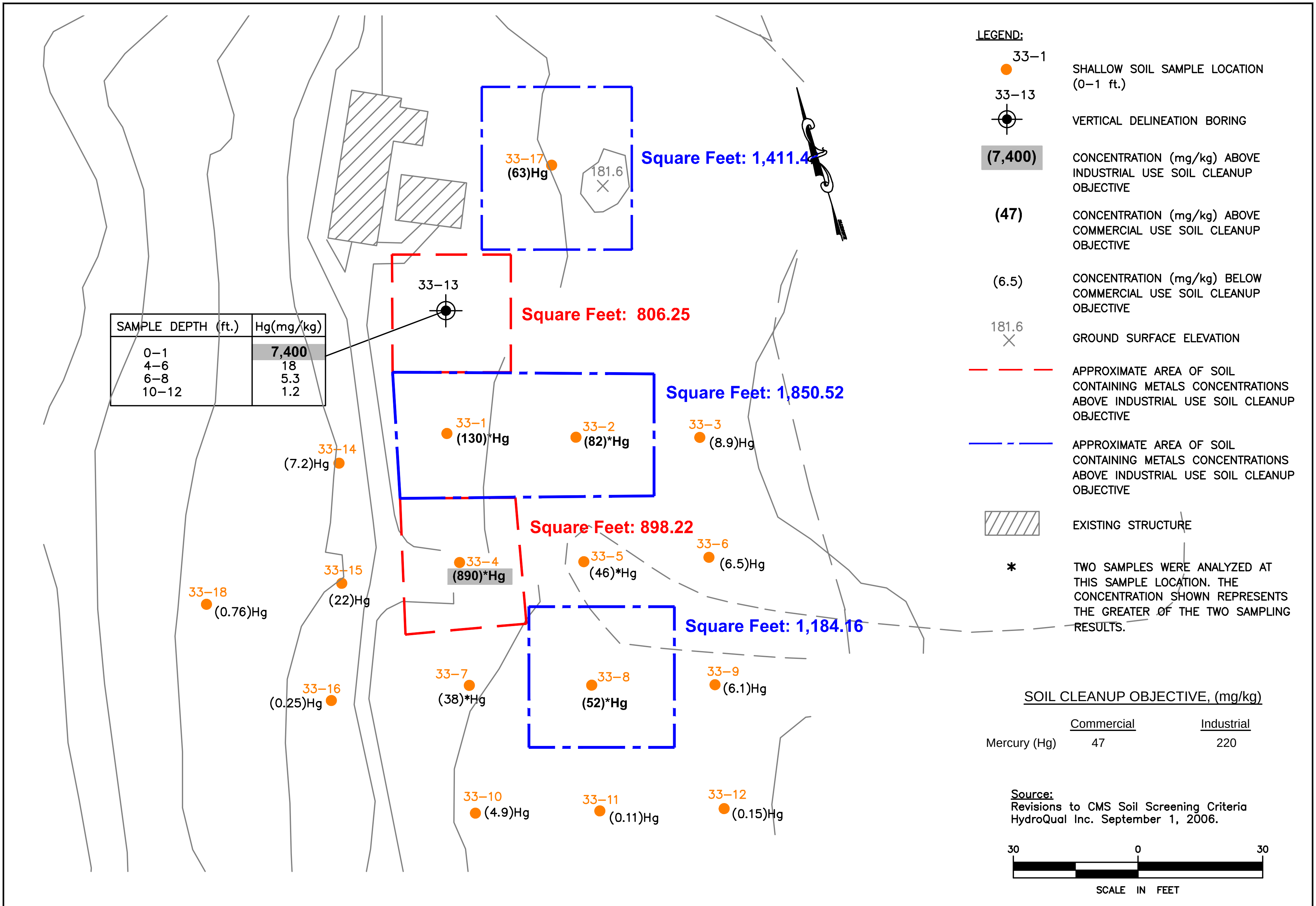
FIGURE 29
COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE DELINEATION: SWMU 29

Drawn By: MDO		Date Drawn:	11/16/2012
Reviewed By: MS		Date Reviewed:	11/2012
Scale:	1" = 50'	Plot Date:	11/2012
Project Number.:			



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Rev.	By:	Date:
Rev.	By:	Date:

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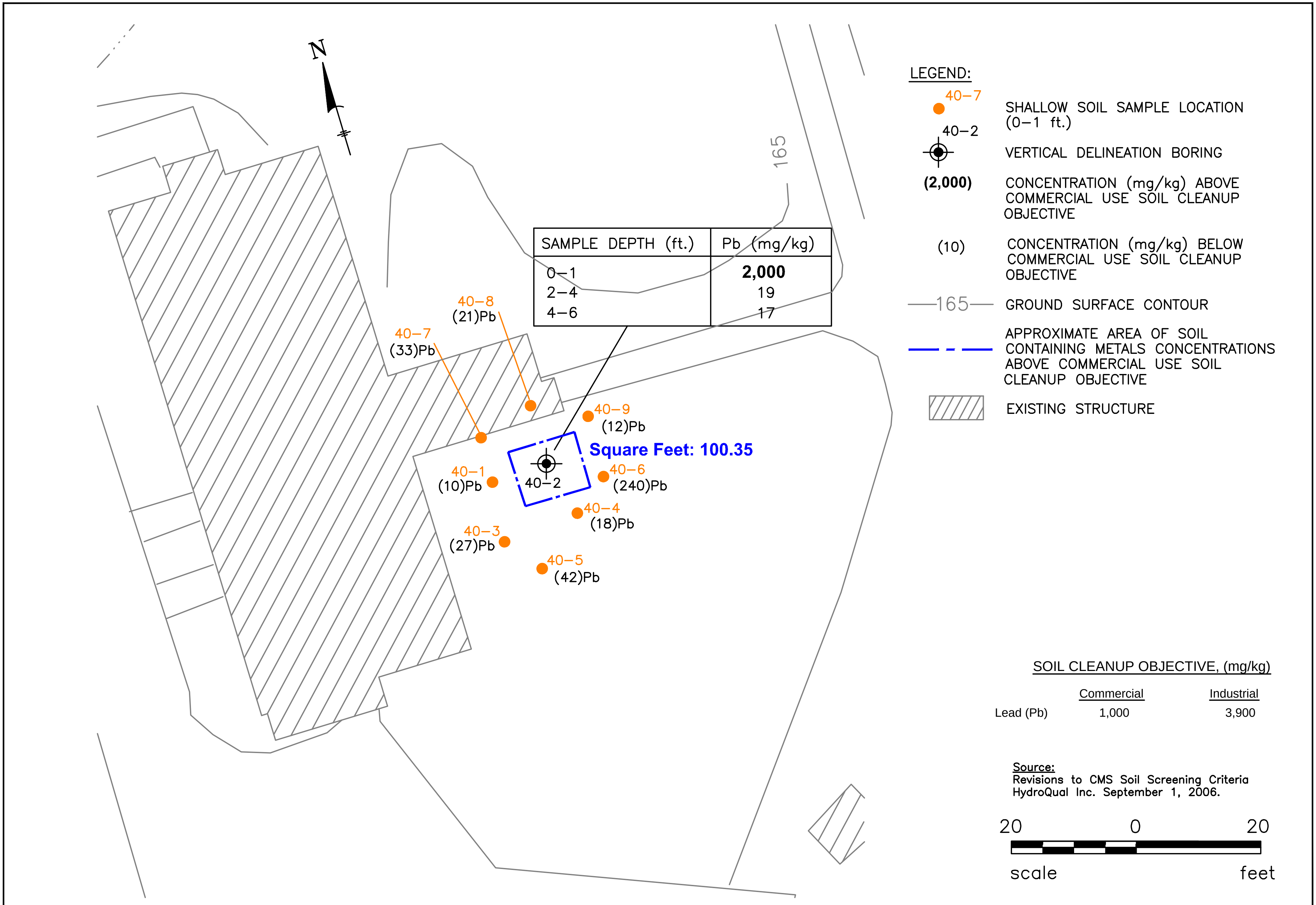
FIGURE 30
COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE DELINEATION: SWMU 33

Drawn By:	MDO	Date Drawn:	11/16/2012
Reviewed By:	MS	Date Reviewed:	11/2012
Scale:	1" = 30'	Plot Date:	11/2012
Project Number.:			



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Rev.	By:	Date:
Rev.	By:	Date:

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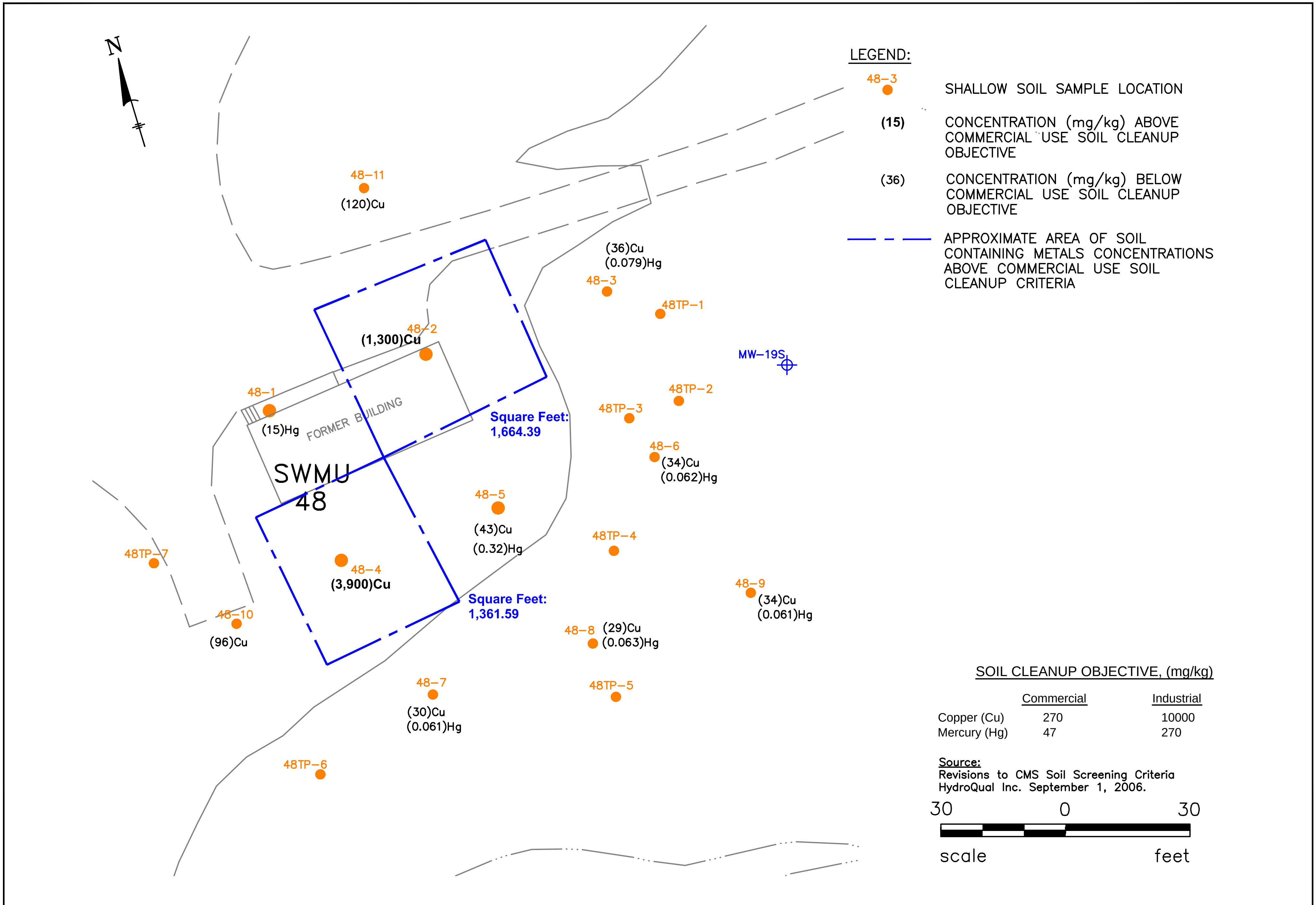
FIGURE 31
COMMERCIAL USE SOIL CLEANUP OBJECTIVE DELINEATION
SWMU 40

Drawn By:	MDO	Date Drawn:	11/16/2012
Reviewed By:	MS	Date Reviewed:	11/2012
Scale:	1" = 20'	Plot Date:	11/2012
Project Number.:			



EHS Support
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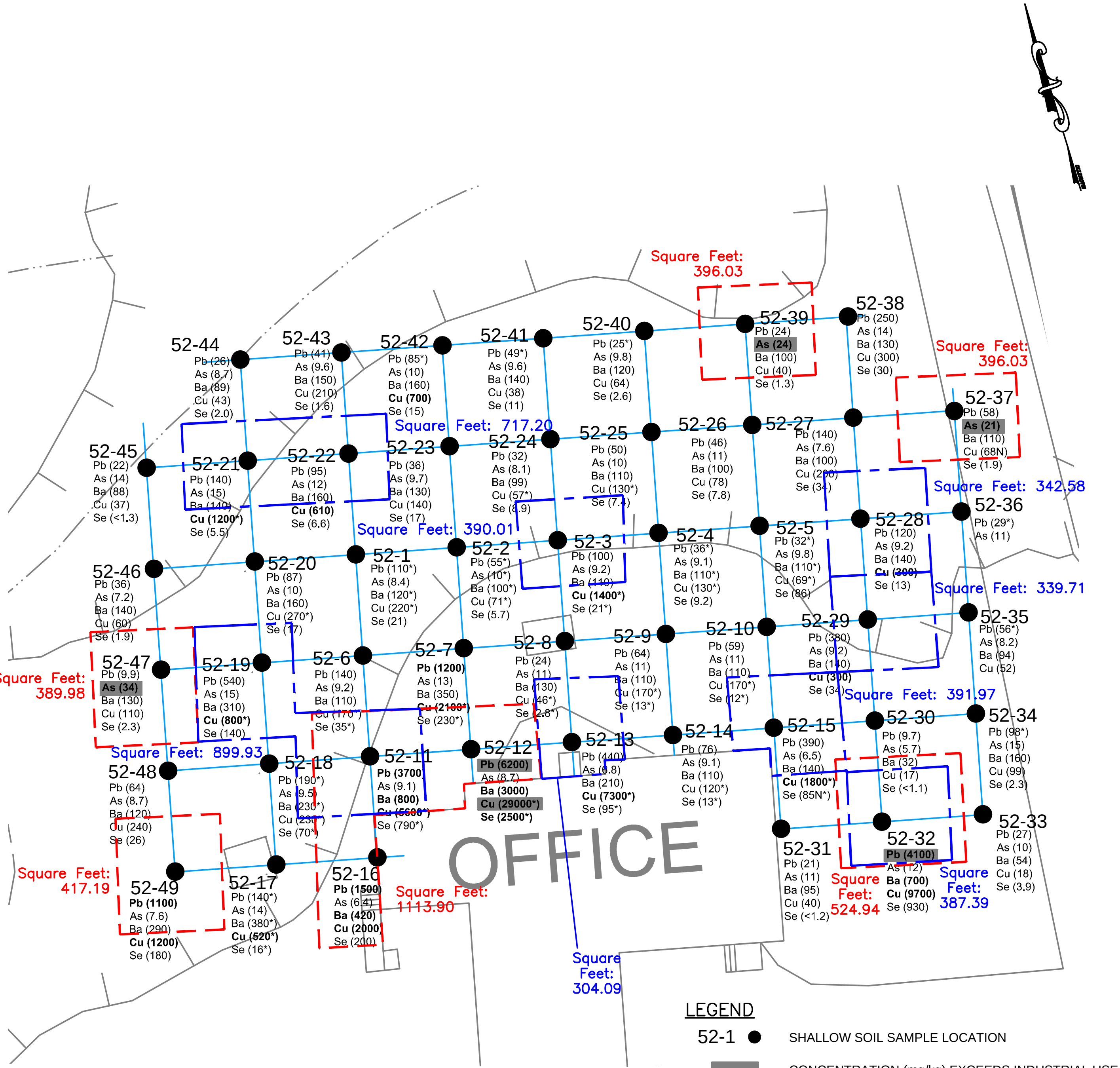
REVISIONS			
Rev.		By:	Date:
Rev.		By:	Date:
Rev.		By:	Date:
Rev.		By:	Date:

DYNO-NOBEL, INC.
PORT EWEN, NY.

FIGURE 32
COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE DELINEATION:
SWMU 48

Drawn By:	MDO	Date Drawn:	11/16/2012
Reviewed By:	MS	Date Reviewed:	11/2012
Scale:	1" = 50'	Plot Date:	11/2012
Project Number.:			



LEGEND

52-1 ● SHALLOW SOIL SAMPLE LOCATION

CONCENTRATION (mg/kg) EXCEEDS INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

(420) CONCENTRATION (mg/kg) EXCEEDS COMMERCIAL USE SOIL CLEANUP OBJECTIVE

(6.9) CONCENTRATION (mg/kg) BELOW COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

GROUND SURFACE CONTOUR

APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Arsenic (As)	16	16
Lead (Pb)	1,000	3,900
Barium (Ba)	400	10,000
Copper (Cu)	270	10,000
Selinium (Se)	1,500	6,800

NOTES:

1. mg/kg = MILLIGRAMS PER KILOGRAM
2. * DENOTES A DUPLICATE SAMPLE. THE HIGHER CONCENTRATION IS SHOWN.

SOURCE:
REVISION TO CMS SOIL SCREENING CRITERIA
DYNO NOBEL SITE, PORT EWEN, NEW YORK
HYDROQUAL INC., SEPTEMBER 1, 2006.

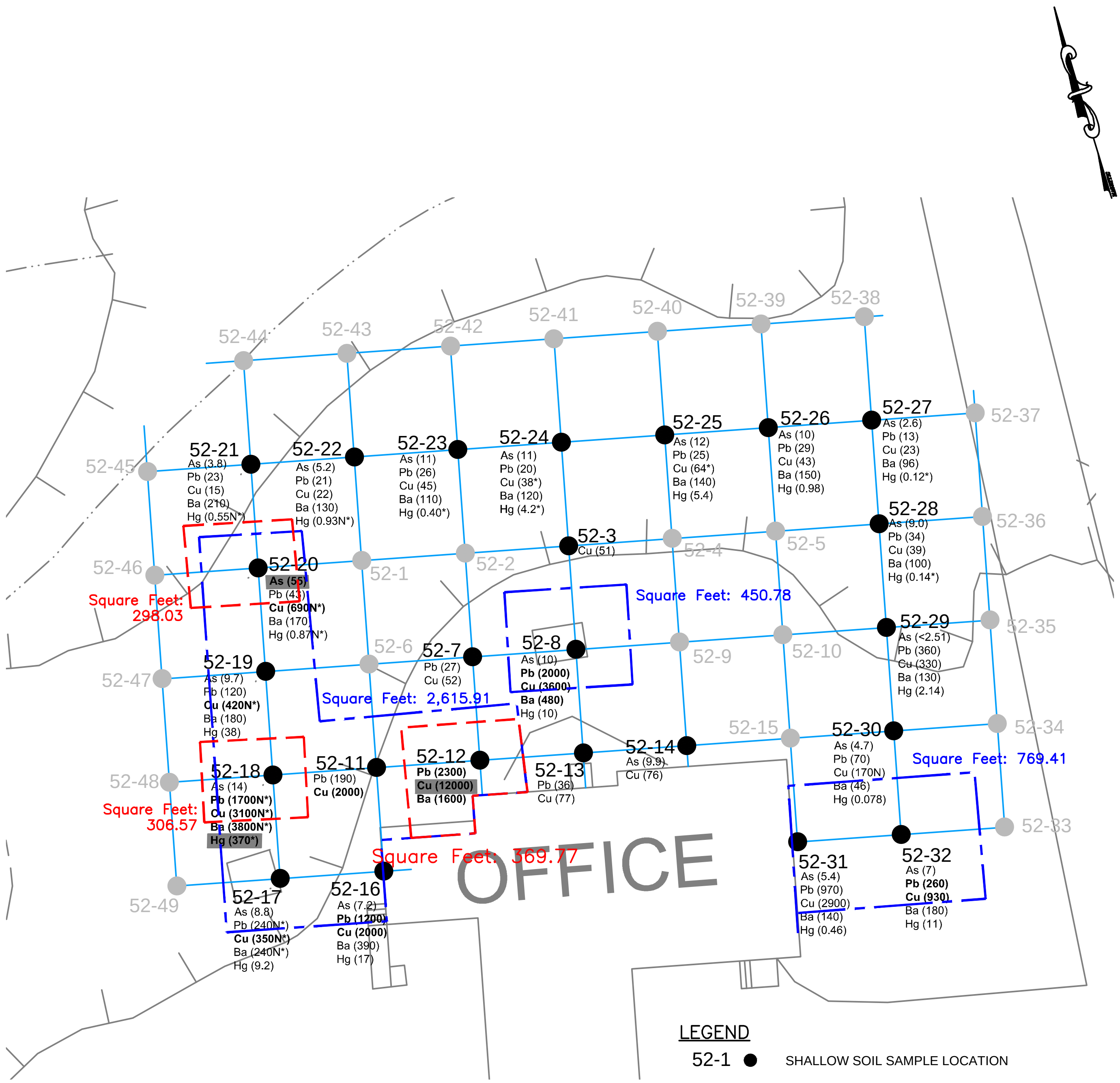
30 0 30
SCALE IN FEET

EHS Support *consider it done*

DYNO-NOBEL, INC.
PORT EWEN, NY.

FIGURE 33
COMMERCIAL AND INDUSTRIAL USE
SOIL CLEANUP OBJECTIVE DELINEATION
SWMU 52: 0-1' INTERVAL

Drawn By: MDO	Date Drawn: 08/21/12
Reviewed By: MB	Date Reviewed: 08/2012
Scale: 1" = 30'	Plot Date: 08/2012
Project Number.:	



LEGEND

52-1 ●	SHALLOW SOIL SAMPLE LOCATION
(37.5)	CONCENTRATION (mg/kg) EXCEEDS INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
(420)	CONCENTRATION (mg/kg) EXCEEDS COMMERCIAL USE SOIL CLEANUP OBJECTIVE
(6.9)	CONCENTRATION (mg/kg) BELOW COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
	GROUND SURFACE CONTOUR
	APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS EXCEEDING INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
	APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS EXCEEDING COMMERCIAL USE SOIL CLEANUP OBJECTIVE

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Arsenic (As)	16	16
Lead (Pb)	1,000	3,900
Copper (Cu)	270	10,000
Barium (Ba)	400	10,000
Mercury (Hg)	47	220

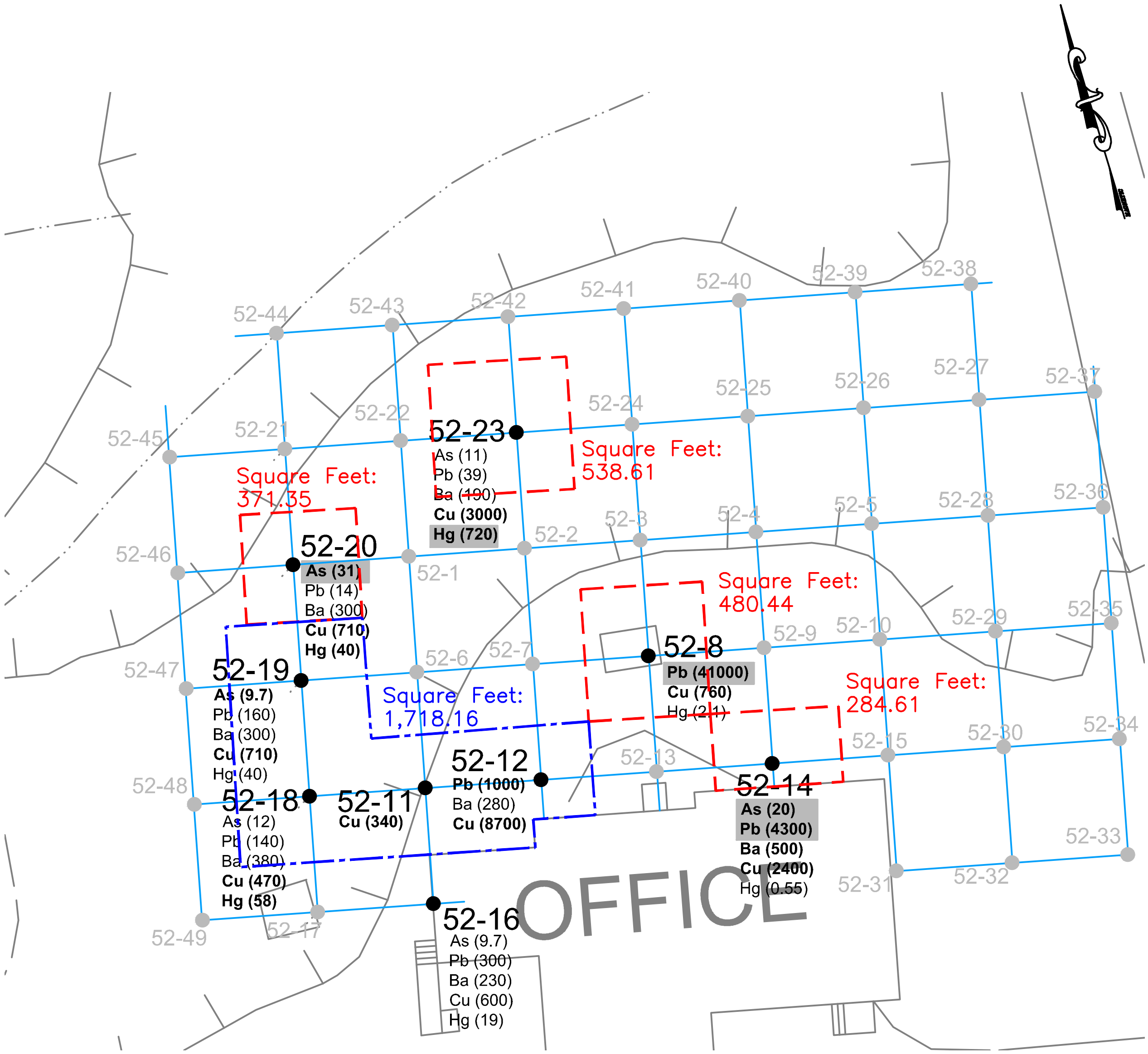
SOURCE:
REVISION TO CMS SOIL SCREENING CRITERIA
DYNO NOBEL SITE, PORT EWEN, NEW YORK
HYDROQUAL INC., SEPTEMBER 1, 2006.

NOTES:

1. mg/kg = MILLIGRAMS PER KILOGRAM
2. * DENOTES A DUPLICATE SAMPLE. THE HIGHER CONCENTRATION IS SHOWN.

30 0 30
SCALE IN FEET

EHS Support consider it done	DYNO-NOBEL, INC. PORT EWEN, NY.	**FIGURE 34** COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE DELINEATION SWMU 52: 1-2' INTERVAL	Drawn By: MDO	Date Drawn: 08/21/12
			Reviewed By: MB	Date Reviewed: 08/2012
			Scale: 1" = 30'	Plot Date: 08/2012
			Project Number.:	



LEGEND

52-20 ●	SHALLOW SOIL SAMPLE LOCATION
(20.0)	CONCENTRATION (mg/kg) EXCEEDS INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
(340)	CONCENTRATION (mg/kg) EXCEEDS COMMERCIAL USE SOIL CLEANUP OBJECTIVE
(9.7)	CONCENTRATION (mg/kg) BELOW COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
	GROUND SURFACE CONTOUR
	APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS EXCEEDING INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
	APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS EXCEEDING COMMERCIAL USE SOIL CLEANUP OBJECTIVE

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Arsenic (As)	16	16
Barium (Ba)	400	10,000
Copper (Cu)	270	10,000
Mercury (Hg)	47	220
Lead (Pb)	1,000	3,900

NOTES:

1. mg/kg = MILLIGRAMS PER KILOGRAM
2. * DENOTES A DUPLICATE SAMPLE. THE HIGHER CONCENTRATION IS SHOWN.

SOURCE:
REVISION TO CMS SOIL SCREENING CRITERIA
DYNO NOBEL SITE, PORT EWEN, NEW YORK
HYDROQUAL INC., SEPTEMBER 1, 2006.

30 0 30
SCALE IN FEET

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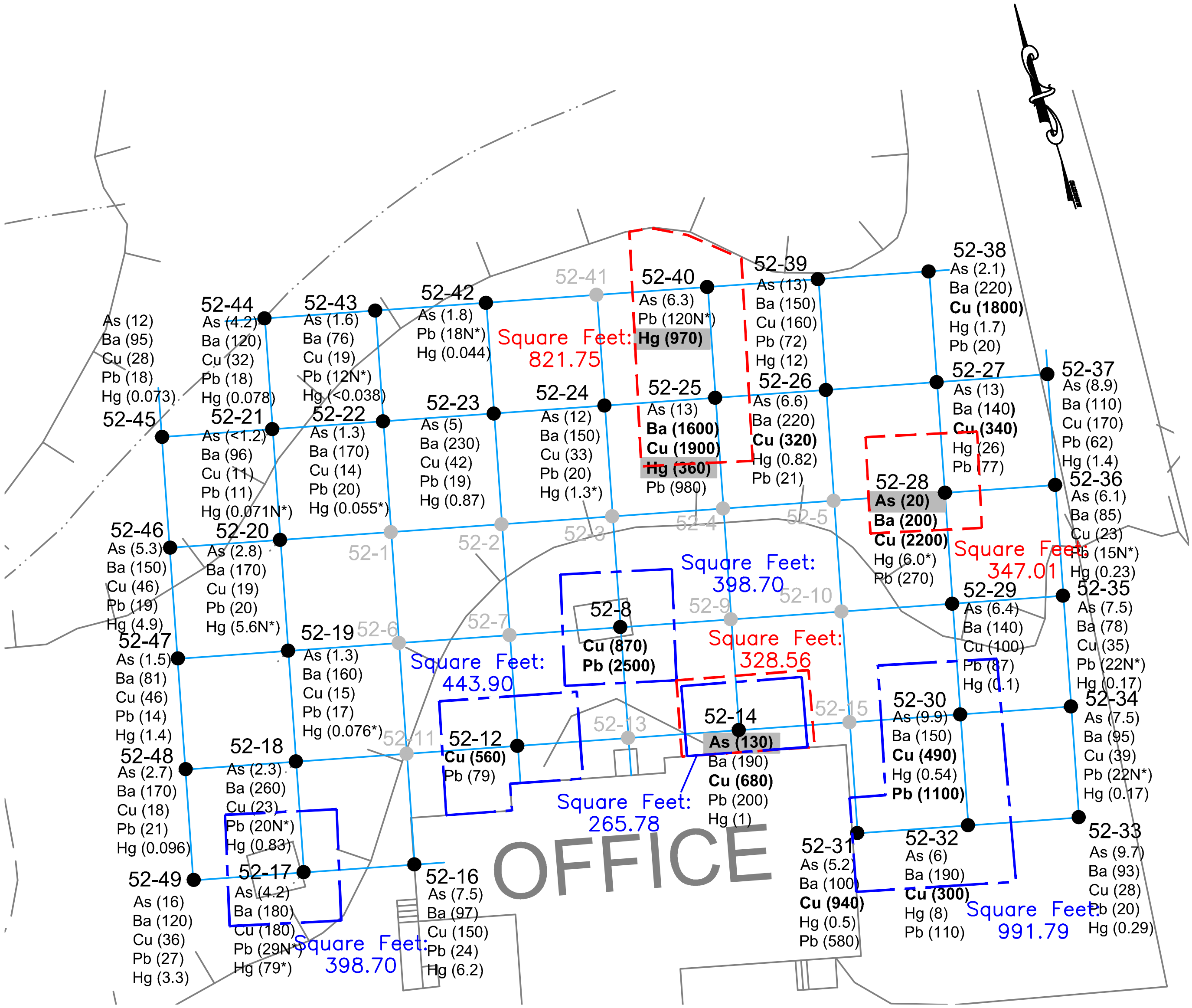
DYNO-NOBEL, INC.
PORT EWEN, NY.

FIGURE 35
COMMERCIAL AND INDUSTRIAL USE
SOIL CLEANUP OBJECTIVE DELINEATION
SWMU 52: 2-3' INTERVAL

Drawn By: MDO	Date Drawn: 08/22/12
Reviewed By: MB	Date Reviewed: 08/2012
Scale: 1" = 30'	Plot Date: 08/2012
Project Number.:	



SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Arsenic (As)	16	16
Barium (Ba)	400	10,000
Copper (Cu)	270	10,000
Mercury (Hg)	47	220
Lead (Pb)	1,000	3,900

NOTES:

1. mg/kg = MILLIGRAMS PER KILOGRAM
2. * DENOTES A DUPLICATE SAMPLE. THE HIGHER CONCENTRATION IS SHOWN.

SOURCE:
REVISION TO CMS SOIL SCREENING CRITERIA
DYNO NOBEL SITE, PORT EWEN, NEW YORK
HYDROQUAL INC., SEPTEMBER 1, 2006.

LEGEND

52-11 ●	SHALLOW SOIL SAMPLE LOCATION
(20.0)	CONCENTRATION (mg/kg) EXCEEDS INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
(340)	CONCENTRATION (mg/kg) EXCEEDS COMMERCIAL USE SOIL CLEANUP OBJECTIVE
(9.7)	CONCENTRATION (mg/kg) BELOW COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
	GROUND SURFACE CONTOUR
	APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS EXCEEDING INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
	APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS EXCEEDING COMMERCIAL USE SOIL CLEANUP OBJECTIVE

30 0 30
SCALE IN FEET

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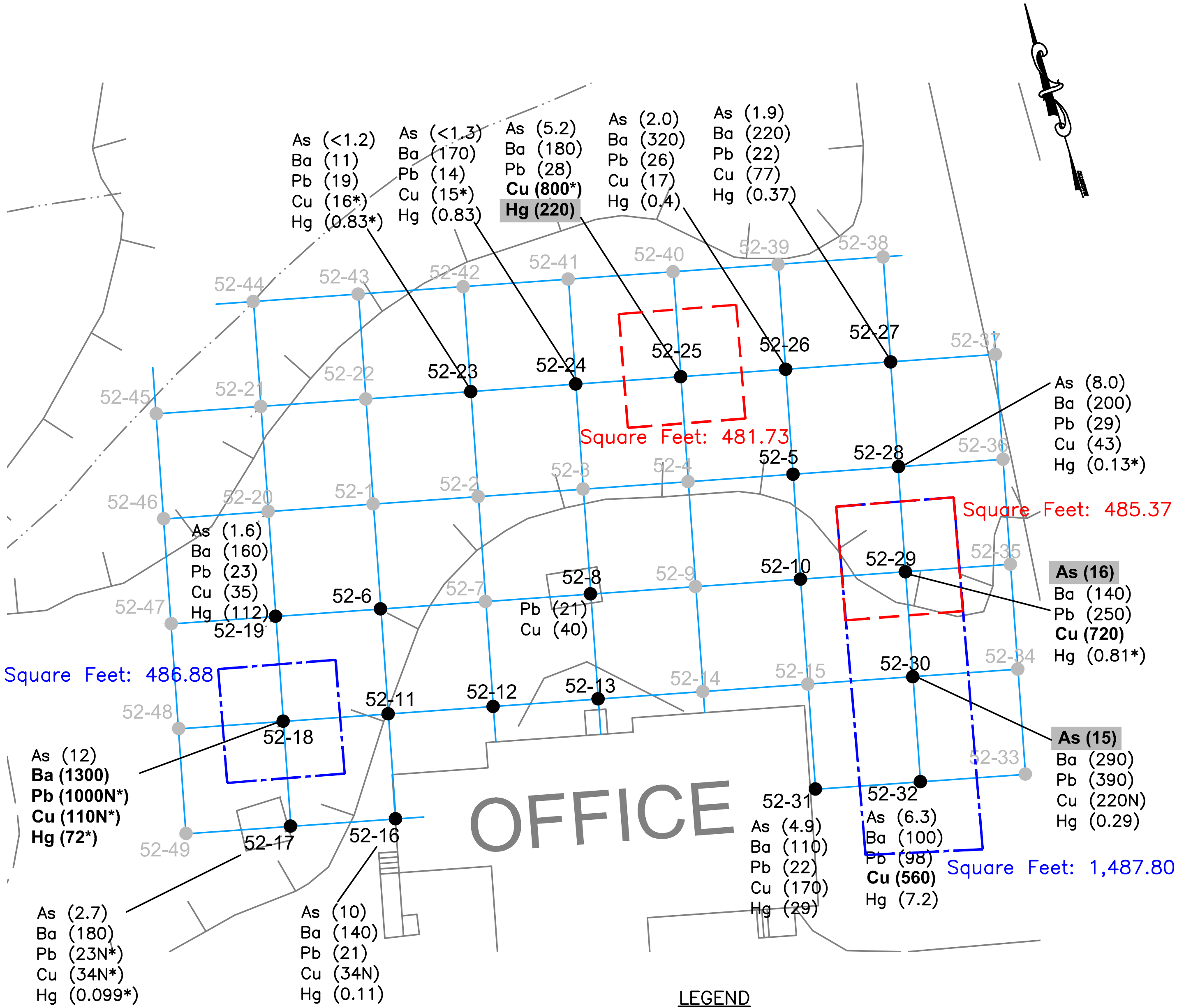
DYNO-NOBEL, INC.
PORT EWEN, NY.

FIGURE 36
INDUSTRIAL USE SOIL CLEANUP CRITERIA DELINEATION
SWMU 52 - 3-4' INTERVAL

Drawn By: MDO	Date Drawn: 08/22/12
Reviewed By: MB	Date Reviewed: 08/2012
Scale: 1" = 30'	Plot Date: 08/2012
Project Number.:	



LEGEND

52-20 ● SHALLOW SOIL SAMPLE LOCATION

(20.0) CONCENTRATION (mg/kg) EXCEEDS INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

(340) CONCENTRATION (mg/kg) EXCEEDS COMMERCIAL USE SOIL CLEANUP OBJECTIVE

(9.7) CONCENTRATION (mg/kg) BELOW COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

GROUND SURFACE CONTOUR

APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS EXCEEDING INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS EXCEEDING COMMERCIAL USE SOIL CLEANUP OBJECTIVE

30 0 30

SCALE IN FEET

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Arsenic (As)	16	16
Barium (Ba)	400	10,000
Copper (Cu)	270	10,000
Mercury (Hg)	47	220
Lead (Pb)	1,000	3,900
Selinium (Se)	1,500	6,800

NOTES:

1. mg/kg = MILLIGRAMS PER KILOGRAM
2. * DENOTES A DUPLICATE SAMPLE. THE HIGHER CONCENTRATION IS SHOWN.

SOURCE:
REVISION TO CMS SOIL SCREENING CRITERIA
DYNO NOBEL SITE, PORT EWEN, NEW YORK
HYDROQUAL INC., SEPTEMBER 1, 2006.

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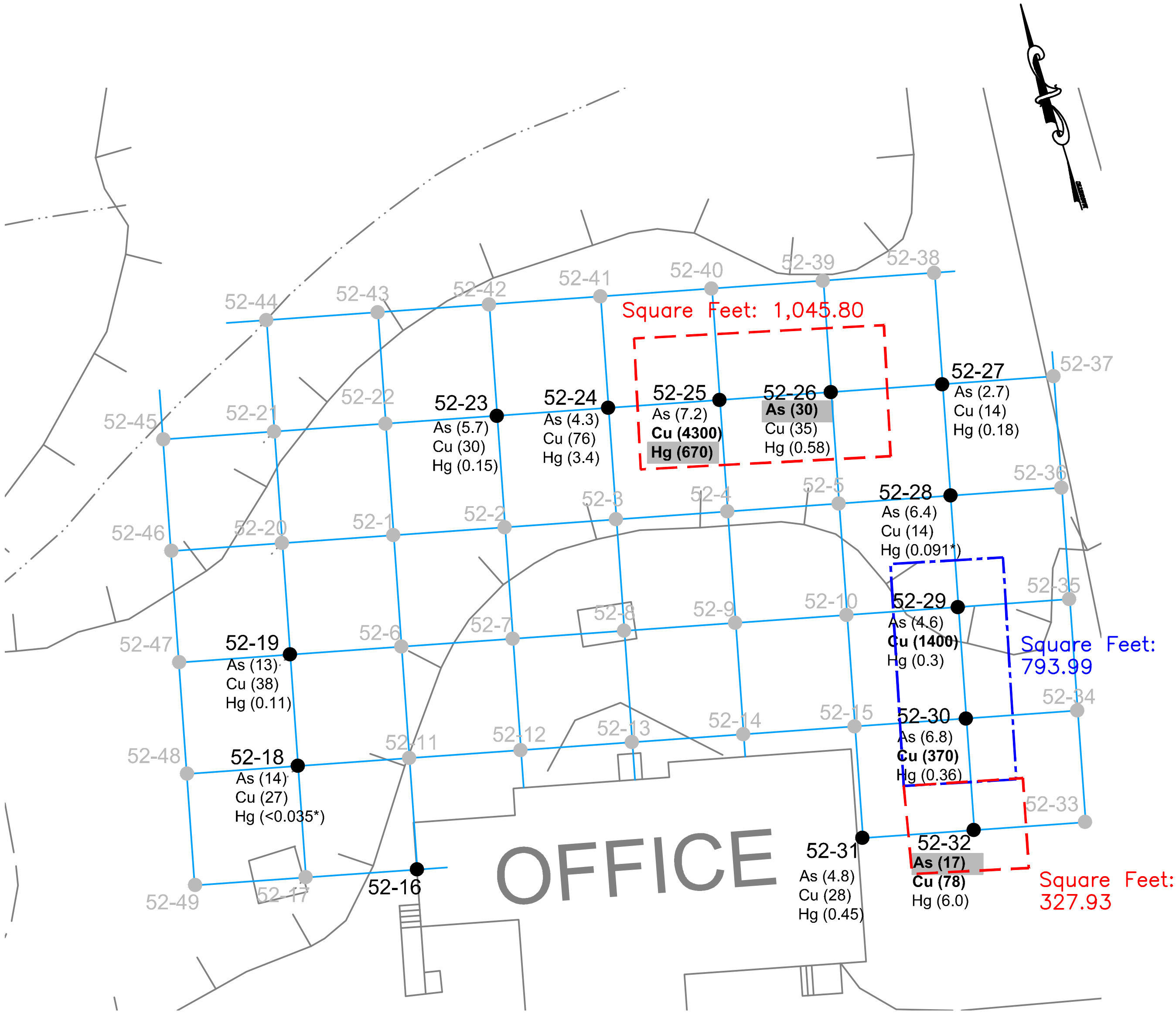
DYNO-NOBEL, INC.
PORT EWEN, NY.

FIGURE 37
COMMERCIAL AND INDUSTRIAL USE
SOIL SCREENING CRITERIA DELINEATION
SWMU 52 - 4-5' INTERVAL

Drawn By:	MDO	Date Drawn:	08/21/12
Reviewed By:	MB	Date Reviewed:	08/2012
Scale:	1" = 30'	Plot Date:	08/2012
Project Number.:			



SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Arsenic (As)	16	16
Copper (Cu)	270	10,000
Mercury (Hg)	47	220

LEGEND

52-1 ● SHALLOW SOIL SAMPLE LOCATION

(20.0) CONCENTRATION (mg/kg) EXCEEDS INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

(340) CONCENTRATION (mg/kg) EXCEEDS COMMERCIAL USE SOIL CLEANUP OBJECTIVE

(9.7) CONCENTRATION (mg/kg) BELOW COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

GROUND SURFACE CONTOUR

APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS EXCEEDING INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS EXCEEDING COMMERCIAL USE SOIL CLEANUP OBJECTIVE

30 0 30

SCALE IN FEET

NOTES:

1. mg/kg = MILLIGRAMS PER KILOGRAM
2. * DENOTES A DUPLICATE SAMPLE. THE HIGHER CONCENTRATION IS SHOWN.

SOURCE:
REVISION TO CMS SOIL SCREENING CRITERIA
DYNO NOBEL SITE, PORT EWEN, NEW YORK
HYDROQUAL INC., SEPTEMBER 1, 2006.

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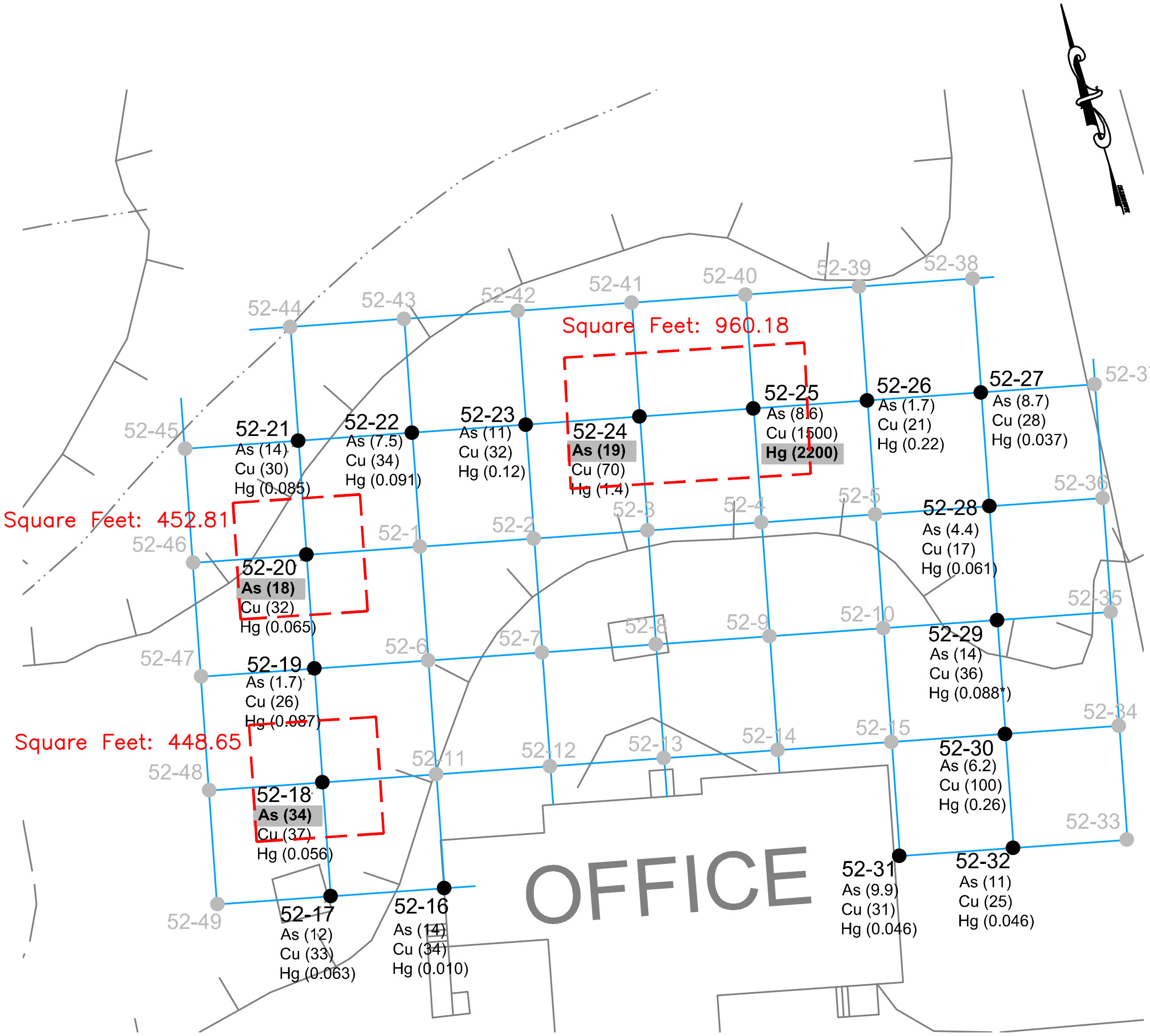
DYNO-NOBEL, INC.
PORT EWEN, NY.

FIGURE 38
COMMERCIAL AND INDUSTRIAL USE
SOIL CLEANUP CRITERIA DELINEATION
SWMU 52 - 5-6' INTERVAL

Drawn By: MDO	Date Drawn: 08/22/12
Reviewed By: MB	Date Reviewed: 08/2012
Scale: 1" = 30'	Plot Date: 08/2012
Project Number.:	



LEGEND

52-1 ●	SHALLOW SOIL SAMPLE LOCATION
(34.0)	CONCENTRATION (mg/kg) EXCEEDS INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
(1500)	CONCENTRATION (mg/kg) EXCEEDS COMMERCIAL USE SOIL CLEANUP OBJECTIVE
(32)	CONCENTRATION (mg/kg) BELOW COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
	GROUND SURFACE CONTOUR
	APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS EXCEEDING INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Arsenic (As)	16	16
Copper (Cu)	270	10,000
Mercury (Hg)	47	220

NOTES:

1. mg/kg = MILLIGRAMS PER KILOGRAM
2. * DENOTES A DUPLICATE SAMPLE. THE HIGHER CONCENTRATION IS SHOWN.

SOURCE:
REVISION TO CMS SOIL SCREENING CRITERIA
DYNO NOBEL SITE, PORT EWEN, NEW YORK
HYDROQUAL INC., SEPTEMBER 1, 2006.

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SCALE IN FEET

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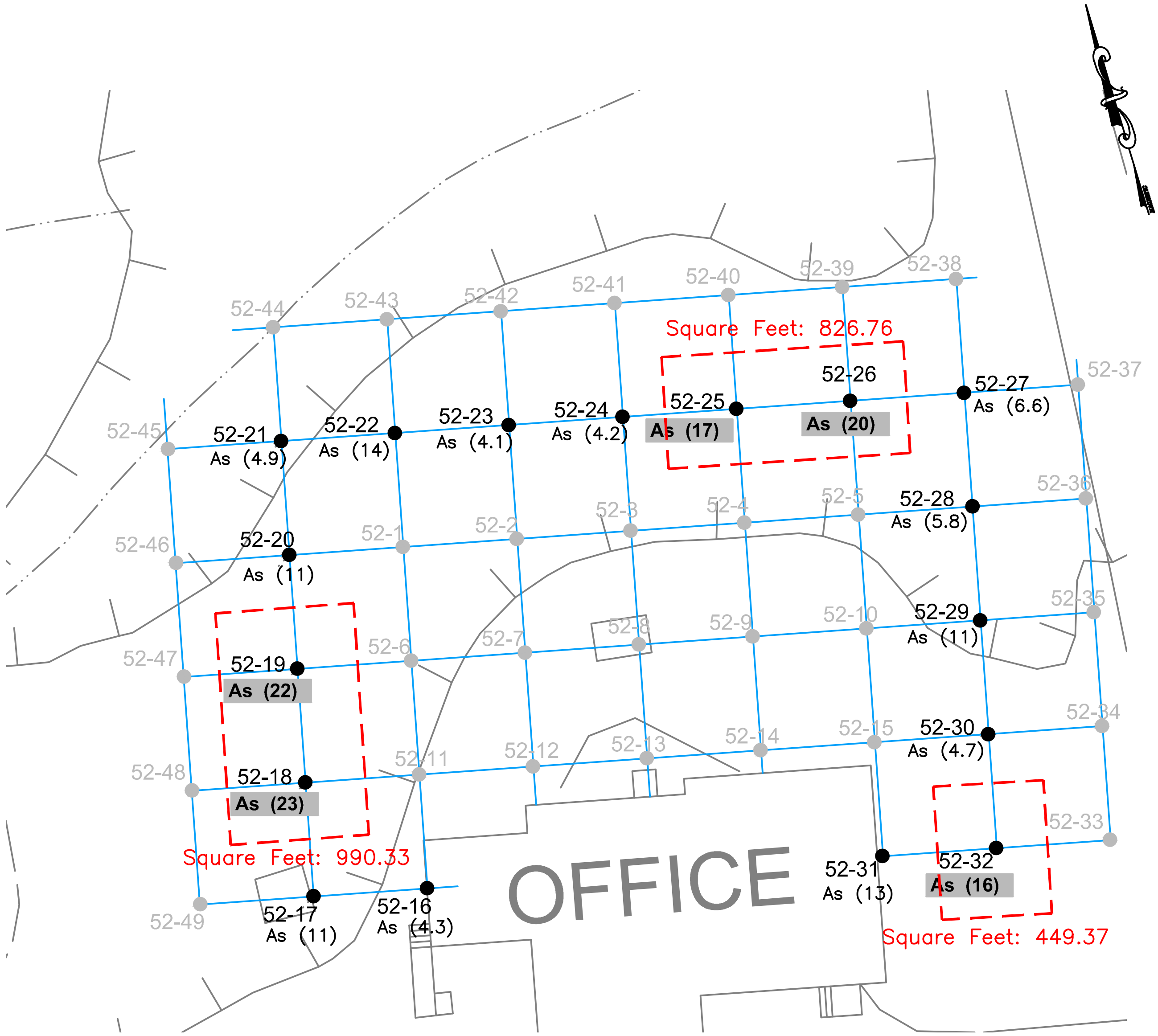
PORT EWEN, NY.

FIGURE 39
COMMERCIAL AND INDUSTRIAL USE
SOIL CLEANUP CRITERIA DELINEATION
SWMU 52 - 6-7' INTERVAL

Drawn By: MDO	Date Drawn: 08/22/12
Reviewed By: MB	Date Reviewed: 08/2012
Scale: 1" = 30'	Plot Date: 08/2012
Project Number.:	



LEGEND

52-25●	SHALLOW SOIL SAMPLE LOCATION
(20.0)	CONCENTRATION (mg/kg) EXCEEDS INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
(340)	CONCENTRATION (mg/kg) EXCEEDS COMMERCIAL USE SOIL CLEANUP OBJECTIVE
(9.7)	CONCENTRATION (mg/kg) BELOW COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
	GROUND SURFACE CONTOUR
	APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS EXCEEDING INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Arsenic (As)	16	16

NOTES:

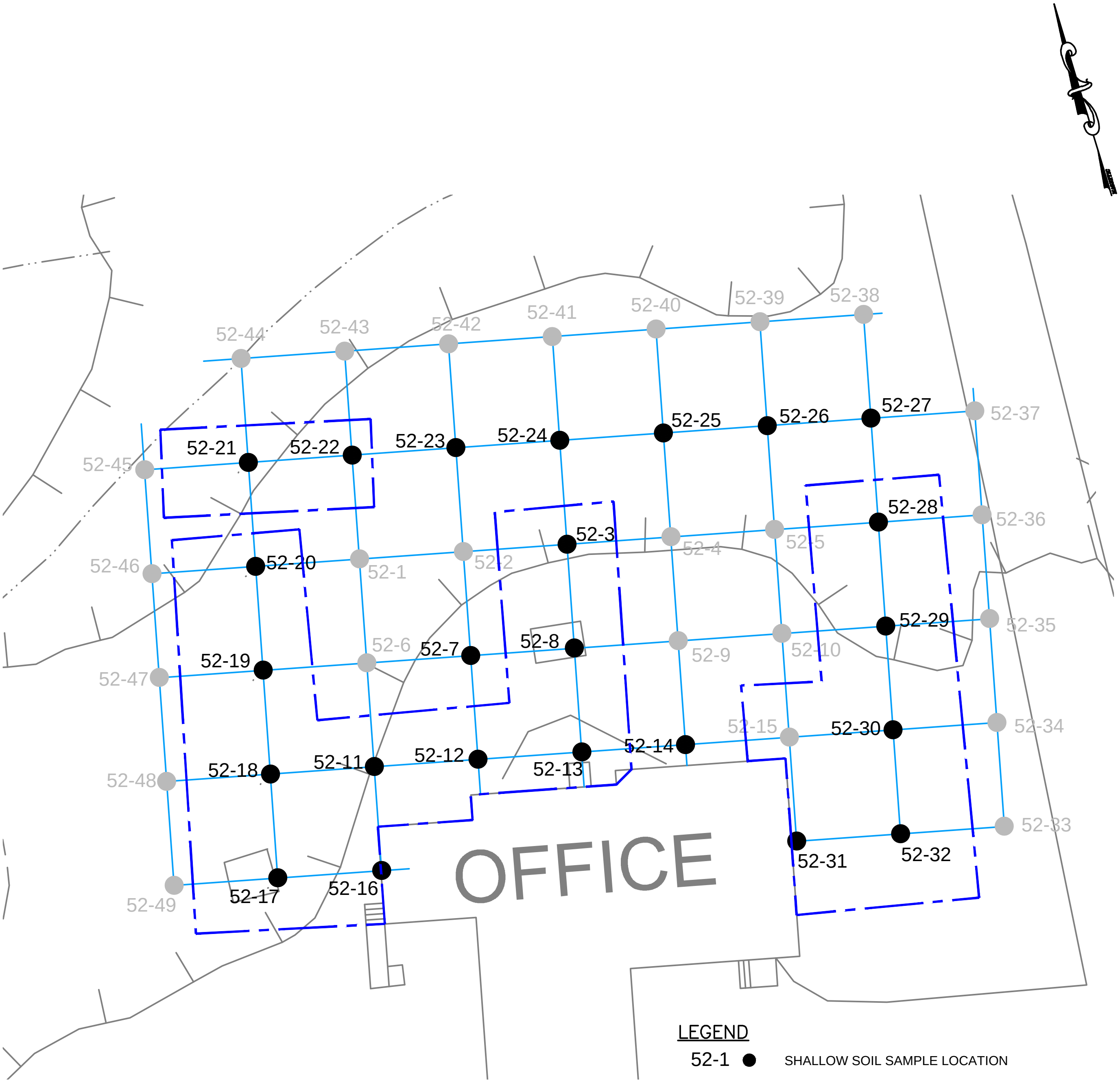
1. mg/kg = MILLIGRAMS PER KILOGRAM
2. * DENOTES A DUPLICATE SAMPLE. THE HIGHER CONCENTRATION IS SHOWN.

SOURCE:
REVISION TO CMS SOIL SCREENING CRITERIA
DYNO NOBEL SITE, PORT EWEN, NEW YORK
HYDROQUAL INC., SEPTEMBER 1, 2006.

30 0 30

SCALE IN FEET

EHS Support *consider it done*	**DYNO-NOBEL, INC.** **PORT EWEN, NY.**	**FIGURE 40** COMMERCIAL AND INDUSTRIAL USE SOIL SCREENING CRITERIA DELINEATION SWMU 52 - 7-8' INTERVAL	Drawn By: MDO	Date Drawn: 08/21/12
			Reviewed By: MB	Date Reviewed: 08/2012
			Scale: 1" = 30'	Plot Date: 08/2012
			Project Number.:	



LEGEND

52-1 ●	SHALLOW SOIL SAMPLE LOCATION
(grey box)	CONCENTRATION (mg/kg) EXCEEDS INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
(420)	CONCENTRATION (mg/kg) EXCEEDS COMMERCIAL USE SOIL CLEANUP OBJECTIVE
(6.9)	CONCENTRATION (mg/kg) BELOW COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
	GROUND SURFACE CONTOUR
	APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS EXCEEDING COMMERCIAL USE SOIL CLEANUP OBJECTIVE

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Arsenic (As)	16	16
Lead (Pb)	1,000	3,900
Copper (Cu)	270	10,000
Barium (Ba)	400	10,000
Mercury (Hg)	47	220

SOURCE:
REVISION TO CMS SOIL SCREENING CRITERIA
DYNO NOBEL SITE, PORT EWEN, NEW YORK
HYDROQUAL INC., SEPTEMBER 1, 2006.

NOTES:

1. mg/kg = MILLIGRAMS PER KILOGRAM
2. * DENOTES A DUPLICATE SAMPLE. THE HIGHER CONCENTRATION IS SHOWN.

30 0 30
SCALE IN FEET

EHS Support
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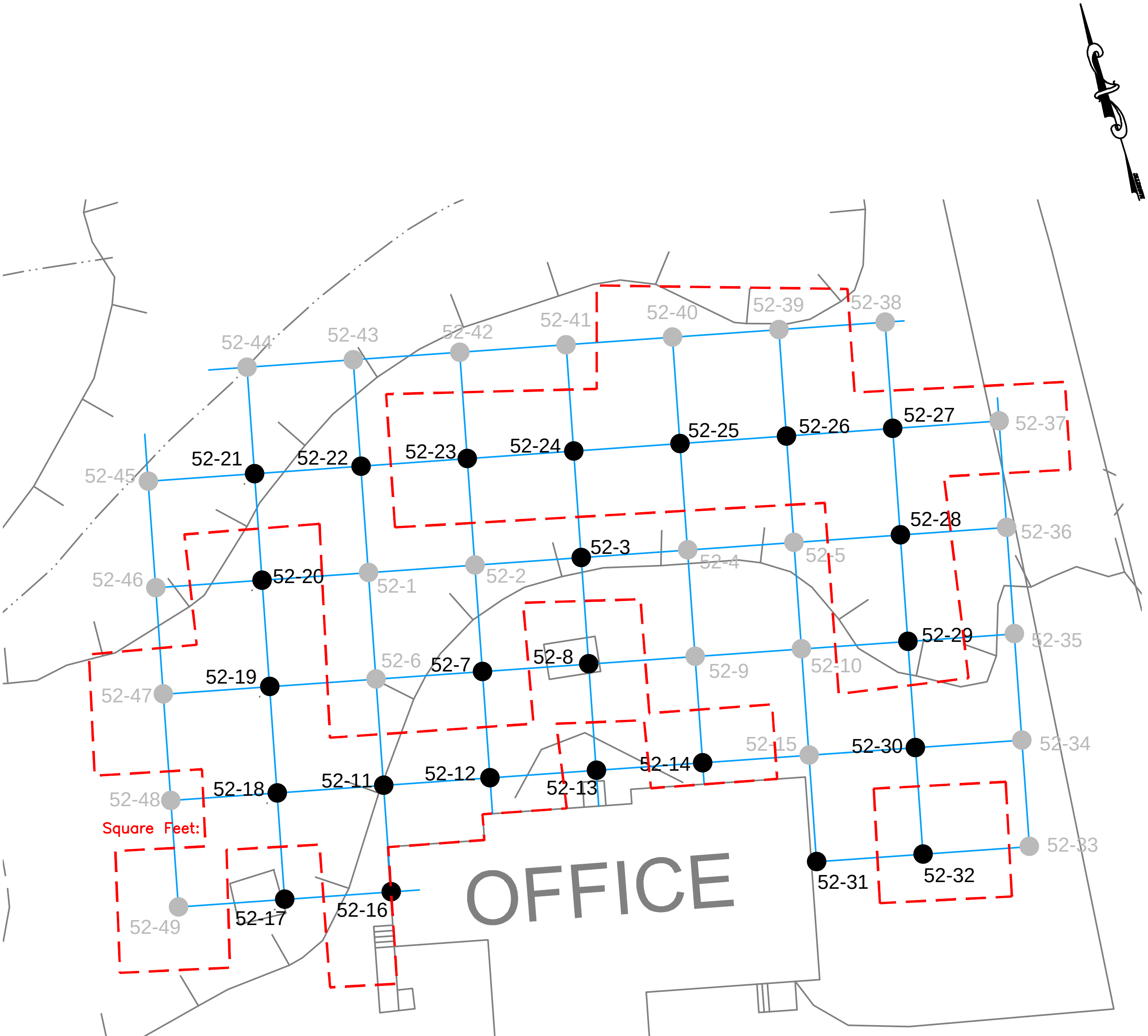
DYNO-NOBEL, INC.
PORT EWEN, NY.

FIGURE 41
COMMERCIAL SOIL CLEANUP
OBJECTIVE DELINEATION
SWMU 52: COMPOSITE

Drawn By: MDO	Date Drawn: 08/21/12
Reviewed By: MB	Date Reviewed: 08/2012
Scale: 1" = 30'	Plot Date: 08/2012
Project Number.:	



LEGEND

52-1 ●	SHALLOW SOIL SAMPLE LOCATION
	CONCENTRATION (mg/kg) EXCEEDS INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
(420)	CONCENTRATION (mg/kg) EXCEEDS COMMERCIAL USE SOIL CLEANUP OBJECTIVE
(6.9)	CONCENTRATION (mg/kg) BELOW COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
	GROUND SURFACE CONTOUR
	APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS EXCEEDING INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Arsenic (As)	16	16
Lead (Pb)	1,000	3,900
Copper (Cu)	270	10,000
Barium (Ba)	400	10,000
Mercury (Hg)	47	220

SOURCE:
REVISION TO CMS SOIL SCREENING CRITERIA
DYNO NOBEL SITE, PORT EWEN, NEW YORK
HYDROQUAL INC., SEPTEMBER 1, 2006.

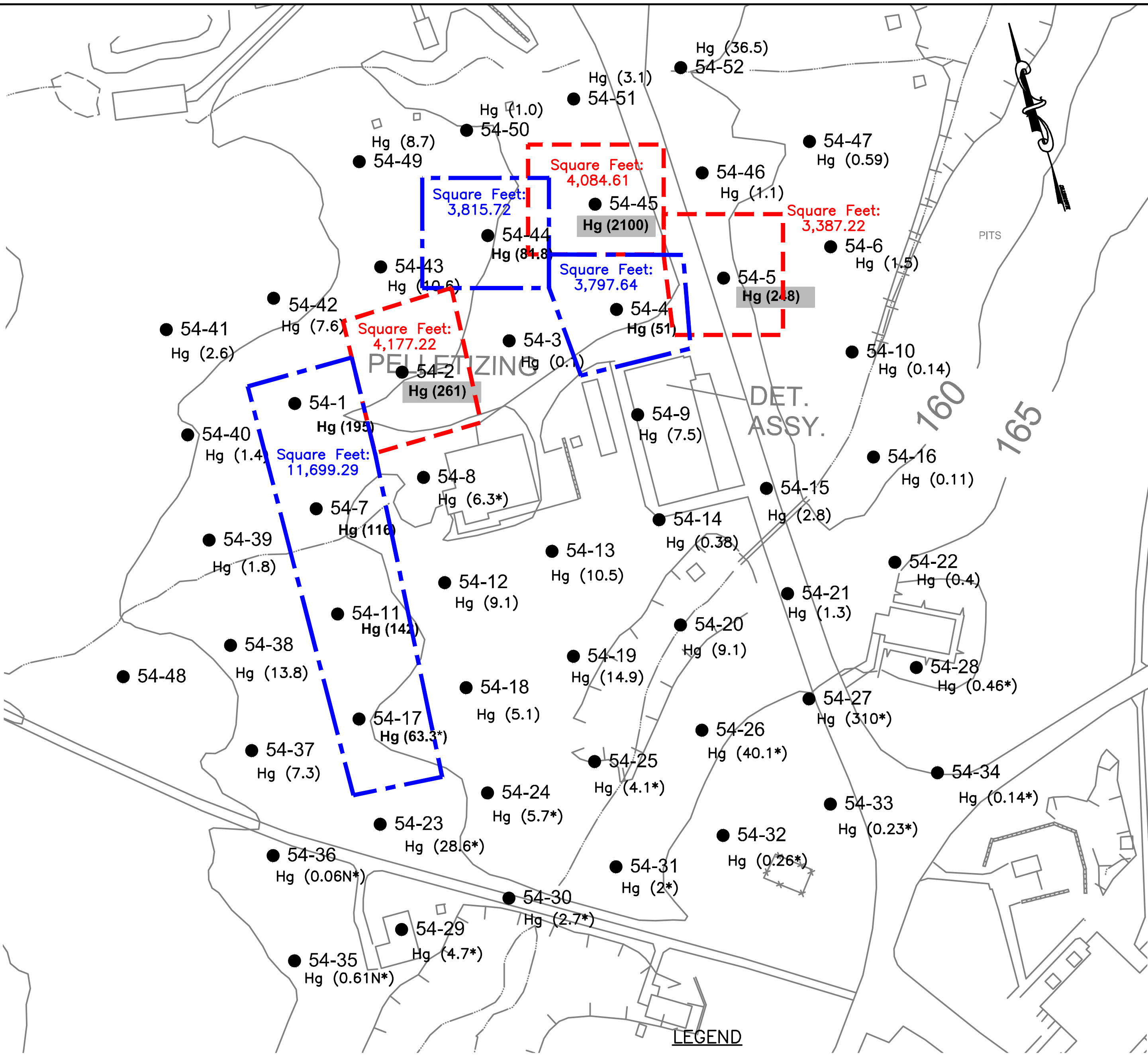
NOTES:

1. mg/kg = MILLIGRAMS PER KILOGRAM
2. * DENOTES A DUPLICATE SAMPLE. THE HIGHER CONCENTRATION IS SHOWN.

30 0 30

SCALE IN FEET

EHS Support consider it done	DYNO-NOBEL, INC. PORT EWEN, NY.	**FIGURE 41A** INDUSTRIAL USE SOIL CLEANUP OBJECTIVE DELINEATION SWMU 52: COMPOSITE	Drawn By: MDO	Date Drawn: 08/21/12
			Reviewed By: MB	Date Reviewed: 08/2012
			Scale: 1" = 30'	Plot Date: 08/2012
			Project Number.:	



LEGEND

54-41 ● SHALLOW SOIL SAMPLE LOCATION

(32.0) CONCENTRATION (mg/kg) EXCEEDS INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

(355) CONCENTRATION (mg/kg) EXCEEDS COMMERCIAL USE SOIL CLEANUP OBJECTIVE

(6.7) CONCENTRATION (mg/kg) BELOW COMMERCIAL USE SOIL CLEANUP OBJECTIVE

GROUND SURFACE CONTOUR

APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Mercury (Hg)	47	220

QUALIFIERS:

N – SPIKED SAMPLE RECOVERY NOT WITHIN CONTROL LIMITS

E – ESTIMATED VALUE BECAUSE OF INTERFERENCE

* – DUPLICATE ANALYSIS NOT WITHIN CONTROL LIMITS

NOTES:

1. FOR DUPLICATE SAMPLES HIGHER VALUES OF TWO SHOWN.
2. CONCENTRATIONS IN SAMPLES AT 2'–4' INTERVAL WERE BELOW COMMERCIAL AND INDUSTRIAL USE SCOs.

SOURCE:
HYDORQUAL ENVIRONMENTAL ENGINEERS AND SCIENTISTS, P.C.
FIGURE 24 INDUSTRIAL USE SOIL CLEANUP CRITERIA DELINEATION
SWMU 54 – 0–2' INTERVAL.

80 0 80

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Rev.	By:	Date:
Rev.	By:	Date:

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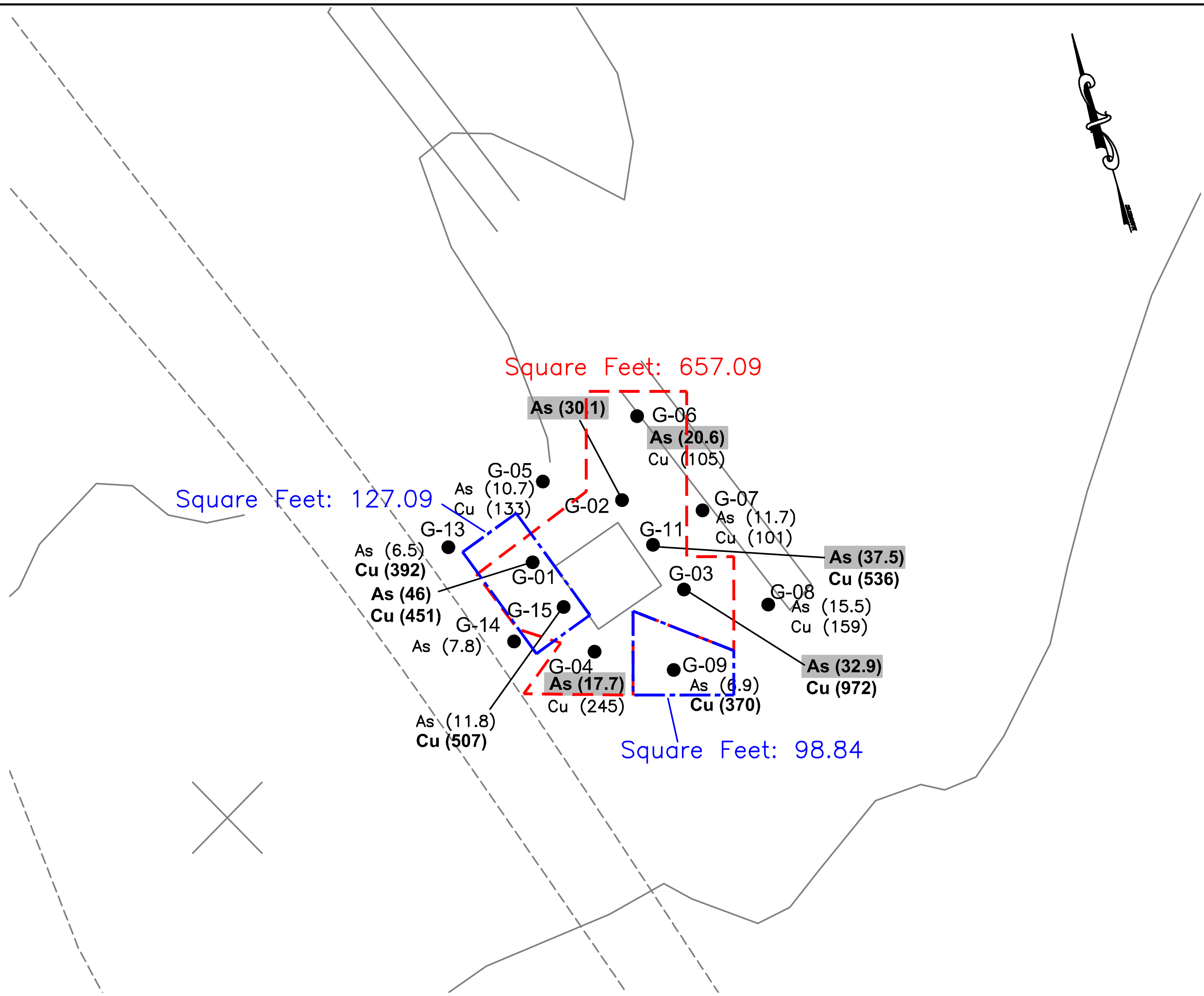
DYNO-NOBEL, INC.
PORT EWEN, NY.

FIGURE 42
COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP CRITERIA DELINEATION
SWMU 54 - 0-2' INTERVAL

Drawn By: MDO	Date Drawn: 11/16/12
Reviewed By: MB	Date Reviewed: 11/2012
Scale: 1" = 80'	Plot Date: 11/2012
Project Number.:	



LEGEND

G-09 ●	SHALLOW SOIL SAMPLE LOCATION
(20.6)	CONCENTRATION (mg/kg) EXCEEDS INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
(536)	CONCENTRATION (mg/kg) EXCEEDS COMMERCIAL USE SOIL CLEANUP OBJECTIVE
(6.9)	CONCENTRATION (mg/kg) BELOW COMMERCIAL USE SOIL CLEANUP OBJECTIVE
	GROUND SURFACE CONTOUR
	APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
	APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Arsenic (As)	16	16
Copper (Cu)	270	10,000

QUALIFIERS:

N – SPIKED SAMPLE RECOVERY NOT WITHIN CONTROL LIMITS

E – ESTIMATED VALUE BECAUSE OF INTERFERENCE

* – DUPLICATE ANALYSIS NOT WITHIN CONTROL LIMITS

NOTES:

1. FOR DUPLICATE SAMPLES HIGHER VALUES OF TWO SHOWN.
2. SAMPLES G–10 AND G–12 NOT COLLECTED – CONCRETE SLAB.
3. CONCENTRATIONS IN SAMPLES AT 2'–4' INTERVAL WERE BELOW COMMERCIAL AND INDUSTRIAL USE SCOs.

20 0 20

SCALE IN FEET

SOURCE:
HYDORQUAL ENVIRONMENTAL ENGINEERS AND SCIENTISTS, P.C.
FIGURE 25 INDUSTRIAL USE SOIL CLEANUP CRITERIA DELINEATION
AOC G – 0–2' INTERVAL.

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Rev.	By:	Date:
Rev.	By:	Date:

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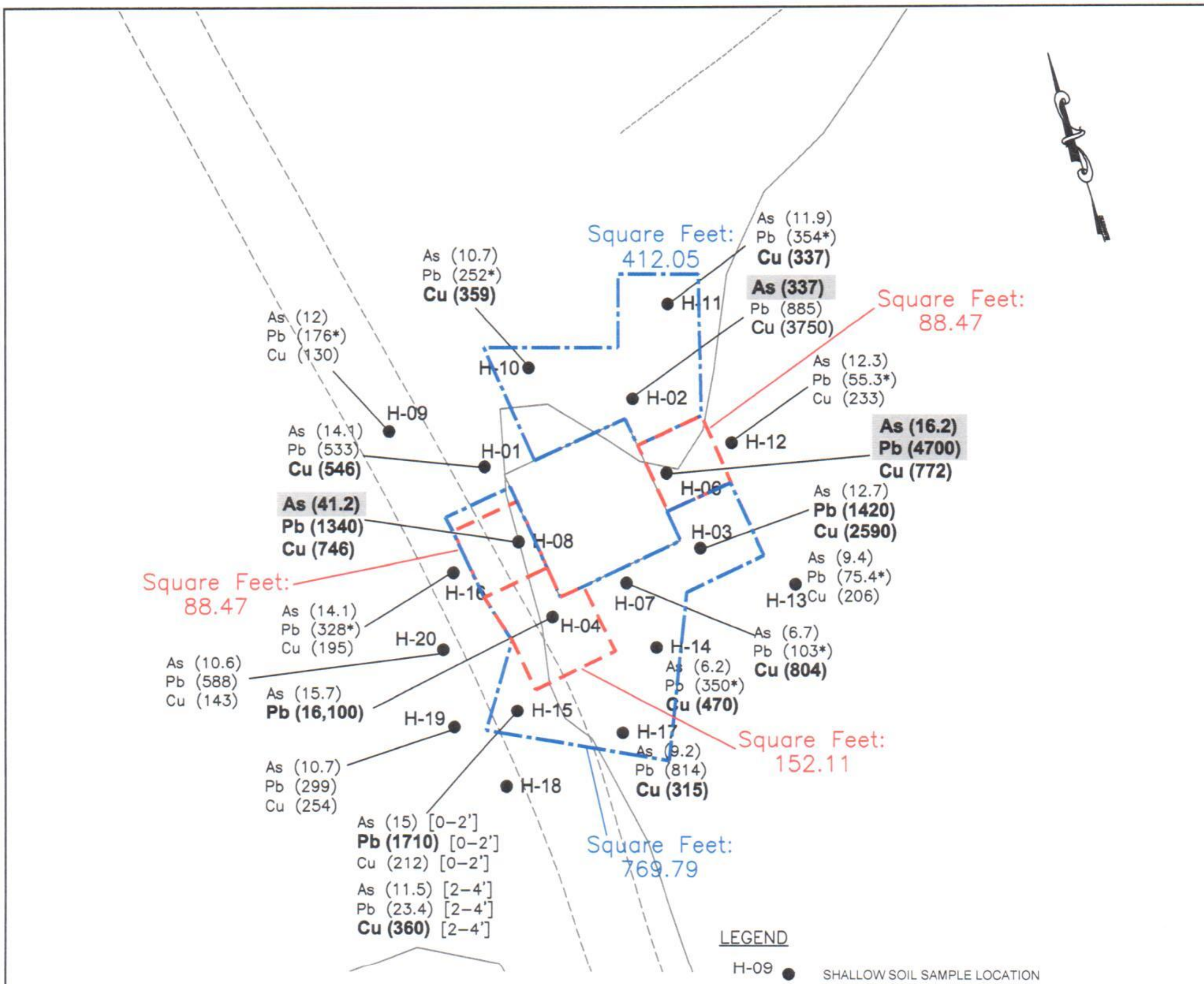
DYNO-NOBEL, INC.
PORT EWEN, NY.

FIGURE 43
COMMERCIAL AND INDUSTRIAL USE
SOIL CLEANUP OBJECTIVE DELINEATION
AOC G - 0-2' INTERVAL

Drawn By: MDO	Date Drawn: 11/16/12
Reviewed By: MS	Date Reviewed: 11/2012
Scale: 1" = 20'	Plot Date: 11/2012
Project Number.:	



LEGEND

H-09 ●	SHALLOW SOIL SAMPLE LOCATION
(32.0)	CONCENTRATION (mg/kg) EXCEEDS INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
(355)	CONCENTRATION (mg/kg) EXCEEDS COMMERCIAL USE SOIL CLEANUP OBJECTIVE
(6.7)	CONCENTRATION (mg/kg) BELOW COMMERCIAL USE SOIL CLEANUP OBJECTIVE
	GROUND SURFACE CONTOUR
	APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
	APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Arsenic (As)	16	16
Lead (Pb)	1,000	3,900
Copper (Cu)	270	10,000

QUALIFIERS:

N – SPIKED SAMPLE RECOVERY NOT WITHIN CONTROL LIMITS

E – ESTIMATED VALUE BECAUSE OF INTERFERENCE

* – DUPLICATE ANALYSIS NOT WITHIN CONTROL LIMITS

NOTES:
1. FOR DUPLICATE SAMPLES HIGHER VALUES OF TWO SHOWN.
2. SAMPLE H–05 NOT COLLECTED – CONCRETE SLAB.
3. CONCENTRATIONS IN SAMPLES AT 2'–4' INTERVAL WERE BELOW COMMERCIAL AND INDUSTRIAL USE SCOs WITH THE EXCEPTION OF SAMPLE LOCATION H–15.
4. NO DATA POSTED FOR H–18.

20 0 20

SCALE IN FEET

REVISIONS		
Rev.	By:	Date:
Rev.	By:	Date:
Rev.	By:	Date:
Rev.	By:	Date:

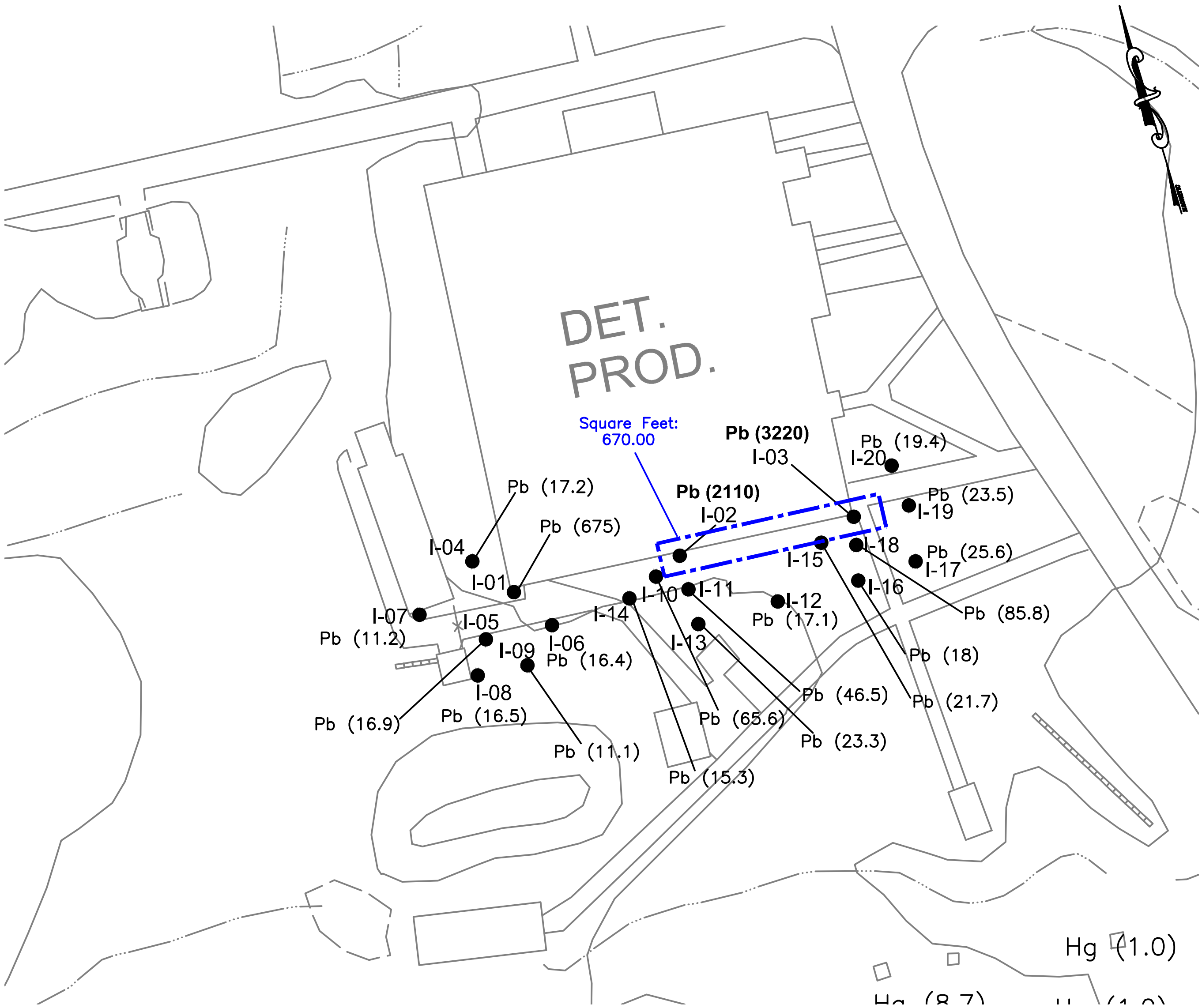
SOURCE:
HYDORQUAL ENVIRONMENTAL ENGINEERS AND SCIENTISTS, P.C. FIGURE 26 INDUSTRIAL USE SOIL CLEANUP CRITERIA DELINEATION AOC H – 0–2' INTERVAL.

EHS Support *consider it done*

DYNO-NOBEL, INC.
PORT EWEN, NY.

FIGURE 44
COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE DELINEATION
AOC H - 0-2' INTERVAL

Drawn By: MDO	Date Drawn: 11/16/12
Reviewed By: MS	Date Reviewed: 11/2012
Scale: 1" = 20'	Plot Date: 11/2012
Project Number.:	



LEGEND

M-9 ●	SHALLOW SOIL SAMPLE LOCATION
(32.0)	CONCENTRATION (mg/kg) EXCEEDS INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
(355)	CONCENTRATION (mg/kg) EXCEEDS COMMERCIAL USE SOIL CLEANUP OBJECTIVE
(6.7)	CONCENTRATION (mg/kg) BELOW COMMERCIAL USE SOIL CLEANUP OBJECTIVE
	GROUND SURFACE CONTOUR
	APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Lead (Pb)	1,000	3,900

QUALIFIERS:

N – SPIKED SAMPLE RECOVERY NOT WITHIN CONTROL LIMITS

E – ESTIMATED VALUE BECAUSE OF INTERFERENCE

* – DUPLICATE ANALYSIS NOT WITHIN CONTROL LIMITS

NOTE:

1. CONCENTRATIONS IN SAMPLES AT 2'–4' INTERVAL WERE BELOW COMMERCIAL AND INDUSTRIAL USE SCOs.

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SCALE IN FEET

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Rev.	By:	Date:
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Rev.	By:	Date:

SOURCE:
HYDORQUAL ENVIRONMENTAL ENGINEERS AND SCIENTISTS, P.C.
FIGURE 27 INDUSTRIAL USE SOIL CLEANUP
CRITERIA DELINEATION
AOC I – 0–2' INTERVAL.

EHS Support
consider it done

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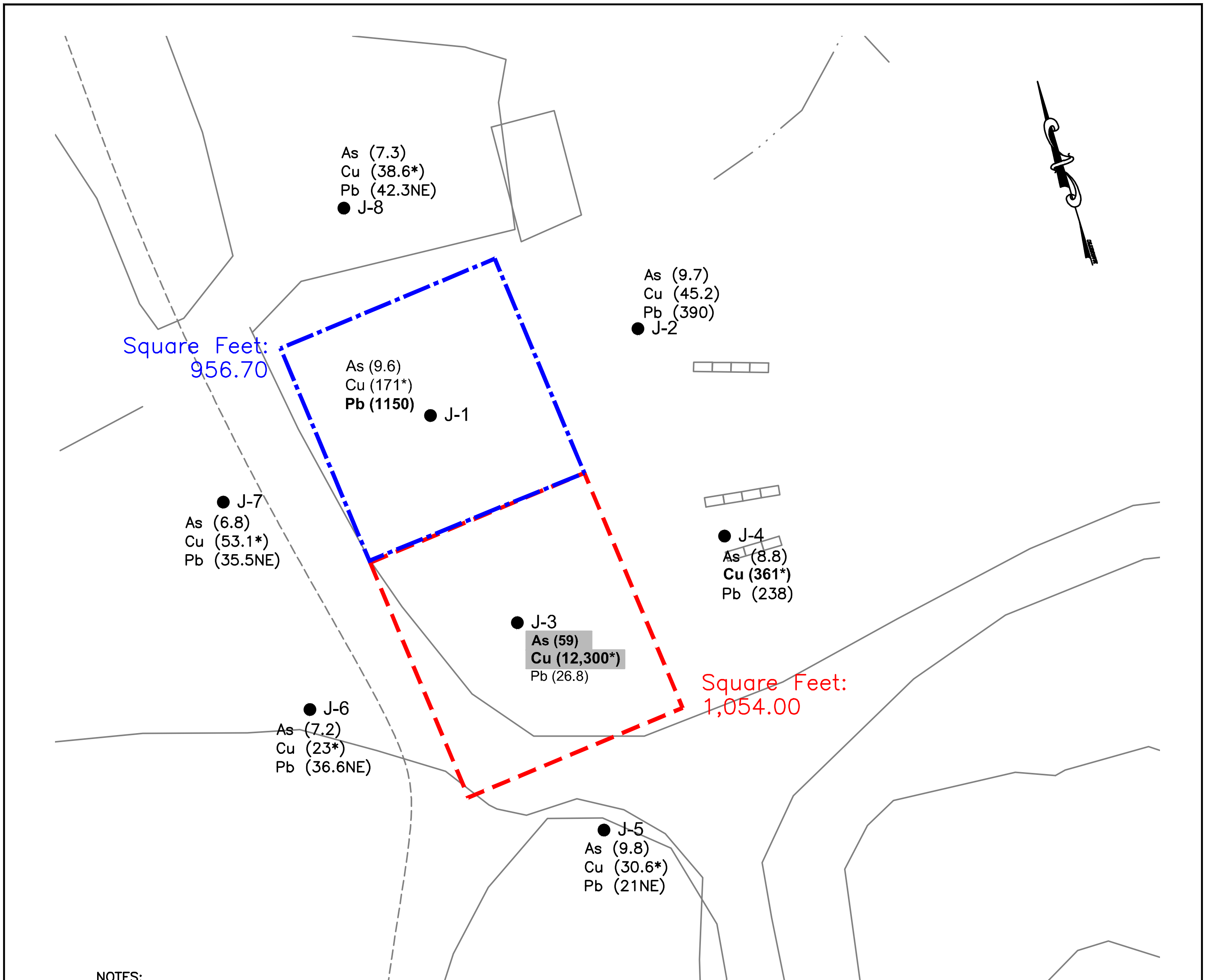
FIGURE 45
COMMERCIAL AND INDUSTRIAL USE
SOIL CLEANUP OBJECTIVE DELINEATION
AOC I - 0-2' INTERVAL

Drawn By: MDO	Date Drawn: 11/16/12
Reviewed By: MS	Date Reviewed: 11/2012
Scale: 1" = 50'	Plot Date: 11/2012
Project Number.:	



NOTES:

1. FOR DUPLICATE SAMPLES HIGHER VALUES OF TWO SHOWN.
2. NO VERTICAL SAMPLES WERE COLLECTED FROM AOC J.

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Arsenic (As)	16	16
Lead (Pb)	1,000	3,900
Copper (Cu)	270	10,000

QUALIFIERS:

N – SPIKED SAMPLE RECOVERY NOT WITHIN CONTROL LIMITS

E – ESTIMATED VALUE BECAUSE OF INTERFERENCE

* – DUPLICATE ANALYSIS NOT WITHIN CONTROL LIMITS

LEGEND

M-9 ● SHALLOW SOIL SAMPLE LOCATION

(32.0) CONCENTRATION (mg/kg) EXCEEDS INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

(355) CONCENTRATION (mg/kg) EXCEEDS COMMERCIAL USE SOIL CLEANUP OBJECTIVE

(6.7) CONCENTRATION (mg/kg) BELOW COMMERCIAL USE SOIL CLEANUP OBJECTIVE

GROUND SURFACE CONTOUR

APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE

REVISIONS		
Rev.	By:	Date:
Rev.	By:	Date:
Rev.	By:	Date:
Rev.	By:	Date:

SOURCE:
HYDORQUAL ENVIRONMENTAL ENGINEERS AND SCIENTISTS, P.C.
FIGURE 28 INDUSTRIAL USE SOIL CLEANUP
CRITERIA DELINEATION
AOC J – 0–2' INTERVAL.

20 0 20

SCALE IN FEET

EHS Support
consider it done

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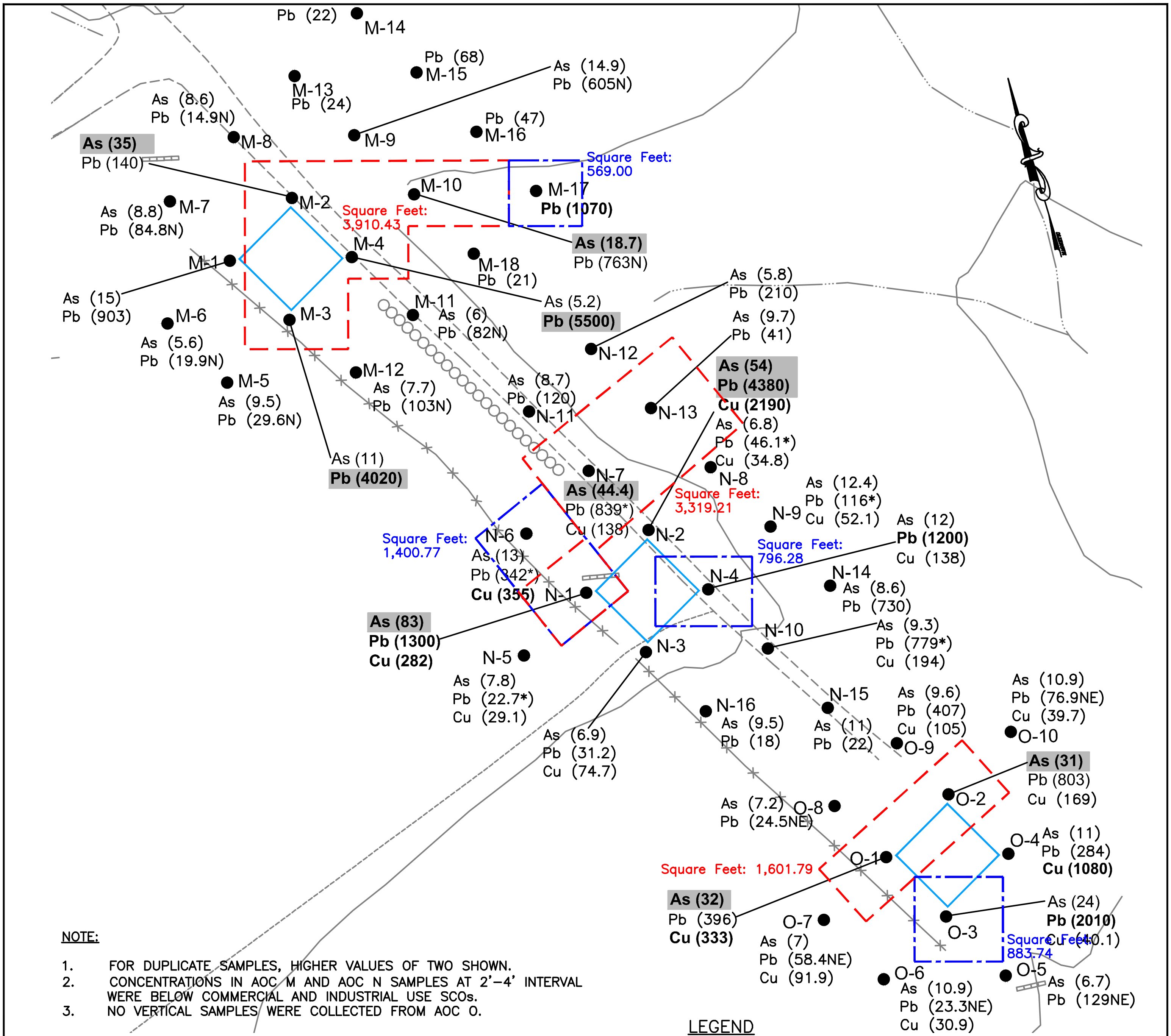
FIGURE 46
COMMERCIAL AND INDUSTRIAL USE
SOIL CLEANUP OBJECTIVE DELINEATION
AOC J - 0-2' INTERVAL

Drawn By: MDO	Date Drawn: 11/16/12
Reviewed By: MS	Date Reviewed: 11/2012
Scale: 1" = 50'	Plot Date: 11/2012
Project Number.:	



NOTE:

1. FOR DUPLICATE SAMPLES, HIGHER VALUES OF TWO SHOWN.
2. CONCENTRATIONS IN AOC M AND AOC N SAMPLES AT 2'–4' INTERVAL WERE BELOW COMMERCIAL AND INDUSTRIAL USE SCOs.
3. NO VERTICAL SAMPLES WERE COLLECTED FROM AOC O.

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Arsenic (As)	16	16
Lead (Pb)	1,000	3,900
Copper (Cu)	270	10,000

QUALIFIERS:

N – SPIKED SAMPLE RECOVERY NOT WITHIN CONTROL LIMITS

E – ESTIMATED VALUE BECAUSE OF INTERFERENCE

* – DUPLICATE ANALYSIS NOT WITHIN CONTROL LIMITS

LEGEND

N-16 ●	SHALLOW SOIL SAMPLE LOCATION
(32.0)	CONCENTRATION (mg/kg) EXCEEDS INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
(355)	CONCENTRATION (mg/kg) EXCEEDS COMMERCIAL USE SOIL CLEANUP OBJECTIVE
(6.7)	CONCENTRATION (mg/kg) BELOW COMMERCIAL USE SOIL CLEANUP OBJECTIVE
	GROUND SURFACE CONTOUR
	APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
	APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

50 0 50

SCALE IN FEET

REVISIONS		
Rev.	By:	Date:
Rev.	By:	Date:
Rev.	By:	Date:
Rev.	By:	Date:

SOURCE:
HYDORQUAL ENVIRONMENTAL ENGINEERS AND SCIENTISTS, P.C.
FIGURE 29 INDUSTRIAL USE SOIL CLEANUP CRITERIA DELINEATION
AOC M,N,O – 0–2' INTERVAL.

EHS Support consider it done

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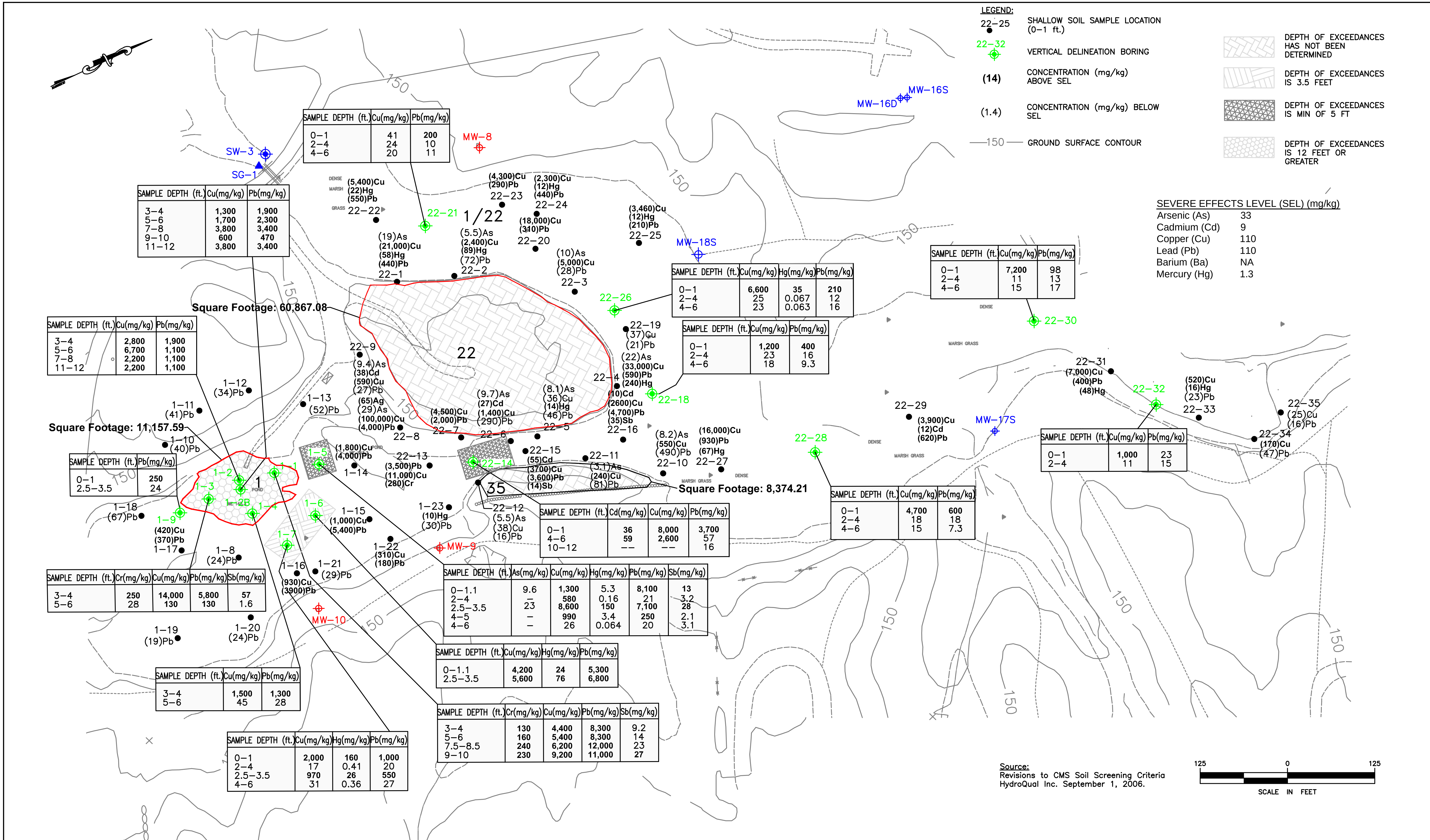
PORT EWEN, NY.

FIGURE 47
COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP CRITERIA DELINEATION
AOC M,N,O - 0-2' INTERVAL

Drawn By: MDO	Date Drawn: 08/22/12
Reviewed By: MB	Date Reviewed: 08/2012
Scale: 1" = 50'	Plot Date: 08/2012
Project Number.:	

APPENDIX D

Below SCO Delineation Figures



SAMPLE DEPTH (ft.)	Cu(mg/kg)	Pb(mg/kg)
0–1	41	200
2–4	24	10
4–6	20	11

SAMPLE DEPTH (ft.)	Cu(mg/kg)	Pb(mg/kg)
3–4	1,300	1,900
5–6	1,700	2,300
7–8	3,800	3,400
9–10	600	470
11–12	3,800	3,400

SAMPLE DEPTH (ft.)	Cu(mg/kg)	Pb(mg/kg)
3–4	2,800	1,900
5–6	6,700	1,100
7–8	2,200	1,100
11–12	2,200	1,100

SAMPLE DEPTH (ft.)	Pb(mg/kg)
0–1	250
2.5–3.5	24

SAMPLE DEPTH (ft.)	Cr(mg/kg)	Cu(mg/kg)	Pb(mg/kg)	Sb(mg/kg)
3–4	250	14,000	5,800	57
5–6	28	130	130	1.6

SAMPLE DEPTH (ft.)	Cu(mg/kg)	Pb(mg/kg)
3–4	1,500	1,300
5–6	45	28

SAMPLE DEPTH (ft.)	Cu(mg/kg)	Hg(mg/kg)	Pb(mg/kg)
0–1	2,000	160	1,000
2–4	17	0.41	20
2.5–3.5	970	26	550
4–6	31	0.36	27

SAMPLE DEPTH (ft.)	Cu(mg/kg)	Hg(mg/kg)	Pb(mg/kg)
0–1	6,600	35	210
2–4	25	0.067	12
4–6	23	0.063	16

SAMPLE DEPTH (ft.)	Cu(mg/kg)	Pb(mg/kg)
0–1	1,200	400
2–4	23	16
4–6	18	9.3

SAMPLE DEPTH (ft.)	Cu(mg/kg)	Pb(mg/kg)
0–1	7,200	98
2–4	11	13
4–6	15	17

SAMPLE DEPTH (ft.)	Cu(mg/kg)	Pb(mg/kg)
0–1	1,000	23
2–4	11	15

SAMPLE DEPTH (ft.)	Cu(mg/kg)	Pb(mg/kg)
0–1	4,700	600
2–4	18	18
4–6	15	7.3

SAMPLE DEPTH (ft.)	Cd(mg/kg)	Cu(mg/kg)	Pb(mg/kg)
0–1	36	8,000	3,700
4–6	59	2,600	57
10–12	––	––	16

SAMPLE DEPTH (ft.)	As(mg/kg)	Cu(mg/kg)	Hg(mg/kg)	Pb(mg/kg)	Sb(mg/kg)
0–1.1	9.6	1,300	5.3	8,100	13
2–4	–	580	0.16	21	3.2
2.5–3.5	23	8,600	150	7,100	28
4–5	–	990	3.4	250	2.1
4–6	–	26	0.064	20	3.1

SAMPLE DEPTH (ft.)	Cu(mg/kg)	Hg(mg/kg)	Pb(mg/kg)
0–1.1	4,200	24	5,300
2.5–3.5	5,600	76	6,800

SAMPLE DEPTH (ft.)	Cr(mg/kg)	Cu(mg/kg)	Pb(mg/kg)	Sb(mg/kg)
3–4	130	4,400	8,300	9.2
5–6	160	5,400	8,300	14
7.5–8.5	240	6,200	12,000	23
9–10	230	9,200	11,000	27

SEVERE EFFECTS LEVEL (SEL) (mg/kg)

Arsenic (As)	33
Cadmium (Cd)	9
Copper (Cu)	110
Lead (Pb)	110
Barium (Ba)	NA
Mercury (Hg)	1.3

EHS Support *consider it done*

REVISIONS

Rev.	By:	Disc.:	Date:
Rev.	By:	Disc.:	Date:
Rev.	By:	Disc.:	Date:
Rev.	By:	Disc.:	Date:

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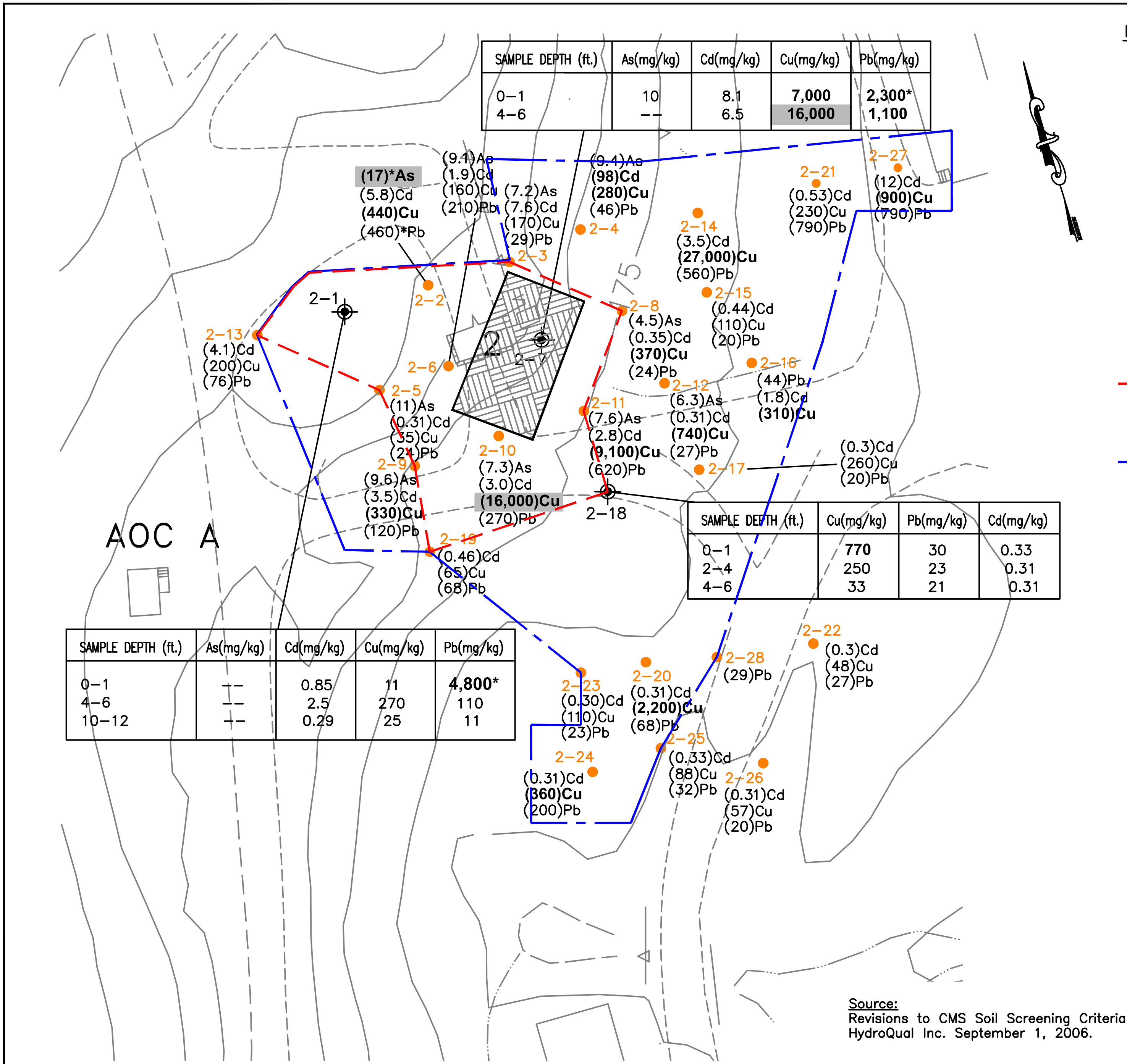
PORT EWEN, NY.

FIGURE 17
SEVERE EFFECTS LEVEL (SEL) DELINEATION
SWMUs 1 AND 22

Drawn By: BC	Date Drawn:
Reviewed By: KV	Date Reviewed:
Scale: 1" = 125'	Plot Date:
Project Number.:	



SAMPLE DEPTH (ft.)	As(mg/kg)	Cd(mg/kg)	Cu(mg/kg)	Pb(mg/kg)
0–1	10	8.1	**7,000**	**2,300***
4–6	––	6.5	**16,000**	1,100

SAMPLE DEPTH (ft.)	Cu(mg/kg)	Pb(mg/kg)	Cd(mg/kg)
0–1	**770**	30	0.33
2–4	250	23	0.31
4–6	33	21	0.31

SAMPLE DEPTH (ft.)	As(mg/kg)	Cd(mg/kg)	Cu(mg/kg)	Pb(mg/kg)
0–1	––	0.85	11	**4,800***
4–6	––	2.5	270	110
10–12	––	0.29	25	11

LEGEND:

2-3 SHALLOW SOIL SAMPLE LOCATION (0–1 ft.)

2-7 VERTICAL DELINEATION BORING

(12) CONCENTRATION (mg/kg) ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

(12) CONCENTRATION (mg/kg) ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE

(1.5) CONCENTRATION (mg/kg) BELOW COMMERCIAL USE SOIL CLEANUP OBJECTIVE

—175— GROUND SURFACE CONTOUR

APPROXIMATE AREA OF SOIL CONTAINING METALS CONCENTRATIONS ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

APPROXIMATE AREA OF SOIL CONTAINING METALS CONCENTRATIONS ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE

DEPTH OF EXCEEDANCES IS 6 FEET

* TWO SAMPLES WERE ANALYZED AT THIS SAMPLE LOCATION. THE CONCENTRATION SHOWN REPRESENTS THE GREATER OF THE TWO SAMPLING RESULTS.

NOTE:
1. mg/kg = MILLIGRAMS PER KILOGRAM
2. THE AREA EXCEEDING THE INDUSTRIAL SOIL CLEANUP OBJECTIVE IS 7,144 SQ. FT.
3. THE AREA EXCEEDING THE COMMERCIAL SOIL CLEANUP OBJECTIVE IS 27,328 SQ. FT.
4. THE AREA EXCEEDING THE INDUSTRIAL AND COMMERCIAL SOIL CLEANUP OBJECTIVES TO A DEPTH OF 6 FT EQUALS 1,441 SQ. FT.

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Arsenic (As)	16	16
Cadmium (Cd)	9.3	60
Copper (Cu)	270	10,000
Lead (Pb)	1,000	3,900

Source:
Revisions to CMS Soil Screening Criteria
HydroQual Inc. September 1, 2006.

50 0 50
SCALE IN FEET

EHS Support
consider it done

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Rev.	By:	Date:
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Rev.	By:	Date:
Rev.	By:	Date:

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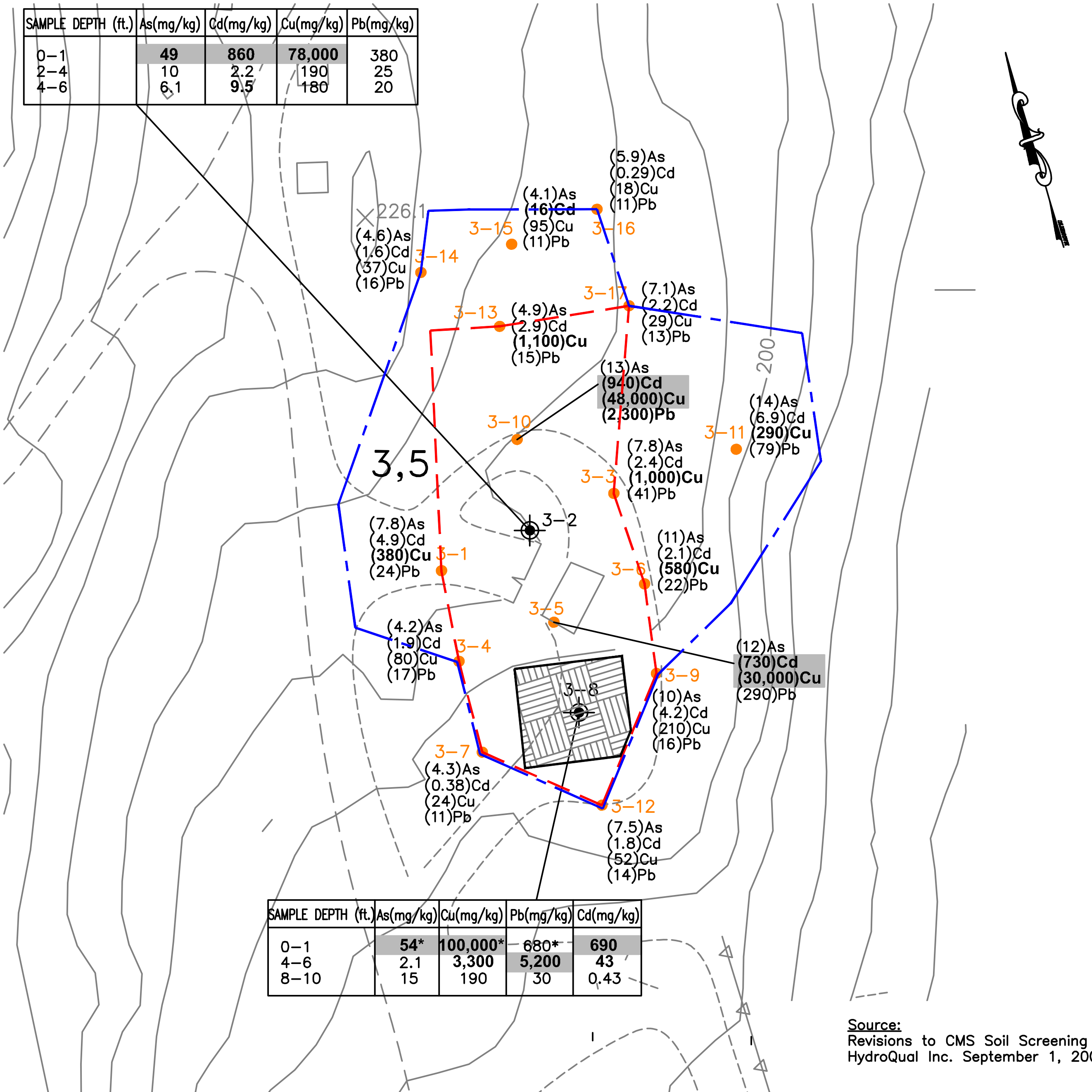
FIGURE 18
COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE DELINEATION
SWMU 2 AND AOC A

Drawn By:	BC	Date Drawn:	11/25/13
Reviewed By:	KV	Date Reviewed:	11/2013
Scale:	1" = 50'	Plot Date:	11/2013
Project Number.:			



SAMPLE DEPTH (ft.)	As(mg/kg)	Cd(mg/kg)	Cu(mg/kg)	Pb(mg/kg)
0–1	49	860	78,000	380
2–4	10	2.2	190	25
4–6	6.1	9.5	180	20

SAMPLE DEPTH (ft.)	As(mg/kg)	Cu(mg/kg)	Pb(mg/kg)	Cd(mg/kg)
0–1	54*	100,000*	680*	690
4–6	2.1	3,300	5,200	43
8–10	15	190	30	0.43

LEGEND:

- 3–16 SHALLOW SOIL SAMPLE LOCATION (0–1 ft.)
- 3–2 VERTICAL DELINEATION BORING
- (16) CONCENTRATION (mg/kg) ABOVE INDUSTRIAL USE SOIL OBJECTIVE
- (16) CONCENTRATION (mg/kg) ABOVE COMMERCIAL USE SOIL OBJECTIVE
- (1.8) CONCENTRATION (mg/kg) BELOW COMMERCIAL USE SOIL OBJECTIVE
- 200 GROUND SURFACE CONTOUR
- 226.1 GROUND SURFACE ELEVATION
- APPROXIMATE AREA OF SOIL CONTAINING METALS CONCENTRATIONS ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
- APPROXIMATE AREA OF SOIL CONTAINING METALS CONCENTRATIONS ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE
- * TWO SAMPLES WERE ANALYZED AT THIS SAMPLE LOCATION. THE CONCENTRATION SHOWN REPRESENTS THE GREATER OF THE TWO SAMPLING RESULTS.
- DEPTH OF EXCEEDANCES IS 6 FEET MINIMUM

NOTE:

1. mg/kg = MILLIGRAMS PER KILOGRAM
2. THE AREA EXCEEDING THE INDUSTRIAL SOIL CLEANUP OBJECTIVE IS 8,363 SQ. FT.
3. THE AREA EXCEEDING THE COMMERCIAL SOIL CLEANUP OBJECTIVE IS 18,153 SQ. FT.
4. THE AREA EXCEEDING THE INDUSTRIAL AND COMMERCIAL SOIL CLEANUP OBJECTIVES TO A DEPTH OF 6 FT EQUALS 1,059 SQ. FT.

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Arsenic (As)	16	16
Cadmium (Cd)	9.3	60
Copper (Cu)	270	10,000
Lead (Pb)	1,000	3,900

Source:
Revisions to CMS Soil Screening Criteria
HydroQual Inc. September 1, 2006.

50 0 50
SCALE IN FEET

EHS Support consider it done

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Rev.	By:	Date:

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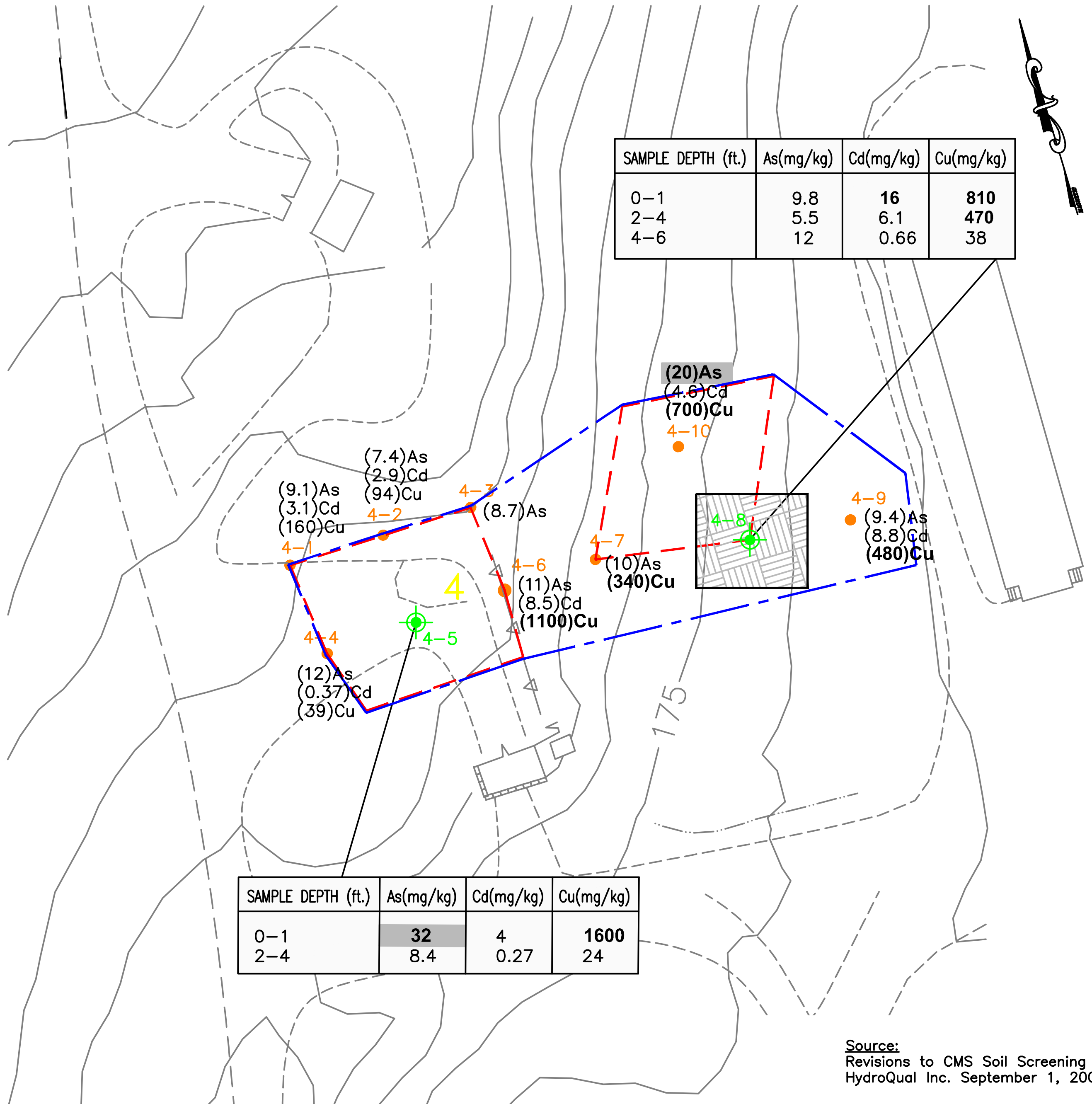
PORT EWEN, NY.

FIGURE 19
COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE DELINEATION: SWMU 3 AND 5

Drawn By:	BC	Date Drawn:	11/25/13
Reviewed By:	KV	Date Reviewed:	11/2013
Scale:	1" = 50'	Plot Date:	11/2013
Project Number.:			



SAMPLE DEPTH (ft.)	As(mg/kg)	Cd(mg/kg)	Cu(mg/kg)
0–1	9.8	**16**	**810**
2–4	5.5	6.1	**470**
4–6	12	0.66	38

SAMPLE DEPTH (ft.)	As(mg/kg)	Cd(mg/kg)	Cu(mg/kg)
0–1	**32**	4	**1600**
2–4	8.4	0.27	24

LEGEND:

11–1 SHALLOW SOIL SAMPLE LOCATION (0–1ft)

11–3 VERTICAL DELINEATION BORING

(12) CONCENTRATION (mg/kg) ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

(12) CONCENTRATION (mg/kg) ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE

(4.9) CONCENTRATION (mg/kg) BELOW COMMERCIAL USE SOIL CLEANUP OBJECTIVE

181.6 × GROUND SURFACE ELEVATION

—175— GROUND SURFACE CONTOUR

APPROXIMATE AREA OF SOIL CONTAINING METALS CONCENTRATIONS ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

APPROXIMATE AREA OF SOIL CONTAINING METALS CONCENTRATIONS ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE

DEPTH OF EXCEEDANCES IS 4 FEET

NOTE:
1. mg/kg = MILLIGRAMS PER KILOGRAM
2. THE AREA EXCEEDING THE INDUSTRIAL SOIL CLEANUP OBJECTIVE IS 5,244 SQ. FT.
3. THE AREA EXCEEDING THE COMMERCIAL SOIL CLEANUP OBJECTIVE IS 11,029 SQ. FT.
4. THE AREA EXCEEDING THE COMMERCIAL SOIL CLEANUP OBJECTIVES TO A DEPTH OF 6 FT EQUALS 1,034 SQ. FT.

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Arsenic (As)	16	16
Cadmium (Cd)	9.3	60
Copper (Cu)	270	10,000

Source:
Revisions to CMS Soil Screening Criteria
HydroQual Inc. September 1, 2006.

50 0 50
SCALE IN FEET

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Rev.		By:	Date:
Rev.		By:	Date:
Rev.		By:	Date:

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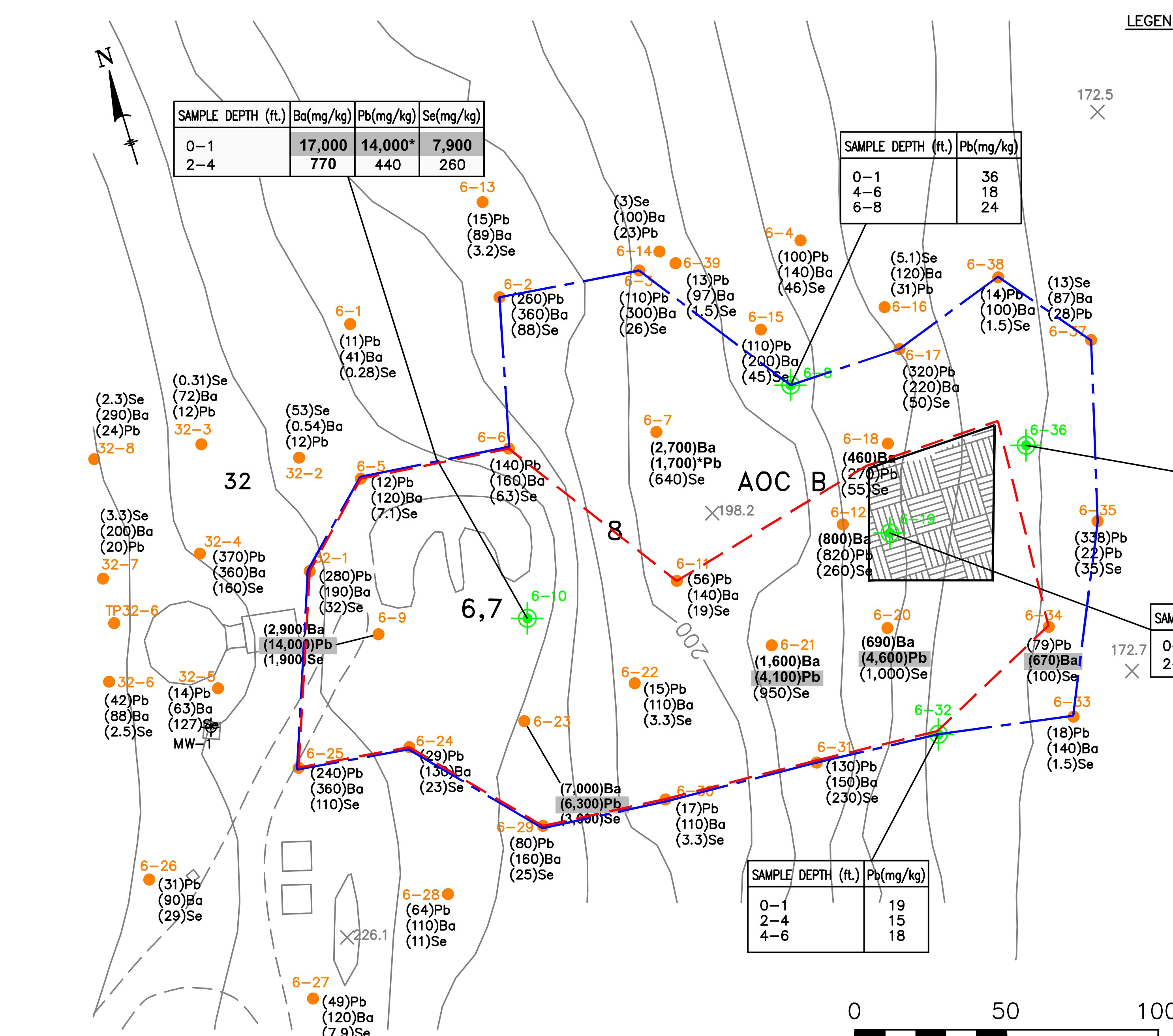
FIGURE 20
COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE DELINEATION: SWMU 4

Drawn By: BC		Date Drawn:	11/25/2013
Reviewed By: KV		Date Reviewed:	11/2013
Scale:	1" = 50'	Plot Date:	11/2013
Project Number.:			



LEGEND:

- 6–4 SHALLOW SOIL SAMPLE LOCATION (0–1 ft.)
- 6–8 VERTICAL DELINEATION BORING
- **(1,000)** CONCENTRATION (mg/kg) ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
- **(1,000)** CONCENTRATION (mg/kg) ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE
- (15) CONCENTRATION (mg/kg) BELOW COMMERCIAL USE SOIL CLEANUP OBJECTIVE
- 200 GROUND SURFACE CONTOUR
- 172.5 GROUND SURFACE ELEVATION
- APPROXIMATE AREA OF SOIL CONTAINING METALS CONCENTRATIONS ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
- APPROXIMATE AREA OF SOIL CONTAINING METALS CONCENTRATIONS ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE
- DEPTH OF EXCEEDANCES IS 4 FEET

* TWO SAMPLES WERE ANALYZED AT THIS SAMPLE LOCATION. THE CONCENTRATION SHOWN REPRESENTS THE GREATER OF THE TWO SAMPLING RESULTS.

NOTE:
1. mg/kg = MILLIGRAMS PER KILOGRAM
2. THE AREA EXCEEDING THE INDUSTRIAL SOIL CLEANUP OBJECTIVE IS 21,580 SQ. FT.
3. THE AREA EXCEEDING THE COMMERCIAL SOIL CLEANUP OBJECTIVE IS 34,943 SQ. FT.
4. THE AREA EXCEEDING THE INDUSTRIAL AND COMMERCIAL SOIL CLEANUP OBJECTIVES TO A DEPTH OF 6 FT EQUALS 1,809 SQ. FT.

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Barium (Ba)	400	10,000
Lead (Pb)	1,000	3,900
Selinium (Se)	1,500	6,800

0 50 100
scale feet

Source:
Revisions to CMS Soil Screening Criteria
HydroQual Inc. September 1, 2006.

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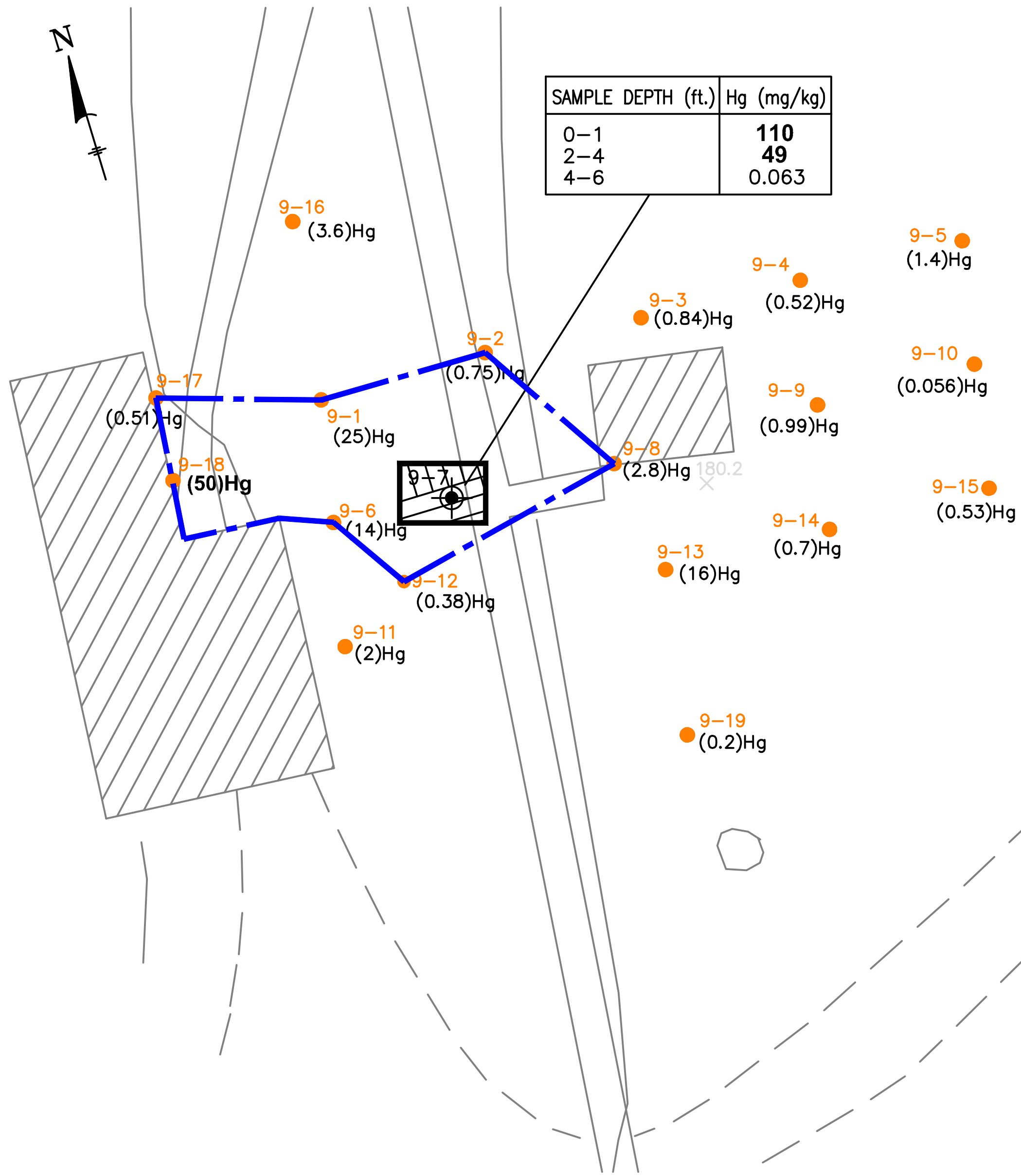
Rev.	By:	Date:
Rev.	By:	Date:
Rev.	By:	Date:
Rev.	By:	Date:

DYNO-NOBEL, INC.
PORT EWEN, NY.

FIGURE 21
COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE DELINEATION
SWMU NOS. 6, 7, 8, 32 & AOC B

Drawn By:	BC	Date Drawn:	11/25/2013
Reviewed By:	KV	Date Reviewed:	11/2013
Scale:	1" = 50'	Plot Date:	11/2013
Project Number.:			



LEGEND:

- 9–3 — SHALLOW SOIL SAMPLE LOCATION (0–1 ft.)
- 9–7 — VERTICAL DELINEATION BORING
- **(16)** — CONCENTRATION (mg/kg) ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE
- (1.4) — CONCENTRATION (mg/kg) BELOW COMMERCIAL USE SOIL CLEANUP OBJECTIVE
- 180.2 — GROUND SURFACE ELEVATION
- APPROXIMATE AREA OF SOIL CONTAINING METALS CONCENTRATIONS ABOVE COMMERCIAL USE SOIL CLEANUP CRITERIA
- EXISTING STRUCTURE
- DEPTH OF EXCEEDANCES IS 4 FT

NOTE:
1. mg/kg = MILLIGRAMS PER KILOGRAM
2. THE AREA EXCEEDING THE COMMERCIAL SOIL CLEANUP OBJECTIVE IS 867 SQ. FT.
3. THE AREA EXCEEDING THE COMMERCIAL SOIL CLEANUP OBJECTIVES TO A DEPTH OF 4 FT EQUALS 74 SQ. FT.

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Mercury (Hg)	47	270

20 0 20
scale feet

Source:
Revisions to CMS Soil Screening Criteria
HydroQual Inc. September 1, 2006.

EHS Support consider it done

REVISIONS		
Rev.	By:	Date:
Rev.	By:	Date:
Rev.	By:	Date:
Rev.	By:	Date:

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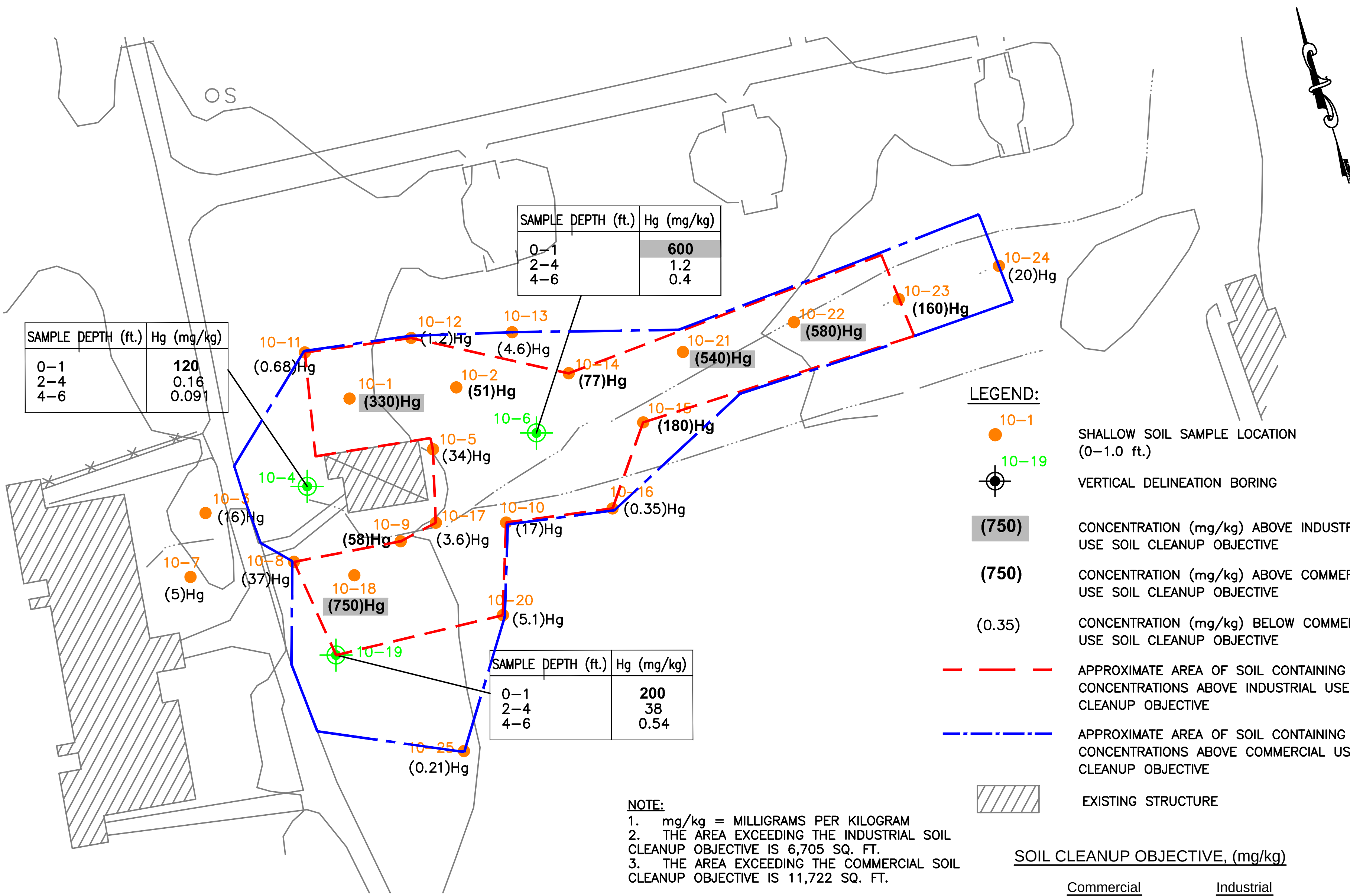
PORT EWEN, NY.

FIGURE 22
COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE DELINEATION: SWMU 9

Drawn By: BC		Date Drawn:	11/25/2013
Reviewed By: KV		Date Reviewed:	11/2013
Scale:	1" = 50'	Plot Date:	11/2013
Project Number.:			



LEGEND:

10–1	SHALLOW SOIL SAMPLE LOCATION (0–1.0 ft.)
10–19	VERTICAL DELINEATION BORING
(750)	CONCENTRATION (mg/kg) ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
(750)	CONCENTRATION (mg/kg) ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE
(0.35)	CONCENTRATION (mg/kg) BELOW COMMERCIAL USE SOIL CLEANUP OBJECTIVE
	APPROXIMATE AREA OF SOIL CONTAINING METALS CONCENTRATIONS ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
	APPROXIMATE AREA OF SOIL CONTAINING METALS CONCENTRATIONS ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE
	EXISTING STRUCTURE

NOTE:
1. mg/kg = MILLIGRAMS PER KILOGRAM
2. THE AREA EXCEEDING THE INDUSTRIAL SOIL CLEANUP OBJECTIVE IS 6,705 SQ. FT.
3. THE AREA EXCEEDING THE COMMERCIAL SOIL CLEANUP OBJECTIVE IS 11,722 SQ. FT.

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Mercury (Hg)	47	220

Source:
Revisions to CMS Soil Screening Criteria
HydroQual Inc. September 1, 2006.

40 0 40
SCALE IN FEET

EHS Support
consider it done

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Rev.	By:	Date:
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Rev.	By:	Date:

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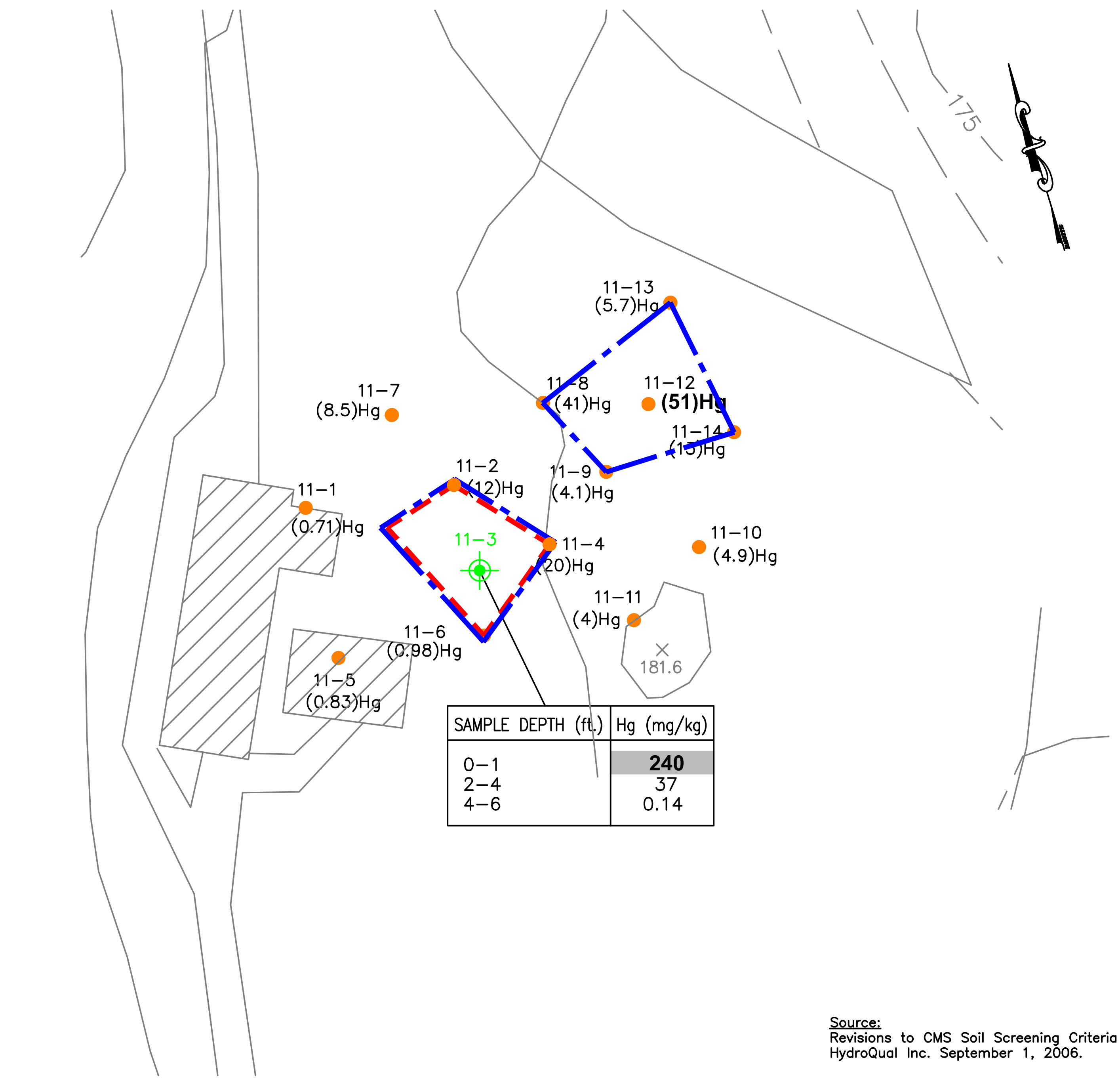
PORT EWEN, NY.

FIGURE 23
COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE DELINEATION: SWMU 10

Drawn By: BC	Date Drawn: 11/25/2013
Reviewed By: KV	Date Reviewed: 11/2013
Scale: 1" = 40'	Plot Date: 11/2013
Project Number.:	



SAMPLE DEPTH (ft.)	Hg (mg/kg)
0–1	**240**
2–4	37
4–6	0.14

LEGEND:

11–1 — SHALLOW SOIL SAMPLE LOCATION (0–1.0 ft.)

11–3 — VERTICAL DELINEATION BORING

(240) — CONCENTRATION (mg/kg) ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

(240) — CONCENTRATION (mg/kg) ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE

(4.9) — CONCENTRATION (mg/kg) BELOW COMMERCIAL USE SOIL CLEANUP OBJECTIVE

181.6 — GROUND SURFACE ELEVATION

—175— GROUND SURFACE CONTOUR

APPROXIMATE AREA OF SOIL CONTAINING METALS CONCENTRATIONS ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

APPROXIMATE AREA OF SOIL CONTAINING METALS CONCENTRATIONS ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE

EXISTING STRUCTURE

NOTE:
1. mg/kg = MILLIGRAMS PER KILOGRAM
2. THE AREA EXCEEDING THE INDUSTRIAL SOIL CLEANUP OBJECTIVE IS 207 SQ. FT.
3. THE AREA EXCEEDING THE COMMERCIAL SOIL CLEANUP OBJECTIVE IS 538 SQ. FT.

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Mercury (Hg)	47	220

Source:
Revisions to CMS Soil Screening Criteria
HydroQual Inc. September 1, 2006.

20 0 20
SCALE IN FEET

EHS Support
consider it done

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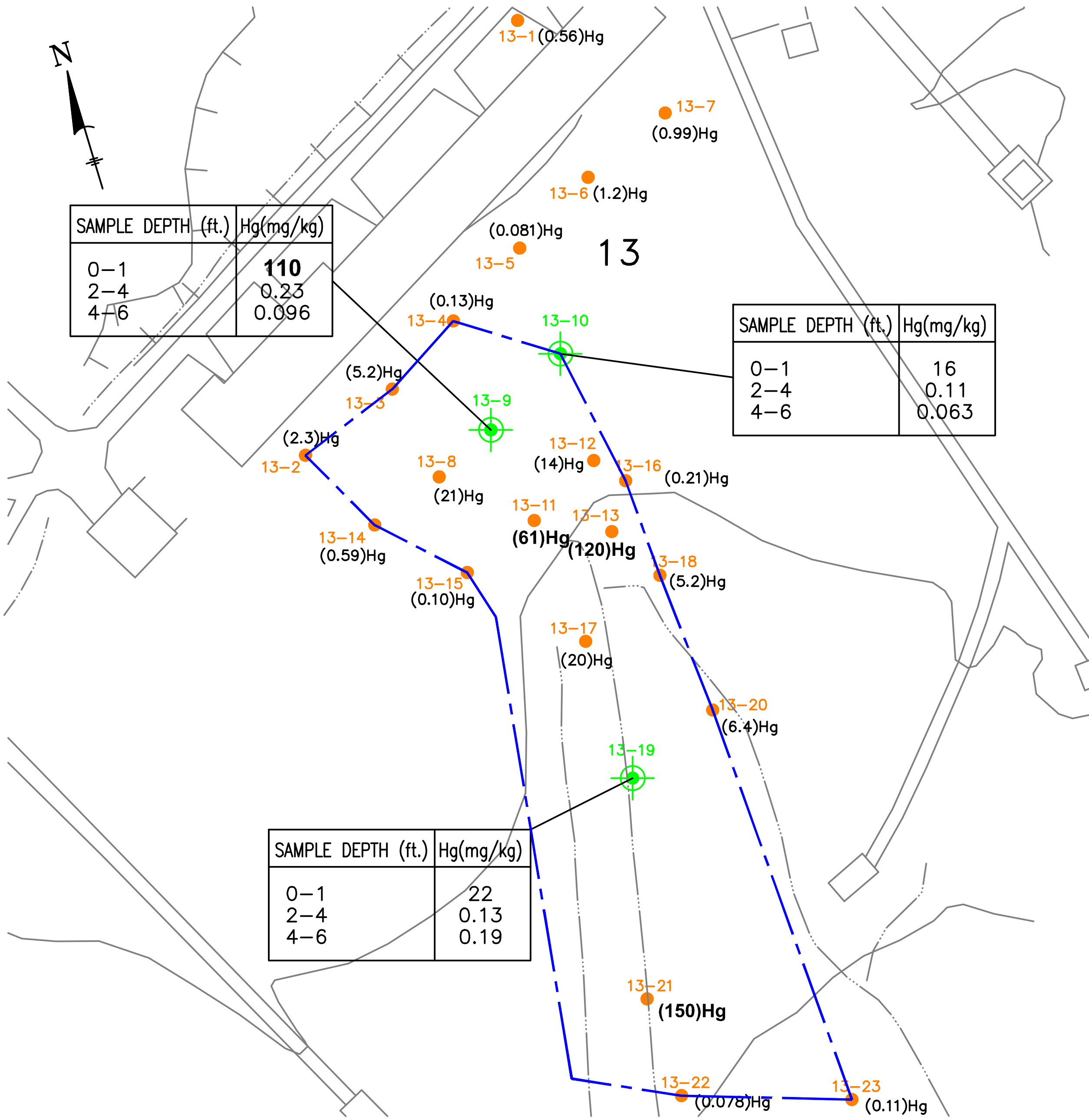
Rev.	By:	Date:
Rev.	By:	Date:
Rev.	By:	Date:
Rev.	By:	Date:

DYNO-NOBEL, INC.
PORT EWEN, NY.

FIGURE 24
COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE DELINEATION: SWMU 11

Drawn By:	BC	Date Drawn:	12/06/13
Reviewed By:	KV	Date Reviewed:	12/2013
Scale:	1" = 20'	Plot Date:	12/2013
Project Number.:			



SAMPLE DEPTH (ft.)	Hg(mg/kg)
0–1	**110**
2–4	0.23
4–6	0.096

SAMPLE DEPTH (ft.)	Hg(mg/kg)
0–1	16
2–4	0.11
4–6	0.063

SAMPLE DEPTH (ft.)	Hg(mg/kg)
0–1	22
2–4	0.13
4–6	0.19

LEGEND:

13–3 SHALLOW SOIL SAMPLE LOCATION (0–1 ft.)

13–9 VERTICAL DELINEATION BORING

(110) CONCENTRATION (mg/kg) ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE

(1.2) CONCENTRATION (mg/kg) BELOW COMMERCIAL USE SOIL CLEANUP OBJECTIVE

APPROXIMATE AREA OF SOIL CONTAINING METALS CONCENTRATIONS ABOVE COMMERCIAL USE SOIL CLEANUP CRITERIA

NOTE:
1. mg/kg = MILLIGRAMS PER KILOGRAM
2. THE AREA EXCEEDING THE COMMERCIAL SOIL CLEANUP OBJECTIVE IS 15,534 SQ. FT.

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Mercury (Hg)	47	270

Source:
Revisions to CMS Soil Screening Criteria
HydroQual Inc. September 1, 2006.

0 50 100
scale feet

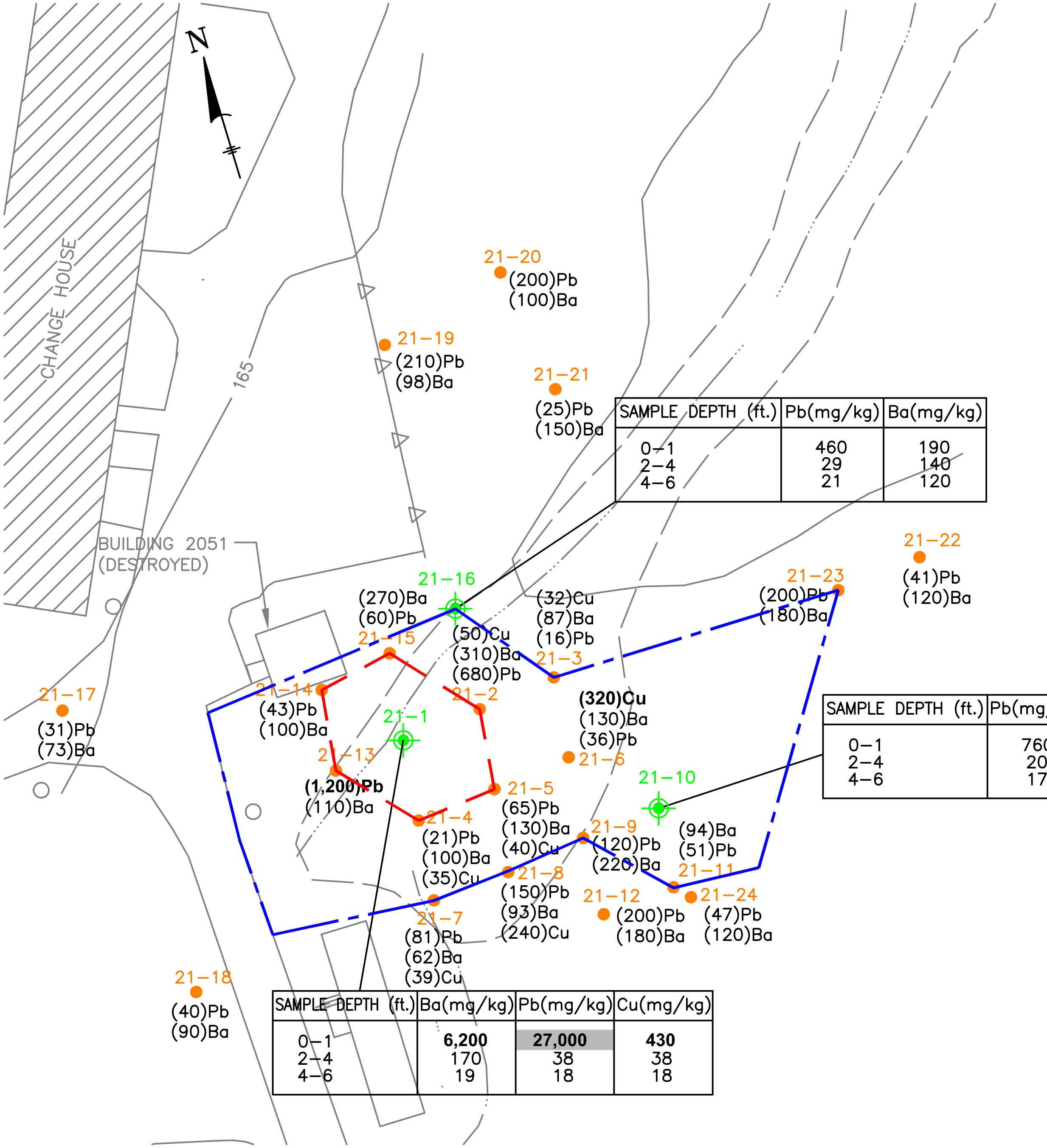
EHS Support *consider it done*

REVISIONS			
Rev.		By:	Date:
Rev.		By:	Date:
Rev.		By:	Date:
Rev.		By:	Date:

DYNO-NOBEL, INC.
PORT EWEN, NY.

FIGURE 25
COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE DELINEATION: SWMU 13

Drawn By: BC		Date Drawn:	11/26/2013
Reviewed By: KV		Date Reviewed:	11/2013
Scale:	1" = 50'	Plot Date:	11/2013
Project Number.:			



SAMPLE DEPTH (ft.)	Pb(mg/kg)	Ba(mg/kg)
0–1	460	190
2–4	29	140
4–6	21	120

SAMPLE DEPTH (ft.)	Pb(mg/kg)	Ba(mg/kg)
0–1	760	**680**
2–4	20	81
4–6	17	130

SAMPLE DEPTH (ft.)	Ba(mg/kg)	Pb(mg/kg)	Cu(mg/kg)
0–1	**6,200**	**27,000**	**430**
2–4	170	38	38
4–6	19	18	18

LEGEND:

- 21–21 — SHALLOW SOIL SAMPLE LOCATION (0–1.0 ft.)
- 21–16 — VERTICAL DELINEATION BORING
- **(2,700)** (shaded) — CONCENTRATION (mg/kg) ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
- **(2,700)** — CONCENTRATION (mg/kg) ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE
- (210) — CONCENTRATION (mg/kg) BELOW COMMERCIAL USE SOIL CLEANUP OBJECTIVE
- APPROXIMATE AREA OF SOIL CONTAINING METALS CONCENTRATIONS ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVES
- APPROXIMATE AREA OF SOIL CONTAINING METALS CONCENTRATIONS ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVES
- 165 — GROUND SURFACE CONTOUR
- EXISTING STRUCTURE

NOTE:

1. mg/kg = MILLIGRAMS PER KILOGRAM
2. THE AREA EXCEEDING THE INDUSTRIAL SOIL CLEANUP OBJECTIVE IS 1,154.36 SQ. FT.
3. THE AREA EXCEEDING THE COMMERCIAL SOIL CLEANUP OBJECTIVE IS 8,151.90 SQ. FT.

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Barium (Ba)	400	10,000
Copper (Cu)	270	10,000
Lead (Pb)	1,000	3,900

Source:
Revisions to CMS Soil Screening Criteria
HydroQual Inc. September 1, 2006.

40 0 40
scale feet

EHS Support consider it done

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Rev.	By:	Date:
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Rev.	By:	Date:
Rev.	By:	Date:

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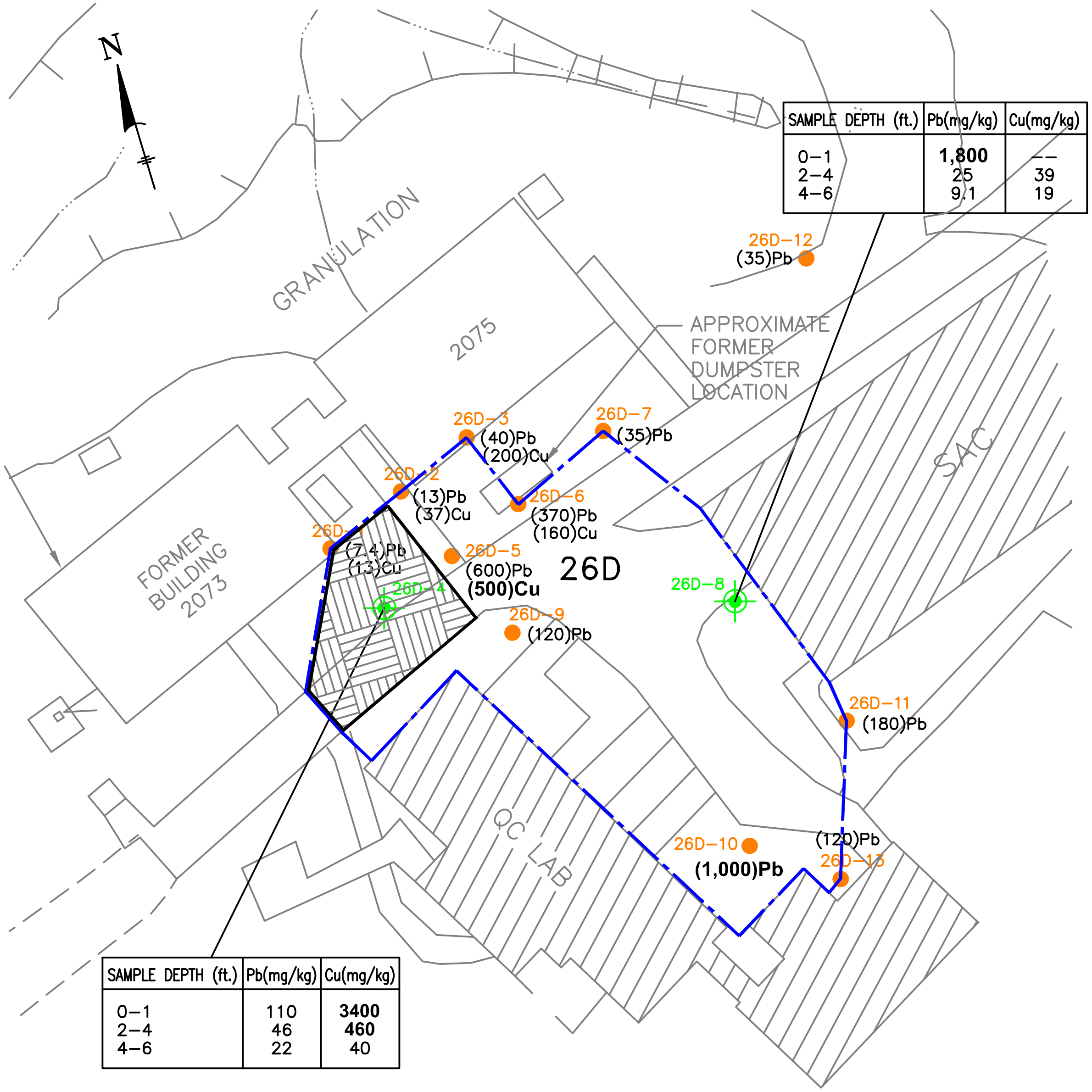
PORT EWEN, NY.

FIGURE 26
COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE DELINEATION: SWMU 21

Drawn By:	BC	Date Drawn:	11/26/2013
Reviewed By:	KV	Date Reviewed:	11/2013
Scale:	1" = 40'	Plot Date:	11/2013
Project Number.:			



SAMPLE DEPTH (ft.)	Pb(mg/kg)	Cu(mg/kg)
0–1	**1,800**	––
2–4	25	39
4–6	9.1	19

SAMPLE DEPTH (ft.)	Pb(mg/kg)	Cu(mg/kg)
0–1	110	**3400**
2–4	46	**460**
4–6	22	40

LEGEND:

26D–12 SHALLOW SOIL SAMPLE LOCATION (0–1 ft.)

26D–8 VERTICAL DELINEATION BORING

(1,800) CONCENTRATION (mg/kg) ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE

(7.4) CONCENTRATION (mg/kg) BELOW COMMERCIAL USE SOIL CLEANUP OBJECTIVE

APPROXIMATE AREA OF SOIL CONTAINING METALS CONCENTRATIONS ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE

EXISTING STRUCTURE

DEPTH OF EXCEEDANCES IS 4 FEET MINIMUM

NOTE:
1. mg/kg = MILLIGRAMS PER KILOGRAM
2. THE AREA EXCEEDING THE COMMERCIAL SOIL CLEANUP OBJECTIVE IS 7,741 SQ. FT.
3. THE AREA EXCEEDING THE COMMERCIAL SOIL CLEANUP OBJECTIVES TO A DEPTH OF 4 FT EQUALS 1,051 SQ. FT.

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Lead (Pb)	1,000	3,900
Copper (Cu)	270	10,000

Source:
Revisions to CMS Soil Screening Criteria
HydroQual Inc. September 1, 2006.

40 0 40
scale feet

EHS Support
consider it done

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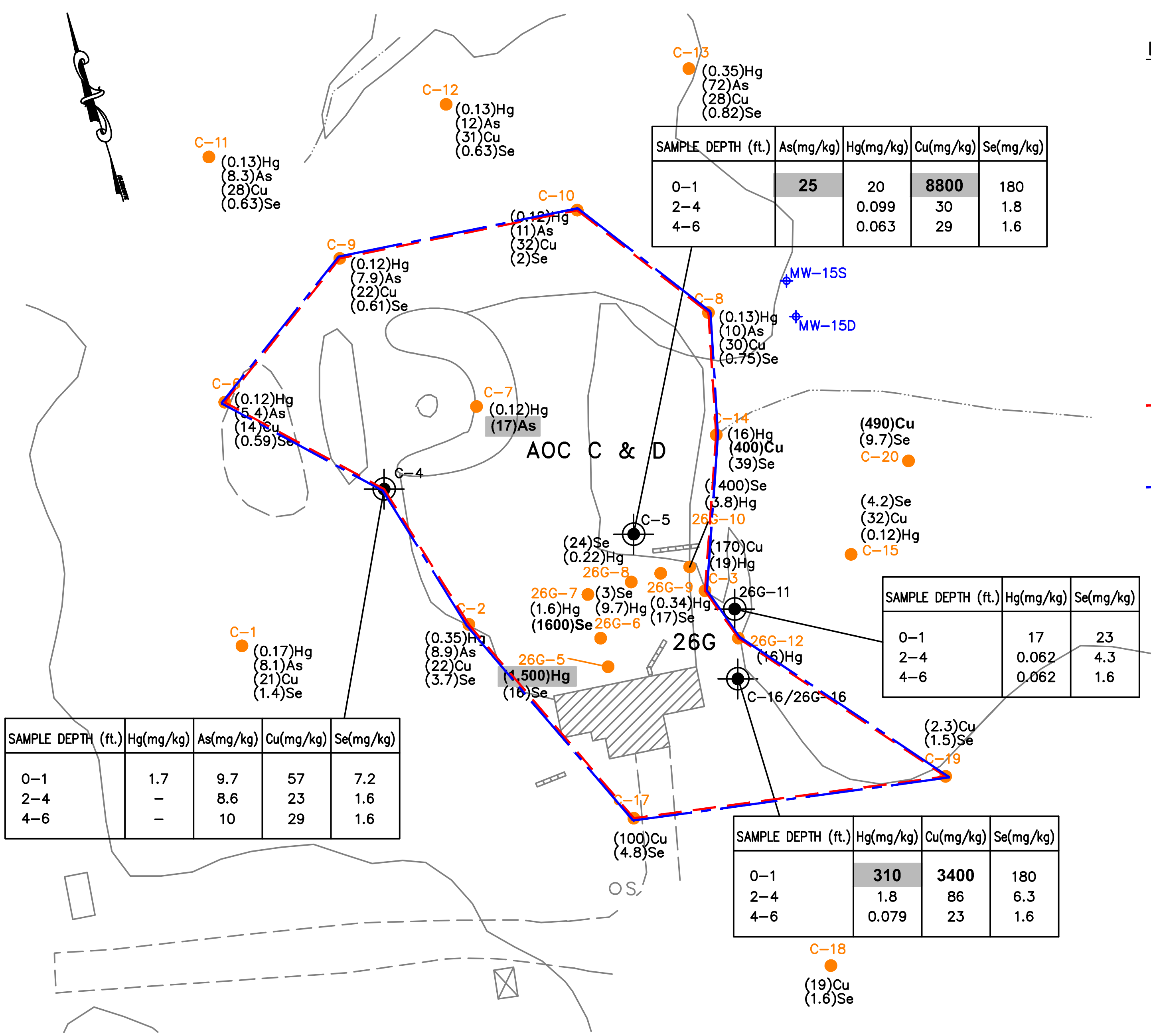
Rev.		By:	Date:
Rev.		By:	Date:
Rev.		By:	Date:

DYNO-NOBEL, INC.
PORT EWEN, NY.

FIGURE 27
COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE DELINEATION: SWMU 26D

Drawn By: BC		Date Drawn:	11/26/2013
Reviewed By: KV		Date Reviewed:	11/2013
Scale:	1" = 40'	Plot Date:	11/2013
Project Number.:			



SAMPLE DEPTH (ft.)	As(mg/kg)	Hg(mg/kg)	Cu(mg/kg)	Se(mg/kg)
0-1	**25**	20	**8800**	180
2-4		0.099	30	1.8
4-6		0.063	29	1.6

SAMPLE DEPTH (ft.)	Hg(mg/kg)	Se(mg/kg)
0-1	17	23
2-4	0.062	4.3
4-6	0.062	1.6

SAMPLE DEPTH (ft.)	Hg(mg/kg)	As(mg/kg)	Cu(mg/kg)	Se(mg/kg)
0-1	1.7	9.7	57	7.2
2-4	–	8.6	23	1.6
4-6	–	10	29	1.6

SAMPLE DEPTH (ft.)	Hg(mg/kg)	Cu(mg/kg)	Se(mg/kg)
0-1	**310**	**3400**	180
2-4	1.8	86	6.3
4-6	0.079	23	1.6

LEGEND:

C-8 — SHALLOW SOIL SAMPLE LOCATION (0-1 ft.)

26G-11 — VERTICAL DELINEATION BORING

(15,000) (shaded) — CONCENTRATION (mg/kg) ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

(15,000) — CONCENTRATION (mg/kg) ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE

(1.4) — CONCENTRATION (mg/kg) BELOW COMMERCIAL USE SOIL CLEANUP OBJECTIVE

APPROXIMATE AREA OF SOIL CONTAINING METALS CONCENTRATIONS ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

APPROXIMATE AREA OF SOIL CONTAINING METALS CONCENTRATIONS ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE

NOTE:
1. mg/kg = MILLIGRAMS PER KILOGRAM
2. THE AREA EXCEEDING THE INDUSTRIAL SOIL CLEANUP OBJECTIVE IS 21,049 SQ. FT.
3. THE AREA EXCEEDING THE COMMERCIAL SOIL CLEANUP OBJECTIVE IS 21,049 SQ. FT.

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Copper (Cu)	270	10,000
Mercury (Hg)	47	220
Selenium (Se)	1,500	6,800
Arsenic (As)	16	16

Source:
Revisions to CMS Soil Screening Criteria
HydroQual Inc. September 1, 2006.

50 0 50
SCALE IN FEET

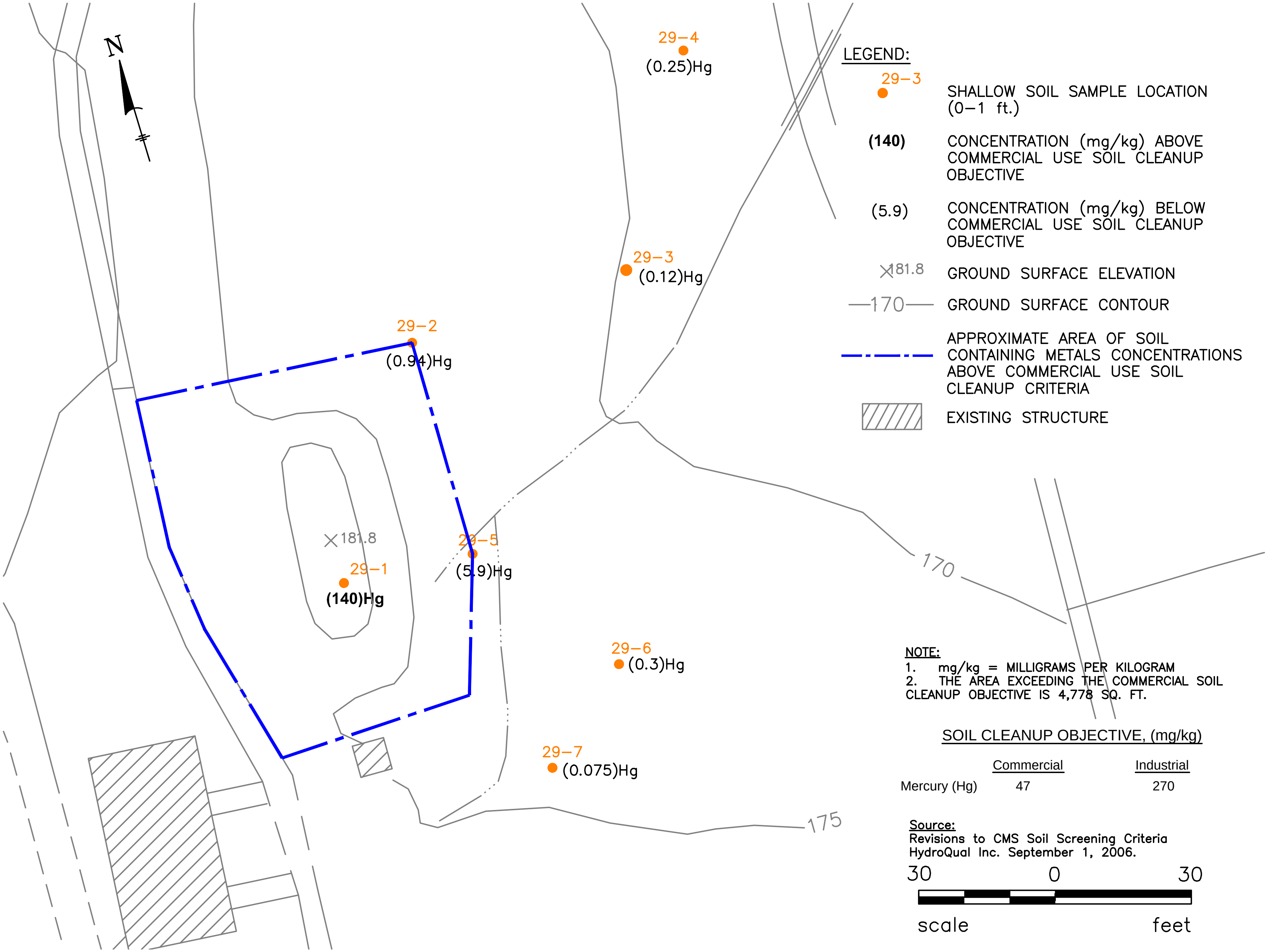
EHS Support
consider it done

REVISIONS		
Rev.	By:	Date:
Rev.	By:	Date:
Rev.	By:	Date:
Rev.	By:	Date:

DYNO-NOBEL, INC.
PORT EWEN, NY.

FIGURE 28
COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE DELINEATION SWMU 26G AND AOC C AND D

Drawn By: BC		Date Drawn:	12/06/13
Reviewed By: KV		Date Reviewed:	12/2013
Scale: 1" = 50'		Plot Date:	12/2013
Project Number.:			



NOTE:
1. mg/kg = MILLIGRAMS PER KILOGRAM
2. THE AREA EXCEEDING THE COMMERCIAL SOIL CLEANUP OBJECTIVE IS 4,778 SQ. FT.

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Mercury (Hg)	47	270

Source:
Revisions to CMS Soil Screening Criteria
HydroQual Inc. September 1, 2006.

EHS Support *consider it done*

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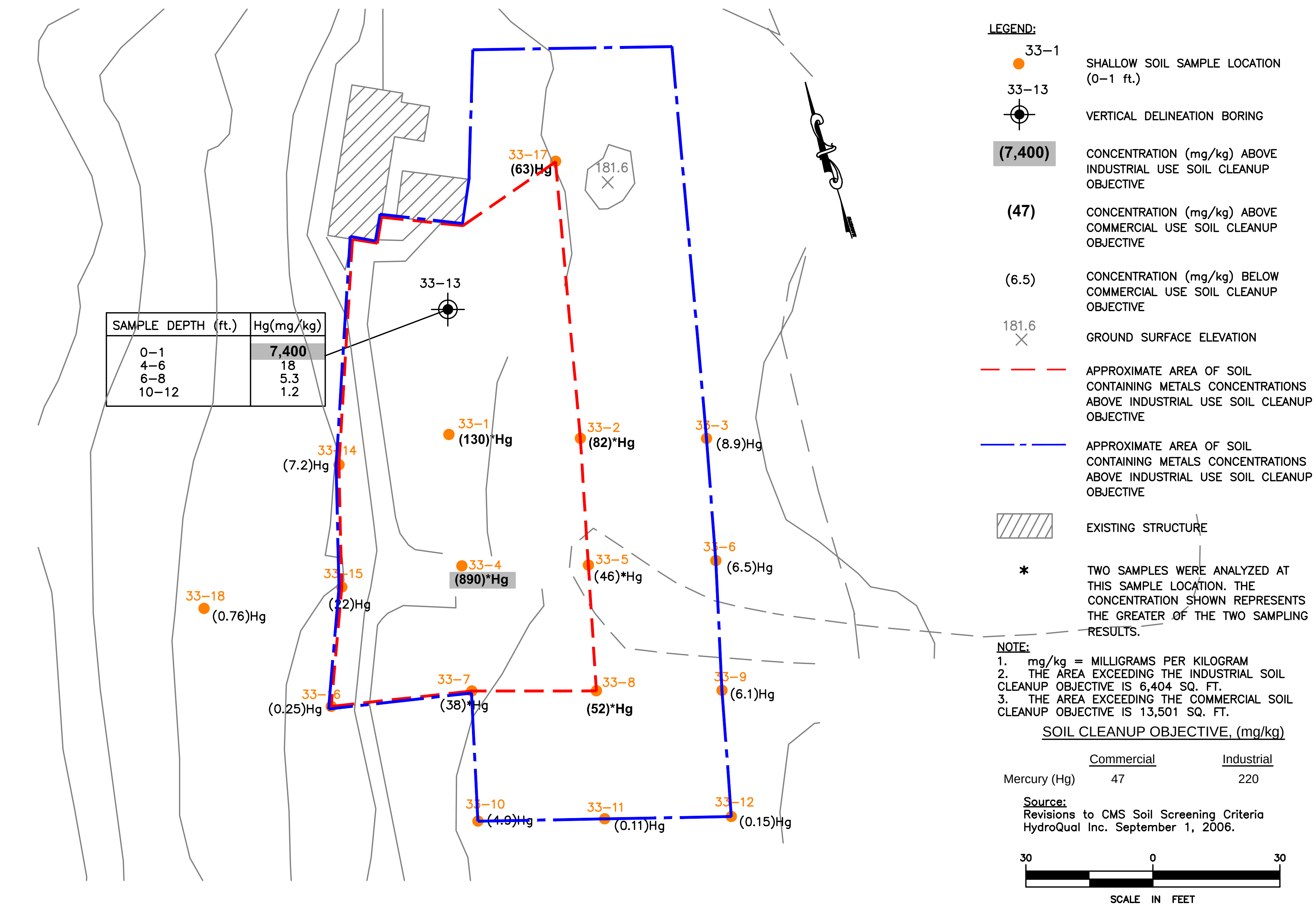
Rev.	By:	Date:
Rev.	By:	Date:
Rev.	By:	Date:

DYNO-NOBEL, INC.
PORT EWEN, NY.

FIGURE 29
COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE DELINEATION: SWMU 29

Drawn By:	BC	Date Drawn:	11/26/2013
Reviewed By:	KV	Date Reviewed:	11/2013
Scale:	1" = 50'	Plot Date:	11/2013
Project Number.:			



EHS Support consider it done

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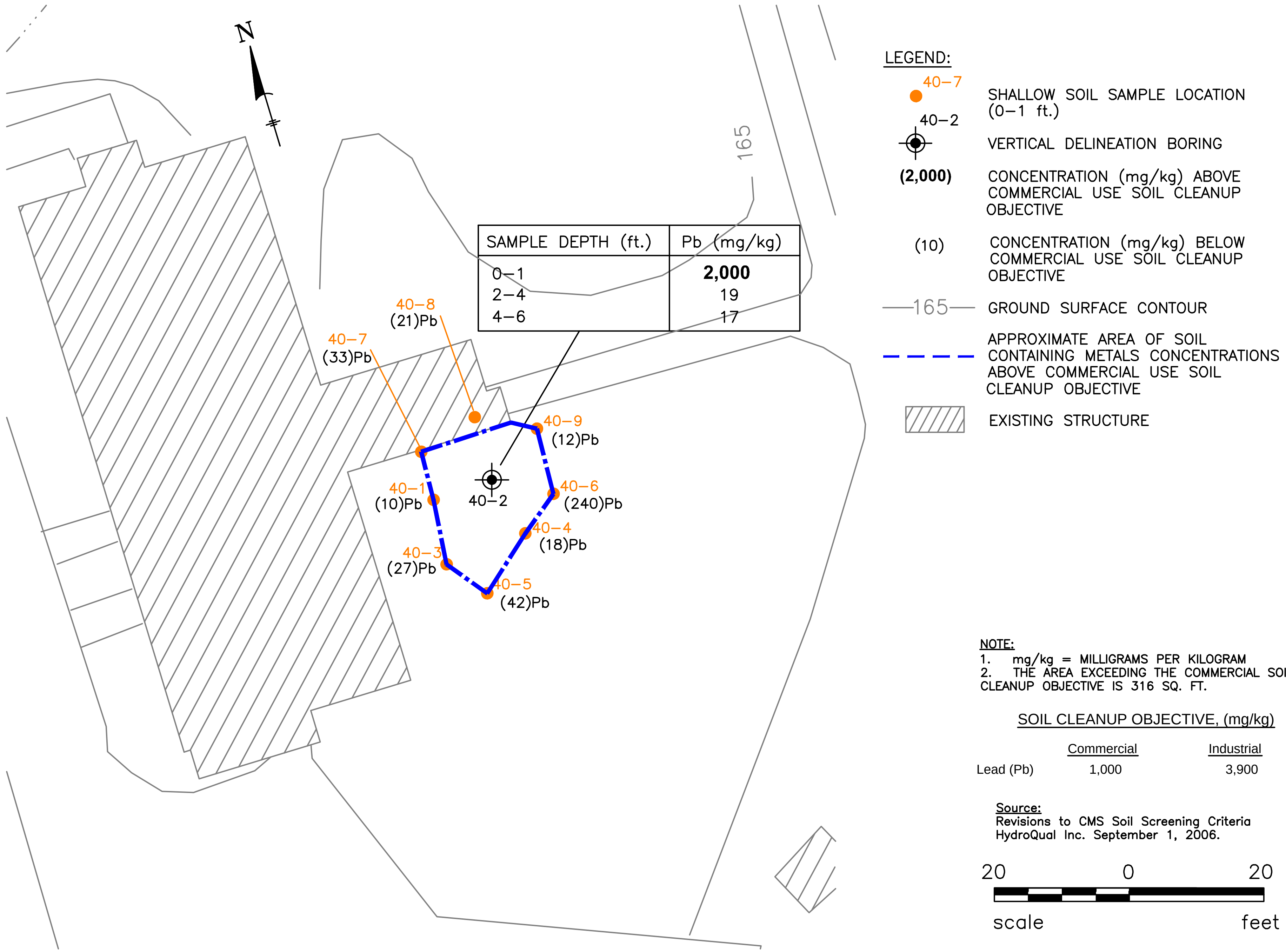
Rev.	By:	Date:
Rev.	By:	Date:
Rev.	By:	Date:
Rev.	By:	Date:

DYNO-NOBEL, INC.
PORT EWEN, NY.

FIGURE 30
COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE DELINEATION: SWMU 33

Drawn By:	BC	Date Drawn:	12/06/13
Reviewed By:	KV	Date Reviewed:	12/2013
Scale:	1" = 30'	Plot Date:	12/2013
Project Number.:			



NOTE:
1. mg/kg = MILLIGRAMS PER KILOGRAM
2. THE AREA EXCEEDING THE COMMERCIAL SOIL CLEANUP OBJECTIVE IS 316 SQ. FT.

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Lead (Pb)	1,000	3,900

Source:
Revisions to CMS Soil Screening Criteria
HydroQual Inc. September 1, 2006.

EHS Support *consider it done*

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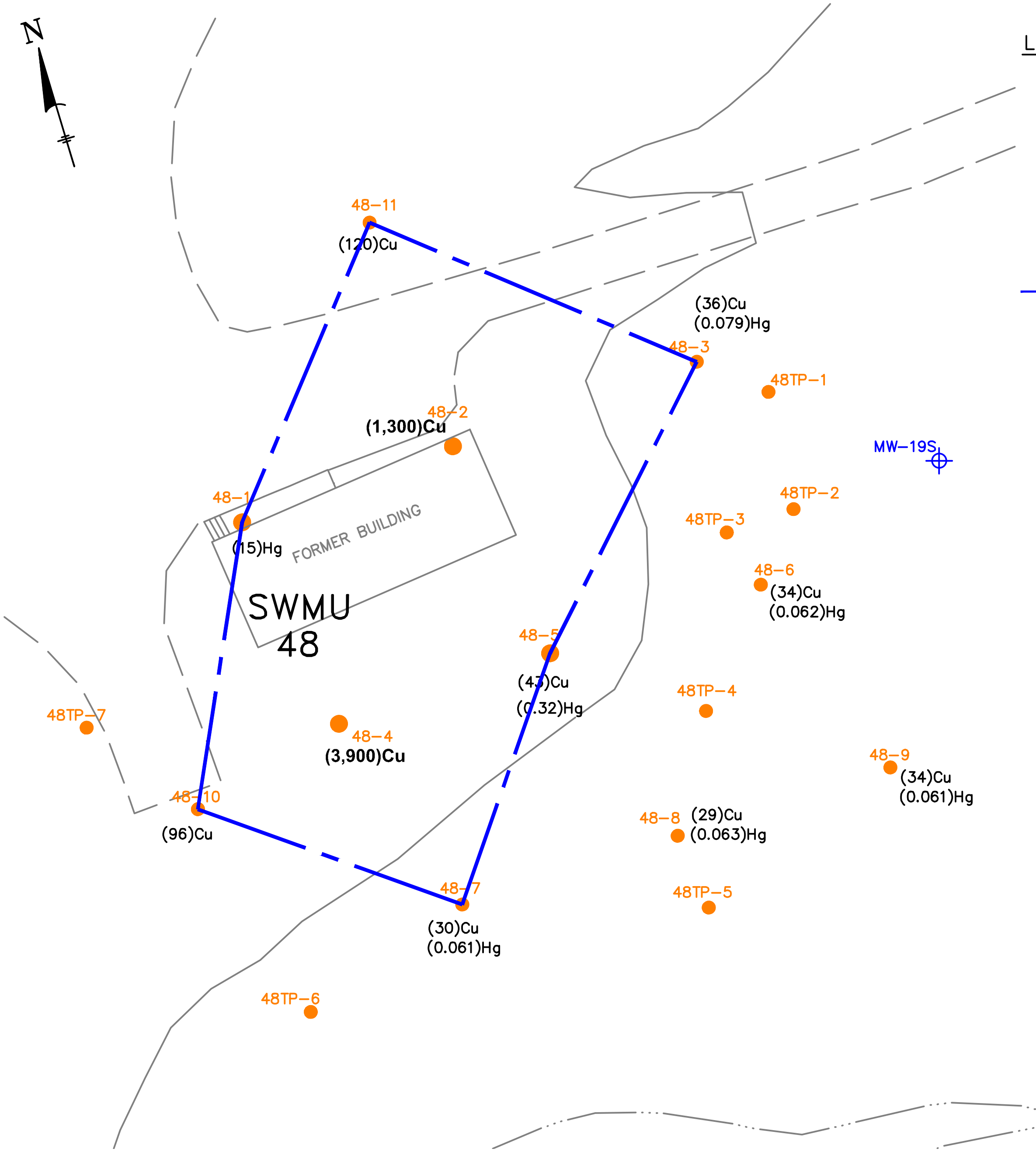
Rev.		By:	Date:
Rev.		By:	Date:
Rev.		By:	Date:

DYNO-NOBEL, INC.
PORT EWEN, NY.

FIGURE 31
COMMERCIAL USE SOIL CLEANUP OBJECTIVE DELINEATION
SWMU 40

Drawn By:	BC	Date Drawn:	11/26/2013
Reviewed By:	KV	Date Reviewed:	11/2013
Scale:	1" = 20'	Plot Date:	11/2013
Project Number.:			



LEGEND:

48–3 ● SHALLOW SOIL SAMPLE LOCATION

(15) CONCENTRATION (mg/kg) ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE

(36) CONCENTRATION (mg/kg) BELOW COMMERCIAL USE SOIL CLEANUP OBJECTIVE

— — — APPROXIMATE AREA OF SOIL CONTAINING METALS CONCENTRATIONS ABOVE COMMERCIAL USE SOIL CLEANUP CRITERIA

NOTE:
1. mg/kg = MILLIGRAMS PER KILOGRAM
2. THE AREA EXCEEDING THE COMMERCIAL SOIL CLEANUP OBJECTIVE IS 6,299 SQ. FT.

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Copper (Cu)	270	10000
Mercury (Hg)	47	270

Source:
Revisions to CMS Soil Screening Criteria
HydroQual Inc. September 1, 2006.

30 0 30
scale feet

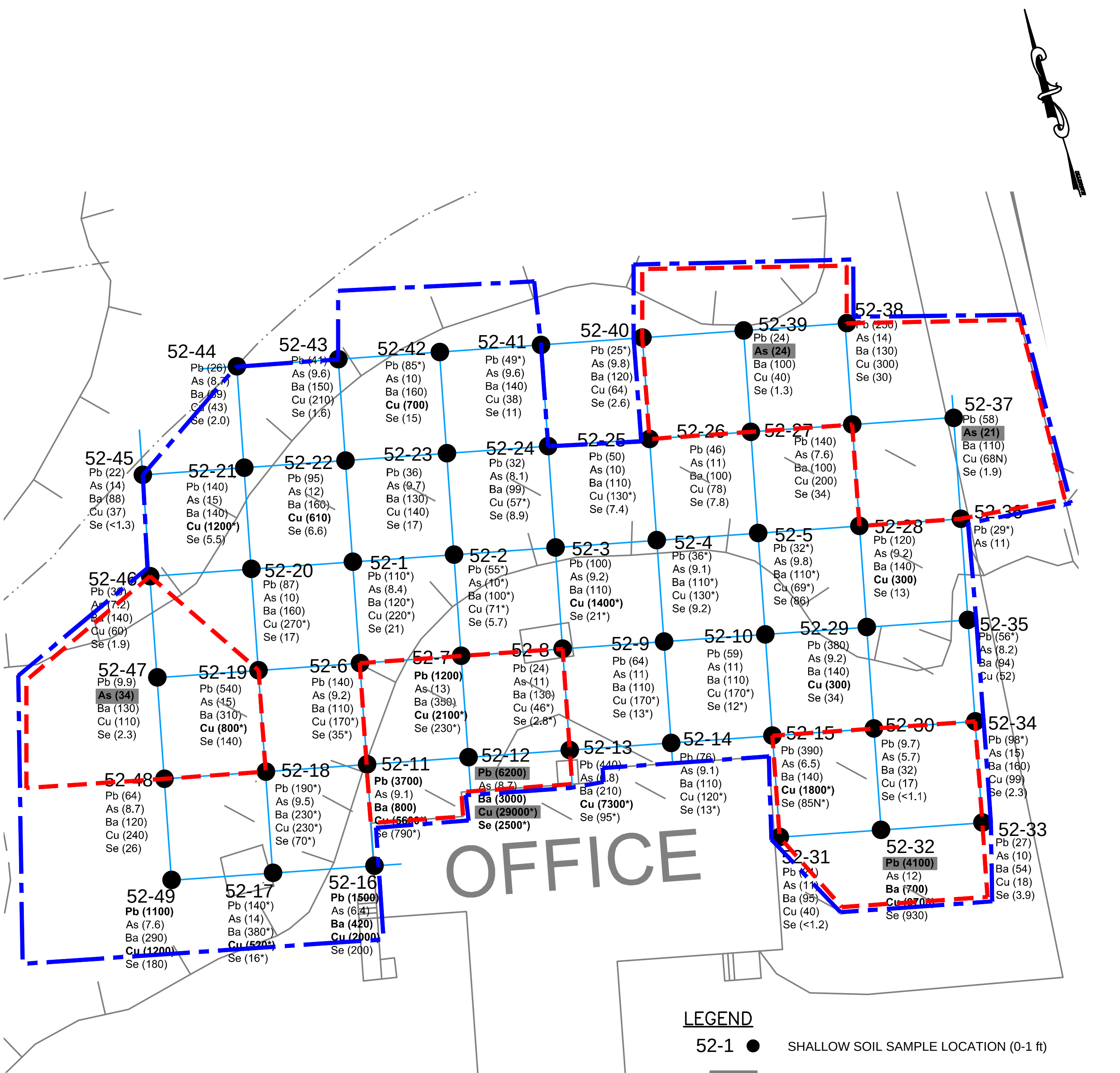
EHS Support *consider it done*

REVISIONS			
Rev.		By:	Date:
Rev.		By:	Date:
Rev.		By:	Date:
Rev.		By:	Date:

DYNO-NOBEL, INC.
PORT EWEN, NY.

FIGURE 32
COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE DELINEATION: SWMU 48

Drawn By: BC		Date Drawn:	11/27/2013
Reviewed By: KV		Date Reviewed:	11/2013
Scale:	1" = 50'	Plot Date:	11/2013
Project Number.:			



LEGEND

52-1 ● SHALLOW SOIL SAMPLE LOCATION (0-1 ft)

CONCENTRATION (mg/kg) EXCEEDS INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

(420) CONCENTRATION (mg/kg) EXCEEDS COMMERCIAL USE SOIL CLEANUP OBJECTIVE

(6.9) CONCENTRATION (mg/kg) BELOW COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

GROUND SURFACE CONTOUR

APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE

NOTES:

1. mg/kg = MILLIGRAMS PER KILOGRAM
2. * DENOTES A DUPLICATE SAMPLE. THE HIGHER CONCENTRATION IS SHOWN.
3. THE AREA EXCEEDING THE INDUSTRIAL SOIL CLEANUP OBJECTIVE IS 6,615 SQ. FT.
4. THE AREA EXCEEDING THE COMMERCIAL SOIL CLEANUP OBJECTIVE IS 19,435 SQ. FT.

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Arsenic (As)	16	16
Lead (Pb)	1,000	3,900
Barium (Ba)	400	10,000
Copper (Cu)	270	10,000
Selinium (Se)	1,500	6,800

SOURCE:
REVISION TO CMS SOIL SCREENING CRITERIA
DYNO NOBEL SITE, PORT EWEN, NEW YORK
HYDROQUAL INC., SEPTEMBER 1, 2006.

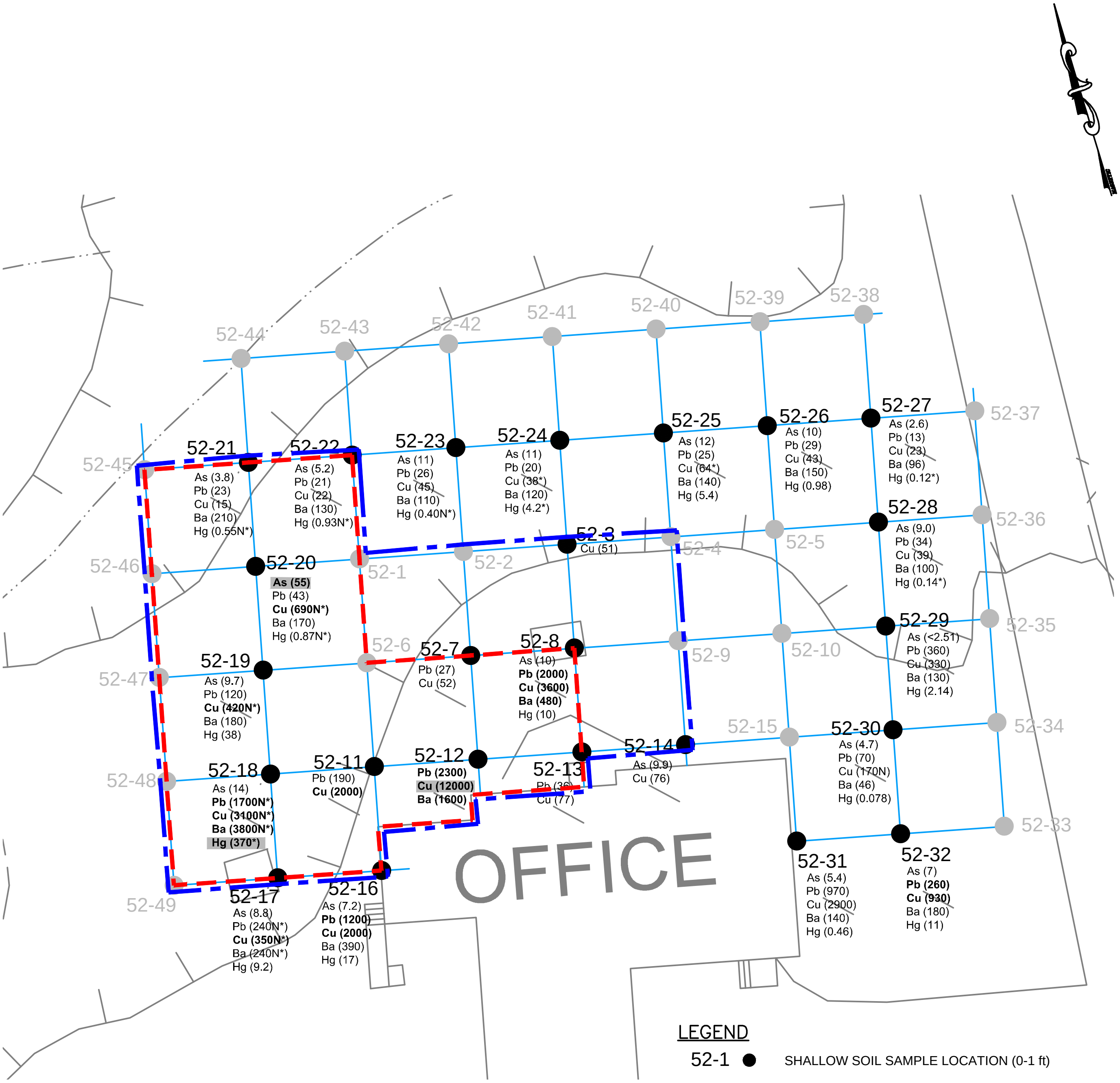
30 0 30
SCALE IN FEET

EHS Support
consider it done

DYNO-NOBEL, INC.
PORT EWEN, NY.

FIGURE 33
COMMERCIAL AND INDUSTRIAL USE
SOIL CLEANUP OBJECTIVE DELINEATION
SWMU 52: 0-1' INTERVAL

Drawn By: BC	Date Drawn: 12/03/13
Reviewed By: KV	Date Reviewed: 12/2013
Scale: 1" = 30'	Plot Date: 12/2013
Project Number.:	



LEGEND

52-1 ●	SHALLOW SOIL SAMPLE LOCATION (0-1 ft)
(37.5)	CONCENTRATION (mg/kg) EXCEEDS INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
(420)	CONCENTRATION (mg/kg) EXCEEDS COMMERCIAL USE SOIL CLEANUP OBJECTIVE
(6.9)	CONCENTRATION (mg/kg) BELOW COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
	GROUND SURFACE CONTOUR
	APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS EXCEEDING INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
	APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS EXCEEDING COMMERCIAL USE SOIL CLEANUP OBJECTIVE

NOTES:

1. mg/kg = MILLIGRAMS PER KILOGRAM
2. * DENOTES A DUPLICATE SAMPLE. THE HIGHER CONCENTRATION IS SHOWN.
3. THE AREA EXCEEDING THE INDUSTRIAL SOIL CLEANUP OBJECTIVE IS 4,357 SQ. FT.
4. THE AREA EXCEEDING THE COMMERCIAL SOIL CLEANUP OBJECTIVE IS 6,398 SQ. FT.

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Arsenic (As)	16	16
Lead (Pb)	1,000	3,900
Copper (Cu)	270	10,000
Barium (Ba)	400	10,000
Mercury (Hg)	47	220

SOURCE:
REVISION TO CMS SOIL SCREENING CRITERIA
DYNO NOBEL SITE, PORT EWEN, NEW YORK
HYDROQUAL INC., SEPTEMBER 1, 2006.

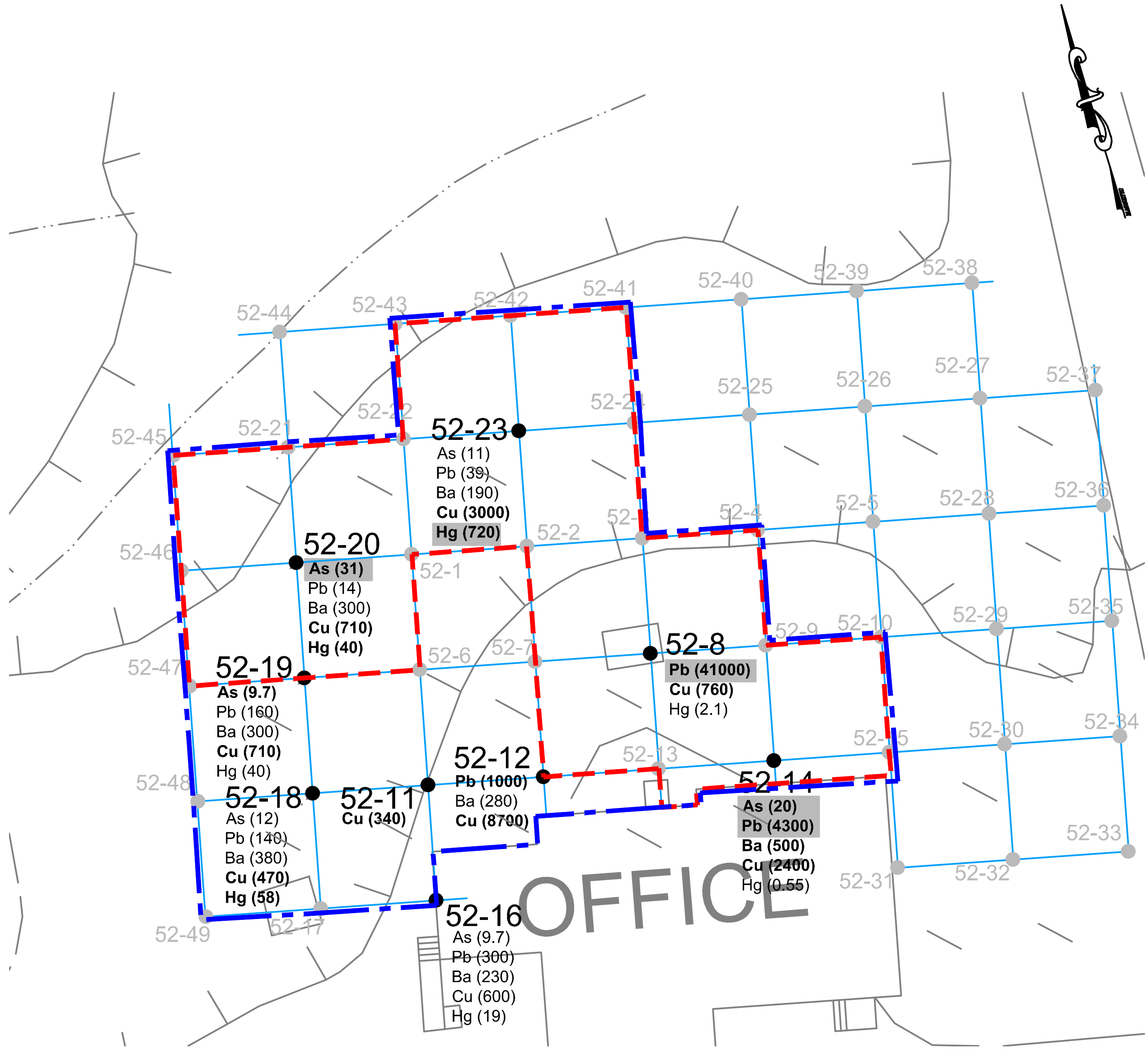
30 0 30
SCALE IN FEET

EHS Support consider it done

DYNO-NOBEL, INC.
PORT EWEN, NY.

FIGURE 34
COMMERCIAL AND INDUSTRIAL USE
SOIL CLEANUP OBJECTIVE DELINEATION
SWMU 52: 1-2' INTERVAL

Drawn By: BC	Date Drawn: 12/04/13
Reviewed By: KV	Date Reviewed: 12/2013
Scale: 1" = 30'	Plot Date: 12/2013
Project Number.:	



LEGEND

52-20 ●	SHALLOW SOIL SAMPLE LOCATION
(20.0)	CONCENTRATION (mg/kg) EXCEEDS INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
(340)	CONCENTRATION (mg/kg) EXCEEDS COMMERCIAL USE SOIL CLEANUP OBJECTIVE
(9.7)	CONCENTRATION (mg/kg) BELOW COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
	GROUND SURFACE CONTOUR
	APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS EXCEEDING INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
	APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS EXCEEDING COMMERCIAL USE SOIL CLEANUP OBJECTIVE

NOTES:

1. mg/kg = MILLIGRAMS PER KILOGRAM
2. THE AREA EXCEEDING THE INDUSTRIAL SOIL CLEANUP OBJECTIVE IS 5,377 SQ. FT.
3. THE AREA EXCEEDING THE COMMERCIAL SOIL CLEANUP OBJECTIVE IS 8,408 SQ. FT.

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Arsenic (As)	16	16
Barium (Ba)	400	10,000
Copper (Cu)	270	10,000
Mercury (Hg)	47	220
Lead (Pb)	1,000	3,900

SOURCE:
REVISION TO CMS SOIL SCREENING CRITERIA
DYNO NOBEL SITE, PORT EWEN, NEW YORK
HYDROQUAL INC., SEPTEMBER 1, 2006.

30 0 30
SCALE IN FEET

EHS Support
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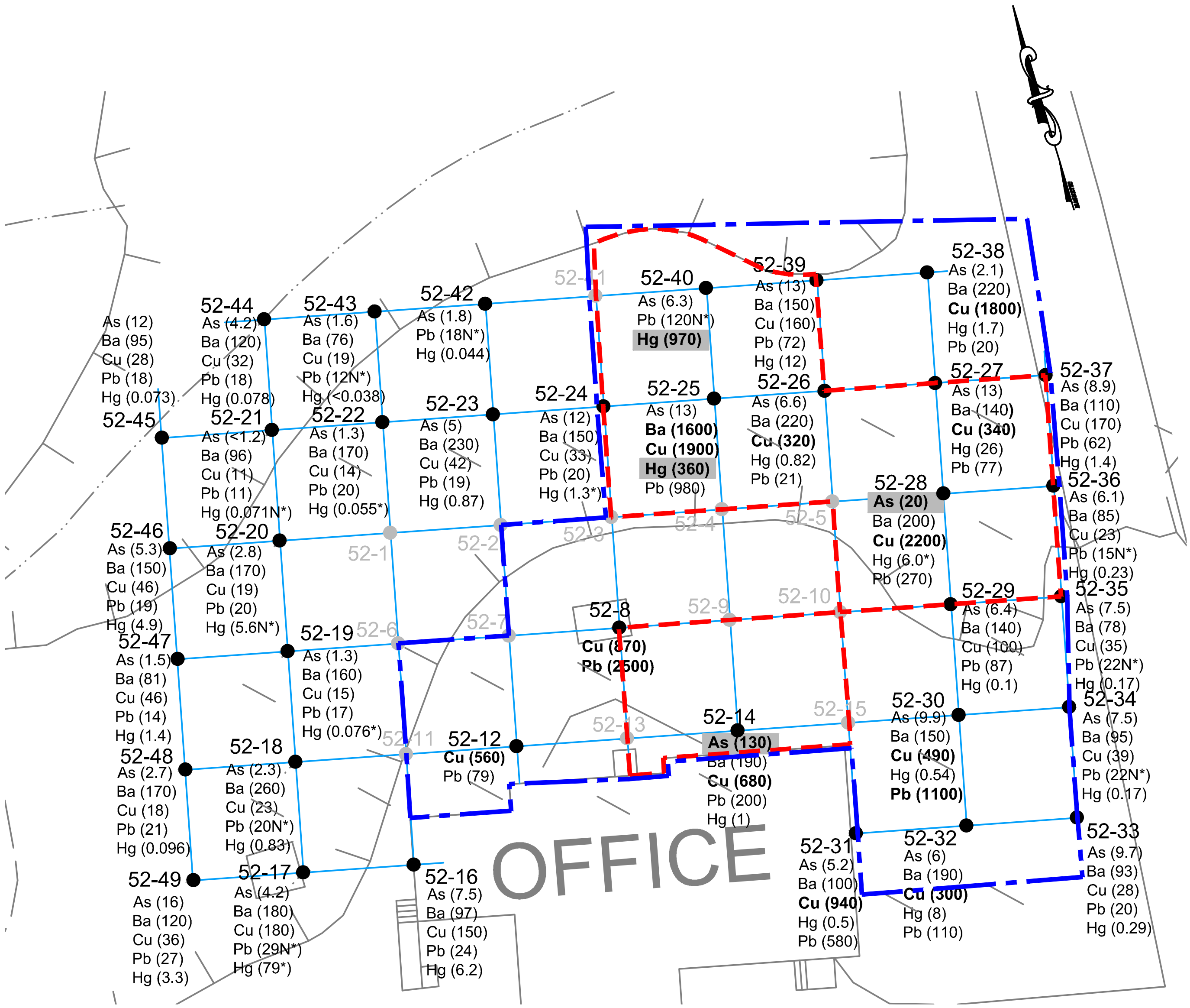
DYNO-NOBEL, INC.
PORT EWEN, NY.

FIGURE 35
COMMERCIAL AND INDUSTRIAL USE
SOIL CLEANUP OBJECTIVE DELINEATION
SWMU 52: 2-3' INTERVAL

Drawn By: BC	Date Drawn: 12/03/13
Reviewed By: KV	Date Reviewed: 12/2013
Scale: 1" = 30'	Plot Date: 12/2013
Project Number.:	



NOTES:

1. mg/kg = MILLIGRAMS PER KILOGRAM
2. * DENOTES A DUPLICATE SAMPLE. THE HIGHER CONCENTRATION IS SHOWN.
3. THE AREA EXCEEDING THE INDUSTRIAL SOIL CLEANUP OBJECTIVE IS 4,463 SQ. FT.
4. THE AREA EXCEEDING THE COMMERCIAL SOIL CLEANUP OBJECTIVE IS 10,334 SQ. FT.

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Arsenic (As)	16	16
Barium (Ba)	400	10,000
Copper (Cu)	270	10,000
Mercury (Hg)	47	220
Lead (Pb)	1,000	3,900

SOURCE:
REVISION TO CMS SOIL SCREENING CRITERIA
DYNO NOBEL SITE, PORT EWEN, NEW YORK
HYDROQUAL INC., SEPTEMBER 1, 2006.

LEGEND

52-11 ● SHALLOW SOIL SAMPLE LOCATION (0-1 ft)

(20.0) CONCENTRATION (mg/kg) EXCEEDS INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

(340) CONCENTRATION (mg/kg) EXCEEDS COMMERCIAL USE SOIL CLEANUP OBJECTIVE

(9.7) CONCENTRATION (mg/kg) BELOW COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

GROUND SURFACE CONTOUR

APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS EXCEEDING INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS EXCEEDING COMMERCIAL USE SOIL CLEANUP OBJECTIVE

30 0 30

SCALE IN FEET

EHS Support *consider it done*

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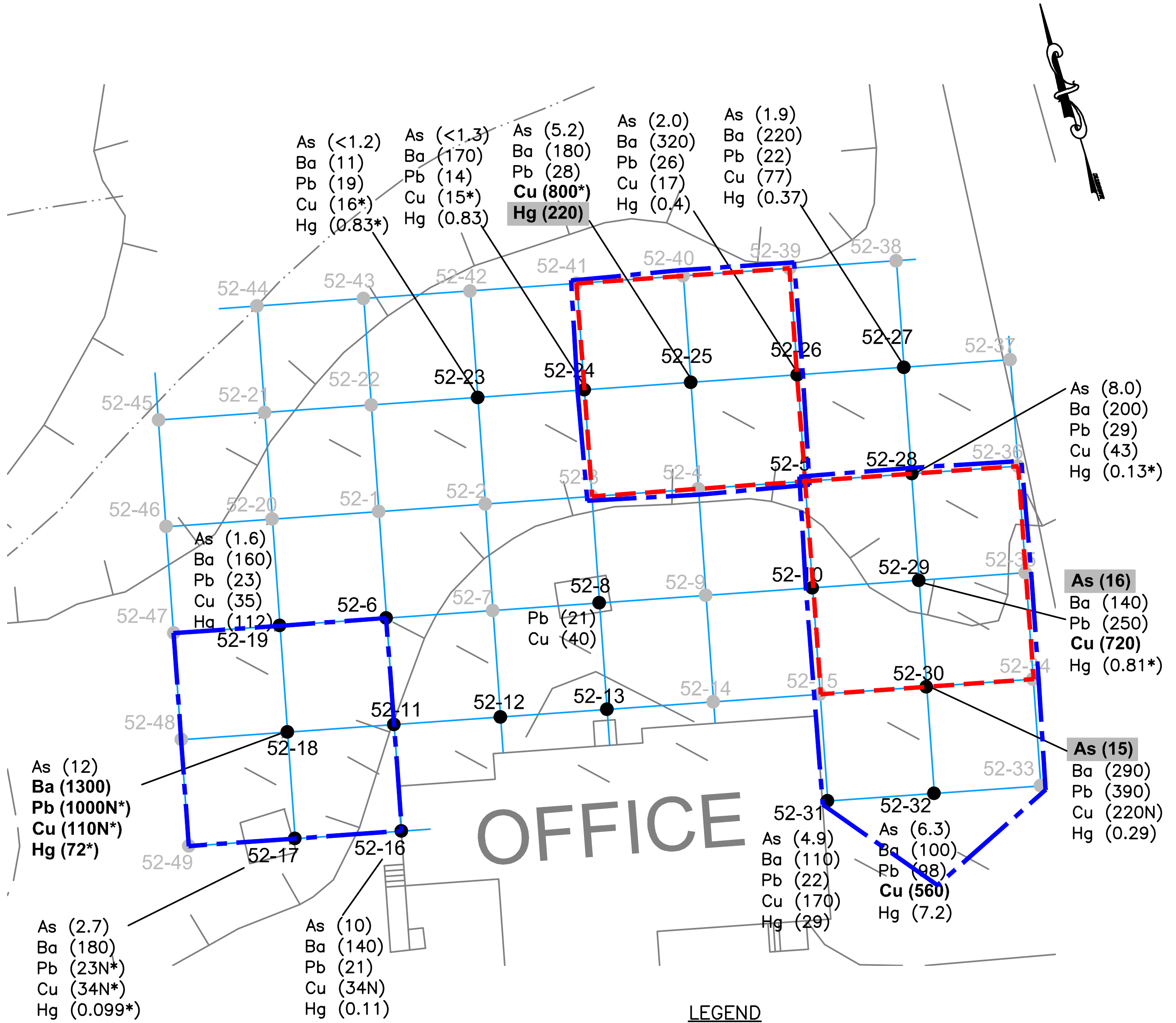
PORT EWEN, NY.

FIGURE 36
INDUSTRIAL USE SOIL CLEANUP CRITERIA DELINEATION
SWMU 52 - 3-4' INTERVAL

Drawn By: BC	Date Drawn: 12/03/13
Reviewed By: KV	Date Reviewed: 12/2013
Scale: 1" = 30'	Plot Date: 12/2013
Project Number.:	



LEGEND

52-20●	SHALLOW SOIL SAMPLE LOCATION (0-1 ft)
(20.0)	CONCENTRATION (mg/kg) EXCEEDS INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
(340)	CONCENTRATION (mg/kg) EXCEEDS COMMERCIAL USE SOIL CLEANUP OBJECTIVE
(9.7)	CONCENTRATION (mg/kg) BELOW COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
	GROUND SURFACE CONTOUR
	APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS EXCEEDING INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
	APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS EXCEEDING COMMERCIAL USE SOIL CLEANUP OBJECTIVE

NOTES:

1. mg/kg = MILLIGRAMS PER KILOGRAM
2. * DENOTES A DUPLICATE SAMPLE. THE HIGHER CONCENTRATION IS SHOWN.
2. THE AREA EXCEEDING THE INDUSTRIAL SOIL CLEANUP OBJECTIVE IS 3,196 SQ. FT.
3. THE AREA EXCEEDING THE COMMERCIAL SOIL CLEANUP OBJECTIVE IS 6,304 SQ. FT.

SOIL CLEANUP OBJECTIVE, (mg/kg)

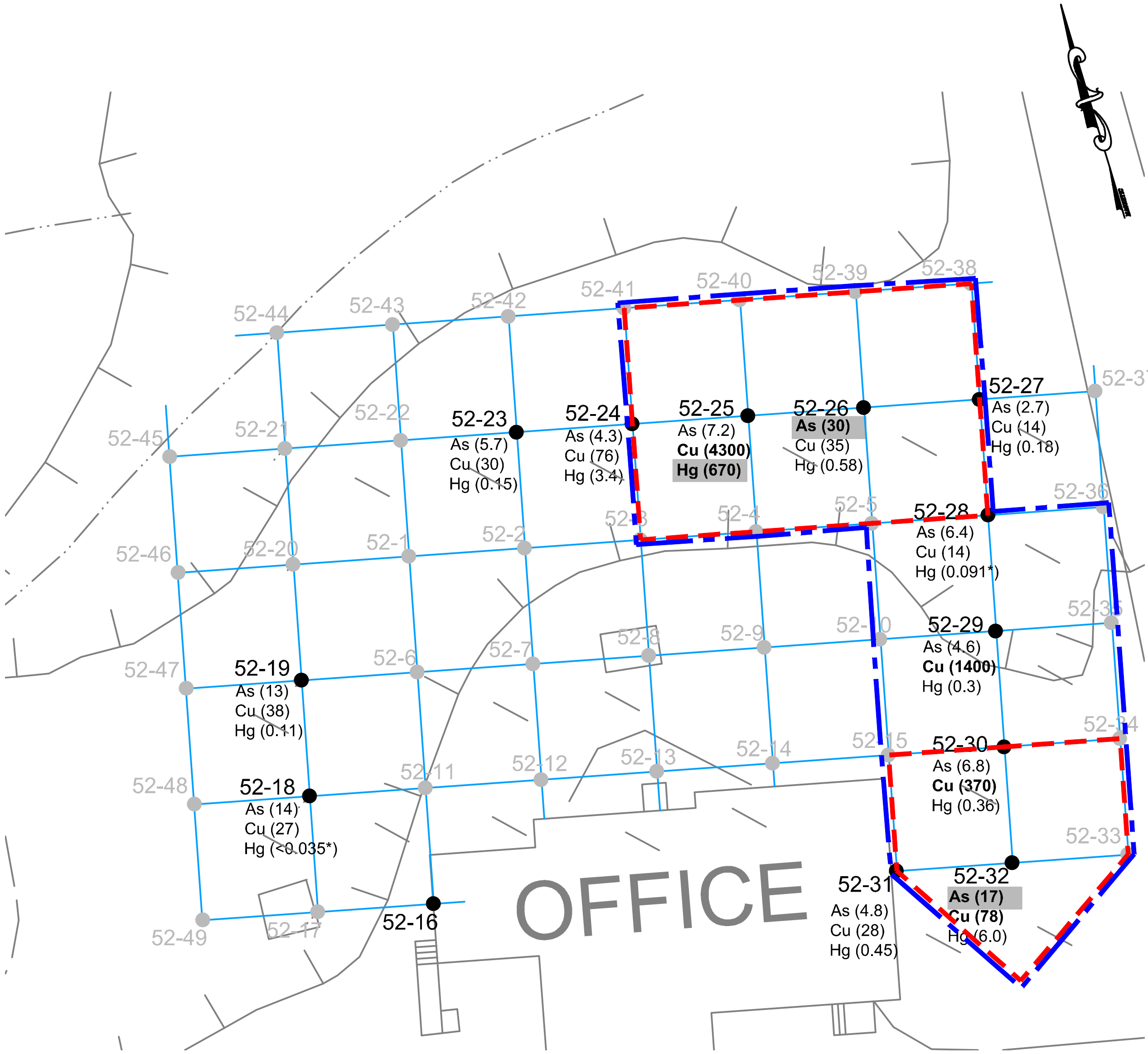
	Commercial	Industrial
Arsenic (As)	16	16
Barium (Ba)	400	10,000
Copper (Cu)	270	10,000
Mercury (Hg)	47	220
Lead (Pb)	1,000	3,900
Selinium (Se)	1,500	6,800

30 0 30

SCALE IN FEET

SOURCE:
REVISION TO CMS SOIL SCREENING CRITERIA
DYNO NOBEL SITE, PORT EWEN, NEW YORK
HYDROQUAL INC., SEPTEMBER 1, 2006.

EHS Support *consider it done*	**DYNO-NOBEL, INC. PORT EWEN, NY.**	**FIGURE 37** COMMERCIAL AND INDUSTRIAL USE SOIL SCREENING CRITERIA DELINEATION SWMU 52 - 4-5' INTERVAL	Drawn By: BC	Date Drawn: 12/03/13
			Reviewed By: KV	Date Reviewed: 12/2013
			Scale: 1" = 30'	Plot Date: 12/2013
			Project Number.:	



NOTES:

1. mg/kg = MILLIGRAMS PER KILOGRAM
2. * DENOTES A DUPLICATE SAMPLE. THE HIGHER CONCENTRATION IS SHOWN.
3. THE AREA EXCEEDING THE INDUSTRIAL SOIL CLEANUP OBJECTIVE IS 3,609 SQ. FT.
4. THE AREA EXCEEDING THE COMMERCIAL SOIL CLEANUP OBJECTIVE IS 5,566 SQ. FT.

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Arsenic (As)	16	16
Copper (Cu)	270	10,000
Mercury (Hg)	47	220

SOURCE:
REVISION TO CMS SOIL SCREENING CRITERIA
DYNO NOBEL SITE, PORT EWEN, NEW YORK
HYDROQUAL INC., SEPTEMBER 1, 2006.

LEGEND

52-1 ● SHALLOW SOIL SAMPLE LOCATION (0-1 ft)

(20.0) CONCENTRATION (mg/kg) EXCEEDS INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

(340) CONCENTRATION (mg/kg) EXCEEDS COMMERCIAL USE SOIL CLEANUP OBJECTIVE

(9.7) CONCENTRATION (mg/kg) BELOW COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

GROUND SURFACE CONTOUR

APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS EXCEEDING INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS EXCEEDING COMMERCIAL USE SOIL CLEANUP OBJECTIVE

30 0 30

SCALE IN FEET

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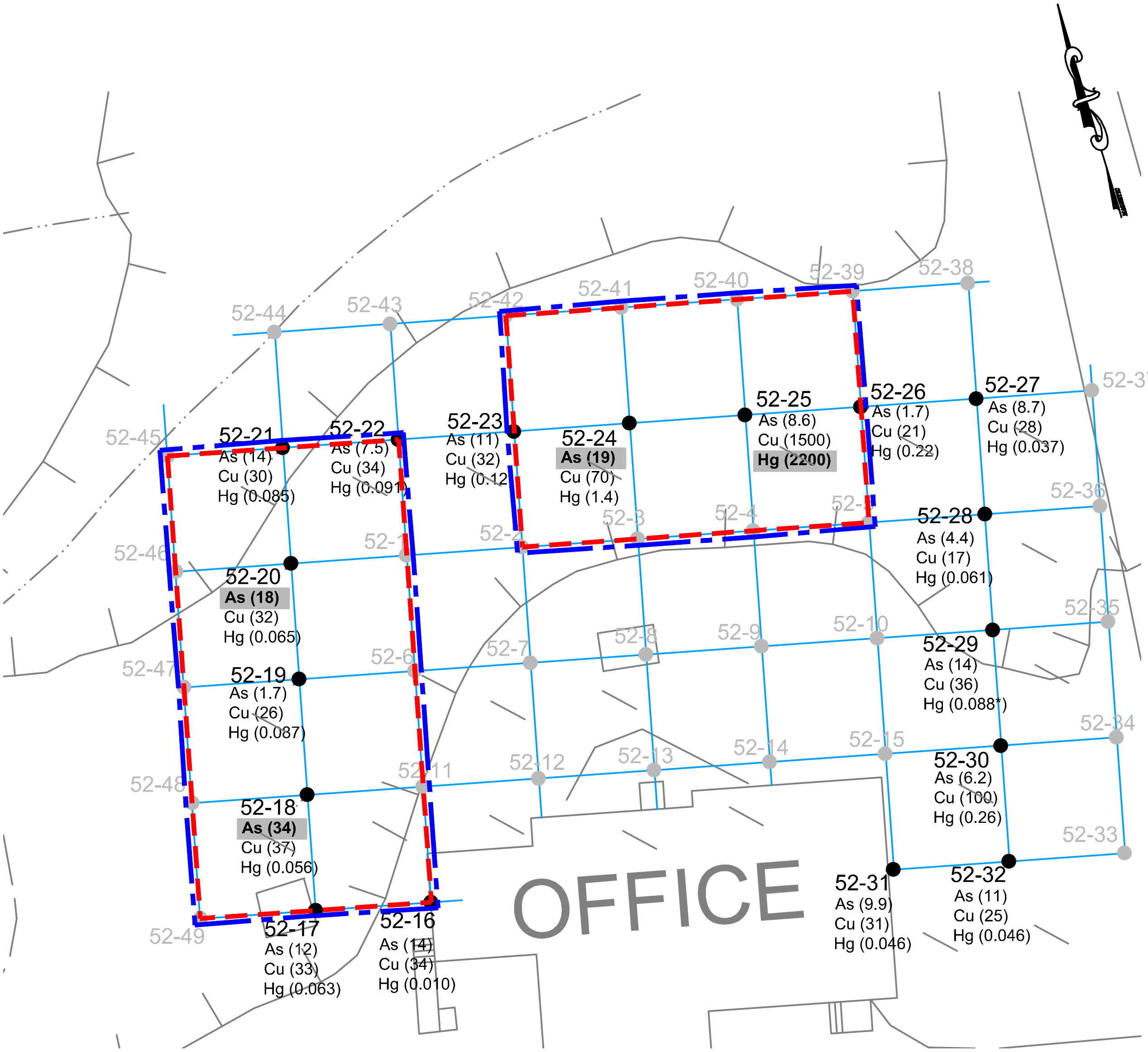
PORT EWEN, NY.

FIGURE 38
COMMERCIAL AND INDUSTRIAL USE
SOIL CLEANUP CRITERIA DELINEATION
SWMU 52 - 5-6' INTERVAL

Drawn By: BC	Date Drawn: 12/03/13
Reviewed By: KV	Date Reviewed: 12/2013
Scale: 1" = 30'	Plot Date: 12/2013
Project Number.:	



NOTES:

1. mg/kg = MILLIGRAMS PER KILOGRAM
2. THE AREA EXCEEDING THE INDUSTRIAL SOIL CLEANUP OBJECTIVE IS 6,068 SQ. FT.
3. THE AREA EXCEEDING THE COMMERCIAL SOIL CLEANUP OBJECTIVE IS 6,068 SQ. FT.

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Arsenic (As)	16	16
Copper (Cu)	270	10,000
Mercury (Hg)	47	220

SOURCE:
REVISION TO CMS SOIL SCREENING CRITERIA
DYNO NOBEL SITE, PORT EWEN, NEW YORK
HYDROQUAL INC., SEPTEMBER 1, 2006.

LEGEND

52-1 ●	SHALLOW SOIL SAMPLE LOCATION (0-1 ft)
(34.0)	CONCENTRATION (mg/kg) EXCEEDS INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
(1500)	CONCENTRATION (mg/kg) EXCEEDS COMMERCIAL USE SOIL CLEANUP OBJECTIVE
(32)	CONCENTRATION (mg/kg) BELOW COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
	GROUND SURFACE CONTOUR
	APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS EXCEEDING INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
	APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS EXCEEDING COMMERCIAL USE SOIL CLEANUP OBJECTIVE

30 0 30
SCALE IN FEET

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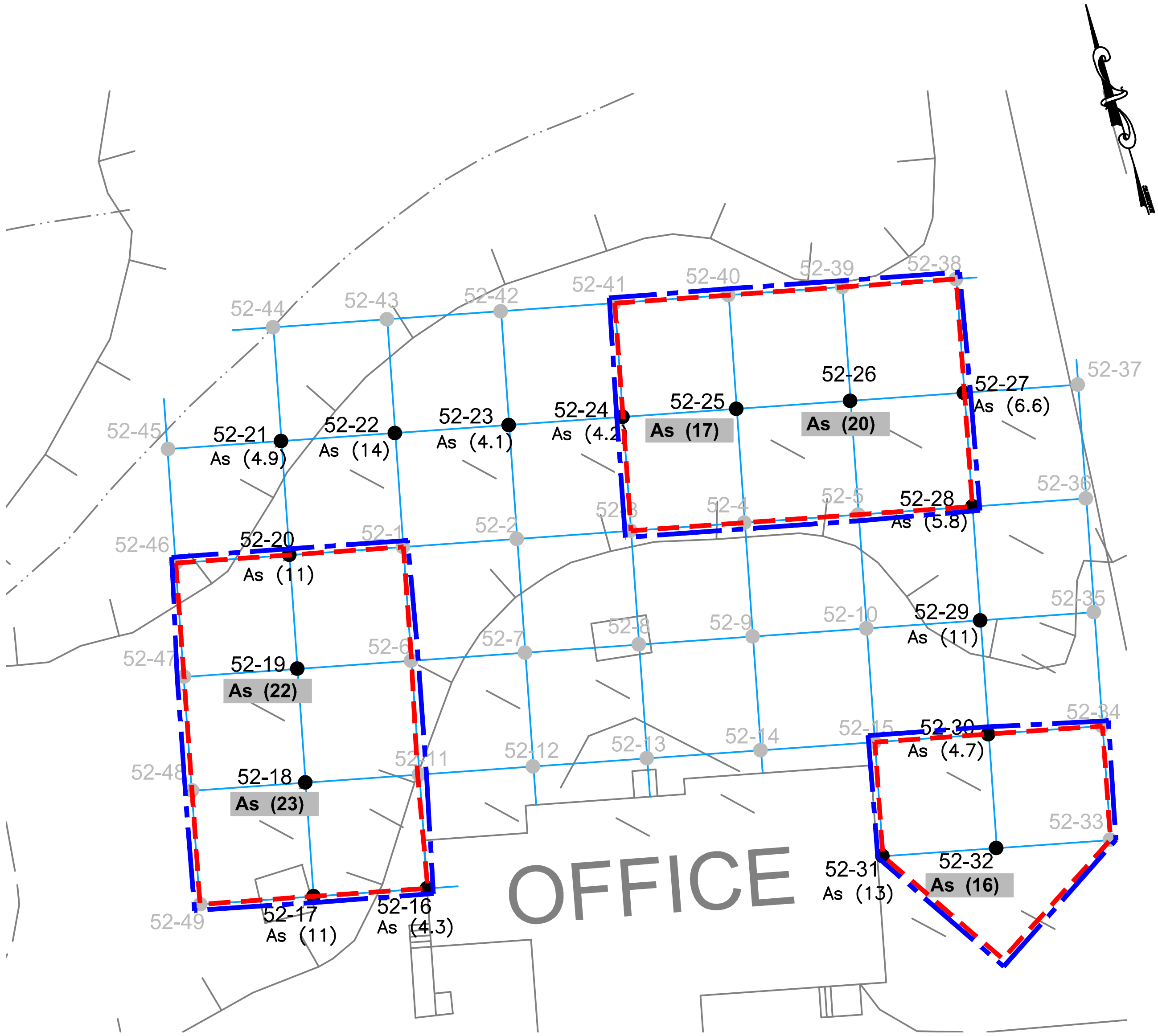
PORT EWEN, NY.

FIGURE 39
COMMERCIAL AND INDUSTRIAL USE
SOIL CLEANUP CRITERIA DELINEATION
SWMU 52 - 6-7' INTERVAL

Drawn By: BC	Date Drawn: 12/03/13
Reviewed By: KV	Date Reviewed: 12/2013
Scale: 1" = 30'	Plot Date: 12/2013
Project Number.:	



LEGEND

52-25 SHALLOW SOIL SAMPLE LOCATION (0-1 ft)

(20.0) CONCENTRATION (mg/kg) EXCEEDS INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

(340) CONCENTRATION (mg/kg) EXCEEDS COMMERCIAL USE SOIL CLEANUP OBJECTIVE

(9.7) CONCENTRATION (mg/kg) BELOW COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

GROUND SURFACE CONTOUR

APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS EXCEEDING INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS EXCEEDING COMMERCIAL USE SOIL CLEANUP OBJECTIVE

NOTES:

1. mg/kg = MILLIGRAMS PER KILOGRAM
2. * DENOTES A DUPLICATE SAMPLE. THE HIGHER CONCENTRATION IS SHOWN.
3. THE AREA EXCEEDING THE INDUSTRIAL SOIL CLEANUP OBJECTIVE IS 6,563 SQ. FT.
4. THE AREA EXCEEDING THE COMMERCIAL SOIL CLEANUP OBJECTIVE IS 6,563 SQ. FT.

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Arsenic (As)	16	16

30 0 30

SCALE IN FEET

SOURCE:
REVISION TO CMS SOIL SCREENING CRITERIA
DYNO NOBEL SITE, PORT EWEN, NEW YORK
HYDROQUAL INC., SEPTEMBER 1, 2006.

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DYNO-NOBEL, INC.
PORT EWEN, NY.

FIGURE 40
COMMERCIAL AND INDUSTRIAL USE
SOIL SCREENING CRITERIA DELINEATION
SWMU 52 - 7-8' INTERVAL

Drawn By:	BC	Date Drawn:	12/04/13
Reviewed By:	KV	Date Reviewed:	12/2013
Scale:	1" = 30'	Plot Date:	12/2013
Project Number.:			

LEGEND

52-1 ● SHALLOW SOIL SAMPLE LOCATION

GROUND SURFACE CONTOUR

APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS EXCEEDING COMMERCIAL USE SOIL CLEANUP OBJECTIVE

NOTES:

1. mg/kg = MILLIGRAMS PER KILOGRAM
2. THE AREA EXCEEDING THE COMMERCIAL SOIL CLEANUP OBJECTIVE IS 20,268 SQ. FT.

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Arsenic (As)	16	16
Lead (Pb)	1,000	3,900
Copper (Cu)	270	10,000
Barium (Ba)	400	10,000
Mercury (Hg)	47	220

SOURCE:
REVISION TO CMS SOIL SCREENING CRITERIA
DYNO NOBEL SITE, PORT EWEN, NEW YORK
HYDROQUAL INC., SEPTEMBER 1, 2006.

30 0 30

SCALE IN FEET

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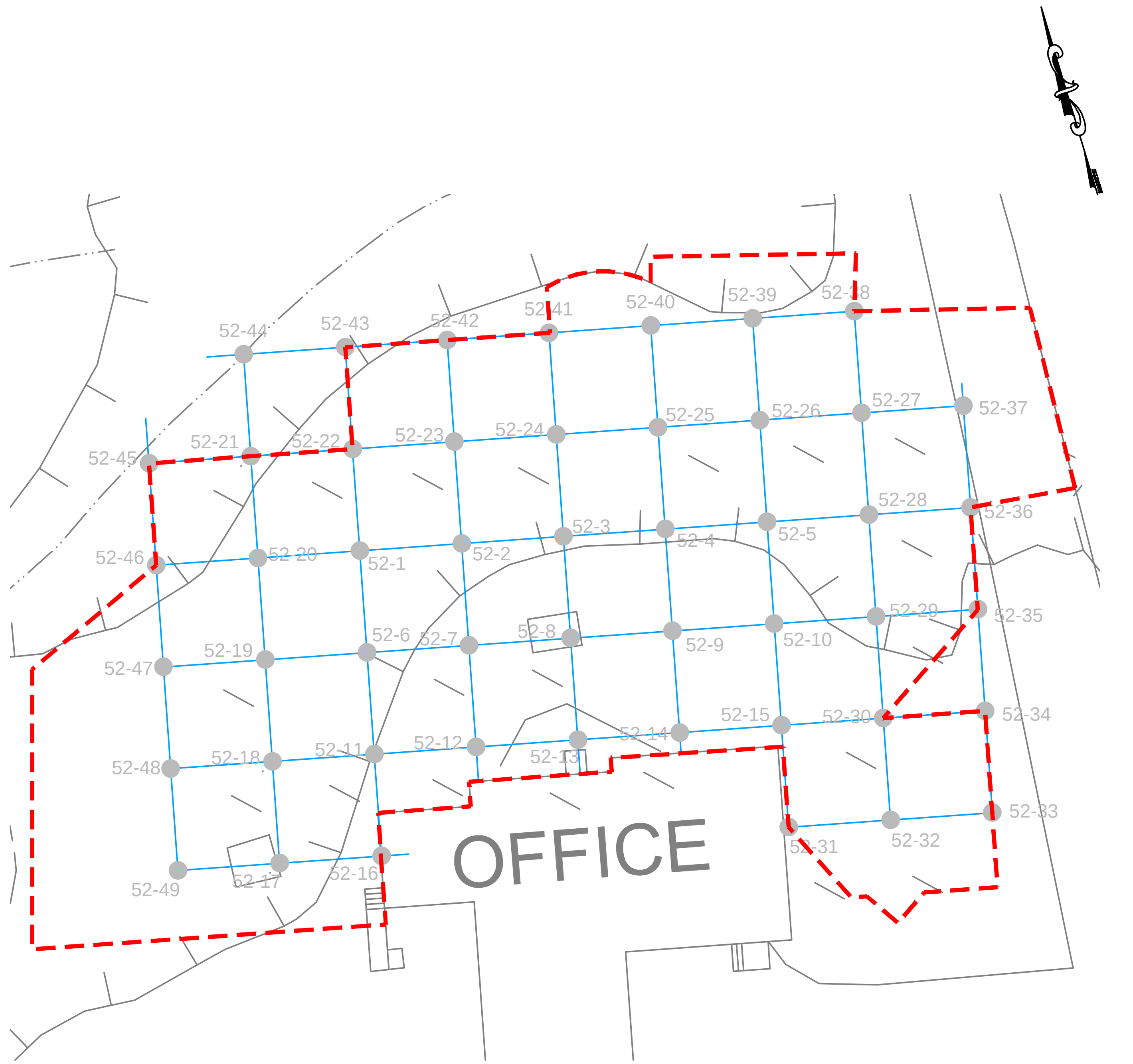
PORT EWEN, NY.

FIGURE 41
COMMERCIAL SOIL CLEANUP OBJECTIVE DELINEATION
SWMU 52: COMPOSITE

Drawn By:	BC	Date Drawn:	12/04/13
Reviewed By:	KV	Date Reviewed:	12/2013
Scale:	1" = 30'	Plot Date:	12/2013
Project Number.:			



NOTES:

1. mg/kg = MILLIGRAMS PER KILOGRAM
2. THE AREA EXCEEDING THE INDUSTRIAL SOIL CLEANUP OBJECTIVE IS 18,121 SQ. FT.

LEGEND

52-1 ● SHALLOW SOIL SAMPLE LOCATION

GROUND SURFACE CONTOUR

APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS EXCEEDING INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Arsenic (As)	16	16
Lead (Pb)	1,000	3,900
Copper (Cu)	270	10,000
Barium (Ba)	400	10,000
Mercury (Hg)	47	220

SOURCE:
REVISION TO CMS SOIL SCREENING CRITERIA
DYNO NOBEL SITE, PORT EWEN, NEW YORK
HYDROQUAL INC., SEPTEMBER 1, 2006.

30 0 30

SCALE IN FEET

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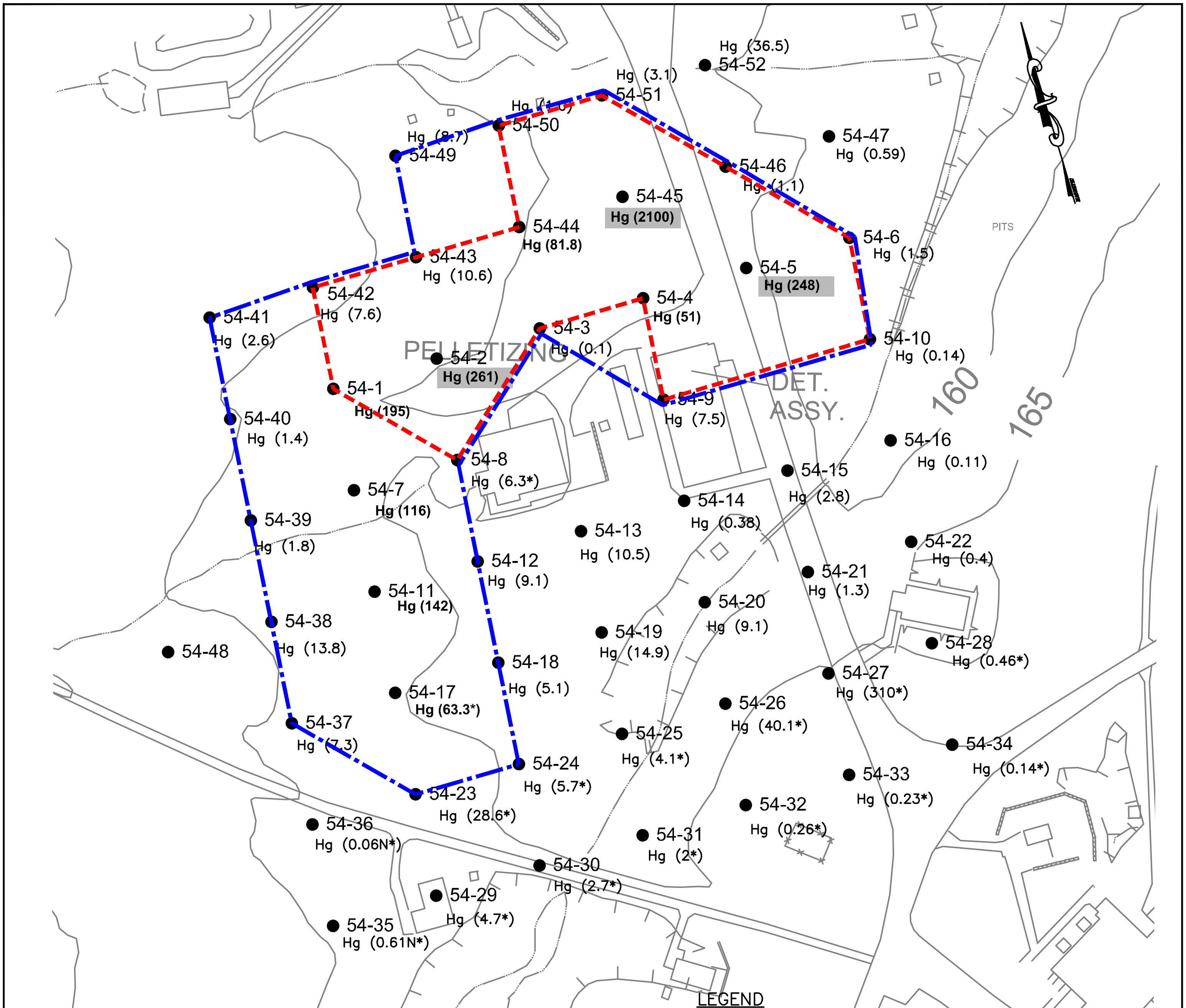
DYNO-NOBEL, INC.
PORT EWEN, NY.

FIGURE 41A
INDUSTRIAL USE SOIL CLEANUP
OBJECTIVE DELINEATION
SWMU 52: COMPOSITE

Drawn By: BC	Date Drawn: 12/04/13
Reviewed By: KV	Date Reviewed: 12/2013
Scale: 1" = 30'	Plot Date: 12/2013
Project Number.:	



LEGEND

54-41 ●	SHALLOW SOIL SAMPLE LOCATION
(32.0)	CONCENTRATION (mg/kg) EXCEEDS INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
(355)	CONCENTRATION (mg/kg) EXCEEDS COMMERCIAL USE SOIL CLEANUP OBJECTIVE
(6.7)	CONCENTRATION (mg/kg) BELOW COMMERCIAL USE SOIL CLEANUP OBJECTIVE
	GROUND SURFACE CONTOUR
	APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
	APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE

NOTES:

1. mg/kg = MILLIGRAMS PER KILOGRAM
2. * DENOTES A DUPLICATE SAMPLE. THE HIGHER CONCENTRATION IS SHOWN.
3. CONCENTRATIONS IN SAMPLES AT 2'-4' INTERVAL WERE BELOW COMMERCIAL AND INDUSTRIAL USE SCOs.
4. THE AREA EXCEEDING THE INDUSTRIAL SOIL CLEANUP OBJECTIVE IS 29,413 SQ. FT.
5. THE AREA EXCEEDING THE COMMERCIAL SOIL CLEANUP OBJECTIVE IS 62,216 SQ. FT.

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Mercury (Hg)	47	220

REVISIONS		
Rev.	By:	Date:
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Rev.	By:	Date:

SOURCE:
HYDORQUAL ENVIRONMENTAL ENGINEERS AND SCIENTISTS, P.C.
FIGURE 24 INDUSTRIAL USE SOIL CLEANUP
CRITERIA DELINEATION
SWMU 54 – 0-2' INTERVAL.

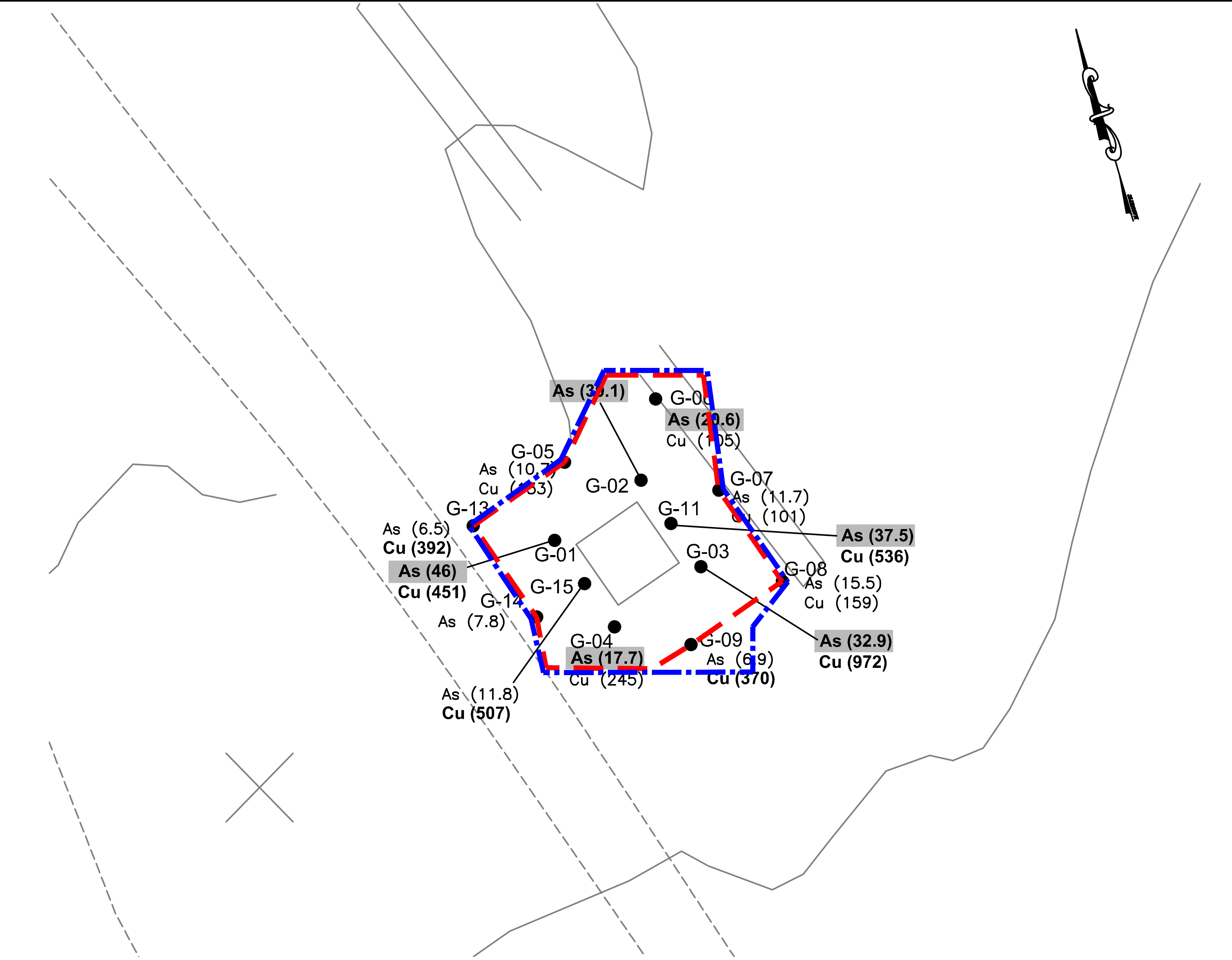
80 0 80
SCALE IN FEET

EHS Support *consider it done*

DYNO-NOBEL, INC.
PORT EWEN, NY.

FIGURE 42
COMMERCIAL AND INDUSTRIAL USE
SOIL CLEANUP CRITERIA DELINEATION
SWMU 54 - 0-2' INTERVAL

Drawn By: BC	Date Drawn: 12/03/13
Reviewed By: KV	Date Reviewed: 12/2013
Scale: 1" = 80'	Plot Date: 12/2013
Project Number.:	



LEGEND

G-09 ●	SHALLOW SOIL SAMPLE LOCATION
(20.6)	CONCENTRATION (mg/kg) EXCEEDS INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
(536)	CONCENTRATION (mg/kg) EXCEEDS COMMERCIAL USE SOIL CLEANUP OBJECTIVE
(6.9)	CONCENTRATION (mg/kg) BELOW COMMERCIAL USE SOIL CLEANUP OBJECTIVE
	GROUND SURFACE CONTOUR
	APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
	APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE

NOTES:

1. mg/kg = MILLIGRAMS PER KILOGRAM
2. FOR DUPLICATE SAMPLES HIGHER VALUES OF TWO SHOWN.
3. SAMPLES G-10 AND G-12 NOT COLLECTED - CONCRETE SLAB.
4. CONCENTRATIONS IN SAMPLES AT 2'-4' INTERVAL WERE BELOW COMMERCIAL AND INDUSTRIAL USE SCOs.
5. THE AREA EXCEEDING THE INDUSTRIAL SOIL CLEANUP OBJECTIVE IS 902 SQ. FT.
6. THE AREA EXCEEDING THE COMMERCIAL SOIL CLEANUP OBJECTIVE IS 1,026 SQ. FT.

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Arsenic (As)	16	16
Copper (Cu)	270	10,000

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Rev.	By:	Date:
Rev.	By:	Date:

SOURCE:
HYDORQUAL ENVIRONMENTAL ENGINEERS AND SCIENTISTS, P.C.
FIGURE 25 INDUSTRIAL USE SOIL CLEANUP
CRITERIA DELINEATION
AOC G – 0–2' INTERVAL.

20 0 20
SCALE IN FEET

EHS Support
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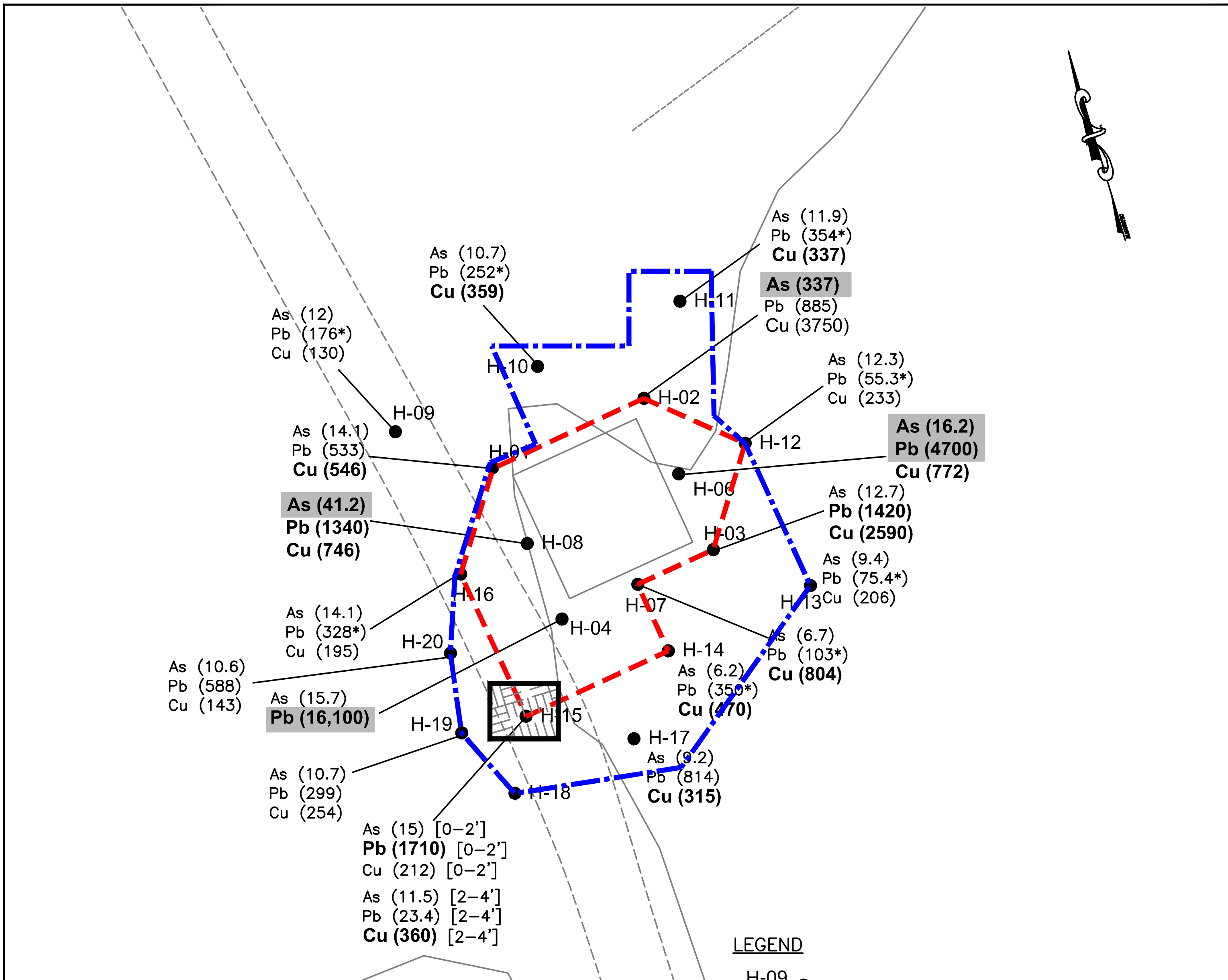
PORT EWEN, NY.

FIGURE 43
COMMERCIAL AND INDUSTRIAL USE
SOIL CLEANUP OBJECTIVE DELINEATION
AOC G - 0-2' INTERVAL

Drawn By: BC	Date Drawn: 11/26/13
Reviewed By: KV	Date Reviewed: 11/2013
Scale: 1" = 20'	Plot Date: 11/2013
Project Number.:	



LEGEND

H-09 ●	SHALLOW SOIL SAMPLE LOCATION
(32.0)	CONCENTRATION (mg/kg) EXCEEDS INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
(355)	CONCENTRATION (mg/kg) EXCEEDS COMMERCIAL USE SOIL CLEANUP OBJECTIVE
(6.7)	CONCENTRATION (mg/kg) BELOW COMMERCIAL USE SOIL CLEANUP OBJECTIVE
	GROUND SURFACE CONTOUR
	APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
	APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE

NOTES:

1. mg/kg = MILLIGRAMS PER KILOGRAM
2. * DENOTES A DUPLICATE SAMPLE. THE HIGHER CONCENTRATION IS SHOWN.
3. SAMPLE H-05 NOT COLLECTED - CONCRETE SLAB.
4. CONCENTRATIONS IN SAMPLES AT 2'-4' INTERVAL WERE BELOW COMMERCIAL AND INDUSTRIAL USE SCOs WITH THE EXCEPTION OF SAMPLE LOCATION H-15.
5. NO DATA POSTED FOR H-18.
6. THE AREA EXCEEDING THE INDUSTRIAL SOIL CLEANUP OBJECTIVE IS 914 SQ. FT.
7. THE AREA EXCEEDING THE COMMERCIAL SOIL CLEANUP OBJECTIVE IS 2,079 SQ. FT.
8. THE AREA EXCEEDING THE COMMERCIAL SOIL CLEANUP OBJECTIVES TO A DEPTH OF 4 FT EQUALS 64 SQ. FT.

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Arsenic (As)	16	16
Lead (Pb)	1,000	3,900
Copper (Cu)	270	10,000

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Rev.	By:	Date:

SOURCE:
HYDORQUAL ENVIRONMENTAL ENGINEERS AND SCIENTISTS, P.C.
FIGURE 26 INDUSTRIAL USE SOIL CLEANUP CRITERIA DELINEATION
AOC H – 0–2' INTERVAL.

20 0 20
SCALE IN FEET

EHS Support
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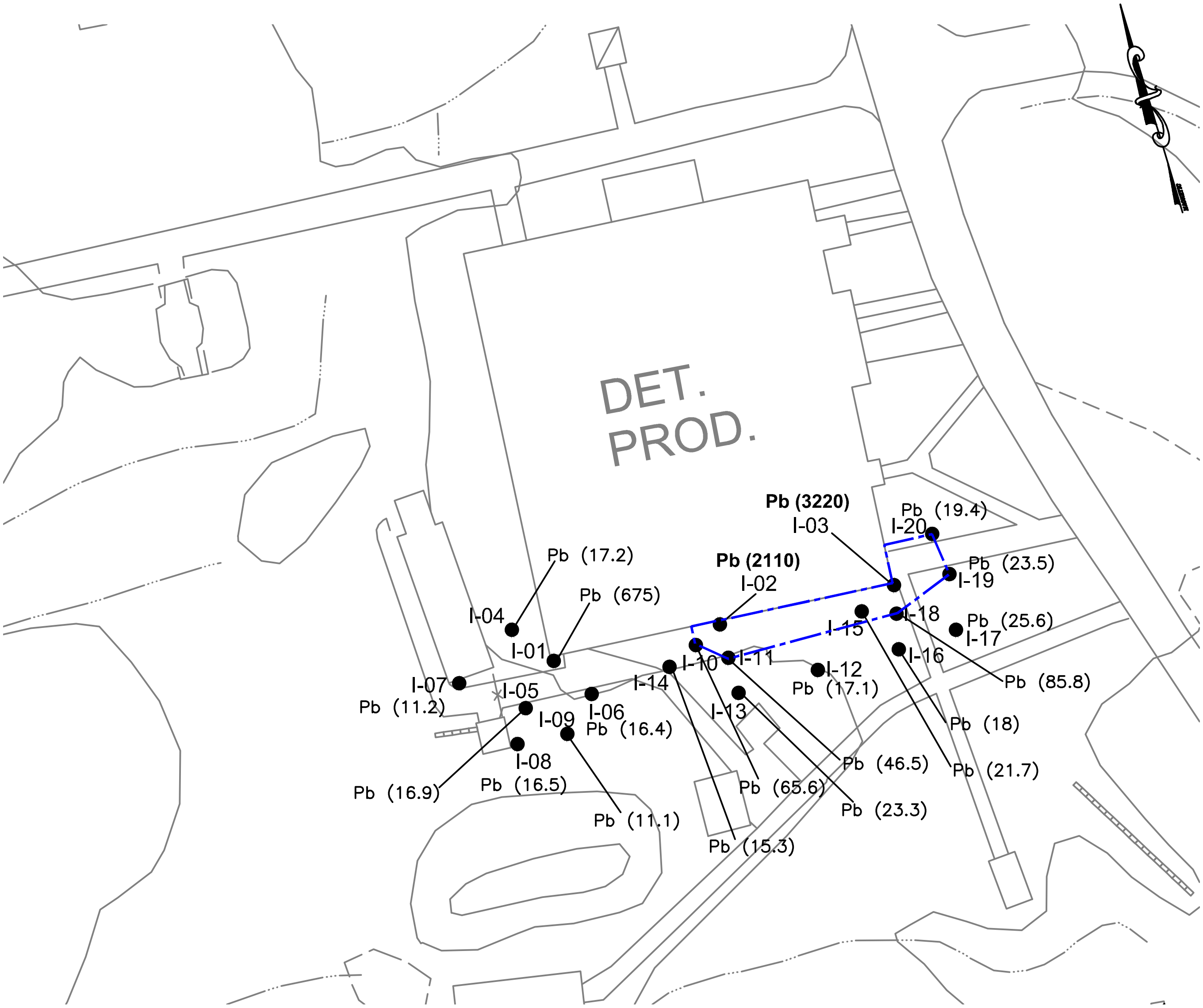
PORT EWEN, NY.

FIGURE 44
COMMERCIAL AND INDUSTRIAL USE SOIL CLEANUP OBJECTIVE DELINEATION
AOC H - 0-2' INTERVAL

Drawn By: BC	Date Drawn: 11/26/13
Reviewed By: KV	Date Reviewed: 11/2013
Scale: 1" = 20'	Plot Date: 11/2013
Project Number.:	



NOTES:

1. mg/kg = MILLIGRAMS PER KILOGRAM
2. CONCENTRATIONS IN SAMPLES AT 2'-4' INTERVAL WERE BELOW COMMERCIAL AND INDUSTRIAL USE SCOs.
3. THE AREA EXCEEDING THE COMMERCIAL SOIL CLEANUP OBJECTIVE IS 867 SQ. FT.

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Lead (Pb)	1,000	3,900

LEGEND

M-9 ● SHALLOW SOIL SAMPLE LOCATION

(32.0) CONCENTRATION (mg/kg) EXCEEDS INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

(355) CONCENTRATION (mg/kg) EXCEEDS COMMERCIAL USE SOIL CLEANUP OBJECTIVE

(6.7) CONCENTRATION (mg/kg) BELOW COMMERCIAL USE SOIL CLEANUP OBJECTIVE

GROUND SURFACE CONTOUR

APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE

REVISIONS		
Rev.	By:	Date:
Rev.	By:	Date:
Rev.	By:	Date:
Rev.	By:	Date:

SOURCE:
HYDORQUAL ENVIRONMENTAL ENGINEERS AND SCIENTISTS, P.C.
FIGURE 27 INDUSTRIAL USE SOIL CLEANUP
CRITERIA DELINEATION
AOC I – 0–2' INTERVAL.

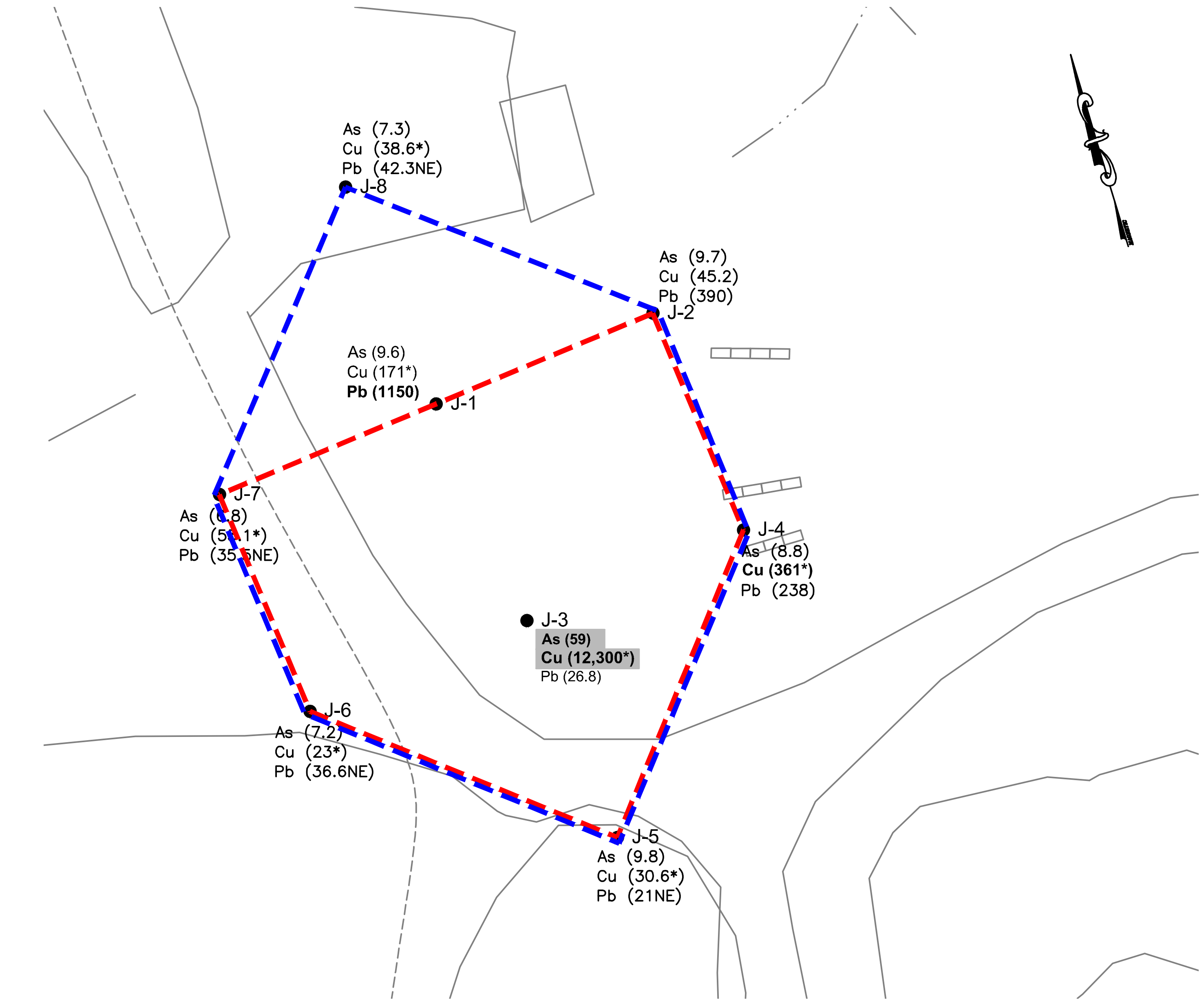
50 0 50
SCALE IN FEET

EHS Support consider it done

DYNO-NOBEL, INC.
PORT EWEN, NY.

FIGURE 45
COMMERCIAL AND INDUSTRIAL USE
SOIL CLEANUP OBJECTIVE DELINEATION
AOC I - 0-2' INTERVAL

Drawn By: BC	Date Drawn: 11/26/13
Reviewed By: KV	Date Reviewed: 11/2013
Scale: 1" = 50'	Plot Date: 11/2013
Project Number.:	



LEGEND

M-9 ●	SHALLOW SOIL SAMPLE LOCATION
(32.0)	CONCENTRATION (mg/kg) EXCEEDS INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
(355)	CONCENTRATION (mg/kg) EXCEEDS COMMERCIAL USE SOIL CLEANUP OBJECTIVE
(6.7)	CONCENTRATION (mg/kg) BELOW COMMERCIAL USE SOIL CLEANUP OBJECTIVE
	GROUND SURFACE CONTOUR
	APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVE
	APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS ABOVE COMMERCIAL USE SOIL CLEANUP OBJECTIVE

NOTES:

1. mg/kg = MILLIGRAMS PER KILOGRAM
2. * DENOTES A DUPLICATE SAMPLE. THE HIGHER CONCENTRATION IS SHOWN.
3. NO VERTICAL SAMPLES WERE COLLECTED FROM AOC J.
4. THE AREA EXCEEDING THE INDUSTRIAL SOIL CLEANUP OBJECTIVE IS 2,700 SQ. FT.
5. THE AREA EXCEEDING THE COMMERCIAL SOIL CLEANUP OBJECTIVE IS 3,716 SQ. FT.

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Arsenic (As)	16	16
Lead (Pb)	1,000	3,900
Copper (Cu)	270	10,000

REVISIONS		
Rev.	By:	Date:
Rev.	By:	Date:
Rev.	By:	Date:
Rev.	By:	Date:

SOURCE:
HYDORQUAL ENVIRONMENTAL ENGINEERS AND SCIENTISTS, P.C.
FIGURE 28 INDUSTRIAL USE SOIL CLEANUP
CRITERIA DELINEATION
AOC J – 0–2' INTERVAL.

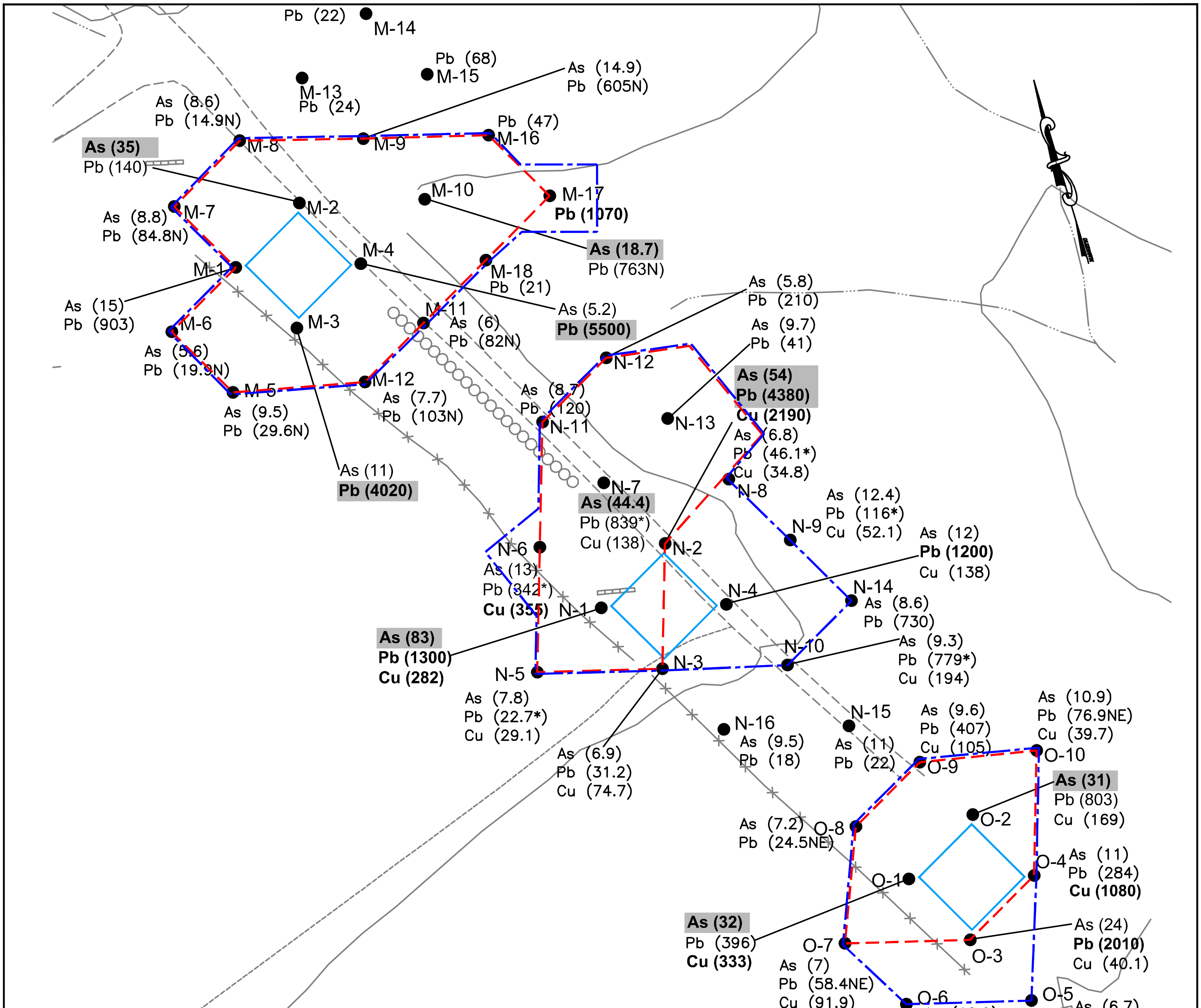
20 0 20
SCALE IN FEET

EHS Support
consider it done

DYNO-NOBEL, INC.
PORT EWEN, NY.

FIGURE 46
COMMERCIAL AND INDUSTRIAL USE
SOIL CLEANUP OBJECTIVE DELINEATION
AOC J - 0-2' INTERVAL

Drawn By: BC	Date Drawn: 11/26/13
Reviewed By: KV	Date Reviewed: 11/2013
Scale: 1" = 50'	Plot Date: 11/2013
Project Number.:	



NOTES:

1. mg/kg = MILLIGRAMS PER KILOGRAM
2. * DENOTES A DUPLICATE SAMPLE. THE HIGHER CONCENTRATION IS SHOWN.
3. CONCENTRATIONS IN AOC M AND AOC N SAMPLES AT 2'-4' INTERVAL WERE BELOW COMMERCIAL AND INDUSTRIAL USE SCOs.
4. NO VERTICAL SAMPLES WERE COLLECTED FROM AOC O.
5. THE AREA EXCEEDING THE INDUSTRIAL SOIL CLEANUP OBJECTIVE IS 16,065 SQ. FT.
6. THE AREA EXCEEDING THE COMMERCIAL SOIL CLEANUP OBJECTIVE IS 21,469 SQ. FT.

SOIL CLEANUP OBJECTIVE, (mg/kg)

	Commercial	Industrial
Arsenic (As)	16	16
Lead (Pb)	1,000	3,900
Copper (Cu)	270	10,000

LEGEND

N-16 ● SHALLOW SOIL SAMPLE LOCATION

(32.0) CONCENTRATION (mg/kg) EXCEEDS INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

(355) CONCENTRATION (mg/kg) EXCEEDS COMMERCIAL USE SOIL CLEANUP OBJECTIVE

(6.7) CONCENTRATION (mg/kg) BELOW COMMERCIAL USE SOIL CLEANUP OBJECTIVE

GROUND SURFACE CONTOUR

APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

APPROXIMATE AREA OF SOIL WITH METALS CONCENTRATIONS ABOVE INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

50 0 50

SCALE IN FEET

REVISIONS		
Rev.	By:	Date:
Rev.	By:	Date:
Rev.	By:	Date:
Rev.	By:	Date:

SOURCE:
HYDORQUAL ENVIRONMENTAL ENGINEERS AND SCIENTISTS, P.C.
FIGURE 29 INDUSTRIAL USE SOIL CLEANUP CRITERIA DELINEATION
AOC M,N,O – 0-2' INTERVAL.

EHS Support
consider it done

DYNO-NOBEL, INC.
PORT EWEN, NY.

FIGURE 47
COMMERCIAL AND INDUSTRIAL USE
SOIL CLEANUP CRITERIA DELINEATION
AOC M,N,O - 0-2' INTERVAL

Drawn By: BC	Date Drawn: 11/26/13
Reviewed By: KV	Date Reviewed: 11/2013
Scale: 1" = 50'	Plot Date: 11/2013
Project Number.:	

APPENDIX E

Soil Corrective Measures Cost Estimates based on Mid-Point Delineation Figures

AOC G

Planning Level Engineering Estimate for Remediation

Commercial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	56	$8	$448	56	$8	$448	0	$8	$0
13	Backfill material	cy	56	$18	$1,008	56	$18	$1,008	0	$18	$0
14	Spread and Compact	cy	112	$8	$896	56	$8	$448	0	$8	$0
15	Load (soil)	cy	56	$3	$168	56	$3	$168	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	56	$3	$168	112	$3	$336	0	$3	$0
17	Silt Fence (sediment control)	lf	240	$1.5	$360	240	$1.5	$360	240	$1.5	$360
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	756	$0.2	$151
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	42	$16	$672
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	14	$21	$294
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$85,807**			**$85,527**			**$63,736**
33	Waste Characterization	ea	0.0	$400	$0	0.2	$400	$67	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	84	$120	$10,080	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$10,147**			**$0**
	Total Construction and Waste Disposal Costs				**$85,807**			**$95,674**			**$63,736**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,290	$4,290	1	$4,276	$4,276	1	$3,187	$3,187
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$8,581	$8,581	1	$8,553	$8,553	1	$6,374	$6,374
3	Contingency (20% of subtotal construction costs)	ls	1	$17,161	$17,161	1	$17,105	$17,105	1	$12,747	$12,747
	Total Construction Services Costs				**$30,032**			**$29,934**			**$22,308**
	TOTAL CAPITAL COSTS				**$115,839**			**$125,608**			**$86,044**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	1.4	$21	$29.40
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$189**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$189	**$5,682**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$6,588**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$2,598**
	Total cost				**$115,839**			**$125,608**			**$88,641**

AOC G

Planning Level Engineering Estimate for Remediation

Industrial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	50	$8	$400	50	$8	$400	0	$8	$0
13	Backfill material	cy	50	$18	$900	50	$18	$900	0	$18	$0
14	Spread and Compact	cy	100	$8	$800	50	$8	$400	0	$8	$0
15	Load (soil)	cy	50	$3	$150	50	$3	$150	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	50	$3	$150	100	$3	$300	0	$3	$0
17	Silt Fence (sediment control)	lf	240	$1.5	$360	240	$1.5	$360	240	$1.5	$360
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	657	$0.2	$131
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	37	$16	$592
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	12	$21	$252
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$85,519**			**$85,269**			**$63,594**
33	Waste Characterization	ea	0.0	$400	$0	0.2	$400	$60	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	75	$120	$9,000	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$9,060**			**$0**
	Total Construction and Waste Disposal Costs				**$85,519**			**$94,329**			**$63,594**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,276	$4,276	1	$4,263	$4,263	1	$3,180	$3,180
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$8,552	$8,552	1	$8,527	$8,527	1	$6,359	$6,359
3	Contingency (20% of subtotal construction costs)	ls	1	$17,104	$17,104	1	$17,054	$17,054	1	$12,719	$12,719
	Total Construction Services Costs				**$29,932**			**$29,844**			**$22,258**
	TOTAL CAPITAL COSTS				**$115,450**			**$124,173**			**$85,852**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	1.2	$21	$25.20
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$185**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$185	**$5,556**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$6,442**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$2,540**
	Total cost				**$115,450**			**$124,173**			**$88,392**

AOC H
Planning Level Engineering Estimate for Remediation
Commercial Use Soil Clean Up Objectives
Dyno Nobel
Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	95	$8	$760	95	$8	$760	0	$8	$0
13	Backfill material	cy	95	$18	$1,710	95	$18	$1,710	0	$18	$0
14	Spread and Compact	cy	190	$8	$1,520	95	$8	$760	0	$8	$0
15	Load (soil)	cy	95	$3	$285	95	$3	$285	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	95	$3	$285	190	$3	$570	0	$3	$0
17	Silt Fence (sediment control)	lf	280	$1.5	$420	280	$1.5	$420	280	$1.5	$420
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	1271	$0.2	$254
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	71	$16	$1,136
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	24	$21	$504
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$87,739**			**$87,264**			**$64,573**
33	Waste Characterization	ea	0.0	$400	$0	0.3	$400	$114	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	143	$120	$17,100	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$17,214**			**$0**
	Total Construction and Waste Disposal Costs				**$87,739**			**$104,478**			**$64,573**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,387	$4,387	1	$4,363	$4,363	1	$3,229	$3,229
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$8,774	$8,774	1	$8,726	$8,726	1	$6,457	$6,457
3	Contingency (20% of subtotal construction costs)	ls	1	$17,548	$17,548	1	$17,453	$17,453	1	$12,915	$12,915
	Total Construction Services Costs				**$30,709**			**$30,542**			**$22,601**
	TOTAL CAPITAL COSTS				**$118,447**			**$135,020**			**$87,174**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	2.4	$21	$50.40
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$210**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$210	**$6,312**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$7,319**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$2,886**
	Total cost				**$118,447**			**$135,020**			**$90,059**

AOC H

Planning Level Engineering Estimate for Remediation

Industrial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	25	$8	$200	25	$8	$200	0	$8	$0
13	Backfill material	cy	25	$18	$450	25	$18	$450	0	$18	$0
14	Spread and Compact	cy	50	$8	$400	25	$8	$200	0	$8	$0
15	Load (soil)	cy	25	$3	$75	25	$3	$75	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	25	$3	$75	50	$3	$150	0	$3	$0
17	Silt Fence (sediment control)	lf	140	$1.5	$210	140	$1.5	$210	140	$1.5	$210
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	329	$0.2	$66
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	10	$16	$160
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	4	$21	$84
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$84,169**			**$84,044**			**$62,779**
33	Waste Characterization	ea	0.0	$400	$0	0.1	$400	$30	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	38	$120	$4,500	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$4,530**			**$0**
	Total Construction and Waste Disposal Costs				**$84,169**			**$88,574**			**$62,779**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,208	$4,208	1	$4,202	$4,202	1	$3,139	$3,139
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$8,417	$8,417	1	$8,404	$8,404	1	$6,278	$6,278
3	Contingency (20% of subtotal construction costs)	ls	1	$16,834	$16,834	1	$16,809	$16,809	1	$12,556	$12,556
	Total Construction Services Costs				**$29,459**			**$29,415**			**$21,973**
	TOTAL CAPITAL COSTS				**$113,628**			**$117,989**			**$84,751**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	0.4	$21	$8.40
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$168**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$168	**$5,052**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$5,858**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$2,310**
	Total cost				**$113,628**			**$117,989**			**$87,061**

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Planning Level Engineering Estimate for Remediation

Commercial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	50	$8	$400	50	$8	$400	0	$8	$0
13	Backfill material	cy	50	$18	$900	50	$18	$900	0	$18	$0
14	Spread and Compact	cy	100	$8	$800	50	$8	$400	0	$8	$0
15	Load (soil)	cy	50	$3	$150	50	$3	$150	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	50	$3	$150	100	$3	$300	0	$3	$0
17	Silt Fence (sediment control)	lf	280	$1.5	$420	280	$1.5	$420	280	$1.5	$420
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	670	$0.2	$134
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	37	$16	$592
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	12.5	$21	$263
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$85,579**			**$85,329**			**$63,667**
33	Waste Characterization	ea	0.0	$400	$0	0.2	$400	$60	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	75	$120	$9,000	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$9,060**			**$0**
	Total Construction and Waste Disposal Costs				**$85,579**			**$94,389**			**$63,667**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,279	$4,279	1	$4,266	$4,266	1	$3,183	$3,183
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$8,558	$8,558	1	$8,533	$8,533	1	$6,367	$6,367
3	Contingency (20% of subtotal construction costs)	ls	1	$17,116	$17,116	1	$17,066	$17,066	1	$12,733	$12,733
	Total Construction Services Costs				**$29,953**			**$29,865**			**$22,284**
	TOTAL CAPITAL COSTS				**$115,531**			**$124,254**			**$85,951**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	1.25	$21	$26.25
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$186**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$186	**$5,588**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$6,479**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$2,555**
	Total cost				**$115,531**			**$124,254**			**$88,505**

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Planning Level Engineering Estimate for Remediation
Commercial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	149	$8	$1,192	149	$8	$1,192	0	$8	$0
13	Backfill material	cy	149	$18	$2,682	149	$18	$2,682	0	$18	$0
14	Spread and Compact	cy	298	$8	$2,384	149	$8	$1,192	0	$8	$0
15	Load (soil)	cy	149	$3	$447	149	$3	$447	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	149	$3	$447	298	$3	$894	0	$3	$0
17	Silt Fence (sediment control)	lf	260	$1.5	$390	260	$1.5	$390	260	$1.5	$390
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	2011	$0.2	$402
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	112	$16	$1,792
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	38	$21	$798
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$90,301**			**$89,556**			**$65,641**
33	Waste Characterization	ea	0.0	$400	$0	0.4	$400	$179	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	224	$120	$26,820	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$26,999**			**$0**
	Total Construction and Waste Disposal Costs				**$90,301**			**$116,555**			**$65,641**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,515	$4,515	1	$4,478	$4,478	1	$3,282	$3,282
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$9,030	$9,030	1	$8,956	$8,956	1	$6,564	$6,564
3	Contingency (20% of subtotal construction costs)	ls	1	$18,060	$18,060	1	$17,911	$17,911	1	$13,128	$13,128
	Total Construction Services Costs				**$31,605**			**$31,345**			**$22,974**
	TOTAL CAPITAL COSTS				**$121,906**			**$147,899**			**$88,615**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	3.8	$21	$79.80
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$240**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$240	**$7,194**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$8,341**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$3,289**
	Total cost				**$121,906**			**$147,899**			**$91,904**

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Industrial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.25	$200	$50	0.25	$200	$50	0.25	$200	$50
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$1,029	$1,029	1	$1,029	$1,029	1	$1,029	$1,029
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	78	$8	$624	78	$8	$624	0	$8	$0
13	Backfill material	cy	78	$18	$1,404	78	$18	$1,404	0	$18	$0
14	Spread and Compact	cy	156	$8	$1,248	78	$8	$624	0	$8	$0
15	Load (soil)	cy	78	$3	$234	78	$3	$234	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	78	$3	$234	156	$3	$468	0	$3	$0
17	Silt Fence (sediment control)	lf	130	$1.5	$195	130	$1.5	$195	130	$1.5	$195
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	1054	$0.2	$211
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	112	$16	$1,792
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	38	$21	$798
28	Seeding	acre	0.25	$3,200	$800	0.25	$3,200	$800	0.25	$3,200	$800
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$84,818**			**$84,428**			**$63,375**
33	Waste Characterization	ea	0.0	$400	$0	0.2	$400	$94	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	117	$120	$14,040	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$14,134**			**$0**
	Total Construction and Waste Disposal Costs				**$84,818**			**$98,562**			**$63,375**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,241	$4,241	1	$4,221	$4,221	1	$3,169	$3,169
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$8,482	$8,482	1	$8,443	$8,443	1	$6,338	$6,338
3	Contingency (20% of subtotal construction costs)	ls	1	$16,964	$16,964	1	$16,886	$16,886	1	$12,675	$12,675
	Total Construction Services Costs				**$29,686**			**$29,550**			**$22,181**
	TOTAL CAPITAL COSTS				**$114,505**			**$128,112**			**$85,557**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	3.8	$21	$79.80
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.025	$3,200	$80
	Estimated Annual O&M Cost				**$0**			**$0**			**$160**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$160	**$4,794**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$5,559**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$2,192**
	Total cost				**$114,505**			**$128,112**			**$87,748**

AOC M

Planning Level Engineering Estimate for Remediation

Commercial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	332	$8	$2,656	332	$8	$2,656	0	$8	$0
13	Backfill material	cy	332	$18	$5,976	332	$18	$5,976	0	$18	$0
14	Spread and Compact	cy	664	$8	$5,312	332	$8	$2,656	0	$8	$0
15	Load (soil)	cy	332	$3	$996	332	$3	$996	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	332	$3	$996	664	$3	$1,992	0	$3	$0
17	Silt Fence (sediment control)	lf	520	$1.5	$780	520	$1.5	$780	520	$1.5	$780
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	4480	$0.2	$896
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	249	$16	$3,984
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	83	$21	$1,743
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$99,475**			**$97,815**			**$69,662**
33	Waste Characterization	ea	0.0	$400	$0	1.0	$400	$398	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	498	$120	$59,760	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$60,158**			**$0**
	Total Construction and Waste Disposal Costs				**$99,475**			**$157,973**			**$69,662**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,974	$4,974	1	$4,891	$4,891	1	$3,483	$3,483
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$9,947	$9,947	1	$9,781	$9,781	1	$6,966	$6,966
3	Contingency (20% of subtotal construction costs)	ls	1	$19,895	$19,895	1	$19,563	$19,563	1	$13,932	$13,932
	Total Construction Services Costs				**$34,816**			**$34,235**			**$24,382**
	TOTAL CAPITAL COSTS				**$134,291**			**$192,208**			**$94,043**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	8.3	$21	$174.30
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$334**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$334	**$10,029**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$11,629**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$4,585**
	Total cost				**$134,291**			**$192,208**			**$98,629**

AOC M

Planning Level Engineering Estimate for Remediation

Industrial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

#	Description	Unit	Option 1: Excavation/Onsite Consolidation Estimated Quantity	Option 1: Unit Cost ($)	Option 1: Total Cost	Option 2: Excavation/Offsite Disposal Estimated Quantity	Option 2: Unit Cost ($)	Option 2: Total Cost	Option 3: Permeable Cover Estimated Quantity	Option 3: Unit Cost ($)	Option 3: Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	290	$8	$2,320	290	$8	$2,320	0	$8	$0
13	Backfill material	cy	290	$18	$5,220	290	$18	$5,220	0	$18	$0
14	Spread and Compact	cy	580	$8	$4,640	290	$8	$2,320	0	$8	$0
15	Load (soil)	cy	290	$3	$870	290	$3	$870	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	290	$3	$870	580	$3	$1,740	0	$3	$0
17	Silt Fence (sediment control)	lf	520	$1.5	$780	520	$1.5	$780	520	$1.5	$780
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	3911	$0.2	$782
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	217	$16	$3,472
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	73	$21	$1,533
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$97,459**			**$96,009**			**$68,826**
33	Waste Characterization	ea	0.0	$400	$0	0.9	$400	$348	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	435	$120	$52,200	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$52,548**			**$0**
	Total Construction and Waste Disposal Costs				**$97,459**			**$148,557**			**$68,826**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,873	$4,873	1	$4,800	$4,800	1	$3,441	$3,441
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$9,746	$9,746	1	$9,601	$9,601	1	$6,883	$6,883
3	Contingency (20% of subtotal construction costs)	ls	1	$19,492	$19,492	1	$19,202	$19,202	1	$13,765	$13,765
	Total Construction Services Costs				**$34,111**			**$33,603**			**$24,089**
	TOTAL CAPITAL COSTS				**$131,569**			**$182,160**			**$92,915**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	7.3	$21	$153.30
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$313**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$313	**$9,399**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$10,898**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$4,297**
	Total cost				**$131,569**			**$182,160**			**$97,212**

AOC N

Planning Level Engineering Estimate for Remediation

Commercial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	364	$8	$2,912	364	$8	$2,912	0	$8	$0
13	Backfill material	cy	364	$18	$6,552	364	$18	$6,552	0	$18	$0
14	Spread and Compact	cy	728	$8	$5,824	364	$8	$2,912	0	$8	$0
15	Load (soil)	cy	364	$3	$1,092	364	$3	$1,092	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	364	$3	$1,092	728	$3	$2,184	0	$3	$0
17	Silt Fence (sediment control)	lf	480	$1.5	$720	480	$1.5	$720	480	$1.5	$720
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	4912	$0.2	$982
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	273	$16	$4,368
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	91	$21	$1,911
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$100,951**			**$99,131**			**$70,240**
33	Waste Characterization	ea	0.0	$400	$0	1.1	$400	$437	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	546	$120	$65,520	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$65,957**			**$0**
	Total Construction and Waste Disposal Costs				**$100,951**			**$165,088**			**$70,240**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$5,048	$5,048	1	$4,957	$4,957	1	$3,512	$3,512
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$10,095	$10,095	1	$9,913	$9,913	1	$7,024	$7,024
3	Contingency (20% of subtotal construction costs)	ls	1	$20,190	$20,190	1	$19,826	$19,826	1	$14,048	$14,048
	Total Construction Services Costs				**$35,333**			**$34,696**			**$24,584**
	TOTAL CAPITAL COSTS				**$136,284**			**$199,783**			**$94,824**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	9.1	$21	$191.10
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$351**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$351	**$10,533**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$12,213**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$4,816**
	Total cost				**$136,284**			**$199,783**			**$99,640**

AOC N

Planning Level Engineering Estimate for Remediation

Industrial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	246	$8	$1,968	246	$8	$1,968	0	$8	$0
13	Backfill material	cy	246	$18	$4,428	246	$18	$4,428	0	$18	$0
14	Spread and Compact	cy	492	$8	$3,936	246	$8	$1,968	0	$8	$0
15	Load (soil)	cy	246	$3	$738	246	$3	$738	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	246	$3	$738	492	$3	$1,476	0	$3	$0
17	Silt Fence (sediment control)	lf	480	$1.5	$720	480	$1.5	$720	480	$1.5	$720
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	3320	$0.2	$664
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	185	$16	$2,960
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	62	$21	$1,302
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$95,287**			**$94,057**			**$67,905**
33	Waste Characterization	ea	0.0	$400	$0	0.7	$400	$295	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	369	$120	$44,280	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$44,575**			**$0**
	Total Construction and Waste Disposal Costs				**$95,287**			**$138,632**			**$67,905**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,764	$4,764	1	$4,703	$4,703	1	$3,395	$3,395
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$9,529	$9,529	1	$9,406	$9,406	1	$6,790	$6,790
3	Contingency (20% of subtotal construction costs)	ls	1	$19,057	$19,057	1	$18,811	$18,811	1	$13,581	$13,581
	Total Construction Services Costs				**$33,350**			**$32,920**			**$23,767**
	TOTAL CAPITAL COSTS				**$128,637**			**$171,552**			**$91,672**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	6.2	$21	$130.20
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$290**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$290	**$8,706**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$10,095**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$3,980**
	Total cost				**$128,637**			**$171,552**			**$95,652**

AOC N

Planning Level Engineering Estimate for Remediation

Commercial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	184	$8	$1,472	184	$8	$1,472	0	$8	$0
13	Backfill material	cy	184	$18	$3,312	184	$18	$3,312	0	$18	$0
14	Spread and Compact	cy	368	$8	$2,944	184	$8	$1,472	0	$8	$0
15	Load (soil)	cy	184	$3	$552	184	$3	$552	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	184	$3	$552	368	$3	$1,104	0	$3	$0
17	Silt Fence (sediment control)	lf	380	$1.5	$570	380	$1.5	$570	380	$1.5	$570
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	2486	$0.2	$497
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	138	$16	$2,208
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	46	$21	$966
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$92,161**			**$91,241**			**$66,500**
33	Waste Characterization	ea	0.0	$400	$0	0.6	$400	$221	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	276	$120	$33,120	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$33,341**			**$0**
	Total Construction and Waste Disposal Costs				**$92,161**			**$124,582**			**$66,500**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,608	$4,608	1	$4,562	$4,562	1	$3,325	$3,325
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$9,216	$9,216	1	$9,124	$9,124	1	$6,650	$6,650
3	Contingency (20% of subtotal construction costs)	ls	1	$18,432	$18,432	1	$18,248	$18,248	1	$13,300	$13,300
	Total Construction Services Costs				**$32,256**			**$31,934**			**$23,275**
	TOTAL CAPITAL COSTS				**$124,417**			**$156,516**			**$89,775**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	4.6	$21	$96.60
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$257**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$257	**$7,698**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$8,926**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$3,519**
	Total cost				**$124,417**			**$156,516**			**$93,294**

SWMU 2 and AOC A

Planning Level Engineering Estimate for Remediation

Commercial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	2.4	$200	$480	2.4	$200	$480	2.4	$200	$480
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$9,882	$9,882	1	$9,882	$9,882	1	$9,882	$9,882
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	900	$8	$7,200	900	$8	$7,200	0	$8	$0
13	Backfill material	cy	900	$18	$16,200	900	$18	$16,200	0	$18	$0
14	Spread and Compact	cy	1,800	$8	$14,400	900	$8	$7,200	0	$8	$0
15	Load (soil)	cy	900	$3	$2,700	900	$3	$2,700	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	900	$3	$2,700	1,800	$3	$5,400	0	$3	$0
17	Silt Fence (sediment control)	lf	1,300	$1.5	$1,950	1,300	$1.5	$1,950	1,300	$1.5	$1,950
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	15988	$0.2	$3,198
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	888	$16	$14,208
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	592	$21	$12,432
28	Seeding	acre	2.4	$3,200	$7,680	2.4	$3,200	$7,680	2.4	$3,200	$7,680
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$142,192**			**$137,692**			**$108,330**
33	Waste Characterization	ea	0.0	$400	$0	2.7	$400	$1,080	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	1,350	$120	$162,000	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$163,080**			**$0**
	Total Construction and Waste Disposal Costs				**$142,192**			**$300,772**			**$108,330**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$7,110	$7,110	1	$6,885	$6,885	1	$5,416	$5,416
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$14,219	$14,219	1	$13,769	$13,769	1	$10,833	$10,833
3	Contingency (20% of subtotal construction costs)	ls	1	$28,438	$28,438	1	$27,538	$27,538	1	$21,666	$21,666
	Total Construction Services Costs				**$49,767**			**$48,192**			**$37,915**
	TOTAL CAPITAL COSTS				**$191,960**			**$348,965**			**$146,245**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	59.2	$21	$1,243.20
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.24	$3,200	$768
	Estimated Annual O&M Cost				**$0**			**$0**			**$2,011**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$2,011	**$60,336**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$69,959**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$27,585**
	Total cost				**$191,960**			**$348,965**			**$173,830**

SWMU 2 and AOC A

Planning Level Engineering Estimate for Remediation

Industrial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.5	$200	$100	0.5	$200	$100	0.5	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$9,882	$9,882	1	$9,882	$9,882	1	$9,882	$9,882
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	447	$8	$3,576	447	$8	$3,576	0	$8	$0
13	Backfill material	cy	447	$18	$8,046	447	$18	$8,046	0	$18	$0
14	Spread and Compact	cy	894	$8	$7,152	447	$8	$3,576	0	$8	$0
15	Load (soil)	cy	447	$3	$1,341	447	$3	$1,341	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	447	$3	$1,341	894	$3	$2,682	0	$3	$0
17	Silt Fence (sediment control)	lf	460	$1.5	$690	460	$1.5	$690	460	$1.5	$690
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	5144	$0.2	$1,029
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	286	$16	$4,576
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	96	$21	$2,016
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$112,728**			**$110,493**			**$78,393**
33	Waste Characterization	ea	0.0	$400	$0	1.3	$400	$536	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	671	$120	$80,460	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$80,996**			**$0**
	Total Construction and Waste Disposal Costs				**$112,728**			**$191,490**			**$78,393**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$5,636	$5,636	1	$5,525	$5,525	1	$3,920	$3,920
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$11,273	$11,273	1	$11,049	$11,049	1	$7,839	$7,839
3	Contingency (20% of subtotal construction costs)	ls	1	$22,546	$22,546	1	$22,099	$22,099	1	$15,679	$15,679
	Total Construction Services Costs				**$39,455**			**$38,673**			**$27,438**
	TOTAL CAPITAL COSTS				**$152,183**			**$230,162**			**$105,831**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	9.6	$21	$201.60
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$362**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$362	**$10,848**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$12,578**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$4,960**
	Total cost				**$152,183**			**$230,162**			**$110,790**

SWMU 3 and 5

Planning Level Engineering Estimate for Remediation

Commercial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

Description		Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	1.5	$200	$300	1.5	$200	$300	1.5	$200	$300
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$6,176	$6,176	1	$6,176	$6,176	1	$6,176	$6,176
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	2,038	$8	$16,304	2,038	$8	$16,304	0	$8	$0
13	Backfill material	cy	2,038	$18	$36,684	2,038	$18	$36,684	0	$18	$0
14	Spread and Compact	cy	4,076	$8	$32,608	2,038	$8	$16,304	0	$8	$0
15	Load (soil)	cy	2,038	$3	$6,114	2,038	$3	$6,114	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	2,038	$3	$6,114	4,076	$3	$12,228	0	$3	$0
17	Silt Fence (sediment control)	lf	1,000	$1.5	$1,500	1,000	$1.5	$1,500	1,000	$1.5	$1,500
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	13753	$0.2	$2,751
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	764	$16	$12,224
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	255	$21	$5,355
28	Seeding	acre	1.5	$3,200	$4,800	1.5	$3,200	$4,800	1.5	$3,200	$4,800
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$189,600**			**$179,410**			**$91,606**
33	Waste Characterization	ea	0.0	$400	$0	6.1	$400	$2,446	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	3,057	$120	$366,840	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$369,286**			**$0**
	Total Construction and Waste Disposal Costs				**$189,600**			**$548,696**			**$91,606**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$9,480	$9,480	1	$8,971	$8,971	1	$4,580	$4,580
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$18,960	$18,960	1	$17,941	$17,941	1	$9,161	$9,161
3	Contingency (20% of subtotal construction costs)	ls	1	$37,920	$37,920	1	$35,882	$35,882	1	$18,321	$18,321
	Total Construction Services Costs				**$66,360**			**$62,794**			**$32,062**
	TOTAL CAPITAL COSTS				**$255,961**			**$611,490**			**$123,668**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	25.5	$21	$535.50
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.15	$3,200	$480
	Estimated Annual O&M Cost				**$0**			**$0**			**$1,016**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$1,016	**$30,465**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$35,324**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$13,928**
	Total cost				**$255,961**			**$611,490**			**$137,596**

SWMU 3 and 5
Planning Level Engineering Estimate for Remediation
Industrial Use Soil Clean Up Objectives
Dyno Nobel
Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.5	$200	$100	0.5	$200	$100	0.5	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	356	$8	$2,848	356	$8	$2,848	0	$8	$0
13	Backfill material	cy	356	$18	$6,408	356	$18	$6,408	0	$18	$0
14	Spread and Compact	cy	712	$8	$5,696	356	$8	$2,848	0	$8	$0
15	Load (soil)	cy	356	$3	$1,068	356	$3	$1,068	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	356	$3	$1,068	712	$3	$2,136	0	$3	$0
17	Silt Fence (sediment control)	lf	360	$1.5	$540	360	$1.5	$540	360	$1.5	$540
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	3842	$0.2	$768
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	214	$16	$3,424
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	71	$21	$1,491
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$100,387**			**$98,607**			**$68,482**
33	Waste Characterization	ea	0.0	$400	$0	1.1	$400	$427	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	534	$120	$64,080	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$64,507**			**$0**
	Total Construction and Waste Disposal Costs				**$100,387**			**$163,114**			**$68,482**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$5,019	$5,019	1	$4,930	$4,930	1	$3,424	$3,424
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$10,039	$10,039	1	$9,861	$9,861	1	$6,848	$6,848
3	Contingency (20% of subtotal construction costs)	ls	1	$20,077	$20,077	1	$19,721	$19,721	1	$13,696	$13,696
	Total Construction Services Costs				**$35,135**			**$34,512**			**$23,969**
	TOTAL CAPITAL COSTS				**$135,522**			**$197,626**			**$92,451**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	7.1	$21	$149.10
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$309**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$309	**$9,273**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$10,752**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$4,239**
	Total cost				**$135,522**			**$197,626**			**$96,691**

SWMU 4
Planning Level Engineering Estimate for Remediation
Commercial Use Soil Clean Up Objectives
Dyno Nobel
Port Ewen, New York

#	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
	Construction Costs										
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.75	$200	$150	0.75	$200	$150	0.75	$200	$150
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$3,088	$3,088	1	$3,088	$3,088	1	$3,088	$3,088
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	1,011	$8	$8,088	1,011	$8	$8,088	0	$8	$0
13	Backfill material	cy	1,011	$18	$18,198	1,011	$18	$18,198	0	$18	$0
14	Spread and Compact	cy	2,022	$8	$16,176	1,011	$8	$8,088	0	$8	$0
15	Load (soil)	cy	1,011	$3	$3,033	1,011	$3	$3,033	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	1,011	$3	$3,033	2,022	$3	$6,066	0	$3	$0
17	Silt Fence (sediment control)	lf	680	$1.5	$1,020	680	$1.5	$1,020	680	$1.5	$1,020
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	6827	$0.2	$1,365
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	379	$16	$6,064
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	127	$21	$2,667
28	Seeding	acre	0.75	$3,200	$2,400	0.75	$3,200	$2,400	0.75	$3,200	$2,400
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$134,186**			**$129,131**			**$75,255**
33	Waste Characterization	ea	0.0	$400	$0	3.0	$400	$1,213	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	1,517	$120	$181,980	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$183,193**			**$0**
	Total Construction and Waste Disposal Costs				**$134,186**			**$312,324**			**$75,255**
	Construction Services										
1	Engineering (5% of subtotal construction costs)	ls	1	$6,709	$6,709	1	$6,457	$6,457	1	$3,763	$3,763
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$13,419	$13,419	1	$12,913	$12,913	1	$7,525	$7,525
3	Contingency (20% of subtotal construction costs)	ls	1	$26,837	$26,837	1	$25,826	$25,826	1	$15,051	$15,051
	Total Construction Services Costs				**$46,965**			**$45,196**			**$26,339**
	TOTAL CAPITAL COSTS				**$181,151**			**$357,520**			**$101,594**
	Annual Operation & Maintenance										
1	Inspection and maintenance of permeable cover		Cost captured in wetlands estimate			Cost captured in wetlands estimate					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	12.7	$21	$266.70
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.075	$3,200	$240
	Estimated Annual O&M Cost				**$0**			**$0**			**$507**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$507	**$15,201**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$17,626**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$6,950**
	Total cost				**$181,151**			**$357,520**			**$108,543**

SWMU 4

Planning Level Engineering Estimate for Remediation

Industrial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	97	$8	$776	97	$8	$776	0	$8	$0
13	Backfill material	cy	97	$18	$1,746	97	$18	$1,746	0	$18	$0
14	Spread and Compact	cy	194	$8	$1,552	97	$8	$776	0	$8	$0
15	Load (soil)	cy	97	$3	$291	97	$3	$291	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	97	$3	$291	194	$3	$582	0	$3	$0
17	Silt Fence (sediment control)	lf	500	$1.5	$750	500	$1.5	$750	500	$1.5	$750
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	2583	$0.2	$517
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	144	$16	$2,304
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	48	$21	$1,008
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$88,165**			**$87,680**			**$66,837**
33	Waste Characterization	ea	0.0	$400	$0	0.3	$400	$116	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	146	$120	$17,460	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$17,576**			**$0**
	Total Construction and Waste Disposal Costs				**$88,165**			**$105,256**			**$66,837**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,408	$4,408	1	$4,384	$4,384	1	$3,342	$3,342
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$8,816	$8,816	1	$8,768	$8,768	1	$6,684	$6,684
3	Contingency (20% of subtotal construction costs)	ls	1	$17,633	$17,633	1	$17,536	$17,536	1	$13,367	$13,367
	Total Construction Services Costs				**$30,858**			**$30,688**			**$23,393**
	TOTAL CAPITAL COSTS				**$119,023**			**$135,944**			**$90,231**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	4.8	$21	$100.80
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$261**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$261	**$7,824**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$9,072**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$3,577**
	Total cost				**$119,023**			**$135,944**			**$93,808**

SWMU 6, 7, 8 and AOC B

Planning Level Engineering Estimate for Remediation

Commercial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	1.75	$200	$350	1.75	$200	$350	1.75	$200	$350
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$7,206	$7,206	1	$7,206	$7,206	1	$7,206	$7,206
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	2,310	$8	$18,480	2,310	$8	$18,480	0	$8	$0
13	Backfill material	cy	2,310	$18	$41,580	2,310	$18	$41,580	0	$18	$0
14	Spread and Compact	cy	4,620	$8	$36,960	2,310	$8	$18,480	0	$8	$0
15	Load (soil)	cy	2,310	$3	$6,930	2,310	$3	$6,930	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	2,310	$3	$6,930	4,620	$3	$13,860	0	$3	$0
17	Silt Fence (sediment control)	lf	1,040	$1.5	$1,560	1,040	$1.5	$1,560	1,040	$1.5	$1,560
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	15590	$0.2	$3,118
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	866	$16	$13,856
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	289	$21	$6,069
28	Seeding	acre	1.75	$3,200	$5,600	1.75	$3,200	$5,600	1.75	$3,200	$5,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$204,596**			**$193,046**			**$96,259**
33	Waste Characterization	ea	0.0	$400	$0	6.9	$400	$2,772	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	3,465	$120	$415,800	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$418,572**			**$0**
	Total Construction and Waste Disposal Costs				**$204,596**			**$611,618**			**$96,259**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$10,230	$10,230	1	$9,652	$9,652	1	$4,813	$4,813
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$20,460	$20,460	1	$19,305	$19,305	1	$9,626	$9,626
3	Contingency (20% of subtotal construction costs)	ls	1	$40,919	$40,919	1	$38,609	$38,609	1	$19,252	$19,252
	Total Construction Services Costs				**$71,609**			**$67,566**			**$33,691**
	TOTAL CAPITAL COSTS				**$276,204**			**$679,184**			**$129,949**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	28.9	$21	$606.90
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.175	$3,200	$560
	Estimated Annual O&M Cost				**$0**			**$0**			**$1,167**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$1,167	**$35,007**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$40,590**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$16,005**
	Total cost				**$276,204**			**$679,184**			**$145,954**

SWMU 6, 7, 8 and AOC B

Planning Level Engineering Estimate for Remediation

Industrial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	1.00	$200	$200	1.00	$200	$200	1.00	$200	$200
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$4,118	$4,118	1	$4,118	$4,118	1	$4,118	$4,118
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	1,457	$8	$11,656	1,457	$8	$11,656	0	$8	$0
13	Backfill material	cy	1,457	$18	$26,226	1,457	$18	$26,226	0	$18	$0
14	Spread and Compact	cy	2,914	$8	$23,312	1,457	$8	$11,656	0	$8	$0
15	Load (soil)	cy	1,457	$3	$4,371	1,457	$3	$4,371	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	1,457	$3	$4,371	2,914	$3	$8,742	0	$3	$0
17	Silt Fence (sediment control)	lf	760	$1.5	$1,140	760	$1.5	$1,140	760	$1.5	$1,140
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	9185	$0.2	$1,837
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	511	$16	$8,176
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	170	$21	$3,570
28	Seeding	acre	1	$3,200	$3,200	1	$3,200	$3,200	1	$3,200	$3,200
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$157,594**			**$150,309**			**$80,741**
33	Waste Characterization	ea	0.0	$400	$0	4.4	$400	$1,748	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	2,186	$120	$262,260	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$264,008**			**$0**
	Total Construction and Waste Disposal Costs				**$157,594**			**$414,317**			**$80,741**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$7,880	$7,880	1	$7,515	$7,515	1	$4,037	$4,037
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$15,759	$15,759	1	$15,031	$15,031	1	$8,074	$8,074
3	Contingency (20% of subtotal construction costs)	ls	1	$31,519	$31,519	1	$30,062	$30,062	1	$16,148	$16,148
	Total Construction Services Costs				**$55,158**			**$52,608**			**$28,259**
	TOTAL CAPITAL COSTS				**$212,751**			**$466,925**			**$109,000**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	17	$21	$357.00
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.1	$3,200	$320
	Estimated Annual O&M Cost				**$0**			**$0**			**$677**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$677	**$20,310**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$23,549**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$9,285**
	Total cost				**$212,751**			**$466,925**			**$118,285**

SWMU 9
Planning Level Engineering Estimate for Remediation
Commercial Use Soil Clean Up Objectives
Dyno Nobel
Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	58	$8	$464	58	$8	$464	0	$8	$0
13	Backfill material	cy	58	$18	$1,044	58	$18	$1,044	0	$18	$0
14	Spread and Compact	cy	116	$8	$928	58	$8	$464	0	$8	$0
15	Load (soil)	cy	58	$3	$174	58	$3	$174	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	58	$3	$174	116	$3	$348	0	$3	$0
17	Silt Fence (sediment control)	lf	180	$1.5	$270	180	$1.5	$270	180	$1.5	$270
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	390	$0.2	$78
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	22	$16	$352
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	7.5	$21	$158
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$85,813**			**$85,523**			**$63,116**
33	Waste Characterization	ea	0.0	$400	$0	0.2	$400	$70	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	87	$120	$10,440	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$10,510**			**$0**
	Total Construction and Waste Disposal Costs				**$85,813**			**$96,032**			**$63,116**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,291	$4,291	1	$4,276	$4,276	1	$3,156	$3,156
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$8,581	$8,581	1	$8,552	$8,552	1	$6,312	$6,312
3	Contingency (20% of subtotal construction costs)	ls	1	$17,163	$17,163	1	$17,105	$17,105	1	$12,623	$12,623
	Total Construction Services Costs				**$30,034**			**$29,933**			**$22,091**
	TOTAL CAPITAL COSTS				**$115,847**			**$125,965**			**$85,207**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	0.75	$21	$15.75
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$176**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$176	**$5,273**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$6,113**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$2,411**
	Total cost				**$115,847**			**$125,965**			**$87,618**

SWMU 10
Planning Level Engineering Estimate for Remediation
Commercial Use Soil Clean Up Objectives
Dyno Nobel
Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	1.00	$200	$200	1.00	$200	$200	1.00	$200	$200
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$4,118	$4,118	1	$4,118	$4,118	1	$4,118	$4,118
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	244	$8	$1,952	244	$8	$1,952	0	$8	$0
13	Backfill material	cy	244	$18	$4,392	244	$18	$4,392	0	$18	$0
14	Spread and Compact	cy	488	$8	$3,904	244	$8	$1,952	0	$8	$0
15	Load (soil)	cy	244	$3	$732	244	$3	$732	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	244	$3	$732	488	$3	$1,464	0	$3	$0
17	Silt Fence (sediment control)	lf	820	$1.5	$1,230	820	$1.5	$1,230	820	$1.5	$1,230
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	6570	$0.2	$1,314
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	365	$16	$5,840
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	122	$21	$2,562
28	Seeding	acre	1	$3,200	$3,200	1	$3,200	$3,200	1	$3,200	$3,200
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$99,460**			**$98,240**			**$76,964**
33	Waste Characterization	ea	0.0	$400	$0	0.7	$400	$293	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	366	$120	$43,920	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$44,213**			**$0**
	Total Construction and Waste Disposal Costs				**$99,460**			**$142,452**			**$76,964**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,973	$4,973	1	$4,912	$4,912	1	$3,848	$3,848
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$9,946	$9,946	1	$9,824	$9,824	1	$7,696	$7,696
3	Contingency (20% of subtotal construction costs)	ls	1	$19,892	$19,892	1	$19,648	$19,648	1	$15,393	$15,393
	Total Construction Services Costs				**$34,811**			**$34,384**			**$26,937**
	TOTAL CAPITAL COSTS				**$134,271**			**$176,836**			**$103,901**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	12.2	$21	$256.20
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.1	$3,200	$320
	Estimated Annual O&M Cost				**$0**			**$0**			**$576**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$576	**$17,286**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$20,043**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$7,903**
	Total cost				**$134,271**			**$176,836**			**$111,804**

SWMU 10

Planning Level Engineering Estimate for Remediation

Industrial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	113	$8	$904	113	$8	$904	0	$8	$0
13	Backfill material	cy	113	$18	$2,034	113	$18	$2,034	0	$18	$0
14	Spread and Compact	cy	226	$8	$1,808	113	$8	$904	0	$8	$0
15	Load (soil)	cy	113	$3	$339	113	$3	$339	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	113	$3	$339	226	$3	$678	0	$3	$0
17	Silt Fence (sediment control)	lf	600	$1.5	$900	600	$1.5	$900	600	$1.5	$900
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	3028	$0.2	$606
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	168	$16	$2,688
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	56	$21	$1,176
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$89,083**			**$88,518**			**$67,628**
33	Waste Characterization	ea	0.0	$400	$0	0.3	$400	$136	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	170	$120	$20,340	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$20,476**			**$0**
	Total Construction and Waste Disposal Costs				**$89,083**			**$108,993**			**$67,628**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,454	$4,454	1	$4,426	$4,426	1	$3,381	$3,381
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$8,908	$8,908	1	$8,852	$8,852	1	$6,763	$6,763
3	Contingency (20% of subtotal construction costs)	ls	1	$17,817	$17,817	1	$17,704	$17,704	1	$13,526	$13,526
	Total Construction Services Costs				**$31,179**			**$30,981**			**$23,670**
	TOTAL CAPITAL COSTS				**$120,262**			**$139,975**			**$91,298**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	5.6	$21	$117.60
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$278**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$278	**$8,328**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$9,656**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$3,807**
	Total cost				**$120,262**			**$139,975**			**$95,106**

SWMU 11
Planning Level Engineering Estimate for Remediation
Commercial Use Soil Clean Up Objectives
Dyno Nobel
Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	12	$8	$96	12	$8	$96	0	$8	$0
13	Backfill material	cy	12	$18	$216	12	$18	$216	0	$18	$0
14	Spread and Compact	cy	24	$8	$192	12	$8	$96	0	$8	$0
15	Load (soil)	cy	12	$3	$36	12	$3	$36	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	12	$3	$36	24	$3	$72	0	$3	$0
17	Silt Fence (sediment control)	lf	240	$1.5	$360	240	$1.5	$360	240	$1.5	$360
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	308	$0.2	$62
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	17	$16	$272
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	6	$21	$126
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$83,695**			**$83,635**			**$63,078**
33	Waste Characterization	ea	0.0	$400	$0	0.0	$400	$14	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	18	$120	$2,160	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$2,174**			**$0**
	Total Construction and Waste Disposal Costs				**$83,695**			**$85,809**			**$63,078**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,185	$4,185	1	$4,182	$4,182	1	$3,154	$3,154
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$8,369	$8,369	1	$8,363	$8,363	1	$6,308	$6,308
3	Contingency (20% of subtotal construction costs)	ls	1	$16,739	$16,739	1	$16,727	$16,727	1	$12,616	$12,616
	Total Construction Services Costs				**$29,293**			**$29,272**			**$22,077**
	TOTAL CAPITAL COSTS				**$112,988**			**$115,081**			**$85,156**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	0.6	$21	$12.60
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$173**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$173	**$5,178**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$6,004**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$2,367**
	Total cost				**$112,988**			**$115,081**			**$87,523**

SWMU 11

Planning Level Engineering Estimate for Remediation

Industrial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	6	$8	$48	6	$8	$48	0	$8	$0
13	Backfill material	cy	6	$18	$108	6	$18	$108	0	$18	$0
14	Spread and Compact	cy	12	$8	$96	6	$8	$48	0	$8	$0
15	Load (soil)	cy	6	$3	$18	6	$3	$18	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	6	$3	$18	12	$3	$36	0	$3	$0
17	Silt Fence (sediment control)	lf	80	$1.5	$120	80	$1.5	$120	80	$1.5	$120
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	150	$0.2	$30
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	9	$16	$144
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	3	$21	$63
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$83,167**			**$83,137**			**$62,616**
33	Waste Characterization	ea	0.0	$400	$0	0.0	$400	$7	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	9	$120	$1,080	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$1,087**			**$0**
	Total Construction and Waste Disposal Costs				**$83,167**			**$84,224**			**$62,616**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,158	$4,158	1	$4,157	$4,157	1	$3,131	$3,131
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$8,317	$8,317	1	$8,314	$8,314	1	$6,262	$6,262
3	Contingency (20% of subtotal construction costs)	ls	1	$16,633	$16,633	1	$16,627	$16,627	1	$12,523	$12,523
	Total Construction Services Costs				**$29,108**			**$29,098**			**$21,916**
	TOTAL CAPITAL COSTS				**$112,275**			**$113,322**			**$84,531**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	0.3	$21	$6.30
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$166**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$166	**$4,989**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$5,785**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$2,281**
	Total cost				**$112,275**			**$113,322**			**$86,812**

SWMU 13
Planning Level Engineering Estimate for Remediation
Commercial Use Soil Clean Up Objectives
Dyno Nobel
Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.75	$200	$150	0.75	$200	$150	0.75	$200	$150
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$3,088	$3,088	1	$3,088	$3,088	1	$3,088	$3,088
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	317	$8	$2,536	317	$8	$2,536	0	$8	$0
13	Backfill material	cy	317	$18	$5,706	317	$18	$5,706	0	$18	$0
14	Spread and Compact	cy	634	$8	$5,072	317	$8	$2,536	0	$8	$0
15	Load (soil)	cy	317	$3	$951	317	$3	$951	0	$3	$0
16	Haul/Handling of Soil (on-site)	cy	317	$3	$951	634	$3	$1,902	0	$3	$0
17	Silt Fence (sediment control)	lf	760	$1.5	$1,140	760	$1.5	$1,140	760	$1.5	$1,140
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	8540	$0.2	$1,708
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	18	$16	$288
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	6	$21	$126
28	Seeding	acre	0.75	$3,200	$2,400	0.75	$3,200	$2,400	0.75	$3,200	$2,400
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$100,994**			**$99,409**			**$67,400**
33	Waste Characterization	ea	0.0	$400	$0	1.0	$400	$380	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	476	$120	$57,060	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$57,440**			**$0**
	Total Construction and Waste Disposal Costs				**$100,994**			**$156,850**			**$67,400**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$5,050	$5,050	1	$4,970	$4,970	1	$3,370	$3,370
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$10,099	$10,099	1	$9,941	$9,941	1	$6,740	$6,740
3	Contingency (20% of subtotal construction costs)	ls	1	$20,199	$20,199	1	$19,882	$19,882	1	$13,480	$13,480
	Total Construction Services Costs				**$35,348**			**$34,793**			**$23,590**
	TOTAL CAPITAL COSTS				**$136,342**			**$191,643**			**$90,990**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	0.6	$21	$12.60
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.075	$3,200	$240
	Estimated Annual O&M Cost				**$0**			**$0**			**$253**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$253	**$7,578**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$8,787**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$3,465**
	Total cost				**$136,342**			**$191,643**			**$94,455**

SWMU 21

Planning Level Engineering Estimate for Remediation

Commercial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	69	$8	$552	69	$8	$552	0	$8	$0
13	Backfill material	cy	69	$18	$1,242	69	$18	$1,242	0	$18	$0
14	Spread and Compact	cy	138	$8	$1,104	69	$8	$552	0	$8	$0
15	Load (soil)	cy	69	$3	$207	69	$3	$207	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	69	$3	$207	138	$3	$414	0	$3	$0
17	Silt Fence (sediment control)	lf	460	$1.5	$690	460	$1.5	$690	460	$1.5	$690
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	1859	$0.2	$372
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	103	$16	$1,648
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	35	$21	$735
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$86,761**			**$86,416**			**$65,704**
33	Waste Characterization	ea	0.0	$400	$0	0.2	$400	$83	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	104	$120	$12,420	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$12,503**			**$0**
	Total Construction and Waste Disposal Costs				**$86,761**			**$98,919**			**$65,704**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,338	$4,338	1	$4,321	$4,321	1	$3,285	$3,285
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$8,676	$8,676	1	$8,642	$8,642	1	$6,570	$6,570
3	Contingency (20% of subtotal construction costs)	ls	1	$17,352	$17,352	1	$17,283	$17,283	1	$13,141	$13,141
	Total Construction Services Costs				**$30,366**			**$30,246**			**$22,996**
	TOTAL CAPITAL COSTS				**$117,127**			**$129,164**			**$88,700**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	3.5	$21	$73.50
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$234**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$234	**$7,005**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$8,122**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$3,203**
	Total cost				**$117,127**			**$129,164**			**$91,902**

SWMU 21

Planning Level Engineering Estimate for Remediation

Industrial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.25	$200	$50	0.25	$200	$50	0.25	$200	$50
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$1,029	$1,029	1	$1,029	$1,029	1	$1,029	$1,029
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	13	$8	$104	13	$8	$104	0	$8	$0
13	Backfill material	cy	13	$18	$234	13	$18	$234	0	$18	$0
14	Spread and Compact	cy	26	$8	$208	13	$8	$104	0	$8	$0
15	Load (soil)	cy	13	$3	$39	13	$3	$39	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	13	$3	$39	26	$3	$78	0	$3	$0
17	Silt Fence (sediment control)	lf	120	$1.5	$180	120	$1.5	$180	120	$1.5	$180
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	327	$0.2	$65
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	18	$16	$288
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	6	$21	$126
28	Seeding	acre	0.25	$3,200	$800	0.25	$3,200	$800	0.25	$3,200	$800
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$81,683**			**$81,618**			**$61,039**
33	Waste Characterization	ea	0.0	$400	$0	0.0	$400	$16	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	20	$120	$2,340	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$2,356**			**$0**
	Total Construction and Waste Disposal Costs				**$81,683**			**$83,974**			**$61,039**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,084	$4,084	1	$4,081	$4,081	1	$3,052	$3,052
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$8,168	$8,168	1	$8,162	$8,162	1	$6,104	$6,104
3	Contingency (20% of subtotal construction costs)	ls	1	$16,337	$16,337	1	$16,324	$16,324	1	$12,208	$12,208
	Total Construction Services Costs				**$28,589**			**$28,566**			**$21,364**
	TOTAL CAPITAL COSTS				**$110,273**			**$112,540**			**$82,402**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	0.6	$21	$12.60
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.025	$3,200	$80
	Estimated Annual O&M Cost				**$0**			**$0**			**$93**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$93	**$2,778**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$3,221**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$1,270**
	Total cost				**$110,273**			**$112,540**			**$83,672**

SWMU 22
Planning Level Engineering Estimate for Remediation
Commercial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	0	$20,000	$0	0	$20,000	$0	1	$20,000	$20,000
2	Site Preparation/Decon/Staging Areas Setup/Erosion Control	ls	0	$25,000	$0	0	$25,000	$0	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.00	$200	$0	0.00	$200	$0	1.50	$200	$300
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	0	$0	$0	0	$0	$0	1	$6,176	$6,176
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	0	$1,000	$0	0	$1,000	$0	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	0	$0	$0	0	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	0	$1,000	$0	0	$1,000	$0	1	$1,000	$1,000
12	Excavation (soil)	cy	0	$8	$0	0	$8	$0	0	$8	$0
13	Backfill material	cy	0	$18	$0	0	$18	$0	0	$18	$0
14	Spread and Compact	cy	0	$8	$0	0	$8	$0	0	$8	$0
15	Load (soil)	cy	0	$3	$0	0	$3	$0	0	$3	$0
16	Haul/Handling of Soils/Staging (on-site)	cy	0	$3	$0	0	$3	$0	0	$3	$0
17	Silt Fence (sediment control)	lf	0	$1.5	$0	0	$1.5	$0	1,000	$1.5	$1,500
18	Equipment Decontamination	ea	0	$250	$0	0	$250	$0	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	0	$1	$0	0	$1	$0	0	$1	$0
20	Ambient Air Monitoring	ls	0	$5,000	$0	0	$5,000	$0	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	60867	$0.2	$12,173
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	3382	$16	$54,112
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	1128	$21	$23,688
28	Seeding	acre	0	$3,200	$0	0	$3,200	$0	1.5	$3,200	$4,800
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	0	$6,500	$0	0	$6,500	$0	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	0	$5,000	$0	0	$5,000	$0	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	0	$5,000	$0	0	$5,000	$0	1	$5,000	$5,000
	Subtotal Construction Costs				**$0**			**$0**			**$161,250**
33	Waste Characterization	ea	0.0	$400	$0	0.0	$400	$0	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	0	$120	$0	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$0**			**$0**
	Total Construction and Waste Disposal Costs				**$0**			**$0**			**$161,250**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$0	$0	1	$0	$0	1	$8,062	$8,062
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$0	$0	1	$0	$0	1	$16,125	$16,125
3	Contingency (20% of subtotal construction costs)	ls	1	$0	$0	1	$0	$0	1	$32,250	$32,250
	Total Construction Services Costs				**$0**			**$0**			**$56,437**
	TOTAL CAPITAL COSTS				**$0**			**$0**			**$217,687**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	112.8	$21	$2,368.80
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.15	$3,200	$480
	Estimated Annual O&M Cost				**$0**			**$0**			**$2,849**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$2,849	**$85,464**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$99,095**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$39,073**
	Total cost				**$0**			**$0**			**$256,760**

SWMU 23
Planning Level Engineering Estimate for Remediation
Commercial Use Soil Clean Up Objectives
Dyno Nobel
Port Ewen, New York

#	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
	Construction Costs										
1	Mobilization/Demobilization	ls	0	$20,000	$0	0	$20,000	$0	1	$20,000	$20,000
2	Site Preparation/Decon/Staging Areas Setup/Erosion Control	ls	0	$25,000	$0	0	$25,000	$0	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.00	$200	$0	0.00	$200	$0	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	0	$0	$0	0	$0	$0	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	0	$1,000	$0	0	$1,000	$0	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	0	$0	$0	0	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	0	$1,000	$0	0	$1,000	$0	1	$1,000	$1,000
12	Excavation (soil)	cy	0	$8	$0	0	$8	$0	0	$8	$0
13	Backfill material	cy	0	$18	$0	0	$18	$0	0	$18	$0
14	Spread and Compact	cy	0	$8	$0	0	$8	$0	0	$8	$0
15	Load (soil)	cy	0	$3	$0	0	$3	$0	0	$3	$0
16	Haul/Handling of Soils/Staging (on-site)	cy	0	$3	$0	0	$3	$0	0	$3	$0
17	Silt Fence (sediment control)	lf	0	$1.5	$0	0	$1.5	$0	600	$1.5	$900
18	Equipment Decontamination	ea	0	$250	$0	0	$250	$0	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	0	$1	$0	0	$1	$0	0	$1	$0
20	Ambient Air Monitoring	ls	0	$5,000	$0	0	$5,000	$0	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	20358	$0.2	$4,072
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	1131	$16	$18,096
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	377	$21	$7,917
28	Seeding	acre	0	$3,200	$0	0	$3,200	$0	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	0	$6,500	$0	0	$6,500	$0	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	0	$5,000	$0	0	$5,000	$0	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	0	$5,000	$0	0	$5,000	$0	1	$5,000	$5,000
	Subtotal Construction Costs				**$0**			**$0**			**$93,243**
33	Waste Characterization	ea	0.0	$400	$0	0.0	$400	$0	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	0	$120	$0	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$0**			**$0**
	Total Construction and Waste Disposal Costs				**$0**			**$0**			**$93,243**
	Construction Services										
1	Engineering (5% of subtotal construction costs)	ls	1	$0	$0	1	$0	$0	1	$4,662	$4,662
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$0	$0	1	$0	$0	1	$9,324	$9,324
3	Contingency (20% of subtotal construction costs)	ls	1	$0	$0	1	$0	$0	1	$18,649	$18,649
	Total Construction Services Costs				**$0**			**$0**			**$32,635**
	TOTAL CAPITAL COSTS				**$0**			**$0**			**$125,879**
	Annual Operation & Maintenance										
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	37.7	$21	$791.70
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$952**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$952	**$28,551**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$33,105**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$13,053**
	Total cost				**$0**			**$0**			**$138,932**

SWMU 26D

Planning Level Engineering Estimate for Remediation

Commercial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	280	$8	$2,240	280	$8	$2,240	0	$8	$0
13	Backfill material	cy	280	$18	$5,040	280	$18	$5,040	0	$18	$0
14	Spread and Compact	cy	560	$8	$4,480	280	$8	$2,240	0	$8	$0
15	Load (soil)	cy	280	$3	$840	280	$3	$840	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	280	$3	$840	560	$3	$1,680	0	$3	$0
17	Silt Fence (sediment control)	lf	440	$1.5	$660	440	$1.5	$660	440	$1.5	$660
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	395	$0.2	$79
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	222	$16	$3,552
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	74	$21	$1,554
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$96,859**			**$95,459**			**$68,104**
33	Waste Characterization	ea	0.0	$400	$0	0.8	$400	$336	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	420	$120	$50,400	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$50,736**			**$0**
	Total Construction and Waste Disposal Costs				**$96,859**			**$146,195**			**$68,104**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,843	$4,843	1	$4,773	$4,773	1	$3,405	$3,405
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$9,686	$9,686	1	$9,546	$9,546	1	$6,810	$6,810
3	Contingency (20% of subtotal construction costs)	ls	1	$19,372	$19,372	1	$19,092	$19,092	1	$13,621	$13,621
	Total Construction Services Costs				**$33,901**			**$33,411**			**$23,836**
	TOTAL CAPITAL COSTS				**$130,759**			**$179,605**			**$91,940**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	7.4	$21	$155.40
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$315**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$315	**$9,462**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$10,971**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$4,326**
	Total cost				**$130,759**			**$179,605**			**$96,266**

SWMU 26G and AOC C and D
Planning Level Engineering Estimate for Remediation
Commercial Use Soil Clean Up Objectives
Dyno Nobel
Port Ewen, New York

Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
		Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs										
1 Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2 Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3 Clearing and Grubbing	acre	0.75	$200	$150	0.75	$200	$150	0.75	$200	$150
4 Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5 Spraying Vegetation	ls	1	$3,088	$3,088	1	$3,088	$3,088	1	$3,088	$3,088
6 Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7 Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8 Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9 Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10 reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11 SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12 Excavation (soil)	cy	78	$8	$624	78	$8	$624	0	$8	$0
13 Backfill material	cy	78	$18	$1,404	78	$18	$1,404	0	$18	$0
14 Spread and Compact	cy	156	$8	$1,248	78	$8	$624	0	$8	$0
15 Load (soil)	cy	78	$3	$234	78	$3	$234	0	$3	$0
16 Haul/Handling of Soils (on-site)	cy	78	$3	$234	156	$3	$468	0	$3	$0
17 Silt Fence (sediment control)	lf	640	$1.5	$960	640	$1.5	$960	640	$1.5	$960
18 Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19 Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20 Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21 Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22 Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23 Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24 Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25 Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	2109	$0.2	$422
26 Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	117	$16	$1,872
27 Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	39	$21	$819
28 Seeding	acre	0.75	$3,200	$2,400	0.75	$3,200	$2,400	0.75	$3,200	$2,400
29 Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30 Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31 Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32 Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
Subtotal Construction Costs				**$89,342**			**$88,952**			**$68,211**
33 Waste Characterization	ea	0.0	$400	$0	0.2	$400	$94	0.0	$400	$0
34 Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	117	$120	$14,040	0	$120	$0
35 Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36 reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
Subtotal Waste Disposal Cost				**$0**			**$14,134**			**$0**
Total Construction and Waste Disposal Costs				**$89,342**			**$103,086**			**$68,211**
Construction Services										
1 Engineering (5% of subtotal construction costs)	ls	1	$4,467	$4,467	1	$4,448	$4,448	1	$3,411	$3,411
2 Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$8,934	$8,934	1	$8,895	$8,895	1	$6,821	$6,821
3 Contingency (20% of subtotal construction costs)	ls	1	$17,868	$17,868	1	$17,790	$17,790	1	$13,642	$13,642
Total Construction Services Costs				**$31,270**			**$31,133**			**$23,874**
TOTAL CAPITAL COSTS				**$120,612**			**$134,219**			**$92,085**
Annual Operation & Maintenance										
1 Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2 a Topsoil	cy	0	$21	$0	0	$21	$0	3.9	$21	$81.90
3 b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.075	$3,200	$240
Estimated Annual O&M Cost				**$0**			**$0**			**$322**
Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$322	**$9,657**
O&M Total Expenditure, 30 years				**$0**			**$0**			**$11,197**
O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$4,415**
Total cost				**$120,612**			**$134,219**			**$96,500**

SWMU 26G and AOC C and D

Planning Level Engineering Estimate for Remediation

Industrial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.75	$200	$150	0.75	$200	$150	0.75	$200	$150
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$3,088	$3,088	1	$3,088	$3,088	1	$3,088	$3,088
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	60	$8	$480	60	$8	$480	0	$8	$0
13	Backfill material	cy	60	$18	$1,080	60	$18	$1,080	0	$18	$0
14	Spread and Compact	cy	120	$8	$960	60	$8	$480	0	$8	$0
15	Load (soil)	cy	60	$3	$180	60	$3	$180	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	60	$3	$180	120	$3	$360	0	$3	$0
17	Silt Fence (sediment control)	lf	640	$1.5	$960	640	$1.5	$960	640	$1.5	$960
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	1609	$0.2	$322
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	90	$16	$1,440
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	30	$21	$630
28	Seeding	acre	0.75	$3,200	$2,400	0.75	$3,200	$2,400	0.75	$3,200	$2,400
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$88,478**			**$88,178**			**$67,490**
33	Waste Characterization	ea	0.0	$400	$0	0.2	$400	$72	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	90	$120	$10,800	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$10,872**			**$0**
	Total Construction and Waste Disposal Costs				**$88,478**			**$99,050**			**$67,490**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,424	$4,424	1	$4,409	$4,409	1	$3,375	$3,375
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$8,848	$8,848	1	$8,818	$8,818	1	$6,749	$6,749
3	Contingency (20% of subtotal construction costs)	ls	1	$17,696	$17,696	1	$17,636	$17,636	1	$13,498	$13,498
	Total Construction Services Costs				**$30,967**			**$30,862**			**$23,622**
	TOTAL CAPITAL COSTS				**$119,446**			**$129,913**			**$91,112**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	3	$21	$63.00
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.075	$3,200	$240
	Estimated Annual O&M Cost				**$0**			**$0**			**$303**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$303	**$9,090**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$10,540**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$4,156**
	Total cost				**$119,446**			**$129,913**			**$95,267**

SWMU 29

Planning Level Engineering Estimate for Remediation

Commercial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	30	$8	$240	30	$8	$240	0	$8	$0
13	Backfill material	cy	30	$18	$540	30	$18	$540	0	$18	$0
14	Spread and Compact	cy	60	$8	$480	30	$8	$240	0	$8	$0
15	Load (soil)	cy	30	$3	$90	30	$3	$90	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	30	$3	$90	60	$3	$180	0	$3	$0
17	Silt Fence (sediment control)	lf	200	$1.5	$300	200	$1.5	$300	200	$1.5	$300
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	809	$0.2	$162
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	45	$16	$720
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	15	$21	$315
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$84,499**			**$84,349**			**$63,756**
33	Waste Characterization	ea	0.0	$400	$0	0.1	$400	$36	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	45	$120	$5,400	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$5,436**			**$0**
	Total Construction and Waste Disposal Costs				**$84,499**			**$89,785**			**$63,756**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,225	$4,225	1	$4,217	$4,217	1	$3,188	$3,188
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$8,450	$8,450	1	$8,435	$8,435	1	$6,376	$6,376
3	Contingency (20% of subtotal construction costs)	ls	1	$16,900	$16,900	1	$16,870	$16,870	1	$12,751	$12,751
	Total Construction Services Costs				**$29,575**			**$29,522**			**$22,314**
	TOTAL CAPITAL COSTS				**$114,073**			**$119,307**			**$86,070**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	1.5	$21	$31.50
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$192**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$192	**$5,745**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$6,661**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$2,627**
	Total cost				**$114,073**			**$119,307**			**$88,697**

SWMU 32

Planning Level Engineering Estimate for Remediation

Commercial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	0	$20,000	$0	0	$20,000	$0	1	$20,000	$20,000
2	Site Preparation/Decon/Staging Areas Setup/Erosion Control	ls	0	$25,000	$0	0	$25,000	$0	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.00	$200	$0	0.00	$200	$0	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	0	$0	$0	0	$0	$0	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	0	$1,000	$0	0	$1,000	$0	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	0	$0	$0	0	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	0	$1,000	$0	0	$1,000	$0	1	$1,000	$1,000
12	Excavation (soil)	cy	0	$8	$0	0	$8	$0	0	$8	$0
13	Backfill material	cy	0	$18	$0	0	$18	$0	0	$18	$0
14	Spread and Compact	cy	0	$8	$0	0	$8	$0	0	$8	$0
15	Load (soil)	cy	0	$3	$0	0	$3	$0	0	$3	$0
16	Haul/Handling of Soils/Staging (on-site)	cy	0	$3	$0	0	$3	$0	0	$3	$0
17	Silt Fence (sediment control)	lf	0	$1.5	$0	0	$1.5	$0	500	$1.5	$750
18	Equipment Decontamination	ea	0	$250	$0	0	$250	$0	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	0	$1	$0	0	$1	$0	0	$1	$0
20	Ambient Air Monitoring	ls	0	$5,000	$0	0	$5,000	$0	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	11556	$0.2	$2,311
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	642	$16	$10,272
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	214	$21	$4,494
28	Seeding	acre	0	$3,200	$0	0	$3,200	$0	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	0	$6,500	$0	0	$6,500	$0	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	0	$5,000	$0	0	$5,000	$0	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	0	$5,000	$0	0	$5,000	$0	1	$5,000	$5,000
	Subtotal Construction Costs				**$0**			**$0**			**$80,086**
33	Waste Characterization	ea	0.0	$400	$0	0.0	$400	$0	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	0	$120	$0	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$0**			**$0**
	Total Construction and Waste Disposal Costs				**$0**			**$0**			**$80,086**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$0	$0	1	$0	$0	1	$4,004	$4,004
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$0	$0	1	$0	$0	1	$8,009	$8,009
3	Contingency (20% of subtotal construction costs)	ls	1	$0	$0	1	$0	$0	1	$16,017	$16,017
	Total Construction Services Costs				**$0**			**$0**			**$28,030**
	TOTAL CAPITAL COSTS				**$0**			**$0**			**$108,116**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	21.4	$21	$449.40
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$609**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$609	**$18,282**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$21,198**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$8,358**
	Total cost				**$0**			**$0**			**$116,474**

SWMU 33

Planning Level Engineering Estimate for Remediation

Commercial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	228	$8	$1,824	228	$8	$1,824	0	$8	$0
13	Backfill material	cy	228	$18	$4,104	228	$18	$4,104	0	$18	$0
14	Spread and Compact	cy	456	$8	$3,648	228	$8	$1,824	0	$8	$0
15	Load (soil)	cy	228	$3	$684	228	$3	$684	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	228	$3	$684	456	$3	$1,368	0	$3	$0
17	Silt Fence (sediment control)	lf	560	$1.5	$840	560	$1.5	$840	560	$1.5	$840
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	6151	$0.2	$1,230
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	342	$16	$5,472
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	114	$21	$2,394
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$94,543**			**$93,403**			**$72,195**
33	Waste Characterization	ea	0.0	$400	$0	0.7	$400	$274	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	342	$120	$41,040	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$41,314**			**$0**
	Total Construction and Waste Disposal Costs				**$94,543**			**$134,716**			**$72,195**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,727	$4,727	1	$4,670	$4,670	1	$3,610	$3,610
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$9,454	$9,454	1	$9,340	$9,340	1	$7,220	$7,220
3	Contingency (20% of subtotal construction costs)	ls	1	$18,909	$18,909	1	$18,681	$18,681	1	$14,439	$14,439
	Total Construction Services Costs				**$33,090**			**$32,691**			**$25,268**
	TOTAL CAPITAL COSTS				**$127,633**			**$167,407**			**$97,463**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	11.4	$21	$239.40
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$399**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$399	**$11,982**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$13,893**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$5,478**
	Total cost				**$127,633**			**$167,407**			**$102,941**

SWMU 33

Planning Level Engineering Estimate for Remediation

Indusrtial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

#	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
	Construction Costs										
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.25	$200	$50	0.25	$200	$50	0.25	$200	$50
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$1,029	$1,029	1	$1,029	$1,029	1	$1,029	$1,029
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	64	$8	$512	64	$8	$512	0	$8	$0
13	Backfill material	cy	64	$18	$1,152	64	$18	$1,152	0	$18	$0
14	Spread and Compact	cy	128	$8	$1,024	64	$8	$512	0	$8	$0
15	Load (soil)	cy	64	$3	$192	64	$3	$192	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	64	$3	$192	128	$3	$384	0	$3	$0
17	Silt Fence (sediment control)	lf	280	$1.5	$420	280	$1.5	$420	280	$1.5	$420
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	1705	$0.2	$341
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	95	$16	$1,520
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	32	$21	$672
28	Seeding	acre	0.25	$3,200	$800	0.25	$3,200	$800	0.25	$3,200	$800
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$84,371**			**$84,051**			**$63,332**
33	Waste Characterization	ea	0.0	$400	$0	0.2	$400	$77	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	96	$120	$11,520	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$11,597**			**$0**
	Total Construction and Waste Disposal Costs				**$84,371**			**$95,648**			**$63,332**
	Construction Services										
1	Engineering (5% of subtotal construction costs)	ls	1	$4,219	$4,219	1	$4,203	$4,203	1	$3,167	$3,167
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$8,437	$8,437	1	$8,405	$8,405	1	$6,333	$6,333
3	Contingency (20% of subtotal construction costs)	ls	1	$16,874	$16,874	1	$16,810	$16,810	1	$12,666	$12,666
	Total Construction Services Costs				**$29,530**			**$29,418**			**$22,166**
	TOTAL CAPITAL COSTS				**$113,901**			**$125,066**			**$85,499**
	Annual Operation & Maintenance										
1	Inspection and maintenance of permeable cover		Cost captured in wetlands estimate			Cost captured in wetlands estimate					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	3.2	$21	$67.20
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.025	$3,200	$80
	Estimated Annual O&M Cost				**$0**			**$0**			**$147**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$147	**$4,416**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$5,120**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$2,019**
	Total cost				**$113,901**			**$125,066**			**$87,518**

SWMU 35

Planning Level Engineering Estimate for Remediation

Commercial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
		Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs										
1 Mobilization/Demobilization	ls	0	$20,000	$0	0	$20,000	$0	1	$20,000	$20,000
2 Site Preparation/Decon/Staging Areas Setup/Erosion Control	ls	0	$25,000	$0	0	$25,000	$0	1	$25,000	$25,000
3 Clearing and Grubbing	acre	0.00	$200	$0	0.00	$200	$0	0.50	$200	$100
4 Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5 Spraying Vegetation	ls	0	$0	$0	0	$0	$0	1	$2,059	$2,059
6 Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7 Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8 Dust control/suppression	ls	0	$1,000	$0	0	$1,000	$0	1	$1,000	$1,000
9 Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10 reserved	ls	0	$0	$0	0	$0	$0	1	$0	$0
11 SWMU Boundary Survey	ls	0	$1,000	$0	0	$1,000	$0	1	$1,000	$1,000
12 Excavation (soil)	cy	0	$8	$0	0	$8	$0	0	$8	$0
13 Backfill material	cy	0	$18	$0	0	$18	$0	0	$18	$0
14 Spread and Compact	cy	0	$8	$0	0	$8	$0	0	$8	$0
15 Load (soil)	cy	0	$3	$0	0	$3	$0	0	$3	$0
16 Haul/Handling of Soils/Staging (on-site)	cy	0	$3	$0	0	$3	$0	0	$3	$0
17 Silt Fence (sediment control)	lf	0	$1.5	$0	0	$1.5	$0	500	$1.5	$750
18 Equipment Decontamination	ea	0	$250	$0	0	$250	$0	0	$250	$0
19 Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	0	$1	$0	0	$1	$0	0	$1	$0
20 Ambient Air Monitoring	ls	0	$5,000	$0	0	$5,000	$0	0	$5,000	$0
21 Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22 Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23 Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24 Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25 Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	10062	$0.2	$2,012
26 Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	559	$16	$8,944
27 Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	186	$21	$3,906
28 Seeding	acre	0	$3,200	$0	0	$3,200	$0	0.5	$3,200	$1,600
29 Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	0	$6,500	$0	0	$6,500	$0	1	$6,500	$6,500
30 Confirmatory Sampling and Reporting	ls	0	$5,000	$0	0	$5,000	$0	0	$50,000	$0
31 Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32 Site Survey/As-Built	ls	0	$5,000	$0	0	$5,000	$0	1	$5,000	$5,000
Subtotal Construction Costs				**$0**			**$0**			**$77,871**
33 Waste Characterization	ea	0.0	$400	$0	0.0	$400	$0	0.0	$400	$0
34 Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	0	$120	$0	0	$120	$0
35 Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36 reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
Subtotal Waste Disposal Cost				**$0**			**$0**			**$0**
Total Construction and Waste Disposal Costs				**$0**			**$0**			**$77,871**
Construction Services										
1 Engineering (5% of subtotal construction costs)	ls	1	$0	$0	1	$0	$0	1	$3,894	$3,894
2 Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$0	$0	1	$0	$0	1	$7,787	$7,787
3 Contingency (20% of subtotal construction costs)	ls	1	$0	$0	1	$0	$0	1	$15,574	$15,574
Total Construction Services Costs				**$0**			**$0**			**$27,255**
TOTAL CAPITAL COSTS				**$0**			**$0**			**$105,126**
Annual Operation & Maintenance										
1 Inspection and maintenance of permeable cover		Cost captured in wetlands estimate			Cost captured in wetlands estimate					
2 a Topsoil	cy	0	$21	$0	0	$21	$0	18.6	$21	$390.60
3 b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
Estimated Annual O&M Cost				**$0**			**$0**			**$551**
Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$551	**$16,518**
O&M Total Expenditure, 30 years				**$0**			**$0**			**$19,153**
O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$7,552**
Total cost				**$0**			**$0**			**$112,678**

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Planning Level Engineering Estimate for Remediation

Commercial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	4	$8	$32	4	$8	$32	0	$8	$0
13	Backfill material	cy	4	$18	$72	4	$18	$72	0	$18	$0
14	Spread and Compact	cy	8	$8	$64	4	$8	$32	0	$8	$0
15	Load (soil)	cy	4	$3	$12	4	$3	$12	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	4	$3	$12	8	$3	$24	0	$3	$0
17	Silt Fence (sediment control)	lf	120	$1.5	$180	120	$1.5	$180	120	$1.5	$180
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	101	$0.2	$20
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	6	$16	$96
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	2	$21	$42
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$83,131**			**$83,111**			**$62,597**
33	Waste Characterization	ea	0.0	$400	$0	0.0	$400	$5	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	6	$120	$720	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$725**			**$0**
	Total Construction and Waste Disposal Costs				**$83,131**			**$83,836**			**$62,597**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,157	$4,157	1	$4,156	$4,156	1	$3,130	$3,130
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$8,313	$8,313	1	$8,311	$8,311	1	$6,260	$6,260
3	Contingency (20% of subtotal construction costs)	ls	1	$16,626	$16,626	1	$16,622	$16,622	1	$12,519	$12,519
	Total Construction Services Costs				**$29,096**			**$29,089**			**$21,909**
	TOTAL CAPITAL COSTS				**$112,227**			**$112,924**			**$84,506**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	0.2	$21	$4.20
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$164**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$164	**$4,926**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$5,712**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$2,252**
	Total cost				**$112,227**			**$112,924**			**$86,758**

SWMU 48

Planning Level Engineering Estimate for Remediation

Commercial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	112	$8	$896	112	$8	$896	0	$8	$0
13	Backfill material	cy	112	$18	$2,016	112	$18	$2,016	0	$18	$0
14	Spread and Compact	cy	224	$8	$1,792	112	$8	$896	0	$8	$0
15	Load (soil)	cy	112	$3	$336	112	$3	$336	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	112	$3	$336	224	$3	$672	0	$3	$0
17	Silt Fence (sediment control)	lf	440	$1.5	$660	440	$1.5	$660	440	$1.5	$660
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	3026	$0.2	$605
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	168	$16	$2,688
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	56	$21	$1,176
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$88,795**			**$88,235**			**$67,388**
33	Waste Characterization	ea	0.0	$400	$0	0.3	$400	$134	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	168	$120	$20,160	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$20,294**			**$0**
	Total Construction and Waste Disposal Costs				**$88,795**			**$108,529**			**$67,388**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,440	$4,440	1	$4,412	$4,412	1	$3,369	$3,369
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$8,879	$8,879	1	$8,823	$8,823	1	$6,739	$6,739
3	Contingency (20% of subtotal construction costs)	ls	1	$17,759	$17,759	1	$17,647	$17,647	1	$13,478	$13,478
	Total Construction Services Costs				**$31,078**			**$30,882**			**$23,586**
	TOTAL CAPITAL COSTS				**$119,873**			**$139,411**			**$90,974**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	5.6	$21	$117.60
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$278**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$278	**$8,328**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$9,656**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$3,807**
	Total cost				**$119,873**			**$139,411**			**$94,781**

SWMU 52

Planning Level Engineering Estimate for Remediation

Commercial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.75	$200	$150	0.75	$200	$150	0.75	$200	$150
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$3,088	$3,088	1	$3,088	$3,088	1	$3,088	$3,088
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	1,022	$8	$8,176	1,022	$8	$8,176	0	$8	$0
13	Backfill material	cy	1,022	$18	$18,396	1,022	$18	$18,396	0	$18	$0
14	Spread and Compact	cy	2,044	$8	$16,352	1,022	$8	$8,176	0	$8	$0
15	Load (soil)	cy	1,022	$3	$3,066	1,022	$3	$3,066	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	1,022	$3	$3,066	2,044	$3	$6,132	0	$3	$0
17	Silt Fence (sediment control)	lf	600	$1.5	$900	600	$1.5	$900	600	$1.5	$900
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	27593	$0.2	$5,519
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	1533	$16	$24,528
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	511	$21	$10,731
28	Seeding	acre	0.75	$3,200	$2,400	0.75	$3,200	$2,400	0.75	$3,200	$2,400
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$134,594**			**$129,484**			**$105,816**
33	Waste Characterization	ea	0.0	$400	$0	3.1	$400	$1,226	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	1,533	$120	$183,960	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$185,186**			**$0**
	Total Construction and Waste Disposal Costs				**$134,594**			**$314,671**			**$105,816**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$6,730	$6,730	1	$6,474	$6,474	1	$5,291	$5,291
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$13,459	$13,459	1	$12,948	$12,948	1	$10,582	$10,582
3	Contingency (20% of subtotal construction costs)	ls	1	$26,919	$26,919	1	$25,897	$25,897	1	$21,163	$21,163
	Total Construction Services Costs				**$47,108**			**$45,319**			**$37,036**
	TOTAL CAPITAL COSTS				**$181,702**			**$359,990**			**$142,851**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	51.1	$21	$1,073.10
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.075	$3,200	$240
	Estimated Annual O&M Cost				**$0**			**$0**			**$1,313**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$1,313	**$39,393**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$45,676**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$18,010**
	Total cost				**$181,702**			**$359,990**			**$160,861**

SWMU 52

Planning Level Engineering Estimate for Remediation

Industrial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.75	$200	$150	0.75	$200	$150	0.75	$200	$150
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$3,088	$3,088	1	$3,088	$3,088	1	$3,088	$3,088
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	515	$8	$4,120	515	$8	$4,120	0	$8	$0
13	Backfill material	cy	515	$18	$9,270	515	$18	$9,270	0	$18	$0
14	Spread and Compact	cy	1,030	$8	$8,240	515	$8	$4,120	0	$8	$0
15	Load (soil)	cy	515	$3	$1,545	515	$3	$1,545	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	515	$3	$1,545	1,030	$3	$3,090	0	$3	$0
17	Silt Fence (sediment control)	lf	600	$1.5	$900	600	$1.5	$900	600	$1.5	$900
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	13856	$0.2	$2,771
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	770	$16	$12,320
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	257	$21	$5,397
28	Seeding	acre	0.75	$3,200	$2,400	0.75	$3,200	$2,400	0.75	$3,200	$2,400
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$110,258**			**$107,683**			**$85,526**
33	Waste Characterization	ea	0.0	$400	$0	1.5	$400	$618	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	773	$120	$92,700	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$93,318**			**$0**
	Total Construction and Waste Disposal Costs				**$110,258**			**$201,001**			**$85,526**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$5,513	$5,513	1	$5,384	$5,384	1	$4,276	$4,276
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$11,026	$11,026	1	$10,768	$10,768	1	$8,553	$8,553
3	Contingency (20% of subtotal construction costs)	ls	1	$22,052	$22,052	1	$21,537	$21,537	1	$17,105	$17,105
	Total Construction Services Costs				**$38,590**			**$37,689**			**$29,934**
	TOTAL CAPITAL COSTS				**$148,849**			**$238,690**			**$115,461**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	25.7	$21	$539.70
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.075	$3,200	$240
	Estimated Annual O&M Cost				**$0**			**$0**			**$780**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$780	**$23,391**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$27,122**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$10,694**
	Total cost				**$148,849**			**$238,690**			**$126,155**

SWMU 54

Planning Level Engineering Estimate for Remediation

Commercial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	3.50	$200	$700	3.50	$200	$700	3.50	$200	$700
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$14,412	$14,412	1	$14,412	$14,412	1	$14,412	$14,412
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	2,294	$8	$18,352	2,294	$8	$18,352	0	$8	$0
13	Backfill material	cy	2,294	$18	$41,292	2,294	$18	$41,292	0	$18	$0
14	Spread and Compact	cy	4,588	$8	$36,704	2,294	$8	$18,352	0	$8	$0
15	Load (soil)	cy	2,294	$3	$6,882	2,294	$3	$6,882	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	2,294	$3	$6,882	4,588	$3	$13,764	0	$3	$0
17	Silt Fence (sediment control)	lf	1,520	$1.5	$2,280	1,520	$1.5	$2,280	1,520	$1.5	$2,280
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0	$0	0	$0	$0	0	$0	$0
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	1720	$16	$27,520
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	574	$21	$12,054
28	Seeding	acre	3.5	$3,200	$11,200	3.5	$3,200	$11,200	3.5	$3,200	$11,200
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$217,704**			**$206,234**			**$126,666**
33	Waste Characterization	ea	0.0	$400	$0	6.9	$400	$2,753	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	3,441	$120	$412,920	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$415,673**			**$0**
	Total Construction and Waste Disposal Costs				**$217,704**			**$621,907**			**$126,666**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$10,885	$10,885	1	$10,312	$10,312	1	$6,333	$6,333
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$21,770	$21,770	1	$20,623	$20,623	1	$12,667	$12,667
3	Contingency (20% of subtotal construction costs)	ls	1	$43,541	$43,541	1	$41,247	$41,247	1	$25,333	$25,333
	Total Construction Services Costs				**$76,196**			**$72,182**			**$44,333**
	TOTAL CAPITAL COSTS				**$293,900**			**$694,088**			**$170,999**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	57.4	$21	$1,205.40
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.35	$3,200	$1,120
	Estimated Annual O&M Cost				**$0**			**$0**			**$2,325**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$2,325	**$69,762**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$80,889**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$31,894**
	Total cost				**$293,900**			**$694,088**			**$202,893**

SWMU 54

Planning Level Engineering Estimate for Remediation

Industrial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.27	$200	$53	0.27	$200	$53	0.27	$200	$53
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$1,101	$1,101	1	$1,101	$1,101	1	$1,101	$1,101
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	863	$8	$6,904	863	$8	$6,904	0	$8	$0
13	Backfill material	cy	863	$18	$15,534	863	$18	$15,534	0	$18	$0
14	Spread and Compact	cy	1,726	$8	$13,808	863	$8	$6,904	0	$8	$0
15	Load (soil)	cy	863	$3	$2,589	863	$3	$2,589	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	863	$3	$2,589	1,726	$3	$5,178	0	$3	$0
17	Silt Fence (sediment control)	lf	1,520	$1.5	$2,280	1,520	$1.5	$2,280	1,520	$1.5	$2,280
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	11649	$0.2	$2,330
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	1720	$16	$27,520
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	574	$21	$12,054
28	Seeding	acre	0.27	$3,200	$856	0.27	$3,200	$856	0.27	$3,200	$856
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$124,714**			**$120,399**			**$104,694**
33	Waste Characterization	ea	0.0	$400	$0	2.6	$400	$1,036	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	1,295	$120	$155,340	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$156,376**			**$0**
	Total Construction and Waste Disposal Costs				**$124,714**			**$276,775**			**$104,694**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$6,236	$6,236	1	$6,020	$6,020	1	$5,235	$5,235
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$12,471	$12,471	1	$12,040	$12,040	1	$10,469	$10,469
3	Contingency (20% of subtotal construction costs)	ls	1	$24,943	$24,943	1	$24,080	$24,080	1	$20,939	$20,939
	Total Construction Services Costs				**$43,650**			**$42,140**			**$36,643**
	TOTAL CAPITAL COSTS				**$168,364**			**$318,915**			**$141,337**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	57.4	$21	$1,205.40
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.03	$3,200	$86
	Estimated Annual O&M Cost				**$0**			**$0**			**$1,291**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$1,291	**$38,729**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$44,906**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$17,707**
	Total cost				**$168,364**			**$318,915**			**$159,044**

APPENDIX F

Soil Corrective Measures Cost Estimates based on Below SCO Delineation Figures

AOC G

Planning Level Engineering Estimate for Remediation

Commercial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	76	$8	$608	76	$8	$608	0	$8	$0
13	Backfill material	cy	76	$18	$1,368	76	$18	$1,368	0	$18	$0
14	Spread and Compact	cy	152	$8	$1,216	76	$8	$608	0	$8	$0
15	Load (soil)	cy	76	$3	$228	76	$3	$228	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	76	$3	$228	152	$3	$456	0	$3	$0
17	Silt Fence (sediment control)	lf	240	$1.5	$360	240	$1.5	$360	240	$1.5	$360
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	1026	$0.2	$205
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	57	$16	$912
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	19	$21	$399
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$86,767**			**$86,387**			**$64,135**
33	Waste Characterization	ea	0.0	$400	$0	0.2	$400	$91	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	114	$120	$13,680	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$13,771**			**$0**
	Total Construction and Waste Disposal Costs				**$86,767**			**$100,158**			**$64,135**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,338	$4,338	1	$4,319	$4,319	1	$3,207	$3,207
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$8,677	$8,677	1	$8,639	$8,639	1	$6,414	$6,414
3	Contingency (20% of subtotal construction costs)	ls	1	$17,353	$17,353	1	$17,277	$17,277	1	$12,827	$12,827
	Total Construction Services Costs				**$30,368**			**$30,235**			**$22,447**
	TOTAL CAPITAL COSTS				**$117,135**			**$130,393**			**$86,582**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	1.9	$21	$39.90
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$200**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$200	**$5,997**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$6,953**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$2,742**
	Total cost				**$117,135**			**$130,393**			**$89,324**

AOC G
Planning Level Engineering Estimate for Remediation
Industrial Use Soil Clean Up Objectives
Dyno Nobel
Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	67	$8	$536	67	$8	$536	0	$8	$0
13	Backfill material	cy	67	$18	$1,206	67	$18	$1,206	0	$18	$0
14	Spread and Compact	cy	134	$8	$1,072	67	$8	$536	0	$8	$0
15	Load (soil)	cy	67	$3	$201	67	$3	$201	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	67	$3	$201	134	$3	$402	0	$3	$0
17	Silt Fence (sediment control)	lf	240	$1.5	$360	240	$1.5	$360	240	$1.5	$360
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	902	$0.2	$180
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	50	$16	$802
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	17	$21	$351
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$86,335**			**$86,000**			**$63,952**
33	Waste Characterization	ea	0.0	$400	$0	0.2	$400	$80	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	101	$120	$12,060	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$12,140**			**$0**
	Total Construction and Waste Disposal Costs				**$86,335**			**$98,140**			**$63,952**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,317	$4,317	1	$4,300	$4,300	1	$3,198	$3,198
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$8,633	$8,633	1	$8,600	$8,600	1	$6,395	$6,395
3	Contingency (20% of subtotal construction costs)	ls	1	$17,267	$17,267	1	$17,200	$17,200	1	$12,790	$12,790
	Total Construction Services Costs				**$30,217**			**$30,100**			**$22,383**
	TOTAL CAPITAL COSTS				**$116,552**			**$128,240**			**$86,335**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	1.7	$21	$35.08
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$195**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$195	**$5,852**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$6,786**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$2,676**
	Total cost				**$116,552**			**$128,240**			**$89,011**

AOC H
Planning Level Engineering Estimate for Remediation
Commercial Use Soil Clean Up Objectives
Dyno Nobel
Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	159	$8	$1,272	159	$8	$1,272	0	$8	$0
13	Backfill material	cy	159	$18	$2,862	159	$18	$2,862	0	$18	$0
14	Spread and Compact	cy	318	$8	$2,544	159	$8	$1,272	0	$8	$0
15	Load (soil)	cy	159	$3	$477	159	$3	$477	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	159	$3	$477	318	$3	$954	0	$3	$0
17	Silt Fence (sediment control)	lf	280	$1.5	$420	280	$1.5	$420	280	$1.5	$420
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	2079	$0.2	$416
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	$116	$16	$1,848
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	$39	$21	$809
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$90,811**			**$90,016**			**$65,751**
33	Waste Characterization	ea	0.0	$400	$0	0.5	$400	$191	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	239	$120	$28,620	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$28,811**			**$0**
	Total Construction and Waste Disposal Costs				**$90,811**			**$118,827**			**$65,751**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,541	$4,541	1	$4,501	$4,501	1	$3,288	$3,288
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$9,081	$9,081	1	$9,002	$9,002	1	$6,575	$6,575
3	Contingency (20% of subtotal construction costs)	ls	1	$18,162	$18,162	1	$18,003	$18,003	1	$13,150	$13,150
	Total Construction Services Costs				**$31,784**			**$31,506**			**$23,013**
	TOTAL CAPITAL COSTS				**$122,595**			**$150,332**			**$88,764**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	3.9	$21	$80.85
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$241**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$241	**$7,226**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$8,378**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$3,303**
	Total cost				**$122,595**			**$150,332**			**$92,067**

AOC H

Planning Level Engineering Estimate for Remediation

Industrial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

#	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	68	$8	$544	68	$8	$544	0	$8	$0
13	Backfill material	cy	68	$18	$1,224	68	$18	$1,224	0	$18	$0
14	Spread and Compact	cy	136	$8	$1,088	68	$8	$544	0	$8	$0
15	Load (soil)	cy	68	$3	$204	68	$3	$204	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	68	$3	$204	136	$3	$408	0	$3	$0
17	Silt Fence (sediment control)	lf	140	$1.5	$210	140	$1.5	$210	140	$1.5	$210
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	914	$0.2	$183
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	51	$16	$812
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	17	$21	$355
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$86,233**			**$85,893**			**$63,820**
33	Waste Characterization	ea	0.0	$400	$0	0.2	$400	$82	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	102	$120	$12,240	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$12,322**			**$0**
	Total Construction and Waste Disposal Costs				**$86,233**			**$98,214**			**$63,820**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,312	$4,312	1	$4,295	$4,295	1	$3,191	$3,191
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$8,623	$8,623	1	$8,589	$8,589	1	$6,382	$6,382
3	Contingency (20% of subtotal construction costs)	ls	1	$17,247	$17,247	1	$17,179	$17,179	1	$12,764	$12,764
	Total Construction Services Costs				**$30,181**			**$30,062**			**$22,337**
	TOTAL CAPITAL COSTS				**$116,414**			**$128,277**			**$86,156**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	1.7	$21	$35.54
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$196**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$196	**$5,866**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$6,802**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$2,682**
	Total cost				**$116,414**			**$128,277**			**$88,838**

AOC I

Planning Level Engineering Estimate for Remediation

Commercial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

Description		Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	65	$8	$520	65	$8	$520	0	$8	$0
13	Backfill material	cy	65	$18	$1,170	65	$18	$1,170	0	$18	$0
14	Spread and Compact	cy	130	$8	$1,040	65	$8	$520	0	$8	$0
15	Load (soil)	cy	65	$3	$195	65	$3	$195	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	65	$3	$195	130	$3	$390	0	$3	$0
17	Silt Fence (sediment control)	lf	280	$1.5	$420	280	$1.5	$420	280	$1.5	$420
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	867	$0.2	$173
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	48	$16	$771
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	16	$21	$337
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$86,299**			**$85,974**			**$63,960**
33	Waste Characterization	ea	0.0	$400	$0	0.2	$400	$78	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	98	$120	$11,700	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$11,778**			**$0**
	Total Construction and Waste Disposal Costs				**$86,299**			**$97,752**			**$63,960**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,315	$4,315	1	$4,299	$4,299	1	$3,198	$3,198
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$8,630	$8,630	1	$8,597	$8,597	1	$6,396	$6,396
3	Contingency (20% of subtotal construction costs)	ls	1	$17,260	$17,260	1	$17,195	$17,195	1	$12,792	$12,792
	Total Construction Services Costs				**$30,205**			**$30,091**			**$22,386**
	TOTAL CAPITAL COSTS				**$116,503**			**$127,843**			**$86,346**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	1.6	$21	$33.72
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$194**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$194	**$5,812**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$6,738**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$2,657**
	Total cost				**$116,503**			**$127,843**			**$89,003**

AOC J

Planning Level Engineering Estimate for Remediation

Commercial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

#	Description	Unit	Option 1: Excavation/Onsite Consolidation – Estimated Quantity	Option 1: Unit Cost ($)	Option 1: Total Cost	Option 2: Excavation/Offsite Disposal – Estimated Quantity	Option 2: Unit Cost ($)	Option 2: Total Cost	Option 3: Permeable Cover – Estimated Quantity	Option 3: Unit Cost ($)	Option 3: Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	276	$8	$2,208	276	$8	$2,208	0	$8	$0
13	Backfill material	cy	276	$18	$4,968	276	$18	$4,968	0	$18	$0
14	Spread and Compact	cy	552	$8	$4,416	276	$8	$2,208	0	$8	$0
15	Load (soil)	cy	276	$3	$828	276	$3	$828	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	276	$3	$828	552	$3	$1,656	0	$3	$0
17	Silt Fence (sediment control)	lf	260	$1.5	$390	260	$1.5	$390	260	$1.5	$390
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	3716	$0.2	$743
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	206	$16	$3,303
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	69	$21	$1,445
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$96,397**			**$95,017**			**$68,140**
33	Waste Characterization	ea	0.0	$400	$0	0.8	$400	$331	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	414	$120	$49,680	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$50,011**			**$0**
	Total Construction and Waste Disposal Costs				**$96,397**			**$145,028**			**$68,140**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,820	$4,820	1	$4,751	$4,751	1	$3,407	$3,407
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$9,640	$9,640	1	$9,502	$9,502	1	$6,814	$6,814
3	Contingency (20% of subtotal construction costs)	ls	1	$19,279	$19,279	1	$19,003	$19,003	1	$13,628	$13,628
	Total Construction Services Costs				**$33,739**			**$33,256**			**$23,849**
	TOTAL CAPITAL COSTS				**$130,136**			**$178,284**			**$91,989**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	7	$21	$144.51
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$305**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$305	**$9,135**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$10,592**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$4,177**
	Total cost				**$130,136**			**$178,284**			**$96,166**

AOC J

Planning Level Engineering Estimate for Remediation

Industrial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

Description		Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.25	$200	$50	0.25	$200	$50	0.25	$200	$50
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$1,029	$1,029	1	$1,029	$1,029	1	$1,029	$1,029
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	200	$8	$1,600	200	$8	$1,600	0	$8	$0
13	Backfill material	cy	200	$18	$3,600	200	$18	$3,600	0	$18	$0
14	Spread and Compact	cy	400	$8	$3,200	200	$8	$1,600	0	$8	$0
15	Load (soil)	cy	200	$3	$600	200	$3	$600	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	200	$3	$600	400	$3	$1,200	0	$3	$0
17	Silt Fence (sediment control)	lf	130	$1.5	$195	130	$1.5	$195	130	$1.5	$195
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	2700	$0.2	$540
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	150	$16	$2,400
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	50	$21	$1,050
28	Seeding	acre	0.25	$3,200	$800	0.25	$3,200	$800	0.25	$3,200	$800
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$90,674**			**$89,674**			**$64,564**
33	Waste Characterization	ea	0.0	$400	$0	0.6	$400	$240	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	300	$120	$36,000	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$36,240**			**$0**
	Total Construction and Waste Disposal Costs				**$90,674**			**$125,914**			**$64,564**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,534	$4,534	1	$4,484	$4,484	1	$3,228	$3,228
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$9,067	$9,067	1	$8,967	$8,967	1	$6,456	$6,456
3	Contingency (20% of subtotal construction costs)	ls	1	$18,135	$18,135	1	$17,935	$17,935	1	$12,913	$12,913
	Total Construction Services Costs				**$31,736**			**$31,386**			**$22,598**
	TOTAL CAPITAL COSTS				**$122,410**			**$157,300**			**$87,162**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	5	$21	$105.00
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.025	$3,200	$80
	Estimated Annual O&M Cost				**$0**			**$0**			**$185**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$185	**$5,550**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$6,435**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$2,537**
	Total cost				**$122,410**			**$157,300**			**$89,699**

AOC M

Planning Level Engineering Estimate for Remediation

Commercial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	608	$8	$4,864	608	$8	$4,864	0	$8	$0
13	Backfill material	cy	608	$18	$10,944	608	$18	$10,944	0	$18	$0
14	Spread and Compact	cy	1,216	$8	$9,728	608	$8	$4,864	0	$8	$0
15	Load (soil)	cy	608	$3	$1,824	608	$3	$1,824	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	608	$3	$1,824	1,216	$3	$3,648	0	$3	$0
17	Silt Fence (sediment control)	lf	520	$1.5	$780	520	$1.5	$780	520	$1.5	$780
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	8204	$0.2	$1,641
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	456	$16	$7,292
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	152	$21	$3,190
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$112,723**			**$109,683**			**$75,163**
33	Waste Characterization	ea	0.0	$400	$0	1.8	$400	$730	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	912	$120	$109,440	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$110,170**			**$0**
	Total Construction and Waste Disposal Costs				**$112,723**			**$219,852**			**$75,163**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$5,636	$5,636	1	$5,484	$5,484	1	$3,758	$3,758
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$11,272	$11,272	1	$10,968	$10,968	1	$7,516	$7,516
3	Contingency (20% of subtotal construction costs)	ls	1	$22,545	$22,545	1	$21,937	$21,937	1	$15,033	$15,033
	Total Construction Services Costs				**$39,453**			**$38,389**			**$26,307**
	TOTAL CAPITAL COSTS				**$152,176**			**$258,241**			**$101,469**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	15	$21	$319.04
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$479**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$479	**$14,371**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$16,664**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$6,570**
	Total cost				**$152,176**			**$258,241**			**$108,040**

AOC M
Planning Level Engineering Estimate for Remediation
Industrial Use Soil Clean Up Objectives
Dyno Nobel
Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	551	$8	$4,408	551	$8	$4,408	0	$8	$0
13	Backfill material	cy	551	$18	$9,918	551	$18	$9,918	0	$18	$0
14	Spread and Compact	cy	1,102	$8	$8,816	551	$8	$4,408	0	$8	$0
15	Load (soil)	cy	551	$3	$1,653	551	$3	$1,653	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	551	$3	$1,653	1,102	$3	$3,306	0	$3	$0
17	Silt Fence (sediment control)	lf	520	$1.5	$780	520	$1.5	$780	520	$1.5	$780
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	7435	$0.2	$1,487
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	413	$16	$6,609
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	138	$21	$2,891
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$109,987**			**$107,232**			**$74,026**
33	Waste Characterization	ea	0.0	$400	$0	1.7	$400	$661	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	827	$120	$99,180	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$99,841**			**$0**
	Total Construction and Waste Disposal Costs				**$109,987**			**$207,073**			**$74,026**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$5,499	$5,499	1	$5,362	$5,362	1	$3,701	$3,701
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$10,999	$10,999	1	$10,723	$10,723	1	$7,403	$7,403
3	Contingency (20% of subtotal construction costs)	ls	1	$21,997	$21,997	1	$21,446	$21,446	1	$14,805	$14,805
	Total Construction Services Costs				**$38,495**			**$37,531**			**$25,909**
	TOTAL CAPITAL COSTS				**$148,482**			**$244,604**			**$99,935**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	14	$21	$289.14
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$449**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$449	**$13,474**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$15,623**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$6,160**
	Total cost				**$148,482**			**$244,604**			**$106,095**

AOC N
Planning Level Engineering Estimate for Remediation
Commercial Use Soil Clean Up Objectives
Dyno Nobel
Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	631	$8	$5,048	631	$8	$5,048	0	$8	$0
13	Backfill material	cy	631	$18	$11,358	631	$18	$11,358	0	$18	$0
14	Spread and Compact	cy	1,262	$8	$10,096	631	$8	$5,048	0	$8	$0
15	Load (soil)	cy	631	$3	$1,893	631	$3	$1,893	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	631	$3	$1,893	1,262	$3	$3,786	0	$3	$0
17	Silt Fence (sediment control)	lf	480	$1.5	$720	480	$1.5	$720	480	$1.5	$720
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	8506	$0.2	$1,701
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	473	$16	$7,561
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	158	$21	$3,308
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$113,767**			**$110,612**			**$75,549**
33	Waste Characterization	ea	0.0	$400	$0	1.9	$400	$757	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	947	$120	$113,580	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$114,337**			**$0**
	Total Construction and Waste Disposal Costs				**$113,767**			**$224,949**			**$75,549**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$5,688	$5,688	1	$5,531	$5,531	1	$3,777	$3,777
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$11,377	$11,377	1	$11,061	$11,061	1	$7,555	$7,555
3	Contingency (20% of subtotal construction costs)	ls	1	$22,753	$22,753	1	$22,122	$22,122	1	$15,110	$15,110
	Total Construction Services Costs				**$39,818**			**$38,714**			**$26,442**
	TOTAL CAPITAL COSTS				**$153,585**			**$263,663**			**$101,991**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	16	$21	$330.79
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$491**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$491	**$14,724**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$17,072**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$6,731**
	Total cost				**$153,585**			**$263,663**			**$108,722**

AOC N

Planning Level Engineering Estimate for Remediation

Industrial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
		Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs										
1 Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2 Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3 Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4 Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5 Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6 Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7 Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8 Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9 Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10 reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11 SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12 Excavation (soil)	cy	397	$8	$3,176	397	$8	$3,176	0	$8	$0
13 Backfill material	cy	397	$18	$7,146	397	$18	$7,146	0	$18	$0
14 Spread and Compact	cy	794	$8	$6,352	397	$8	$3,176	0	$8	$0
15 Load (soil)	cy	397	$3	$1,191	397	$3	$1,191	0	$3	$0
16 Haul/Handling of Soils (on-site)	cy	397	$3	$1,191	794	$3	$2,382	0	$3	$0
17 Silt Fence (sediment control)	lf	480	$1.5	$720	480	$1.5	$720	480	$1.5	$720
18 Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19 Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20 Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21 Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22 Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23 Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24 Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25 Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	5353	$0.2	$1,071
26 Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	297	$16	$4,758
27 Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	99	$21	$2,082
28 Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29 Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30 Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31 Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32 Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
Subtotal Construction Costs				**$102,535**			**$100,550**			**$70,889**
33 Waste Characterization	ea	0.0	$400	$0	1.2	$400	$476	0.0	$400	$0
34 Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	596	$120	$71,460	0	$120	$0
35 Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36 reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
Subtotal Waste Disposal Cost				**$0**			**$71,936**			**$0**
Total Construction and Waste Disposal Costs				**$102,535**			**$172,486**			**$70,889**
Construction Services										
1 Engineering (5% of subtotal construction costs)	ls	1	$5,127	$5,127	1	$5,027	$5,027	1	$3,544	$3,544
2 Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$10,253	$10,253	1	$10,055	$10,055	1	$7,089	$7,089
3 Contingency (20% of subtotal construction costs)	ls	1	$20,507	$20,507	1	$20,110	$20,110	1	$14,178	$14,178
Total Construction Services Costs				**$35,887**			**$35,192**			**$24,811**
TOTAL CAPITAL COSTS				**$138,422**			**$207,679**			**$95,701**
Annual Operation & Maintenance										
1 Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2 a Topsoil	cy	0	$21	$0	0	$21	$0	10	$21	$208.17
3 b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
Estimated Annual O&M Cost				**$0**			**$0**			**$368**
Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$368	**$11,045**
O&M Total Expenditure, 30 years				**$0**			**$0**			**$12,807**
O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$5,050**
Total cost				**$138,422**			**$207,679**			**$100,750**

AOC N

Planning Level Engineering Estimate for Remediation

Commercial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

#	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	353	$8	$2,824	353	$8	$2,824	0	$8	$0
13	Backfill material	cy	353	$18	$6,354	353	$18	$6,354	0	$18	$0
14	Spread and Compact	cy	706	$8	$5,648	353	$8	$2,824	0	$8	$0
15	Load (soil)	cy	353	$3	$1,059	353	$3	$1,059	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	353	$3	$1,059	706	$3	$2,118	0	$3	$0
17	Silt Fence (sediment control)	lf	380	$1.5	$570	380	$1.5	$570	380	$1.5	$570
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	4759	$0.2	$952
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	264	$16	$4,230
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	88	$21	$1,851
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$100,273**			**$98,508**			**$69,862**
33	Waste Characterization	ea	0.0	$400	$0	1.1	$400	$424	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	530	$120	$63,540	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$63,964**			**$0**
	Total Construction and Waste Disposal Costs				**$100,273**			**$162,471**			**$69,862**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$5,014	$5,014	1	$4,925	$4,925	1	$3,493	$3,493
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$10,027	$10,027	1	$9,851	$9,851	1	$6,986	$6,986
3	Contingency (20% of subtotal construction costs)	ls	1	$20,055	$20,055	1	$19,702	$19,702	1	$13,972	$13,972
	Total Construction Services Costs				**$35,095**			**$34,478**			**$24,452**
	TOTAL CAPITAL COSTS				**$135,368**			**$196,949**			**$94,313**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	9	$21	$185.07
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$345**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$345	**$10,352**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$12,003**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$4,733**
	Total cost				**$135,368**			**$196,949**			**$99,046**

AOC N

Planning Level Engineering Estimate for Remediation

Industial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	243	$8	$1,944	243	$8	$1,944	0	$8	$0
13	Backfill material	cy	243	$18	$4,374	243	$18	$4,374	0	$18	$0
14	Spread and Compact	cy	486	$8	$3,888	243	$8	$1,944	0	$8	$0
15	Load (soil)	cy	243	$3	$729	243	$3	$729	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	243	$3	$729	486	$3	$1,458	0	$3	$0
17	Silt Fence (sediment control)	lf	380	$1.5	$570	380	$1.5	$570	380	$1.5	$570
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	3277	$0.2	$655
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	182	$16	$2,913
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	61	$21	$1,274
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$94,993**			**$93,778**			**$67,672**
33	Waste Characterization	ea	0.0	$400	$0	0.7	$400	$292	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	365	$120	$43,740	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$44,032**			**$0**
	Total Construction and Waste Disposal Costs				**$94,993**			**$137,809**			**$67,672**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,750	$4,750	1	$4,689	$4,689	1	$3,384	$3,384
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$9,499	$9,499	1	$9,378	$9,378	1	$6,767	$6,767
3	Contingency (20% of subtotal construction costs)	ls	1	$18,999	$18,999	1	$18,756	$18,756	1	$13,534	$13,534
	Total Construction Services Costs				**$33,247**			**$32,822**			**$23,685**
	TOTAL CAPITAL COSTS				**$128,240**			**$170,632**			**$91,357**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	6	$21	$127.44
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$287**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$287	**$8,623**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$9,999**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$3,942**
	Total cost				**$128,240**			**$170,632**			**$95,299**

SWMU 2 and AOC A
Planning Level Engineering Estimate for Remediation
Commercial Use Soil Clean Up Objectives
Dyno Nobel
Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	1.0	$200	$200	1.0	$200	$200	1.0	$200	$200
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$4,118	$4,118	1	$4,118	$4,118	1	$4,118	$4,118
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	1,279	$8	$10,232	1,279	$8	$10,232	0	$8	$0
13	Backfill material	cy	1,279	$18	$23,022	1,279	$18	$23,022	0	$18	$0
14	Spread and Compact	cy	2,558	$8	$20,464	1,279	$8	$10,232	0	$8	$0
15	Load (soil)	cy	1,279	$3	$3,837	1,279	$3	$3,837	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	1,279	$3	$3,837	1,800	$3	$5,400	0	$3	$0
17	Silt Fence (sediment control)	lf	1,300	$1.5	$1,950	1,300	$1.5	$1,950	1,300	$1.5	$1,950
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	27328	$0.2	$5,466
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	1518	$16	$24,292
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	506	$21	$10,628
28	Seeding	acre	1.0	$3,200	$3,200	1.0	$3,200	$3,200	1.0	$3,200	$3,200
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$149,860**			**$141,191**			**$108,352**
33	Waste Characterization	ea	0.0	$400	$0	3.8	$400	$1,535	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	1,919	$120	$230,220	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$231,755**			**$0**
	Total Construction and Waste Disposal Costs				**$149,860**			**$372,945**			**$108,352**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$7,493	$7,493	1	$7,060	$7,060	1	$5,418	$5,418
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$14,986	$14,986	1	$14,119	$14,119	1	$10,835	$10,835
3	Contingency (20% of subtotal construction costs)	ls	1	$29,972	$29,972	1	$28,238	$28,238	1	$21,670	$21,670
	Total Construction Services Costs				**$52,451**			**$49,417**			**$37,923**
	TOTAL CAPITAL COSTS				**$202,311**			**$422,362**			**$146,276**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	51	$21	$1,062.76
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.1	$3,200	$320
	Estimated Annual O&M Cost				**$0**			**$0**			**$1,383**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$1,383	**$41,483**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$48,099**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$18,965**
	Total cost				**$202,311**			**$422,362**			**$165,241**

SWMU 2 and AOC A
Planning Level Engineering Estimate for Remediation
Industrial Use Soil Clean Up Objectives
Dyno Nobel
Port Ewen, New York

Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
		Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs										
1 Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2 Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3 Clearing and Grubbing	acre	0.3	$200	$66	0.3	$200	$66	0.3	$200	$66
4 Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5 Spraying Vegetation	ls	1	$9,882	$9,882	1	$9,882	$9,882	1	$9,882	$9,882
6 Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7 Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8 Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9 Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10 reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11 SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12 Excavation (soil)	cy	531	$8	$4,248	531	$8	$4,248	0	$8	$0
13 Backfill material	cy	531	$18	$9,558	531	$18	$9,558	0	$18	$0
14 Spread and Compact	cy	1,062	$8	$8,496	531	$8	$4,248	0	$8	$0
15 Load (soil)	cy	531	$3	$1,593	531	$3	$1,593	0	$3	$0
16 Haul/Handling of Soils (on-site)	cy	531	$3	$1,593	1,062	$3	$3,186	0	$3	$0
17 Silt Fence (sediment control)	lf	460	$1.5	$690	460	$1.5	$690	460	$1.5	$690
18 Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19 Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20 Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21 Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22 Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23 Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24 Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25 Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	7144	$0.2	$1,429
26 Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	397	$16	$6,350
27 Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	132	$21	$2,778
28 Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29 Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30 Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31 Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32 Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
Subtotal Construction Costs				**$116,726**			**$114,071**			**$81,296**
33 Waste Characterization	ea	0.0	$400	$0	1.6	$400	$637	0.0	$400	$0
34 Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	797	$120	$95,580	0	$120	$0
35 Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36 reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
Subtotal Waste Disposal Cost				**$0**			**$96,217**			**$0**
Total Construction and Waste Disposal Costs				**$116,726**			**$210,289**			**$81,296**
Construction Services										
1 Engineering (5% of subtotal construction costs)	ls	1	$5,836	$5,836	1	$5,704	$5,704	1	$4,065	$4,065
2 Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$11,673	$11,673	1	$11,407	$11,407	1	$8,130	$8,130
3 Contingency (20% of subtotal construction costs)	ls	1	$23,345	$23,345	1	$22,814	$22,814	1	$16,259	$16,259
Total Construction Services Costs				**$40,854**			**$39,925**			**$28,453**
TOTAL CAPITAL COSTS				**$157,581**			**$250,214**			**$109,749**
Annual Operation & Maintenance										
1 Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2 a Topsoil	cy	0	$21	$0	0	$21	$0	13	$21	$277.82
3 b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
Estimated Annual O&M Cost				**$0**			**$0**			**$438**
Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$438	**$13,135**
O&M Total Expenditure, 30 years				**$0**			**$0**			**$15,230**
O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$6,005**
Total cost				**$157,581**			**$250,214**			**$115,754**

SWMU 3 and 5
Planning Level Engineering Estimate for Remediation
Commercial Use Soil Clean Up Objectives
Dyno Nobel
Port Ewen, New York

Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
		Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs										
1 Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2 Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3 Clearing and Grubbing	acre	1.5	$200	$300	1.5	$200	$300	1.5	$200	$300
4 Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5 Spraying Vegetation	ls	1	$6,176	$6,176	1	$6,176	$6,176	1	$6,176	$6,176
6 Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7 Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8 Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9 Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10 reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11 SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12 Excavation (soil)	cy	868	$8	$6,944	868	$8	$6,944	0	$8	$0
13 Backfill material	cy	868	$18	$15,624	868	$18	$15,624	0	$18	$0
14 Spread and Compact	cy	1,736	$8	$13,888	868	$8	$6,944	0	$8	$0
15 Load (soil)	cy	868	$3	$2,604	868	$3	$2,604	0	$3	$0
16 Haul/Handling of Soils (on-site)	cy	868	$3	$2,604	1,736	$3	$5,208	0	$3	$0
17 Silt Fence (sediment control)	lf	1,000	$1.5	$1,500	1,000	$1.5	$1,500	1,000	$1.5	$1,500
18 Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19 Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20 Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21 Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22 Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23 Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24 Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25 Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	18153	$0.2	$3,631
26 Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	1009	$16	$16,136
27 Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	336	$21	$7,060
28 Seeding	acre	1.5	$3,200	$4,800	1.5	$3,200	$4,800	1.5	$3,200	$4,800
29 Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30 Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31 Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32 Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
Subtotal Construction Costs				**$133,440**			**$129,100**			**$98,103**
33 Waste Characterization	ea	0.0	$400	$0	2.6	$400	$1,042	0.0	$400	$0
34 Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	1,302	$120	$156,240	0	$120	$0
35 Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36 reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
Subtotal Waste Disposal Cost				**$0**			**$157,282**			**$0**
Total Construction and Waste Disposal Costs				**$133,440**			**$286,382**			**$98,103**
Construction Services										
1 Engineering (5% of subtotal construction costs)	ls	1	$6,672	$6,672	1	$6,455	$6,455	1	$4,905	$4,905
2 Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$13,344	$13,344	1	$12,910	$12,910	1	$9,810	$9,810
3 Contingency (20% of subtotal construction costs)	ls	1	$26,688	$26,688	1	$25,820	$25,820	1	$19,621	$19,621
Total Construction Services Costs				**$46,704**			**$45,185**			**$34,336**
TOTAL CAPITAL COSTS				**$180,145**			**$331,567**			**$132,438**
Annual Operation & Maintenance										
1 Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2 a Topsoil	cy	0	$21	$0	0	$21	$0	34	$21	$705.95
3 b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.15	$3,200	$480
Estimated Annual O&M Cost				**$0**			**$0**			**$1,186**
Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$1,186	**$35,579**
O&M Total Expenditure, 30 years				**$0**			**$0**			**$41,253**
O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$16,266**
Total cost				**$180,145**			**$331,567**			**$148,705**

SWMU 3 and 5

Planning Level Engineering Estimate for Remediation

Industrial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.5	$200	$100	0.5	$200	$100	0.5	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	506	$8	$4,048	506	$8	$4,048	0	$8	$0
13	Backfill material	cy	506	$18	$9,108	506	$18	$9,108	0	$18	$0
14	Spread and Compact	cy	1,012	$8	$8,096	506	$8	$4,048	0	$8	$0
15	Load (soil)	cy	506	$3	$1,518	506	$3	$1,518	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	506	$3	$1,518	1,012	$3	$3,036	0	$3	$0
17	Silt Fence (sediment control)	lf	360	$1.5	$540	360	$1.5	$540	360	$1.5	$540
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	8363	$0.2	$1,673
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	465	$16	$7,434
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	155	$21	$3,252
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$107,587**			**$105,057**			**$75,157**
33	Waste Characterization	ea	0.0	$400	$0	1.5	$400	$607	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	759	$120	$91,080	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$91,687**			**$0**
	Total Construction and Waste Disposal Costs				**$107,587**			**$196,744**			**$75,157**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$5,379	$5,379	1	$5,253	$5,253	1	$3,758	$3,758
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$10,759	$10,759	1	$10,506	$10,506	1	$7,516	$7,516
3	Contingency (20% of subtotal construction costs)	ls	1	$21,517	$21,517	1	$21,011	$21,011	1	$15,031	$15,031
	Total Construction Services Costs				**$37,655**			**$36,770**			**$26,305**
	TOTAL CAPITAL COSTS				**$145,242**			**$233,514**			**$101,463**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	15	$21	$325.23
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$485**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$485	**$14,557**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$16,879**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$6,655**
	Total cost				**$145,242**			**$233,514**			**$108,118**

SWMU 4

Planning Level Engineering Estimate for Remediation

Commercial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.75	$200	$150	0.75	$200	$150	0.75	$200	$150
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$3,088	$3,088	1	$3,088	$3,088	1	$3,088	$3,088
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	523	$8	$4,184	523	$8	$4,184	0	$8	$0
13	Backfill material	cy	523	$18	$9,414	523	$18	$9,414	0	$18	$0
14	Spread and Compact	cy	1,046	$8	$8,368	523	$8	$4,184	0	$8	$0
15	Load (soil)	cy	523	$3	$1,569	523	$3	$1,569	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	523	$3	$1,569	1,046	$3	$3,138	0	$3	$0
17	Silt Fence (sediment control)	lf	680	$1.5	$1,020	680	$1.5	$1,020	680	$1.5	$1,020
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	11029	$0.2	$2,206
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	613	$16	$9,804
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	204	$21	$4,289
28	Seeding	acre	0.75	$3,200	$2,400	0.75	$3,200	$2,400	0.75	$3,200	$2,400
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$110,762**			**$108,147**			**$81,457**
33	Waste Characterization	ea	0.0	$400	$0	1.6	$400	$628	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	785	$120	$94,140	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$94,768**			**$0**
	Total Construction and Waste Disposal Costs				**$110,762**			**$202,915**			**$81,457**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$5,538	$5,538	1	$5,407	$5,407	1	$4,073	$4,073
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$11,076	$11,076	1	$10,815	$10,815	1	$8,146	$8,146
3	Contingency (20% of subtotal construction costs)	ls	1	$22,152	$22,152	1	$21,629	$21,629	1	$16,291	$16,291
	Total Construction Services Costs				**$38,767**			**$37,852**			**$28,510**
	TOTAL CAPITAL COSTS				**$149,529**			**$240,766**			**$109,966**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	20	$21	$428.91
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.075	$3,200	$240
	Estimated Annual O&M Cost				**$0**			**$0**			**$669**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$669	**$20,067**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$23,268**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$9,174**
	Total cost				**$149,529**			**$240,766**			**$119,141**

SWMU 4
Planning Level Engineering Estimate for Remediation
Industrial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	194	$8	$1,552	194	$8	$1,552	0	$8	$0
13	Backfill material	cy	194	$18	$3,492	194	$18	$3,492	0	$18	$0
14	Spread and Compact	cy	388	$8	$3,104	194	$8	$1,552	0	$8	$0
15	Load (soil)	cy	194	$3	$582	194	$3	$582	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	194	$3	$582	388	$3	$1,164	0	$3	$0
17	Silt Fence (sediment control)	lf	500	$1.5	$750	500	$1.5	$750	500	$1.5	$750
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	5244	$0.2	$1,049
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	291	$16	$4,661
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	97	$21	$2,039
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$92,821**			**$91,851**			**$70,758**
33	Waste Characterization	ea	0.0	$400	$0	0.6	$400	$233	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	291	$120	$34,920	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$35,153**			**$0**
	Total Construction and Waste Disposal Costs				**$92,821**			**$127,004**			**$70,758**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,641	$4,641	1	$4,593	$4,593	1	$3,538	$3,538
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$9,282	$9,282	1	$9,185	$9,185	1	$7,076	$7,076
3	Contingency (20% of subtotal construction costs)	ls	1	$18,564	$18,564	1	$18,370	$18,370	1	$14,152	$14,152
	Total Construction Services Costs				**$32,487**			**$32,148**			**$24,765**
	TOTAL CAPITAL COSTS				**$125,308**			**$159,151**			**$95,524**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		Cost captured in wetlands estimate			Cost captured in wetlands estimate					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	10	$21	$203.93
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$364**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$364	**$10,918**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$12,659**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$4,992**
	Total cost				**$125,308**			**$159,151**			**$100,515**

SWMU 6, 7, 8, 32 and AOC B

Planning Level Engineering Estimate for Remediation

Commercial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	1.75	$200	$350	1.75	$200	$350	1.75	$200	$350
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$7,206	$7,206	1	$7,206	$7,206	1	$7,206	$7,206
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	1,453	$8	$11,624	1,453	$8	$11,624	0	$8	$0
13	Backfill material	cy	1,453	$18	$26,154	1,453	$18	$26,154	0	$18	$0
14	Spread and Compact	cy	2,906	$8	$23,248	1,453	$8	$11,624	0	$8	$0
15	Load (soil)	cy	1,453	$3	$4,359	1,453	$3	$4,359	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	1,453	$3	$4,359	2,906	$3	$8,718	0	$3	$0
17	Silt Fence (sediment control)	lf	1,040	$1.5	$1,560	1,040	$1.5	$1,560	1,040	$1.5	$1,560
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	34943	$0.2	$6,989
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	1941	$16	$31,060
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	647	$21	$13,589
28	Seeding	acre	1.75	$3,200	$5,600	1.75	$3,200	$5,600	1.75	$3,200	$5,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$163,460**			**$156,195**			**$124,854**
33	Waste Characterization	ea	0.0	$400	$0	4.4	$400	$1,744	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	2,180	$120	$261,540	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$263,284**			**$0**
	Total Construction and Waste Disposal Costs				**$163,460**			**$419,478**			**$124,854**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$8,173	$8,173	1	$7,810	$7,810	1	$6,243	$6,243
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$16,346	$16,346	1	$15,619	$15,619	1	$12,485	$12,485
3	Contingency (20% of subtotal construction costs)	ls	1	$32,692	$32,692	1	$31,239	$31,239	1	$24,971	$24,971
	Total Construction Services Costs				**$57,211**			**$54,668**			**$43,699**
	TOTAL CAPITAL COSTS				**$220,671**			**$474,147**			**$168,553**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		Cost captured in wetlands estimate			Cost captured in wetlands estimate					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	65	$21	$1,358.89
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.175	$3,200	$560
	Estimated Annual O&M Cost				**$0**			**$0**			**$1,919**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$1,919	**$57,567**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$66,749**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$26,319**
	Total cost				**$220,671**			**$474,147**			**$194,872**

SWMU 6, 7, 8, 32 and AOC B
Planning Level Engineering Estimate for Remediation
Industrial Use Soil Clean Up Objectives
Dyno Nobel
Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	1.00	$200	$200	1.00	$200	$200	1.00	$200	$200
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$4,118	$4,118	1	$4,118	$4,118	1	$4,118	$4,118
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	683	$8	$5,464	683	$8	$5,464	0	$8	$0
13	Backfill material	cy	683	$18	$12,294	683	$18	$12,294	0	$18	$0
14	Spread and Compact	cy	1,366	$8	$10,928	683	$8	$5,464	0	$8	$0
15	Load (soil)	cy	683	$3	$2,049	683	$3	$2,049	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	683	$3	$2,049	1,366	$3	$4,098	0	$3	$0
17	Silt Fence (sediment control)	lf	760	$1.5	$1,140	760	$1.5	$1,140	760	$1.5	$1,140
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	21580	$0.2	$4,316
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	1199	$16	$19,182
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	400	$21	$8,392
28	Seeding	acre	1	$3,200	$3,200	1	$3,200	$3,200	1	$3,200	$3,200
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$120,442**			**$117,027**			**$99,048**
33	Waste Characterization	ea	0.0	$400	$0	2.0	$400	$820	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	1,025	$120	$122,940	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$123,760**			**$0**
	Total Construction and Waste Disposal Costs				**$120,442**			**$240,786**			**$99,048**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$6,022	$6,022	1	$5,851	$5,851	1	$4,952	$4,952
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$12,044	$12,044	1	$11,703	$11,703	1	$9,905	$9,905
3	Contingency (20% of subtotal construction costs)	ls	1	$24,088	$24,088	1	$23,405	$23,405	1	$19,810	$19,810
	Total Construction Services Costs				**$42,155**			**$40,959**			**$34,667**
	TOTAL CAPITAL COSTS				**$162,596**			**$281,746**			**$133,715**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	40	$21	$839.22
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.1	$3,200	$320
	Estimated Annual O&M Cost				**$0**			**$0**			**$1,159**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$1,159	**$34,777**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$40,323**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$15,899**
	Total cost				**$162,596**			**$281,746**			**$149,614**

SWMU 9
Planning Level Engineering Estimate for Remediation
Commercial Use Soil Clean Up Objectives
Dyno Nobel
Port Ewen, New York

No.	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	40	$8	$320	40	$8	$320	0	$8	$0
13	Backfill material	cy	40	$18	$720	40	$18	$720	0	$18	$0
14	Spread and Compact	cy	80	$8	$640	40	$8	$320	0	$8	$0
15	Load (soil)	cy	40	$3	$120	40	$3	$120	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	40	$3	$120	80	$3	$240	0	$3	$0
17	Silt Fence (sediment control)	lf	180	$1.5	$270	180	$1.5	$270	180	$1.5	$270
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	867	$0.2	$173
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	48	$16	$771
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	16	$21	$337
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$84,949**			**$84,749**			**$63,810**
33	Waste Characterization	ea	0.0	$400	$0	0.1	$400	$48	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	60	$120	$7,200	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$7,248**			**$0**
	Total Construction and Waste Disposal Costs				**$84,949**			**$91,997**			**$63,810**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,247	$4,247	1	$4,237	$4,237	1	$3,191	$3,191
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$8,495	$8,495	1	$8,475	$8,475	1	$6,381	$6,381
3	Contingency (20% of subtotal construction costs)	ls	1	$16,990	$16,990	1	$16,950	$16,950	1	$12,762	$12,762
	Total Construction Services Costs				**$29,732**			**$29,662**			**$22,334**
	TOTAL CAPITAL COSTS				**$114,681**			**$121,659**			**$86,144**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	2	$21	$33.72
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$194**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$194	**$5,812**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$6,738**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$2,657**
	Total cost				**$114,681**			**$121,659**			**$88,801**

SWMU 10

Planning Level Engineering Estimate for Remediation

Commercial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
		Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs										
1 Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2 Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3 Clearing and Grubbing	acre	1.00	$200	$200	1.00	$200	$200	1.00	$200	$200
4 Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5 Spraying Vegetation	ls	1	$4,118	$4,118	1	$4,118	$4,118	1	$4,118	$4,118
6 Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7 Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8 Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9 Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10 reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11 SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12 Excavation (soil)	cy	434	$8	$3,472	434	$8	$3,472	0	$8	$0
13 Backfill material	cy	434	$18	$7,812	434	$18	$7,812	0	$18	$0
14 Spread and Compact	cy	868	$8	$6,944	434	$8	$3,472	0	$8	$0
15 Load (soil)	cy	434	$3	$1,302	434	$3	$1,302	0	$3	$0
16 Haul/Handling of Soils (on-site)	cy	434	$3	$1,302	868	$3	$2,604	0	$3	$0
17 Silt Fence (sediment control)	lf	820	$1.5	$1,230	820	$1.5	$1,230	820	$1.5	$1,230
18 Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19 Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20 Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21 Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22 Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23 Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24 Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25 Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	11722	$0.2	$2,344
26 Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	651	$16	$10,420
27 Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	217	$21	$4,559
28 Seeding	acre	1	$3,200	$3,200	1	$3,200	$3,200	1	$3,200	$3,200
29 Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30 Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31 Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32 Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
Subtotal Construction Costs				**$108,580**			**$106,410**			**$84,570**
33 Waste Characterization	ea	0.0	$400	$0	1.3	$400	$521	0.0	$400	$0
34 Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	651	$120	$78,120	0	$120	$0
35 Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36 reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
Subtotal Waste Disposal Cost				**$0**			**$78,641**			**$0**
Total Construction and Waste Disposal Costs				**$108,580**			**$185,050**			**$84,570**
Construction Services										
1 Engineering (5% of subtotal construction costs)	ls	1	$5,429	$5,429	1	$5,320	$5,320	1	$4,229	$4,229
2 Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$10,858	$10,858	1	$10,641	$10,641	1	$8,457	$8,457
3 Contingency (20% of subtotal construction costs)	ls	1	$21,716	$21,716	1	$21,282	$21,282	1	$16,914	$16,914
Total Construction Services Costs				**$38,003**			**$37,243**			**$29,600**
TOTAL CAPITAL COSTS				**$146,583**			**$222,294**			**$114,170**
Annual Operation & Maintenance										
1 Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2 a Topsoil	cy	0	$21	$0	0	$21	$0	22	$21	$455.86
3 b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.1	$3,200	$320
Estimated Annual O&M Cost				**$0**			**$0**			**$776**
Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$776	**$23,276**
O&M Total Expenditure, 30 years				**$0**			**$0**			**$26,988**
O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$10,641**
Total cost				**$146,583**			**$222,294**			**$124,811**

SWMU 10
Planning Level Engineering Estimate for Remediation
Industrial Use Soil Clean Up Objectives
Dyno Nobel
Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	249	$8	$1,992	249	$8	$1,992	0	$8	$0
13	Backfill material	cy	249	$18	$4,482	249	$18	$4,482	0	$18	$0
14	Spread and Compact	cy	498	$8	$3,984	249	$8	$1,992	0	$8	$0
15	Load (soil)	cy	249	$3	$747	249	$3	$747	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	249	$3	$747	498	$3	$1,494	0	$3	$0
17	Silt Fence (sediment control)	lf	600	$1.5	$900	600	$1.5	$900	600	$1.5	$900
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	6705	$0.2	$1,341
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	373	$16	$5,960
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	124	$21	$2,608
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$95,611**			**$94,366**			**$73,067**
33	Waste Characterization	ea	0.0	$400	$0	0.7	$400	$299	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	374	$120	$44,820	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$45,119**			**$0**
	Total Construction and Waste Disposal Costs				**$95,611**			**$139,485**			**$73,067**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,781	$4,781	1	$4,718	$4,718	1	$3,653	$3,653
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$9,561	$9,561	1	$9,437	$9,437	1	$7,307	$7,307
3	Contingency (20% of subtotal construction costs)	ls	1	$19,122	$19,122	1	$18,873	$18,873	1	$14,613	$14,613
	Total Construction Services Costs				**$33,464**			**$33,028**			**$25,574**
	TOTAL CAPITAL COSTS				**$129,075**			**$172,513**			**$98,641**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	12.4	$21	$260.75
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$421**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$421	**$12,623**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$14,636**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$5,771**
	Total cost				**$129,075**			**$172,513**			**$104,412**

SWMU 11
Planning Level Engineering Estimate for Remediation
Commercial Use Soil Clean Up Objectives
Dyno Nobel
Port Ewen, New York

#	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	20	$8	$160	20	$8	$160	0	$8	$0
13	Backfill material	cy	20	$18	$360	20	$18	$360	0	$18	$0
14	Spread and Compact	cy	40	$8	$320	20	$8	$160	0	$8	$0
15	Load (soil)	cy	20	$3	$60	20	$3	$60	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	20	$3	$60	40	$3	$120	0	$3	$0
17	Silt Fence (sediment control)	lf	240	$1.5	$360	240	$1.5	$360	240	$1.5	$360
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	538	$0.2	$108
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	30	$16	$478
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	10	$21	$209
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$84,079**			**$83,979**			**$63,414**
33	Waste Characterization	ea	0.0	$400	$0	0.1	$400	$24	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	30	$120	$3,600	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$3,624**			**$0**
	Total Construction and Waste Disposal Costs				**$84,079**			**$87,603**			**$63,414**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,204	$4,204	1	$4,199	$4,199	1	$3,171	$3,171
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$8,408	$8,408	1	$8,398	$8,398	1	$6,341	$6,341
3	Contingency (20% of subtotal construction costs)	ls	1	$16,816	$16,816	1	$16,796	$16,796	1	$12,683	$12,683
	Total Construction Services Costs				**$29,428**			**$29,393**			**$22,195**
	TOTAL CAPITAL COSTS				**$113,506**			**$116,995**			**$85,609**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	1	$21	$20.92
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$181**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$181	**$5,428**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$6,293**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$2,481**
	Total cost				**$113,506**			**$116,995**			**$88,090**

SWMU 11

Planning Level Engineering Estimate for Remediation

Industrial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	8	$8	$64	8	$8	$64	0	$8	$0
13	Backfill material	cy	8	$18	$144	8	$18	$144	0	$18	$0
14	Spread and Compact	cy	16	$8	$128	8	$8	$64	0	$8	$0
15	Load (soil)	cy	8	$3	$24	8	$3	$24	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	8	$3	$24	16	$3	$48	0	$3	$0
17	Silt Fence (sediment control)	lf	80	$1.5	$120	80	$1.5	$120	80	$1.5	$120
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	207	$0.2	$41
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	12	$16	$184
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	4	$21	$81
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$83,263**			**$83,223**			**$62,685**
33	Waste Characterization	ea	0.0	$400	$0	0.0	$400	$10	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	12	$120	$1,440	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$1,450**			**$0**
	Total Construction and Waste Disposal Costs				**$83,263**			**$84,672**			**$62,685**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,163	$4,163	1	$4,161	$4,161	1	$3,134	$3,134
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$8,326	$8,326	1	$8,322	$8,322	1	$6,268	$6,268
3	Contingency (20% of subtotal construction costs)	ls	1	$16,653	$16,653	1	$16,645	$16,645	1	$12,537	$12,537
	Total Construction Services Costs				**$29,142**			**$29,128**			**$21,940**
	TOTAL CAPITAL COSTS				**$112,405**			**$113,800**			**$84,624**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	0.4	$21	$8.05
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$168**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$168	**$5,042**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$5,846**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$2,305**
	Total cost				**$112,405**			**$113,800**			**$86,929**

SWMU 13

Planning Level Engineering Estimate for Remediation

Commercial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.75	$200	$150	0.75	$200	$150	0.75	$200	$150
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$3,088	$3,088	1	$3,088	$3,088	1	$3,088	$3,088
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	575	$8	$4,600	575	$8	$4,600	0	$8	$0
13	Backfill material	cy	575	$18	$10,350	575	$18	$10,350	0	$18	$0
14	Spread and Compact	cy	1,150	$8	$9,200	575	$8	$4,600	0	$8	$0
15	Load (soil)	cy	575	$3	$1,725	575	$3	$1,725	0	$3	$0
16	Haul/Handling of Soil (on-site)	cy	575	$3	$1,725	1,150	$3	$3,450	0	$3	$0
17	Silt Fence (sediment control)	lf	760	$1.5	$1,140	760	$1.5	$1,140	760	$1.5	$1,140
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	15534	$0.2	$3,107
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	863	$16	$13,808
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	288	$21	$6,041
28	Seeding	acre	0.75	$3,200	$2,400	0.75	$3,200	$2,400	0.75	$3,200	$2,400
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$113,378**			**$110,503**			**$88,234**
33	Waste Characterization	ea	0.0	$400	$0	1.7	$400	$690	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	863	$120	$103,500	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$104,190**			**$0**
	Total Construction and Waste Disposal Costs				**$113,378**			**$214,693**			**$88,234**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$5,669	$5,669	1	$5,525	$5,525	1	$4,412	$4,412
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$11,338	$11,338	1	$11,050	$11,050	1	$8,823	$8,823
3	Contingency (20% of subtotal construction costs)	ls	1	$22,676	$22,676	1	$22,101	$22,101	1	$17,647	$17,647
	Total Construction Services Costs				**$39,682**			**$38,676**			**$30,882**
	TOTAL CAPITAL COSTS				**$153,061**			**$253,369**			**$119,116**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	29	$21	$604.10
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.075	$3,200	$240
	Estimated Annual O&M Cost				**$0**			**$0**			**$844**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$844	**$25,323**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$29,362**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$11,577**
	Total cost				**$153,061**			**$253,369**			**$130,693**

SWMU 21
Planning Level Engineering Estimate for Remediation
Commercial Use Soil Clean Up Objectives
Dyno Nobel
Port Ewen, New York

Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
		Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs										
1 Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2 Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3 Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4 Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5 Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6 Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7 Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8 Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9 Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10 reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11 SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12 Excavation (soil)	cy	302	$8	$2,416	302	$8	$2,416	0	$8	$0
13 Backfill material	cy	302	$18	$5,436	302	$18	$5,436	0	$18	$0
14 Spread and Compact	cy	604	$8	$4,832	302	$8	$2,416	0	$8	$0
15 Load (soil)	cy	302	$3	$906	302	$3	$906	0	$3	$0
16 Haul/Handling of Soils (on-site)	cy	302	$3	$906	604	$3	$1,812	0	$3	$0
17 Silt Fence (sediment control)	lf	460	$1.5	$690	460	$1.5	$690	460	$1.5	$690
18 Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19 Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20 Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21 Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22 Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23 Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24 Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25 Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	8152	$0.2	$1,630
26 Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	453	$16	$7,246
27 Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	151	$21	$3,170
28 Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29 Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30 Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31 Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32 Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
Subtotal Construction Costs				**$97,945**			**$96,435**			**$74,996**
33 Waste Characterization	ea	0.0	$400	$0	0.9	$400	$362	0.0	$400	$0
34 Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	453	$120	$54,360	0	$120	$0
35 Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36 reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
Subtotal Waste Disposal Cost				**$0**			**$54,722**			**$0**
Total Construction and Waste Disposal Costs				**$97,945**			**$151,157**			**$74,996**
Construction Services										
1 Engineering (5% of subtotal construction costs)	ls	1	$4,897	$4,897	1	$4,822	$4,822	1	$3,750	$3,750
2 Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$9,794	$9,794	1	$9,643	$9,643	1	$7,500	$7,500
3 Contingency (20% of subtotal construction costs)	ls	1	$19,589	$19,589	1	$19,287	$19,287	1	$14,999	$14,999
Total Construction Services Costs				**$34,281**			**$33,752**			**$26,248**
TOTAL CAPITAL COSTS				**$132,226**			**$184,909**			**$101,244**
Annual Operation & Maintenance										
1 Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2 a Topsoil	cy	0	$21	$0	0	$21	$0	15	$21	$317.02
3 b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
Estimated Annual O&M Cost				**$0**			**$0**			**$477**
Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$477	**$14,311**
O&M Total Expenditure, 30 years				**$0**			**$0**			**$16,593**
O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$6,543**
Total cost				**$132,226**			**$184,909**			**$107,787**

SWMU 21
Planning Level Engineering Estimate for Remediation
Industrial Use Soil Clean Up Objectives
Dyno Nobel
Port Ewen, New York

Description		Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.25	$200	$50	0.25	$200	$50	0.25	$200	$50
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$1,029	$1,029	1	$1,029	$1,029	1	$1,029	$1,029
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	43	$8	$344	43	$8	$344	0	$8	$0
13	Backfill material	cy	43	$18	$774	43	$18	$774	0	$18	$0
14	Spread and Compact	cy	86	$8	$688	43	$8	$344	0	$8	$0
15	Load (soil)	cy	43	$3	$129	43	$3	$129	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	43	$3	$129	86	$3	$258	0	$3	$0
17	Silt Fence (sediment control)	lf	120	$1.5	$180	120	$1.5	$180	120	$1.5	$180
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	1154	$0.2	$231
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	64	$16	$1,026
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	21	$21	$449
28	Seeding	acre	0.25	$3,200	$800	0.25	$3,200	$800	0.25	$3,200	$800
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$83,123**			**$82,908**			**$62,265**
33	Waste Characterization	ea	0.0	$400	$0	0.1	$400	$52	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	65	$120	$7,740	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$7,792**			**$0**
	Total Construction and Waste Disposal Costs				**$83,123**			**$90,700**			**$62,265**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,156	$4,156	1	$4,145	$4,145	1	$3,113	$3,113
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$8,312	$8,312	1	$8,291	$8,291	1	$6,226	$6,226
3	Contingency (20% of subtotal construction costs)	ls	1	$16,625	$16,625	1	$16,582	$16,582	1	$12,453	$12,453
	Total Construction Services Costs				**$29,093**			**$29,018**			**$21,793**
	TOTAL CAPITAL COSTS				**$112,217**			**$119,718**			**$84,057**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	2	$21	$44.88
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.025	$3,200	$80
	Estimated Annual O&M Cost				**$0**			**$0**			**$125**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$125	**$3,746**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$4,344**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$1,713**
	Total cost				**$112,217**			**$119,718**			**$85,770**

SWMU 22

Planning Level Engineering Estimate for Remediation

Commercial or Industrial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	0	$20,000	$0	0	$20,000	$0	1	$20,000	$20,000
2	Site Preparation/Decon/Staging Areas Setup/Erosion Control	ls	0	$25,000	$0	0	$25,000	$0	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.00	$200	$0	0.00	$200	$0	1.50	$200	$300
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	0	$0	$0	0	$0	$0	1	$6,176	$6,176
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	0	$1,000	$0	0	$1,000	$0	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	0	$0	$0	0	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	0	$1,000	$0	0	$1,000	$0	1	$1,000	$1,000
12	Excavation (soil)	cy	0	$8	$0	0	$8	$0	0	$8	$0
13	Backfill material	cy	0	$18	$0	0	$18	$0	0	$18	$0
14	Spread and Compact	cy	0	$8	$0	0	$8	$0	0	$8	$0
15	Load (soil)	cy	0	$3	$0	0	$3	$0	0	$3	$0
16	Haul/Handling of Soils/Staging (on-site)	cy	0	$3	$0	0	$3	$0	0	$3	$0
17	Silt Fence (sediment control)	lf	0	$1.5	$0	0	$1.5	$0	1,000	$1.5	$1,500
18	Equipment Decontamination	ea	0	$250	$0	0	$250	$0	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	0	$1	$0	0	$1	$0	0	$1	$0
20	Ambient Air Monitoring	ls	0	$5,000	$0	0	$5,000	$0	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	60867	$0.2	$12,173
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	3382	$16	$54,104
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	1127	$21	$23,671
28	Seeding	acre	0	$3,200	$0	0	$3,200	$0	1.5	$3,200	$4,800
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	0	$6,500	$0	0	$6,500	$0	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	0	$5,000	$0	0	$5,000	$0	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	0	$5,000	$0	0	$5,000	$0	1	$5,000	$5,000
	Subtotal Construction Costs				**$0**			**$0**			**$161,224**
33	Waste Characterization	ea	0.0	$400	$0	0.0	$400	$0	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	0	$120	$0	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$0**			**$0**
	Total Construction and Waste Disposal Costs				**$0**			**$0**			**$161,224**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$0	$0	1	$0	$0	1	$8,061	$8,061
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$0	$0	1	$0	$0	1	$16,122	$16,122
3	Contingency (20% of subtotal construction costs)	ls	1	$0	$0	1	$0	$0	1	$32,245	$32,245
	Total Construction Services Costs				**$0**			**$0**			**$56,429**
	TOTAL CAPITAL COSTS				**$0**			**$0**			**$217,653**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	113	$21	$2,367.05
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.15	$3,200	$480
	Estimated Annual O&M Cost				**$0**			**$0**			**$2,847**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$2,847	**$85,412**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$99,034**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$39,049**
	Total cost				**$0**			**$0**			**$256,702**

SWMU 26D

Planning Level Engineering Estimate for Remediation

Commercial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	404	$8	$3,232	404	$8	$3,232	0	$8	$0
13	Backfill material	cy	404	$18	$7,272	404	$18	$7,272	0	$18	$0
14	Spread and Compact	cy	808	$8	$6,464	404	$8	$3,232	0	$8	$0
15	Load (soil)	cy	404	$3	$1,212	404	$3	$1,212	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	404	$3	$1,212	808	$3	$2,424	0	$3	$0
17	Silt Fence (sediment control)	lf	440	$1.5	$660	440	$1.5	$660	440	$1.5	$660
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	7741	$0.2	$1,548
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	430	$16	$6,881
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	143	$21	$3,010
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$102,811**			**$100,791**			**$74,358**
33	Waste Characterization	ea	0.0	$400	$0	1.2	$400	$485	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	606	$120	$72,720	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$73,205**			**$0**
	Total Construction and Waste Disposal Costs				**$102,811**			**$173,996**			**$74,358**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$5,141	$5,141	1	$5,040	$5,040	1	$3,718	$3,718
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$10,281	$10,281	1	$10,079	$10,079	1	$7,436	$7,436
3	Contingency (20% of subtotal construction costs)	ls	1	$20,562	$20,562	1	$20,158	$20,158	1	$14,872	$14,872
	Total Construction Services Costs				**$35,984**			**$35,277**			**$26,025**
	TOTAL CAPITAL COSTS				**$138,795**			**$209,272**			**$100,384**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	14	$21	$301.04
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$461**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$461	**$13,831**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$16,037**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$6,323**
	Total cost				**$138,795**			**$209,272**			**$106,707**

SWMU 26G and AOC C and D

Planning Level Engineering Estimate for Remediation

Commercial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.75	$200	$150	0.75	$200	$150	0.75	$200	$150
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$3,088	$3,088	1	$3,088	$3,088	1	$3,088	$3,088
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	780	$8	$6,240	780	$8	$6,240	0	$8	$0
13	Backfill material	cy	780	$18	$14,040	780	$18	$14,040	0	$18	$0
14	Spread and Compact	cy	1,560	$8	$12,480	780	$8	$6,240	0	$8	$0
15	Load (soil)	cy	780	$3	$2,340	780	$3	$2,340	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	780	$3	$2,340	1,560	$3	$4,680	0	$3	$0
17	Silt Fence (sediment control)	lf	640	$1.5	$960	640	$1.5	$960	640	$1.5	$960
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	21049	$0.2	$4,210
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	1169	$16	$18,710
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	390	$21	$8,186
28	Seeding	acre	0.75	$3,200	$2,400	0.75	$3,200	$2,400	0.75	$3,200	$2,400
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$123,038**			**$119,138**			**$96,204**
33	Waste Characterization	ea	0.0	$400	$0	2.3	$400	$936	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	1,170	$120	$140,400	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$141,336**			**$0**
	Total Construction and Waste Disposal Costs				**$123,038**			**$260,474**			**$96,204**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$6,152	$6,152	1	$5,957	$5,957	1	$4,810	$4,810
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$12,304	$12,304	1	$11,914	$11,914	1	$9,620	$9,620
3	Contingency (20% of subtotal construction costs)	ls	1	$24,608	$24,608	1	$23,828	$23,828	1	$19,241	$19,241
	Total Construction Services Costs				**$43,063**			**$41,698**			**$33,671**
	TOTAL CAPITAL COSTS				**$166,102**			**$302,173**			**$129,875**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	39	$21	$818.57
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.075	$3,200	$240
	Estimated Annual O&M Cost				**$0**			**$0**			**$1,059**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$1,059	**$31,757**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$36,822**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$14,519**
	Total cost				**$166,102**			**$302,173**			**$144,394**

SWMU 26G and AOC C and D

Planning Level Engineering Estimate for Remediation

Industrial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.75	$200	$150	0.75	$200	$150	0.75	$200	$150
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$3,088	$3,088	1	$3,088	$3,088	1	$3,088	$3,088
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	780	$8	$6,240	780	$8	$6,240	0	$8	$0
13	Backfill material	cy	780	$18	$14,040	780	$18	$14,040	0	$18	$0
14	Spread and Compact	cy	1,560	$8	$12,480	780	$8	$6,240	0	$8	$0
15	Load (soil)	cy	780	$3	$2,340	780	$3	$2,340	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	780	$3	$2,340	1,560	$3	$4,680	0	$3	$0
17	Silt Fence (sediment control)	lf	640	$1.5	$960	640	$1.5	$960	640	$1.5	$960
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	21049	$0.2	$4,210
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	1169	$16	$18,710
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	390	$21	$8,186
28	Seeding	acre	0.75	$3,200	$2,400	0.75	$3,200	$2,400	0.75	$3,200	$2,400
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$123,038**			**$119,138**			**$96,204**
33	Waste Characterization	ea	0.0	$400	$0	2.3	$400	$936	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	1,170	$120	$140,400	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$141,336**			**$0**
	Total Construction and Waste Disposal Costs				**$123,038**			**$260,474**			**$96,204**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$6,152	$6,152	1	$5,957	$5,957	1	$4,810	$4,810
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$12,304	$12,304	1	$11,914	$11,914	1	$9,620	$9,620
3	Contingency (20% of subtotal construction costs)	ls	1	$24,608	$24,608	1	$23,828	$23,828	1	$19,241	$19,241
	Total Construction Services Costs				**$43,063**			**$41,698**			**$33,671**
	TOTAL CAPITAL COSTS				**$166,102**			**$302,173**			**$129,875**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		Cost captured in wetlands estimate			Cost captured in wetlands estimate					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	39	$21	$818.57
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.075	$3,200	$240
	Estimated Annual O&M Cost				**$0**			**$0**			**$1,059**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$1,059	**$31,757**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$36,822**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$14,519**
	Total cost				**$166,102**			**$302,173**			**$144,394**

SWMU 29

Planning Level Engineering Estimate for Remediation

Commercial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	177	$8	$1,416	177	$8	$1,416	0	$8	$0
13	Backfill material	cy	177	$18	$3,186	177	$18	$3,186	0	$18	$0
14	Spread and Compact	cy	354	$8	$2,832	177	$8	$1,416	0	$8	$0
15	Load (soil)	cy	177	$3	$531	177	$3	$531	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	177	$3	$531	354	$3	$1,062	0	$3	$0
17	Silt Fence (sediment control)	lf	200	$1.5	$300	200	$1.5	$300	200	$1.5	$300
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	4778	$0.2	$956
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	265	$16	$4,247
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	88	$21	$1,858
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$91,555**			**$90,670**			**$69,620**
33	Waste Characterization	ea	0.0	$400	$0	0.5	$400	$212	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	266	$120	$31,860	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$32,072**			**$0**
	Total Construction and Waste Disposal Costs				**$91,555**			**$122,742**			**$69,620**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,578	$4,578	1	$4,533	$4,533	1	$3,481	$3,481
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$9,155	$9,155	1	$9,067	$9,067	1	$6,962	$6,962
3	Contingency (20% of subtotal construction costs)	ls	1	$18,311	$18,311	1	$18,134	$18,134	1	$13,924	$13,924
	Total Construction Services Costs				**$32,044**			**$31,734**			**$24,367**
	TOTAL CAPITAL COSTS				**$123,599**			**$154,477**			**$93,987**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	9	$21	$185.81
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$346**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$346	**$10,374**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$12,029**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$4,743**
	Total cost				**$123,599**			**$154,477**			**$98,730**

SWMU 32
Planning Level Engineering Estimate for Remediation
Commercial or Industrial Use Soil Clean Up Objectives
Dyno Nobel
Port Ewen, New York

Description		Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	0	$20,000	$0	0	$20,000	$0	1	$20,000	$20,000
2	Site Preparation/Decon/Staging Areas Setup/Erosion Control	ls	0	$25,000	$0	0	$25,000	$0	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.00	$200	$0	0.00	$200	$0	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	0	$0	$0	0	$0	$0	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	0	$1,000	$0	0	$1,000	$0	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	0	$0	$0	0	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	0	$1,000	$0	0	$1,000	$0	1	$1,000	$1,000
12	Excavation (soil)	cy	0	$8	$0	0	$8	$0	0	$8	$0
13	Backfill material	cy	0	$18	$0	0	$18	$0	0	$18	$0
14	Spread and Compact	cy	0	$8	$0	0	$8	$0	0	$8	$0
15	Load (soil)	cy	0	$3	$0	0	$3	$0	0	$3	$0
16	Haul/Handling of Soils/Staging (on-site)	cy	0	$3	$0	0	$3	$0	0	$3	$0
17	Silt Fence (sediment control)	lf	0	$1.5	$0	0	$1.5	$0	500	$1.5	$750
18	Equipment Decontamination	ea	0	$250	$0	0	$250	$0	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	0	$1	$0	0	$1	$0	0	$1	$0
20	Ambient Air Monitoring	ls	0	$5,000	$0	0	$5,000	$0	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	11556	$0.2	$2,311
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	642	$16	$10,272
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	214	$21	$4,494
28	Seeding	acre	0	$3,200	$0	0	$3,200	$0	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	0	$6,500	$0	0	$6,500	$0	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	0	$5,000	$0	0	$5,000	$0	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	0	$5,000	$0	0	$5,000	$0	1	$5,000	$5,000
	Subtotal Construction Costs				**$0**			**$0**			**$80,086**
33	Waste Characterization	ea	0.0	$400	$0	0.0	$400	$0	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	0	$120	$0	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$0**			**$0**
	Total Construction and Waste Disposal Costs				**$0**			**$0**			**$80,086**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$0	$0	1	$0	$0	1	$4,004	$4,004
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$0	$0	1	$0	$0	1	$8,009	$8,009
3	Contingency (20% of subtotal construction costs)	ls	1	$0	$0	1	$0	$0	1	$16,017	$16,017
	Total Construction Services Costs				**$0**			**$0**			**$28,030**
	TOTAL CAPITAL COSTS				**$0**			**$0**			**$108,116**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	21.4	$21	$449.40
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$609**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$609	**$18,282**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$21,198**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$8,358**
	Total cost				**$0**			**$0**			**$116,474**

SMMU 33
Planning Level Engineering Estimate for Remediation
Commercial Use Soil Clean Up Objectives
Dyno Nobel
Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	500	$8	$4,000	500	$8	$4,000	0	$8	$0
13	Backfill material	cy	228	$18	$4,104	500	$18	$9,000	0	$18	$0
14	Spread and Compact	cy	728	$8	$5,824	500	$8	$4,000	0	$8	$0
15	Load (soil)	cy	500	$3	$1,500	500	$3	$1,500	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	500	$3	$1,500	728	$3	$2,184	0	$3	$0
17	Silt Fence (sediment control)	lf	560	$1.5	$840	560	$1.5	$840	560	$1.5	$840
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	13501	$0.2	$2,700
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	750	$16	$12,001
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	250	$21	$5,250
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$100,527**			**$104,283**			**$83,050**
33	Waste Characterization	ea	0.0	$400	$0	1.5	$400	$600	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	750	$120	$90,000	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$90,600**			**$0**
	Total Construction and Waste Disposal Costs				**$100,527**			**$194,883**			**$83,050**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$5,026	$5,026	1	$5,214	$5,214	1	$4,153	$4,153
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$10,053	$10,053	1	$10,428	$10,428	1	$8,305	$8,305
3	Contingency (20% of subtotal construction costs)	ls	1	$20,105	$20,105	1	$20,857	$20,857	1	$16,610	$16,610
	Total Construction Services Costs				**$35,184**			**$36,499**			**$29,068**
	TOTAL CAPITAL COSTS				**$135,711**			**$231,382**			**$112,118**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	25	$21	$525.04
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$685**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$685	**$20,551**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$23,829**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$9,396**
	Total cost				**$135,711**			**$231,382**			**$121,514**

SWMU 33
Planning Level Engineering Estimate for Remediation
Indusrtial Use Soil Clean Up Objectives
Dyno Nobel
Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.25	$200	$50	0.25	$200	$50	0.25	$200	$50
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$1,029	$1,029	1	$1,029	$1,029	1	$1,029	$1,029
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	237	$8	$1,896	237	$8	$1,896	0	$8	$0
13	Backfill material	cy	64	$18	$1,152	237	$18	$4,266	0	$18	$0
14	Spread and Compact	cy	301	$8	$2,408	237	$8	$1,896	0	$8	$0
15	Load (soil)	cy	237	$3	$711	237	$3	$711	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	237	$3	$711	301	$3	$903	0	$3	$0
17	Silt Fence (sediment control)	lf	280	$1.5	$420	280	$1.5	$420	280	$1.5	$420
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	6404	$0.2	$1,281
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	356	$16	$5,692
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	119	$21	$2,490
28	Seeding	acre	0.25	$3,200	$800	0.25	$3,200	$800	0.25	$3,200	$800
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$88,177**			**$90,971**			**$70,263**
33	Waste Characterization	ea	0.0	$400	$0	0.7	$400	$284	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	356	$120	$42,660	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$42,944**			**$0**
	Total Construction and Waste Disposal Costs				**$88,177**			**$133,916**			**$70,263**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,409	$4,409	1	$4,549	$4,549	1	$3,513	$3,513
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$8,818	$8,818	1	$9,097	$9,097	1	$7,026	$7,026
3	Contingency (20% of subtotal construction costs)	ls	1	$17,635	$17,635	1	$18,194	$18,194	1	$14,053	$14,053
	Total Construction Services Costs				**$30,862**			**$31,840**			**$24,592**
	TOTAL CAPITAL COSTS				**$119,040**			**$165,756**			**$94,855**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	12	$21	$249.04
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.025	$3,200	$80
	Estimated Annual O&M Cost				**$0**			**$0**			**$329**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$329	**$9,871**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$11,446**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$4,513**
	Total cost				**$119,040**			**$165,756**			**$99,368**

SWMU 35

Planning Level Engineering Estimate for Remediation

Commercial or Industrial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

Description		Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	0	$20,000	$0	0	$20,000	$0	1	$20,000	$20,000
2	Site Preparation/Decon/Staging Areas Setup/Erosion Control	ls	0	$25,000	$0	0	$25,000	$0	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.00	$200	$0	0.00	$200	$0	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	0	$0	$0	0	$0	$0	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	0	$1,000	$0	0	$1,000	$0	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	0	$0	$0	0	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	0	$1,000	$0	0	$1,000	$0	1	$1,000	$1,000
12	Excavation (soil)	cy	0	$8	$0	0	$8	$0	0	$8	$0
13	Backfill material	cy	0	$18	$0	0	$18	$0	0	$18	$0
14	Spread and Compact	cy	0	$8	$0	0	$8	$0	0	$8	$0
15	Load (soil)	cy	0	$3	$0	0	$3	$0	0	$3	$0
16	Haul/Handling of Soils/Staging (on-site)	cy	0	$3	$0	0	$3	$0	0	$3	$0
17	Silt Fence (sediment control)	lf	0	$1.5	$0	0	$1.5	$0	500	$1.5	$750
18	Equipment Decontamination	ea	0	$250	$0	0	$250	$0	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	0	$1	$0	0	$1	$0	0	$1	$0
20	Ambient Air Monitoring	ls	0	$5,000	$0	0	$5,000	$0	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	10062	$0.2	$2,012
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	559	$16	$8,944
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	186	$21	$3,913
28	Seeding	acre	0	$3,200	$0	0	$3,200	$0	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	0	$6,500	$0	0	$6,500	$0	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	0	$5,000	$0	0	$5,000	$0	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	0	$5,000	$0	0	$5,000	$0	1	$5,000	$5,000
	Subtotal Construction Costs				**$0**			**$0**			**$77,878**
33	Waste Characterization	ea	0.0	$400	$0	0.0	$400	$0	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	0	$120	$0	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$0**			**$0**
	Total Construction and Waste Disposal Costs				**$0**			**$0**			**$77,878**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$0	$0	1	$0	$0	1	$3,894	$3,894
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$0	$0	1	$0	$0	1	$7,788	$7,788
3	Contingency (20% of subtotal construction costs)	ls	1	$0	$0	1	$0	$0	1	$15,576	$15,576
	Total Construction Services Costs				**$0**			**$0**			**$27,257**
	TOTAL CAPITAL COSTS				**$0**			**$0**			**$105,136**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	19	$21	$391.30
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$551**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$551	**$16,539**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$19,177**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$7,561**
	Total cost				**$0**			**$0**			**$112,697**

SWMU 40

Planning Level Engineering Estimate for Remediation

Commercial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	12	$8	$96	12	$8	$96	0	$8	$0
13	Backfill material	cy	12	$18	$216	12	$18	$216	0	$18	$0
14	Spread and Compact	cy	24	$8	$192	12	$8	$96	0	$8	$0
15	Load (soil)	cy	12	$3	$36	12	$3	$36	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	12	$3	$36	24	$3	$72	0	$3	$0
17	Silt Fence (sediment control)	lf	120	$1.5	$180	120	$1.5	$180	120	$1.5	$180
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	316	$0.2	$63
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	18	$16	$281
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	6	$21	$123
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$83,515**			**$83,455**			**$62,906**
33	Waste Characterization	ea	0.0	$400	$0	0.0	$400	$14	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	18	$120	$2,160	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$2,174**			**$0**
	Total Construction and Waste Disposal Costs				**$83,515**			**$85,629**			**$62,906**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,176	$4,176	1	$4,173	$4,173	1	$3,145	$3,145
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$8,351	$8,351	1	$8,345	$8,345	1	$6,291	$6,291
3	Contingency (20% of subtotal construction costs)	ls	1	$16,703	$16,703	1	$16,691	$16,691	1	$12,581	$12,581
	Total Construction Services Costs				**$29,230**			**$29,209**			**$22,017**
	TOTAL CAPITAL COSTS				**$112,745**			**$114,838**			**$84,923**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	0.6	$21	$12.29
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$172**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$172	**$5,169**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$5,993**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$2,363**
	Total cost				**$112,745**			**$114,838**			**$87,286**

SWMU 48
Planning Level Engineering Estimate for Remediation
Commercial Use Soil Clean Up Objectives
Dyno Nobel
Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.50	$200	$100	0.50	$200	$100	0.50	$200	$100
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$2,059	$2,059	1	$2,059	$2,059	1	$2,059	$2,059
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	233	$8	$1,864	233	$8	$1,864	0	$8	$0
13	Backfill material	cy	233	$18	$4,194	233	$18	$4,194	0	$18	$0
14	Spread and Compact	cy	466	$8	$3,728	233	$8	$1,864	0	$8	$0
15	Load (soil)	cy	233	$3	$699	233	$3	$699	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	233	$3	$699	466	$3	$1,398	0	$3	$0
17	Silt Fence (sediment control)	lf	440	$1.5	$660	440	$1.5	$660	440	$1.5	$660
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	6299	$0.2	$1,260
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	350	$16	$5,599
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	117	$21	$2,450
28	Seeding	acre	0.5	$3,200	$1,600	0.5	$3,200	$1,600	0.5	$3,200	$1,600
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$94,603**			**$93,438**			**$72,227**
33	Waste Characterization	ea	0.0	$400	$0	0.7	$400	$280	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	350	$120	$41,940	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$42,220**			**$0**
	Total Construction and Waste Disposal Costs				**$94,603**			**$135,657**			**$72,227**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$4,730	$4,730	1	$4,672	$4,672	1	$3,611	$3,611
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$9,460	$9,460	1	$9,344	$9,344	1	$7,223	$7,223
3	Contingency (20% of subtotal construction costs)	ls	1	$18,921	$18,921	1	$18,688	$18,688	1	$14,445	$14,445
	Total Construction Services Costs				**$33,111**			**$32,703**			**$25,280**
	TOTAL CAPITAL COSTS				**$127,714**			**$168,361**			**$97,507**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	12	$21	$244.96
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.05	$3,200	$160
	Estimated Annual O&M Cost				**$0**			**$0**			**$405**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$405	**$12,149**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$14,087**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$5,554**
	Total cost				**$127,714**			**$168,361**			**$103,061**

SMMU 52
Planning Level Engineering Estimate for Remediation
Commercial Use Soil Clean Up Objectives
Dyno Nobel
Port Ewen, New York

Description		Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.75	$200	$150	0.75	$200	$150	0.75	$200	$150
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$3,088	$3,088	1	$3,088	$3,088	1	$3,088	$3,088
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	2,559	$8	$20,472	2,559	$8	$20,472	0	$8	$0
13	Backfill material	cy	2,559	$18	$46,062	2,559	$18	$46,062	0	$18	$0
14	Spread and Compact	cy	5,118	$8	$40,944	2,559	$8	$20,472	0	$8	$0
15	Load (soil)	cy	2,559	$3	$7,677	2,559	$3	$7,677	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	2,559	$3	$7,677	5,118	$3	$15,354	0	$3	$0
17	Silt Fence (sediment control)	lf	600	$1.5	$900	600	$1.5	$900	600	$1.5	$900
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	20268	$0.2	$4,054
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	1126	$16	$18,016
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	375	$21	$7,882
28	Seeding	acre	0.75	$3,200	$2,400	0.75	$3,200	$2,400	0.75	$3,200	$2,400
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$208,370**			**$195,575**			**$94,990**
33	Waste Characterization	ea	0.0	$400	$0	7.7	$400	$3,071	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	3,839	$120	$460,620	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$463,691**			**$0**
	Total Construction and Waste Disposal Costs				**$208,370**			**$659,266**			**$94,990**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$10,419	$10,419	1	$9,779	$9,779	1	$4,749	$4,749
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$20,837	$20,837	1	$19,558	$19,558	1	$9,499	$9,499
3	Contingency (20% of subtotal construction costs)	ls	1	$41,674	$41,674	1	$39,115	$39,115	1	$18,998	$18,998
	Total Construction Services Costs				**$72,930**			**$68,451**			**$33,246**
	TOTAL CAPITAL COSTS				**$281,300**			**$727,717**			**$128,236**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	38	$21	$788.20
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.075	$3,200	$240
	Estimated Annual O&M Cost				**$0**			**$0**			**$1,028**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$1,028	**$30,846**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$35,766**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$14,102**
	Total cost				**$281,300**			**$727,717**			**$142,339**

SWMU 52
Planning Level Engineering Estimate for Remediation
Industrial Use Soil Clean Up Objectives
Dyno Nobel

Port Ewen, New York

Description		Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.75	$200	$150	0.75	$200	$150	0.75	$200	$150
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$3,088	$3,088	1	$3,088	$3,088	1	$3,088	$3,088
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	1,490	$8	$11,920	1,490	$8	$11,920	0	$8	$0
13	Backfill material	cy	1,490	$18	$26,820	1,490	$18	$26,820	0	$18	$0
14	Spread and Compact	cy	2,980	$8	$23,840	1,490	$8	$11,920	0	$8	$0
15	Load (soil)	cy	1,490	$3	$4,470	1,490	$3	$4,470	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	1,490	$3	$4,470	2,980	$3	$8,940	0	$3	$0
17	Silt Fence (sediment control)	lf	600	$1.5	$900	600	$1.5	$900	600	$1.5	$900
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	18121	$0.2	$3,624
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	1007	$16	$16,108
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	336	$21	$7,047
28	Seeding	acre	0.75	$3,200	$2,400	0.75	$3,200	$2,400	0.75	$3,200	$2,400
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$157,058**			**$149,608**			**$91,817**
33	Waste Characterization	ea	0.0	$400	$0	4.5	$400	$1,788	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	2,235	$120	$268,200	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$269,988**			**$0**
	Total Construction and Waste Disposal Costs				**$157,058**			**$419,596**			**$91,817**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$7,853	$7,853	1	$7,480	$7,480	1	$4,591	$4,591
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$15,706	$15,706	1	$14,961	$14,961	1	$9,182	$9,182
3	Contingency (20% of subtotal construction costs)	ls	1	$31,412	$31,412	1	$29,922	$29,922	1	$18,363	$18,363
	Total Construction Services Costs				**$54,970**			**$52,363**			**$32,136**
	TOTAL CAPITAL COSTS				**$212,029**			**$471,959**			**$123,953**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	34	$21	$704.71
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.075	$3,200	$240
	Estimated Annual O&M Cost				**$0**			**$0**			**$945**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$945	**$28,341**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$32,861**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$12,957**
	Total cost				**$212,029**			**$471,959**			**$136,910**

SWMU 54
Planning Level Engineering Estimate for Remediation
Commercial Use Soil Clean Up Objectives
Dyno Nobel
Port Ewen, New York

Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
		Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs										
1 Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2 Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3 Clearing and Grubbing	acre	3.50	$200	$700	3.50	$200	$700	3.50	$200	$700
4 Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5 Spraying Vegetation	ls	1	$14,412	$14,412	1	$14,412	$14,412	1	$14,412	$14,412
6 Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7 Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8 Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9 Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10 reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11 SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12 Excavation (soil)	cy	4,609	$8	$36,872	4,609	$8	$36,872	0	$8	$0
13 Backfill material	cy	4,609	$18	$82,962	4,609	$18	$82,962	0	$18	$0
14 Spread and Compact	cy	9,218	$8	$73,744	4,609	$8	$36,872	0	$8	$0
15 Load (soil)	cy	4,609	$3	$13,827	4,609	$3	$13,827	0	$3	$0
16 Haul/Handling of Soils (on-site)	cy	4,609	$3	$13,827	9,218	$3	$27,654	0	$3	$0
17 Silt Fence (sediment control)	lf	1,520	$1.5	$2,280	1,520	$1.5	$2,280	1,520	$1.5	$2,280
18 Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19 Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20 Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21 Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22 Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23 Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24 Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25 Permeable Cover - Geotextile (in place)	sf	0	$0	$0	0	$0	$0	62216	$0	$12,443
26 Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	3456	$16	$55,303
27 Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	1152	$21	$24,195
28 Seeding	acre	3.5	$3,200	$11,200	3.5	$3,200	$11,200	3.5	$3,200	$11,200
29 Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30 Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31 Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32 Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
Subtotal Construction Costs				**$328,824**			**$305,779**			**$179,033**
33 Waste Characterization	ea	0.0	$400	$0	13.8	$400	$5,531	0.0	$400	$0
34 Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	6,914	$120	$829,620	0	$120	$0
35 Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36 reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
Subtotal Waste Disposal Cost				**$0**			**$835,151**			**$0**
Total Construction and Waste Disposal Costs				**$328,824**			**$1,140,930**			**$179,033**
Construction Services										
1 Engineering (5% of subtotal construction costs)	ls	1	$16,441	$16,441	1	$15,289	$15,289	1	$8,952	$8,952
2 Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$32,882	$32,882	1	$30,578	$30,578	1	$17,903	$17,903
3 Contingency (20% of subtotal construction costs)	ls	1	$65,765	$65,765	1	$61,156	$61,156	1	$35,807	$35,807
Total Construction Services Costs				**$115,088**			**$107,023**			**$62,662**
TOTAL CAPITAL COSTS				**$443,912**			**$1,247,952**			**$241,695**
Annual Operation & Maintenance										
1 Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2 a Topsoil	cy	0	$21	$0	0	$21	$0	115	$21	$2,419.51
3 b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.35	$3,200	$1,120
Estimated Annual O&M Cost				**$0**			**$0**			**$3,540**
Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$3,540	**$106,185**
O&M Total Expenditure, 30 years				**$0**			**$0**			**$123,122**
O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$48,547**
Total cost				**$443,912**			**$1,247,952**			**$290,241**

SWMU 54

Planning Level Engineering Estimate for Remediation

Industial Use Soil Clean Up Objectives

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Excavation/Onsite Consolidation			Option 2: Excavation/Offsite Disposal			Option 3: Permeable Cover		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Load Out Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	0.27	$200	$53	0.27	$200	$53	0.27	$200	$53
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$1,101	$1,101	1	$1,101	$1,101	1	$1,101	$1,101
6	Dewatering	ls	0	$100,000	$0	0	$100,000	$0	0	$100,000	$0
7	Stream Realignment	lf	0	$100	$0	0	$100	$0	0	$100	$0
8	Dust control/suppression	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
9	Fencing	lf	0	$22	$0	0	$22	$0	0	$22	$0
10	reserved	ls	1	$0	$0	1	$0	$0	1	$0	$0
11	SWMU Boundary Survey	ls	1	$1,000	$1,000	1	$1,000	$1,000	1	$1,000	$1,000
12	Excavation (soil)	cy	2,179	$8	$17,432	2,179	$8	$17,432	0	$8	$0
13	Backfill material	cy	2,179	$18	$39,222	2,179	$18	$39,222	0	$18	$0
14	Spread and Compact	cy	4,358	$8	$34,864	2,179	$8	$17,432	0	$8	$0
15	Load (soil)	cy	2,179	$3	$6,537	2,179	$3	$6,537	0	$3	$0
16	Haul/Handling of Soils (on-site)	cy	2,179	$3	$6,537	4,358	$3	$13,074	0	$3	$0
17	Silt Fence (sediment control)	lf	1,520	$1.5	$2,280	1,520	$1.5	$2,280	1,520	$1.5	$2,280
18	Equipment Decontamination	ea	30	$250	$7,500	30	$250	$7,500	0	$250	$0
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	0	$1	$0
20	Ambient Air Monitoring	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$5,000	$0
21	Fly Ash for Stabilization	ton	0	$50	$0	0	$50	$0	0	$50	$0
22	Soil Blending for Stabilization	cy	0	$3	$0	0	$3	$0	0	$3	$0
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	29413	$0.2	$5,883
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	1634	$16	$26,145
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	545	$21	$11,438
28	Seeding	acre	0.27	$3,200	$856	0.27	$3,200	$856	0.27	$3,200	$856
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$5,000	$5,000	1	$5,000	$5,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	0	$75,000	$0	0	$5,000	$0	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000
	Subtotal Construction Costs				**$187,882**			**$176,987**			**$106,256**
33	Waste Characterization	ea	0.0	$400	$0	6.5	$400	$2,615	0.0	$400	$0
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	3,269	$120	$392,220	0	$120	$0
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$0**			**$394,835**			**$0**
	Total Construction and Waste Disposal Costs				**$187,882**			**$571,822**			**$106,256**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$9,394	$9,394	1	$8,849	$8,849	1	$5,313	$5,313
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$18,788	$18,788	1	$17,699	$17,699	1	$10,626	$10,626
3	Contingency (20% of subtotal construction costs)	ls	1	$37,576	$37,576	1	$35,397	$35,397	1	$21,251	$21,251
	Total Construction Services Costs				**$65,759**			**$61,946**			**$37,190**
	TOTAL CAPITAL COSTS				**$253,641**			**$633,768**			**$143,446**
Annual Operation & Maintenance											
1	Inspection and maintenance of permeable cover		**Cost captured in wetlands estimate**			**Cost captured in wetlands estimate**					
2	a Topsoil	cy	0	$21	$0	0	$21	$0	$54	$21	$1,143.84
3	b Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0.03	$3,200	$86
	Estimated Annual O&M Cost				**$0**			**$0**			**$1,229**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$1,229	**$36,882**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$42,765**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$16,862**
	Total cost				**$253,641**			**$633,768**			**$160,308**

APPENDIX G

Greenhouse Gas Emissions Calculations

Average fuel consumption: 6.5 mpg of diesel

Nearest Subtitle C landfill: Model City NY – 361 miles per one-way trip or 722 miles roundtrip

Sediment Disposal: Mass Removal: 1,372 roundtrips [17,829 CY/13 CY [standardard dump truck capacity)]

Soil Disposal: Industrial SCO 648 roundtrips [8,424 CY/13 CY (standard dump truck capacity)]]
Commercial SCO - 1,302 roundtrips [16,936 CY/13 CY (standardard dump truck capacity)

Media	Average MPG	Diesel Consumption per Mile	Miles (Roundtrip)	Total Number of Roundtrips	Total Number of Miles for All Roundtrips	Total Fuel Used (gallons)	Total CO2 Equivalent Emissions (metric tons)
Soil (Commercial SCO)	6.5	0.15	722	1302	940044	144622	1478
Soil (Industrial SCO)	6.5	0.15	722	648	467856	71978	736
Sediment	6.5	0.15	722	1372	990584	152398	1558

Media	Average MPG	Diesel Consumption per Mile	Miles (One-way trip)	Total Number of One-way Trips	Total Number of Miles for All One-Way Trips	Total Gallons Used During Project	Total CO2 Equivalent Emissions (metric tons)
Soil (Commercial SCO)	6.5	0.15	361	1302	470022	72311	739
Soil (Industrial SCO)	6.5	0.15	361	648	233928	35989	368
Sediment	6.5	0.15	361	1372	495292	76199	779

APPENDIX H

Sediment Corrective Measures Cost Estimates

Wetlands Complex

Planning Level Engineering Estimate for Remediation

Excavation, On-Site Consolidation and Capping

Dyno Nobel

Port Ewen, New York

Description	Unit	Option 1: Cleanup to SELs			Option 2: Cleanup to PRGs			Option 3: Mass Removal		
		Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Pre-Construction Costs										
1 Wetlands Survey	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
2 PRG Sampling and Development	ls	0	$250,000	$0	1	$250,000	$250,000	0	$250,000	$0
3 Delineation Sampling	ls	1	$100,000	$100,000	1	$100,000	$100,000	0	$100,000	$0
4 Permitting	ls	1	$100,000	$100,000	1	$100,000	$100,000	1	$100,000	$100,000
5 Contingency (20%)				$45,000			$95,000			$25,000
Total Pre-Construction Costs				**$270,000**			**$570,000**			**$150,000**
Construction Costs										
1 Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2 Site Preparation/Decon/Staging Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3 Clearing and Grubbing	acre	10.3	$200	$2,053	8.7	$200	$1,748	11.1	$200	$2,210
4 Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5 Spraying Vegetation	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
6 Dewatering	ls	1	$100,000	$100,000	1	$100,000	$100,000	1	$100,000	$100,000
7 Stream Realignment	lf	3329	$100	$332,900	3329	$100	$332,900	3329	$100	$332,900
8 Dust control/suppression	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
9 Fencing	lf	1,400	$22	$30,800	1,400	$22	$30,800	1,400	$22	$30,800
10 reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
11 Impacted Sediment Boundary Survey	ls	1	$10,000	$10,000	1	$10,000	$10,000	1	$10,000	$10,000
12 Excavation (sediment)	cy	16,557	$8	$132,457	14,102	$8	$112,812	17,829	$8	$142,631
13 Backfill material (for SWMU 1 and berms)	cy	9,367	$18	$168,606	9,367	$18	$168,606	9,367	$18	$168,606
14 Spread and Compact	cy	25,924	$8	$207,393	23,469	$8	$187,748	27,196	$8	$217,567
15 Load (sediment)	cy	16,557	$7	$115,900	14,102	$7	$98,711	17,829	$7	$124,802
16 Haul/Handling of Sediment (on-site)	cy	16,557	$3	$49,671	14,102	$3	$42,305	17,829	$3	$53,486
17 Silt Fence (sediment control)	lf	3,800	$1.5	$5,700	3,800	$1.5	$5,700	3,800	$1.5	$5,700
18 Equipment Decontamination	ls	1	$15,000	$15,000	1	$15,000	$15,000	1	$15,000	$15,000
19 Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	3000	$1	$3,000
20 Ambient Air Monitoring	ls	1	$50,000	$50,000	1	$50,000	$50,000	1	$50,000	$50,000
21 Fly Ash for Stabilization	ton	1987	$50	$99,343	1692	$50	$84,609	2139	$50	$106,973
22 Soil Blending/Loading for Stabilization	cy	16,557	$10	$165,571	17,366	$10	$173,660	17,829	$10	$178,288
23 Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24 Rock (material and placement)	ton	1289	$65	$83,785	1289	$65	$83,785	1289	$65	$83,785
25 Permeable Cover - Geotextile (in place)	sf	176656	$0.2	$35,331	176656	$0.2	$35,331	176656	$0.2	$35,331
26 Permeable Cover - 18" Fill/Clay (in place)	cy	8179	$16	$130,864	8179	$16	$130,864	8179	$16	$130,864
27 Permeable Cover - 6" Topsoil (in place)	cy	2726	$21	$57,246	2726	$21	$57,246	2726	$21	$57,246
28 Seeding	acre	3.5	$3,200	$11,200	3.5	$3,200	$11,200	3.5	$3,200	$11,200
29 Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30 Confirmatory Sampling and Reporting	ls	1	$50,000	$50,000	1	$50,000	$50,000	0	$50,000	$0
31 Equipment/Personnel Standby Time	ls	1	$75,000	$75,000	1	$75,000	$75,000	0	$75,000	$0
32 Site Survey/As-Built	ls	1	$10,000	$10,000	1	$10,000	$10,000	1	$10,000	$10,000
33 Wetlands Restoration	ls	2.5	$63,706	$159,265	2.5	$63,706	$159,265	2.5	$63,706	$159,265
34 Wetlands Creation	ls	12.9	$119,414	$1,539,729	10.6	$119,414	$1,267,092	14.1	$119,414	$1,680,917
Subtotal Construction Costs				**$3,742,315**			**$3,398,882**			**$3,812,070**
33 Waste Characterization	ea	58.5	$400	$23,400	42.3	$400	$16,922	53.5	$400	$21,395
34 Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	0	$120	$0	0	$120	$0	0	$120	$0
35 Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36 reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
Subtotal Waste Disposal Cost				**$23,400**			**$16,922**			**$21,395**
Total Construction and Waste Disposal Costs				**$3,765,715**			**$3,415,804**			**$3,833,465**
Construction Services										
1 Engineering (5% of subtotal construction costs)	ls	1	$187,116	$187,116	1	$169,944	$169,944	1	$190,604	$190,604
2 Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$374,232	$374,232	1	$339,888	$339,888	1	$381,207	$381,207
3 Contingency (20% of subtotal construction costs)	ls	1	$748,463	$748,463	1	$679,776	$679,776	1	$762,414	$762,414
Total Construction Services Costs				**$1,309,810**			**$1,189,609**			**$1,334,225**
TOTAL CAPITAL COSTS				**$5,345,525**			**$5,175,412**			**$5,317,689**
Annual Operation & Maintenance										
1 a Cover Inspection	ls	1	$5,000	$5,000	1	$5,000	$5,000	1	$5,000	$5,000.00
2 b Topsoil	cy	272.6	$21	$5,725	272.6	$21	$5,725	272.6	$21	$5,724.60
3 c Vegetative Cover	acre	0.35	$3,200	$1,120	0.35	$3,200	$1,120	0.35	$3,200	$1,120
Estimated Annual O&M Cost				**$11,845**			**$11,845**			**$11,845**
Total O&M Cost	years	30	$11,845	**$355,338**	30	$11,845	**$355,338**	30	$11,845	**$355,338**
O&M Total Expenditure, 30 years				**$412,013**			**$412,013**			**$412,013**
O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$162,456**			**$162,456**			**$162,456**
Total cost				**$5,507,981**			**$5,337,868**			**$5,480,145**

Wetlands Complex

Planning Level Engineering Estimate for Remediation

Excavation and Off-Site Disposal

Dyno Nobel

Port Ewen, New York

	Description	Unit	Option 1: Cleanup to SELs			Option 2: Cleanup to PRGs			Option 3: Mass Removal		
			Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost	Estimated Quantity	Unit Cost ($)	Total Cost
Pre-Construction Costs											
1	Wetlands Survey	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
2	PRG Sampling and Development	ls	0	$250,000	$0	1	$250,000	$250,000	0	$250,000	$0
3	Delineation Sampling	ls	1	$100,000	$100,000	0	$100,000	$0	0	$100,000	$0
4	Permitting	ls	1	$100,000	$100,000	1	$100,000	$100,000	1	$100,000	$100,000
5	Contingency (20%)				$45,000			$75,000			$25,000
	Total Pre-Construction Costs				**$270,000**			**$450,000**			**$150,000**
Construction Costs											
1	Mobilization/Demobilization	ls	1	$20,000	$20,000	1	$20,000	$20,000	1	$20,000	$20,000
2	Site Preparation/Decon/Staging Areas Setup/Erosion Control	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
3	Clearing and Grubbing	acre	10.3	$200	$2,053	8.7	$200	$1,748	11.1	$200	$2,210
4	Clearing and Grubbing (potential for energetic materials)	acre	0	$400	$0	0	$400	$0	0	$400	$0
5	Spraying Vegetation	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
6	Dewatering	ls	1	$100,000	$100,000	1	$100,000	$100,000	1	$100,000	$100,000
7	Stream Realignment	lf	3329	$100	$332,900	3329	$100	$332,900	3329	$100	$332,900
8	Dust control/suppression	ls	1	$25,000	$25,000	1	$25,000	$25,000	1	$25,000	$25,000
9	Fencing	lf	1,400	$22	$30,800	1,400	$22	$30,800	1,400	$22	$30,800
10	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
11	Impacted Sediment Boundary Survey	ls	1	$10,000	$10,000	1	$10,000	$10,000	1	$10,000	$10,000
12	Excavation (soil)	cy	16,557	$8	$132,457	15,518	$8	$124,144	16,664	$8	$133,312
13	Backfill material	cy	0	$18	$0	0	$18	$0	0	$18	$0
14	Spread and Compact	cy	0	$8	$0	0	$8	$0	0	$8	$0
15	Load (soil)	cy	14,485	$7	$101,395	14,102	$7	$98,711	16,414	$7	$114,898
16	Haul/Handling of Soils/Staging (on-site)	cy	16,557	$3	$49,671	15,518	$3	$46,554	17,829	$3	$53,486
17	Silt Fence (sediment control)	lf	3,800	$1.5	$5,700	3,800	$1.5	$5,700	3,800	$1.5	$5,700
18	Equipment Decontamination	ls	1	$15,000	$15,000	1	$15,000	$15,000	1	$15,000	$15,000
19	Decon Water/IDW Transportation & Disposal (non-hazardous)	gal	3000	$1	$3,000	3000	$1	$3,000	3000	$1	$3,000
20	Ambient Air Monitoring	ls	1	$50,000	$50,000	1	$50,000	$50,000	1	$50,000	$50,000
21	Fly Ash for Stabilization	ton	1987	$50	$99,343	1862	$50	$93,108	2000	$50	$99,984
22	Soil Blending/Loading for Stabilization	cy	16,557	$10	$165,571	15,518	$10	$155,180	16,664	$10	$166,640
23	Sheetpiling	lf	0	$80	$0	0	$80	$0	0	$80	$0
24	Rock (material and placement)	ton	0	$65	$0	0	$65	$0	0	$65	$0
25	Permeable Cover - Geotextile (in place)	sf	0	$0.2	$0	0	$0.2	$0	0	$0.2	$0
26	Permeable Cover - 18" Fill/Clay (in place)	cy	0	$16	$0	0	$16	$0	0	$16	$0
27	Permeable Cover - 6" Topsoil (in place)	cy	0	$21	$0	0	$21	$0	0	$21	$0
28	Seeding	acre	0	$3,200	$0	0	$3,200	$0	0	$3,200	$0
29	Miscellaneous/Warning Signs/Equipment Rental/Lighting/Site Cleanup	ls	1	$6,500	$6,500	1	$6,500	$6,500	1	$6,500	$6,500
30	Confirmatory Sampling and Reporting	ls	1	$50,000	$50,000	1	$50,000	$50,000	0	$50,000	$0
31	Equipment/Personnel Standby Time	ls	1	$75,000	$75,000	1	$75,000	$75,000	0	$75,000	$0
32	Site Survey/As-Built	ls	1	$10,000	$10,000	1	$10,000	$10,000	1	$10,000	$10,000
33	Wetlands Restoration	ls	2.5	$63,706	$159,265	2.5	$63,706	$159,265	2.5	$63,706	$159,265
34	Wetlands Creation	ls	12.9	$119,414	$1,539,729	10.6	$119,414	$1,267,092	14.1	$119,414	$1,680,917
	Subtotal Construction Costs				**$3,033,385**			**$2,729,702**			**$3,069,612**
33	Waste Characterization	ea	58.5	$400	$23,400	46.6	$400	$18,622	50.0	$400	$19,997
34	Off-Site Disposal of Non-Hazardous Soils (includes T&D by truck)	ton	24,836	$120	$2,980,287	23,277	$120	$2,793,240	24,996	$120	$2,999,520
35	Off-Site Disposal of Hazardous Soils (includes T&D by truck)	ton	0	$262	$0	0	$262	$0	0	$262	$0
36	reserved	ls	0	$0	$0	0	$0	$0	0	$0	$0
	Subtotal Waste Disposal Cost				**$3,003,687**			**$2,811,862**			**$3,019,517**
	Total Construction and Waste Disposal Costs				**$6,037,071**			**$5,541,563**			**$6,089,129**
Construction Services											
1	Engineering (5% of subtotal construction costs)	ls	1	$151,669	$151,669	1	$136,485	$136,485	1	$153,481	$153,481
2	Construction Mgt/Admin (10% of subtotal construction costs)	ls	1	$303,338	$303,338	1	$272,970	$272,970	1	$306,961	$306,961
3	Contingency (20% of subtotal construction costs)	ls	1	$606,677	$606,677	1	$545,940	$545,940	1	$613,922	$613,922
	Total Construction Services Costs				**$1,061,685**			**$955,396**			**$1,074,364**
	TOTAL CAPITAL COSTS				**$7,368,756**			**$6,946,959**			**$7,313,493**
Annual Operation & Maintenance											
1	a Cover Inspection	ls	0	$5,000	$0	0	$5,000	$0	0	$5,000	$0.00
2	b Topsoil	cy	0	$21	$0	0	$21	$0	0	$21	$0.00
3	c Vegetative Cover	acre	0	$3,200	$0	0	$3,200	$0	0	$3,200	$0
	Estimated Annual O&M Cost				**$0**			**$0**			**$0**
	Total O&M Cost	years	30	$0	**$0**	30	$0	**$0**	30	$0	**$0**
	O&M Total Expenditure, 30 years				**$0**			**$0**			**$0**
	O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$0**			**$0**			**$0**
	Total cost				**$7,368,756**			**$6,946,959**			**$7,313,493**

APPENDIX I

Groundwater and Indoor Air Corrective Measures Cost Estimates

Groundwater Alternative GW2
Planning Level Engineering Estimate for Remediation
Monitored Natural Attenuation
Dyno Nobel
Port Ewen, New York

Description				Unit	Alternative GW2 Monitored Natural Attenuation		
					Estimated Quantity	Unit Cost ($)	Total Cost
Annual Monitoring and Report							
	41	a	Monitoring and Reporting	ls	1	$16,000	$16,000
		b	Project Management	ls	1	$2,400	$2,400
			Estimated Annual O&M Cost				**$18,400**
			Total O&M Cost	years	30	$18,400	**$552,000**
			O&M Total Expenditure, 30 years				**$640,042**
			O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$252,367**

Indoor Air Alternative
Planning Level Engineering Estimate for Remediation
Annual Indoor Air Monitoring
Dyno Nobel
Port Ewen, New York

Description	Unit	Indoor Air Monitoring		
		Estimated Quantity	Unit Cost ($)	Total Cost
Annual Monitoring and Report				
41 a Monitoring and Reporting	ls	1	$5,000	$5,000
b Project Management	ls	1	$750	$750
Estimated Annual O&M Cost				**$5,750**
Total O&M Cost	years	30	$5,750	**$172,500**
O&M Total Expenditure, 30 years				**$200,013**
O&M Present Worth @ 7% discount, 1% inflation, 30 years				**$78,865**