INTERMEDIATE (60%) DESIGN REPORT FOR THE YORK OIL SUPERFUND SITE OPERABLE UNIT NO. 1

PREPARED FOR

PREPARED BY

PARSONS ENGINEERING SCIENCE, INC.
Syracuse, New York

PARSONS

AUGUST 1998
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ALUMINUM COMPANY OF AMERICA
MASSENA OPERATIONS
P.O. BOX 150
MASSENA, NEW YORK 13662

ALCOA

September 4, 1998

Mr. Arnold Bernas
U.S. Environmental Protection Agency
Region II
290 Broadway, 20th Floor
New York, NY

RE: York Oil Superfund Site (Operable Unit No. 1) - Intermediate (60%) Design Report

Dear Mr. Bernas:

Enclosed is the Intermediate Design report for OU-1 at the York Oil site. This report is being submitted in accordance with the OU-1 Consent Decree. It incorporates the Government's comments received on the Preliminary Design Report, including comments received from the State of New York during August.

Storm water from construction areas will be treated, if warranted. Confirmatory sampling will be conducted within the excavation areas to show the objective of 10 parts per million PCBs.

The only Government comments not addressed in this report pertain to testing for TCLP parameters and to an interim leachate collection system. TCLP parameters are not proposed to be addressed based on them not being defined as a concern within the OU-1 Record of Decision, Consent Decree or Statement of Work. At this site, lead is not significantly moving via any potential pathway such as groundwater. Regarding an interim leachate collection system, such a system is not needed, because PCBs are not seen in site groundwater which confirms for this site that they are associated with solids rather than with leachate or groundwater.

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(REVISIONS TO THE 30% DESIGN REPORT ARE HIGHLIGHTED)

INTERMEDIATE (60%) ~~PRELIMINARY (30%)~~ DESIGN REPORT FOR THE YORK OIL SUPERFUND SITE

Submitted to:

United States Environmental Protection Agency
Region II, New York, NY

Submitted by:

Aluminum Company of America
Massena, NY

Prepared By:

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AUGUST ~~APRIL~~ 1998

September 2, 1998

Mr. Arnold Bernas
U.S. Environmental Protection Agency
Region II
290 Broadway, 20th Floor
New York, NY

RE: York Oil Superfund Site (Operable Unit No. 1) - Intermediate (60%) Design Report

Dear Mr. Bernas:

Enclosed is the Intermediate Design report for OU-1 at the York Oil site. This report is being submitted in accordance with the OU-1 Consent Decree. It incorporates the Government's comments received on the Preliminary Design Report, including comments received from the State of New York during August.

Storm water from construction areas will be treated, if warranted. The only Government comments not addressed in this report pertain to testing for TCLP parameters and to an interim leachate collection system.

TCLP parameters are not proposed to be addressed based on the Consent Decree and Statement of Work. Any leaching of lead can be controlled by S/S using cement as demonstrated at many other waste sites. Bench-scale treatability results showed only one with a RLP lead level over 5 ppm following addition of cement even without a lead performance objective included in the bench-scale work. Additional cement can be added if needed based on pilot-scale treatability (i.e., full-scale demonstration) results. Regarding an interim leachate collection system, PCBs are not seen in site groundwater which confirms for this site that they are associated with solids rather than with leachate or groundwater.

Confirmatory sampling will be conducted within the excavation areas to show the objective of 10 parts per million PCBs.

Alcoa and the Parsons ES-Kiber team are ready to discuss the contents of this report at any time. Please contact me with any questions or comments as the Government's review of this document proceeds. We are proceeding with the procurement effort and with the project plans in the interim.

Very truly yours,

Aluminum Company of America

Patrick C. Dargan, P.E.
Project Coordinator

Enclosure

cc: V. Cardona, NYSDEC
B. Nelson, Malcolm Pirnie
U.S. DOJ (2)
M. Thomas, McDermott, Will & Emery
B. Thompson, de maximis
D. Babcock, Parsons ES
R. Semenah, Kiber Enviro. Services

(REVISIONS TO THE 30% DESIGN REPORT ARE HIGHLIGHTED)

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SECTION 1

INTRODUCTION

1.1 REPORT OBJECTIVES AND BACKGROUND

This report constitutes the submittal of intermediate ~~preliminary~~ plans and specifications as stated within Subtask 5.1.2~~1~~ of the Statement of Work attached to the Consent Decree for the York Oil Superfund site. It is an update of the 30% Design Report (Parsons ES, April 1997). ~~This report provides the basis of design for the York Oil remedy.~~ The Consent Decree binds the United States, including settling federal departments, the Aluminum Company of America (Alcoa), and various other settling defendants to implement the Record of Decision for the site proper signed by the United States Environmental Protection Agency (USEPA) on February 9, 1988. The 1988 Record of Decision (ROD) for the site proper is known as the ROD for Operable Unit Number 1 (OU-1).

Since 1995, Alcoa and its consultants for OU-1, Parsons Engineering Science, Inc., (Parsons ES) and Kiber Environmental Services, Inc., (Kiber) have been working with the Government to complete the tasks identified within the Statement of Work. Predesign investigation work was largely completed in 1996. Bench-scale solidification/stabilization soil testing and treatability testing for groundwater were both completed in early 1997. The predesign investigation report and bench-scale treatability reports for soil and groundwater were all submitted to the Government in April 1997. One additional four-day field effort requested by the Government was completed in October 1997 for which an addendum report was submitted in December 1997.

The investigation and feasibility study efforts for OU-2 were initiated in 1992 and have been conducted by the York Oil group of potentially responsible parties (including Alcoa) and their consultant, Blasland, Bouck and Lee, Inc. (BBL). OU-2 is comprised of the potential contamination pathways emanating from OU-1 which include surface water draining to the west and north from OU-1 and groundwater migrating to the south away from OU-1. The feasibility study for OU-2 was completed in March, and the USEPA issued a Proposed Remedial Action Plan for OU-2 in June 1998. A public meeting on the OU-2 proposed plan was held on July 13, 1998. ~~is being completed in early 1998 with a~~ A Record of Decision is expected to be issued by the USEPA for OU-2 later this year ~~during the Spring of 1998~~.

EPA has also conducted various investigations at the site since the ROD for OU-1 was issued.

1.2 REPORT ORGANIZATION

Including this introductory section, this report consists of five sections and eight appendices. Section 2 presents the requirements for the design and implementation of the York Oil remedy. These requirements are based on the remedy itself and on applicable or relevant and appropriate requirements that originate either from rules, regulations and other regulatory requirements or from steps essential for implementing a site remedy. Section 3 presents the design elements to the extent they have been formulated to date. Section 4 presents the organization of entities that will carry out the remedy as they have been identified to date. Section 4 also includes a ~~proposed~~ schedule for ~~initiating~~ conducting the OU-1 remedial action ~~early~~ within the 1999 construction season. ~~This schedule allows some time this year for merging OU-2 into the overall site remedy.~~ Finally, Section 5 lists the future submittals prior to implementing the remedy that are identified in the Statement of Work. The purpose of Section 5 is to provide all parties a "road map" for the design effort.

Appendix A herein is Appendix C from the 30% Design Report. Appendices B and C are the draft specification and the 60% drawings, respectively. Appendices A, B, F, G, and H from the 30% Design Report are not repeated herein (list of references, pertinent investigation results, letter notifications, groundwater flow model output, and extraction well filter pack design).

1.3 SITE LOCATION AND HISTORICAL SITE INFORMATION

The York Oil Site is located about one mile northwest of the Hamlet of Moira, in the Town of Moira, Franklin County, New York (see Figure 1.1). The site is approximately 20 miles southeast of Massena, New York and 10 miles west of Malone, New York. OU-1 is approximately 17 acres in size, including a 1,000 foot by 200 foot (i.e., 4.6-acre) strip of land called the Western Drainage Area (WDA) located west of the upland portion of the Site. OU-1 is located in the drainage area of Lawrence Brook, a tributary to the Deer River, which in turn discharges to the St. Regis River and ultimately to the St. Lawrence River. All of OU-1, except for the WDA, is enclosed with a six-foot high chain link fence.

The fenced portion of OU-1 slopes to the southwest and has generally sparse to moderate vegetative cover that has been in place since the early 1980s. Within the fenced portion of OU-1 is the area of Former Lagoons 1 and 2, which is now a large mound created by consolidation and stabilization activities conducted in the early 1980s. The flat area of Former Lagoon 3, located down slope (i.e., west-southwest) from Former Lagoons 1 and 2, is also within the fenced portion of OU-1. Adjacent to the fenced portion of OU-1 is the Town of Moira garage to the north, North Lawrence Road (County Route 6) to the northeast, an abandoned milk house to the east, and an abandoned railroad bed along the southern boundary of OU-1. The WDA and OU-2 are relatively flat.

Surface water leaving OU-1 drains to the southwest and passes through the Western Drainage Area via a drainage ditch. From the drainage ditch, water enters a beaver pond

within OU-2 and flows north-northwest before entering Lawrence Brook approximately three miles downstream of OU-1. The portions of OU-2 that received surface drainage from OU-1 include a portion of the Western Wetland and a portion of the Northwestern Wetland (formerly called Northwest Wetland No. 1 - see Figure 3 within the OU-2 feasibility study, BBL, 1997). Property parcels that make up OU-1 and OU-2 are privately owned. Neither OU-1 nor OU-2 are currently being used for any consistent purpose.

The York Oil Site was first used in 1954 by the York Oil Company, which recycled used oils collected from service stations, car dealers, certain federal facilities, and a variety of industrial facilities. The oil was processed with heat and a silica-based substance to remove impurities and dirt and then resold to a number of businesses. This operation was discontinued around 1962.

From 1962 to 1977, Pierce Brothers Oil Service, Inc., stored and processed used oils within the fenced portion of the York Oil Site. Processing of used oils at the site was discontinued in the mid-1960s; from then until 1977 the site was an oil storage facility. Some oil accepted by the facility contained polychlorinated biphenyls (PCBs) and other constituents. Oil was stored in storage tanks and in Former Lagoons 1, 2 and 3. Residuals that settled in the lagoons were separated from light oils that were decanted and sold as fuel oil.

Investigation work at OU-1 was conducted during the mid-1980s by consultants working for EPA. The Addendum Feasibility Study for OU-1 was completed in 1987. EPA also conducted additional investigation work at OU-1 in 1994 and 1995 prior to the 1996 predesign investigation effort conducted by Alcoa and Parsons ES. Appendix A includes a list of OU-1 investigation report deliverables.

Investigation work at OU-2 began in 1992. The feasibility study from OU-2 was submitted in 1996 and revised in 1997. Final revisions to the OU-2 FS are being completed in early 1998. Appendix A includes a list of OU-2 investigation report deliverables.

1.4 SITE REMEDIAL ACTION OBJECTIVES AND SELECTED REMEDY

The objective for the remedial action at York Oil OU-1, as presented in the Record of Decision and in the Statement of Work (SOW) for OU-1, is to prevent further contaminant migration from impacting human health and the environment by:

- Eliminating the potential for direct contact with OU-1 wastes,
- Eliminating the migration of PCB-contaminated oils and other contaminants via surface water and groundwater, and

- Eliminating the potential for precipitation/infiltration water to react with the OU-1 wastes.

The remedy selected for OU-1 as outlined in the ROD and the Consent Decree consists of the following elements:

(1) Excavation of soils and sediments from the site (which includes the former lagoon areas and the WDA) containing PCBs greater than 10 mg/kg or parts per million (ppm), onsite solidification/stabilization (S/S) of this material, placement of the S/S material within the same unit from which it originated (i.e., site proper), installation of a low permeability cover (consistent with RCRA landfill closure requirements, 40 CFR Part 264.310 and Title 6, Part 360 of the New York Code of Rules and Regulations (6NYCRR Part 360)) over these areas, and surface grading;

(2) Installation of deep groundwater drawdown wells along the southern and western perimeter of the site to collect what is referred to in the ROD as a "sinking" contaminant plume and installation of shallow dewatering wells to collect contaminated groundwater and oil during excavation of soils and sediments;

(3) Onsite treatment of the collected contaminated groundwater with subsequent discharge of the treated groundwater in accordance with limits established by the New York State Pollutant Discharge Elimination System requirements;

(4) Offsite thermal treatment of tank oils and other oils collected previously at the site (this action was completed by Alcoa in 1994);

(5) Cleaning and demolition of the empty tanks, and disposal of all drums and materials stored in drums in accordance with applicable or relevant and appropriate requirements (this action was completed by Alcoa in 1994);

(6) Bench-scale treatability studies to determine optimal physical/chemical fixation mixtures for S/S of the soils/sediments. These bench-scale studies were completed in 1996-1997 by Alcoa and its OU-1 consultants. Pilot-scale S/S testing will be conducted as the initial step of the full-scale S/S effort;

(7) Bench-scale treatability studies to determine the optimal treatment system for the groundwater to be collected based on items (2) and (3) above. These bench-scale studies were completed in 1996-1997 by Alcoa and its OU-1 consultants;

(8) A cultural resources survey in accordance with the National Historic Preservation Act (completed in 1996 as part of the OU-1 predesign investigation); and

(9) Long-term groundwater monitoring and a review of the remedy at least every five years.

In addition, the USEPA installed three recovery wells, and, in 1995, Alcoa installed a 300-foot long interception trench. The purpose of these recovery wells and the interception trench was to prevent light nonaqueous phase liquid (LNAPL) (or oil) from leaving the site and migrating downstream. The trench is approximately 300 feet in length extending east-west along the southern side of the fenced (upland) portion of OU-1 downgradient of where LNAPL has been observed. The trench is now in its third year of operation, and ~~To date,~~ no significant quantities of LNAPL have been collected.

For OU-2, remedial action objectives and the selected remedy ~~have not yet been proposed by the USEPA for review and comment as part of a Proposed Remedial Action Plan.~~include removal of sediment from OU-2 followed by consolidation and solidification/stabilization of OU-2 sediment within OU-1. Locations and quantities of sediment to be removed have not yet been fully delineated.

1.5 YORK OIL REMEDIAL DESIGN ELEMENTS

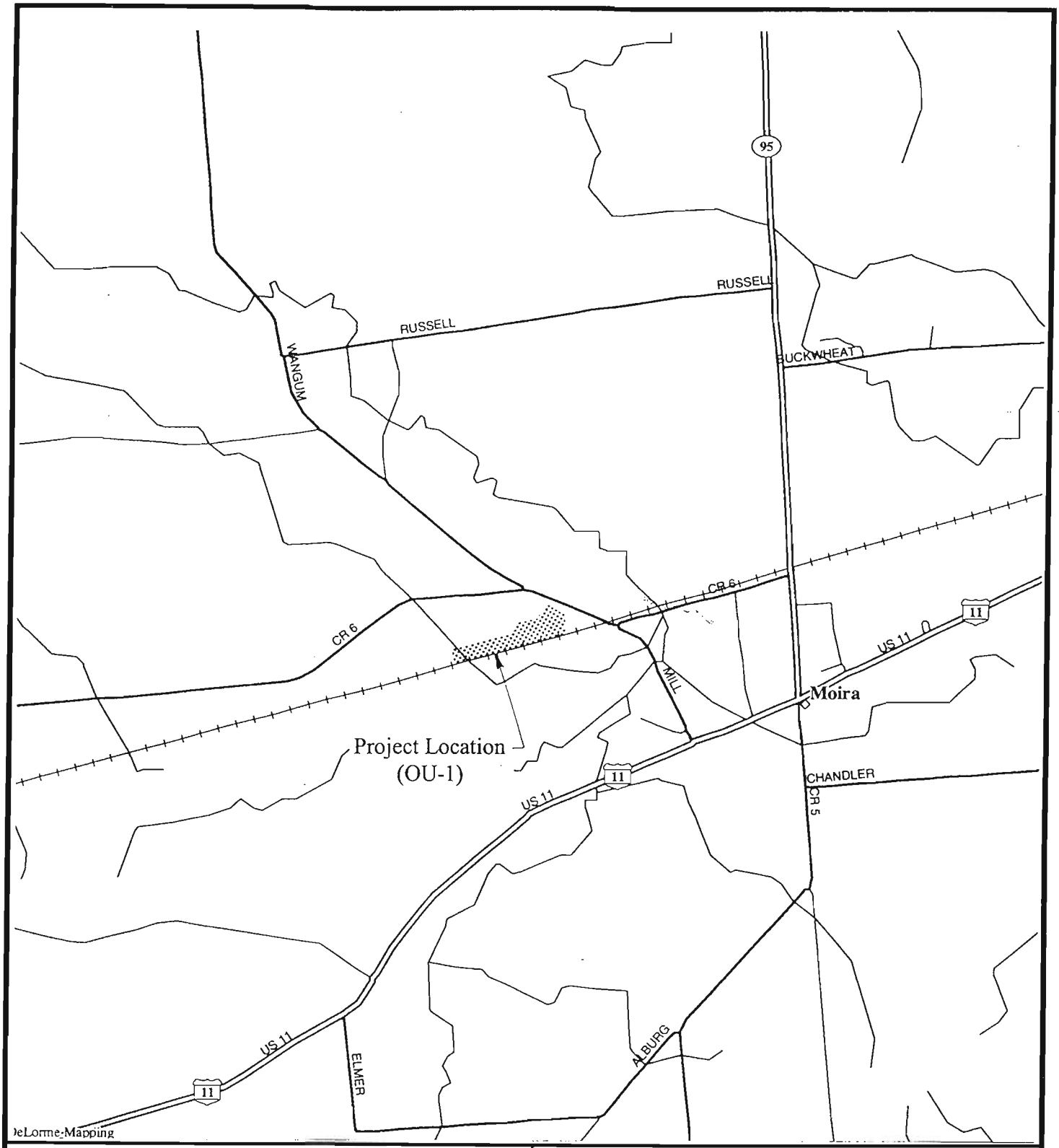
The following are the design elements addressed in this report. They are the elements on which this ~~30~~60 percent design is based as described in Sections 2 and 3.

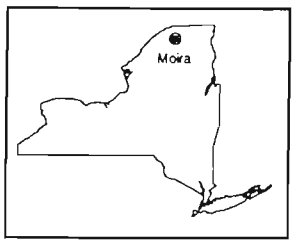
- Regulatory requirements presented in Section 2 for items such as wetland disturbance (U.S. Army COE, ~~and~~ NYSDEC, USEPA, and USFWS), stormwater (NYSDEC), and discharge of treated groundwater (NYSDEC and USEPA) as well as other requirements;
- Site preparation to prepare the site for the remediation effort and to limit the impact of earthwork on adjacent areas as needed;
- ~~Preliminary e~~Excavation and grading plans to accommodate consolidated and treated soil including earthwork balance calculations and locations and depths above the water table for placing treated soil;
- Plans for capping over consolidated and treated soil and sediment within the upland area including the cap extent, cross-section, and materials;
- Wetland restoration due to sediment removal.
- Solidification/stabilization (S/S) including an example site design, plans for pilot-scale testing, defining full-scale S/S requirements based on bench-scale test results, and methods to confirm S/S effectiveness;
- Stormwater control measures;
- Waste liquid (i.e., LNAPL) management and groundwater extraction including removal methods, locations, and sizes of extraction equipment and impacts of pumping groundwater on adjacent wetlands; and

- Groundwater treatment, storage, and disposal, including an example groundwater treatment process design.

This ~~30~~ 60 percent submittal includes four types of information: (1) a description of the basis of design which includes assumptions and calculations; (2) example designs for the solidification/stabilization and groundwater treatment efforts, (3) ~~preliminary~~ drawings and/or diagrams showing soil excavation, soil consolidation and grading following treatment, and groundwater extraction, (4) a listing of future submittals based on a proposed schedule, and (5) draft~~a listing of design drawings and~~ specifications.

Summaries of analytical results from sampling used as a basis of this design effort are presented in Table 3.1 and in Appendix B of the 30% design report. Sampling at this site has included the 1984-1987 RI/FS effort conducted for the NYSDEC, the 1993-1994 OU-2 investigation work conducted for potentially responsible parties, the 1994-1995 investigation work conducted for the USEPA, and the 1996-1997 predesign investigation and treatability work conducted for Alcoa by Parsons Engineering Science. Each of these sampling and analytical efforts were performed in accordance with approved quality assurance plans developed specifically for these individual projects. As needed, data qualifiers identified by data validators are included with the results.





NEW YORK
QUADRANGLE LOCATION

Scale 1:31,250 (at center)

2000 Feet

1000 Meters

FIGURE 1.1

YORK OIL SUPERFUND SITE
MOIRA, NEW YORK

SITE VICINITY MAP

PARSONS ENGINEERING SCIENCE, INC.
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SECTION 2

SITEWIDE REMEDIATION REQUIREMENTS AND CRITERIA

2.1 APPLICABLE OR RELEVANT AND APPROPRIATE REGULATORY REQUIREMENTS

Remediation requirements and criteria include regulatory requirements and elements of the remedy selected by EPA to be implemented within OU-1. Regulatory requirements that pertain to the York Oil remedial design are summarized in this subsection based on chemical-specific, location-specific, and action-specific requirements.

2.1.1 Chemical-Specific Requirements

These requirements include the following:

- Excavation of soil and sediment within OU-1 based on 10 ppm of total PCBs as specified within the ROD for OU-1. Specific requirements for OU-2 have not yet been determined.
- Treatment of soil and sediment based on a TCLP PCB requirement of 0.5 part per billion (ppb) or lower of leachable PCBs and a minimum unconfined compressive strength of 100 pounds per square inch (psi) after 28 days of curing. These requirements are specified within the Statement of Work that is attached to the Consent Decree for the OU-1 remedy.
- New York State groundwater and surface water quality standards, particularly as they pertain to discharging groundwater that is pumped and treated as specified within the Record of Decision for OU-1. Discharge requirements established within the State of New York under the State Discharge Permit Elimination System are based on meeting water quality standards for the body of water receiving the discharge. The ditch flowing west and then north away from OU-1 is regulated by the State of New York as a Class C(t) surface water, so surface water quality standards for Class C(t) waters are applicable for discharging pumped groundwater.
- USEPA water quality criteria.
- State requirements pertaining to emissions of volatile compounds from water treatment operations based on New York State ambient air quality standards and ambient level guidelines from the NYSDEC's Division of Air Resources.

2.1.2 Location-Specific Requirements

These requirements are associated with protecting existing resources potentially impacted by site remediation activities. Location-specific requirements pertaining to the proposed remediation are the following:

- Protecting wetland resources - accomplished by working with the EPA, the U.S. Fish and Wildlife Service, the Department of Environmental Conservation (DEC) within New York State, and the U.S. Army Corps of Engineers (New York District). Specific requirements will need to be met based on dredge and fill requirements administered by the U.S. Army Corps of Engineers, Executive Order 11990 for protecting wetlands, and New York State regulations for protecting freshwater wetlands.

- Protecting threatened and endangered species - Appropriate federal agencies (i.e., EPA, the U.S. Fish and Wildlife Service, and the National Marine Fisheries Service) and the State DEC have compiled information and experience to assess whether such species could be impacted by the remediation. Based on contacts with these agencies, no threatened or endangered species are suspected of being present within the vicinity of the York Oil site.

- Protecting navigable waterways - Sediment removal and any filling that takes place within wetlands is subject to Federal and State requirements to protect the wetland resource and to protect downstream navigable waters. Discharges of dredged or fill material into waters of the United States (which include the wetland areas at this site) must be authorized.

- Protecting fish and wildlife - Such measures are only needed if remediation activities are determined to significantly impact fish and wildlife. Such a need usually comes from permanent stream channel relocation or related physical modifications rather than from temporary modifications that are part of the site remedy.

- Protecting cultural and historical resources - It must be shown that resources that can be protected under Federal or State programs do not exist within the vicinity of the site. If they do exist, they need to be protected. A cultural resource survey has been conducted as part of the OU-1 Predesign Investigation (Parsons ES, 1997a). In addition, contacts with agencies have already been made, and such resources have not been identified within the site vicinity.

- Protecting waters - Since the ditch flowing west and north away from OU-1 is classified as Class C(t), it is subject to 6NYCRR Part 608, Use and Protection of Waters. A water quality certification will be needed.

In addition to the above requirements, floodplains as located by the Federal Emergency Management Agency also need to be protected. As noted on page 3-9 within the OU-1 Remedial Investigation, the 100-year floodplain (area flooded from a specific

storm predicted to occur once in 100 years) associated with the watershed where the York oil site is located (i.e., Lawrence Brook) does not extend to the OU-1 or OU-2 areas.

2.1.3 Action-Specific Requirements

These requirements are associated with specific elements of the remedy for the York Oil site:

- Soil and sediment movement, treatment, and disposal - Federal and State requirements that pertain to treatment, storage, and disposal of solid and hazardous wastes have been thoroughly evaluated as part of the remedy selection process summarized within the Record of Decision for OU-1.
- Construction worker and exposure protection - Occupational Safety and Health Administration requirements pertaining to work at hazardous waste sites will be included within the documented project requirements to ensure that workers are properly protected. Site monitoring will be conducted as warranted to assure concentrations at the perimeter of the exclusion zone do not exceed requirements.
- Stormwater and erosion control during remediation - Requirements equivalent to those contained within a general permit from the DEC for stormwater discharges will need to be met, because more than five acres will be disturbed. A stormwater pollution prevention plan is the key technical requirement; this plan will be included with the 95%~~project~~ specifications. Existing drainage patterns will be used wherever possible. Slopes and channels will be designed and constructed to minimize erosion to the extent practicable. Likely construction measures to control erosion and sedimentation during remediation will include silt fences, hay bales, and, where appropriate, temporary vegetation.
- Stormwater and erosion control following remediation - A stormwater discharge permit is not required for a capped landfill.
- Water and air discharges - State discharge requirements for monitoring and treating groundwater and air emissions (if any) will be met. ~~by c~~Coordination~~ng~~ with the USEPA and NYSDEC ~~State DEC~~ contacts is ongoing as the design of this remedy continues.
- Local building authorization - The Town of Moira has a procedure for documenting the construction of a building. Such a building would house the groundwater treatment system onsite.
- Implementation of institutional controls, such as deed restrictions, affecting future use of the property. The following three elements are being evaluated relative to institutional controls: (1) the only permissible site use will be commercial/industrial, (2) any subsurface excavation must be conducted under OHSA hazardous waste regulations, as found in 29 CFR 1910.120, with

excavated material disposed according to prevailing regulations, and (3) water supply well installation will be prohibited.

2.2 SITEWIDE REMEDIATION PERFORMANCE CRITERIA

The following are performance criteria based on the various requirements for the York Oil remediation effort discussed in Subsection 2.1.

- Soil and sediment excavation based on 10 ppm PCBs in OU-1 and requirements for OU-2 that have not yet been specified. In addition, LNAPL will be removed from two small areas of OU-1: (1) at GP-43, RW-2, and at YO-16S adjacent to the southern edge of the Mound and (2) at GP-18-OFF and GP-YO-9 near the interception trench. At these two locations, LNAPL was observed in significant quantities during the 1996 and 1997 OU-1 predesign investigation efforts adjacent to, but outside, the PCB excavation areas based on 10 ppm of total PCBs in the soil.
- Soil and sediment that is excavated and contains concentrations of total PCBs over 10 ppm will be treated to meet the maximum TCLP PCB requirement of 0.5 ppb total leachable PCBs and the minimum unconfined compressive strength of 100 psi after 28 days of curing. Treatment will be conducted using Portland Cement or an equivalent reagent based on bench-scale test results using various site samples from four different portions of OU-1. Pilot-scale testing will be conducted prior to full-scale soil treatment to further evaluate soil treatability.
- Material from the former lagoons will be managed to address *cis*-1,2-DCE that is the source of groundwater quality standard exceedances in deep groundwater downgradient of OU-1. The sinking phenolics plume referenced in the ROD for OU-1 is not evident at the site. Based on available analytical results for site media samples, the *cis*-1,2-DCE appears to be originating from within the Mound and, to a lesser extent, from the Former Lagoon #3 area.
- Construction workers will be protected and the site air quality will be monitored during construction in accordance with the construction health and safety plan that will be prepared and submitted for review and approval before construction is initiated.
- The area where soil and sediment is to be consolidated following treatment will be capped in accordance with RCRA and NYSDEC 6NYCRR Part 360 landfill closure requirements.
- Impacts of the remediation on local wetlands ~~will be~~ are being addressed as warranted in accordance with requirements administered jointly by the Army Corps of Engineers and the NYSDEC.
- Stormwater and erosion will be controlled during and following construction based on State of New York requirements.

- Groundwater that is extracted will be treated to meet State of New York surface water discharge requirements appropriate for the Lawrence Brook watershed, which will receive the treated water. These requirements ~~will be~~ are being developed in conjunction with the NYSDEC as this design effort continues.
- Any air discharge from groundwater treatment units would meet State of New York air quality requirements.
- Building construction for the groundwater treatment system will be done following Town approval.
- Remediation activities on various properties will be based on access arrangements currently being discussed with the various property owners.

2.3 NOTIFICATION REQUIREMENTS AND STATUS

Table 2.1 lists agency interactions anticipated in association with this remediation effort. Table 2.2 lists the pertinent contacts that have been identified. While formal permits are not needed for a CERCLA site remediation, the applicable permit requirements will be met.

As shown in Table 2.1, four of these agencies have already been contacted and their responses have been obtained: (1) NYS Office of Parks, Recreation, and Historic Preservation, (2) U.S. Fish and Wildlife, pertaining to threatened or endangered species and critical habitats, (3) National Marine Fisheries Service for the same reason as for contacting the U.S. Fish and Wildlife Service, and (4) NYS Natural Heritage Program at the NYSDEC Wildlife Resources Center. Response letters from each of these four agencies are included in Appendix F of the 30% Design Report. Responses from these agencies do not identify any cultural resources, threatened or endangered species, or critical habitat that require particular mitigation during remediation.

Table 2.1 also indicates the remaining contacts that are being made and will be made prior to completing ~~during the next (i.e., intermediate or 60%) phase of~~ the design process.

2.4 ACCESS NEEDS DURING REMEDIATION

Access needs to be obtained from the various property owners in order for the remediation work to be completed. OU-1 consists of portions of three parcels.

Alcoa is in the process of obtaining access and permission from property owners to remediate within OU-1 based on information available about property ownership from local tax maps.

TABLE 2.1

AGENCY NOTIFICATION REQUIREMENTS FOR YORK OIL REMEDIATION

Application/Form	Responsible. Agency	Supporting Documentation	Estimated Submittal Timeframe
Nationwide 38 Permit (Sect. 404 Clean Water Act) Joint Applic. for Permit x - Freshwater Wetlands x - Freshwater Wetlands x - Disturbance of bedding *Form 95-19-3 (6/95) -7e*	~~USCOE/NYSDEC~~USEPA and NYSDEC with input from U.S. Fish and Wildlife Service (USFWS) and U.S. Army Corps of Engineers, as appropriate.	• Notice of Intent • Remediation Project Scope of Work narrative. Indicate its an NPL/ CERCLA site. • Location Map (USGS Quad) • Site/Remediation/Grading Plan • Details (e.g., Erosion & Sed Controls, cross-sections, treatment options) • Photographs of the Project Area • Statement of the status of Endangered/ Threatened Species Resources Archaeological Resources • Vegetative Community Species List • Wetlands Delineation Report • Wetlands Restoration Program/Plan	~~60%~~ ~~Design~~Onsite discussions with NYSDEC held August 18, 1998
401 Water Quality Certification	USEPA and NYSDEC ~~Region 5 Regional Permit Admin.~~	• Notice of Intent • Complete copy of package submitted to the New York District ~~USCOE~~Army Corps of Engineers	~~60~~95% Design
Request for Authorization Letter	NYS Office of Parks, Recreation, & Historic Preservation (OPRHP)	• Letter of Intent requesting OPRHP to identify any potential resource in the project area • Scope of Work - Brief remedy narrative • Location Map (USGS Quad w/site location) & Cultural Resource Survey prep for York Oil	Completed
Request for Authorization Letter	~~U.S. Fish & Wildlife Service (USWFS)~~	• Letter of Intent requesting USWFS to identify any potential endangered or threatened species or critical habitats in the project area. • Scope of Work - Brief narrative of remedy • Location Map (USGS Quad with site location)	Completed
Request for Authorization Letter	National Marine Fisheries Services (NMFS)	• Letter of Intent requesting NMFS to identify any potential endangered or threatened species or critical habitats in the project area • Scope of Work - Brief narrative of remedy • Location Map (USGS Quad with site location)	Completed

TABLE 2.1

AGENCY NOTIFICATION REQUIREMENTS FOR YORK OIL REMEDIATION

Application/Form	Responsible. Agency	Supporting Documentation	Estimated Submittal Timeframe
Request for Authorization Letter	NYS Natural Heritage Program, NYSDEC Wildlife Resources Center	• Letter of Intent requesting NYSNHP to identify any potential endangered or threatened species or critical habitats in the project area • Scope of Work - Brief narrative of remedy • Location Map (USGS Quad with site location)	Completed
Stormwater Management& Erosion Control Plan General Permit (Stormwater Pollution Prevention)	USEPA and NYSDEC Division of Water	• Notice of Intent to Discharge • Stormwater management scope of work narrative. Indicate its an NPL/CERCLA site • Erosion & Sedimentation Control Plan	At ~~60~~95% design
SPDES (substantive requirements)	USEPA and NYSDEC Division of Water	• Notice of Intent to Discharge • Wastewater management scope of work narrative. Indicate its an NPL/CERCLA site. • Details and tech info including : 1) Site status & site number 2) DHWR Engineer contact 3) Treatment system description 4) Discharge rate and duration 5) Description of receiving stream 6) Wastewater monitoring data (e.g., if system is new, then provide soil/sediment, groundwater, and surface water sampling data as representative of projected influent constituents) • ~~Sampling & Analysis Plan - Implemented for the duration of the treatment system operation~~ • Request effluent discharge criteria (suggest that Best Available Technology/Best Available Practice (BAT/BAP) criteria be used, along with the applicable analytical methods) • Sampling & Analysis Plan - Implemented for the duration of the treatment system operation	~~At 60% design~~Submitted August 6, 1998 Project Plans (with 95% Design)

TABLE 2.1

AGENCY NOTIFICATION REQUIREMENTS FOR YORK OIL REMEDIATION

Application/Form	Responsible. Agency	Supporting Documentation	Estimated Submittal Timeframe
Local Building Permit (Bldg. Permit Applic./Form)	**Town of Moira**	• Notice of Intent to construct a building to house a groundwater treatment system as part of a long term operation at the site • Location Map of the site (USGS Quad & Local) • Drawings of the structure (plan & profile)	**At ~~60~~95% design**

TABLE 2.2

REGULATORY AGENCY CONTACTS OUTSIDE THE SUPERFUND PROGRAM FOR THE YORK OIL REMEDIATION

Corps of Engineers

Ms. Kim Copenhaver
Project Manager
Department of the Army
New York District, Corps of Engineers
Albany Field Office
One Bond Street
Troy, New York 12180
(518) 270-0589

Regional NYSDEC

Mr. Kenneth Kogut~~Richard Wild~~
Regional Permit Administrator
NYS Department of Environmental Conservation
Region 5
P.O. Box 296
Ray Brook, NY 12977-0296
(518) 897-1291~~34~~

US Fish and ~~w~~Wildlife Service

Mr. Michael Stoll
U.S. Fish & Wildlife Service
3817 Luker Road
Cortland, New York 13045
(607) 753-9334

NYSNHP NYSDEC WRC

Ms. Kathryn Schneider
Director
Information Services
New York State Natural Heritage Program (NYSNHP)
NYS Department of Environmental Conservation
Wildlife Resources Center (WRC)
700 Troy Schenectady Road
Latham, New York 12110-2400
Director Phone: (518) 783-3937

Alternate:
Ms. Rachel Novak
Info Services Rep. NYS NHP
(518) 783-3932

TABLE 2.2

(CONTINUED)

REGULATORY AGENCY CONTACTS OUTSIDE THE SUPERFUND PROGRAM FOR THE YORK OIL REMEDIATION

NMFS

Ms. Diane Rusanowsky
Fishery Biologist
U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service (NMFS)
Habitat and Protected Resources Division
212 Rodgers Avenue
Milford, Connecticut 06460-6499
Administration: (203) 783-4261

Alternate
Mr. Michael Ludwig, NMFS
(203) 783-4213

NYS OPRHP

Mr. James Warren
New York State Office of Parks, Recreation, and Historic Preservation (OPRHP)
Field Services Bureau - P.O. Box 189
Peebles Island State Park
Waterford, New York 12188-0189
(518) 237-8643

Alternate:
Ms. Ruth L. Pierpont
Director, Historic Preservation
Field Services Bureau

NYSDEC DOW

Mr. Robert Wither
NYS Dept. of Environmental Conservation
Chemical Systems Section
Division of Water (DOW)
50 Wolf Road
Albany, New York 12233-3505
(518) 457-0661

Alternate:
Mr. Angus Eaton
NYSDEC DOW

Town of Moira

Mr. Warren Lane
Code Official
P.O. Box 150
Town of Moira
Moira, New York 12957
(518) 529-6080
Fax: (518) 529-0045

Alternate:
Ms. Rita Hutchin
Town Supervisor
Town of Moira

Note:
Code official is in the office building only one day per week on Wednesday morning.

SECTION 3

DESIGN ELEMENTS AND STATUS

3.1 INTRODUCTION

This section provides specific design information for each aspect of the OU-1 remediation: site preparation, excavation, capping, restoration, wetland management, solidification/stabilization, stormwater/erosion and sediment control, LNAPL management, groundwater extraction, and groundwater treatment and discharge. Design information for OU-2 cannot be provided until the Record of Decision for OU-2 is issued by EPA.

Drawings showing the preliminary excavation and grading plans and the groundwater treatment processes are included. Much of the information provided in this section will be incorporated into the specifications for contracting the work. A draft listing of the types of drawings and specifications currently anticipated is also included (see Appendix D). A draft of the specifications themselves will be provided with the 60% (intermediate) design package.

Topographic surveys of the York Oil site features and/or sampling locations have been performed by Erdman Anthony, Associates (EA) from 1984 through 1987, Blasland, Bouck and Lee (BBL) in 1995 based on 1992 aerial photography, OH Materials Corporation (OHM) in 1995 and Parsons ES in 1996. The BBL survey established the topography for the site and the locations of major features such as roads, buildings, and fences. The OHM and Parsons ES surveys of sampling locations, as well as this remedial design for OU-1, were based on the previous BBL survey.

Although the OHM survey was based on the BBL survey, discrepancies noted between the two surveys needed to be reconciled in order to incorporate the investigation information from both efforts into this design. To reconcile the discrepancies, results from the OHM survey were adjusted, while results from other surveys were not adjusted. The site, as shown on the OHM survey, was approximately 35 feet less in length from east to west, than shown on the BBL survey. The locations of permanent structures such as roads, buildings, fences, and wells varied. Additionally, an elevation difference of approximately seven feet was noted in the well casing and groundwater elevations. Since the OHM survey was based on the BBL survey, which in turn, was based on aerial photos, the BBL survey has been assumed to be correct. On this basis, the OHM well casing and groundwater elevations have been adjusted by seven feet to match the elevations established by BBL. In addition, the Geoprobe (GP) sample locations included in the OHM survey have been adjusted to best fit the BBL survey by aligning the location of well YO-15 from each survey. YO-15 is located near the center of the GP sampling area; therefore, any GP sample location discrepancies have been minimized. Most importantly,

the excavation areas have been made large enough to account for the GP sample location discrepancies. A new survey of the GP sample locations cannot be performed, because the GP sample locations were not permanently marked.

3.2 SITE PREPARATION

Prior to beginning any excavation work, temporary silt fencing will be erected. The temporary silt fencing will be maintained throughout the project and will not be removed until permanent vegetation has been established.

OU-1 will be cleared of trees, other vegetation, and structures as needed. Woody material from the clearing and grubbing of above-ground stems and trees will be chipped and ~~either reused as mulch on-site or stockpiled~~ placed beneath the cap. Stumps that are removed will be chipped and handled with the soil. Metallic material, such as worn portions of fencing, will be taken down to provide access. Miscellaneous metal debris will be buried beneath the cap or disposed of at an off-site scrap metal recycling facility. Other oversized material will be placed beneath the cap. Topsoil and vegetation will be stripped from sections where soil is to be excavated. The stripped material will be stockpiled and reused in thin layers as on-site fill material, as warranted. Fill below the water table will be clean fill in accordance with the excavation plan (Drawing C-2). Clearing will also include demolition of former drainage structures within OU-1 as needed to implement the excavation plan. The LNAPL interception trench will be removed, as needed, to conduct the excavation efforts. The existing subsurface electrical line inside the eastern and southern fence lines ~~will be protected during construction activities or~~ will be replaced with a new subsurface line following the OU-1 earthwork. Certain monitoring wells within the excavation area will be properly abandoned.

3.3 EXCAVATION PLAN

Areas within OU-1 to be excavated are shown on the ~~preliminary~~ excavation plan (see Drawing C-2 in Appendix E). These areas are based on locations where soil contains PCBs at total concentrations above 10 ppm based on the multiple soil investigations conducted at this site since 1985. Background information for the earthwork design effort is presented in Appendix ~~-~~B of the 30% design report~~.~~ In addition, as discussed in Section 3.9, LNAPL will be removed by extracting or excavating two areas adjacent to the excavation areas where significant thicknesses (i.e., 0.5 foot or more) of LNAPL have been observed within monitoring wells.

The locations of former lagoons #1, 2, and 3 shown on Drawings C-1, C-2, and C-4 are based on aerial photographs of the site from 1962, 1968, 1972, and 1978, which clearly showed the extent of each separate lagoon. Locations with total PCB concentrations greater than or equal to 10 ppm are predominantly within or directly downgradient of the lagoon areas.

Former Lagoons #1 and 2 (Mound)

Former lagoons #1 and 2 contain clean fill over oil-stained soil and oily sludge. The oily sludge is approximately ~~two to~~ four to nine feet thick at a depth of 12 to 26 feet below the existing ground surface. Based on boring logs, the bottom of the oily sludge is approximately at elevation 382 feet in lagoon #1 and elevation 378 in lagoon #2. Based on site investigation results, the oily sludge contains material with more than 10 ppm of total PCBs, but not at all locations. The oily sludge also contains *cis*-1,2-DCE and appears to be the source of *cis*-1,2-DCE in the deep groundwater.

Once the overlying soil has been removed, the oily sludge from within the Mound will be excavated. Excavation and backfilling of former lagoons #1 and 2 will proceed as follows:

a. Remove and stockpile the clean fill at the top of the mound;

b. Remove and stockpile the oil-stained soil that contains less than 10 ppm total PCBs based on test kit results and keep separate from the clean fill;

c. Remove and solidify/stabilize the oily sludge and soil that contains more than 10 ppm total PCBs; based on test kit results;

d. Perform confirmatory sampling of the excavation bottom and sides for total PCBs in accordance with the sampling and analysis project plan to be submitted with the 95% (prefinal) design. Excavate further if needed based on confirmatory sampling results.;

e. Place the clean site fill, and imported clean fill as needed to an elevation of 383 feet ~~384~~ up to 389 feet (see Drawing C-2)which is, based on available monitoring data, the estimated maximum groundwater elevation after capping. Placement of fill will be in accordance with compaction specifications to minimize settlement in the bottom of the excavation. As needed, water will be removed prior to placing fill;

f. Place material from the three former lagoons that contains less than 10 ppm total PCBs and the treated material on top of the clean fill in accordance with compaction specifications to minimize settlement. Treated material will be placed separate from untreated material pending verification testing of the treated material as discussed in Section 3.7; and

g. Place the cap over the treated and consolidated material.

Former Lagoon #3.

Former lagoon #3 contains oil-stained soil overlaid by unstained fill. Concentrations of total PCBs equal to or greater than 10 ppm are found at some of the oil-stained soil sample locations, generally to a depth of three feet, equal to elevation 376 feet. However, eight isolated areas contain PCB exceedances (i.e., concentrations above 10 ppm) at depths up to nine feet below ground surface.

The areas of PCB exceedances will be excavated to the maximum depth of any known exceedance in that particular area. Most of the former lagoon #3 will be excavated to a depth of approximately three feet. 20 by 20-foot areas will be excavated to the maximum contamination depth around the areas of deeper contamination ranging from four to nine feet deep. The excavation bottom and sides will then be sampled in accordance with the sampling and analysis project plan.

~~Excavated s~~Soil excavated at former lagoon #3 will be solidified/stabilized and placed beneath the cap. Completed excavation areas will be backfilled with clean soil in accordance with the site grading plan using onsite soil whenever reasonably possible.

Excavations at all three former lagoons may extend below the groundwater table to some extent. The exact amount of excavation below the groundwater table will depend upon groundwater conditions at the time of excavation. At former lagoons #1 and 2, the excavation will extend down to elevations of 382 and 378 feet, respectively. Based on available water level measurements, the groundwater table ranges from an elevation of approximately 378 feet to a maximum elevation of approximately 394 feet. Groundwater elevations above 389 feet are not representative of former lagoons #1 and #2, based on available water level measurements. At former lagoon #3, the average excavation will extend to an elevation of 376 feet, while the groundwater table ranges from a minimum elevation of approximately 367 feet to a maximum elevation of approximately 380 feet based on available water level measurements. Wide ranges of groundwater levels are not surprising given the fine-grained soil at this site. Such fluctuations are short term as observed during the November 1996 pump test, for example.

Shallow groundwater entering the excavations will be pumped from temporary sumps or from wellpoints, if needed, into a temporary storage area prior to being tested. Any treatment of shallow groundwater that is needed would most likely be provided using a temporary package treatment system. Shallow groundwater would then be discharged to the drainage ditch in accordance with discharge limits that need to be established. Groundwater treatment is discussed in Section 3.11. If quantities of shallow groundwater are small and treatment is needed, the shallow groundwater would be transported offsite for treatment and disposal.

Western Drainage Area and Drainage Ditch

Portions of the Western Drainage Area and the drainage ditch along the south side of former lagoon #3 contain concentrations of total PCBs greater than or equal to 10 ppm in the surficial soil/sediment to a depth of up to 12 inches. PCB concentrations of over 10 ppm within these two areas are limited, with one exception within the drainage ditch in the WDA, to the top 12 inches of soil/sediment as reported from the pre-design investigation and other previous site investigations. The concentrations of total PCBs greater than 10 ppm are generally limited to the low-lying drainage path, but not all drainage path sample locations showed total PCB concentrations above 10 ppm.

Following removal of surface water, the entire drainage path west to within approximately 120 feet of the OU-1/OU-2 boundary (see Drawing C-2), including both the areas with more and less than 10 ppm total PCBs, will be excavated to a depth of one foot. The basis for not excavating further west toward OU-2 is the presence of a beaver pond that has a fluctuating water level. An average water level within the pond is approximately 366 feet. Excavation as part of the OU-1 remedy will be to an elevation of 368 feet. ~~Excavation of an additional six inches at the one location where PCBs were observed above 10 ppm at a depth of 12 to 18 inches will ensure that the PCB exceedances are removed. No c~~Confirmatory sampling will be conducted ~~based on the extent of sampling done to date to delineate areas containing PCBs and based on this excavation plan~~ in accordance with the project plans to be submitted with the 95 percent design. Section 3.6 provides a discussion of restoring the excavated wetland area following sediment removal.

The excavated soil/sediment will be stabilized/solidified and placed with the other treated soil beneath the cap shown in the ~~preliminary~~ grading plan (see Drawing C-4 in Appendix E).

3.4 CAPPING PLAN

In accordance with the ROD, a RCRA cap (40 CFR Part 264.300 - 264.310) in conformance with 6NYCRR Part 360 ~~will be~~ designed to cover the stabilized/solidified material. The cap will contain the following layers from the top down:

- A minimum of 6 inches of topsoil;
- A minimum of 12 inches of protective cover soil;
- A minimum of 12 inches of drainage sand; and
- a 40-mil linear low-density polyethylene (LLPE) or 60-mil high density polyehtylene (HDPE)~~or 60-mil high-density polyethylene (HDPE)~~ geomembrane.

A separation or cushion geotextile will be placed between the subgrade and the geomembrane. A gas venting layer will not be needed, because the placed material will not generate methane or other gases. A leachate collection system will also not be needed, because the treated material will be placed above the groundwater table. Additionally, the cap will be graded and vegetated and will include drainage improvements and a perimeter gravel access road.

The cap will be located primarily in the area of the three former lagoons. The ~~exact~~ size of the final cap can not be estimated until the quantity of material from OU-2 to be excavated is determined. The quantity of material from OU-1 to be capped is approximately 23,500 cubic yards (see Appendix A~~-C~~ for calculations). The portion of OU-1 within the westernmost portion of the Western Drainage Area below elevation 368

feet will be left in place until OU-2 is remediated (see Drawing C-2). The elevation of the beaver pond within the Western Wetland portion of OU-2 is approximately 366 feet. ~~An approximate cap location~~ The final grading plan for the upland area based on material from OU-1 is shown in Drawing C-4 (see Appendix C~~E~~).

The cap ~~is required to~~ will have a minimum grade of four percent and a maximum grade of 20~~33~~ percent~~. The cap will be designed with a maximum grade between 15 and 20 percent~~ to ensure slope stability and allow for flexibility in the final grade should actual material quantities differ from the design quantities. The ~~site~~ soils being excavated are generally sands, which are stable up to approximately 20 to 25 percent without the need for slope reinforcement. ~~Additionally, a final grade of less than 20 percent will allow construction equipment to work both parallel and perpendicular to the slopes.~~

As the cap design is completed, the Hydraulic Evaluation of Performance (HELP) model will be used as needed to assess the permeability of the selected cap. In addition, a hydraulic calculation using TR-55, the rational method, or a comparable method will be performed to establish the basis for site stormwater management design.

3.5 SITE RESTORATION

Upon the completion of excavation and capping activities, disturbed areas of the site will be restored. Excavation areas #1, 2, and 3 shown on Drawing C-2 will generally be covered by the cap. Upland excavation areas #4, 5, and 6 shown on Drawing C-2 will be backfilled with clean soil, graded to drain, covered with topsoil, and seeded. Other disturbed upland areas will be graded to drain, covered with topsoil, and seeded. Portions of ~~excavation areas #7 and 8, shown on Drawing C-2,~~ the Western Drainage Area that are not juridictional wetland areas will be restored by seeding only.

3.6 WETLAND MANAGEMENT

An unavoidable impact of sediment excavation within the WDA of OU-1 will be temporary disturbance of jurisdictional wetlands. The excavation plan (Drawing C-2) shows soil from approximately ~~one~~ two acres of jurisdictional wetlands ~~being~~ to be excavated within the WDA.

As described in Section 2, wetland restoration is required by Federal programs under Section 404 of the Clean Water Act and administered by EPA and the Corps of Engineers with input from the U.S. Fish and Wildlife Service. Restoration is also required based on State of New York wetland protection requirements. Permits are not required for remediation of ~~CERCLA~~ a Superfund sites, but substantive requirements of the regulations will be met.

3.6.1 Current Situation

Wetlands within OU-1 and OU-2 were delineated in 1993 as part of the OU-2 Contamination Pathways Remedial Investigation Report. In addition to the field

delineation, the National Wetland Inventory map for the Brushton, NY quadrangle and the NYSDEC Freshwater Wetlands map for Franklin County are available. These maps are based on interpretation of aerial photographs. The Contamination Pathways Remedial Investigation effort included field delineation of OU-1 and OU-2 wetlands. In July 1998, wetland boundaries within the Western Drainage Area were checked and revised by a Parsons ES subcontractor (Terrestrial Environmental Specialists, Inc.) (see Drawing C-1). A NYSDEC representative concurred with the revised boundaries during an August 1998 field check. Updated wetland boundaries within the Western Drainage Area were surveyed. Wetland vegetation documentation was also developed during the July 1998 field effort (see Figure 3-1). The wetland vegetation within the Western Drainage Area is a mixture of emergent and scrub-shrub vegetation. No forested wetlands exist within this area.

Additional ~~Specific~~ information about existing ~~site~~ wetlands within OU-1 and OU-2 is available from the Interim Ecological Investigation Report (IEIR) conducted by Blasland, Bouck and Lee (BBL, 1994) as part of the OU-2 contamination pathways investigation effort. Field work for the interim ecological investigation was conducted during 1993. The investigation included wetland delineation as far north as North Lawrence Road (see Drawing C-1), surveying of the delineated wetland boundaries, floral and faunal surveys, and terrestrial and aquatic biota sampling.

Aerial photos from May 1992 are available. In addition, the 1993 vegetation within the Western Wetland, which includes the western portion of the WDA within OU-1, has been qualitatively documented within the IEIR. ~~The area is a mix of scrub-shrub-emergent and forested wetland types with a small portion of a beaver pond making up the western edge of the WDA.~~ The beaver pond extends approximately 70 feet eastward into the Western Drainage Area portion of OU-1. ~~-~~Most of the beaver pond exists within the Western Wetland portion of OU-2.

3.6.2 Wetland Restoration Following Sediment Removal

At the present time, wetland remediation is anticipated to be conducted during the Summer or Fall of 1999 once most of the OU-1 remediation further upgradient is complete. No seasonal restrictions to working within the Western Drainage Area have been identified, except to avoid spring high-water periods.

Restoration will be conducted, as warranted, to maintain wetland functions temporarily lost due to sediment removal. Many functions provided by the wetlands, such as groundwater recharge, flood attenuation, and sediment retention, will not be lost due to sediment removal. Temporary loss of wildlife habitat is the most significant function affected by the removal of the contaminated soils primarily because of the resultant loss of vegetation ~~and wildlife habitat~~. Thus, the wetland functions that are lost are considered a temporary impact. In addition, hundreds of acres of similar types of wetlands shown on the federal and state wetlands maps already exist adjacent to the area being remediated.

To the extent practicable, impacts to adjacent wetland areas where sediment will not

be removed will be limited by controlling the time that surface waters are diverted. For example, a two-month lowering of the water level within certain areas during the construction season is not expected to result in a long-term loss of wetland vegetation outside the remediation area. Silt fences will be strategically placed as well.

The wetland areas disturbed by sediment removal efforts will be restored ~~in place.~~ by placing clean topsoil to a level at or near the existing grade. The topsoil will be from an approved source. Seeding of the excavated area will be done by hand with a suitable northern climate wetland seed mix. If the area is excavated late in the year, an equivalent of an annual rye or winter wheat seed will be used to quickly re-establish a temporary vegetation cover. Straw mulch will be used if needed to control erosion immediately following restoration. The excavated area will then be naturally colonized by seeds of plant~~by~~ species migrating to the area from adjacent, unaffected wetlands. ~~The value of backfilling with topsoil to the elevations that existed prior to sediment removal will be evaluated later in this design effort based on where sediment is to be removed and vegetation types located within the removal areas.~~ A NYSDEC representative has concurred with this approach and has also requested that a handful of small 20- to 30-inch deep depressions be placed within the Western Drainage Area as part of the restoration effort.

~~If topsoil is imported to the site for placement within a wetland area, t~~The topsoil will need to meet the following three minimum requirements to promote wetland restoration: at least five percent organic matter, clean (i.e. no PCBs and from a clean source), and no visible nuisance weeds, seeds, stems, or rhizomes of purple loosestrife or phragmites. ~~or stones. The value of seeding or planting will also be determined later in the design effort.~~

3.6.3 Post-Remediation Wetland Monitoring

Monitoring at many sites is warranted following remediation to ensure~~determine~~ the success of wetland restoration. The baseline data already gathered provide specific information for the area to be impacted by sediment removal. ~~The type and duration of m~~Monitoring following sediment removal will be ~~determined in the later design effort.~~based on checks of hydrology, vegetation cover, vegetation types, and wildlife made one or two times during the first, second, and fourth years following remediation with the times to correspond with checks of OU-2 following its remediation. Photos and water level readings from staff gages will be included as part of the checks. The goal will be to have the area revegetated with a mixture of wetland plant types within five years following remediaton.

~~The most useful forms of post-remediation monitoring are evaluations of hydrology and vegetation temporarily disturbed by the remediation efforts. Hydrology can be monitored, as needed, using staff gauges in standing water areas and monitoring wells in saturated soil areas. Also, if needed, vegetation types and percent cover can be monitored and photographed for representative transects or plots within the disturbed wetland.~~

3.7 SOLIDIFICATION/STABILIZATION OF SOIL AND PLACEMENT FOLLOWING TREATMENT

The solidification/stabilization (S/S) effort at this site is being designed to address site soil and sediment containing 10 ppm or more of total PCBs. The following S/S performance objectives were established within the Statement of Work: (1) toxicity characteristic leach procedure (TCLP) PCB concentrations within the treated extract less than 0.5 ppb, and (2) unconfined compressive strength (UCS) of 100 psi or higher. A description of example unit processes to address these objectives is presented in this subsection. Specifications for this S/S work will be performance based to provide flexibility, so the project can benefit from a remediation contractor's specific skills and experience. The remediation contractor may choose to use a different S/S procedure which would need to be documented, tested and approved in advance of mobilizing for the remedial action.

Bench-scale soil treatability work (Parsons ES, and Kiber Environmental Services, 1997) completed in early 1997 provides much of the basis for the preliminary design information provided herein. Bench-scale testing was conducted using site samples from the four areas within OU-1 that contain more than 10 ppm total PCBs: the Mound, Former Lagoon #3, the WDA, and the area north of the Mound. The bench-scale testing was performed in accordance with the Statement of Work and the Predesign Work Plan (Parsons ES, 1996). Results of that testing were reviewed previously by the Government.

Untreated samples from each of the four areas and two composite samples showed TCLP PCB concentrations less than the method detection limits of 0.50 to 0.74 ppb. Based on multiple phases of bench-scale testing, Type I Portland cement added at rates of 7 to 23 percent by weight was found to be effective at meeting the TCLP PCB and UCS treatment objectives. For the drier material from the Mound and from the area north of the Mound, 4 to 8 percent water needed to be added during the bench-scale testing to provide an effective mixing of the cement with the material being treated. Type I Portland cement is relatively inexpensive, readily available, and commonly used as a S/S reagent. Other additives were not needed to augment the cement.

The bench-scale treatability work was done on representative samples collected from the site independent of LNAPL content. Sample Composite-2 from the bench-scale tests contained 11 percent petroleum hydrocarbons, and solidification/stabilization of that sample with cement was shown to be effective. LNAPL content should not affect performance of the solidification/stabilization treatment based on site conditions and testing conducted to date.

3.7.1 Basis of S/S Design

The process design information provided in this section is an example design that will be provided to bidding remediation contractors together with the civil drawings, a

performance specification (Section 02445, Solidification/Stabilization), earthwork specifications, and various project plans listed in Section 5 of this report.

Although the material will be effectively treated, it will also be placed above the water table beneath a RCRA cap to minimize long-term leaching and contact with groundwater and precipitation. The best way to minimize leaching and thereby minimize impacts is to effectively treat the material and then minimize the amount of water that comes in contact with the treated material.

This example design is presented based on treating soil using a continuous-feed pugmill. A pugmill is a well-established, easy-to-control tool for effectively mixing the reagent with the material being treated. Based on this example design, S/S treatment elements would consist of the following three elements:

- Stockpile containment for soil and sediment to be treated;
- Reagent feed and mixing equipment and procedure; and
- Placing treated material above the high water table within the area to be capped.

Elements of the earthwork activities presented earlier in this section of the report also apply to the S/S work as warranted. For example, control of dust and volatiles to protect construction workers will be conducted in association with the S/S effort in the same manner as it will be conducted for other earthwork efforts. Monitoring procedures and contingency controls for dust and potential volatile emissions will be specified in the project plan for site safety.

Element 1 - Stockpile Containment In this example design, soil and sediment excavated from the site that contains greater than 10 ppm total PCBs would be stockpiled either within the excavation area or on a lined, bermed pad separate from the soil that contains less than 10 ppm PCBs. ~~Material greater than two inches in diameter would be removed from the material to be treated using, for example, a vibratory screen. Stockpiles would be constructed within the footprint of the excavation areas to be capped (see Drawing C-4).~~ The stockpile area would be large enough to accommodate at least five days worth of soil to be treated. At a maximum treatment rate of 1,000 tons per day, the area would typically need to accommodate at least 5,000 tons or 3,300 cubic yards of material (e.g. two piles each approximately 80 feet in diameter based on a 30-foot pile height or one pile 110 feet long by 100 feet wide by 20 feet high). The stockpile area would be underlain with flexible plastic to denote ground elevation prior to stockpiling and gently sloped to minimize ponding of rainwater. Temporary berms would be provided surrounding the stockpile area which are a minimum of 12 inches in height with controlled access at certain locations along the berm to safeguard berm integrity as needed. Water collected from the stockpile area may be used as water reagent in the S/S process provided it meets the requirements shown in Element 2 below.

A removable impermeable geomembrane cover would be provided over each stockpile of untreated material. This cover would have a minimum thickness of 10 mils to prevent precipitation from entering the stockpile.

Element 2 - Reagent Feed and Mixing Equipment and Procedure In addition to a backhoe or front-end loader, feed and mixing equipment would include silos or hoppers equipped with feed devices, conveyors to transport the material prior to and following treatment, a pugmill to provide mixing, and process control instrumentation. Descriptions of the basic feed and mixing equipment included in this example design are as follows:

- Reagent Feed Units: In this example, the feed rate of the cement would be controlled with a rate-adjustable pneumatic pump that would feed the cement from a silo directly to the pugmill. Similarly, the water would be pumped with an adjustable-rate pump directly to the pugmill from a holding tank. Eight cement silos would be needed to store, for example, five days of cement at the maximum anticipated feed rate of 230 tons per day (based on the bench-scale results) would be 10 feet in diameter and 40 feet high based on a cylindrical silo shape. Silos/hoppers and feeders would be equipped and operated so that caking of material or variation in feed is adequately minimized. Provision will be made so that each reagent can be easily sampled.

- Pugmill: A continuous-feed mixing unit having twin screws rotating in parallel to mix the material is envisioned in this example. The pugmill would be equipped with positive means for controlling the mix proportions, mixing time, and mixing rotation speed. Soil/sediment would be fed into the pugmill via conveyor belts transporting the material from a stockpile. The material and reagents would reside within the pugmill for approximately 15 to 30 seconds. For a 30-second residence time, the pugmill would need to have a volume capacity of less than one cubic yard to process a total of 1,230 combined tons of soil-sediment and cement over an 8-hour work day. Treated material would exit the pugmill below the mixing chamber onto a conveyor belt.

- Water Flow Control System: Means to measure and control the flow of water used for S/S will include a totalizing water meter. Water would only be needed to treat the soil from the former lagoons #1 and #2 and from the area north of former lagoons #1 and #2, if these materials are treated separately from the wetter soil or sediment that is to be treated from the other areas. Water would be stored in transportable holding tanks as needed. Based on a water tank diameter of 10 feet and a tanks height of 40 feet, up to four tanks would be needed on site to provide five days of water storage and assuming the dry material is treated separately. Alternatively, five 20,000-gallon rectangular-shaped water storage tanks would provide five days of storage.

A representative sample of the Portland Cement will be analyzed for TCLP metals and approved by the engineer prior to being used as a reagent at the site. Similarly, the

water can not contain significant concentrations of oil, acid, salt alkali, organic matter or other substances the will be detrimental to the S/S treatment effort.

Scales, meters, and volumetric measuring devices used for measuring contaminated material, reagents, and water for S/S processing will be accurate to plus or minus one percent of the quantity being measured. A check of calibration of measuring equipment will be performed once every five working days. Effective mixing is generally achieved when no streaks of material being treated or cement are visible within the material-reagent mixture.

The procedure for mixing reagents with the material being treated is as follows:

- The amount of reagent to add would be fed directly to the pugmill via a silo or hopper in proportion to quantities of material being treated.
- The material being treated would be fed to the pugmill using a totalizing belt that has a built-in scale.
- The Portland Cement, water (as needed), and material to be treated would then be mixed within the pugmill, and the mixture would be transferred using a conveyor and radial stacker to its final location within a designated area above the high groundwater elevation.

Based on this design, a maximum material processing rate of 1,000 tons per day could be achieved assuming S/S can be done continuously throughout an eight-hour daily effort. Over a multiple week timeframe, an average processing rate of 500 to 1,000 tons per day is commonly achieved. S/S treatment rates are usually limited by how much material can be loaded from the stockpile. The total amount of working space needed to conduct the treatment effort, excluding the disposal area, is approximately 0.5 to 1.0 acre. If possible, this working space will be located within the area to be capped. ~~to be located within the area to be capped.~~

Temporary utility needs include electricity and water. Sufficient electricity will be needed to drive the pumps, hoppers, belts, conveyors, and pugmill. Water needed for mixing with the Portland Cement can be obtained from the site as long as it is free of oil, acid, salt, alkali, organic matter, or other deleterious substances which will be detrimental to the successful execution of the S/S treatment process.

Element 3 - Placement of Treated Material In this example, the treated mixture would be placed in its final location above the highest anticipated groundwater elevation (i.e., an elevation of 383 to 389~~9~~ feet above mean sea level in accordance with the backfilling plan~~or higher~~) within the area to be capped. Final placement would take place as soon as reasonably possible following mixing of the Portland Cement (and water as needed) with the soil and sediment being treated. The batch identification number, date mixed, soil source area, percents of cement and water added, and area of final placement would then be recorded. Treated material would be placed in sectioned lifts or cells for

curing and testing. The depth of the treated soil placed at any one time would be kept at approximately two to three feet to allow for curing. A solid monolith can result with a UCS of 100 to 300 psi or more. The 100 psi UCS performance requirement may be met without the material forming a monolith following curing. The exact UCS value at which a monolith forms varies with soil and S/S agent characteristics.

S/S treatment can proceed while excavation work continues. In order to prepare the area receiving the treated material, the area would be filled in accordance with the excavation plan prior to receiving the treated material. The general area where these treated soils would be placed and capped is shown in the final grading plan (Drawing C-4) and corresponds to the areas of former lagoons #1, #2, and #3. After results show treatment performance requirements are met, the treated material would be capped in place. Cement would be added to ~~s~~Screened ~~cement would be added to~~ oversized material ~~separated as indicated under Element 1~~ before it is placed within the area between lifts of treated material.

Within the same timeframe that the treated mixture is placed, test cylinders will be made by the Parsons ES-Kiber team into standard molds for testing. The molds used for this testing are typically three inches in diameter and six inches tall. Correlations will be developed during the pilot-scale testing between TCLP PCB and UCS values at 28 days following placement and ~~TCLP and~~ UCS values at, for example, one to three days following placement in order to provide flexibility to proceed with the S/S treatment before the 28 days of curing are complete.

Following a pre-specified number of days of curing (typically one to three days), one set of test molds will be sent to an offsite laboratory procured by Alcoa or by the Parsons ES-Kiber team and analyzed for ~~TCLP PCBs and~~ unconfined compressive strength. The frequency of this testing is typically one for every 1,000 cubic yards ~~300 to 500 tons~~ of material treated ~~(e.g., two to three per day)~~. If the molds show the one- to three-day cures (UCS) ~~treatment objectives~~ are met, as derived from the pilot testing, then no further action is needed. ~~If one sample fails the requirements, a second and third mold would be analyzed. If more than one sample does not meet the UCS requirement of 100 psi, the material could be checked with a penetrometer. Penetrometer readings are typically provided in units of tons per square foot. 100 psi is equivalent to 7.2 tons per square foot as read on a typical penetrometer. If needed, cores could be collected over time to assess the long-term UCS of the treated material.~~ In the unlikely event a failure occurs, two additional molds from the same treated material would be tested to determine if the failure was due, for example, to sample collection or mold preparation variability. If both of the two additional molds pass, then the treatment would be considered effective. Only if one of the two additional test molds fails would a contingency action like using a penetrometer on the cured material, or core sampling, be implemented.

EPA-approved laboratory procedures for chemical analyses and ASTM-approved methods for physical analyses will be used. EPA Level III quality assurance/quality

control standards will be adhered to for chemical analyses. The test frequency and other QA/QC items will be addressed within the project plans.

3.7.2 Pilot-Scale S/S Testing

The Statement of Work also specifies that pilot-scale testing be performed prior to the full-scale remedial action. Pilot-scale objectives from the Statement of Work are to: (1) refine or modify the admixture formulation (as needed) and (2) determine the optimal mixing and placement methods for the material being treated. A third objective of the pilot-scale testing is to assess the effectiveness of the mobilized, full-scale equipment to meet the treatment performance objectives and maximize field full-scale efficiency. To address the first objective, the completed bench-scale testing has shown that the York Oil material can be successfully treated with Portland cement. Hence, this first objective of the pilot-scale testing becomes primarily a confirmation of the bench-scale results at a larger scale, unless the remediation contractor wishes to alter the S/S reagent by conducting separate bench-scale tests, the results of which would be confirmed by the Parsons ES - Kiber team. The second objective of determining optimal mixing and placement methods is best addressed once the selected remediation contractor is mobilized at the site for full-scale operations. The third objective can only be accomplished with mobilized full-scale equipment and construction personnel. Part ~~An example~~ of maximizing full-scale efficiency that can be accomplished during the pilot-scale testing is developing a correlation for ~~TCLP PCBs and~~ for UCS following 28 days of curing with TCLP PCBs and UCS following some shorter time duration of curing, such as one to three days.

The pilot-scale S/S testing will be performed by the selected remediation contractor in accordance with project requirements using the same techniques and equipment to be used during the full-scale soil treatment effort. Reagents, mix ratios, mixing procedures (including mixing time and mixing speed), material curing conditions and duration, sample collection, and post-treatment testing used during the pilot-scale testing will be the same as those used for the remainder of the work unless otherwise approved by the engineer. The pilot test will result in processing a minimum of 100 tons of material, including at least 25 tons from each of the following areas: former lagoons #1 and #2, former lagoon #3, the WDA, and the area north of former lagoon #1 and #2. Samples composited from more than one of these five areas will also most likely be tested. Prior to performing the pilot-scale testing, contaminated material to be used will be tested to verify it contains at least 10 ppm of total PCBs.

Laboratory testing will be performed following the field preparation, mixing, and curing to verify that the treated material from the field demonstration meets the specified physical and chemical criteria. Test cylinders as described under element 3 in Section 3.7.1 will be used to measure TCLP PCBs and UCS. Laboratory testing and QA procedures will be the same as those used by the Parsons ES-Kiber team during the 1997 bench-scale testing. Testing will be conducted on cylinders after one, three, and seven days of curing. Test results will then be compared to the TCLP PCB and UCS

performance requirements. If performance requirements are not met after one, three or seven days, testing will be conducted after a longer number of curing days. Correlations will then be compiled of TCLP PCB and UCS results to determine the length of time needed to monitor curing during full-scale operations.

The Parsons ES-Kiber team will prepare a report documenting ~~of~~ the pilot-scale testing effort once the pilot-scale field and laboratory results are available.

3.8 STORMWATER / EROSION AND SEDIMENT CONTROL

Specifications ~~will be provided to the remediation contractor in future design submittals~~ for appropriate stormwater controls during construction ~~that~~ are ~~described~~ included in Appendix D and summarized herein. ~~In addition, design drawings and specifications will also include stormwater controls. Hydraulic calculations to be conducted as discussed in Section 3.4 will be an important basis for site stormwater management design.~~ A stormwater pollution prevention plan will be developed in accordance with New York State general permits for discharges from construction activities.

3.8.1 Stormwater During Remediation

PCBs are associated with soil and sediment particles, so controlling erosion during remediation will control any potential impact of PCBs migrating downstream. Temporary erosion and sedimentation control will consist of silt fencing so significant soil or sediment is not allowed to erode from the site. In addition, stormwater from upgradient locations will be routed away from exposed materials, ~~and~~ stormwater contact with exposed material will be minimized to the extent practical, and oil booms will be provided within downstream drainage paths adjacent to construction in order to avoid releases of sheens.

Silt Fencing

Regrading and capping activities will result in sheet flow, so silt fencing will be used as the primary sediment control measure. Prior to extensive clearing, grading, excavation, and placement of cap soils, silt fences will be installed along construction perimeter areas to prevent sedimentation in low areas and drainage areas. The perimeter silt fences will remain in place until construction activities in the area are completed and vegetative cover or other erosion control measures are adequately established.

Intermediate silt fencing will be used upslope of perimeter areas where phased construction activities are occurring. This fencing will lower sheet flow velocities and reduce sediment loads to perimeter fencing. In addition, silt fencing will be used around soil stockpiles.

3.8.2 Permanent Measures Following Remediation

The final grading plan will include slope, drainage channels, and other permanent erosion control measures. Design features to be incorporated into the construction plans

to control erosion include limiting steep slopes, routing runoff to surface water collection channels, and limiting flow velocities in the collection channels to the extent practical. In areas where flow will be concentrated (i.e., collection channels), the channel slopes and configuration will be designed to maintain channel stability.

Vegetation serves to reduce erosion, enhance evapotranspiration, and improve runoff water quality. A seed mixture will be selected to control erosion and to minimize long-term maintenance. In addition, mulch, mulch blankets, or synthetic fabric will be placed to prevent erosion during grass establishment. Drainage ditches and swales will be protected against erosion as well. Specifications ~~for the~~ include topsoil, seeding, and erosion control fabric ~~will be provided in a later design submittal~~.

Stormwater channels will be grass or riprap-lined channels with dimensions to control velocities of stormwater leaving the upland portion of the site following remediation. These channels are being ~~will also be~~ designed to maintain channel stability.

Prolonged traffic over vegetated areas has the potential to hamper vegetative growth, which could then lead to soil erosion. A gravel-covered roadway ~~may~~ will be placed around the northern and eastern half of the capped area to direct maintenance equipment traffic off vegetated areas (see Drawing C-4 - final grading plan). Once OU-2 is remediated, the roadway could be placed around the entire capped area if warranted.

3.9 LNAPL MANAGEMENT

If the soil containing LNAPL is excavated and does not contain greater than 10 ppm PCBs, it will not be solidified/stabilized, but it will be dried and/or handled with other excavated material, placed above the water table and capped. If the excavated soil containing LNAPL also contains more than 10 ppm PCBs, then it will also be treated.

LNAPL that exists outside the excavation area can be addressed in case significant quantities of LNAPL are mobile and could reach the drainage ditch along the south side of OU-1 and flow offsite. Two options have been identified for addressing the LNAPL outside the proposed excavation areas: (1) extract the LNAPL via wellpoints, or (2) excavate LNAPL along with the soil containing more than 10 ppm of total PCBs. These areas with LNAPL found in wells at thicknesses of 0.5 foot or more outside the area with soil containing PCBs at concentrations of 10 ppm or more are confined to the southern edge of the Mound at YO-16, GP-43 and RW-2 and to the pump test area at GP-18-OFF and GP-Y09 (see Figure 3.2~~1~~). The other area found to contain significant LNAPL is beneath the Mound which will be addressed as part of the excavation effort.

The purpose of the Fall 1997 addendum predesign investigation effort within OU-1 was to collect additional York Oil site data requested by the Government. This additional data included sampling and analyzing light nonaqueous phase liquid (LNAPL) from the site, and removing LNAPL one time from selected onsite wells and measuring natural

LNAPL recovery following removal (called baildown tests). The results from these LNAPL-related efforts were as follows:

- LNAPL density is less than water, and LNAPL viscosity is over 200 times higher than the viscosity of water. The density and viscosity measurements confirm previous onsite measurements. The density indicates the LNAPL, where present, will float on top of the water table. The high viscosity indicates potential LNAPL mobility is much less than water. Two types of interfacial tension were also measured. Results for one of these types of interfacial tension is consistent with past measurements, and the other type had not been measured previously.
- LNAPL was observed at only seven monitoring wells when measured the day before baildown tests were conducted. Baildown tests were conducted at the three wells showing the thickest LNAPL. Baildown test results were then analyzed following the tests to further assess LNAPL mobility. The analysis of the baildown test data, using the interfacial tension data and baildown test results, indicates a LNAPL recovery system would not be effective. This predicted lack of effectiveness at recovering LNAPL at this site is consistent with the lack of LNAPL collected to date within the onsite interceptor trench that was installed in November 1995 and the previous lack of success recovering LNAPL from three recovery wells.

The remediation effort for OU-1 will handle these significant quantities of LNAPL outside the excavation area using either of the two options described in this subsection or a combination of the two options. The decision as to how to address the LNAPL will be made in the field in consultation with the USEPA and the NYSDEC based on what is found during the remediation effort and what proves to be cost effective. Any LNAPL that may be collected separately will be disposed offsite.

Option 1 - Vacuum e~~E~~xtracting the LNAPL via wellpoints could perhaps ~~can~~ be effective depending on how much oil and water are collected. Based on the results from baildown tests conducted in the Fall of 1997 as part of the Predesign Investigation for OU-1, vacuum extraction would collect more oil than bailing; however estimates only show approximately 0.4 gallons of LNAPL collected per day on the average over one year (i.e., approximately 3 drums per year) from a single well. In addition, approximately 0.5 gpm of water would be collected at the same time as the oil and would need to be managed properly. LNAPL could be extracted periodically (e.g., once every two weeks for four hours) which would generate approximately 3,000 gallons of water per well over a one-year period. One possible scenario would be to install extraction wells within the two areas and extract LNAPL from each of the wells periodically for a prescribed period of time. From multiple wells, perhaps less water and more oil per well would be able to be collected. A few days of total effort intermittent during the remediation may suffice. Pilot test work would be needed to assess the effectiveness and cost of vacuum extraction. This pilot test work could be done at the start of the remedial action or sooner if it makes sense to do so.

Option 2 - LNAPL could be excavated as the soil containing PCBs is excavated. LNAPL and soil containing PCBs concentrations over 10 ppm are not necessarily co-located. The excavation plan presented in this design report focuses on soil containing over 10 ppm PCBs. The volume of soil to excavate in order to address LNAPL is not able to be estimated at this time based on previous investigation results. This volume of soil to excavate would vary with the lateral and vertical extent of excavation. The water table elevation fluctuates as much as 10 to 12 feet in this portion of the site south of the Mound, so excavation quantities would vary depending on the depth to the water table when the remedial action takes place.

3.10 EXTRACTION OF DEEP GROUNDWATER

Pumping and treating deep groundwater over the long term and shallow groundwater during excavation are two elements of the ROD for OU-1. The OU-1 ROD suggests 13 deep extraction wells located along the western and southern perimeter of the fenced area and shallow dewatering wells. Since the ROD was prepared, the focus of deep groundwater extraction has shifted, based on available investigation information, from a sinking phenolics plume to a plume of *cis*-1,2-DCE. In addition, water level data collected since 1984 and results of a 72-hour pump test conducted in November 1996 provide more of a basis for designing both the deep and shallow groundwater extraction systems. Furthermore, the soil remediation effort will also address *cis*-1,2-DCE by lifting Mound sludge and other excavated materials with more than 10 ppm PCBs above the high water table in accordance with the excavation plan (see Section 3.3) and capping the materials onsite.

A numerical, three-dimensional groundwater flow model was developed to evaluate pumping from the shallow and deep groundwater zones within the upland (fenced) portion of OU-1. The model was calibrated based on water levels recorded over a 16-year period onsite and verified using data from the November 1996 pumping test conducted during the OU-1 predesign investigation. Results from the modeling effort are presented in the Predesign Investigation Report (Parsons ES, 1997a).

Initial modeling results presented within the Predesign Investigation Report indicated that complete capture of the deep groundwater could be achieved with a single well pumping at a rate of 10 gallons per minute (gpm) located on the southeast boundary of OU-1. Non-steady-state (transient) simulations performed as part of this design lead to the recommendation that two extraction wells, each pumping at a rate of 5 gpm, be pumped to provide a suitable safety factor for assuring the effectiveness of the deep groundwater extraction system.

Both steady-state and transient modeling indicate that impacts to the adjacent wetlands from groundwater extraction would be small enough to be immeasurable.

Dewatering of the shallow groundwater during upland soil excavation within the fenced area may be needed to provide sufficiently dry excavations for material handling

purposes. Dewatering can be achieved by pumping from a sump within an excavation because of the low transmissivity of the shallow groundwater system and resultant low pumping rates. A transient groundwater flow modeling simulation of an intense precipitation event indicates that short-term dewatering rates could increase to approximately 13 gpm due to the precipitation event depending on the area of excavation that needs to be dewatered at any particular time during the remediation.

3.10.1 Groundwater Extraction Design

A groundwater model was developed using the numerical groundwater flow MODFLOW (McDonald and Harbaugh, 1988). Information about model development, including hydrogeologic setting and conceptual model, model design, calibration and verification, sensitivity analyses, preliminary predictive simulations and model limitations, were provided in the Predesign Investigation Report (Parsons ES, 1997a). Comments from the Government about the modeling effort presented in the Presdesign Investigation Report were addressed in responses provided in a letter from Alcoa to EPA, dated August 29, 1997. The calibrated, steady-state heads calculated as part of the predesign modeling effort were used as starting heads for the design simulations reported in this section. Government comments on the model were also factored into the design simulations as appropriate based on the August 29, 1997 responses.

Deep Groundwater Extraction

Based on the modeling conducted for the Predesign Investigation, it was concluded that a single well screened in the deep groundwater system could sustain an average pumping rate of 10 gpm that likely would not fluctuate significantly due to weather conditions. It was further concluded that the 10 gpm pumping rate would be sufficient to maintain hydraulic control over the deep groundwater system.

A series of transient simulations representing a 365-day period of time were performed during the preliminary design to verify these conclusions. As part of the simulations, hydraulic conductivity values were increased by two times, four times and more from the calibrated hydraulic conductivity. To preserve water levels across the model, recharge values were also doubled whenever hydraulic conductivity was doubled. Storage was varied between 0.001 and 0.1, although storage had very little impact on water levels and pumping rates calculated at 365 days. These simulations support use of a single 10-gpm well to maintain hydraulic control over the site. However, at higher hydraulic conductivities (four times or greater), the capture zone calculated for the single well would not fully encompass the site. The model output files for the design simulations reported herein are presented in Appendix G of the 30% Design Report.

The simulations were repeated using two extraction wells pumping at 5 gpm each. These simulations indicated complete capture over the range of hydraulic conductivity values simulated. Therefore, to provide a suitable safety factor, the deep groundwater extraction design includes two wells. The well locations, calculated water levels, and

capture zones are shown on Figure 3.32. The capture zones shown on Figure 3.32 were calculated using the hydraulic conductivity, recharge, and porosity values calculated from the transient calibration presented in the Predesign Investigation Report. The location of either of these wells can be adjusted to some extent, if needed, as the design proceeds.

The filter pack and well screens for the deep extraction wells have been designed using the methodology described in Driscoll (1986). Grain-size analysis charts were plotted for the deeper soils (see Appendix H of the 30% Design Report). The 70 percent finer values for the finest, coarsest, and average soils were identified and multiplied by a factor of four. A line with a uniformity coefficient of 1.3 was fit through each of the three points. From Appendix H of the 30% Design Report, it can be seen that a filter pack designed for the coarsest soils would allow too many fines to pass into the well. There was only a small difference in filter pack characteristics based on the average soils and the fine soils; therefore, a filter pack fitting the fine soils was selected for the design. The filter pack was matched against Morie Filter sands ~~(see Appendix H)~~. A Morie #1 filter sand was found to be the best match. A 30-slot well screen (0.030 inches) was selected to retain better than 90 percent of the filter pack.

The design of the deep groundwater extraction system is based on two extraction wells placed approximately 200 feet apart. The wells would be screened between a depth of 30 and 45 feet below ground surface. Each well would be provided with 15 feet of 0.030-inch (30-slot), continuous wire-wound screen. A Morie #1 filter sand would be placed to 2 feet above the well screen. A two-foot bentonite seal would be placed above the filter pack, and the remaining annulus would be grouted to the ground surface with a cement-bentonite grout.

Groundwater from the two deep extraction wells can be conveyed to the onsite groundwater treatment building using heat-traced lines. A decision about the depth and location of the conveyance piping can be made once the grading plan is complete.

Shallow Groundwater Extraction

Shallow groundwater will be pumped from excavation areas as needed to enhance excavation efforts. The pumping of shallow groundwater will likely be done with sumps, because the soil is permeable enough that wellpoints will probably not be needed.

Estimates of the volume of shallow groundwater to pump vary greatly depending on the extent of storm events while excavation work is being conducted. Estimates made using the groundwater flow model developed for the site indicate these shallow groundwater flows can vary from 2.5 to 13 gallons per minute for the time the excavation area is exposed.

The calibrated groundwater flow model was used to evaluate potential groundwater extraction or dewatering that may be required during soil excavation. Dewatering of a 100-foot by 100-foot excavation was simulated using drain nodes. The drain nodes were

placed in the Former Lagoon 3 area and set at an elevation of five feet below the calibrated, steady-state water table. The model indicated that approximately 2.5 gpm would be required to dewater a 100-foot square excavation. A storm event was simulated by increasing recharge throughout the modeled area to 1 inch in 24 hours. This transient simulation indicated that dewatering rates could increase to 13 gpm during such an event. These low pumping rates of 2.5 to 13 gpm indicate that an excavation could be dewatered using only a sump and that a wellpoint extraction system would be unnecessary.

3.10.2 Impacts on Shallow Aquifer and Adjacent Wetlands

Modeling results show that pumping a single well in the deep groundwater system would result in a maximum drawdown of eight feet in the shallow groundwater system (at the pumping well) and a drawdown of three to four feet across the upland area of OU-1. Pumping two wells each at five gpm would reduce the drawdown at the pumping well to seven feet with the drawdown across the upland area of OU-1 remaining at three to four feet. Although these predicted drawdowns indicate large hydraulic potential between the wetlands and the deep groundwater system, the impact on the wetlands would be minimal. The groundwater extraction rate is only one percent of precipitation and approximately five percent of groundwater recharge within the model area. Furthermore, treated groundwater would be returned to the ditch draining the wetlands, so there would be no net loss of water to the wetlands.

3.11 TREATMENT AND DISCHARGE OF GROUNDWATER

Figure 3.4~~3~~ is a process flow diagram that depicts the type of groundwater treatment system being designed for the treatment of ~~deep~~ groundwater at the York Oil site. The system is designed to remove volatile organic compounds, iron, and semi-volatile organics based on the groundwater samples obtained following 72 hours of pumping during the November 1996 pump test (see Table 3.1). The groundwater quality ~~represented by water sampled following 72 hours of pumping~~ information presented in Table 3.1 was assumed to correspond to treatment influent concentrations and is generally representative of maximum historical concentrations found in groundwater from deep wells along the southern end of OU-1 as also shown on Table 3.1. The only possible exceptions are copper, nickel and zinc found in various concentrations in deep groundwater along the southern end of OU-1which could easily be tied up with suspended solids that would be removed with the proposed treatment processes. The treatment design is based on removing constituents as needed to meet Class C(t) water quality criteria. Once discharge limits are established, the design will be re-evaluated. A description of each unit process is presented in this section. The bench-scale groundwater treatability work (Parsons ES, 1997b) provides much of the basis for the ~~preliminary~~ design information provided herein. If warranted, some additional groundwater treatability testing may be conducted once discharge limits are established.

As with soil solidification/stabilization, the process design information provided in this section will be provided to bidding remediation contractors in the form of this example

design, a performance specification under Section 02141 of the specifications (removal, treatment, and disposal of groundwater), and the various project plans listed in Section 5 of this report that will be prepared and submitted with the 95% design. This performance specification will provide limits for treated water discharges and information about the treatment system design basis, processes, components such as sampling ports and pressure gauges, replacement provisions, installation, startup, and quality control. The limits for treated water discharges will be provided within the specification based on requirements currently being developed ~~in conjunction with~~ through the USEPA and the Division of Water within the NYSDEC's Albany headquarters. Discussions with the NYSDEC Division of Water have ~~not yet~~ been initiated. Treated groundwater will be discharged to the surface drainage ditch in OU-1 that drains into the Western Wetland. This portion of the Lawrence Brook watershed is classified as Class C(t) suitable for trout propagation.

The basis of design presented in this section is for treating deep groundwater to be pumped from extraction wells at an average flow rate of 10 gallons per minute. This type of treatment system in the form of a temporary package treatment unit would also work for managing shallow groundwater generated during the remedial action. The pumped shallow groundwater would be stored to allow particle settling and then treated using a portable treatment system equivalent to the treatment system shown in the process flow diagram for managing deep groundwater (Figure 3.3). The following additional steps ~~are~~ may be needed to ensure that the treatment system would effectively manage shallow groundwater:

- Bulk solids are removed in a temporary lined pond or equivalent water storage unit equipped with an oil skimmer or some equivalent means to remove any oil that may be floating on the water surface before the water is treated with a temporary treatment system onsite, or ~~.~~
- Water from excavation work will be pumped to a storage tank and then offsite.
- ~~Total inflows to the treatment process units as sized below are 10 gallons per minute or less based on groundwater pumped from the deep zone. Flows of shallow groundwater during storm events can vary widely. The maximum flow of shallow groundwater estimated from one inch of recharge over 24 hours is 13 gallons per minute without any water storage.~~

The amount of shallow groundwater to be managed will depend on the water table levels when particular portions of all three of the former lagoons are excavated. If ~~the lined pond needs to be larger~~ more water storage is needed, due to a high water table during construction, a larger or second temporary cell can be constructed so as not to slow the rate of excavation. Total inflows to the treatment process units as sized below are 10 gallons per minute or less based on groundwater pumped from the deep zone. Flows of shallow groundwater and/or surface water to treat following storm events can vary widely. The maximum flow of shallow groundwater estimated from one inch of recharge over 24 hours is 13 gallons per minute without any water storage.

If appropriate, a sequestering agent may be added to keep iron and manganese in solution and thereby enhance groundwater treatment efforts.

Step 1 - Equalization The first unit process is equalization with air sparging. The equalization tank will dampen the hydraulic fluctuations inherent in groundwater recovery systems due to well pump cycling. In addition to providing hydraulic equalization, the tank will provide equalization of the groundwater constituent concentrations assuming more than one well is to be pumped at any one time. The tank will be a closed-top vessel equipped with an air sparger to provide mixing and aeration. The air sparger will supply oxygen to oxidize iron and will also result in some stripping of volatile organics. Although the true kinetics of iron oxidation have not been determined experimentally for this groundwater, a hydraulic retention time (HRT) of four hours should be sufficient to allow for iron oxidation. Ancillary facilities include an air compressor with a coarse bubble diffuser system and equipment for addition of anti-foaming agent. Foaming observed during treatability testing could be controlled through the use of an anti-foaming agent. Anti-foaming agents are petroleum-based commonly used in wastewater applications. Any oxygen demand added by the anti-foaming agent would likely be removed with subsequent GAC treatment. In addition, an activated carbon canister can be provided for VOC removal from the process off-gas (if required). See the process description for off-gas treatment below. Process features include:

Influent Flow:	0 to 20 gpm based on the groundwater flow analysis for the deep zone
Effluent Flow:	10 gpm based on groundwater flow modeling results for the deep zone
Tank Size:	2,400 gallons, vertical cylindrical, conical bottom; for example, 86-inch diameter by 102 inches tall (side wall) by 159 inches tall (bottom of stand to top of tank).
Tank Fittings:	Influent flow (2-inch), forward flow pump suction line (2-inch), high-level overflow (3-inch), bottom drain (3-inch), air sparger (1-inch), and air vent (3-inch).
Materials of Construction:	HDPE or XLPE
HRT:	4 hours
Air Flow:	100 SCFM at 10 psi (based on mixing requirements) (assumed submergence depth is 8 feet)
Diffuser Type:	Coarse Bubble (rack mounted)

Step 2 - Pre-Filtration Pre-filtration will be provided to remove oxidized iron prior to the shallow tray air stripper. Pre-filtration will help prevent clogging and fouling of the air stripper trays. The filters will consist of bag filters that will be multi-plexed in parallel and sized to allow sufficient run-time between servicing. Each filter will be equipped with an air release valve. There will be pressure gauges upstream and downstream of the bag filters. The bag filters will be changed based on the pressure differential measured across the filters as they become clogged. Pressure differential sensors and control switches will

also provide for emergency shutoff capability of the groundwater recovery system. There are no provisions for filter backwashing. The dissolved iron analytical testing results for settled groundwater from the bench-scale testing were less that 0.1 part per million. These results indicate that the iron is almost completely in solid form, so that filtration can be effective. By using bag filters, the filtration run time and mesh size can be easily adjusted, if needed, to meet discharge requirements. The use of bag filters seems appropriate based on the filterability of the water observed using cartridge filters during the bench-scale testing. The optimal pH for iron precipitation is approximately 7, and pH measured for the groundwater following 72 hours of pumping was 6.96 (see Table 3.1). In the event bag filters are not effective, the treatment system can be modified during startup to go to a more labor intensive system. For example, chemical addition could be considered at that time, if warranted, and the time frame for implementing the groundwater treatment system would not be significantly affected.

Process features include:

Influent Flow:	10 gallons per minute
Operating Pressure:	0 to 75 psi
Solids Loading	20 mg/l of total suspended solids (2.5 pounds per day)

Step 3 - Shallow Tray Air Stripper The shallow tray air stripper is provided to air strip any remaining volatile organics. The process offgas from the air stripper will be passed through a granular activated carbon adsorber (if required). See the process description for off-gas treatment below.

An antifoaming reagent is expected to be required in the operation of the air stripping system. Addition of antifoaming agent would occur in the equalization tank. In the event that the use of an antifoaming agent is not effective, elimination of treatment Steps 3 and 4 would have to be evaluated. Elimination of Steps 3 and 4 would likely result in an increase in liquid phase granular activated carbon (GAC) utilization, but the overall treatment objectives of the system would be preserved.

Air Stripper Process features include:

Influent Water Flow:	10 gallons per minute
Airflow:	150 SCFM (based on modeling results presented in Parsons ES, 1997b)
Air to Liquid Ratio:	112 to 1
Number of Trays:	2

Step 4 - Filtration Filtration is provided to filter out any additional iron precipitant that is formed in the shallow tray air stripper, prior to the activated carbon adsorbers. Filtration will help prevent clogging and fouling of the activated carbon. The filters will consist of bag filters that will be multi-plexed in parallel and sized to allow sufficient run-time between servicing. Each filter will be equipped with an air release valve. There will be pressure gauges upstream and downstream of the bag filters. The bag filters will be

changed when they are clogged. Pressure differential sensors and control switches will also provide for emergency shutoff capability of the groundwater recovery system. There are no provisions for filter backwashing. Process features include:

Influent Flow:	10 gallons per minute
Operating Pressure:	0 to 75 psi (maximum)
Solids Loading	Assumed to be less than 5 mg/l of total suspended solids (0.6 pounds per day)

Step 5 - Granular Activated Carbon (GAC) Aqueous Phase Adsorption Granular activated carbon aqueous phase adsorbers are provided to remove dissolved organic constituents, primarily VOCs (polishing), SVOCs, and any PCBs that may be present in the groundwater to be pumped. Each adsorber will be equipped with an air release valve. There will be pressure gauges upstream and downstream of each adsorber. Three GAC cannisters will be employed in series operation. Piping connections and valving will be arranged to allow for intra-cannister sampling as well as the positioning of any cannister in the lead, mid, or lag treatment position. An empty bed contact time (EBCT) of 20 minutes has been specified based on the characteristics of the deep well pump test groundwater. If influent concentrations of PCBs increase during actual operation, a greater EBCT may be required based on our experience. If required, EBCT would be increased by the addition of modular GAC cannisters.

Process features include:

Influent Flow:	10 gallons per mimute
Operating Pressure:	0 to 75 psi (maximum)
EBCT:	20 minutes
Canister Size:	High Pressure Filament Wound Cannister (22-inch diameter by 48 inches high) with 200 pounds of GAC
Number of Canisters:	3 in series
Pressure Drop:	1.5 psi per canister maximum (clean water)

Step 6 - Post-Filtration Post-filtration is provided to filter out any activated carbon fines that may carry over from the GAC adsorbers so that the GAC is not discharged to the drainage ditch. The post filter will consist of a single 25-micron bag filter. The filter will be equipped with an air release valve. There will be a pressure gauge upstream and downstream of the bag filter. The bag filters will be changed when ~~it is~~ clogged. There are no provisions for filter backwashing. Process features include:

Influent Flow:	10 gpm
Operating Pressure:	0 to 75 psi (maximum)
Solids Loading:	Negligible

Effluent Flow Meter The effluent flow will be monitored by an in-line magnetic flow meter with local display and a totalizer to record the number of gallons of water discharged (used to pace the sampler).

Effluent Sampler The effluent flow will be sampled using an off-the-shelf flow - proportioned composite sampler. The sampler will be driven by the 4 to 20 mA output from the effluent flow meter by means of a 4 to 20 mA pulse converter. The sampler will allow for fully programmed sample collection, and will have a refrigerated sample container compartment.

Granular Activated Carbon Vapor Phase Adsorption Separate vapor phase canisters of GAC can be provided, as needed, to meet air discharge requirements. One vapor phase canister would be for the equalization/aeration tank, and one for the air stripper offgas. Each canister will be used for VOC adsorption, as required.

Process features of vapor phase GAC system are as follows:

Aeration/Equalization Tank GAC Canister:

Influent Flow:	100 SCFM
Operating Pressure:	0 to 5 psi (maximum)
Canister Size:	Drum (24-inch diameter by 36 inches high) with 170 pounds of GAC
Number of Canisters:	1
Pressure Drop:	2 inches of water maximum (0.06 psi)

Air Stripper Off-Gas GAC Canister:

Influent Flow:	150 SCFM
Operating Pressure:	0 to 5 psi (maximum)
Canister Size:	Drum (24-inch diameter by 36 inches high) with 170 pounds of GAC
Number of Canisters:	1
Pressure Drop:	2 inches of water (maximum) (0.06 psi)

Design information about process piping, process pumps, process controls, and instrumentation will be provide in future design submittals.

This groundwater treatment system will be housed along the western perimeter of the upland portion of OU- 1 within a heated building (see Drawing C-4)~~onsite away from the capped area to be developed within the central and southwestern (downgradient) portion of the site (see Drawing C-4)~~. The size of the building to house this treatment system is estimated to be approximately 3~~2~~0 feet by 4~~3~~0 feet in plan view.

Utility needs include electricity, water, ~~and~~ telephone, and possibly propane or an equivalent fuel. Sufficient electricity will be needed to drive the extraction wells and sumps, heat tracing of conveyance lines from the extraction wells to the treatment building, treatment system pumps, air stripper blower, air compressor, building heat, and lighting. Telephone service as needed can be provided for an autodialer and on-site communications; a cellular hook-up may be able to be used. Water needed for maintenance activities would need to be transported from a potable source to the site.

A need for pilot-scale groundwater treatability testing has not been identified up to this time. Once discharge limits are established and groundwater extraction locations are finalized, the need for additional treatability work will be reassessed. If additional treatability testing is warranted at a later time, the scope and procedures for such testing will be provided for Government review before the testing is conducted.

TABLE 3.1
YORK OIL OU-1
Deep Groundwater Data in the Vicinity of Proposed Pumping Wells

ALCOA YORK OIL SUPERFUND SITE DEEP GROUNDWATER DATA IN THE VICINITY OF PROPOSED PUMPING WELLS			ARARS	DEEP WELL PUMP TEST (* = Treatability Sample Collection Time)				Historical Data	Surface Water Standards	Existing Ground Water Quality
				T = 0 hrs	T = 24 hrs	T = 48 hrs	T = 72 hrs *			
		SAMPLE ID:		PW-1-0HR	PW-1-24HR	PW-1-48HR	PW-1-72HR	Maximum Historical Concentration Deep Wells YO-1R, YO-12R YO-14, YO-16L		
		LAB ID:		L33794-1	L33825-1	L33867-1	L33884-1			
		SOURCE:		GALSON	GALSON	GALSON	GALSON			
		SDG:		L33679	L33679	L33679	L33679			
		MATRIX:	NYSDEC	WATER	WATER	WATER	WATER			Background Groundwater Quality For Adjacent Areas
		SAMPLED:	Class GA	11/18/96	11/19/96	11/20/96	11/21/96		NYSDEC Class D - Surface Water Standards	
		VALIDATED:	Groundwater							
CAS NO.	COMPOUND	UNITS:	Standards/Guidelines							
	VOCs									
71-43-2	Benzene	UG/L	0.7 (GA)	130	1 J	11	8	4 J	6	
156-59-2	cis-1,2-Dichloroethene	UG/L	5 (GA)	4400 J	38	350 J	300 J	200		
156-60-5	trans-1,2-Dichloroethene	UG/L	5 (GA)	19 J	5 U	1 J	1 J			
1330-20-7	Xylene(Total)	UG/L	5 (GA)	19 J	5 U	2 J	5 U	2 J		
	SVOCs									
108-95-2	Phenol	UG/L	1 (GA)	2 J	0.8 J	10 U	10 U		5 (1)	
105-67-9	2,4-Dimethylphenol	UG/L	1 (GA)	10 U	0.6 J	10 U	10 U	14 J	1 (2)	
	PCBs									
	NOT DETECTED									
	OTHER - TOTAL METALS									
7440-38-2	Arsenic	UG/L	25 (GA)	13.9 J	12.3 J	14.5	13.8	4.8 J		
7440-43-9	Cadmium	UG/L	10 (GA)	2 U	2 U	2 U	2 U	1.4 J	3.9 (3)	
7440-47-3	Chromium	UG/L	50 (GA)	3 U	3 U	3 U	3 U	29.2	1736 (3)	
7440-50-8	Copper	UG/L	200 (GA)	7 U	7 U	7 U	7 U	448	17.7 (3)	
7439-89-6	Iron	UG/L	300 (GA)	10200	9500	9660	9600	4,880	300	12800
7439-92-1	Lead	UG/L	25 (GA)	2 U	2.9 UJ	2.2 UJ	2 U	123	82.6 (3)	
7439-96-5	Manganese	UG/L	300 (GA)	471	523	530	533	97.6	N.L.	2010
7440-02-0	Nickel	UG/L	15.4 (CWA)	1 U	1 UJ	1 UJ	1 U	82.7	1844 (3)	
7440-66-6	Zinc	UG/L	300 (GA)	126	61.2	36.8	43.4	776	321 (3)	
	OTHER - DISSOLVED METALS									
7440-38-2	Arsenic	UG/L	25 (GA)	16.8 J	14.1 J	13	12.7		360	
7439-89-6	Iron	UG/L	300 (GA)	10100	9840	9860	9920			
7439-96-5	Manganese	UG/L	300 (GA)	473	527	534	537			
7440-02-0	Nickel	UG/L	15.4 (CWA)	1 U	1 J	1.2 J	1 U			
7440-66-6	Zinc	UG/L	300 (GA)	42.6	38.5	29.9	29			
	OTHER - CONVENTIONALS									
	pH	Std. units					6.96			
	Temperature	oF					50			
	Conductivity	uS/cm					320			
108-95-2	Total Phenolics	mg/l	0.001 (GA)	0.012	0.012	0.011	0.012	0.027	0.005	0.042
ES-5026	Alkalinity	mgCaCo3		430	404	460	450			
11-02-9	Hardness	mgCaCo3		940	900	740	740			
ES-5001	BOD5	mg/l		5	4	2 U	5			
ES-5002	COD	mg/l		102	101	101	101			
PARESSYR1	MBAS	mg/l					3.67			
ES-5006	Total Dissolved Solids	mg/l		2540	1780	1580	1590			
10-32-2	Total Suspended Solids	mg/l		29	23	18	20			

U - Not detected.
J - Estmated value.
R - Rejected data.
1 - Total unchlorinated
2 - Total chlorinated
3 - Assumes hardness of 100 ppm
Shaded values exceed the ARARs

I:\USERS\49178\YORK2.XLS

E 471300
E 471600
E 471900
E 472200
E 472500
E 472800

NYS Grid North

Western Drainage Area
Of OU-1

York Oil Site
Operable Unit No. 1
(OU-1)

Operable Unit No. 2
(OU-2)

Open Water With
Dead Standing Timber

SSU
SSW
SSU
EW/SSW
EW
SSU
EW
SSW
EW
DFU
Ditch
EW
DFU

Legend

SSU	Scrub-Shrub Upland
DFU	Deciduous Forest Upland
SSW	Scrub-Shrub Wetland
EW	Emergent Wetland

Approximate Scale In Feet

0 50 100 200

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DATE: 09/01/98 (SEH)
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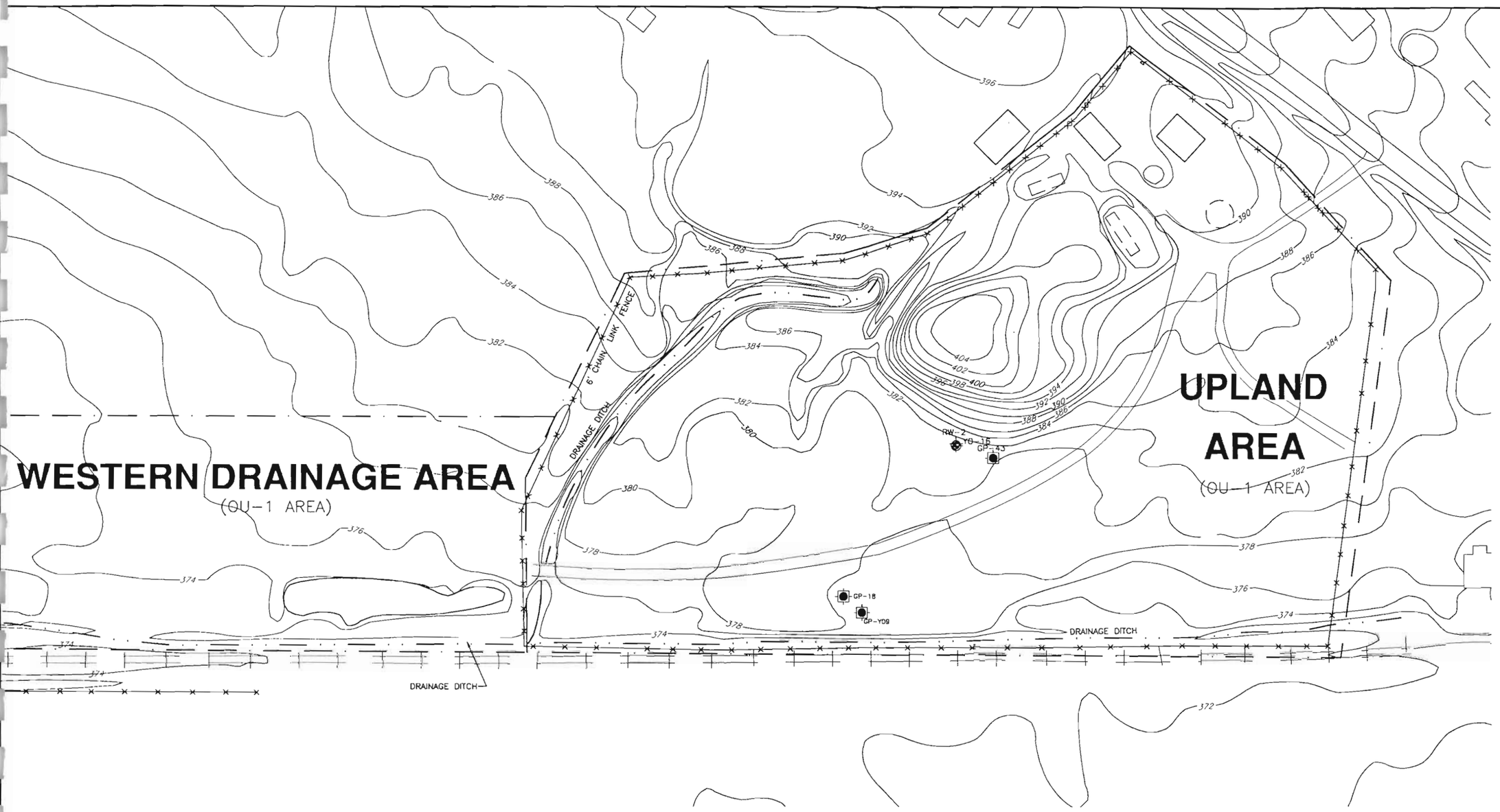
SCALE: PAPER SCALE, 1=1
XREF'S: NONE

Figure 3.1
Vegetation Cover Map
For the Western Drainage Area of OU-1

Figure Prepared By:
Terrestrial Environmental Specialists, Inc.

Base Map Provided By:
S.F. Thew



LEGEND

- EXISTING FENCE
- ABANDONED RAIL ROAD TRACK
- DRAINAGE DITCH
- OU-1 BOUNDARY
- GP-43 GEOPROBE
- RW-2 RECOVERY WELL
- YO-16 YORK OIL WELL
- GP-Y09 YORK OIL GEOPROBE

NOTE:
SIGNIFICANT LNAPL IS GREATER THAN 0.5 FOOT LNAPL THICKNESS MEASURED AT ANY TIME.

100 50 0 100 200

SCALE: 1"=100'

DATE: 09/01/98 (SEH)
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SCALE: PAPER SCALE, 1=1
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FIGURE 3.2

ALUMINUM COMPANY OF AMERICA
MASSENA OPERATIONS

GEOPROBE AND WELL LOCATIONS WITH SIGNIFICANT LNAPL OUTSIDE EXCAVATION AREAS

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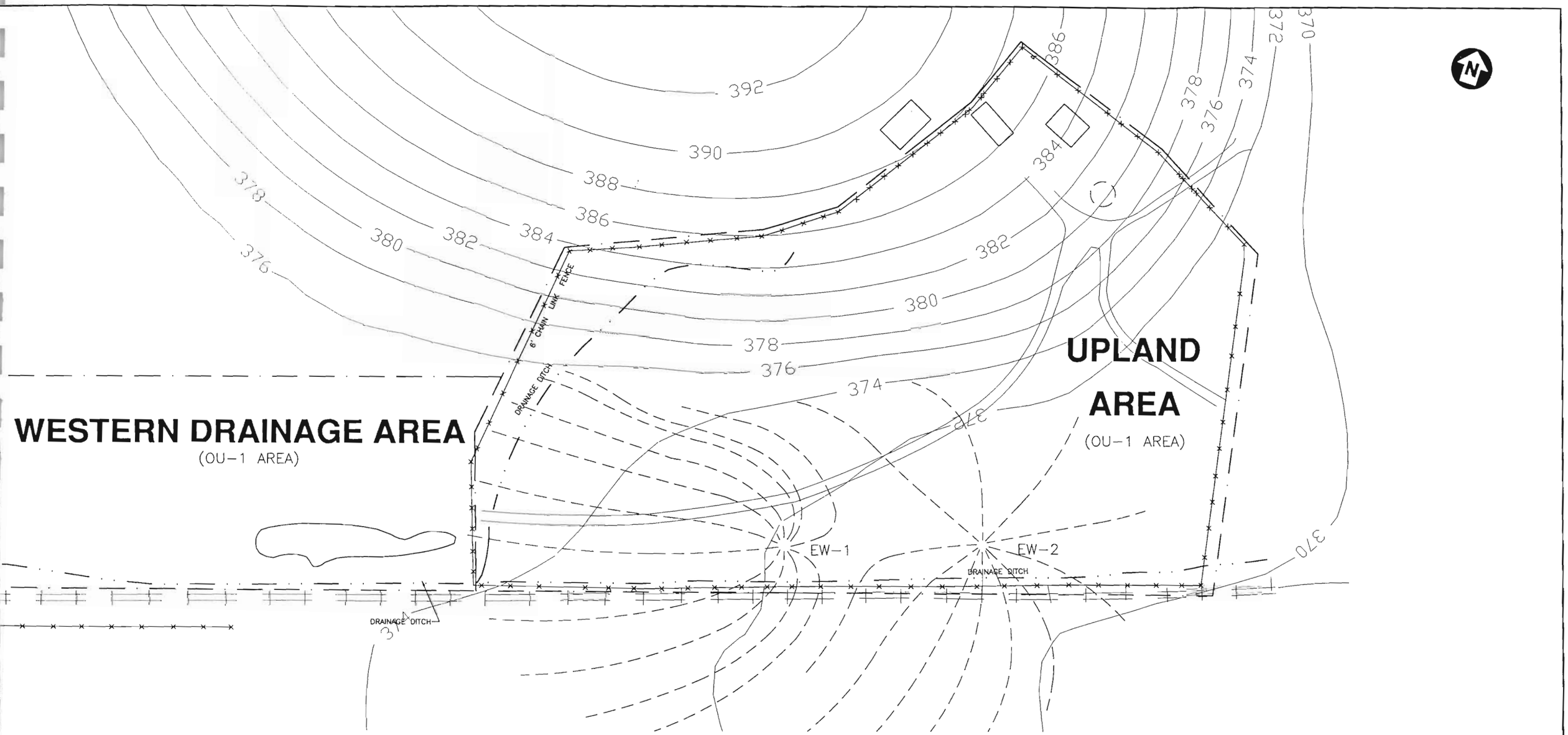

LEGEND

- EXISTING FENCE
- ABANDONED RAIL ROAD TRACK
- DRAINAGE DITCH
- OU-1 BOUNDARY
- EW-1 PROPOSED DEEP EXTRACTION WELL (2)
- 372 POTENTIOMETRIC SURFACE ELEVATION, FEET ABOVE MEAN SEA LEVEL
- GROUNDWATER FLOW LINE

100 50 0 100 200

SCALE: 1"=100'

DATE: 09/01/98 (SEH)
FILE: P:\728129\CAD\28129C03.DWG
SCALE: PAPER SCALE, 1=1

FIGURE 3.3

ALUMINUM COMPANY OF AMERICA
MASSENA OPERATIONS

PROPOSED DEEP EXTRACTION WELL LOCATIONS

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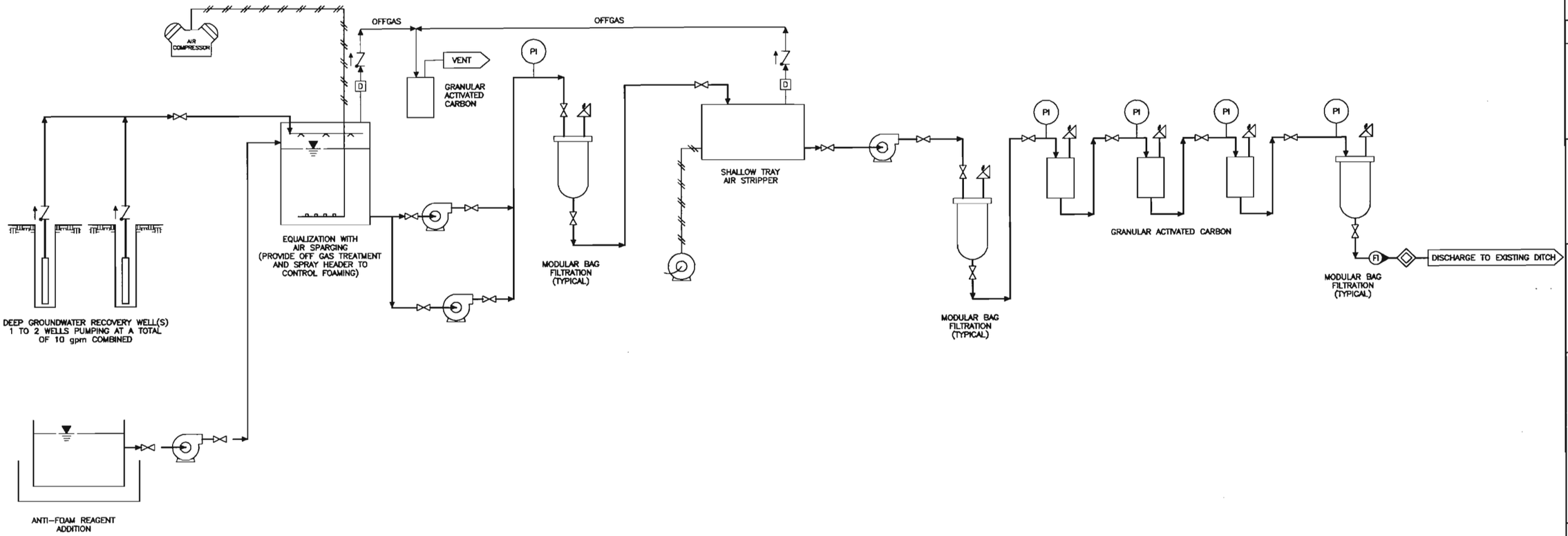


LEGEND:

- CHECK VALVE
- GATE VALVE
- AIR RELIEF VALVE
- PUMP
- BLOWER
- PROCESS OR MECHANICAL LINE
- PNEUMATIC LINE
- FI — FLOW METER
- COMPOSITE SAMPLER
- PI — PRESSURE INDICATOR
- MODULAR BAG FILTRATION
- D — DEMISTER

NOTE:
SAMPLING PORTS NOT INCLUDED HEREIN

Rev	Date	Description	By
A	04/06/98	ISSUED FOR REVIEW	

Job No. 728128
Designed JSG
Drawn SEH
Checked
Reviewed DBB
Approved LC
Reg. No.
Date 19 FEB 1998

Issue Certification: NOT FOR BIDDING OR CONSTRUCTION

PARSONS ENGINEERING SCIENCE, INC.
LIVERPOOL, N.Y.
(315) 451-9560

ALCOA

MOIRA, NEW YORK
YORK OIL SITE

PROCESS FLOW DIAGRAM FOR DEEP GROUNDWATER TREATMENT

FIGURE NO. 3.4

REV. —

DATE: 08/21/98 (SEH)
FILE: P:\728128\CAD\YRKDIL2S.DWG
SCALE: MODELSPACE SCALE, 1=1
XREF'S: NONE

SECTION 4

REMEDIAL ACTION ORGANIZATION AND SCHEDULE

4.1 ORGANIZATION

The York Oil site remediation is being designed and implemented in accordance with a Consent Decree associated with Civil Actions 83-CV-1623 and 92-CV-562 in the United States District Court for the Northern District of New York. A Statement of Work is attached to the Consent Decree that outlines the tasks for completing the site remediation.

Parsons ES and Kiber Environmental Services are under contract with Alcoa as a team to design and oversee construction of the selected remedy. The various tasks outlined in the Statement of Work are being implemented by Alcoa and the Parsons-Kiber team. Each work task is, in accordance with the Consent Decree, overseen and reviewed by the Government. A remediation contractor will be procured to implement the remedy under the oversight of Alcoa and the Parsons ES-Kiber team.

4.2 PROPOSED SCHEDULE

The following schedule is proposed to address pre-remedial action efforts based on the tasks outlined within the Statement of Work, durations of tasks specified within the Consent Decree, and assumptions about Government review times.

- Submit 60% design 9/4/98
- Government review of 60% design complete (60 days) 11/3/98
- Submit 95% design and draft project plans (45 days per Consent Decree) 12/18/98
- Government review of 95% design and plans complete (30 days) 1/18/99
- Complete and distribute bid documents (part of the two-step procurement process in accordance with Federal Acquisition Regulations) 1/22/99
- Select remediation contractor 4/16/99
- Obtain Government approval and award construction contract 5/14/99

This schedule keeps the project design and construction plans steadily moving through 1998 so the remedial action, including the pilot-scale solidification-stabilization testing, can begin as early as possible during the 1999 construction season. Alcoa and the Parsons-Kiber team are willing to communicate frequently with the Government as input on the design and project plans is generated in order to streamline the review process

wherever it makes sense to do so. Conference calls at appropriate times can be used to expedite the document review process.

This schedule and task listing is in conformance with the Consent Decree requirements.

The selected remedy for OU-2, once it is developed, can be incorporated into the design and construction of the site remedy. ~~Assuming~~ OU-2 a predesign investigation ~~is needed within OU-2, investigation~~ activities could follow already-approved site investigation procedures from previous efforts. However, a total of at least 60 to 90 days will most likely be needed to complete the OU-2 predesign field work, laboratory analyses, data validation, and data evaluation following agreement on the predesign investigation procedures. ~~Ideally, the OU-2 predesign investigation results would be incorporated within the 60% design.~~

SECTION 5

FUTURE PRE-CONSTRUCTION AND POST-CONSTRUCTION SUBMITTALS

Following pre-construction submittals are listed as part of the fifth and final task of the Statement of Work that is attached to the Consent Decree. These submittals are in addition to or part of ~~the intermediate (60%) or~~ prefinal (95%) design.

- Project plans to address construction activities including site safety, quality assurance, sampling and analysis, and contingency in case of an unexpected event;
- A construction management plan submitted as part of the project plans to describe the organization, responsibilities of each party, and reporting to be done during construction;
- A draft plan for operation and maintenance as part of the project plans that includes post-construction sampling, maintenance, monitoring, and reporting; and
- An updated project schedule.

Post-construction submittals will include the following:

- A report documenting the pilot-scale S/S testing;
- A final draft operation and maintenance plan if revisions to the draft plan are needed prior to the pre-final inspection;
- A pre-final inspection report following the pre-final construction inspection to discuss remaining construction items, actions needed, and a schedule to complete the remaining items;
- Any final changes to the operation and maintenance plan resulting from the pre-final inspection; and
- A draft and final remedial action report that include as-built drawings and other documentation to demonstrate that the construction and verification efforts have been properly completed.

APPENDIX A

~~REFERENCE LIST~~EARTHWORK VOLUME ESTIMATES

(Appendix C from the 30% design report)

PARSONS ENGINEERING SCIENCE, INC.

Client ALCOA | Job No. 728129.0511 | Sheet 1 of 1

Subject YORK OIL - OU1 | By WJL | Date 3-4-98

MOUND AREA - SLUDGE ESTIMATE | Checked [illegible] | Rev.

FORMER LAGOON #1

LOCATION	SLUDGE ELEVATION	THICKNESS (FT)	CLEAN FILL THICKNESS
YO-53	387.25 - 390.75	3.5	1'
YO-54	389.18 - 384.18	5	3'
YO-55	NONE	— (OUTSIDE LAGOON)	4'
SB-12	382.5 - 386.5	4	5 (PARSONS OBSERVATION)
	MIN ELEV = 382.5	AVG = 4.2 FT	AVG = 3.25 FT
	MAX ELEV = 390.75		
	DIFF = 8.25 FT		

VOLUME = AREA × AVG DEPTH
= 11,445 SF × 4.2 FT
= 1,780 CY

VOLUME = 11,445 SF × 3.25 FT
1,375 CY
1,370 CY

FORMER LAGOON #2

LOCATION	SLUDGE ELEVATION	THICKNESS (FT)	
YO-17	381.5 - 383.0	1.5	6
YO-52	379.34 - 383.34	4	1'
SB-10	378.75 - 384.25	5.5	2'
SB-13	378 - 387.0	11 9	2 (PARSONS OBS)
	MIN ELEV = 378.0	AVG = 5.5 FT	AVG = 2.75 FT.
	MAX ELEV = 387.0		
	DIFF = 9.0 FT		

VOLUME = AREA × AVG DEPTH
= 14,734 × 5.5
= 3000 CY

VOLUME = 14,734 SF × 2.75
1500 CY

TOTAL SLUDGE = 1,780 + 3000 = 4,780 CY

TOTAL CLEAN FILL
V = 2,875 CY
AVG DEPTH = 3.0 FT

PARSONS ENGINEERING SCIENCE, INC.

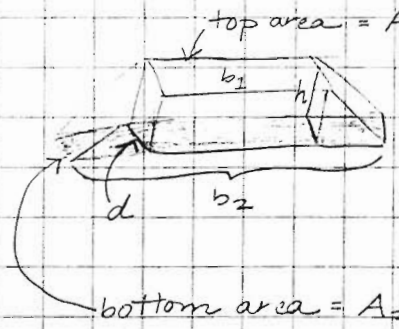
Client York OU-1 Job No. 72312.05 Sheet 1 of 5

Subject [illegible] - MOUND AREA By JHP Date 3/6/93

Checked WJC 3/12/93 Rev.

Former Lagoons #1 & 2 - above ground

Elevation (ft.)	N	Area = N x C_A (C_A = 40' x 0.01) (ft.²)	
386	1637	26,192	AVG = 26,456
	1670	26,720	
388	1582	25,312	AVG = 24,976
	1540	24,640	
390	1438	23,008	AVG = 23,504
	1500	24,000	
392	1338	21,408	AVG = 21,912
	1401	22,416	
394	1224	19,584	AVG = 20,222
	1306	20,896	
396	1150	18,400	AVG = 17,368
	1021	16,336	
398	0760	12,160	AVG = 11,248
	0646	10,336	
400	0496	7,936	AVG = 7,635
	0459	7,334	
402	0296	4,736	AVG = 5,032
	0333	5,328	
404	0195	3,120	AVG = 2,792
	0154	2,464	



Volume of trapezoidal figure

$= \underbrace{\frac{1}{2}(b_1 + b_2) \times h}_{\text{area of trapezoid}} \times \underbrace{d}_{\text{depth}}$

Assume $A_1 = b_1 \times d$

$A_2 = b_2 \times d$

Then $V = \frac{1}{2}(b_1 + b_2) \times h \times d$

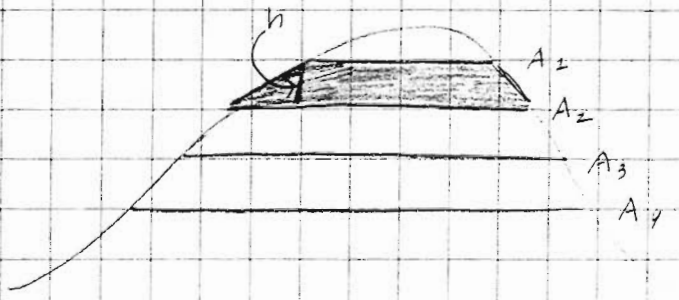
$= (\frac{1}{2} b_1 + \frac{1}{2} b_2) \times h d$

$= \frac{1}{2} b_1 h d + \frac{1}{2} b_2 h d$

$= \frac{1}{2} h A_1 + \frac{1}{2} h A_2$

$= \frac{1}{2} h (A_1 + A_2)$

At former lagoons # 1 & 2, assume mound is a stack of trapezoidal volumes:



where $h = 2$ ft.

Volume $= \frac{1}{2} \times 2 \text{ ft} (A_1 + A_2)$

$= 1 \text{ ft} (A_1 + A_2)$

Total Volume $= \left[\left[\sum 2 (A_1 + A_2 + \cdots + A_n)\right] - (A_1 + A_n)\right] \times \frac{h}{2}$

PARSONS ENGINEERING SCIENCE, INC.

Client: York Oil | Job No. 725129.05111 | Sheet 3 of 5

Subject: Volume Estimates | By: JHP | Date: 3/6/98

Checked: WJC 3/12/98 | Rev.:

Elevation (ft.)	Area (ft.²)	Volume (ft³)	(CY)
402-404	A_1 = 2,792 A_2 = 5,032	7,824	290
400-402	A_1 = 5,032 A_2 = 7,635	12,667	469
398-400	A_1 = 7,635 A_2 = 11,248	18,883	699
396-398	A_1 = 11,248 A_2 = 17,368	28,616	1060
394-396	A_1 = 17,368 A_2 = 20,222	37,590	1392
392-394	A_1 = 20,222 A_2 = 21,912	42,134	1561
390-392	A_1 = 21,912 A_2 = 23,504	45,416	1682
388-390	A_1 = 23,504 A_2 = 24,976	48,480	1796
386-388	A_1 = 24,976 A_2 = 26,456	51,432	1905

Σ = 293,042 ft.³

≈ 10,853 CY

Check: Area of mound (26,179 ft.²) [from CAD] × Avg. depth (9 ft.) [[illegible]] ⟶ 235,611 ft.³

PESI-COR-8 (12/94)

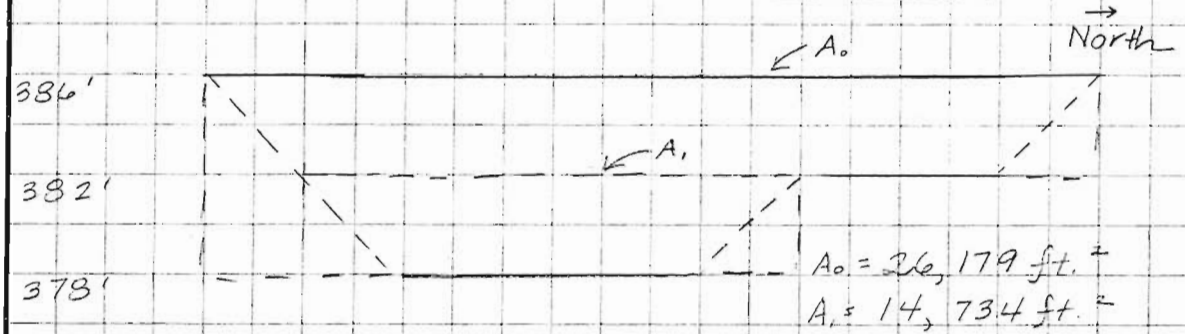
PARSONS ENGINEERING SCIENCE, INC.

Client York Oil | Job No. 728129.0511 | Sheet 4 of 5

Subject Volume Estimation | By [illegible] | Date 5/6/[illegible]

Checked WJL 3/12/98 | Rev.

Former Lagoons #1 + #2 - below ground



A_0 = 26,179 ft.²
A_1 = 14,734 ft.²

By CAD:
A_1 = 11.445 ac
A_2 = 14,734 ac
A_T = 26,179 ac

1) For section from 386' to 382',

$V = A \times h$
$= 26{,}179 \text{ ft.}^2 \times 4 \text{ ft.} = 104{,}716 \text{ ft.}^3 = 3878 \text{ CY}$

2) For section from 382' to 378',

$V = 14{,}734 \text{ ft.}^2 \times 4 \text{ ft.} = 58{,}936 \text{ ft.}^3 = 2{,}183 \text{ CY}$

6,061 CY

3) For triangular sections, assume 1:1 slope,

south: 8' × 8' × 355' (length of southern excavation limit)

$V = \frac{1}{2}(8' \times 8') \times 355'$
$= 2840 \text{ ft.}^3 = 105 \text{ CY}$

north: 4' × 4' × 285' (length of northern excavation limit)

$V = \frac{1}{2}(4' \times 4') \times 285'$
$= 2280 \text{ ft.}^3 = 84 \text{ CY}$

Lagoon #2

4' × 4' × 160' (length of line dividing Lagoons 1 + 2)

$V = \frac{1}{2}(4' \times 4') \times 160'$
$= 1280 \text{ ft.}^3 \pm 47 \text{ CY}$

Lagoon #1

236 CY

east & west: 540' (east) + 960' (west)

$V = \frac{1}{2}(8' \times 8') \times 540' = 26{,}880 \text{ ft.}^3$

$V = \frac{1}{2}(8' \times 8') \times 960' = 30{,}720 \text{ ft.}^3$

from 386' → 382'	104,716 ft.^{3}	=	3,878
+ from 382' → 375'	+ 58,736 ft.^{3}	=	2,183
− triangular sections	− 2840 ft.^{3}	=	105
	− 2280 ft.^{3}	=	84
	− 1280 ft.^{3}	=	47
	157,252 ft.^{3}	=	5824 CY

Σ (Volume above ground + Volume below ground)

= 10,853 CY + 5824 CY

TOTAL VOLUME = 16,677 CY ⟹ SAY 16,700 CY

SOIL TYPE	VOLUME (CY) AREA 1	AREA 2	TOTAL
CLEAN FILL	1,400	1,500	2,900
OILY SLUDGE	1,800	3,000	4,800
	3,200	4,500	7,700
OIL-STAINED SOIL (BY % AREA)	3,900	5,100	9,000
TOTAL	7,100	9,600	16,700

16,700 CY TOTAL
− 7,700
9,000 CY OIL-STAINED SOIL

A_1 = 11,445 SF (43.7 %)
A_2 = 14,734 (56.3 %)
A_T = 26,179 SF

PARSONS ENGINEERING SCIENCE, INC.

Client York Oil | Job No. 733127.01000 | Sheet 1 of 1

Subject Volume Estimates | By JHP | Date 3/12/98

Checked WJL 3/12/98 | Rev.

Former Lagoon #3

Elevation (ft)	N	Area = N × C_A (ft.²) (C_A = 40' × 0.01)	
376	1941	31,056	AVG = 31,024
	1937	30,992	
378	1537	24,592	AVG = 24,840
	1568	25,088	
380	0138	2208	AVG = 2192
	0136	2176	

$$\Sigma V = \frac{h}{2}\left[\left[\Sigma 2(A_1 + A_2 + \cdots + A_{n-1})\right] - (A_1 + A_n)\right] \quad \text{where } h = 2 \text{ ft.}$$

$$= \frac{2 \text{ ft}}{2}(31{,}024 + 2(24{,}840) + 2192)\text{ ft}^2$$

$$= 82{,}896 \text{ ft.}^3 = 3070 \text{ CY}$$

Rough Estimate / Check

V = A × avg. height

V = 31,024 ft.² × 3 ft.

= 93,072 ft.³

= 3447 CY

PARSONS ENGINEERING SCIENCE, INC.

Client Vor-Oil Job No. 729129.05111 Sheet 1 of 3

Subject Clean Fill Volume & Cooped Volume Estimates By JHP Date 3/13/98

Checked WJC 3/13/98 Rev.

I. Volume of Clean Fill to Add to 384' (elevation of water table)

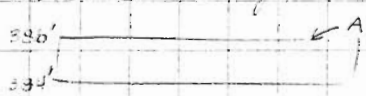
a) Volume of Excavated Clean Fill = 2900 CY

b) Volume Below Grade @ Lagoons 1 + 2 (from 378' → 384'):

1) Volume from 378' to 336' (see Vol. Est. 3/16/98) = 5824 CY

2) Volume from 384' to 336' = $A_o \times h$

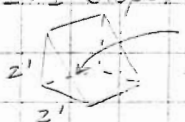
Assume rectangular volume:



$V = 26,179 ft.^2 \times 2 ft.$

$= 53,438 ft.^3$

Subtract triangular volumes on all four sides (to accomodate 1:1 slope):



$V_1 = \frac{1}{2}(2' \times 2') \times 355' = 710 ft.^3$

$V_2 = \frac{1}{2}(2' \times 2') \times 285' = 570 ft.^3$

$\Sigma(V_1 + V_2) = 1280 ft.^3$

$V_{rect} - V_{triang} = 53,438 ft.^3 - 1280 ft.^3$

$= 52,158 ft.^3$

$= 1932 CY$

3) Volume from 378' to 384' = 5824 CY − 1932 CY

= 3892 CY

≈ 3900 CY

c) Volume Below Grade − Volume of Excavated Clean Fill

= 3900 CY − 2900 CY

= 1000 CY of clean fill to import

1000 CY of imported clean fill req'd to fill excavated hole @ Lagoons 1+2 to 384' (elev. of water table)

PARSONS ENGINEERING SCIENCE, INC.

Client York Oil | Job No. 7231-9.05111 | Sheet 2 of 3

Subject Clean Fill Volume Capped. Volume Estimate | By JHP | Date 3/13/90

Checked WJC 3/13/90 | Rev.

II. Area Needed to Place Oily Sludge and Oily-Stained Soil

OIL-STAINED = 27,630
OILY-SLUDGE = 4,800
CLEAN FILL = 2,900
TOTAL = 35,330
-CLEAN FILL = -2,900
TOTAL TO BE PLACED = 32,430 CY

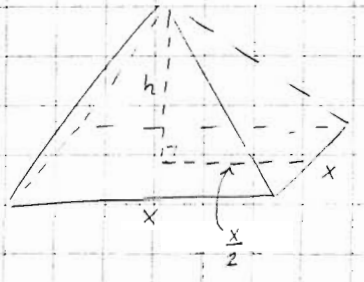
a) Assumptions

Volume of Oily Stuff = 32,430 CY

Max Slope of Side = 15% ; Flat Bottom

30-ft buffer zone from western ditch, fence, & northern decon pad

Volume of mound will be a square-based pyramid



$V = \frac{1}{3}(x^2)h$

where $\frac{h}{\frac{x}{2}} = 0.15$

$2h = 0.15x$

$h = 0.075x$

b) Calculation I

$V = \frac{1}{3}(x^2)h = 32,430$ cy

$= \frac{1}{3}(x^2)(0.075x) = 32,430$ yd.^{3}

$0.025x^3 = 32,430$ yd.^{3}

$x^3 = 1,297,200$ yd.^{3}

$x = 109$ yd. $= 327$ ft. $h = 24.5$ ft.

∴ length of side of base = 327 ft.

height = 24.5 ft

c) Calculation II

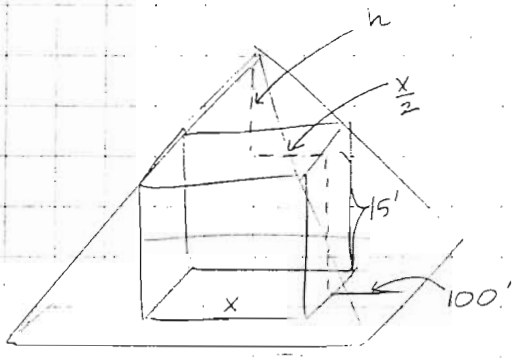
To set height @ 15 ft, assume pyramid with top cut off and side slopes @ 15%.

PARSONS ENGINEERING SCIENCE, INC.

Client York Oil | Job No. 723.29.05111 | Sheet 3 of 3

Subject Clean Fill Volume & Capped Volume Estimating | By JHP | Date 3/13/98

Checked WJL 3/13/98 | Rev.



$\frac{h}{\frac{x}{2}} = 0.15$

V_o = volume of entire pyramid

V_T = volume of pyramid on top

$V_o = \frac{1}{3}(x+200)^2(15+h)$

$V_T = \frac{1}{3}x^2h$

x	$\frac{x}{2}$	h	V_o ($ft.^3$)	V_T ($ft.^3$)	$V_o - V_T$ ($ft.^3$)
135'	67.5'	10.125'	939,884	61,509	878,375

$V_o = \frac{1}{3}(135'+200')^2(15'+10.125')$

$= \frac{1}{3}(335')^2(25.125')$

$= 939,384\ ft.^3$

$V_T = \frac{1}{3}(135')^2 \times 10.125'$

$= 61,509\ ft.^3$

$\approx 875,610\ ft.^3$ (or 32,430 CY) of oily stuff

∴ length of side of base = 335 ft.
height = 15 ft.

NOTE: As per phone conversation w/ Don DeNero of Parsons ES Atlanta office (geotechnical engineer) @ stability of sandy material:

- Maximum slope without stability concerns approx 25 %. Greater slopes will need reinforcement with geogrid.

- Approximate cap footprint sizes based on % slopes: (using pyramid formula & 32,430 CY)

15 %	= 327' square	= 106,930 SF	=	2.455 Acres
20 %	= 297	= 88,209 SF	=	2.025 "
25 %	= 276	= 76,176 SF	=	1.749 "

(REVISIONS TO THE 30% DESIGN REPORT ARE HIGHLIGHTED)

APPENDIX BA

~~REFERENCE LIST~~60% SPECIFICATIONS

SPECIFICATIONS

TABLE OF CONTENTS

YORK OIL SUPERFUND SITE
REMEDIAL ACTION FOR OU-1

CONTRACT NO. ***

END OF TABLE OF CONTENTS

SECTION 01010

SUMMARY OF THE WORK

PART 1 - GENERAL

1.01 IDENTIFICATION

The work shall be performed at the York Oil Site located on County Route 6 (North Lawrence Road) about one mile northwest of the Hamlet of Moira, in the Town of Moira, Franklin County, New York.

1.02 CONTRACT DOCUMENTS

A. Requirements of the work are contained in the Contract Documents, and include cross-references herein to published information, which is not necessarily bound therewith.

B. Included in the general contract are site grading, excavation, soil/sediment removal, wastewater treatment, landfill cover construction, general construction, electrical, mechanical, and all other operations and work required to complete the remedial construction according to the intent of the Contract Documents.

1.03 SITE BACKGROUND

The York Oil facility was constructed in the 1950s by the York Oil Company, which processed used oils collected form service stations, car dealers, and industrial facilities. The oils, some of which contained polychlorinated biphenyls (PCBs) were processed to remove impurities and resold to other businesses. The oil recycling operation was discontinued in the mid-1960s; the property was then used by Pierce Brothers Oil Services, Inc. for used oil storage. The collected oils were stored or processed in eight aboveground storage tanks, three earthen-dammed settling lagoons, and at least once underground storage tank. The recycled oil either was sold as No. 2 fuel oil or was used in dust control for the unpaved roads in the vicinity of the site.

During heavy rains and spring thaws, the oil-water mixture from the lagoons would often overflow onto surrounding lands and into adjacent wetlands, which Pierce Brothers Oil Services, Inc. purchased in 1964. Contamination at the site first was reported by a state road crew in 1979. In 1982, the County assumed title because of unpaid property taxes.

In 1980, EPA began emergency cleanup activities at the site. It secured the property to limit access and to reduce the threat of direct contact with hazardous substances, and it removed oil and contaminated water from the lagoons, which then were filled with a concrete by-product and sand. The top three feet of the oil-soaked soil were excavated from the neighboring wetlands. Contaminated oil was transferred to aboveground storage tanks, and contaminated soil was contained onsite. Contaminated water from one of the lagoons was treated and discharged into the wetlands. An interceptor trench was dug to alter the flow of surface water and groundwater. In 1983, EPA conducted additional emergency actions including the collection of oil seeping into drainage ditches, the installation of a new filter fence system, and the posting of warning signs.

An RI/FS associated with the Site Proper was completed in November 1987 by Erdman, Anthony, Associates on behalf of the New York State Department of Environmental Conservation (NYSDEC). In February 1988, EPA signed a first operable unit ROD, selecting a remedy for controlling the source of the contamination. Initiation of the first operable unit remedial design and remedial action was delayed due to protracted negotiations between EPA and the Potentially Responsible Parties (PRPs).

In late 1994, EPA issued a Unilateral Administrative Order (UAO) to Alcoa to perform several components of the selected remedy, including removing the contaminated tank oils and incinerating them at an EPA-approved facility and cleaning and demolishing the empty storage tanks. Under the UAO, 9,654 gallons of PCB-contaminated debris were removed from the site.

In December 1995, Alcoa also installed another interceptor trench to collect oil seeping into the wetlands. A settlement with the PRPs in the form of a consent decree was finalized in August 1996, which provided for the design and implementation of the selected remedy.

1.04 SUMMARY OF WORK

A. The work consists of furnishing all labor, materials, supervision, equipment, and services necessary to complete the scope of work detailed in the Specifications and Contract Drawings. The work includes, but is not limited to, the following:

1. Preparation of Contractor Plans.
2. Mobilization to the site and installation of temporary facilities and equipment.
3. Performing preconstruction survey to document preconstruction grades and conditions.
4. Installation of surface water diversion system and erosion and sedimentation control devices.
5. Clearing of the work areas.
6. Begin excavation of soils/sludges and perform pilot scale stabilization (S/S) mix design.
7. Perform excavation and S/S of contaminated materials along with backfill, compaction, and grading.
8. Perform intermediate surveys as needed to document quantities and performance of the work.
9. Construct the landfill cap and associated drainage system.
10. Construction of access roads and permanent installations.
11. Construction of a groundwater extraction and treatment system;
12. Well abandonment; and
13. Restoration of disturbed areas including wetlands.
14. Perform final site survey to document final site conditions.
15. Attend post construction meeting and final inspection.
16. Perform punch list items identified during final inspection
17. Demobilization from the site.
18. Prepare final submittals including final site drawings and O&M manuals.

1.05 USE OF SITE

The Contractor shall limit his use of the premises to the work indicated.

A. Use of the Site: Confine operations at the site to the areas permitted. Portions of the site beyond areas on which work is indicated are not to be disturbed.

B. Keep existing driveways and entrances serving the premises clear and available at all times. Do not use for parking or storage of materials.

C. Do not encumber the site with materials or equipment. Confine stockpiling of materials and location of storage sheds to the areas indicated or as directed by the Engineer.

D. Lock automotive type vehicles and other mechanized or motorized construction equipment, when parked and unattended. Do not leave vehicles or equipment unattended with the motor running or ignition key in place.

E. Contractor to provide employee parking onsite, not on or adjacent to public roadways.

1.06 SITE SECURITY

The Contractor shall install a secure 5-foot, high-strength polyethylene orange plastic fence and/or the temporary fencing to provide site security where a permanent fence has not been installed. Temporary plastic fencing shall be Tenax Alpi or equal with 7-foot minimum length posts set at a maximum of 10-feet apart. Fencing shall be installed prior to beginning construction of other work items and shall be repaired in an expeditious manner as necessary. One main entrance/exit gate shall be established, with an optional gate for delivery.

1.07 ACCESS ROADS

Access roads shall be maintained for use by the Contractor and the Owner for the duration of the contract. The contractor shall repair ruts and/or weak spots in the roads as necessary. Proper drainage shall be maintained on all access roads. Gravel or crushed stone for use in road construction or repair shall be approved by the Engineer prior to use.

1.08 SIGNS

The Contractor shall post the work zone with signs reading "Warning, Hazardous Work Area, Do Not Enter Unless Authorized". Warning signs shall be posted at a minimum of every 500 feet along the perimeter fencing.

1.09 DUST CONTROL

An erosion/dust control agent can be used with approval of Engineer. Accomplish dust control by water sprinkling or by other methods approved by the Engineer. The use of petroleum products for dust control shall not be permitted.

END OF SECTION 01010

SECTION 01051

GRADES, LINES, AND LEVELS

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes specifications for surveying required for execution of this work. The Contractor shall retain the services of a New York State licensed Professional Land Surveyor (Surveyor). The Surveyor shall establish survey control; perform preconstruction, intermediate, and post-construction surveys; check and verify thickness and elevations of the cover layers with those shown on the plans and as specified; and prepare record drawings of the construction. The Contractor is responsible for controlling lift thickness and cap component thickness such that the cap conforms to the specified dimension.

(1) Data generated by optical survey measurements shall be used for quality control.

(2) The Surveyor is required, as a minimum to provide the following survey data:
   A. Preconstruction site conditions and grades.
   B. The bottom and extent of all excavations following the removal of sediment and soil;
   C. Calculate pay quantities.
   D. Topography following final sub-grade preparation including the top of all clean fill;
   E. Location of geomembrane, including coordinates of all seams (not elevation);
   F. Top of drainage layer with elevations and thicknesses;
   G. Top of barrier protection layer with elevations and thicknesses;
   H. Top of topsoil with elevations and thicknesses;
   I. Conveyance piping inverts;
   J. Miscellaneous details (e.g., drainage features, roads);
   K. Monitoring wells and extraction wells (locations and elevations), including bottom elevations of vaults (mark the inner casing for reference); and
   L. Final record drawings with all improvements shown.

(3) The data must be reduced and plotted in a form acceptable to the Engineer and provided to the Engineer, prior to proceeding to the next construction phase.

(4) The Contractor shall not proceed with placement of an overlying layer or with subsequent work phases until the Surveyor has completed survey measurements and the data have been reviewed by the Engineer.

(5) Upon completion of all services, the Surveyor shall provide to the Engineer a Letter of Certification for the surveys for use in the Certification Report.

1.02 ACCURACY

(1) Optical Survey, Tape Measurements, and Electronic Measurements: Minimum accuracy of $\pm$0.01 feet in vertical measurements and $\pm$0.1 feet in horizontal measurements.

1.03 TOLERANCES

(1) The Contractor shall place all soils and synthetic materials to the lines, grades, slopes, and thickness shown on drawings within the tolerances specified below.

Description	Tolerances
Cover Layer	- 0.00 feet to + 0.20 feet (Thickness)
Excavations	- 0.00 feet to + 0.20 feet (Thickness)

1.04 JOB CONDITIONS

(1) The Contractor shall be responsible for protecting and maintaining all horizontal and vertical control points during construction.

(2) The Contractor shall be responsible for restaking intermediate lifts of required cap system.

(3) Areas which fail to meet the thickness requirements of Paragraph 1.03(1) shall be reworked or replaced as directed by Engineer at no cost to the Owner. The Contractor shall pay for the costs of all additional survey on reworked or replaced areas.

PART 2: PRODUCTS

None

PART 3: EXECUTION

3.01 SURVEY MEASUREMENTS

(1) Prior to commencement of construction work, the Surveyor shall establish all necessary baselines, horizontal control points, and vertical control benchmarks in order to properly complete construction work and make quantity measurements. The Contractor shall establish a minimum of three vertical and horizontal control points with monuments. Survey control points shall be established such that any point within the job site can accurately be re-established and elevations obtained to the required tolerances at any time during the course of construction. The Surveyor shall tie all his baselines, horizontal and vertical control benchmarks into survey information provided by the Owner.

(2) Where appropriate, an orthogonal grid system to reference topographical measurements shall be established on centers approximately 50 feet or less and at all breaklines, crests, slope toes etc., as necessary to accurately measure the work. All cross sections shall be performed at intervals of 50 feet or less. Cross section data shall include baseline station, offset, elevation, and material type.

(3) Initial Record Survey. Prior to performing any work at the site, the Contractor shall conduct a survey of the site within the project boundaries, up to and including the fenceline and including any area outside of the site boundary or fence where work is to be performed. The survey shall document the condition and preconstruction grades for the purposes of measurement and payment and restoration.

(4) Intermediate Record Survey. The Contractor shall perform surveys as needed throughout the progress of the work to determine pay quantities and document work that has been performed. Surveys to be made shall include, but shall not be limited to surveys of cut areas when cut is complete and prior to fill placement. Surveys of the area to be capped immediately prior to cap placement, and during cap placement, and surveys of the as-built locations of all fill material and cap materials.

(5) Final Record Survey. At the conclusion of the work, the Contractor shall perform a survey of the site within the project boundaries, up to and including the fenceline and including any area outside of the site boundary or fence where work was performed. The survey shall document the condition of the site at the conclusion of the work. The survey shall accurately locate features that are to be shown on the Final Record Survey Drawing. Included in this Final Record Survey will be preparation of as-built sections defining cut and fill limits and as-built records of the actual cap and drainage structures.

END OF SECTION 01051

SECTION 01105

HEALTH AND SAFETY

PART 1 GENERAL

1.01 DESCRIPTION

The Contractor shall develop and implement a Health and Safety Plan to protect all site personnel including those of the Owner, Engineer, all site visitors, and the community. Compliance shall be strictly adhered to and enforced by the Contractor.

This section describes the minimum health and safety requirements for this project including the requirements for the development of a written Health and Safety Plan (HASP) for the project site. The Contractor's HASP must comply with all applicable Federal and State regulations protecting human health and the environment from the hazards posed by activities during this site remediation. The Contractor's HASP must be approved by a licensed industrial hygienist. The HASP shall be submitted by the apparent low Bidder within 14 days from the date of Notice of Intent to Award letter. If the Contractor is awarded the contract, the HASP will be reviewed. The Contractor will resubmit the HASP, addressing all review comments. The Contractor shall not initiate onsite work in contaminated areas until an approved HASP addressing all comments has been issued. All onsite workers must comply with the requirements of the HASP.

Consistent disregard for the provision of these Health and Safety specifications shall be deemed just and sufficient cause for immediate stoppage of work and/or termination of the Contract or any subcontract without compromise or prejudice to the rights of the Owner.

Any discrepancies between this HASP and the specifications shall be resolved in favor of the more stringent requirements as determined by the Engineer.

1.02 BASIS

The Occupational Safety and Health Administration (OSHA) Standards and Regulations contained in Title 29, Code of Federal Regulations, Parts 1910 and 1926 (20 CFR 1910 and 1926) and subsequent additions and/or modifications, the New York State Labor Law Section 876 (Right-to-Know Law) and the Standard Operating Safety Guidelines by the United States Environmental Protection Agency (USEPA), Office of Emergency and Remedial Response provides the basis for the safety and health program. Additional specifications within this section are in addition to OSHA regulations and reflect the positions of both the USEPA and the National Institute for Occupational Safety and Health (NIOSH) regarding procedures required to ensure safe operations at abandoned hazardous waste disposal sites.

The safety and health of the public and project personnel and the protection of the environment will take precedence over cost and schedule considerations for all project work. Any additional costs will be considered only after the cause for suspension of operations is addressed and work is

resumed. The Engineer and the Contractor's Superintendent will be kept appraised, by the Safety Officer, of conditions which may adversely affect the safety and health of project personnel and the community. The Owner and the Engineer may stop work for health and safety reasons. If work is suspended for health and/or safety reasons, it shall not resume until approval is obtained from the Owner and the Engineer. The cost of work stoppage due to health and/or safety shall be borne entirely by the Contractor.

1.03 DEFINITIONS

The following definitions shall apply to the work of this Contract:

A. Project Personnel: Project personnel include the Owner, Engineer, Contractor, Subcontractors, and Federal and State Representatives working or having official business at the Project Site(s).

B. Authorized Visitor: Visitors shall be prepared by the Contractor. Authorized Federal and State visitors shall receive approval to enter the site. The Safety Officer has primary responsibility on determining who is qualified and may enter the site.

C. Health and Safety Coordinator (HSC): The HSC shall be a Certified Industrial Hygienist (CIH) or Certified Safety Professional (CSP) retained by the Contractor. The HSC will be responsible for the development and implementation of the HASP.

D. Safety Officer (SO): The SO will be the Contractor's onsite person who will be responsible for the day-to-day implementation and enforcement of the HASP. The SO cannot also perform as the Contractor's site superintendent.

E. Health and Safety Technicians (HST): The HST(s) will be the Contractors onsite personnel who will assist the SO in the implementation of the HASP, in particular, with air monitoring in active work areas and maintenance of safety equipment. One HST shall be present for each site. The HST cannot also perform as the Contractor's site superintendent.

F. Medical Consultant (MC): The Medical Consultant is a physician retained by the Contractor who will be responsible for conducting physical exams as specified under the Medical Monitoring Programs in this section.

G. Project Site: The area designated on the Drawings which includes the Contractor Work Area.

H. Contractor Work Area: An area of the project site including Support Zone, access road, staging area and Exclusion Zone.

I. Contractor Support Zone: An area of the Contractor Work Area outside the Exclusion Zone, accessible for deliveries and visitors. No persons, vehicles or equipment may enter these areas from the Exclusion Zone without having gone through specified decontamination procedures in the adjacent Contamination Reduction Zone.

J. Staging Areas: Areas within the Exclusion Zone for the temporary staging of contaminated soil and debris.

K. Exclusion Zone: An area within the Contractor Work Area which encloses the area of contamination. Protective clothing and breathing apparatus as specified in the health and safety requirements and in the Contractor's approved Health and Safety Plan must be worn.

L. Contamination Reduction Zone: An area at the Exit Point of the Exclusion Zone through which all personnel, vehicles and equipment must enter and exit. All decontamination of

vehicles and equipment and removal of personnel protective clothing and breathing apparatus must take place in the Contamination Reduction Zone.

M. Monitoring: The use of direct reading field instrumentation to provide information regarding the levels of gases and/or vapor, which are present during remedial action. Monitoring shall be conducted to evaluate employee exposures to toxic materials and hazardous conditions.

1.04 RESPONSIBILITIES:

The Owner and the Engineer will review modifications to the HASP for the acceptability for its personnel and the impact on the site and human health.

Contractor:

The Contractor will perform all work required by the Contract Documents in a safe and environmentally acceptable manner. The Contractor will provide for the safety of all Project Personnel and the community for the duration of the Contract.

The Contractor shall:

A. Employ a Safety Officer for the project who shall be assigned full-time responsibility for all tasks described under the Health and Safety Plan. In the event the Health and Safety Officer cannot meet his responsibilities, the Contractor shall be responsible for obtaining the services of an "alternate" Health and Safety Officer meeting the minimum requirements and qualifications contained within these plans. No work will proceed on this project in the absence of an approved Health and Safety Officer.

B. Employ a Health and Safety Technician (HST) for the project who will assist the SO in implementing the HASP.

C. Ensure that all Project Personnel have obtained the required physical examination prior to and at the termination of work covered by the contract in accordance with OSHA 1910.120 regulations.

D. Responsibility for the pre-job indoctrination of all Project Personnel with regard to the Safety Plan and other safety requirements to be observed during work, including but not limited to: (1) potential hazard, (2) personal hygiene principles, (3) personal protection equipment, (4) respiratory protection equipment usage and fit testing, and (5) emergency procedures dealing with fire and medical situations.

E. Responsibility for the implementation of this Health and Safety Plan, and the Emergency Contingency Plan and Response Plan.

F. Provide and ensure that all Project Personnel are properly clothed and equipped and that all equipment is kept clean and properly maintained in accordance with the manufacturer's recommendations or replaced as necessary.

G. Alert appropriate emergency services before starting any hazardous work and provide a copy of the Emergency Contingency Plan to the respective emergency services.

H. Have sole and complete responsibility of safety conditions for the project including safety of all persons (including employees).

I. Be responsible for protecting the project personnel and the general public from hazards due to the exposure, handling, and transport of contaminated materials. Barricades, lanterns, roped-off areas, and proper signs shall be furnished in sufficient amounts and locations to safeguard the project personnel and public at all times.
J. Ensure all OSHA health and safety requirements are met.
K. Maintain a chronological log of all persons entering the project site. It will include organization, date, and time of entry and exit. Each person must sign in and out.
L. Post the work zone with signs reading "Warning, Hazardous Work Area, Do Not Enter Unless Authorized," and restrict access by the use of temporary and/or permanent fencing. Warning signs shall be posted at a minimum of every 500 feet along the perimeter fence.
M. Brief all approved visitors to the site on safety and security, provide with temporary identification and safety equipment, and escort throughout their visit.

PART 2 - HEALTH AND SAFETY PLAN

2.01 HEALTH AND SAFETY PLAN

The Health and Safety Plan (HASP) is a deliverable product of this project and shall be submitted within 14 days from the date of Notice of Intent letter. The Contractor shall prepare a HASP, have it approved by a licensed industrial hygienist. If awarded the contract, the Contractor's HASP will be reviewed. Agreed upon responses to all comments will be incorporated into the final copy of the HASP. The HASP shall govern all work performed for this contract.

2.02 PERSONNEL HYGIENE AND DECONTAMINATION

The Contractor shall provide a hygiene facility at each site. The hygiene facility shall include the following:

A. Hand washing facilities for project personnel complete with hot water, soap, paper towels, and mirror;
B. Areas for changing into and out of work clothing. Work clothing should be stored separately from street clothing;
C. Clean and "dirty" locker facilities;
D. Disposal of spent clothing material;
E. Portable "boot wash" decontamination equipment. Clean water shall be provided no less than twice per day; and
F. First aid kit including a portable eye wash station.

2.03 EQUIPMENT DECONTAMINATION

General:

1. All equipment and material used in this project shall be thoroughly washed down in accordance with established Federal and State procedures before it is removed from the project. The cost for this element of work shall be incorporated in the lump sum bid for mobilization/demobilization or as otherwise directed on this project.

2. All vehicles and equipment used in the "Dirty Area" will be decontaminated to the satisfaction of the Safety Officer in the decontamination area on site prior to leaving the project. The Contractor will certify, in writing, that each piece of equipment has been decontaminated prior to removal from the site.
3. Decontamination shall take place within the designated equipment and materials decontamination area. The Contractor shall provide suitable wind barriers. The decontamination shall consist of degreasing (if required), followed by high-pressure, hot water cleaning, supplemented by detergents as appropriate. Wash units shall be portable high-pressure with a self-contained water storage tank and pressurizing system (as required). Each unit shall be capable of heating wash waters to 180 degrees and providing a nozzle pressure of 150 psi.
4. Personnel engaged in vehicle decontamination will wear Level C Protective clothing and equipment. If the Contractor cannot or does not satisfactorily decontaminate the tools or equipment at the completion of the project, the Contractor will dispose such and will bear the cost of such tools and equipment and its disposal without any liability to the Owner. At the completion of the project the Contractor shall completely decontaminate and clean the decontamination area.

2.04 AIR MONITORING PROGRAM

A. The Contractor shall develop as part of the HASP, an Air Monitoring Program (AMP). The purpose of the AMP is to determine the proper level of personnel protective equipment to be used, to document that the level of worker protection is adequate and to assess the migration of contaminants to offsite receptors as a result of site work.

B. The Contractor shall supply all personnel, equipment, facilities and supplies to develop and implement the Air Monitoring Program described in this section.

C. The Contractor's AMP shall include both real-time and documentation air monitoring.
1. The purpose of real-time monitoring will be to determine if an upgrade (or downgrade) of personnel protective equipment is required while performing onsite work and to implement engineering controls, protocols or emergency procedures if Contractor established action levels are encountered.
2. The Contractor shall also use documentation monitoring to ensure that adequate personnel protective equipment is being used and to determine if engineering controls are mitigating the migration of contamination to offsite receptors.
3. Documentation monitoring will also be used to assess if real-time monitoring equipment is adequate to detect the compounds identified to be present. Documentation monitoring results may indicate the need for alternative real-time monitoring devices.

D. During the progress of active remedial work, the Contractor will monitor the quality of the air in and around each active hazardous operation with real-time instrumentation prior to personnel entering these areas. Sampling at the hazardous work site will be conducted on a continuous basis. Any departures from general background will be reported prior to personnel entering a

confined area to the Safety Officer who will determine when and if operations should be shut down.

E. Air monitoring equipment will be operated by personnel trained in the use of the specific equipment provided and will be under the control of the Safety Officer. A log of the location, time, type and value of each reading and/or sampling will be maintained. Copies of log sheets will be provided on a daily basis to the Engineer.

F. Real-Time Air Monitoring:

1. Real-time air monitoring shall be conducted using the following equipment:
   - Volatile organics shall be measured using a photoionizaton detector, or equal. The instrument shall be calibrated twice daily using measures in the users manual.
   - Total particulates shall be measured using an MDA Model P5H digital dust indicator or equal. The instrument shall be calibrated daily according to the procedure in the users manual. The meter shall be capable of measuring dust concentrations down to 0.01 mg/m^3.
2. Real-time monitoring will also be conducted at the work area exclusion zone at a minimum of four locations including one upwind (background) and three downwind locations. A background reading will be established daily during all intrusive activities at the beginning of the work shift. If the wind direction changes during the course of the day, a new background reading will be made. Downwind readings at the exclusion zone perimeter will be made when action levels have been exceeded at the excavation, or a minimum of twice a day.
3. If the level of VOCs at the downwind site perimeter is 5 ppm above background levels measured upwind from the work area, then all work must be suspended and engineering controls must be implemented to bring concentrations back down to acceptable levels.
   If the organic vapor level decreased below 5 ppm above background, work activities can resume. If the organic vapor levels are greater than 5 ppm over background but less than 25 ppm over background at the perimeter of the work area, activities can resume provided:
   - The organic vapor level 200 feet downwind of the work area or half the distance to the nearest residential or commercial structure, whichever is less, is below 5 ppm over background; and
   - More frequent intervals of monitoring, as directed by the Safety Officer, are conducted.
4. If the level of airborne particulates at the downwind site perimeter exceeds the action level of 150 ug/m^3 that is established in the NYSDEC Technical and Administrative Guidance Memorandum HWR.89-4031 entitled "Fugitive Dust Suppression and Particulate Monitoring Program at Inactive Hazardous Sites", then all work must be suspended and engineering controls such as water spray or dust suppressants must be implemented to bring concentrations back down to acceptable levels. No visible dust from exposed waste areas will be permitted.

G. Documentation Monitoring:

Documentation monitoring will be conducted at the perimeter at a minimum of four (4) locations (one upwind and three downwind) for volatile organic compounds and dust. Documentation monitoring will be conducted during any work which exposes waste (i.e. waste relocation/excavation, gas vents, leachate collection, sediment removal, waste paper removal, etc.)

1. Total nuisance dust will be collected using a PVC collection filter and personnel sampling pump and analyzed gravimetrically according to NIOSH Method 0500.
2. Organic vapors will be collected using sorbent tubes and personnel sampling pumps and analyzed according to NIOSH Methods 1500, 1501, and/or 1503.
3. Documentation samples will be collected at four of eight established perimeter locations. The four locations will be chosen according to site activities and expected wind direction. At the end of the sampling period, meteorological data will be reviewed and one upwind and two downwind samples will be chosen to be analyzed. The fourth sample will be discarded.
4. The eight perimeter locations will be established and marked with high visibility paint or flagging at approximately equidistant points around the site. Samples will be collected at a height of 6 feet above ground surface.
5. In addition to the perimeter monitoring, documentation samples will be collected onsite. Onsite samples will be collected by choosing "high-risk" workers to wear appropriate collection media for dust. "High-risk" workers are those workers most likely to encounter contamination on a particular task.
6. Documentation samples will be collected twice a week at regularly scheduled intervals and at the initiation of a new phase of onsite work. Samples will be collected during the normal work hours when activities are occurring onsite.
7. The contractor shall install a meteorological station onsite which will be capable of continuously recording, at a minimum; wind velocity and direction and temperature.

H. Explosive Gas Monitoring:

The Contractor shall monitor for explosive gases in all enclosed spaces (i.e. manholes, tanks) prior to work in those areas.

2.05 SITE SPECIFIC INFORMATION

The Contractor is responsible for protection of project personnel and the community. A significant volume of site-specific analytical data are available in the Remedial Investigation/ Feasibility Study (RI/FS) and Predesign Investigation reports completed for the Site.

2.06 REPORTING

A. The Contractor shall maintain and submit to the Engineer on a daily basis, a daily health and safety report which summarizes the following:
   1. Work performed;
   2. Level of protection;

3. Real-time air monitoring results;
4. Safety related problems; and
5. Corrective actions implemented.

B. The Contractor shall prepare a monthly report of all health and safety monitoring analysis and corrective measures. The monthly report will be provided tot he Engineer no later than two weeks after the end of each month during work involving exposure to wastes. The report shall include all analytical results and maps depicting sampling and work locations, wind direction/velocities, date and time of sampling and monitoring, and action limits. The report shall also include any information regarding the use/implementation of engineering controls to reduce emission and exposure levels.

END OF SECTION 01105

SECTION 01300

SUBMITTALS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Submittal procedures shall conform to requirements of General Conditions and as described in this Section.

1.02 SCHEDULE OF SUBMITTALS

A. Schedule of Submittals: The Contractor shall complete a schedule of submittals 14 days after award of contract. The schedule shall show necessary submission dates for all shop drawings, samples, product data, plans, schedules, etc.

1.03 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

The Contractor shall coordinate submittals with the progress schedule and actual work progress. Allow two weeks for the Engineer's review. Provide additional copies as required by governing authorities:

A. Shop Drawings:
   1. The Contractor shall submit to the Engineer for his review, shop drawings, engineering information, product data, and samples, when requested, of all items of material and equipment as specified.
   2. Initial Submittal: Submit six opaque blue/black line prints. One will be returned.
   3. Final Submittal: After approval, submit six prints; with final submittal, include additional prints as necessary for job use and distribution. Maintain one print as a mark-up copy for the record drawings.

B. Product Data: Mark each copy to indicate the actual product to be provided; show selections from among options in the manufacturer's printed product data. Submit six copies to the Engineer. Where the product data are required for maintenance manuals, submit two additional copies which will be returned. Maintain one additional copy; at the project site for reference purposes.

   Do not proceed with the installation of manufactured products until final review by the Engineer and until a copy of related product is in the installer's possession at the project site.

C. Samples: Submit three sets of samples when requested; one set will be returned. Provide three or more samples in each set where variations in color, pattern or texture are observable; show average condition and extreme range of variations. Submit full documentation with each set. Sample submittals are for Engineer's observation of color,

texture, pattern and "kind". Maintain returned set at project site for purposes of quality control comparisons.

1.04 MISCELLANEOUS SUBMITTALS

A. Provide copies of miscellaneous submittals as follows:
   1. Warranties: Submit two executed copies, plus additional copies as required for maintenance manual.
   2. Operation and Maintenance Manuals: Submit in accordance with Section 01730. Include information for all equipment and materials installed.
   3. Record Drawings: Submit in accordance with Section 01720 original maintained marked-up prints.

1.05 PROCEDURES

A. Submit Shop Drawings to the Engineer.

B. A letter of transmittal shall accompany each submittal. If data for more than one Section of the Specifications is submitted, a separate transmittal letter shall accompany the data submitted for each Section.

C. A the beginning of each letter of transmittal, provide a reference heading indicating the following:

1. Client Name Aluminum Company of America
2. Project Name York Oil Superfund Site (OU-1) Remediation Action
3. Contract No. _____
4. Transmittal No. _____
5. Section No. _____

D. If a submittal deviates from the requirements of the Contract Documents, contractor shall specifically not each variation in his letter of transmittal.

E. All submittals for approval shall have a title block with complete identifying information satisfactory to Engineer.

F. All submittals shall bear the stamp of approval and signature of Contractor as evidence that they have been reviewed by Contractor. Submittals without this stamp of approval will not be reviewed by Engineer and will be returned to Contractor. The stamp shall contain the following minimum information:

Project Name: York Oil Superfund (OU-1) Remedial Action
Contractor's Name: _____
Date: _____
Item: _____
Specifications: _____
Section: _____

Page No.: _____
Para. No.: _____
Drawing No.: _____
Location: _____
Submittal No.: _____
Approved By: _____

G. A number shall be assigned to each submittal by Contractor starting with No. 1 and thence numbered consecutively. Resubmittals shall be identified by the original submittal number followed by the suffix "A" for the first resubmittal, the suffix "B" for the second resubmittal, etc.

H. Contractor shall initially submit to Engineer a minimum of six copies of all submittals.

I. After Engineer completes his review, submittals will be marked with one of the following notations:
   1. Approved
   2. Approved as Corrected
   3. Revise and Resubmit
   4. Not Approved

J. If a submittal is acceptable, it will be marked "Approved" or "Approved as Corrected". Two prints or copies of the submittal will be returned to Contractor.

K. Upon receipt of a submittal marked "Approved" or "Approved as Corrected", Contractor may order, ship, or fabricate the materials included on the submittal, provided it is in accordance with the corrections indicated.

L. If a submittal marked "Approved as Corrected" has extensive corrections or corrections affecting other drawings or Work, Engineer may require that Contractor make the corrections indicated thereon and resubmit for record purposes. Such drawings will have the notation, "Approved as Corrected - Resubmit".

M. If a submittal is unacceptable, 2 copies will be returned to Contractor with one of the following notations:
   a. "Revise and Resubmit"
   b. "Not Approved"

N. Upon return of a submittal marked "Revise and Resubmit", Contractor shall make the corrections indicated and repeat the initial approval procedure. The "Not Approved" notation is used to indicate material or equipment that is not acceptable. Upon return of a submittal so marked, Contractor shall repeat the initial approval procedure utilizing acceptable material or equipment.

O. Any related Work performed or equipment installed without an "Approved" or "Approved as Corrected" Shop Drawing will be at the sole responsibility of the Contractor.

P. Submittals shall be made well in advance of the need for the material or equipment for construction and with ample allowance for the time required to make delivery of material or equipment after data covering such is approved. Contractor shall assume the risk for all materials or equipment which are fabricated or delivered prior to the approval of submittals. Materials or equipment will not be included in periodic progress payments until approval thereof has been obtained in the specified manner.

Q. Engineer will review and process all submittals promptly, but a reasonable time should be allowed for this, for the submittals being revised and resubmitted, and for time required to return the approved submittals to Contractor.

R. It is Contractor's responsibility to review submittals made by his suppliers and Subcontractors before transmitting them to the Engineer to assure proper coordination of the Work and to determine that each submittal is in accordance with his desires and that there is sufficient information about materials and equipment for the Engineer to determine compliance with the Contract Documents. Incomplete or inadequate submittals will be returned for revision without review.

S. Contractor shall furnish required submittals with complete information and accuracy in order to achieve required approval of an item within three submittals. All costs to the Engineer involved with subsequent submittals will be backcharged to the Contractor by deducting such costs from payments due the Contractor for Work completed. In the event that the Contractor requests a substitution for a previously approved item, all of the Engineer's costs in the reviewing and approval of the substitution will be backcharged to the Contractor unless the need for such substitution is beyond the control of the Contractor or provide a significant cost savings to the Owner.

END OF SECTION 01300

SECTION 01310

PROGRESS SCHEDULE

PART 1 - GENERAL

1.01 SCOPE

A. This section covers requirements for submission, approval, and updating of progress schedules and related documents.

1.02 PROGRESS SCHEDULE

A. The Contractor shall submit a preliminary Progress Schedule with the bid.

B. Fifteen (15) days before the date established for "commencement of the work", submit five (5) copies of a comprehensive progress schedule indicating a time bar for each significant category of work to be performed. Arrange schedule to indicate required sequencing and to show time allowances for submittals, inspections, weather allowances, and similar time margins. The schedule shall indicate the estimated dates for the start and completion of the various stages of the work and shall include information regarding man-loading and equipment-loading required to progress the work as shown. Following the initial revision of the schedule after the Engineer's review, print and distribute the schedule to concerned parties, including three (3) copies to the Engineer. The schedule shall be revised and redistributed as determined with each monthly pay requisition, subject to the Owner's approval, at intervals matching application for payment requests.

C. The Contractor shall revise and update his Plan of Operations and Progress Schedule whenever one of the following conditions apply:
   (1) When delays in completion of any work item or sequence of work items results in an indicated extension of the Project completion by 10 working days or more.
   (2) When delays in submittals or deliveries, or work stoppages are encountered which make replanning or rescheduling of the work necessary.
   (3) When the schedule does not represent the actual production and progress of the Project.

D. The Contractor shall submit five (5) copies of the Progress Schedule and each revision to the Company for review.

1.03 PROGRESS REPORT

A. The Contractor shall submit a progress report to the Company with each payment application. Each report shall include a description of the amount of progress during the past period in terms of completed activities in the Plan of Operation and Progress Schedule currently in effect, a description of problem areas, current and anticipated delay factors and their estimated impact on performance of other activities and completion

dates, and an explanation of corrective actions taken or proposed. The progress report shall also include plans for the next period.

B. Five (5) copies of each progress report shall be submitted for review and record purposes.

C. If at any time it appears to the Engineer that the rate of progress of the work being made is insufficient to insure completion of the Work by the scheduled completion date, the Authorized Representative may require the Contractor to take such steps as are necessary to insure completion as scheduled. Any additional costs incurred shall be the sole obligation of the Contractor.

1.04 METHOD STATEMENTS

A. The Contractor shall submit to the Company for review by the Company and Engineer, method statements indicating the Contractor's intended procedure for accomplishing each feature of the work. Method statements shall address:
   (1) Key personnel
   (2) Plans and equipment
   (3) Work sequences
   (4) Estimated rates of progress
   (5) Levels of protection

B. Method statements shall be submitted to the Company at least fifteen (15) days prior to commencement of each feature of the work. Work shall not commence on any feature until approval of the corresponding method statement has been received in writing. Approval of the Contractor's method statement shall not relieve the Contractor of his obligations to perform the work in accordance with the Contract provisions.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 01310

SECTION 01400

QUALITY ASSURANCE AND QUALITY CONTROL SERVICES

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Engineer will execute a quality assurance and quality control (QA/QC) program as required by the Owner and these specifications. All excavation and earthwork related construction must be performed in the presence of the Engineer. The Contractor shall cooperate with the Engineer with sampling and testing as requested by the Engineer. The data generated as part of the quality assurance and quality control program shall govern over data generated from the Contractor's required quality control program and any other test data.

B. Related work specified in other sections:
   1. Section 01300 - Submittals
   2. Section 02228 - Compaction
   3. Section 02260 - Soil Cover Construction
   4. Section 02269 - QA/QC for Soil Cover Materials
   5. Section 02405 - Polyethylene Geomembranes
   6. Section 02445 - Solidification/Stabilization

1.02 TESTING

A. Engineer's Responsibilities: The Engineer shall provide and pay for QA/QC services for the following work items as described in the Engineer's Construction QA/QC Plan.
   1. Tests required for solidification/stabilization.

B. Contractor's Responsibilities: The Contractor shall provide and pay for QC services for the following work items:
   1. Tests required for the initial submittal and approval of all materials at the site.
   2. Compaction testing for all soil placement.
   3. Other geotechnical testing for landfill cover soil materials.

C. The Contractor shall pay for repeat tests performed by the Engineer required because of the Contractor's negligence or failure to meet specification requirements.

1.03 SUBMITTALS

A. The Contractor shall submit the name and qualifications of independent test agencies to be used for this project.

B. The Contractor shall submit a certified written report of each inspection, test or similar service, in duplicate to the Engineer.

Report Data: Written inspection or test reports shall include:

1. Names of testing agency or test laboratory.
2. Dates and locations of samples, tests, or inspections.
3. Names of individuals present.
4. Complete inspection or test data.
5. Test results.
6. Interpretations.
7. Recommendations.

1.04 COORDINATION

A. The Contractor shall coordinate required tests with the Engineer and shall notify the Engineer a minimum of 24 hours in advance.

B. The Contractor shall allow a reasonable amount of time from the time samples are taken to obtain results from the Engineer.

C. The Engineer shall provide copies of all test results to the Contractor.

D. The Contractor shall cooperate with the Engineer and the testing laboratory to provide access to the work and to assist in obtaining samples.

E. The Contractor shall schedule his work to allow the required testing and shall not cover up work for which acceptable test results have not been received.

F. Inspection, sampling, and testing shall be as specified in other sections.

1.05 MEASUREMENT AND PAYMENT

No separate measurement or payment shall be made for work required under this section. All costs in connection therewith shall be considered incidental to the work under this Contract.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 EXECUTION

Upon completion of inspection or testing, repair damaged work and restore substrates and finishes to original form.

END OF SECTION 01400

SECTION 01500

TEMPORARY FACILITIES AND FIELD OFFICE

PART 1 - GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

A. Provide the necessary field offices, ancillary structures, sheds, utility services, and facilities for the workers to carry out the project work as specified. Install the temporary facilities to be ready for use when first needed to avoid delays in the work. Do not remove the facilities until no longer needed and removal is authorized by the Engineer. Usage charges for temporary facilities are to be paid by the Contractor. Temporary services shall be provided at each site.

1.02 QUALITY ASSURANCE

A. Regulation: Comply with requirements of local laws and regulations governing construction and local industry standards, in the installation and maintenance of temporary services and facilities.

B. Standards: Comply with the requirements of NFPA Code 241, "Building Construction and Demolition Operations", the ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition", and the NECA National Joint Guideline NJG-6 "Temporary Job Utilities and Services".

PART 2 - PRODUCTS

2.01 SUBMITTALS

The Contractor shall submit drawings within ten days following Notice of Award and prior to commencing work to the Engineer for approval, showing the layout, furnishings, and facilities of the field office trailer and information concerning how the Contractor proposes to furnish the required utilities.

PART 3 - EXECUTION

3.01 UTILITY INSTALLATION

Engage the local utility company to install temporary service or make connections to existing service, if available. Arrange with the Owner for an acceptable time when service can be interrupted to make connections. The Contractor shall obtain and pay for permits and construction required to bring temporary utilities to each site.

A. Electric Power Service: Comply with applicable requirements of NEMA, NECA and UL standards and governing regulations.

B. Temporary Telephones: Install telephones for the Engineer's field offices. Separate telephone service shall be provided for Engineer and Contractor. Post a list of operational and emergency telephone numbers.

3.02 TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES INSTALLATION

A. Engineer's Field Offices: Provide standard prefabricated or mobile units, or the equivalent job-built field offices, of at least 500 square feet for the Engineer at the site.

1. The office shall be adequately heated, well lighted, suitably ventilated, and cooled with a refrigerated-type air conditioning unit, complete with all piping and electrical connections. An adequate supply of cold drinking water shall be furnished and maintained. Steps and landings shall be provided.
2. The office shall be provided with following items:

1 - fire extinguisher
1 - locking file cabinet (4-drawer)
1 - first aid kit
1 - conference table
(3 ft. x 5 ft. minimum)
2 - full size desks and chairs
2 - shelves (3' x 1' minimum)
2 - waste baskets
1 - paper towel dispenser with towels (to be replenished by Contractor)
8 - chairs (folding or stackable)
1 - telephone answering machine with integral cordless phone
1 - plain paper facsimile machine
1 - plans table
1 - copier capable of copies up to 11"x17" in size (with all needed supplies)
1 - water dispenser with hot and cold water outlets, integral refrigerator, and paper cup
dispenser to be replenished by Contractor (separate refrigerator acceptable)
1 - vertical plan rack (22" x 36" minimum)

B. Sanitary Facilities: Sanitary facilities must be provided at each site and shall include temporary toilets, wash facilities and drinking water fixtures. Comply with governing regulations including safety and health codes for the type, number, location, operation and maintenance of fixtures and facilities. Contractor to empty waste baskets and perform general cleaning in and around the Engineer's Field Office weekly.

C. Temporary Enclosure: Provide temporary enclosure of materials, equipment, to provide protection from exposure, foul weather, other construction operations, and similar activities.

D. The Contractor shall pay for all utilities, including the Engineer's phone charges.

3.03 COLLECTION AND DISPOSAL OF SANITARY WASTES

Establish a system for daily collection and disposal of sanitary waste materials. Dispose of waste material in a lawful matter. Burying or burning of waste materials on the site or washing waste material down sewers shall not be permitted.

3.04 SECURITY AND PROTECTION FACILITIES INSTALLATION

Provide a neat, uniform appearance in security and protection facilities acceptable to the Owner and the Engineer. Maintain site in a safe, lawful and publicly acceptable manner.

A. Temporary Fire Protection: Comply with recommendations of NFPA Standard 10.

B. Barricades, Warning Signs and Lights: Comply with recognized standards and code requirements for erection of substantial barricades where needed to prevent accidents.

C. Security Enclosure and Lockup: Install substantial temporary or permanent enclosures of partially completed areas of construction. Provide locking entrances adequate to prevent unauthorized entrance, vandalism, theft and similar violations of project security.

D. Anchor temporary facilities, as required, to prevent possible roll over or tipping by winds.

3.05 TERMINATION AND REMOVAL

Remove each temporary service and facility when need has ended and approval has been given by the Engineer.

At substantial completion, clean and renovate permanent services and facilities that have been used to provide temporary services and facilities during the construction period.

END OF SECTION 01500

SECTION 01564

EROSION CONTROL

PART - GENERAL

1.01 DESCRIPTION

The work specified in this section consists of the labor, equipment, tools, materials, and services needed to accomplish erosion control measures during and following construction as described herein or shown on the Contract Drawings.

A. Work included in this section:
   1. Installation of sedimentation and erosion control barriers.
   2. Anchoring all topsoil stockpiles with straw mulch and ringing with hay bales.
   3. Inspection of all erosion control measures weekly, after each rainfall and at least daily during prolonged rainfall.
   4. Repairing immediately any failed sedimentation and erosion control barrier.
   5. Removing and disposing of sediment deposits in a manner that does not result in additional erosion or pollution.
   6. Removal of hay bales or silt fences after completion of construction and permanent stabilization is complete.

B. Related work specified in other sections:
   1. Section 02222 - Excavation
   2. Section 02223 - Backfilling
   3. Section 02228 - Compaction
   4. Section 02275 - Rip-Rap
   5. Section 02421 - Geotextiles
   6. Section 02990 - Finish Grading, Topsoil and Seeding

1.02 PERFORMANCE REQUIREMENTS

A. Observe government policy established by United States Environmental Protection Agency (USEPA) Memorandum 78-1.

B. Conform to all erosion and sedimentation control measures of the State of New York.

C. Temporary erosion and sediment control measures shall be installed as the first step in construction, shall be continuously maintained, and shall not be removed until permanent cover is completely established and stabilized, with Engineer's approval.

1.03 SCHEDULE

A. Taking into account specific constraints or other criteria outlined herein, the Contractor shall prepare a detailed schedule which sets forth his program of operations to effectively

control erosion and sediment-runoff at all times during construction and during the one-year guarantee period following completion of the work.

1. Two copies of the schedule shall be filed with the Engineer.
2. At least one copy shall be kept at the project site at all times, and shall be made available for examination by the Engineer.
3. The schedule shall be arranged so as to include:
   a. Chronological completion dates for each temporary (and permanent) measure for controlling erosion and sediment.
   b. Location, type and purpose for each temporary measure to be undertaken.
   c. Dates when those temporary measures will be removed.

1.04 SUBMITTALS

A. Product Data. Provide product data for each component to be used in erosion and sediment control.

B. Methods. Provide a description of and a plan showing implementation measures.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Hay/Straw Bales
   1. Shall be securely tied and measure, at a minimum, 14 inches by 18 inches by 30 inches long (14" x 18" x 30") or greater.

B. Geotextile
   1. Mirafi "Envirofence" or equal shall be used.

C. Stakes and Fasteners
   1. Shall be two #3 rebar or two 2-inch by 2-inch hardwood stakes for each hay/straw bale.
   2. Shall be a 2-inch by 2-inch by 36-inch hardwood post or Standard T or U section steel posts weighing not less than 1.33 pounds per linear foot for silt fences.

D. Erosion Control Fabric
   1. North American Green Type S75 or equal shall be used.

E. Oil Sorbents
   1. Booms - New Pig Spaghetti Boom or equal shall be used.
   2. Socks - New Pig Skimmer Socks or equal shall be used.

2.02 METHODS

A. Sediment Barriers - Sediment barriers shall be hay or straw bales, stone, silt fences or other approved materials that will prevent migration of silts and sediment to receiving waters.

B. Diversion Terraces - Diversion terraces shall be installed on the uphill side of the disturbed areas to divert surface runoff away from unstabilized slopes.

C. Interceptor Channels - Interceptor channels shall be installed across disturbed areas where the slope is running parallel to the direction of trenches.

D. Oil Sorbent Booms/Socks. Oil sorbent booms/socks shall be installed to contain oil sheens emanating from waste materials.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. It is the Contractor's responsibility to implement and maintain erosion and sedimentation control measures which effectively prevent accelerated erosion and sedimentation.

B. Earthmoving activities shall be conducted in such a manner as to prevent accelerated erosion and sedimentation.

C. All erosion and sedimentation control measures shall be inspected by the Contractor immediately after each rainfall and at least daily during prolonged rainfall.
   1. Repair and/or maintenance of sedimentation and erosion control measures will be made as soon as needed.
   2. The Contractor shall be held responsible for the implementation and maintenance of all erosion control measures on this site.

D. Land disturbance shall be kept to a minimum.
   1. Restabilization shall be scheduled immediately after any disturbance.

E. Silt fences or hay bales shall be installed at the toe of all critical cut and fill slopes.

F. Catch basins (sumps) shall be protected with silt fences or hay bales throughout the construction sequence and until all disturbed areas are stabilized.

G. Erosion and sedimentation control measures shall be installed prior to all construction activities.

H. Sediment removal from temporary control structures and from permanent drainage facilities shall be the responsibility of the Contractor.
   1. Sediment shall be disposed of in a manner which is consistent with overall intent of the plan and which does not result in additional erosion.

I. The erosion and sedimentation control measures described herein are intended as a general guide for the Contractor.
   1. It is the Contractor's responsibility to provide any and all work necessary to prevent erosion of soil from the construction site and to provide silt fences, hay bales or

other control measures as the need arises during construction at no additional cost to the Owner.

J. Remove all sedimentation and erosion control barriers after completion of construction and permanent stabilization of erosion.

K. Prior to installation of erosion control fabric, the underlying layer is to be graded as shown on the Contract Drawings and as specified in other sections.

3.02 DIVERSION TERRACES

A. Diversion terraces shall be used as a temporary measure installed on the uphill side of the disturbed areas to divert surface runoff away from unstabilized slopes, and the project area.

3.03 INTERCEPTOR CHANNELS

A. Interceptor channels shall be used across disturbed areas where the slope is running parallel to the direction of trenches.

B. Interceptor channels reduce erosion by intercepting storm runoff and diverting it to outlets on the lower side of the disturbed area where it can be disposed of having minimum erosion impact.

3.04 TRENCH BARRIERS

A. Trench barriers shall be used where the disturbed area is sloped in the direction of required piping, when the slope exceeds 15 percent.

B. Trench barriers shall be earth-filled sacks or piled stone, stacked to the top of the trench after installation of piping and prior to backfill, if backfill is delayed.

C. Trench barriers shall act as an erosion check by preventing the washout of the trench.

3.05 SEDIMENT BARRIERS

A. Sediment barriers shall be used at storm drain sumps; across minor swales and ditches; and at other applications where the structure is of a temporary nature and structural strength is not required.

1. Sediment barriers are temporary berms, diversions, or other barriers that are constructed to retain sediment onsite by retarding and filtering storm runoff.

B. Recommended Materials and Dimensions shall be as specified in Section 2.01 of this specification.

3.06 OIL SORBENT BOOMS/SOCKS

A. Oil sorbent booms/socks shall be utilized to contain oil sheens emanating from waste materials.

3.07 SPECIAL CONDITIONS

Prohibited Construction Practices - Prohibited construction practices include but shall not be limited to the following:

1. Dumping of spoil material into any stream corridor, any wetlands, any surface waters or at unspecified locations.
2. Indiscriminate, arbitrary or capricious operation of equipment in any stream corridors, any wetlands or any surface waters.
3. Pumping of silt-laden water from trenches or other excavations into any surface waters, any stream corridors or any wetlands.
4. Disposal of trees, brush and other debris in any stream corridors, any wetlands, any surface water or at unspecified locations.
5. Permanent or unspecified alteration of the flow line of any stream.
6. Open burning of construction project debris.

3.08 ADJUSTMENT OF PRACTICES

1. If the planned measures do not result in effective control of erosion and sediment runoff to the satisfaction of the regulatory agencies having jurisdiction over the project, the Contractor shall immediately adjust his program and/or institute additional measures so as to eliminate excessive erosion and sediment-runoff.
2. If the Contractor fails or refuses to comply promptly, the Engineer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such stop orders shall be made the subject of a claim for extension of time or for excess costs or damages by the Contractor.

END OF SECTION 01564

SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES:

A. Products

B. Preparation for Shipment

C. Packaging and delivery of spare parts and special tools

D. Shipment and handling

E. Inspection

F. Storage and protection

G. Inventory control

1.02 RELATED SECTIONS

Not Used.

1.03 PRODUCTS

A. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components required for reuse.

B. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.

C. Materials and equipment to be provided under this contract shall be standard catalogue products of manufacturers regularly engaged in the manufacture of the products and shall duplicate material and equipment in satisfactory service for a 5 year minimum.

D. Material and equipment shall meet the requirements of the contract and shall be suitable for the installation. Where two or more units of the same equipment class are furnished, the equipment shall be from the same manufacturer and shall be interchangeable. Materials and equipment shall be new and free from defects.

E. Material and equipment shall be installed in accordance with the requirements of the contract drawings and approved recommendations of the manufacturers.

1.04 PREPARATION FOR SHIPMENT

A. When practical, equipment shall be factory assembled. The equipment parts and assemblies that are shipped unassembled shall be furnished with an assembly plan and instructions. The separate parts and assemblies shall be match-marked or tagged in a manner to facilitate field assembly.

B. Generally, machined and unpainted parts subject to damage by the elements shall be projected with an application of a strippable protective coating.

C. Equipment shall be packaged or crated in a manner that will provide protection from damage during shipping, handling, and storage.

D. The outside of the package or crate shall be adequately marked or tagged to indicate its contents by name and Equipment number, if applicable; approximate weight; any special precautions for handling; and the recommended requirements for storage prior to installation.

1.05 PACKAGING AND DELIVERY OF SPARE PARTS AND SPECIAL TOOLS

A. Spare parts and special tools shall be properly marked to identify the associated equipment by name, equipment, and part number. Parts shall be packaged in a manner for protection against damage from the elements during shipping, handling, and storage. Spare parts and special tools shall be shipped in boxes that shall be marked to indicate the contents. Delivery of spare parts and special tools shall be made prior to the time the associated equipment is scheduled for the initial test run.

1.06 SHIPMENT AND HANDLING

A. Shipments shall be addressed to the Contractor who shall be responsible for their receipt, unloading, handling, and storage at the site. The Owner will not accept deliveries on behalf of the Contractor or his subcontractors or assume responsibility for security of materials, equipment, or supplies delivered to the site.

B. Arrange deliveries of products in accord with construction schedules and in ample time to facilitate inspection prior to installation.

C. Coordinate deliveries to avoid conflict with Work and conditions at site and to accommodate the following:
   1. Work of other Contractors, or Owner.
   2. Limitations of storage space.
   3. Availability of equipment and personnel for handling products.
   4. Owner's use of premises.

D. Do not have products delivered to project site until related Shop Drawings have been approved by the Engineer.

E. Do not have products delivered to site until required storage facilities have been provided.

F. Have products delivered to site in manufacturer's original, unopened, labeled containers. Keep Engineer informed of delivery of all materials to be incorporated in the Work.

G. Partial deliveries of component parts of equipment shall be clearly marked to identify the equipment, to permit easy accumulation of parts, and to facilitate assembly.

H. Materials and equipment shall at all times be handled in a safe manner and as recommended by manufacturer or supplier so that no damage will occur to them. Do not drop, roll, or skid products off delivery vehicles. Hand carry or use suitable materials handling equipment.

I. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement or damage.

J. Provide additional protection during handling as necessary to prevent scraping, marring, or otherwise damaging products or surrounding surfaces.

K. Handle products by methods to prevent bending or overstressing.

1.07 INSPECTION

A. Immediately upon receipt of equipment and materials at the job site, the Contractor shall assure that products comply with requirements, quantities are correct, and products are undamaged. Should there appear to be any damage, the Engineer shall be immediately notified, and the Contractor shall be responsible for informing the manufacturers and the transportation company of the extent of damage. If the items or items require replacing, the Contractors shall take the necessary measures to expedite the replacement.

1.08 STORAGE AND PROTECTION

A. Store and protect materials in accordance with manufacturer's recommendations and requirements of Specifications.

B. Contractor shall make all arrangements and provisions necessary for the storage of materials and equipment. All excavated materials, construction equipment, and materials and equipment to be incorporated into the Work shall be placed so as not to injure any part of the Work or existing facilities and so that free access can be had at all times to all parts of the Work and to all public utility service company installations in the vicinity of Work. Materials and equipment shall be kept neatly and compactly stored in locations that will cause a minimum of inconvenience to other contractors, public travel, adjoining owners, tenants, and occupants.

C. Areas available on the construction site for storage of material and equipment shall be as shown or approved by the Engineer.

D. Fields, grass plots, or other property shall not be used for storage purposes without written permission of the Owner, or other person in possession or control of such premises.

E. Materials and equipment which are to become the property of the Owner shall be stored to facilitate their inspection and insure preservation of the quality and fitness of the Work, including proper protection against damage by freezing and moisture. They shall be placed in inside storage areas unless otherwise acceptable to Owner.

F. Store products with seals and label intact and legible. Store sensitive products in weather-tight enclosures; maintain within temperature and humidity ranges required by manufacturer's instructions.

G. For exterior storage of fabricated products, place on sloped supports above ground. Cover products subject to deterioration with impervious sheet covering; provide ventilation to avoid condensation.

H. Store loose granular materials on solid surfaces in a well-drained area; prevent mixing with foreign matter.

I. Arrange storage to provide access for inspection. Periodically inspect to assure products are undamaged, and are maintained under required conditions.

J. Contractor shall be fully responsible for loss or damage to stored materials and equipment.

K. Do not open manufacturers containers until time of installation unless recommended by the manufacturer or otherwise specified.

L. Maintain periodic system of inspection of stored products on scheduled basis to assure that:
   1. State of storage facilities is adequate to provide required conditions.
   2. Required environmental conditions are maintained on continuing basis.
   3. Products exposed to elements are not adversely affected.

1.09 INVENTORY CONTROL

A. Equipment and materials shall be stored in manner to provide easy access for inspection and inventory control. The Contractor shall keep a running account of all materials in storage to facilitate inspection and to estimate progress payments for materials delivered but not installed in the work.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION 01600

SECTION 01630

SUBSTITUTIONS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Requests for review of a substitution shall conform to the requirements of the General Conditions and shall contain complete data substantiating compliance of proposed substitutions with Contract Documents.

1.02 CONTRACTOR'S OPTIONS

A. For materials or equipment (hereinafter products) specified only by reference standard, select product meeting the standard, by any manufacturer, fabricator, supplier or distributor (hereinafter manufacturer). To the maximum extent possible, provide products of the same generic kind from a single source.

B. For products specified by naming several products or manufacturers, select any one of the products or manufacturers named which complies with Specifications.

C. For products specified by naming several products or manufacturers and stating "or equal", submit a request for a substitution for any product or manufacturer which is not specifically named.

D. For products specified by naming only one product or manufacturer and followed by words indicating that no substitution is permitted, there is no option and no substitution allowed.

E. Where more than one choice is available as a Contractor's option, select product which is compatible with other products already selected or specified.

1.03 SUBSTITUTIONS

A. No item listed on the Contract Drawings, Contractor's shop drawings, or the Detailed Specifications by trade name or by name of manufacturer may be substituted for without the prior approval of the Engineer. Any such substitution or refusal of substitution shall not cause delay or increased costs. In the event the Contractor claims the inability to obtain a specified or indicated item at the proper time, the Owner or Engineer may make inquiries at the Contractor's expense to establish such a claim.

B. During a period of 30 days after date of commencement of Contract Time, Engineer will consider written requests from Contractor for substitution of products or manufacturers, and construction methods (if specified).
   1. After end of specified period, requests will be considered only in case of unavailability of product or other conditions beyond control of Contractor.

C. Submit 5 copies of request for substitution. Submit separate request for each substitution. In addition to requirements set forth in the General Conditions, include in request the following:
   1. For product or manufacturers:
      a. Product identification, including manufacturer's name and address.
      b. Manufacturer's literature with product description, performance and test data, and reference standards.
      c. Samples, if appropriate.
      d. Name and address of similar projects on which product was used, and date of installation.
   2. For construction methods (if specified):
      a. Detailed description of proposed method.
      b. Drawings illustrating method.
   3. Such other data as the Engineer may required to establish that the proposed substitution is equal to the product, manufacturer, or method specified.
   4. All applications for substitutions shall be accompanied by statement of credit or extra cost attributed to the substitution.

D. In making request for substitution, Contractor represent that:
   1. Contractor has investigated proposed substitution, and determined that it is equal to or superior in all respects to the product, manufacturer, or method specified.
   2. Contractor will provide the same or better warranties or bonds for proposed substitution as for product, manufacturer or method specified.
   3. Contractor waives all claims for additional costs or extension of time related to proposed substitution that subsequently may become apparent.

E. Proposed substitutions will not be accepted if:
   1. Acceptance will require substantial revision of Contract Documents.
   2. They will delay completion of the Work, or the work of other contractors.
   3. They are indicated or implied on a Shop Drawing and ar not accompanied by a formal request for substitution from Contractor.

F. If the Engineer determines that a proposed substitute is not equal to that specified, Contractor shall furnish the product, manufacturer, or method specified at no additional cost to the Owner.

G. Approval of a substitution will not relieve Contractor from the requirement for submission of Shop Drawings as set forth in the Contract Documents.

H. Contractor shall carefully verify and shall be fully responsible for determining that the equipment it proposes to provide and install shall fit into the confines indicated on the Contract Drawings, Contractor's shop drawings or Detailed Specifications.

END OF SECTION 01630

SECTION 01650

FACILITIES STARTUP

PART 1 GENERAL

1.01 SUMMARY

A. Except as specifically noted in individual technical Sections, this Section governs the requirements for facilities and system startup.

B. Exceptions in an individual technical Section modify only the individual Article and topic; other topics and Articles in this Section remain in force unless specifically deleted by the technical Section.

C. Section Includes:
   1. Section 01300 - Submittals.
   2. Section 01310 - Progress Schedule
   3. Section 01400 - Quality Assurance and Quality Control
   4. Section 01700 - Project Closeout.

1.02 DEFINITION

A. Acceptance: The act of the Engineer in receiving submittals and finding no obvious reason for its rejecting, but not to indicate certification that Contractor's estimated performance can be achieved.

B. Approve: To accept and to certify.

C. Certify: After ascertaining the facts and making oneself informed, to guarantee the accuracy of the facts according to the requirements of the Conditions of the Contract.

D. Component: An individual item, piece of equipment, or equipment group as specified in a single Section.

E. Facilities Startup Plan: A single and complete plan incorporating all requirements of this Section.

F. Subsystem: A series of components that can be tested together to assure specified performance.

G. System; The complete dynamic components, and associated passive components, of the Work.

H. Validate: To support, substantiate, and authenticate specified operation on a sound or authoritative basis.

1.03 SYSTEM DESCRIPTION

A. Design Requirements:

1. Design temporary connections and utility lines to meet the specified design requirements of the component, subsystem, and system to which they are connected.
2. Include required restraints.
3. Do not place structural loads on permanent facility elements beyond their design load capacity.
4. Provide dielectric unions on temporary connections wherever dissimilar metals connect.
5. Provide safety valves and similar safety devices on temporary connections wherever they would be required if the connections were permanent.
6. Divide subsystems according to the P&ID ladder diagrams wherever practical.

B. Performance Requirements:
1. Performance requirements for components, subsystems, and the system are specified in individual Sections.

1.04 SUBMITTALS

A. Provide submittals according to Section 01300.

B. Facilities Startup Plan:
1. Provide a Facility Startup Plan for the water treatment facility and the extraction wells for acceptance not less than 20 days prior to startup, incorporating the requirements of this Section.
2. The Facilities Startup Plan is the responsibility of the Contractor who is solely responsible for its means, methods, techniques, sequences, procedures, coordination, completeness, accuracy, and validity.
3. Individual sections of the Startup Plan may be accepted by Engineer, with Engineer's prior approval, but must be incorporated into the final accepted Startup Plan.
4. Rejection of individual sections of the Startup Plan by Engineer is not a cause for a claim of delay.
5. Identify each person or organization who will have a functional part in the startup, and identify their duties and responsibilities.
6. Provide for contingencies on validation failure.

C. Temporary Connections:
1. Provide complete information on temporary connections in the form of shop drawings or a complete written description or a combination of both.
2. Provide separate drawings or descriptions, or both for each item or subsystem identified in the startup plan.

D. Validation procedures:
1. Provide a complete written description of each test, simulation, and startup, including:
   a. Schedule.
   b. Listing of components included.
   c. Listing of individuals or organizations involved, and assigned responsibilities.
   d. Test equipment required, accuracy, and calibration information.

e. Detailed listing of procedures necessary to demonstrate compliance with performance requirements specified in technical Sections.

E. Validation reports: Provide validation reports indicating compliance with performance requirements in technical Sections for Engineer's certification.

1.05 QUALITY ASSURANCE

A. Qualifications:
1. Provide complete foremen's qualifications for Owners approval, indicating 3 years of experience operating and maintaining this type of equipment, or academic and factory training to operate and maintain this type of equipment, or another acceptable combination of relevant training and experience. Owner reserves the right to reject foremen who, in their sole opinion, are not qualified by experience and training to operate and maintain the equipment.

B. Regulatory Requirements:
1. Include information relating to regulatory requirements for operation and maintenance of equipment.

C. Certifications: Provide certification required under other sections.

D. Pre-Startup Conference:
1. Arrange for a pre-startup conference scheduled not less than 10 days prior to training.
2. Conference to be attended by AlliedSignal, Engineer, Contractor, Contractor's startup and installation foremen, and other responsible parties.
3. Prepare an agenda for approval prior to conference, to include as a minimum:
a. Startup and demonstration schedule.
b. Facilities examination.
c. Problem resolution.

1.06 SEQUENCING AND SCHEDULING

A. Facilities Startup Schedule:
1. Provide as a sub-schedule of the main project schedule.
2. Include submittal, and approval of submittals required for components.
3. Address each subsystem individually.

1.07 MAINTENANCE

A. Provide maintenance on components through completion of the Reliability Demonstration.

PART 2 PRODUCTS

2.01 TEMPORARY CONNECTIONS

Not Used.

2.02 CHEMICAL AND OPERATING FLUIDS

A. Provide chemicals and operating fluids required for validation and Reliability Demonstration. These are in addition to chemicals and fluids required to be provided to Owner separately under the Specifications.

B. Provide maintenance and replacement parts required during the Reliability Demonstration.

PART 3 - EXECUTION

3.01 COMPONENT VALIDATION

A. Validate each component by one or more of the following procedures, as approved:
   1. Testing to show compliance with specifications.
   2. Simulation of actual operation by a method certified as acceptable and valid by both the component manufacturer and the Engineer.
   3. Certification by an independent testing laboratory that the component type meets a specified industry standard.
   4. Where procedures are specified in individual Sections, substitute procedures will not be accepted without prior written approval.

B. Validate components at component or subsystem level prior to system startup and testing.

C. Component validation must include:
   1. Full range of operation of each component.
   2. Emergency procedures.
   3. Normal start-up and shutdown procedures.
   4. Out-of-parameter correction.
   5. Validate components individually and as part of a subsystem test.

3.02 EXAMINATION

A. Prior to validating components or subsystems, verify that:
   1. Startup submittals have been accepted.
   2. Manufacturers' have certified component installations wherever required.
   3. Coordination with manufacturers' representatives for required field services is completed.
   4. Facility is enclosed weather-tight.
   5. Auxiliary systems are in proper operation.
   6. No safety defects remain unresolved.
   7. Provisions have been made for disposal of solids and liquids generated.
   8. Both hand and automatic operation of equipment is operational.
   9. Equipment is lubricated and serviced, and is ready for continuous operation.

3.03 PREPARATION

A. Temporary connections:
   1. Provide temporary connections as indicated on approved submittals.
   2. Test temporary connections by the same method that would be required if the connections were permanent.

B. Effluent collection, removal, and disposal.

3.04 TESTING REQUIREMENTS

A. Conduct tests using non-process, clean fluids prior to process fluid testing.

B. Effluent from testing not meeting specified system effluent quality are the property of Contractor, who is responsible for legal disposal.

3.05 TESTING OF SYSTEM

A. Validate subsystems and components before beginning system validation.

B. Perform system tests only to certify system, not to certify components or subsystems.

C. System performance is based on specified component performance and system output boundary conditions.

3.06 RELIABILITY DEMONSTRATION

A. Operate and maintain the system for not less than 5 days continuously and at full capacity to demonstrate that the system performs according to specifications.

B. Any system operation outside of specified operating boundary conditions requires a restart of the Reliability Demonstration period for a time specified by the Engineer up to the original time period.

C. Document actions taken and procedures developed that are not covered in the operations manuals, and provide as an appendix to the operating manuals.

D. Where required in individual specification Sections, at the end of the Reliability Demonstration, replace or clean filters, replace fluids, and perform other replacement and adjustment requirements.

3.07 FIELD QUALITY CONTROL

A. Tests:
   1. Calibrate test equipment used to validate compliance immediately prior to testing.
   2. Check calibration of testing equipment immediately after validation tests.

3. Revalidation, including the requirements of this Article, is required whenever test equipment is out of calibration at the completion of the validation testing.

B. Inspection: Thoroughly inspect all aspects of the installation prior to startup.

C. Manufacturer's Field Service: Provide the assistance of the manufacturer's field service technicians, as needed, to assure proper operation.

3.08 ADJUSTING AND CLEANING

A. After the successful completion of the demonstration period, perform the following:
1. Lubricate and service dynamic equipment in accordance with manufacturer's instructions.
2. Clean facility surfaces to a "like-new" condition.
3. Clean equipment inside and out to a "like-new" condition. Dynamic equipment in the process stream such as screw conveyors, pumps, and valves do not require the interior to be cleaned.
4. Perform other cleaning, adjusting, and replacement requirements included in other sections of these specifications.

END OF SECTION 01650

SECTION 01700

PROJECT CLOSEOUT

PART 1 - GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

Provisions of this section apply to the procedural requirements for the actual closeout of the Work, not to administrative matters such as final payment. Closeout requirements relate to both substantial and final completion of the Work; they also apply to individual portions of completed work as well as the total Work. Specific requirements contained in other sections have precedence over the general requirements contained in this section.

1.02 PROCEDURES AT SUBSTANTIAL COMPLETION

A. Prerequisites: Comply with the General Conditions and complete the following before requesting inspection of the Work, or a designated portion of the Work, for certification of substantial completion. A representative of the Owner and the Engineer will perform the substantial completion inspection.

1. Submit executed warranties, maintenance agreements, inspection certificates and similar required documentation for specific units of work, enabling the Owner's unrestricted occupancy and use.
2. Submit record documentation, maintenance manuals, tools, spare parts, keys and similar operational items.
3. Complete final cleaning, and remove temporary facilities and tools.

B. Inspection Procedures: Upon receipt of Contractor's request, the Engineer, and the Owner's project manager will either proceed with inspection or advise the Contractor of prerequisites not fulfilled. Following initial inspection, the Engineer will either prepare the certificate of substantial completion, or advise the Contractor of work which must be performed prior to issuance of the certificate of completion. The Engineer and the Owner project manager will repeat the inspection when requested and assure that the Work has been substantially completed. Results of the completed inspection will form the initial "punch-list" for final acceptance.

1.03 PROCEDURES AT FINAL ACCEPTANCE

A. Reinspection Procedure: The Engineer and the Owner's project manager will reinspect the Work upon receipt of the Contractor's notice that the Work has been completed, including punch-list items from earlier inspections. Upon completion of reinspection, the Engineer will either recommend final acceptance and final payment, or will advise the Contractor of work not completed or obligations not fulfilled as required for final acceptance. If necessary, this procedure will be repeated.

1.04 RECORD DOCUMENTATION

A. Record Drawings: Maintain a complete set of either blue- or black- line prints of the contract drawings and shop drawings for record mark-up purposes throughout the Contract Time. Mark-up these drawings during the course of the work to show both changes and the actual installation, in sufficient detail to form a complete record. Give particular attention to work which will be concealed and difficult to measure and record at a later date, and work which may require servicing or replacement during the life of the project. Require the entities marking prints to sign and date each mark-up. Bind prints into manageable sets, with durable paper covers, appropriately labeled.

These marked prints (Record Drawings) shall be kept current and available on the job site at all times. All changes from the contract plans which are made in the work, or additional information which might be uncovered in the course of construction shall be accurately and neatly recorded as they occur by means of details and notes. The Record Drawings shall be jointly inspected for accuracy and completeness by the Engineer prior to submission of each monthly pay estimate. The drawings shall include but not be limited to the following:

1. Installations of any kind or description known to exist within the construction area. The locations shall include dimensions to permanent features.
2. The location and dimensions of any changes within the design features of any kind or description known to exist within the construction area. The locations shall include dimensions to permanent features.
3. Correct grade or alignment of roads, structures, utilities, or project components if any changes were made from contract drawings.
4. Correct elevations if changes were made in site grading.
5. Changes in details of design or additional information obtained from working drawings specified.
6. The topography and grades of all drainage structures installed or affected as part of the project construction.
7. All changes or modifications which result from authorized field changes.
8. Where contract drawings or specifications allow options, only the option selected for construction shall be shown on the record prints.
9. Additional work ordered by the Engineer or the Owner.

B. Maintenance Manuals: Provide 3-ring vinyl-covered binders containing required maintenance manuals, properly identified and indexed. Include operating and maintenance instructions extended to cover emergencies, spare parts, warranties, inspection procedures, diagrams, safety, security, and similar appropriate data for each system or equipment item.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 OPERATOR INSTRUCTIONS

Require each installer of systems requiring continued operation and maintenance by the Owner's operating personnel, to provide on-location instruction to the Owner's personnel, sufficient to ensure safe, secure, efficient, non-failing utilization and operation of systems.

3.02 FINAL CLEANING

At the time of project close out, clean and return the Work area to its original condition. Complete the following operations before requesting the Engineer's inspection for certification of substantial completion:

A. Remove non-permanent protection and labels.

B. Clean exposed finishes.

C. Touch-up minor finish damage.

D. Remove debris.

E. Police yards and grounds.

END OF SECTION 01700

SECTION 01720

PROJECT RECORD DRAWINGS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section specifies the requirements for recording of field modifications made during construction, to be marked on the design Construction Drawings by the Contractor (Record Drawings) and for preparing Supplemental Record Drawings by the Surveyor to be submitted to the Owner and Engineer.

B. Maintenance of Documents
   1. Maintain in Contractor's field office in clean, dry, legible condition complete sets of the following: Drawings, Specifications, Addenda, approved Shop Drawings, Samples, photographs, Change Orders, other modifications of Contract Documents, test records, survey data, Field Orders, and all other documents pertinent to Contractor's work.
   2. Provide files and racks for proper storage and easy access. File in accordance with filing format of Construction Specification Institute (CSI), unless otherwise approved by the Engineer.
   3. Make documents available at all times for inspection by Engineer, Owner, and NYSDEC.
   4. Record documents shall not be used for any other purpose and shall not be removed from the Contractor's office without the Engineer's approval.

C. Related work specified elsewhere.
   1. Section 01051 - Grades, Lines, and Levels

1.02 SUBMITTALS

A. Record Drawings

The Contractor shall clearly and neatly mark up in red ink one set of paper prints to show the record conditions. These record marked prints (Record Drawings) shall be kept current and available on the job site at all times. All changes from the contract plans which are made in the work, or additional information which might be uncovered in the course of construction shall be accurately and neatly recorded as they occur by means of details and notes. The Record Drawings shall be jointly inspected for accuracy and completeness by the Engineer and a responsible representative of the Contractor prior to submission of each monthly pay estimate. The drawings shall include but not be limited to the following:

1. Installations of any kind or description known to exist within the construction area. The locations shall include dimensions to permanent features.

2. The location and dimensions of any changes within the design features of any kind or description known to exist within the construction area. The locations shall include dimensions to permanent features.
3. Correct grade or alignment of roads, structures, utilities, or project component.
4. Correct elevations.
5. Changes in details or dimensions.
6. The topography and grades of all drainage structures installed or affected as part of the project construction.
7. Additional information obtained from working drawings.
8. Where contract drawings or specifications allow options, only the option selected for construction shall be shown on the record prints.
9. Additional work ordered by the Engineer or Owner.
10. Depths of various elements of foundation in relation to datum.
11. Horizontal and vertical location of underground utilities and appurtenance referenced to permanent surface improvement.
12. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.

B. Supplemental Record Drawings

This section covers the preparation and submittal by the Surveyor retained by the Contractor of Supplemental Record Drawings. The Contractor will retain and coordinate with the independent Surveyor in obtaining field measurements necessary to prepare the supplemental drawings. The Supplemental Record Drawings shall include but not be limited to the following:

1. A topographic survey of the site following contaminated sediment and soil excavation, final subgrade preparation, the drainage layer, the barrier protection layer, and unclassified fill layer and topsoil placement. The survey should, as a minimum, show ground surface elevations on a 50 foot by 50 foot grid and at all grade changes and also indicate the thickness of the cover layers. The survey should adequately extend beyond the limits of work to properly overlap existing conditions (i.e; the railroad, etc.).
2. Preliminary Submittal
   The Contractor shall prepare two (2) copies of the Record Drawings and the Surveyor shall prepare the two (2) copies of the Supplemental Record Drawings. These drawings shall be submitted to the Engineer following completion of that phase of work (within 7 calendar days) for review and approval. These drawings shall be neat, legible, and accurate. The review by the Engineer shall be expedited to the maximum extent possible (expected to be within 7 calendar days). If upon review, the drawings are found to contain errors and/or omissions, they shall be returned to the Contractor and/or Surveyor for corrections. The Contractor and/or Surveyor shall complete the corrections and return the drawings to the Engineer within 10 calendar days for subsequent review.
3. Final Record Drawing Preparation
   a. Upon approval of the Record Drawings and Supplemental Record Drawings submitted, these drawings shall be modified by the Engineer, as necessary, to

add any additional information which is pertinent to the project. These drawings shall be part of the permanent records of this project.

b. Each drawing to be submitted by the Contractor shall be lettered or stamped with the words "RECORD DRAWING" in 1-inch high printed letters followed by the name of the Contractor and the Engineer. All original contract drawings shall be marked by the Engineer either "Record" denoting no revisions on the sheet, or "Revised Record" denoting one or more revisions.

c. The Supplemental Record Drawings to be submitted by the Surveyor shall:
   1. be stamped and signed by the Surveyor retained by the Contractor;
   2. be prepared on a 24" by 36" reproducible sheet with the same Allied Signal Ledger and title block used for contract drawings.
   3. shall locate all work referenced to the limits of the project area; and
   4. have all locations referenced to the site horizontal coordinate system. The grid coordinate system shall be shown on all record drawings. Elevations shall be referenced to the vertical control established for the project.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 01720

SECTION 01730

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 GENERAL

A. Provide operation and maintenance data in the form of instructional manual for use by the Owner's personnel for:
   1. All equipment and systems.
   2. All valves, gates, and related accessories.
   3. All instruments and control devices.
   4. All electrical gear.

B. Definitions:
   1. Operation and Maintenance Data:
      a. The term "Operation and maintenance data: includes all product related information and documents which are required for preparation of the plant operation and maintenance manual. It also includes all data which must accompany said manual as directed by current regulations of any participating government agency.
      b. Required operation and maintenance data includes, but is not limited to, the following:
         (1) Complete, detailed written operating instructions for each product or piece of equipment including: equipment function; operating characteristics; limiting conditions; operating instructions for startup, normal emergency conditions; regulations and control; and shutdown.
         (2) Complete, detailed written preventive maintenance instructions as defined below.
         (3) Recommended spare parts lists and local sources of supply for parts.
         (4) Written explanations of all safety considerations relating to operation and maintenance procedures.
         (5) Name, address, and phone number of manufacturer, manufacturer's local service representative, and Subcontractor or installer.
         (6) Copy of all approved Shop Drawings, and copy of warranty bond and service contract as applicable.
   2. Preventive Maintenance Instructions:
      a. The term "preventive maintenance instructions" includes all information and instructions required to keep a product or piece of equipment properly lubricated, adjusted, and maintained so that the item functions economically throughout its full design life.
      b. Preventive maintenance instructions include, but are not limited to, the following:
         (1) A written explanation with illustrations for each preventive maintenance task.
         (2) Recommend schedule for execution of preventive maintenance tasks.

(3) Lubrication charts.
(4) Table of alternative lubricants.
(5) Trouble shooting instructions.
(6) List of required maintenance tools and equipment.

C. Submittals:
1. General: Submit operations and maintenance data to the Engineer within 90 days after approval of Shop Drawings.
2. Number of Copies: Six of each item.
3. Letter of Transmittal: Provide a letter of transmittal with each submittal and include the following in the letter:
a. Use 8-1/2 inch by 11 inch paper. Larger drawings or illustrations are acceptable if neatly folded to the specified size in a manner which will permit easy unfolding without removal from the binder. Provide reinforced punched binder tab. Or provide fly-leaf for each product.
b. All text must be legible typewritten or machine printed originals or high quality copies of same.
c. Each page shall have a binding margin of approximately 1-1/2 inches and be punched for placement in a three ring looseleaf or triple post binder. Provide binders. Identify each binder with the following:
(1) Title "OPERATING AND MAINTENANCE INSTRUCTIONS".
(2) Title of Project.
(3) Identity of building or structure as applicable.
(4) Identity of general subject matter covered.
d. Use dividers and indexed tabs between major categories of information such as operating instructions, preventive maintenance instructions, or other. When necessary, place each major category in a separate binder.
e. Provide a table of contents for each binder.
f. Identify products by their functional names in the table of contents and at least once in each chapter or Section. Thereafter, abbreviations and acronyms may be used if their meaning is explained in a table in the back of each binder. Use of model or catalog numbers or letters for identification is not acceptable.

END OF SECTION 01730

SECTION 02085

GROUNDWATER MONITORING WELL ABANDONMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. Abandonment of existing groundwater monitoring wells as noted on Drawings and approved well abandonment plan.

B. Related work specified elsewhere in other section.

1.02 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

The publications listed below form a part of the specifications to the extent referenced. The publications are referred to in the text by basis designation only.

A. American Society of Testing and Materials (ASTM)
ASTM C150-89 Type I Portland Cement

B,. New York State Departmetn of Environmental Conservation (NYSDEC) Memorandum "Decommissioning Procedures,: May 1995.

1.03 SUBMITTALS

A. Methods - Proposed drilling and abandonment methods.

B. Mixes - Grout mixes, bentonite mixture.

C. Equipment - Drill rig and related equipment.

D. Drilling Contractor - submit the name and address of the proposed well driller and a list of aleast finve completed project of similar construction.

PART 2 - PRODUCTS

2.01 GROUT

A. Grout shall be a Portland Cement/bentonite grout mixture. The grout shall consist of a mixture of Portland Cement (ASTM C150 Type I), bentonite and water in the proportions of one 94 pound bag of Type I Portland Cement, 9 pounds of powdered bentonite, and 6 to ten gallons of potable water.

2.02 BENTONITE

A. The bentonite seal shall consist of ½-inch diameter sodium bentonite pellets or chips (Baroid Ben Seal or Equivalent).

PART 3 - EXECUTION

3.01 GENERAL

A. No monitoring well abandonment activities shall commence without acceptance of the Engineer/Supervising Geologist.

B. All monitoring well abandonment shall be performed in accordance with the requirements of this Section and to the satisfaction of the Engineer/Supervising Geologist.

C. Review all available information concerning each well to be abandoned which may include a site map, well construction diagram, field inspection long, and proposed well decommissioning procedure.

D. Verify the depth of the well location with a weighted tape and compare measurements with the well construction log. (Refer to Attachment 2 - Existing Monitoring Well Logs)

E. Verify the well location and identification before proceeding with decommissioning.

F. Well materials and soil cuttings shall be disposed of within the limits of the proposed capped area as directed by the Engineer/Supervising Geologist. No well materials to be disposed of within the limits of the capped area shall be greater than 15 feet in length.

G. The Contractor shall restore the area in the vicinity of each well location as directed by the Engineer/Supervising Geologist.

H. Following drilling activities, the Contractor shall decontaminate equipment in accordance with the decontamination protocol in paragraph 3.03.

3.02 ABANDONMENT

A. Group 1 Wells
   1. Group 1 wells are 2-inch diameter wells that are single cased and generally constructed of PVC (refer to individual monitoring well figures for construction details).
   3. Well casing pulling procedures include the following:
      a. The Contractor shall lower a drill rod down the well and perforate the bottom cap.
      b. The Contractor shall add the grout to the well casing and riser prior to pulling the casing.
      c. The Contractor shall pull the well by grappling the protective casing with appropriate devices and pulling the casing and well materials as a single unit.

d. The Contractor shall add grout on an intermittent basis to ensure that the void spaces are adequately filled with grout as the casing and well are withdrawn. Grout is to be added until the level is within five feet of existing ground surface. The balance of the borehole is to be backfilled with clean soil by the Contractor.

e. If all of the well materials are not withdrawn during the pulling process, overdrilling of the remaining portions may be required by the Contractor as directed by the Engineer/Supervising Geologist.

4. The following wells will be removed by overdrilling procedures:
   - [Insert Well IDs]

5. Well overdrilling procedures include the following:
   a. The Contractor shall remove the protective casing, if present, from each well in a manner which minimized disturbance to the well.
   b. The Contractor shall lower a drill rod down the well and perforate the bottom cap.
   c. The Contractor shall overdrill the well using minimum 6 1/4-inch inside diameter (I.D.) hollow stem augers with outward facing cutting teeth to a minimum of 2 feet below the total depth of the original boring or reaming tool with a pilot bit approximately similar in size to the inside diameter of the well material.
   d. Following overdrilling, the Contractor shall withdraw the well materials from within the auger.
   e. The Contractor shall seal the borehole by pressure injection with cement bentonite grout by using a tremie pipe to fill the inside of the augers to ground surface.
   f. Additional grout shall be added as required as the augers are removed to maintain the level of grout at ground surface. Grout is to be added until the level is within five feet of the existing ground surface. The balance of the borehole is to be backfilled with clean soil by the Contractor.

B. Group 2 Wells
   1. Group 2 wells arewells which were constructed as double-cased, overburden monitoring wells. The wells are constructed with either 2-inch or 4-inch diameter PVC and an 8-inch diameter, outer steel casing.
   2. The Contractor shall remove the protective casing, if present, from each well in a manner which minimizes disturbance to the well. If the outer steel steel casing is used as a protective cover, it shall be cut near the ground surface.
   3. The Contractor shall install the cement bentonite grout into the 2-inch diameter well by using a tremie pipe placed at bottom of the well.
   4. Contractor shall advance minimum 3 1/4-inch I.D (7-1/4 OD) . hollow stem augers or 6-inch flush jointed temporary casing inside the outer steelwell casing to a minimum of two feet below the total depth of the original boring. The Contractor shall minimize damage to the outer steel casing.
   5. Following overdrilling, the Contractor shall withdraw the well materials from within the augers.
   6. The Engineer/Supervising Geologist shall inspect the condition of the outer steelwell casing.
      a. If, in the opinion of the Engineer/Supervising Geologist, the well casing and annular seal do not appear to be compromised, then the outer steel casing shall be left in place.

b. If, in the opinion of the Engineer/Supervising Geologist the integrity of the casing appears to be suspect (including, but not limited to, conditions such as the ability to move the outer steel casing, cracked seal, casing has excess rust), the casing shall be removed by overdrilling. A minimum 12-inch ID hollow stem auger shall be advanced over the top of the outer steel casing to the bottom of the casing.

7. The Contractor shall install the cement bentonite grout by using a tremie pipe to fill the inside of the augers/temporary casing to the surface.
   a. If the outer steel casing is to be left in place, the grout shall be installed to the ground surface.
   b. If the outer steelcasing is to be removed, the grout shall be installed to the bottom of the outer steel casing.
   c. Additional grout shall be added as required as the augers are removed to maintain the level of grout at ground surface.
   d. Grout shall be allowed to cure a minimum of 24 hours.
8. Contractor shall remove the outer steel casing.
9. Contractor shall install grout to the ground surface by using a tremie pipe.

3.03 DECONTAMINATION

A. All drilling equipment and materials shall be decontaminated prior to drilling, between bore-holes, and prior to leaving the site. The contractor will not use, reuse, or remove any equipment, materials, samples, or other goods at or from the site until it is certified to be uncontaminated. Decontamination will consist of washing and steam cleaning all equipment and materials that may be required as specified above or at the request of the Supervising Geologist. The drilling crew will undertake the decontamination of the given equipment or materials under the Supervising Geologist's supervision. The Contractor shall comply with all request and procedures of the Supervising Geologist regarding decontamination during the course of the work, close of the workday, and upon completion of the project. Anticipated requests and procedures for decontamination are outlined below:

B. General Decontamination Procedures and Requirements:
   1. All drilling equipment shall be inspected for integrity of hydraulic and oil fluid handling systems and general overall cleanliness. Leaking hoses, tanks, hydraulic lines, etc., shall be replaced or repaired prior to beginning work.

C. Initial Cleaning
   1. All drilling equipment and associated tools shall be steam cleaned, upon arrival at the Site. Equipment will include at a minimum, but not be limited to:
      - drilling rods, bits;
      - augers (clips, pins, and associated hardware);
      - samplers (i.e. split spoon, hydropunch);
      - casing materials (both temporary and permanent);
      - wrenches;
      - hammers;

- other hand tools and tool boxes;
- hoses and tanks;
- cable clamps and other holding devices in direct contact with drilling rods; and
- drill rig and undercarriage, wheel wells, chassis.

2. During and following cleaning, equipment shall be handled only with clean gloves. A new set of gloves will be utilized between each location.
3. Cleaned materials shall be protected from contamination by such means as the Supervising Geologist deems necessary.

D. Onsite Cleaning

1. Following use, all equipment with the exception of the carrier truck and undercarriage, shall be steam-cleaned between borings.
2. Down hole sampling equipment must be washed in laboratory grade detergent and water, and rinsed in clean, clean potable municipal water between consecutive samples and/or each boring, as appropriate.
3. If immiscible products are encountered during drilling, the drilling and sampling equipment must be cleaned in a manner consistent with the equipment decontamination procedures) for the Site.

END OF SECTION 02085

SECTION 02100

SITE CLEARING

PART 1 - GENERAL

1.01 DESCRIPTION

Requirements specified in the Conditions of the Contract and Division 1 form a part of this Section. Remove all stumps, roots, and pavement within the limits designated on the Drawings.

A. Work Included in This Section. Principal items are:
   1. Selective removal to limits shown on the Drawings.
   2. Protection and preservation of trees and vegetation outside the clearing limits.
   3. Disposal off site of all debris, stumps, roots, pavement and other objectionable materials.

B. Related Work Specified in Other Sections.
   1. Section 01564 - Erosion Control
   2. Section 02222 - Excavation

1.02 CODE REQUIREMENTS AND ENVIRONMENTAL SAFEGUARDS

Accomplish disposal of material removed from site in accordance with applicable Federal, State, and local regulations. At all times, comply with regulations in force to prevent pollution of air and water.

1.03 SITE INVESTIGATIONS

The Contractor shall carefully examine the site to determine the full extent of the Work required to conform to the Drawings and Specifications. The Contractor shall satisfy himself as to the nature and location of the Work, conditions, the formation and condition of the existing ground surface and the character, equipment and facilities needed prior to and during prosecution of the Work. Contractor shall satisfy himself as to the obstacles to be encountered. Any inaccuracies or discrepancies between the Drawings and Specifications shall be brought to the Owner's attention in order to clarify the exact nature of the Work to be performed.

PART 2 - PRODUCTS. (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 CLEARING AND SITE PREPARATION.

A. Clearing and site preparation shall include the removal from the site of all vegetation, including, but not limited to, weed growth, brush, shrubs, stumps, logs, roots and boulders within the Project area as well as the foundations, walls, slabs, pavements, walkways, buried drain lines, utilities, pipes indicated on the Project Drawings. Holes resulting from the removal of underground structures

and roots that extend below the finished grade shall be cleaned and backfilled with suitable materials.

B. Contractor shall be responsible for all permits, lighting, temporary barricades, fencing, etc., required for Work on the Owner's property. The Contractor shall relieve the Owner of any and all legal responsibility for this phase of the Work.

C. Removal of trees, shrubs, and vegetation shall occur only with prior Owner approval. Violation of this provision shall require the Contractor to bear all damages and consequences. The roots of trees to remain shall not be damaged by operations under this Section or any other Section. Herbicides for the control of woody plants shall not be used. Trunks, stumps, limbs, branches and roots within the trench alignment shall be removed without Owner approval.

D. Trees and shrubs to remain shall be trimmed so as to avoid removal or damage. Trimmed or damaged trees shall be treated and repaired by persons with experience in this specialty who are approved by the Engineer. Trees and shrubs intended to remaining which are damaged beyond repair or removed, shall be replaced by the Contractor at his own expense.

E. Any such item damaged by the Contractor shall be restored or replaced immediately at the Contractor's expense.

F. Note to Specifier - Select Disposal Method (s)
   1. All metal debris resulting from clearing and grubbing shall be buried beneath the cap or suitably removed from the site and legally disposed of by the Contractor.
   2. All trees, shrubs, stumps, and roots and wood debris from non-contained areas shall be chipped for placement beneath the cap. The Contractor shall provide a chipper of sufficient size to handle all material expected from the cleared areas.
   3. "Wood debris and all material from clearing and grubbing, including stumps, from contaminated areas shall be chipped for placement beneath the cap."

G. No trees, stumps, and other cleared and grubbed material may be used in backfills or structural embankments.

H. Burning onsite shall not be permitted.

3.02 TOPSOIL REMOVAL

Note to Specifier: Determine if topsoil is not contaminated and can be re-used prior to including Section 3.02. Clearly designate areas of topsoil removal.

A. Topsoil is defined as friable clay loam surface found to a depth of not less than 4 inches. Topsoil shall be substantially free of subsoil, clay lumps, stones, and without weeds, roots, and other objectionable material.

B. Strip topsoil which is satisfactory to whatever depths are encountered, and in such manner as to prevent intermingling with the underlying subsoil or other objectionable material. Remove heavy growth of grass from areas before stripping.

1. Where trees are shown or directed to be left standing, stop topsoil stripping a sufficient distance from such trees to prevent damage to the main root system.

C. Stockpile topsoil in temporary storage piles in areas approved by the Engineer. Construct storage piles to freely drain surface water. Cover storage piles if required to prevent windlown dust. Topsoil in excess of quantity required shall remain on-site .

3.03 GUARANTEE

A. Contractor shall guarantee that Work performed under this Section will not permanently damage trees, shrubs, turf, or plants designated to remain, or other adjacent work or facilities. If damage resulting from Contractor's operations appears during the period up to 12 months after completion of the project, he shall replace damaged items at his own expense.

END OF SECTION 02100

SECTION 02222

EXCAVATION

PART 1 - GENERAL

1.01 DESCRIPTION

The work specified in this section consists of the labor, equipment, tools, materials, and services needed to perform all excavation as described herein or shown on the Contract Drawings.

A. Work included in this section:
   1. Excavation of soils whether contaminated or not.
   2. Excavation for drainage ditches, swales, culverts, piping, etc.
   3. Excavation for site structures.

B. Related work specified in other sections:
   1. Section 01500 - Temporary Facilities and Field Office
   2. Section 01564 - Erosion Control
   3. Section 02100 - Site Clearing
   4. Section 02223 - Backfilling
   5. Section 02228 - Compaction
   6. Section 02260 - Soil Cover Construction
   7. Section 02501 - Gravel Access Road
   8. Section 02727 - Drainage Piping
   9. Section 02990 - Finish Grading, Topsoil, and Seeding

1.02 QUALITY ASSURANCE

A. Field Measurements

Verify that survey benchmark, monuments and intended elevations for the work are as shown on the Drawings or as provided by the Engineer.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 PREPARATION

A. Identify required lines, levels, contours, and datum. Review subsurface investigation reports and other available site information.

B. Protect plants, lawns, wetlands, and other features which have been designated on the Contract Drawings to remain as a portion of final landscaping.

C. Protect control points, bench marks, existing structures, fences, sidewalks, paving, and curbs from excavation equipment and vehicular traffic. Damaged items shall be promptly repaired at the Contractor's expense.

D. Prior to start of construction, notify the appropriate organizations, and have staked or marked all underground utilities. Utilities include water, gas, electrical, telephone, cable, storm sewer, sanitary sewers, laterals, and services. In the event such locations indicate a possible interference, or when needed to locate points of connection to existing facilities, perform exploratory excavations to determine the utilities' location and elevation. Provide the utility owner with the results of the exploratory excavations for his review. Allow the Engineer sufficient time to determine any changes required as a result of such exploratory excavations prior to start of construction.

E. Maintain existing manholes, catch basins, and other utility structures above and below grade which are to remain in their pre-work condition. Any material or debris entering same due to the operation shall be promptly removed.

F. Areas to receive compacted fill shall be graded to prevent surface runoff and ponding.

3.02 SOIL EXCAVATION AND HANDLING PROCEDURE

All soil excavated from the designated soil excavation areas will be excavated and handled according to the following procedures:

1. Use visual identification to segregate clean cover soil, where applicable. The visually identified clean top cover soil will be stockpiled in an area which does not interfere with the progress of the work either inside or outside the cap area on the ground in such a manner which protects the stockpiled soil from accumulating excessive moisture.
2. Excavate visually stained soil and stockpile on prepared soil storage pad in approximately 300 to 500 CY piles. Samples will be taken from each pile and composited for laboratory analysis for total PCB's (3 day turnaround for sample results or onsite lab used). If the analytical results show the soil to contain less than 10 PPM total PCB's the soil will be removed from the pad and stockpiled on the ground inside the area to be capped for storage while awaiting backfill or immediately used as backfill within the area to be capped. If the soil shows PCB's greater than 10 PPM, the soil will be taken to the soil processing area for Soil Solidification/Stabilization (S/S) Treatment.
3. Once in the soil processing area, soil will be solidified/stabilized according to the procedures established in the Pilot Scale Testing and then immediately placed in the proposed cap area and compacted. Samples of the Solidified/Stabilized soils will be taken at 1,000 CY intervals for unconfined compressive strength (UCS) testing. The results shall be compared to one to three day UCS criteria established during pilot scale testing to verify compliance with the required 28 day UCS and TCLP parameters. The one to three day UCS verification parameters will be established from results of the Pilot Scale testing correlating one to three day UCS test results with required treatment standards for 28-day UCS and

TCLP results (minimum 28 day UCS value of 100psi and maximum TCLP PCB requirement of 0.5 ppb total leachable PCB's).

3.03 CLASSIFICATION OF EXCAVATED MATERIAL

A. Classifications of excavated materials are as follows:

1. Common Excavation - "Common excavation" shall include all excavation except "rock excavation." All unconsolidated and non-indurated material, rippable rock, loose rock, soft mineral matter, weathered rock or saprolite, and soft or friable shale which is removable with normal earth excavation equipment shall be considered "common excavation." All boulders and detached pieces of solid rock, concrete, or masonry less than 1 cubic yard in volume shall be classified as "common excavation."

3.04 EXCAVATION

A. Underpin adjacent structures which may be damaged by excavation work, including utilities and pipe chases.

B. Excavate subsoil required to accommodate access roads, construction operations, and culverts.

C. Excavate as required to accommodate access roads, ditching, site structures, construction operations, and piping.

D. Banks are to be shored or machine-sloped to an angle which is safe for the specific material in which the excavation is made.

E. Excavations shall not interfere with the normal 45 degree bearing splay of foundations. Undercutting of excavation faces will not be permitted.

F. Grade the top perimeter of excavations to prevent surface water from draining into the excavation.

G. Hand trim excavations to the required undisturbed subgrade. Remove loose matter.

H. Remove lumped subsoil, boulders, and rock under 1 cubic yard. Refill voids with concrete or compacted gravel/crushed stone.

I. Notify the Engineer of unexpected subsurface conditions, or of questionable soils encountered at required subgrade elevations, and discontinue work in the area until notified to resume work.

J. Should the Contractor, through negligence or otherwise, carry his excavation below the designated subgrade, structural backfill or unclassified backfill (material type dependent on the nature of work), shall be furnished and placed as backfill in sufficient quantities to reestablish the designated subgrade surface. Refer to Section 02223 - Backfilling for backfill materials. Granular material used for backfilling shall be spread and compacted in conformance with the requirements of Section 02228, and to the percentage compaction outlined therein. The cost of this over-

excavation and refilling operation, including any tests associated therewith, shall be borne by the Contractor.

K. Stockpile excavated material in areas designated by the Engineer.

3.05 TRENCH EXCAVATION

A. Trenches for drainage, utilities, piping shall be excavated and maintained as shown on the Drawings and specified in this Section. As specified in this section, trench widths shall be held within the minimum and maximum limits shown on the Drawings. If a prefabricated, mobile shield is utilized in lieu of conventional sheeting and bracing in pipe trenches, the bottom of the shield shall be maintained as high as possible (preferably above the spring line of the pipe) so as to prevent disturbance of the pipe foundation material and to avoid forces which would tend to pull pipe joints apart when the shield is dragged forward. Gouged openings or troughs left by the shield shall be filled with additional pipe foundation material and thoroughly compacted. Installation of sheeting and bracing and use of mobile shields shall be in complete accordance with all details of applicable codes, rules and regulations including all applicable local, State and Federal regulations including the Occupational Safety and Health Act (OSHA).

B. Excavation shall be such that a flat bottom trench of allowable width is established at the required subgrade elevation for subsequent installation of pipe foundation material.

C. If indicated on the Drawings or when required as a result of unsuitable soil conditions, trench excavation shall be carried below the required subgrade and a special pipe foundation installed in conformance with the Contract Documents. In any event, operations shall result in stable trench walls and a stable base free from standing water, consistent with trench width requirements.

D. Bedrock, boulders and cobbles greater than 6 inches shall be trimmed back or removed on each side of the trench so that no rock protrudes within 6 inches of the installed pipe. Rock shall also be trimmed back across the bottom of the trench so that no rock, boulder or cobble protrudes within 4 inches of the installed pipe.

E. In general, trenches shall not be opened for more than 50 feet in advance of installed pipe. Excavation of the trench shall be fully completed at least 5 feet in advance of pipe laying operations. No more than 40 feet of trench shall be left open overnight.

3.06 DISPOSAL OF MATERIAL

A. All excavated material shall be classified as surplus material and disposed in an onsite location approved by the Engineer.

B. Reuse of excavated material as onsite fill shall conform with Section 02223.

3.07 FIELD QUALITY CONTROL

A. Field inspection will be performed under provisions of Section 01400.

B. Provide for visual inspection of bearing surfaces.

3.08 PROTECTION OF EXCAVATIONS

A. Protect excavations by methods required to prevent cave-ins or loose soil from falling into excavation.

B. All excavations shall be properly and legally maintained while they are open and exposed. Sufficient and suitable barricades, warning lights, flood lights, signs, etc., to protect life and property shall be installed and maintained at all times until the excavation has been backfilled and graded to a safe and satisfactory condition.

C. Protect the bottom of excavations and soil adjacent to, and beneath, foundations from freezing.

D. Exposed subgrade surfaces shall remain undisturbed, drained, and maintained as uniform areas shaped to receive the foundation components of the structure.

END OF SECTION 02222

SECTION 02223

BACKFILLING

PART 1 - GENERAL

1.01 DESCRIPTION

The work specified in this section consists of the labor, equipment, tools, materials, and services needed to perform all backfilling as described herein or shown on the Contract Drawings.

A. Work included in this section:
   1. Site filling and backfilling.
   2. Fill under culverts and access road.
   3. Classification of materials.

B. Related work specified in other sections:
   1. Section 02222 - Excavation
   2. Section 02228 - Compaction

1.02 SUBMITTALS

A. For each material proposed, notify the Engineer of the source of material and furnish for approval a certified gradation analysis at least 10 days prior to date of anticipated use of such material. Except as specified herein, only offsite approved materials shall be utilized.

1.03 QUALITY ASSURANCE

A. Referenced standards: Comply with the applicable provisions and recommendations of the following, except as otherwise shown or specified.
   1. ASTM D2487 - Classification of Soil.
   2. ASTM 06898 - Standard Proctor Compaction.
   3. ASTM D854, D2216 - Physical Property of Soils
   4. ASTM D4318 - Atterburg Limits.
   5. ASTM D136 - Method for Seive Analysis of Fine and Coarse Aggregates

B. The Owner and the Engineer reserve the right to inspect proposed sources of offsite granular material and to order such tests of the materials deemed necessary to ascertain its quality and graduation of particle size. The Contractor shall, at his own expense, engage an approved testing laboratory to perform such tests, and submit certified test results to the Engineer. If similar tests of the material from a particular source were performed previously, submit results of these tests to the Engineer for consideration.

C. No materials shall be used on this project for fill, backfill, subbase, or other purpose until approval is obtained from the Engineer. Only material from approved sources shall be used.

PART 2 - PRODUCTS

2.01 ONSITE MATERIALS

A. Material under this classification shall be derived solely from non-waste excavations necessary to construct the project to the lines and grades specified. Excavated onsite material may be used for general filling or backfilling purposes. If he so elects, the Contractor may, at his own expense, substitute other types of material in place of the onsite material, provided such substitution is approved in advance by the Engineer.

2.02 OFFSITE MATERIALS

A. Offsite material required for fill or backfill shall be natural material, from offsite sources, free from trash, debris, deleterious materials, snow, or ice.

B. STRUCTURAL BACKFILL/CRUSHED AGGREGATE shall conform to NYSDOT for Type 4 granular fill materials. Materials furnished for Type 4 shall consist of stone, or sand and gravel or blends of these materials. Materials furnished shall be well graded from fine to coarse and shall be free of mud, debris, organic matter or other deleterious materials.

Gradation for Type 4 structural fill/crushed aggregate shall conform to:

Sieve Size Designation	Percent Passing By Weight
2 inch	100
No. 40	20-65
No. 200	0-10

C. UNCLASSIFIED FILL OR BACKFILL shall be materials classified in ASTM D 2487 as GW, GP, GC, SW, SP, SM, SC, and CL and shall be free from roots and other organic matter, trash, debris, frozen materials, and stone larger than 2 inches in any dimension. Additionally, any material classified as SM shall have not more than 25 percent by weight passing the No. 200 sieve. CL soils shall have a liquid limit no greater than 30 and a plasticity index no greater than 15.

D. Unsatisfactory Materials: Unsatisfactory materials shall be materials that do not comply with the requirements of satisfactory materials. Unsatisfactory materials include but are not limited to those materials containing roots and other organic matter, trash, debris, frozen materials, stones larger than 2 inches, and materials classified in ASTM 02487 as PT, OH, and OL. Unsatisfactory materials also include man-made fills, or refuse.

PART 3 - EXECUTION

3.01 GENERAL BACKFILLING REQUIREMENTS

A. Verify that fill materials to be used are acceptable to that specified. Any crushed stone stockpiles which have undergone excessive particle segregation shall be removed prior to backfilling.

B. Verify that all subsurface installations for the project have been inspected and are ready for backfilling.

C. Generally, compact subgrade to density requirements for subsequent backfill materials. Cut out soft areas of subgrade not capable of in-situ compaction. Backfill with a material as specified in Part 2 (above) and compact to density equal to or greater than requirements for subsequent backfill material.

D. Backfill spaces shall be inspected prior to backfilling operations and all unsuitable materials, including sheeting, bracing forms and debris, shall be removed. Remove all water, snow, and ice and debris from surfaces to accept backfill material. No backfill shall be placed against foundation walls of structural members unless they are properly shored and braced or of sufficient strength to withstand lateral soil pressures.

E. Onsite backfill material shall be inspected prior to placement and all roots, vegetation, organic matter, or other foreign debris shall be removed. Stones larger than 12 inches in any dimension shall be removed or broken. Stones shall not be allowed to form clusters with voids. If the contractor fails to stockpile and protect onsite excavated material acceptable for backfill, then the Contractor shall provide an equal quantity of acceptable offsite material at his own expense.

F. Backfilling shall be started as soon as practicable and after structures or pipe installations have been completed and inspected, concrete has acquired 70 percent of design strength, and subgrade waterproofing materials have been in place for at least 48 hours. Backfilling shall be carried on expeditiously thereafter. Backfill shall be started at the lowest section of the area to be backfilled. Natural drainage shall not be obstructed at any time.

G. No backfill material shall be placed on frozen ground nor shall the material itself be frozen or contain frozen soil fragments when placed. No calcium chloride or other chemicals shall be added to prevent freezing. Material incorporated in the backfilling operation which is not in satisfactory condition shall be subject to rejection and removal at the Contractor's expense.

H. Backfill material shall not be placed when moisture content is more than two percent above optimum or is otherwise too high to allow proper compaction. When material is too dry for adequate compaction, water shall be added to the extent necessary. Maintain within two percent of optimum moisture content of backfill materials to attain required compaction density. Rough grade all backfilled and filled areas to meet subsequent topsoiling or paving requirements. Make grade changes gradual. Blend slopes into level areas.

I. Backfill areas to required contours, grades, and elevations.

J. Hydraulic compaction by ponding or jetting will not be permitted except in very unusual conditions and then only upon written request and demonstration of its effectiveness by the Contractor and the written acceptance by the Engineer.

K. Place and compact fill materials in continuous layers to meet appropriate requirements of Table 1 of Section 02228, Compaction.

L. Employ a placement and compaction method consistent with Section 02228 that does not disturb or damage adjacent walls, drainage systems, damp-proofing, waterproofing, protective coverings, utilities in trenches, underground conduits or tanks.

M. Remove surplus backfill materials from site and/or place in an area acceptable to the Engineer.

3.02 TOLERANCES

A. Top Surface of General Backfilling - plus or minus one inch from required elevations.

3.03 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01400.

B. Tests and analysis of fill material will be performed in accordance with Section 02228.

C. Compaction testing will be performed in accordance with Sections 01400 and 02228.

D. If tests indicate the Work does not meet the specified requirements, the Contractor shall remove, replace and retest the work at his own expense.

E. Proof roll compacted fill surfaces under gravel access road.

3.04 PROTECTION OF FINISHED WORK

A. Regrade and recompact fills subjected to vehicular traffic.

END OF SECTION 02223

SECTION 02228

COMPACTION

PART 1 - GENERAL

1.01 DESCRIPTION

The work specified in this section consists of the labor, equipment, tools, materials, and services needed to perform all compaction as described herein or shown on the Contract Drawings.

A. Work included in this section:
   1. Compaction requirements.
   2. Compact all subgrades, foundations, replaced, filled and backfilled material as specified.

B. Related work specified in other sections:
   1. Section 02222 - Excavation
   2. Section 02223 - Backfilling
   3. Section 02260 - Soil Cover Construction
   4. Section 02269 - QA/QC for Soil Cover Soil Material
   5. Section 02501 - Gravel Access Road
   6. Section 02727 - Drainage Piping
   7. Section 02990 - Finish Grading, Topsoil, and Seeding

1.02 QUALITY ASSURANCE

A. The Engineer shall provide in place moisture-density testing to verify the Contractor's work quality.

B. The Contractor shall adopt compaction methods which will produce the degree of compaction specified herein, prevent subsequent settlement, and provide adequate support for the structures and piping to be placed thereon, or therein, without damage to the new or existing facilities.

C. The natural subgrade for all footing, mats, slabs-on-grade for structures, or pipes shall consist of firm undisturbed natural soil, at the grades shown on the drawings.

D. After excavation to subgrade is completed, the subgrade shall be compacted if it consists of loose granular soil or if its surface is disturbed by the teeth of excavating equipment.
   1. This compaction shall be limited to that required to compact loose surface material and shall be terminated in the event that it causes disturbance to underlying fine-grained soils, as revealed by weaving or deflection of the subgrade under the compaction equipment.
   2. If the subgrade soils consist of saturated fine or silty sands, silts, or clay or varved clays, no compaction shall be applied.

1.03 SUBMITTALS

A. Submit in writing a description of the equipment and methods proposed to be used for compaction.

B. Submit samples of materials to be compacted on the project to the testing laboratory for analysis prior to beginning compaction.

C. Submit copies of all compaction test reports. The test reports shall include the test methods used, results, a narrative of tests conducted, locations, elevations, material tested, equipment used, the name of the technician conducting the tests, and a signed certification from the laboratory.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 PREPARATION

A. Brace walls and slabs of structures to support surcharge loads and construction loads imposed by compaction operations.

B. Proof-roll all subgrade surfaces to accept fill or backfill material.

C. Each layer of fill or backfill shall be compacted to the specified density the same day it is placed.
   1. The moisture content of backfill or fill material shall be adjusted, if necessary, to achieve the required degree of compaction.

D. Compact each lift in accordance with Table 02228-1 (attached at end of section).

E. Match compaction equipment and methods to the material and location being compacted in order to obtain the specified compaction, with consideration of the following guidelines:
   1. Vibratory compaction is preferred for dry, granular materials.
   2. Hand compaction equipment such as impact rammers, plate or small drum vibrators, or pneumatic buttonhead compactors should be used in confined areas.
   3. Hydraulic compaction by pounding or jetting will not be permitted except in unusual conditions, and then only upon written approval by the Engineer and after a demonstration of effectiveness.
   4. Backhoe mounted hydraulic or vibratory tampers are preferred for compaction of backfill in trenches over 4 feet in depth. The upper 4 feet shall be compacted as detailed above or with hand-guided or self propelled vibratory compactors or static rollers.
   5. For plastic pipelines (PVC, PE or PB) do not compact directly over the center of the pipe until the backfill has reached 2 feet above the top of the pipe.

6. Compaction of relocated waste material shall be performed by making a minimum of three passes with a vibratory sheepsfoot roller. The roller shall be suitable for use on municipal waste and weigh a minimum of 23,000 pounds.

3.02 FIELD QUALITY CONTROL

A. Material Testing
   1. The Engineer reserves the right to order testing of materials at any time during the work.
   2. Testing will be done by a qualified, independent testing laboratory in accordance with this Section and Section 01400, Quality Assurance and Quality Control Services. The Contractor shall pay for all compaction testing performed by the testing laboratory.
   3. The Contractor shall aid the Engineer in obtaining representative material samples to be used in testing.
   4. For each material which does not meet specifications, the Contractor shall reimburse the Owner for the cost of the test and shall supply an equal quantity of acceptable material, at no additional compensation.
   5. The Contractor shall anticipate these tests and incorporate the time and effort into his procedures.

B. Compaction Testing
   1. The Engineer reserves the right to direct the qualified independent testing laboratory to conduct in-place density tests of compacted lifts.
   2. Testing may be conducted for every 200 cubic yards of fill or backfill, or every 75 linear feet of trench backfill placed.
   3. The Contractor shall dig test holes and provide access to all backfill areas at no additional compensation when requested by the Engineer if an area has been covered without approval or is suspected of not meeting the specifications.
   4. For each test which does not meet the specifications, the Contractor shall pay for the cost of the test and shall replace all material included in that lift or sector with acceptable material and compact to specification, at no additional compensation.
   5. The Contractor shall anticipate these tests and incorporate the time and effort into his procedures.
   6. Nuclear moisture density testing by "probe" methods will be acceptable for compacted layers not exceeding 8 inches of thickness.
      a. Only certified personnel will conduct nuclear testing.

C. Alternate Methods of Compaction - The Contractor may employ alternate methods of compaction if the desired degree of compaction can be successfully demonstrated to the Engineer's satisfaction.

3.03 PROTECTION

A. Prior to terminating work for the day, the final layer of compacted fill shall be rolled with a smooth-drum roller if necessary to eliminate ridges of soil and depressions left by tractors or equipment used for compaction or installing the material.

B. As backfill progresses, the surface shall be graded so as to drain during incidence of rain such that no ponding of water shall occur on the surface of the fill.

C. The Contractor shall not place a layer of fill on snow, ice or frozen soil. Unsatisfactory materials shall be removed prior to fill placement.

-- END OF SECTION 02228 --

TABLE 02228-1
MINIMUM COMPACTION REQUIREMENTS

Construction Element	Maximum Compaction Layer Thickness (Inches)	Minimum Compaction ASTM	Minimum Compaction
I. Structures			
a. Fill under slabs-on-grade, and backfill around structures and above footings	8	D698	100%
II. Trenches			
a. Fill under pipelines and pipe bedding	8	D698	95%
b. Pipe sidefills and first 1 foot of pipe backfill under pavements[1]	12	D698	95%
c. Backfill from 1 foot above pipe to top of trench under pavement[1]	18	D698	95%
d. Backfill under areas to be seeded	18	D698	85%
e. All other trenches	18	D698	85%
III. Embankments and Fills			
a. Rough site grading and backfilling of sorts beneath area to be capped.	12	D698	95%

TABLE 02228-1 (CONTINUED)
MINIMUM COMPACTION REQUIREMENTS

Construction Element		Maximum Layer Thickness (Inches)	Minimum Compaction ASTM	Minimum Compaction
IV.	Access Gravel Roadway			
a.	Crushed stone paving	12	D698	100%
V. Soil cover layers				
	Relocated Waste	12	--	3 passes
	Drainage Layer[3]	6	D698	90% (95% maximum)
	Barrier Protection Layer	15	D698	90%
	Topsoil Layer	6	-- See Section 02990	

Notes:

1. For plastic or polyethylene pipe, use 2 feet over top of pipe.
2. A permeability of 1×10^{-7} cm/sec must also be achieved.
3. Do not overcompact drainage layer as the permeability may be adversely affected.
4. Material will be compacted with a vibratory roller compactor weight 20 tons or more.

SECTION 02260

SOIL COVER CONSTRUCTION

PART 1 - GENERAL

1.01 DESCRIPTION

The work specified in this section consists of the labor, equipment, tools, materials, and services needed to perform the construction of the landfill cover layers described herein or as shown on the Contract Drawings.

A. Work included in this section:
   1. Drainage layer.
   2. Barrier Protection layer.
   3. Topsoil layer.

B. Related work specified in other sections:
   1. Section 01564 - Erosion Control
   2. Section 02100 - Site Clearing
   3. Section 02222 - Excavation
   4. Section 02223 - Backfilling
   5. Section 02228 - Compaction
   6. Section 02269 - QA/QC for Soil Cover Materials
   7. Section 02405 - Polyethylene Geomembrane
   8. Section 02445 - Stabilization/Solidification
   9. Section 02990 - Finish Grading, Topsoil, and Seeding

1.02 QUALITY ASSURANCE

The Contractor shall have successfully completed at least two landfills of equal or larger size, one of which involved the placement of a low permeability soil layer or barrier protection layer.

1.03 SUBMITTALS

A. Submit one series of certified quality control tests for each cover soil material for the Engineer's approval. Include a 50-pound sample and identify the source and location of each material. Resubmit as needed to obtain approval.

B. Submit a list of compaction equipment to be used including the manufacturer, model name and/or number, type, gross weight, and areal loading.

C. Submit written certification from the geomembane installer that he has examined the materials to be in contact with the geomembrane and found them to be compatible.

D. Submit a list of at least two successfully completed projects of equal or larger size and or similar construction.

1.04 DELIVERY, STORAGE, AND HANDLING

Material stockpiles shall be segregated by type of material and shall be stored and handled to prevent inclusion of objectionable material such as trash, debris, organic matter, unapproved materials, stones, ice, snow, or other materials.

PART 2 - PRODUCTS

2.01 DRAINAGE LAYER

The drainage layer material shall be a mixture of sand and gravel meeting the following requirements:

Gradation

Sieve Size	% Passing
1-inch	100
3/4 - inch	85-100
#4 sieve	30-60
#40 sieve	5-25
#100 sieve	5-20
#200 sieve	≤5
Type of Sample	(cm/sec)
Hydraulic Conductivity	$\leq 1 \times 10^{-2}$

2.02 COVER SOIL LAYER (BARRIER PROTECTION LAYER)

The cover soil material shall conform to the following requirements:

Gradation

Sieve Size	% Passing
4 inch	100
#200	0-90

Requirements specified in Section 02223 - Backfilling shall also be adhered to.

2.03 TOPSOIL LAYER

Refer to Section 02990 for specifications relating to finish grading, topsoil, and seeding.

PART 3 - EXECUTION

3.01 SUBGRADE PREPARATION

A. The subgrade elevations shown on the Contract Drawings shall be achieved by the relocation of municipal wastes, slag waste, and contaminated soil as per Section 02219. The subgrade elevations may vary due to variation in the quantities of relocated waste and soil. Final subgrade slopes shall be between 4 and 20 percent which is in accordance with 6NYCRR Part 360 regulations for landfill closures.

B. Prior to construction of the cover layers, the subgrade shall be proof-rolled using a roller of not less than 23,000 pounds. The Engineer shall observe the proof-rolling and also make determinations of unsuitable subgrades. Unsuitable subgrades shall be excavated in one-foot increments up to a maximum of three feet. The subgrade shall be proof-rolled and re-inspected by the Engineer after each increment until accepted. The excavation shall be backfilled and compacted with barrier protection material, or stable waste material.

3.02 SEQUENCING AND SCHEDULING

A. The Contractor shall be responsible for the installation, sequencing, and testing of all cover components.

B. The Contractor shall verify that the subgrade and each cover component has been properly installed, graded, tested, and had the test results accepted as required prior to the installation of subsequent cover components. The Engineer must approve the prior lift surface prior to the installation of subsequent lifts.

C. The Contractor shall be responsible for the layout and protection of a 50-foot survey grid system to be used for identifying all testing locations, seam locations, and panel locations, as required in individual specification services.

D. The Contractor shall notify the Engineer a minimum of 24 hours in advance of required QA/QC testing.

3.03 INSTALLATION (GENERAL)

A. Each lift shall be placed and compacted in uniform lifts in accordance with Section 02228. Employ compaction equipment and methods which will achieve the specified permeabilities and compaction.

B. Employ placement and compaction methods which will not damage previously installed cover layers or geosynthetics and are acceptable to the Engineer. A minimum of three feet of soil shall

be maintained over the geomembrane for wheeled vehicles. Low ground pressure (LGP) tractor-type equipment shall be used to place materials within three feet of the geomembrane.

C. Maintain proper grading and compaction of each cover layer to maintain drainage and prevent ponding. Areas compacted with a sheepfoot roller shall be proof-rolled or back-bladed to a smooth surface each night to prevent infiltration and ponding and to maintain drainage.

D. Do not place materials on spongy, porous, wet or frozen ground or while in a frozen condition.

E. Calcium chloride or other chemicals shall not be used to prevent freezing.

F. QA/QC testing shall be conducted in accordance with Section 02269.

3.04 INSTALLATION (COVER SOIL)

A. Cover soil material shall have all clods and clumps broken down to no larger than 2-inch maximum dimension.

B. If the cover soil is placed on a previously compacted lift, the surface shall be scarified to a nominal depth of 1-inch.

C. Should the soil become overly dry, sprinkle the soil with water, with equipment that shall sufficiently and evenly distribute the water. Sufficient equipment to furnish and blend the required water shall be made available by the Contractor at all times. This work shall be performed at the Contractor's expense.

D. Should the soil be too wet to permit proper compaction, all work on the portions of the soil liner thus affected shall be delayed until the material has dried to the required moisture content. Drying of the soil by manipulation may be necessary to obtain the proper moisture content throughout the material for compaction to achieve the specified permeability. This work shall be performed at the Contractor's expense.

END OF SECTION 02260

SECTION 02269

QUALITY ASSURANCE/QUALITY CONTROL SOIL COVER MATERIALS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work included in this section:

The work specified in this section consists of the labor, equipment, tools, materials, and services needed to perform all QA/QC requirements for the landfill cover only as described herein or shown on the Contract Drawings. The quality assurance/quality control requirements, including sampling frequency and test type; the documentation requirements for the sampling and testing; and the requirements for failed quality control tests.

B. Related work specified in other sections:

1. Section 02222 - Excavation
2. Section 02223 - Backfilling
3. Section 02228 - Compaction
4. Section 02260 - Soil Cover Construction
5. Section 02990 - Finish Grading, Topsoil, and Seeding

1.02 SUBMITTALS

A. The Contractor shall submit one series of quality control tests for each soil material for the Engineer's approval prior to use of that material.

The test reports shall include, at a minimum, the sample number, the location of the sample, the quantity of material represented by the sample, the location of the overall quantity represented by the sample, the test methods used, the name of the technician conducting the tests, and a signed certification from the laboratory. Each certificate shall be signed by an authorized representative of the testing firm, such as the laboratory manager, who will certify that sampling and test methods were performed in accordance with those described for this work. Each certificate shall reference the test sample number.

1.03 REFERRED STANDARDS

A. ASTM D-75, "Standard Practice for Sampling Aggregates".

B. ASTM D-422, "Standard Test Method for Particle-Size Analysis of Soils".

C. ASTM D-1556, "Standard Test Method for Density of Soil in Place by the Sand-Cone Method."

D. ASTM D-698, "Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 pound Rammer and 12-inch Drop."

E. ASTM D-1587, "Standard Practice for Thin-Walled Tube Sampling of Soils."

F. ASTM D-2216, "Standard Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures."

G. ASTM D-2434, "Standard Test Method for Permeability of Granular Soils (Constant Head)."

H. ASTM D-2922, "Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

I. ASTM D-2974, "Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils."

J. ASTM D-3017, "Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)."

K. ASTM D-3740, "Standard Practice for Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as used in Engineering Design and Construction."

L. ASTM D-4220, "Standard Practices for Preserving and Transporting Soil Samples."

M. ASTM D-4253, "Standard Test Methods for Maximum Index Density of Soils Using a Vibrating Table."

N. ASTM D-4254, "Standard Test Methods for Minimum Index Density of Soils and Calculation of Relative Density."

O. ASTM D-4318, "Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils."

P. ASTM D-5084, "Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials using a Flexible Wall Permeameter."

1.04 RESPONSIBILITIES

A. Contractor Responsibilities: The Contractor shall be responsible for and pay for one series of quality control tests for each cover soil material for the Engineer's approval. Resubmissions to obtain approval shall also be at the Contractor's expense.

The Contractor shall notify the Engineer on a daily basis and no less than 24 hours in advance of testing required. The contractor shall make available personnel or equipment as needed to assist with the testing.

B. Engineer's Responsibilities: The Engineer shall be responsible for and pay for all quality control and quality assurance testing with the exception of the initial quality control tests for material approval. The Engineer shall provide copies of all test reports to the Contractor.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Bentonite Plug

A bentonite plug shall be used for repairing penetrations made into the low permeability soil layer. The plug shall consist of a bentonite/soil/water mixture with an equivalent or lower permeability rate than the soil layer.

PART 3 - EXECUTION

3.01 INSPECTION

A. Maintain on the site for inspection, the information outlined in ASTM Designation D-3740.

B. Prior to beginning work, verify that the Engineer has reviewed the testing facilities.

3.02 PREPARATION

A. Verify that the areas to be tested are ready to be tested.

B. Review testing parameters, requirements, and anticipated schedules to ensure that adequate personnel and proper equipment will be available. Notify the Engineer at least 24 hours in advance of the required testing.

C. Perform audits, as needed, to evaluate construction test results and discuss with the Engineer any changes which may simplify and expedite the work.

D. Coordinate sampling and testing operations so as to have the necessary data available on a timely basis.

1. Quality control samples shall be scheduled such that test results are available at the time the sampled material is being placed and compacted.
2. Quality assurance tests should be scheduled immediately after material placement so evaluations and determinations concerning installed material can be made.

3.03 PROTECTION

A. Minimize disturbance of previous completed work during the performance of the work in this Section.

3.04 QUALITY CONTROL SAMPLING AND TESTING

A. The Contractor shall schedule quality control sampling and testing of source materials prior to the use of a specified quantity of materials to determine if mechanical characteristics and laboratory performance criteria are consistent with those required for the work, and to provide information for use in handling, preparation and compaction activities. Quality control testing shall be performed by the Engineer.

B. Inform the Engineer of anticipated quantities and locations of excavated soil on a daily basis and no less than 24 hours in advance to enable the Engineer and the testing firm to prepare for quality control sampling and testing.

C. Based on quantity estimates, notify the Engineer when and where quality control sampling is required.

D. Quality control sampling shall be performed as follows:
   1. For material which is taken directly from its natural state to the landfill, the testing firm shall obtain a representative sample from the next proposed section of the material source, as identified by the Contractor.
   2. For material which is excavated, spread and/or worked to prepare the material, and then used for construction, the testing firm shall obtain a representative sample from the next proposed section of the material source, as identified by the Contractor.
   3. For material which is excavated and stockpiled for later use or excavated, spread and then stockpiled, the testing firm shall obtain a representative sample from the stockpile in accordance with ASTM Designation D-75.
   4. In all cases, the testing firm should visually inspect the proposed borrow material for noticeable variations in material and sample different materials separately.
   5. Mass samples shall be of sufficient quantity for the required testing. Subsamples for individual test procedures shall be extracted as required by specific test methods.
   6. All samples shall be individually labeled for identification purposes.
   7. Subsample labels shall denote the sample from which they were derived.

E. Quality control testing shall be performed as follows:
   1. The minimum frequency of testing and test methods used shall be in accordance with Table 02269-1 at the end of this section.
   2. Samples which must be tested offsite shall be handled in accordance with ASTM Designation D-4220.
   3. Permeability testing of drainage layer material shall be performed at 95% of its maximum dry unit weight as determined by the modified Proctor or relative density analysis.
   4. Permeability testing of low-permeability soil material shall be performed on a sample which has been recompacted to 95% of its maximum dry unit weight at a moisture content which is wetter than the optimum moisture content for that material, as determined by the modified proctor analysis samples shall be tested at hydraulic gradients less than 30. Three-point plots indicating laminar flow conditions shall be

included in the test results. The hydraulic conductivity of the proposed low permeability soil shall be 5 X 10^{-8} cm/sec or less (as tested in the laboratory).

3.05 QUALITY ASSURANCE SAMPLING AND TESTING

A. Quality assurance sampling and testing of compacted soil materials shall be performed by the Engineer after a specified quantity of material has been prepared, placed, and compacted to verify that compaction requirements have been met and that the resulting field performance criteria are consistent with those obtained from quality control testing and those required for the work.

B. Inform the Engineer of anticipated quantities and locations of placed and compacted material on a daily basis and no less than 24 hours in advance to enable the testing firm to prepare for quality assurance sampling and testing.

C. Quality assurance testing and sampling shall be performed as follows:
   1. The minimum frequency of testing and the test methods to be used are listed in Table 02269-2 at the end of this section.
   2. Depending on the nature of the drainage material, field compaction verification testing may be waived and visual observation of compaction may be substituted. A written request with supporting documentation shall be submitted to, and written approval received from the Engineer, prior to a change in the Quality Assurance Program.
   3. Penetrations in the barrier protection layers shall be filled with the same material and compacted.
   4. For low permeability soils (used as barrier layer in the landfill cap:
      a. After nuclear moisture content/density testing has been completed for the first acre of each lift, two thin-walled tube samples shall be taken around the bentonite plugs used to repair the holes made by nuclear testing. These shall be tested for permeability and shall meet a permeability of less than $1X10^{-7}$ cm/sec.
      b. Thin-walled tube samples for use in permeability testing shall be obtained in general compliance with ASTM Designation D-1587, omitting the portions of the standard which deal with drilling equipment and borehole preparation. Care shall be taken not to disturb underlying soil layers during sampling operations.
      c. Record the length of the retrieved sample and determine the weight of the sample.
      d. If the tube samples are to be transported offsite for testing, each sample shall be handled in accordance with ASTM Designation D-4420.

3.06 SPECIAL CONDITIONS

A. Failed Tests
   1. Acceptable soil shall be defined as soil which lies between consecutive sample locations which produced test results meeting all applicable specifications.
   2. In the event that a quality control test result does not meet specifications, the material from which the sample was taken, and which the sample represents, shall be considered unacceptable and shall not be used for construction.
      a. The Engineer may take and test additional samples about the failed sample to limit the area represented by the failed sample at the expense of the Contractor.

b. The Contractor may amend the soil as he deems necessary and retest the soil. The amendment shall be documented by a certified soil testing laboratory at the expense of the Contractor.

3. In the event that a quality assurance test does not meet specifications, the area represented by the failed sample shall be considered unacceptable and shall be removed and replaced with an equivalent amount of acceptable material at no additional compensation.

   a. The Engineer may take and test additional samples about the failed sample to limit the area represented by the failed sample, at the expense of the Contractor.

TABLE 02269-1
QUALITY CONTROL
FREQUENCY OF TESTING

Test (1)	Method	Drainage Layer	Low Permeability Soil Layer	Barrier Protection Layer	Topsoil Layer
Particle Size Analysis	ASTM D-422	1/500cy	1/1,000cy	1/2,500 cy	1/10,000 cy
Standard Proctor Analysis(2)	ASTM D-698	1/500cy	1/1,000cy	1/2,500 cy	N/A
Permeability	ASTM D-2434	1/500cy	N/A	N/A	N/A
Permeability	ASTM D-5084	N/A	1/1,000cy	N/A	N/A
Moisture Content	ASTM D-2216	N/A	1/1,000cy	1/2,500 cy	N/A
Liquid Limit, Plastic Limit Plasticity Index	ASTM D-4318	N/A	1/1,000cy	N/A	N/A
Organic Content	ASTM D-2974	N/A	N/A	N/A	1/10,000 cy

(1) Testing shall also be performed at noticeable changes in material.

(2) Perform minimum/maximum density testing (ASTM D-4253 and ASTM D-4254) for material not meeting the oversize correction requirements of the Standard Proctor Analysis (ASTM D-698).

N/A = Not Applicable

TABLE 02269-2
QUALITY ASSURANCE
FREQUENCY OF TESTING

Test	Method	Gas Venting Sand Layer	Drainage Layer	Low Pearmeability Soil Layer	Barrier Protection Layer	Topsoil Layer
In Place Density (Nuclear)	ASTM D-2922	10/acre/lift	10/acre/lift	10/acre/lift	10/acre/lift	N/A
Moisture Content (Nuclear)	ASTM D-3017	10/acre/lift	10/acre/lift	10/acre/lift	10/acre/lift	N/A
In Place Density (Nuclear)	ASTM D-1556	10/acre/lift	10/acre/lift	10/acre/lift	10/acre/lift	N/A
Moisture Content (Sand cone)	ASTM D-1556	10/acre/lift	10/acre/lift	10/acre/lift	10/acre/lift	N/A
Permeability (1)	ASTM D-5084	N/A	N/A	10/acre/lift	N/A	N/A

END OF SECTION 02269

SECTION 02275
RIPRAP

PART 1 - GENERAL

1.01 DESCRIPTION

The work specified in this section consists of the labor, equipment, tools, materials, and services needed to provide and place riprap as described herein or shown on the Contract Drawings.

A. Items included in this section:
   1. Riprap requirements for shoreline protection, ditches, and outfall structures

B. Related work specified in other sections:
   1. Section 01564 - Erosion Control
   2. Section 02222 - Excavation
   3. Section 02223 - Backfilling

1.02 SUBMITTALS

A. Submit the name and location of the source of stone used.

B. Submit test reports on the materials including sieve analysis, freeze-thaw and magnesium sulfate soundness. Provide proof that the material is New York State Department of Transportation (NYSDOT) approved.

PART 2 - PRODUCTS

2.01 GENERAL

A. Riprap shall be clean, hard, durable, angular stone as delivered from an offsite source.

B. Riprap shall be free from organic matter, trash, debris, shale, show, ice, and other frozen or mechanically deleterious materials.

C. Riprap shall be hard enough to withstand exposure to air, water, freezing, and thawing.

2.02 RIPRAP

A. Riprap shall meet the gradation requirements for NYSDOT stone fill (riprap), item #620-2.02. Gradation shall be as follows:

Stone Filling Item	Stone Size [1]	Percent of Total by Weight
Fine	Smaller than 8 ins. Larger than 3 ins. Smaller than No. 10 Sieve	90 - 100 50 - 100 0 - 10
Light	Lighter than 100 lbs. Larger than 6 ins. Smaller than ½ in.	90 - 100 50 - 100 0 - 10
Medium	Heavier than 100 lbs. Smaller than 4 ins.	50 - 100 0 - 10
Heavy	Heavier than 600 lbs. Smaller than 6 ins.	50 - 100 0 - 10

Add other riprap sizes: Fine
Medium
Heavy

PART 3 - EXECUTION

3.01 PLACEMENT

A. The Contractor shall place the riprap in accordance with NYSDOT Specification 620-3.02 in the locations shown on the Drawings. The subgrade surface on which the riprap is to be placed shall be cut or filled, graded, and compacted to the lines and grades shown on the Drawings and as necessary to provide an even surface.

B. The stone fill shall be placed in a manner that will minimize damage to the underlying geotextile and produce a reasonable well-graded mass of stone with smaller stone fragments filling the space between the larger ones, so as to result in the minimum practicable percentage of voids.

C. The final section of riprap shall be in conformance with the lines, grades, and thicknesses shown on the plans. Riprap used for bank or channel protection shall be placed to its full course thickness in one operation, unless otherwise directed by the Engineer or specified in the special provisions, and in such a manner that the underlying material will not be displaced or worked into the layer of riprap.

D. Placement of stone upon finished bedding material, when used, shall be carefully controlled to avoid disruption and damage to the layer of bedding material. The stone shall be so placed and distributed that there will be no pockets of uniform size material.

E. The desired distribution of the various sizes of stone throughout the mass shall be obtained by selective loading of the material at the quarry of other source; by controlled dumping of successive loads during final placing or by other methods of placement which will produce the specified results. Rearranging of individual stones by mechanical equipment or by hand will be required to the extent necessary to secure the specified results.

F. The riprap shall be placed starting at the bottom of the placement areas and proceed to the top, or in such a manner that stones will not slide or roll down during their placement. On slopes, the largest stones shall be placed at the bottom of the slope.

G. The ground surface on which channel protection is to be placed shall be free of brush, trees, stumps, and other objectionable material and shall be dressed to a smooth surface. Do not place riprap over frozen or spongy subgrade surfaces.

H. Riprap shall be placed to allow the weight of the stone to be carried by the underlying material and not by the adjacent stones.

END OF SECTION 02275

SECTION 02405

POLYETHYLENE GEOMEMBRANES

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work specified herein consists of the furnishment and placement of 40-mil linear low density polyethylene (LLDPE) or 60-mil high density polyethylene (HDPE) geomembranes on the site as shown on the Contract Drawings. The work shall include the furnishing of all labor, supervision, equipment, materials, small tools, seaming devices, and quality control devices to install a complete and watertight geomembrane. The remainder of this specification is for 40-mil LLDPE geomembrane for the purpose of this 60 percent design submittal.

B. Related work specified in other sections:
   1. Section 01400 - Quality Assurance and Quality Control
   2. Section 02222 - Excavation
   3. Section 02223 - Backfilling
   4. Section 02228 - Compaction
   5. Section 02260 -Soil Cover Construction
   6. Section 02269 - QA/QC for Soil Cover Soil Materials

1.02 SUBMITTALS

A. To be submitted prior to construction:
   1. Manufacturer
      a. The name of the intended membrane manufacturer and the geomembrane type to be supplied.
      b. The manufacturer's quality control program or descriptive documentation.
      c. Test results indicating the typical minimum average roll values of the geomembrane which meet or exceed those listed in Table 02405-1 at the end of this section.
      d. Samples of the geomembrane (4 @ 8 x 10 inch).
   2. Manufacturer's Quality Control Submittals:
      a. The origin and identification of the raw materials used to manufacture the geomembrane including the supplier's name, production plant, brand name, and type.
      b. Copies of quality control certificates issued by the producer of the raw materials.
      c. Test reports for specific gravity and melt flow index, to verify the quality of the raw materials used.
      d. Copies of quality control certificates for each roll of geomembrane identifying: a) the date of manufacture and identification number; b) that each roll was continuously inspected for uniformity, damage, imperfections, holes, cracks, thin spots, foreign materials, tears, punctures, and blisters; and c) that non-destructive seam testing was performed on all fabricated seams over their full length. Include copies of tests for seam testing.
      e. Copies of destructive seam testing performed on a minimum of two samples per blanket taken from extra material at the beginning or end of blanket seams such that the blanket

is not damaged or its geometry changed. Testing is to be performed by an independent laboratory.

f. Certification that the geomembrane does not exceed the specified a maximum coefficient of permeability of 1x10-11 cm/s for LLDPE.

g. A compatibility report and certification that the LLDPE membrane will not degrade due to the wastes in the landfill.

3. Installer
   a. The name of intended installer including the company name, field crew foreman, and seaming foreman.
   b. A list of at least ten projects completed by the intended installation company using similar membranes which total a minimum of 100 acres. For each project identify the name and purpose of the facility, location, completion date, owner, designer, installer, point of contact and phone number, total square footage, and geomembrane type and thickness, and seaming method used.
   c. A list of at least five projects completed by the installer's field crew foreman using the same geomembrane which total a minimum of 50 acres. For each project identify the name and purpose of the facility, location, completion date, owner, designer, installer, point of contact and phone number, total square footage, and geomembrane type and thickness, and seaming method used.
   d. A list of at least three projects completed by the installer's seaming foreman using the same geomembrane which total a minimum of 50 acres. For each project identify the name and purpose of the facility, location, completion date, owner, designer, installer, point of contact and phone number, total square footage, and geomembrane type and thickness, and seaming method used.
4. Shop Drawings
   a. Layout of the geomembrane system showing panels, seams, and vent locations as proposed for construction.
   b. Details of seaming and welding the geomembrane material.
   c. Details of joining the geomembrane material to concrete or other dissimilar materials as required.
   d. Details of joining the geomembrane material to pipe penetrations as required.
   e. An installation schedule showing the sequence of operations, the objectives to be completed daily, including personnel, number of shifts, and capacity per shift, and the anticipated total duration required to complete the membrane.
5. Manufacturer's installation instructions, including repair procedures.
6. Quality control requirements and procedures.
7. Qualifications of the independent testing laboratory and its key personnel that the Contractor will retain to perform quality control testing. Submit a listing of the testing apparatus, testing standards typically performed, QA sampling and testing schedule, and a letter stating that the testing laboratory is independent from, and has no financial interest in, the geomembrane installer, manufacturer, or Contractor.

B. To be submitted by installer during liner installation:
   a. Copies of seaming quality assurance records which shall include apparatus temperature, extrudate temperature, if applicable, and ambient air temperature.

b. A letter stating that the granular materials and Contractor's proposed installation methods for soil materials immediately above and below the geomembrane are acceptable for geomembrane installation.

c. Copies of quality assurance certificates and laboratory test results signed by an authorized representative of the testing firm which shall include:
   1) Panel numbers and identification.
   2) Quality assurance test locations, procedures and results.
   3) Documentation of repairs, including location and retest results.

d. Archive samples of material from each destructive seam location. Enough material shall be submitted to allow for one complete set of destructive tests for both peel adhesion and shear strength.

C. To be submitted by installer after completion of construction:

1. As-Built Drawings: Submit within two (2) weeks after demobilization of the liner installer from the construction site, as-built drawings showing the following information:
   a. Layout of geomembrane system showing panels including roll identification, destructive sample locations indexed to test results and repair disposition, and any other repairs or patches.
   b. Any deviation from previously submitted certified drawings.
2. Summary and log of the following information:
   a. Quality assurance testing performed.
   b. Ambient temperature at which seaming was performed recorded every two hours during placement and seaming.
   c. Geomembrane surface temperature recorded every two hours during placement and seaming.
   d. Seam wedge temperature, recorded every two hours during placement and seaming.

PART 2 - PRODUCTS

2.01 SHEET GEOMEMBRANE

A. The LLDPE geomembrane shall be a thickness of 40 mil containing no fillers or extenders certified by the manufacturer to meet or exceed the material properties tabulated in Table -02405-1 of this Section.

2.02 EXTRUSION JOINING RESIN

A. Any resin used for extrusion welding of sheets and/or sheet to penetrations shall be LLDPE produced from the same material as the sheet resin. Physical properties shall also be the same as those of the resin used in manufacture of the geomembrane material.

PART 3 - EXECUTION

3.01 INSPECTION OF SHEET GEOMEMBRANE AT JOBSITE

A. The Engineer will visually inspect the sheet rolls as they arrive on the jobsite for possible damage in transit. If, in the opinion of the Engineer, the roll is not suitable for repair, the roll will be rejected and removed from the jobsite. As each sheet is unrolled, the Engineer will further visually inspect the sheet surfaces. The geomembrane surface shall be brushed, blown or washed by the installation contractor if the amount of dust or mud inhibits inspection. The Engineer shall decide if cleaning of the geomembrane is needed to facilitate inspection. Sharp creases resulting from wrinkles in the material at the time of manufacture are not acceptable. All faulty areas will be repaired in an appropriate manner using methods that meet the approval of the Engineer. Repairs will be tested as described in 3.05-11 of this section.

3.02 DELIVERY, STORAGE, AND HANDLING OF MATERIALS

A. Delivery:
   1. Delivery: Materials shall not be delivered to the site until the appropriate submittals of Section 1.03 of this specification have been approved by the Engineer. At such time, the manufacturer/installer may deliver the materials to the jobsite and shall unload and store materials at an area approved by the Engineer.

B. Storage and Handling:
   1. Storage and handling of the materials shall conform to the manufacturer's recommendations and shall be done in such a manner as to prevent damage or deterioration to any part of the geomembrane. Further, the installer assumes the responsibility for proper storage and handling prior to and during installation of the geomembrane materials. Rolls shall be stored on a prepared surface (not wooden pallets) with no protrusions greater than 1/2 inch and shall not be stacked.
   2. The membrane shall be protected from puncture, mechanical abrasions, dirt, grease, mud, moisture, excessive heat, light, or other damage. Any damage to protective wrapping shall be repaired immediately. The Installation Contractor shall be responsible for the onsite handling of all geomembrane materials. No geomembrane material shall be unloaded without the field crew foreman present.
   3. When using a front end loader to handle geomembrane rolls for transport from storage to the specific installation location, the installer shall incorporate the use of nylon straps and a spreader bar assembly to lift the roll. The nylon straps are to be centered so that the roll can be lifted and remain relatively level. It will not be acceptable to drag one end of the roll during transport. A backhoe with a smooth bucket blade would be an acceptable piece of equipment for lifting the rolls. Only with the Engineer's approval, will a fork truck be used for lifting. Under no circumstances will it be acceptable to force the fork truck tongs under a roll.

C. Equipment and tools shall not damage the membrane. No vehicular equipment shall be driven directly on the membrane. Personnel working on the membrane shall not smoke and shall wear smooth soled shoes. Shoes with uneven bottoms or protrusions which may trap stones are not allowed.

3.03 PRE-INSTALLATION SUBGRADE PREPARATION

A. The surface of the site to be capped with the geomembrane shall be finish graded to the lines and grades as shown on the construction drawings. The surface for placement of the geomembrane cap shall be rolled smooth prior to installation. No standing water will be allowed. The Contractor is to certify to the Engineer that the surface on which the membrane cap is to be installed is acceptable before commencing work. The contractor shall maintain these surfaces in an acceptable condition during installation of the membrane.

3.04 PRE-INSTALLATION CONFERENCE

B. The Contractor shall hold a pre-installation conference with the Owner representative, Engineer, installer, and manufacturer's representative.

3.05 INSTALLATION

A. General: The geomembrane material shall be laid out and installed in accordance with the applicable approved shop drawings by crews experienced in the installation of the geomembrane. Seams directly exposed to weather should be minimized in the fabrication plans. A minimum of three feet (3') of soil for wheeled vehicles and one foot (1') of soil for tracked vehicles shall be maintained over installed geomembranes at all times. The geomembrane shall not be covered until acceptable results for both non-destructive and destructive tests have been submitted to, and approved by, the Engineer. Geomembrane rolls or panels should be placed in an orderly fashion which shall minimize or prevent surface water from flowing below an in-place geomembrane.

B. Weather Conditions: The effects of weather are critically important in obtaining a high quality installation.
   1. Field seaming is not permitted when the ambient air temperature is below 50° F (10° C) or above 100° F (38° C).
   2. Field seaming is not permitted during precipitation, fog, or in the presence of moisture.
   3. Field seaming is not permitted when winds are in excess of 20 miles per hour.

C. Lap joints will not be laid out or prepared for welding (cleaning and/or grinding) further ahead than one day's welding time. Prepared joints that have laid out over night will be recleaned and/or ground prior to welding.

D. Field seams should be oriented parallel to the line of maximum slope, i.e. oriented along, not across the slope. In corners and irregularly shaped locations, the number of field seams should be minimized. No seam should be less than five feet from the edge of the cover.

E. Slack: The geomembrane shall be installed with an adequate amount of slack to allow future temperature shrinkage of the material to occur with minimal stretching and tightening of the geomembrane. As a guideline, for every 100 ft. of surface to be covered, 3/4 inch for each 5° F of temperature differential (the difference between the installation sheet temperature and 35° F, or the average daily minimum winter temperature for the installation site, whichever is lower) should be added to the 100 foot dimension to compensate for shrinkage. Using this approach, a geomembrane installation at a sheet temperature of 75° F would provide for six inches of geomembrane for every 100 linear feet of surface to be covered. Excessively large wrinkles in the

geomembrane, so large that the wrinkle could fold over and cause a sharp crease in the material under overburden pressure, shall be removed.

Cover materials shall be carefully placed over the liner to avoid stretching and folding of the geomembrane.

F. Tenting: There will be no tenting of the geomembrane at the toes of slopes or in corners at a sheet temperature of 35° F or higher. Tenting is the formation of air space beneath the geomembrane that results from temperature changes and/or improper installation.

G. Layout: It will not be an acceptable practice to "free roll" the geomembrane rolls down the slopes. The roll will be controlled as it is unrolled down slopes.

H. Extrusion Welded Field Joints: Extrusion welded field joints shall be made by overlapping adjacent sheets by five inches (minimum) and extruding a ribbon of hot extrusion resin along seams to ensure a complete weld of the joined materials. Prior to extrusion welding of the seams, all areas which are to become seam interfaces shall be cleaned of dust, dirt and moisture. The slick surfaces of the geomembrane sheet which are to become seam interfaces shall be roughened with a wire brush, fine grain sanding disk, or other acceptable means before extrudate is placed between, or at the edge of, the overlapped sheets. Sufficient extrudate shall be used to assure that a weld bead is visible at the edge of the sheet overlap. Joints between the geomembrane sheets shall be field welded using the particular manufacturer's extrusion joining apparatus and technique under suitable ambient conditions. Any joining procedure utilized shall properly prepare the surfaces and heat the geomembrane materials sufficiently with the addition of a molten bead to ensure a homogeneous and consistently fused seam. A moveable protective layer shall be used below each overlap of geomembrane during field seaming to prevent the buildup of moisture between the sheets.

I. Hot Shoe Seamed Field Joints: Hot shoe seaming joints shall be made by overlapping adjacent sheets by five inches (5") (minimum) and running a hot metal shoe wedge between the overlapped area. The controlled heating is followed by pressure/nip rollers which uniformly fuse the materials together. Prior to seaming all areas which are to become seams, interfaces shall be cleaned of dirt, dust and moisture. Depending upon the type of wedge used, a single fusion seam or a double fusion seam may be produced. In the case of the single fusion seam, testing will be conducted in the same manner as with the extrusion welded seam system. If a split wedge is used, the resulting double seam shall also be subjected to testing by air pressure as set out in Section 4 of this specification. A moveable protective layer shall be used below each overlap of geomembrane during field seaming to prevent the buildup of moisture between the sheets.

J. Welder Certification and Testing: Each welder will certify his welding equipment at the beginning of each work shift by running a sample weld on extra material and testing for peel adhesion and seam strength on at least three specimens from the weld. All specimens must pass before production welding will be allowed. Acceptable welds are when elongation occurs in the geomembrane sheeting before there is more than 1/16 inch of peel failure of the weld. A test sample will be removed and tested for peel adhesion and seam strength after every 500 feet of seam welding after every two hours of continuous welding. If the sample fails, then a sample will be taken every ten feet back along the previously welded seam until acceptable production

welding is located. Weld seams designated for repair shall be done by capping the seam. If welding is stopped and the production seam is less than 500 feet, a sample will be tested to represent that footage of seam completed. Geomembrane sheets shall be placed to lay smooth and be allowed time to relax and smooth out prior to seam welding. Welding a wrinkled or rough sheet to a smooth sheet will not be an acceptable practice, nor will the welding together of two wrinkled sheets be accepted.

K. Geomembrane Penetrations: Penetrations through the geomembrane for monitoring wells, piping, support structure, inlet/outlet structures, pump pits, etc., shall be sealed using factory fabricated seals. The liner installer may submit alternate connection systems or methods which will be given full consideration by the Engineer.

A geomembrane reinforcement overlay of thickness equal to the geomembrane shall be placed around the penetration opening. The opening in the overlay shall be of the same size and configuration as the opening in the geomembrane. The overall minimum dimensions of the overlay shall be related to the geomembrane opening as follows:

Reinforcement Overlay		
Penetration Opening Dimension	**Overall Dimension (min)**	**Outside Corner Radius**
< 6 inches	3 feet	6 inches
6 inches to 1 foot	4.5 feet	9 inches
1 foot to 2 feet	7 feet	1.25 feet
2 feet to 3 feet	10 feet	1.75 feet
3 feet to 4 feet	12.5 feet	2.25 feet
4 feet to 5 feet	15.5 feet	2.75 feet
5 feet to 6 feet	18 feet	3 feet
6 feet to 7 feet	21 feet	3.5 feet
> 7 feet	Opening size plus 14 feet	3.5 feet

The outside edge of the overlay shall be welded to the geomembrane.

The factory fabricated seals shall not be installed until after placement of the drainage sand layer for 50 feet in all directions around each penetration to allow for shifting of the geomembrane. The area immediately surrounding each penetration shall be left open until the seal is installed and tested.

L. Repairs in Geomembrane Material: Immediately upon discovery or inspection of the installed geomembrane, all defects and damage shall be repaired in accordance with standard practices as approved by the Engineer.

Repairs of holes and test sample cutouts will be patched with a square or circular shaped precut geomembrane piece. A minimum lap of six inches is required from all cut edges or repairs. If the patch is square or rectangular shaped, the corners of the piece shall be rounded off with a minimum three inch radius of curvature. Cutting out of patch pieces from a piece of geomembrane laid directly on an already installed geomembrane sheet will not be allowed. Patches are to be cut out from pieces laid either on the ground outside the site area or upon a backup board or scrap material laid over the installed geomembrane.

Defective seams shall be rewelded, overlaid, or cut out and replaced as the conditions may dictate. All repairs shall be tested as described in paragraph 3.06 and documented pursuant of paragraphs 1.03 B and C. Exact location of all repairs shall be measured and included in the as-built drawings.

M. Temporary Anchoring: Sandbags or rubber tires may be used as required to hold the membrane in place during installation. Tires shall not have exposed steel cords or other sharp edges which may snag or cut the membrane. At the end of each day the membrane shall be sufficiently anchored to prevent displacement and/or tenting.

N. Final Review: After completion of installation and testing, and prior to construction of subsequent cover layers, all field test results shall be reviewed and a final walk-through inspection performed by the Engineer, and released to contractor in writing.

3.06 QUALITY CONTROL

A Reference Standards: Where Applicable, The Provisions And Recommendations Of The Designated Standards Adopted By The American Society For Testing Materials (ASTM) Shall Be Used As The Basis For The Material Requirements, Unless Otherwise Specified.

B. Testing

1. The Contractor shall perform quality assurance sampling and testing after the installation of each roll or panel to verify that a satisfactory seam has been obtained.
   a. Non-destructive testing shall be performed by the Contractor for the entire length of all seams using one of the methods described in paragraph 3.06.
   b. Destructive testing as described in Paragraph 4.04 shall be performed after every 500 feet of seam welding, after every two hours of continuous welding, or if welding is stopped less than 500 feet, for that section of seam completed.
   c. Both peel adhesion and shear strength tests shall be performed at each destructive testing interval. All testing shall be performed in the presence of the Engineer.
2. During the geomembrane installation process, the Installation Contractor shall record the following information on record drawings.
   a. The location and identification number of each imperfection, the date found, the date repaired and the result of non-destructive testing on the seam (acceptable/unacceptable).
   b. The location, date, sample number and test result (acceptable/unacceptable) of each destructive test series.

c. The location, identification number and date of each non-destructive air pressure seam test, the length of the tested seam, and the result of the test (acceptable/unacceptable), if applicable.
d. The location, date and lengths of nondestructive vacuum box seam testing performed on a daily basis.

C. Non-Destructive Tests:

1. Seam Pressure Testing: In the case of split wedge fusion seams, vacuum testing can be eliminated provided that it passes the seam pressure test.

The seam pressure test shall be conducted along the entire length of a seam as follows:

a. Seal and clamp both ends of the flow channel to assure an air tight seal. During the test, apply soapy water to the clamps to assure adequate air tightness at the clamps.
b. Connect a pump to the test device (a small bicycle pump will suffice) and inflate the flow channel to the desired pressure of 25-30 P.S.I. depending on mil thickness. Allow one (1) minute for the seam to stabilize as indicated by a possible slight drop in the initial pressure reading due to the seam expanding slightly under pressure.
c. Re-inflate to the desired pressure and test for a period of two (2) minutes.
d. At the end of the test period, if the pressure has not dropped more than two (2) P.S.I. (a small pressure drop would be the result of some air seeping around the inflation needle), the test is considered a pass and the following procedure is implemented.
   1) Remove the test device and clamps.
   2) Make any repairs, if necessary, to the area where the flow channel was clamped or inflated.
   3) Record the test results, mark the seam as passing and proceed to the next seam.
e. If the pressure drops below the two (2) P.S.I. allowance, the test is considered a failure, and further testing will be conducted on the seam including vacuum testing until the leak is found and repaired.

2. Air Lance Testing: Air lance testing shall be performed for seams where the vacuum box or seam pressure tests cannot be used. The testing equipment shall consist of a portable air pump, an air lance with a 3/16-inch diameter orifice capable of delivering 50 psi of continuous air, associated hose and fittings, and a mounting cushion to protect the membrane from damage.

3. Testing is performed by placing the orifice of the air lance at the underside of the upper geomembrane panel of the seam at a slightly upward angle. Air of approximately 50 psi (±5 psi) is blown onto the seam being tested. Defective seams are located when the air jet causes the membrane to inflate, flutter, or otherwise behave dissimilarly to properly seamed areas.

D. Destructive Tests

1. Destructive tests, both peel adhesion and shear strength, shall be performed for every 500 feet of seam, after every two hours of continuous welding, or, if welding is stopped less than 500 feet, for that section of seam completed.
   a. Peel Adhesion Testing: Peel adhesion testing shall be performed in accordance with ASTM Method D-4437. The Contractor's approved testing laboratory may perform this test in the field or laboratory provided proper equipment is used.

b. Shear Strength Testing: Shear strength testing shall be performed in accordance with ASTM Method D-4437. The Contractor's approved testing laboratory may perform this test in the field or laboratory provided proper equipment is used.

2. An adequate amount of material from each destructive seam test location shall be taken to perform three (3) complete sets of destructive tests for both peel adhesion and shear strength. Additional material for one set of destructive tests shall be submitted to the Engineer for archiving.

3.07 WARRANTY AND GUARANTEE

A. Prior to acceptance, the manufacturer/installer shall provide evidence in writing of all testing made to ensure joint integrity and to verify conformance to the specifications. The manufacturer/installer shall warrant that materials and workmanship supplied conform to the contract documents.

1. Guarantee of Materials: The lining material shall be guaranteed in writing by the manufacturer on a pro rata basis for a period of 20 years. The guarantee shall be against manufacturing defects of workmanship and against deterioration due to ozone, ultraviolet, or other normal weather aging. The guarantee shall be limited to replacement of material only and shall not cover vandalism, acts of animals, earthquakes, other acts of God.

2. Guarantee of Work: The Contractor shall guarantee in writing the entire work constructed by him under the contract to be free of defects in materials and workmanship for a period of one year following the date of acceptance of the work. The Contractor shall agree to make, at his own expense, any repairs or replacements made necessary by defects in materials or workmanship which become evident within the said guarantee period. The Contractor shall further agree to indemnify and save harmless the Owner and the Engineer and their officers, agents, and employees against and from all claims and liability arising from damage and injury due to said defects. The Contractor shall make repairs and replacements promptly upon receipt of written order. If the Contractor fails to make the repairs and replacements promptly, the Owner may do so and the Contractor shall be liable for the cost of such repairs and replacements.

3.08 CERTIFICATION

A. At the conclusion of placement of the geomembrane, the Contractor shall prepare to submit six (6) copies of a written report of the Work which includes the following:

1. Complete identification of geomembrane, including, but not limited to, resin type, physical properties, an other pertinent data.
2. Complete description of seaming system used, including material, method, temperatures, seam overlap width, and cure or aging time.
3. Complete description of field sampling and testing including test equipment used, location of field tests, copy of field test results, conditioning procedure prior to destructive seam testing, method of recording loading and determining average load for destructive test method, and type of failure in tests (i.e.; within the seam, within the sheet material, clamp edge, seam edge.)
4. As-Built drawings showing:

- actual layout of liner sheets;
- panel identification numbers;
- anchor trench details;
- boot details;
- dimensions of panels;
- locations and type of repairs made; and
- location of destructive tests and seams.

5. Copies of independent laboratory test results.
6. Liner manufacturer's warranty.
7. Certified copies of manufacturer's test results.
8. Written acceptance of liner subgrade.
9. Equipment calibration information.
10. "I (name and title), as the duly authorized representative of (Company name), hereby certify that the installation of the geomembrane has been completed in accordance with the terms and conditions of the Contract Documents entitled (date to be established)."

BY:_____

(Corporate Seal) WITNESS:_____

DATE:_____

The report shall be clear and concise, shall be bound with a cover, and shall contain a Table of Contents. Data for each liner segment, where applicable (i.e.; primary geomembrane, secondary geomembrane), shall be organized separately in the report. Final payment shall not be made until the report is determined to be acceptable to the Engineer."

TABLE 02405-1
REQUIRED PHYSICAL PROPERTIES OF MEMBRANE LINER (LLDPE) SHEET

PROPERTY	TEST METHOD	REQUIRED SMOOTH VALUES 40-MIL	UNITS
Thickness, Mil. (min.)*	ASTM D5199	36/40	Mil
Sheet Density, (min/max)	ASTM D792 or D1505	0.910/0.935	g/cc
Min. Tensile Properties (each direction)	ASTM D638 (As modified in NSF54 Appendix A)		
Stress (Strength) at Break	2.0" gage length	60	lb/in
Strain at Break	2.5" gage length	700	%
Strain (Elongation) at Break		600	%
Tear Resistance, (min).	ASTM D1004	22-26	lbs
Low Temperature Impact, °F(max).	ASTM D746	<-160	°F
Dimensional Stability, (max).	ASTM D5397	±2.0	%
Environmental Stress Crack, (min. hrs. with no failures)	ASTM D1693 (As modified in NSF54 Appendix A)	1800	hrs
Puncture Resistence, (min).	FTMS 101 method 2065	29	lbs
Carbon Black Content (Allowable Range)	ASTM D1603	2.0-3.0	%
Carbon Black Dispersion, (Acceptable Levels)	ASTM D-3015 (As Modified in NSF64 Appendix A)	A1, A2 or B1	

SEAM REQUIREMENTS			
		REQUIRED VALUES	
PROPERTY	TEST METHOD	40-MIL	Units
Peel Adhesion (min).	ASTM D5237	54	lb/in
Bonded Seam Strength, (min).	ASTM D5237	60	lb/in

* Thickness - first value represents lowest individual value.
  - second value represents average across roll.
* Value in parenthesis represents minimum value for textured sheet where it differs from smooth sheet value.

Add: Field Seam Property

Shear	Strength	ASTM4545	44(min)	16/in
Peel	Strength	ASTM4545	40(min)	16/in

END OF SECTION 02405

SECTION 02421

GEOTEXTILES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Separation Geotextile.

B. Reinforcement (Woven) Geotextile.

1.02 RELATED SECTIONS

A. Section 02222 - Backfilling

B. Section 02260 - Soil Cover Construction

C. Section 02275 - Rip-Rap

D. Section 02501 - Gravel Access Road

1.03 REFERENCES

A. Documents
   1. Task Force #25, AASHTO-ABC-ARTBA Joint Committee, "Specifications for Geotextiles." July 1986.

B. Quality Control Testing Standards
   1. ASTM D3786 - Hydraulic Bursting Strength of Knitted Goods and Non-Woven Fabrics.
   2. ASTM D4354 - Sampling of Geosynthetics for Testing.
   3. ASTM D4491 - Water Permeability of Geotextiles by Permittivity.
   4. ASTM D4533 - Trapezordal Teaming Strength of Geotextiles.
   5. ASTM D4594 - Effects of Temperature on Stability of Geotextiles.
   6. ASTM D4595 - Tensile Properties of Geotextiles by the Wide Width Strip Method.
   7. ASTM D4632 - Breaking Load and Elongation of Geotextiles (Grab Method).
   8. ASTM D4751 - Determining Apparent Opening Size of a Geotextile.
   9. ASTM D4833 - Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
   10. ASTM D4873 - Identification, Storage and Handling of Geotextiles.
   11. ASTM D5188 - Nominal Thickness of Geotextiles and Geomembranes.
   12. ASTM D5261 - Mass Per Unit Area of Woven Fabric.

1.04 SUBMITTALS

A. Materials: Submit product data and a 1-foot square sample of each geotextile proposed for use on this project.

B. Certification that each geotextile meets the criteria listed in Table 02421-1 at the end of this section.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store geotextiles out of the elements and protect from abrasion or tearing.

B. Clearly mark rolls showing the type of fabric and manufacturer.

C. Handling of the geotextile rolls shall be based on the manufacturer's recommendations.

D. The requirements for identification, storage and handling of geotextiles in ASTM D4873 shall be followed as a minimum.

PART 2 - MATERIALS AND PRODUCTS

2.01 MATERIALS

A. Separation Geotextile (Filters and Riprap Base)
   1. Shall be heat-bonded (non-woven) geotextile specifically designed for drainage and separation applications.
   2. Shall be composed of polyester and/or polypropylene polymers.
   3. Shall meet the criteria listed in Table 02421-1.

B. Reinforcement Geotextile (Road Reinforcement)
   1. Shall be a woven geotextile specifically designed for reinforcement applications.
   2. Shall be composed of polyester and/or polypropylene polymers.
   3. Shall meet the criteria listed in Table 02421-1.

C. Filtration Geotextile
   1. Shall be a needle-punched, nonwoven geotextile specifically designed for filtration applications.
   2. Shall be composed of polyester and/or polypropylene polymers.
   3. Shall meet the criteria listed in Table 02421-2."

PART 3 - EXECUTION

3.01 INSPECTION

A. The Contractor shall inspect all geotextiles upon delivery and verify that the proper materials and quantities have been supplied.

B. The Contractor shall inspect the subgrade for protrusions or other unacceptable conditions prior to installation of geotextiles.

C. The Contractor shall continuously inspect needle-punched geotextiles during deployment for broken needles remaining from needle-punching operations.

3.02 PREPARATION

A. The subgrade shall be prepared as indicated in the specifications.

3.03 PROTECTION

A. Protect all geotextile materials from damage due to exposure to sunlight, dirt, dust and other hazards.

B. Maintain the protective wrapping on geotextile rolls at all times.

C. The geotextiles shall be covered within 10 days after installation.

D. During spreading operations of backfill, a minimum depth of 12 inches of aggregate shall be maintained over the geotextiles when possible. Construction equipment shall not operate directly on the geotextile.

3.04 PERFORMANCE

A. Geotextile rolls shall be positioned as required and unrolled.

B. When placed on stable subgrades flatter than IV:5H, geotextiles shall be overlapped a minimum of 1.0 feet on all edges.

C. When geotextile is placed on unstable subgrades flatter than 1V:5H or slopes steeper than 1V:5H, horizontal overlaps shall be sewn.

D. When geotextile is placed on slopes steeper than 1V:5H, longitudinal seams shall be sewn or overlapped a minimum of 2 feet.

E. Sewing requirement:
   1. The thread color shall contrast with that of the geotextile.
   2. Sewing operations shall employ a thread tension which secures the geotextile rolls without cutting the material.
   3. Sewing operation shall use a "J" seam secured with a minimum of one row of four-stitch per inch two thread main stitch.

F. When geotextile is placed in trenches, the material shall be overlapped a minimum of 1 foot over the top of the trench. Longitudinal seams between adjacent rolls of material shall be overlapped a minimum of 2 feet.

G. Geotextile rolls shall be cut and laid flat such that buckling of the roll does not occur.

H. If geotextiles are damaged during any phase of construction or installation, a new piece of the same type shall be cut and placed over the damaged area with a 2-foot minimum overlap and sewn.

I. Aggregate shall be spread in the direction of overlap wherever possible.

TABLE 02421-1

MINIMUM ACCEPTANCE CRITERIA GEOTEXTILE

Test Description	Test Method	Criteria
Separation		
Mass per unit area	ASTM D-5261	≥6 oz/SY
Apparent opening size (AOS)	ASTM D-4751	<No. 70 sieve
Puncture resistance	ASTM D-4833	≥60 lb.*
Grab strength	ASTM D-4632	≥150 lb.*
Trapezoidal Teaming strength	ASTM D-4533	≥65 lb.*
Permittivity	ASTM D-4491	≥2.0 sec^{-1}*
Burst strength	ASTM D-3786	≥200 psi*
Reinforcement		
Mass per unit area	ASTM D-5261	>8 oz/SY
Puncture resistance	ASTM D-4833	>150 lb.
Grab strength	ASTM D-4632	>400 lb.
Trapezoidal Teaming strength	ASTM D-4533	>130x150 lb./in.
Burst strength	ASTM D-3786	>800 psi
Filtration		
Mass per unit area	ASTM-D5261	≥6 oz/SY
Apparent opening size (AOS)	ASTM-D4751	<No. 50 sieve
Puncture resistance	ASTM-D-4833	≥75 lb.*
Trapezoidal Teaming	ASTM-D-4595	>50 lb./in.*
Permittivity	ASTM-D-4491	≥1.0 sec^{-1}*

Burst strength	ASTM-D-3786	>200 psi*

NOTE:Specifier should check the properties Individual Geotextiles Required prior to specifying.

Minimum strength criteria shall apply to both the machine direction (MD) and the cross machine direction (XMD).

* Minimum Average Roll Values (MARV)

END OF SECTION 02421

SECTION 02445

SOLIDIFICATION/STABILIZATION

PART 1 - GENERAL

1.01 DESCRIPTION

This specification provides requirements for treatment by solidification/stabilization (S/S) and provides performance requirements for the final stabilized product. A S/S system shall be used which provides a safe, reliable method to treat the contaminated material. The Contractor may select the S/S method to be used and is responsible to demonstrate the capabilities of the proposed method. The Contractor shall be responsible for meeting the specified requirements for safety, reliability, and performance.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS

1. Section 01564 - Erosion Control
2. Section 02222 - Excavation
3. Section 02223 - Backfilling
4. Section 02228 - Compaction
5. Section 02260 - Soil Cover Construction
6. Section 02990 - Topsoil, Seeding and Erosion Control

1.03 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. The date of the reference shall be that in effect at the time of bidding

A. American Society for Testing and Materials (ASTM)

ASTM D1633 Standard Test Method for Compressive Strength of Molded Soil-Cement Cylinders

ASTM D4832 Standard Test Method for Preparation and Testing of Soil-Cement Slurry Test Cylinders

B. Environmental Protection Agency (EPA)

EPA SW-846 Method 1311 Toxicity Characteristic Leaching Procedure (TCLP)

1.04 SUBMITTALS

A. Work Plan: Submit a S/S Work Plan within 30 days after notice to proceed. No S/S of contaminated material shall be performed until the work plan is approved. The Contractor shall allow a period of 30 days in the schedule for review and approval of the work plan. The work plan shall address the technical requirements listed in this section and shall include, but is not limited to the following:

B. Mix Design: A bench-scale treatability study has been performed on the contaminated materials. Results of this study are provided in Appendix A for information only.

The Contractor shall be responsible for the selection of the stabilization/solidification design mixture to ensure that the chemical stability and physical integrity of the final stabilized product meets the performance criteria described herein. The Contractor shall submit proposed mix designs for the various site materials being treated including the source and amount of each ingredient to be used. The proposed source of water to be used for the S/S process shall also be identified. If the Contractor wishes to propose reagents besides Portland cement, submit a minimum of five consecutive test reports for field-proven mixes used within the past three years. Submit trial mixes and performance test reports for testing performed by an independent laboratory on the project material.

Submit a Field Start-up Demonstration (Pilot Test) Work Plan for approval prior to beginning any treatability work. The treatability study test results shall include the proposed reagents and mix ratios to be used during full scale treatment. The test results submitted shall verify that the proposed mix design meets the post-treatment criteria. Consideration shall also be given to the need to monitor off-gas and dust emissions during the treatability study. Detailed information on testing requirements, test methods, detection limits, and off-gas and dust emission monitoring requirements should be presented in the appropriate section. Prior to performing any treatability study, the untreated samples should be tested to verify that they contain the contaminants of concern at high enough concentrations to verify proper S/S treatment. Additional testing may be needed to verify that physical properties of the samples are also representative of site conditions.

C. Equipment: Specifications for the proposed homogenization and mixing equipment, processing equipment, and process control instrumentation. Process flow diagrams, mixing times, and processing rates shall be included. Anticipated pretreatment of the contaminated material shall be identified.

D. Drawings: Drawings indicating dimensions and layout of the S/S system on the site including the process equipment, stockpile areas and work areas. Drawings shall be to scale.

E. Emissions: Air emissions, dust, and noise from the system shall be identified and estimated. Control systems required to maintain compliance with local, state, and federal regulations shall be described as appropriate. Air emissions, dust, and noise testing protocol to be performed during the test run and full scale operations shall also be described.

F. Quality Control: Procedures to control mix proportions, mixing time, mixing speed, sample collection, sample curing, and post-treatment testing.

G. Demobilization: A post-treatment cleanup and sampling procedure for the treatment area.

H. Stockpile Design: A proposed stockpile design which meets the criteria outlined in Part 3 of this section.

I. Schedule: The anticipated production rate and provisions for carefully expediting the work effort.

J. Daily Reports: Submit a daily report detailing the quantities treated, operating times, batch identification number, batch proportions, mixing quality control data, mixing times and speed for each batch, and batch placement location.

K. Test Results: Submit the results of post-treatment tests performed.

L. Field Demonstration Report: Submit a field demonstration report which includes documents relevant field demonstration data including but not limited to: mix proportions, mixing time, and mixing speed.

M. Certificates: Submit certificates of analysis verifying reagent composition. 1.05 qualifications

1.05 QUALIFICATIONS

A. Contractor Experience: The Contractor shall have completed at least three S/S projects of comparable size and scope in accordance with local, state, and federal requirements using the proposed system or a similar system.

B. Key Personnel: Key personnel shall have a minimum of two years of S/S field experience. Key personnel shall include system operators, quality control personnel, and supervisory engineering and technical staff involved with the S/S system operation.

1.06 FIELD TESTING CONTROL

The Engineer shall employ a New York State-approved laboratory to perform the verification sampling and analysis of the stabilized material. Certified test reports shall be submitted to the Contractor within 24 hours of completion of the tests. All chemical analyses will be in accordance with Table 02445-1 at the end of this section.

1.07 PROJECT SITE CONDITIONS

The physical conditions indicated on the drawings and in the specifications are the result of site investigations. While the site investigation data is representative of subsurface conditions at a specific location, variations in the contaminated materials are expected to exist.

PART 2 PRODUCTS

2.01 MATERIALS

A. Water: Water shall not contain significant concentrations of oil, acid, salt, alkali, organic matter, or other deleterious substances which will be detrimental to the successful execution of the S/S treatment process.

B. Reagents: A certificate of analysis showing the chemical composition of reagents supplied by the vendor shall accompany each shipping unit of reagent. Reagents shall be shipped in properly labeled containers with instructions for handling and storage. The instructions shall be strictly adhered to.

2.02 EQUIPMENT

A. Mixing Equipment: The Contractor shall be responsible for the selection of the process facility. The mixing equipment shall have a minimum capacity adequate to meet the performance and schedule requirements and shall be equipped with positive means for controlling the mix proportions, maintaining the time of mixing constant, and maintaining the appropriate speed of rotation of the mixer.

B. Reagent Feed Units: Satisfactory means, incorporating weighing, metering or volumetric measurement shall be provided to separately batch the required amount of each reagent. Silos and feeders shall be equipped and operated so that no caking of material or variation in feed occurs. Provision shall be made so that each reagent can be easily sampled.

C. Water Flow Control System: Satisfactory means to measure and control the flow of water used for S/S shall be provided. The preferred method shall be a flow metering device.

D. Accuracy of Measurement Equipment: Scales, meters, and volumetric measuring devices used for measuring contaminated material, reagents, and water for S/S processing shall be accurate to plus or minus one percent of the quantity being measured. A check of calibration of measuring equipment shall be performed once every five working days.

E. Emission and Noise Controls: As needed, the S/S system shall include control apparatus necessary to meet OSHA worker protection requirements.

PART 3 EXECUTION

3.01 STOCKPILES

Stockpiles shall be constructed for storing contaminated material prior to treatment. If stockpiles are placed outside the excavation area, they shall be constructed to include:

A. An impermeable HDPE or LLDPE geomembrane liner (FML) with a minimum thickness of 40 mils. The liner shall be protected from vehicle damage by a woven Geotextile such as LINQ Industries GTF-300 or equal with high puncture resistance and low elongation properties. The FML shall be placed on a prepared subgrade which is graded to drain and compacted/rolled smooth such that all deleterious material which could damage the FML is removed prior to placement of the FML. If the subgrade contains soils which are excessively wet or weak, the weak materials shall be removed and replaced with soils or other materials which, when compacted in place, will support the FML without excessive deformation. All FML seams shall be welded by an experienced FML seam welder approved by the manufacturer. No seam testing will be necessary. A traffic layer consisting of well graded gravel or stone or other material which will not damage the FML and will be stable and create a firm work surface shall be placed on the FML/Geotextile.

B. An impermeable geomembrane cover with a minimum thickness of 10 mils to prevent precipitation from entering the stockpile.

C. Berms surrounding the stockpile which are a minimum of 12 inches in height.

D. The liner shall be sloped to a low point to allow leachate to be collected. Leachate collected from the stockpile shall be analyzed and, if necessary, treated to meet applicable local, state, and federal regulations. Leachate collected from the stockpile may be used in the S/S process provided the treated material meets the physical and chemical post-treatment test criteria.

3.02 OPERATION

1. Weather Conditions
   S/S shall not take place in an ambient air temperature below 32 degrees Fahrenheit without approval from the Engineer. Provisions shall be made to maintain the temperature of the treated material above freezing while curing. Contaminated material shall not be treated if it contains any frozen material. S/S shall not be performed during periods of heavy rainfall if this will result in the addition of excess water to the mixture.
2. Dissimilar Materials
   Dissimilar materials, for which testing has indicated the need of different mix ratios, shall not be mixed together.
3. Oversize Material
   Contaminated material that exceeds the maximum allowable particle size of the S/S mixing unit and that is amenable to treatment shall be reduced to a size that the mixing unit can accept. Oversize material that cannot be reduced to an allowable size for the S/S unit shall be buried in the cover area with other excavated materials not being treated by S/S.

3.03 FIELD START-UP DEMONSTRATION (PILOT TEST)

Prior to full-scale operations, a field start-up demonstration (also called a pilot test) shall be performed. At least 100 cubic yards of contaminated material shall be processed and the tests listed in Table 02445-1 shall be performed on at least five representative samples of the treated material (one each from Former Lagoons #1, 2 and 3, the Western Drainage Area and north of the mound). The Contractor may also choose to evaluate samples composited from more than one of these five areas. A field demonstration shall be performed on each distinctive type of material to be treated.

1. Full-Scale Processing Equipment

The full-scale processing equipment shall be used for the field demonstration. Reagents, mix ratios, and mixing procedures used during the field demonstration shall be the same as those used for the remainder of the work.

2. Sampling Locations

Contaminated material used for the field demonstration shall be obtained from the oily sludge layer of Former Lagoons #1 and 2, and from Former Lagoon #3, the Western Drainage Area and north of the mound. Prior to performing the field demonstration, contaminated material to be

used for the field demonstration shall be tested to verify it contains the following minimum levels of contamination: Total PCBs ≥10 ppm.

3. Testing

Testing shall be performed by the Engineer's testing laboratory to verify that the treated material from the field demonstration meets the specified physical and chemical criteria. If the treated material produced during the field demonstration does not pass the testing requirements, an equal quantity of the same type of material which failed shall be treated using a new mix design.

4. Volume Increase

The estimated increase in volume resulting from treatment shall be determined and reported with the field demonstration test results. Volume increase shall be determined by comparing the volume of in situ contaminated material to be treated to the volume of treated material using the following formula:

$$B = 100 \times [(1+R) \times (D \text{ in situ}/D \text{ treated}) - 1]$$

B = Volume increase in percent.
R = Dry weight ratio of solidifying agent to waste.
D in situ = Dry unit weight of in situ waste.
D treated = Dry unit weight of compacted treated material.

5. Field Demonstration Test Results

After completion of the field demonstration, no additional contaminated material shall be processed until test results from the field demonstration verify that the treated material meets the physical and chemical criteria listed in Table 02445-1. However, if test results from the field demonstration do not pass the criteria listed in Table 02445-1, the contaminated material treated with the failing mix design shall be reprocessed with a working mix design at the expense of the Contractor.

3.04 TESTS

Leaching and hydraulic conductivity tests are not amenable to real time quality control because of the time required to perform the tests. Therefore, it is preferable to minimize the number of leaching and hydraulic conductivity tests performed and to maintain quality control of the S/S process by verifying that the mix design works during the field demonstration/pilot-scale testing and maintaining quality control by monitoring batch proportions and mixing time. Real time indicator tests such as pH, specific conductance, mix temperature, and water content can also be used as quality control tools as appropriate.

During the Pilot-scale testing, data will be obtained correlating one to three day cure time unconfined compressive strength (UCS) test results with passing 28 day UCS and TCLP PCB test results. These one to three day UCS values will be used to confirm compliance of the S/S treated materials during full scale production. Samples of the S/S treated materials will be taken and cylinders made prior to the material being placed back in the excavation within the area to be capped. After the one to three day cure period, these cylinders shall be tested (UCS testing only)

and the results compared to the one to three day UCS data obtained during pilot-scale testing to provide confirmation of successful treatment.

1. Mix Proportions

Mixing time, mixing speed, and amounts of contaminated material, reagents, and water added to each batch shall be recorded. Mixing time, mixing speed, and mix proportions shall be maintained within the limits specified in the approved Work Plan and as modified during the field demonstration/pilot-scale testing.

2. Segregation

Treated material shall be placed directly into the onsite area to be capped after treatment. Treated material shall be placed such that the material from specific batches or runs can be defined and removed if the material fails post-treatment testing.

3. Test Results

Samples shall be collected immediately after treatment and allowed to cure for one to three days. Samples shall be tested for UCS only and must meet the post treatment testing criteria set up during the pilot-scale testing.

4. Retesting and Reprocessing

Retesting and reprocessing shall be performed at the expense of the Contractor for treated material that does not meet the physical UCS requirements established during pilot-scale testing. Reprocessed material shall be deducted from the daily production rate.

a. Retesting

Any unit that fails post-treatment quality control or quality assurance testing shall be retested or reprocessed. If the Contractor elects to retest the unit, two additional samples shall be collected and tested for the failed parameter. If both tests pass, reprocessing of the unit will not be required. If either sample fails, the unit shall be reprocessed and samples shall be tested as described in Section 3.4.3, Test Results.

b. Reprocessing

Reprocessing and retesting shall be performed on treated material that does not meet the physical UCS requirements. If the Contractor elects to reprocess a unit without retesting, the unit shall be sampled and tested as described in paragraph Test Results after reprocessing.

5. Adjustments to Mix Design

Subject to approval, the mix design may be changed based on the characteristics of the material being treated. An additional field demonstration may be required by the Engineer prior to implementation of the new mix design.

6. Quality Control / Quality Assurance Testing

Duplicate samples shall be submitted to the laboratory provided by the Engineer or Owner. The quality assurance sample frequency shall be one set of samples per ten sets of quality control tests

performed. At least one set of quality assurance samples shall be submitted each week that S/S is performed. The Engineer may require additional quality assurance tests as a result of failed quality assurance or quality control tests. The Engineer may also require additional quality assurance tests due to changes in the mix design or physical appearance of the contaminated material.

3.05 SOIL TREATMENT PERFORMANCE STANDARDS

During full production, the final product of the treatment operation shall be a stabilized matrix. The chemical stability and physical integrity of the matrix shall be documented by monitoring the S/S process for conformance to the mix design established during pilot-scale testing and sampling and UCS testing for one to three-day cured samples at the specified frequency by sampling and analysis. The samples shall be analyzed for the following parameters:

1. Unconfined Compressive Strength (UCS) analysis by ASTM D1633. After one to three days of curing, the samples must have a UCS value better than the one to three day UCS values established during pilot-scale testing.

TABLE 02445-1

STABILIZATION/SOLIDIFICATION TESTING CRITERIA

Parameter	Performance Criteria	Maximum Reporting Limit	Test Method
UCS	100 psi min	25 psi	ASTM D1633
TCLP PCBs	5 ug/l max	0.1 ug/l	EPA SW-846, Methods 1311 and 3510A/8080

END OF SECTION

SECTION 02501

GRAVEL ACCESS ROAD

PART 1 - GENERAL

1.01 DESCRIPTION

A.. The work herein consists of the furnishment and placement of the following materials at the site.

B. Section Includes:
1. Subgrade preparation.
2. Furnishing natural soils.
3. Furnishing select borrow material.
4. Furnishing granular access road material.
5. Temporary drainage.
6. Compaction.
7. Proof rolling.
8. Removal and replacement of unacceptable materials.
9. Grading.
10. Installation of geotextile fabric.

1.02 RELATED SECTIONS

A. Section 01040 - Project Coordination

B. Section 01500 - Temporary Facilities and Controls

C. Section 01564 - Erosion Control

D. Section 02100 - Site Clearing

E. Section 02223 - Backfilling

F. Section 02228 - Compaction

G. Section 02421 - Geotextiles

1.03 REFERENCES

A. ASTM D698 - "Moisture-Density Relations of Soil and Soil Aggregate Mixtures Using 5.5 pound Rammer and 12-inch Drop".

1.04 DEFINITIONS

A. "Subgrade" shall be defined as the foundation layer of natural soils or select borrow material that supports the gravel pavement layer.

1.05 PERFORMANCE REQUIREMENTS

A. Compaction of subgrade shall meet the requirements for compaction as stated in Section 02228, Table 1.
   1. Compaction curves shall be developed for each type of subgrade material when "In-Place Density" tests are required by the Engineer.
   2. The cost of failed compaction tests will be reimbursed by the Contractor.

B. Proof rolling with 8 to 10-ton pneumatic tire compactors to locate areas of inadequate compaction or soft or rutting areas or other defects in the subgrade surface.

1.06 SUBMITTALS

A. Geotextile Fabric - Refer to Section 02421.

B. Granular Materials - Refer to Section 02223.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Provide erosion and sediment controls (refer to Section 01564) to prevent debris, stones and silt from entering drainage systems.

1.08 FIELD MEASUREMENTS

A. Prior to start of construction, verify by field measurements that existing conditions are as shown on Drawings. Notify the Engineer of specific differences.

1.09 COORDINATION

A. Coordinate field work under provisions of Section 01040, including maintenance of traffic and emergency vehicle access.

B. Coordinate work with local utility companies (private and municipal) for location of existing utilities and protection thereof.

1.10 TEST REQUIREMENTS

A. Refer to Article 1.05 above.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Granular access road material shall be NYSDOT Type 2, Item No. 304.03.

B. Subgrade shaping materials shall be as described in Section 02223.

C. The type, size and quantity of granular material shall be that required to prepare a compacted subgrade approved by the Engineer.

D. Geotextile fabric shall be as specified for a reinforcement geotextile in Section 02421.

PART 3 - EXECUTION

3.01 EXAMINATION

A. See Section 02100 and Section 02223.

B. All underground utility installations, including culverts, shall be completed, backfilled and compacted prior to completion of subgrade.

C. Verify that traffic controls and erosion and sediment controls are in place.

3.02 PREPARATION

A. See Section 02100 and Section 02223.

B. Temporary erosion and sediment controls shall be installed prior to construction of subgrade. See Section 01564.

C. Temporary drains and ditches shall be constructed as necessary to remove water from the subgrade area.
   1. Temporary drainage openings in existing catch basins may be made in a manner acceptable to the Engineer. Such openings to be repaired to the satisfaction of the Engineer.
   2. Contractor shall prevent debris, stones and silt from entering drainage systems, including the use of hay bales, screens and other desilting methods.

D. Backfilled areas shall be retested at the discretion of the Engineer.

3.03 INSTALLATION

A. Construct the subgrade by cutting existing grades or by filling with clean offsite fill.
   1. The final subgrade surface shall be fine graded, rolled and compacted to form a smooth, even surface.

B. The subgrade in fill sections shall be placed in maximum 12-inch layers before compaction, and compacted before the next layer is spread.

C. The subgrade surface shall drain to the road edges, be free from holes, bumps, wheel ruts and of standing water, snow, frozen material and organic materials prior to the placement of the next course.
   1. Soft or otherwise unacceptable subgrade materials shall be removed and replaced with select onsite material acceptable to the Engineer.

2. Where no suitable onsite fill is available, granular materials shall be installed and compacted.

3.04 FIELD QUALITY CONTROL

A. For compaction requirements, refer to Section 02228, Table 1.

B. Tolerances - Refer to Section 02223.

C. Proof Rolled - Prior to the placement of the next granular layer or geotextile fabric, the subgrade surface shall be proof rolled to locate areas of inadequate compaction, deflection, or soft or rutting areas requiring undercutting, with 8 to 10-ton pneumatic tire compactors.
   1. Areas of inadequate compaction will be recompacted.
   2. If additional rolling does not correct an area of unstable conditions, the unstable area shall be removed and replaced with select onsite material and compacted.
   3. Where no suitable onsite material is available, granular materials shall be installed and compacted.
   4. Areas inaccessible to rollers are to be compacted by other mechanical methods.

3.05 PROTECTION

A. No vehicular traffic will be allowed on the newly-placed fabric until covered with the granular layer.

3.06 DUST CONTROL

A. Dust Control shall be accomplished by using water, brooming and cleaning methods.
   1. Dust control shall be carried out on a daily basis including weekends and holidays as needed based on the Engineer's direction.

END OF SECTION 02501

SECTION 02671

EXTRACTION WELLS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work included in this section: The Contractor shall provide all labor, materials, equipment, and incidentals as required by this specification to complete the work as described.

B. Groundwater extraction wells will be installed at the Site in locations shown on the drawings. The wells will be constructed using the appropriate equipment to advance the borehole to its completion depth and install well materials. The drilling equipment and well materials include: an appropriate drill rig to drill 10-inch boreholes, 8-inch steel outer casing through the shallow groundwater zone, 6-inch stainless steel well screen and riser, properly sized sand filter pack, bentonite, and cement/bentonite grout.

C. Related work specified in other section:
   1. Section 02673 - Well Pumping Equipment (not included in 60% submittal)
   2. Section xxxxx - Well Enclosure (not included in 60% submittal)

1.02 SUBMITTALS

A. Product Data: The product data for each component to be used in construction of the extraction well, including well screen, filter pack, cement and bentonite must be submitted by the Contractor. Product data must include manufacturer's name and the source of the material and be submitted prior to use in extraction well construction.

B. Installer: The name and address of the proposed well driller and a list of at least five completed projects of similar construction must be submitted by the Contractor.

1.03 REFERENCE STANDARDS

A. Title 6, New York Code of Rules and Regulations, Part 360 and Part 373.

PART 2 - PRODUCTS

2.01 OUTER CASING

A. The outer casing will be 10-inch ID, flush joint, welded, steel.

B. The outer casing shall be installed through the shallow groundwater zone to a depth of 20 feet below ground level.

C. The outer casing will be grouted in place. Well installation will not continue until the grout has set-up for a minimum period of 24 hours.

2.02 RISER AND SUMP

A. The well riser and sump pipe will be 6-inch ID, flush joint, threaded, schedule 5 304 stainless steel.

B. The well sump will be five-feet long.

C. The well riser will extend a minimum 1 foot and a maximum 2 feet above the ground surface.

2.03 WELL SCREEN

A. The well screen will be 6-inch ID, wire wound 304 stainless steel with flush threaded joints. The screen section will be a minimum of 10-feet in length with a slot size of 0.01 inches (10-slot).

2.04 SAND PACK

A. The primary sand pack surrounding the well screen will be a clean, inert, siliceous material with a grain size greater than 0.01 inches (Morie # 0 or equivalent).

2.05 BENTONITE SEAL

A. The seal will consist of 3/8-inch diameter sodium bentonite pellets. In unsaturated conditions, the bentonite pellets will be hydrated with potable water. The bentonite pellets will be allowed to hydrate a minimum of 30 minutes after installation.

2.06 GROUT MIXTURE

A. The grout mixture shall be a mixture of Type I, Portland Cement (one 94 lb. bag), minus No. 200 sieve bentonite powder (3 lbs.), and potable water (7 gallons) in appropriate quantity to fill the borehole.

PART 3 - EXECUTION

3.01 GROUNDWATER EXTRACTION WELL INSTALLATION

A. Installation of the groundwater extraction well shall be supervised by the Engineer/Supervising Geologist and recorded in a field log book.

B. Extraction wells shall be installed to specified depths using either hollow stem auger or air-rotary drilling techniques. Each extraction well will be drilled from the ground surface. The extraction wells will be screened at the elevations noted in the Drawings. All cuttings and drilling fluids will be disposed of in an area designated by the Engineer/Supervising Geologist. Drilling equipment shall be decontaminated prior to drilling, between boreholes, and before leaving the site.

C. Upon reaching the required depth, the groundwater extraction well will be constructed in the borehole. Each groundwater extraction well will be constructed with the appropriate length of slotted well screen. The borehole annulus around the outside of the screen will be backfilled with a properly sized clean, inert, silica sand that extends from six inches below the bottom of the screen to 2 feet, or 20 percent, of the length of the well screen (whichever is greater) above the top of the screen. The sand pack will be placed using methods that avoid bridging and ensure accurate placement of filter materials. A minimum three foot thick bentonite pellet seal will be placed above the sandpack, hydrated, if necessary, and allowed to swell a minimum of 30 minutes. After allowing the bentonite seal to swell, cement/bentonite ground will be installed above the bentonite seal to within three to five feet of ground surface. The grout will be placed ensuring that it is not diluted by formation water and that any water in the annular space is displaced.

3.02 ACCEPTANCE

A. If at any time during the installation of a groundwater extraction well the Engineer/Supervising Geologist determines that the groundwater extraction well has not been properly installed, the Driller shall abandon the hole and slurry grout its full depth as directed by the Engineer/Supervising Geologist and initiate construction of a new groundwater extraction well at a location determined by the Engineer/Supervising Geologist at no cost to the Owner.

B. Upon completion of a groundwater extraction well, the Driller shall demonstrate to the Engineer that the full depth of the groundwater extraction well is free from any obstructions and clear of any formation materials and that it will produce clean sediment-free water, or the groundwater extraction well shall be deemed unacceptable and shall be abandoned and re-drilled at no cost to the Owner.

3.03 DRILLING RECORDS

A. The Engineer/Supervising Geologist will record all drilling activities in a well log. The well log will contain the following information:
   1. A record of the soil materials penetrated and the depth to which they were encountered in accordance with 6 NYCRR 360-2.11(a)(10).
   2. A record showing the measurements of casing and screen used and the location of packers, plugs and seals.
   3. Static groundwater level and the levels at which water was encountered during drilling.

3.04 SURVEYING

A. Vertical and horizontal coordinates of newly installed groundwater extraction wells will be determined by a state licensed land surveyor. Each well shall be surveyed from the permanent measuring point scribed onto the well riser. Vertical measurements (elevations) will be measured to within +/-0.01 feet and horizontal measurements within 0.1 feet. Measurements will be tied into the horizontal and vertical control established for the site.

B. Surveying shall be provided by the Owner or Engineer.

3.05 DECONTAMINATION

A. The contractor will not use, reuse, or remove any equipment, materials, samples, or other goods at or from the site until it is certified to be uncontaminated. Decontamination will consist of washing and steam cleaning all equipment and materials that may be required as specified above or at the request of the Supervising Geologist. The drilling crew will undertake the decontamination of the given equipment or materials under the field Geologist's supervision. The Contractor shall comply with all request and procedures of the onsite Geologist regarding decontamination during the course of the work, close of the workday, and upon completion of the project. Anticipated requests and procedures for decontamination are outlined below.

B. General Decontamination Procedures and Requirements Surveying
   1. All drilling equipment shall be inspected for integrity of hydraulic and oil fluid handling systems and general overall cleanliness. Leaking hoses, tanks, hydraulic lines, etc., shall be replaced or repaired prior to beginning work.
   2. All well casing, screens, and other construction materials must be in new condition. Used materials shall not be permitted in well construction.

C. Initial Cleaning
   1. All drilling equipment and associated tools shall be steam cleaned upon arrival at the Site. Equipment will include at a minimum, but not be limited to:
      - drilling rods and bits;
      - augers (clips, pins, and associated hardware);
      - samplers (i.e. split spoon, hydropunch);
      - casing materials (both temporary and permanent);
      - wrenches;
      - hammers;
      - other hand tools and tool boxes;
      - hoses and tanks;
      - able clamps and other holding devices in direct contact with drilling rods; and
      - rill rig and undercarriage, wheel wells, chassis.
   2. During and following cleaning, equipment shall be handled only with clean gloves. A new set of gloves will be utilized between each location.
   3. Cleaned materials shall be protected from contamination by such means as the Supervising Geologist deems necessary.

D. Onsite Cleaning
   1. Following use, all equipment with the exception of the carrier truck and undercarriage, shall be steam-cleaned between borings.
   2. Down hole sampling equipment must be washed in laboratory grade detergent and water, and rinsed in clean, clean potable municipal water between consecutive samples and/or each boring, as appropriate.

3. If immiscible products are encountered during drilling, the drilling and sampling equipment must be cleaned in a manner consistent with the equipment decontamination procedures described in the Post-Remedial Construction Operations and Maintenance Plan for the Site.

END OF SECTION 02671

SECTION 02910

WETLAND RESTORATION

PART 1 - GENERAL

1.01 DESCRIPTION

The work specified herein includes the material, equipment and labor necessary to place topsoil, fertilizer, seed, and mulch within wetlands at the Western Drainage Area.

A. Work included in this section:

1. Soil preparation at all planted areas including placing, loosening, conditioning, and fertilizing the soil

2. Cleanup of all project areas.

3. Maintenance for 60 days.

B. Related work not included in this section:

1. Section 02222 - Excavation;

2. Section 02223 - Backfilling;

3. Section 02228 - Compaction; and

4. Section 02990 - Final Grading, Topsoil, and Seeding

1.02 SUBMITTALS

A. Topsoil source: The Contractor shall submit for approval by the Engineer a written statement giving location of soil source and test results for pH, organic content, PCB content, and sieve analysis.

B. Wetland Seed Vendors Certificate: The Contractor shall submit the seed vendor's certified statement for the wetland seed mixture required, stating common name, percentage by weight, and percentages of purity and germination rates for the grasses and sedges used for seeding.

C. Fertilizer: The Contractor shall submit for approval by the Engineer, the manufacturer's literature concerning chemical composition, chemical make-up,, application rates, and application procedures.

D. Hydroseeders: The Contractor shall submit for approval by the Engineer all data concerning hydroseeding equipment including all material application rates.

E. Erosion Control Fabrics: The Contractor shall submit for approval by the Engineer, the erosion control fabric manufacturer's literature, sample and specifications.

1.03 QUALITY ASSURANCE

A. Certificates. In addition to any other certificates specified, the Contractor shall furnish a certificate with each delivery of material, in containers or bulk, the analysis of the material, together with the date of delivery. All certificates shall be delivered to the Engineer, who will inspect the materials prior to its use.

B. Seeding. Seed shall be labeled in accordance with USDA Rules and Regulations under the Federal Seed Act and applicable State seed laws. Seed shall be furnished in sealed bags or containers bearing the date of the last germination which shall be within a period of six (6) months prior to commencement of planting operations. Seeding material shall be inspected upon arrival at the job site, and unacceptable material shall be removed from the job site. Seed shall be from same or previous year's crop; each variety of seed shall have a purity of not less then 85%, a percentage of germination not less than 90%, shall have a weed content of not more than 1% and contain no noxious weeds such as purple loosestrife or phrogmites.

PART 2 - PRODUCTS

2.01 SUBSTRATE SOIL

A. Substrate soil shall be friable, fertile soil of loamy character, containing an amount of organic matter normal to the region, capable of sustaining healthy plant life, and reasonably free from subsoil, roots, heavy or stiff clay, stones larger than 2" in greatest dimension, noxious weeds, sticks, brush, litter, and other deleterious matter. Substrate soil as delivered to the site or stockpiled shall meet the following requirements for topsoil as specified under Section 02990 Finish Grading, Topsoil, and Seeding.

B. Fertilizer. Fertilizer shall be a starter fertilizer of commercial stock, of neutral character, with elements derived from organic sources. It shall be a complete, prepared and packaged material and shall contain a minimum of 8% nitrogen, 20% phosphoric acid and 10% potash. Each bag of fertilizer shall bear the manufacturer's guaranteed statement of analysis.

2.02 WETLAND RESTORATION

A. Wetland Seed Mix

A suggested wetland seed mixture is as follows:

Common Name	Scientific Name	Weight	Percentage of Mixture
Rattlesnake grass	*Glyceria canadensis*	6 oz.	37.50
Sedge	*Carex crinita or C. comosa*	5 oz.	31.25

Rice cutgrass	*Leersia oryzoides*		3 oz.	18.75
Green bulrush	*Scirpus atrovirens*		1 oz.	6.25
Woolgrass	*Scirpus cyperinus*		1 oz.	6.25
		Total	16 oz (1lb)	100%

Suggested application rate of wetland seed mixture is 5 lbs/acre with an annual cover crop (e.g., winter rye or winter wheat at 25 to 30 lbs./acre).

B. Product and Manufacturer. An approved Central or Northern New York Sate, Vermont, New Hampshire, Michigan or Wisconsin nursery or equivalent.

C. If a variety of specified seed is not available at the time of seeding, substitutes will be approved by the Engineer. To obtain approval for substitutes, submit signed statements from three recognized seed vendors that the specified seed of the required species is not available.

2.03 EROSION CONTROL MULCH

A. Refer to Section 02990 - Finish Grading, Topsoil and Seeding for material requirements.

PART 3 - EXECUTION

3.01 GENERAL

A. Contractor shall coordinate all work with waste excavation, sediment removal, and cover system construction.

3.02 INSTALLING SUBSTRATE SOIL

A. Substrate Soil

1. Substrate soil shall be placed in receptive shoreline systems as shown on Drawings, to a depth sufficiently greater than required so that after natural settlement and light rolling, the complete work shall conform to the lines, grades and elevations indicated on the Drawings. No substrate soil shall be spread while frozen or muddy.

2. The substrate soil shall then be rolled or compacted with a cultipacker weighing not more than 100 pounds per foot of width. During the rolling, all depressions caused by settlement of rolling shall be filled with additional topsoil, and the surface shall be regraded and rolled until a smooth and even finished grade is created.

B. Fertilizer.

1. The fertilizer shall be applied with a mechanical spreader at a minimum rate of 200 lbs/acre or in accordance with the manufacturer's suggested rate.

2. After substrate soil has been spread and the fertilizer applied, it shall be carefully prepared by scarifying or harrowing to a depth of 2 inches and left in a roughened condition for seeding. All stiff clods, lumps, roots, litter and other foreign material shall be removed from the area and disposed of by the Contractor. The areas shall also be free of smaller stones, in excessive quantities, as determined by the Engineer.

C. Quality Control

1. The contractor shall provide the services of an Engineer and an independent soils testing laboratory to conduct quality assurance testing.

2. The following material property test methods and frequency shall be conducted for soil:

Material Property	Test Method	Frequency
Grain-size Analysis with Fines	ASTM D-422	2,000 cubic yards
Soil pH	ASTM D-4972	2,000 cubic yards
Organic Content	ASTM D-2974	2,000 cubic yards

3. Additional testing will be required if alternate sources are proposed or utilized.

3.03 INSTALLING ADDITIONAL SEEDING

A. Seeding

1. Moldy or damaged seed will not be accepted.

2. The seed mixture shall be applied uniformly upon the prepared surface with a hydroseeder at a minimum rate as specified immediately following the application of fertilizer.

3. If seed materials arrive before sufficient areas are prepared, provide temporary storage areas that are sheltered from wildlife, vandalism, theft, and adverse weather.

3.04 EROSION CONTROL FABRIC

A. Install erosion control fabric as needed as noted on the plans.

3.05 MAINTENANCE

A. The Contractor shall begin a maintenance period immediately after planting of landscape materials.

B. Seeding establishment period is for one year. If in the judgment of the Engineer coverage has not been met, the Contractor must reseed those areas lacking acceptable coverage. Upon reseeding, the seeded areas shall be reinspected after establishment.

3.06 WARRANTY

A. The warranty period shall be one year from the date of substantial completion or correction period as specified in General Conditions. Areas of erosion shall be immediately repaired, re-seeded, and maintained until an acceptable grass stand is established.

B. Failed plant materials exhibiting conditions that are determined by the Engineer as being unacceptable due to workmanship shall be replaced by the Contractor at no additional cost to the Owner or Engineer. Replacement plant materials must match the size of adjacent specimens of the same specimens of the same species.

END OF SECTION 02910

SECTION 02990

FINISH GRADING, TOPSOIL, AND SEEDING

PART 1 GENERAL

1.01 WORK SPECIFIED

A. The work specified herein includes the material, equipment, and labor necessary to provide finish grading and to place topsoil, fertilizer, seed, mulch, and erosion control fabric. The mulch and erosion control fabric shall be placed as follows:

1. Mulch - shall be utilized on all slopes.
2. Natural and synthetic erosion control fabrics - shall be utilized as indicated on the Drawings.

B. Related work specified in other sections:

1. Section 01500 - Temporary Facilities and Field Office
2. Section 01564 - Erosion Control
3. Section 02100 - Site Clearing
4. Section 02222 - Excavation
5. Section 02260 - Soil Cover Construction
6. Section 02269 - QA/QC for Soil Cover Soil Material
7. Section 02910 - Wetland Restoration

1.02 SUBMITTALS

A. Materials and Products: Submit for approval data.

1. Topsoil Source: The Contractor shall submit for approval by the Engineer, a written statement giving location of topsoil source. If soil amendments are proposed, submit amendment types, quantities, mixes and test results.
2. Grass Seed Vendors Certificate: The Contractor shall submit the seed vendor's certified statement for the grass seed mixture required, stating common name, percentage by weight, and percentages of purity, and germination.
3. Fertilizer: Submit manufacturer's product data showing contents and test results.
4. Hydroseeders: The Contractor shall submit for approval by the Engineer, all data concerning hydroseeding equipment (if used) including all material application rates.
5. Erosion Control Fabrics: The Contractor shall submit for approval by the Engineer, the erosion control fabric manufacturer's literature, samples and specifications.

B. Installer - Submit the name of subcontractors (if used) and Qualification Statements.

C. Manufacturer's Certification - Certify that products meet or exceed specified requirements.

1.03 QUALITY ASSURANCE

A. All plants shall conform to or surpass minimum quality standards as defined by the American Association of Nurserymen. All plant materials must be clearly labeled with genus, species, and

common name. These plants may be inspected for conditions of root ball, disease, insects, or injury. All rejected plant materials must be removed immediately from the job site and must be replaced by the Contractor at no cost to the Owner within 5 working days. The Engineer has the right to inspect and reject plant materials up to the final acceptance.

B. Certificates. In addition to any other certificates specified, the Contractor shall furnish a certificate with each delivery of material, in containers or bulk, the analysis of the material, together with the date of delivery. All certificates shall be delivered to the Engineer, who will inspect the materials prior to its use.

C. Seeding. Seed shall be labeled in accordance with USDA Rules and Regulations under the Federal Seed Act and applicable State seed laws. Seed shall be furnished in sealed bags or containers bearing the date of the last germination which shall be within a period of six (6) months prior to commencement of planting operations. Seeding material shall be inspected upon arrival at the job site, and unacceptable material shall be removed from the job site. Seed shall be from same or previous year's crop; each variety of seed shall have a purity of not less than 85%, a percentage of germination not less than 90%, shall have a weed content of not more than 1% and contain no noxious weeds.

PART 2 - PRODUCTS

2.01 TOPSOIL

A. Topsoil shall be natural, friable, fertile soil of loamy character, capable of sustaining healthy plant life, and reasonably free from subsoil, roots, heavy or stiff clay, stones larger than 2 inches in greatest dimension, noxious weeds, sticks, brush, litter, and other deleterious matter. Topsoil as delivered to the site or stockpiled shall meet the following requirements:
   1. shall be well graded with a maximum particle size of 2 inches, 85 to 100 percent passing 1 inch, 65 to 95 percent passing 1/4 inch, and 20 to 80 percent passing a Number 200 sieve. Clay content of material passing the Number 200 sieve shall not be greater than 30 percent, as determined by hydrometer analysis;
   2. pH between 6.0 and 7.5;
   3. shall contain not less than 3 percent organic matter nor more than 20 percent as determined by loss of ignition of moisture-free samples dried at 100° to 110° Celsius;
   4. free of pest larvae; and
   5. soluble salt content not greater than 500 ppm.

2.01(B). TOPSOIL AMENDMENTS

A. Natural topsoil materials may be amended or substituted completely with processed materials subject to the Engineer's review and approval. The materials may be processed sewage sludge of yard wastes, manures, mulches, or other like materials. If the Contractor decides to use the materials, he shall be responsible for testing these materials and obtaining the necessary permits, as required under Title 6 NYCRR Part 360 for processing or application of these materials.

B. Topsoil amendments or substitutes shall meet the following requirements as evidenced by laboratory analysis in conformance with Title 6 of the New York State Code of Rules and Regulations Part 360 Section 4.4:

Parameter	Maximum Concentration mg/kg., dry weight
Mercury (hg)	10
Cadmium (Cd)	25
Nickel (Ni)	200
Lead (Pb)	1000
Chromium (total (Cr)	1000
Copper (Cu)	1000
Zinc (Zn)	2500
PCBs (total)	1

C. The completed topsoil mixture or substitute layer shall be free from nuisance odors, unattractive to vectors, adequately mixed to ensure uniformity of nutrients and properties, and capable of sustaining vigorous growth of plant material. The material shall have no recognizable solid waste materials and a maximum particle size of 1 inch.

D. Guarantee

1. If it is the Contractor's decision to use topsoil amendments or substitutes and the material cannot support vigorous vegetation, it shall be removed and replaced with an equivalent volume of natural topsoil at the Contractor's expense.

2.02 FERTILIZER

A. Fertilizer shall be a starter fertilizer of commercial stock, of neutral character, with elements derived from organic sources. It shall be a complete, prepared and packaged material and shall contain a minimum of 18 percent nitrogen, 24 percent phosphoric acid, and 6 percent potash. Other fertilizer mixes may be acceptable provided the application rate is adjusted to provide equal quantities. Each bag of fertilizer shall bear the manufacturer's guaranteed statement of analysis.

1. Product and Manufacturers:
   a. Scotts Starter Fertilizer by Scott and Son
   b. or equal

2.04 GRASS SEED

The seed mixture will consist of the following proportions or approved equal.

Common Name	% By Weight
Red, Chewing, and Tall Fescue	40
Perennial Ryegrass	25
Annual Ryegrass	15
Climax Timothy	15
White Clover	05

Optimal Seed Mix

2.05 MULCH

A. Straw Mulch

Mulch shall be comprised of clean, threshed straw of oats, wheat, barley, or rye that is free from noxious weeds, mold or other objectionable material. The straw mulch shall contain at least 50 percent by weight of material to be 10 inches or longer. Straw shall be in an air-dry condition and suitable for placement with blower equipment.

B. Hydromulch

Hydromulch - Wood Cellulose Fiber Pulp.

a. Provide a specially prepared wood cellulose fiber, processed to contain no growth or germination inhibitor factors, and dyed an appropriate color to facilitate visual metering of application of the materials.
b. Hydromulch manufactured from recycled paper products will be acceptable.
c. Product and Manufacturer:
    1. Conwed Virgin Wood Fiber Mulch by Conwed, Inc.
    2. Silva Fiber by Weyerhaeuser Co.
    3. or equal

2.06 EROSION CONTROL FABRICS

A. Natural Erosion Control Fabrics: The natural erosion control fabric shall be a machine-produced mat of 100 percent biodegradable material.
    1. Straw matting
        a. The material shall contain straw at 0.5 pounds per square yard with netting on one side only.
        b. Product and Manufacturer:
            1. Erosion Mat S75 by North American Green
            2. or equal
    2. Wood Excelsior Blanket
        a. Provide a specially prepared machine produced mat of curled and barbed wood excelsior. 80 percent of the fibers shall be 6-inches or longer. Fibers shall be evenly distributed through the blanket and secured by a photodegradable plastic mesh. The fibers shall not contain growth or germination inhibitors.
        b. Product and Manufacturer:
            1. Curlex Blanket by American Excelsior Co.
            2. or equal
    3. Jute Mesh
        a. Provide a mesh blanket of coired coconut fiber twine.
        b. Product and Manufacturer:
            1. Bio D-Mat 90 by Rolanka International, Inc.
            2. or equal.

B. Synthetic Erosion Control Fabric

The synethic erosion fabric shall be an open 3-dimensional web of bonded PVC monofilaments with a minimum porosity of 85-90%, have a minimum unit weight of 18oz. Per square yard and a minimum thickness of 0.12 inches (Mirafi, Miramat 1800 or approved equal). The synthetic erosion control fabric must be approved by the Engineer.

C. The wire staples for securing erosion control fabrics shall be U-shaped and formed of 11-gauge plain iron wire with dimensions of 6-inch minimum length and 2-inch minimum width.

PART 3 - EXECUTION

3.01 APPLICATION PROCEDURES

A. All final grade surfaces shall receive six (6) inches minimum of compacted topsoil, seeding, mulch/or erosion control fabric, and fertilizer in accordance with this section.

B. All final grade surfaces outside the cover limits that have been disturbed or damaged during completion of the work shall be reseeded using a mixture of seed which shall produce similar vegetative growth as existed prior to commencement of the work.

C. The Contractor shall place mulch or erosion control fabric as follows:
   1. Mulch on all slopes less than or equal to 15 percent.
   2. Natural erosion control fabric on all disturbed or constructed slopes greater than 15 percent or as indicated on the Drawings, whichever is more stringent.

3.02. TOPSOIL

A. The Contractor shall place a minimum of six (6) inches of compacted topsoil over excavated areas, the landfill cover area, and the disturbed areas as directed by the Engineer.

B. The underlying soil shall be tilled to a depth of 2 inches by disking or harrowing before topsoil placement. Tillage shall be parallel to contours, and shall not be performed when the cover is frozen or excessively wet.

C. Topsoil shall be placed to a depth sufficiently greater than required so that after compaction, the complete work will conform to the lines, grades, and elevations indicated on the Drawings and the six (6) inch minimum requirement. No topsoil shall be spread in water or while frozen or muddy.

D. The topsoil shall then be rolled or compacted with a cultipacker weighing not more than 100 pounds per foot of width. During the rolling, all depressions caused by settlement of rolling shall be filled with additional topsoil, and the surface shall be regraded and rolled until a smooth and even finished grade is created.

E. Quality Control

1. The Contractor shall provide the services of an Engineer and an independent soils testing laboratory to conduct quality assurance testing.
2. The following material property test methods and frequency shall be conducted for soil:

Material Property	Test Method	Frequency
Grain-size Analysis with Fines	ASTM D-422	10,000 cubic yards
Soil pH	ASTM D-4972	10,000 cubic yards
Organic Content	ASTM D-2974	10,000 cubic yards

3. Additional testing will be required if alternate sources are proposed or utilized.

3.03. FERTILIZER

A. The fertilizer shall be applied with a mechanical spreader at a minimum rate of 200 lbs/acre or in accordance with the manufacturer's suggested rate.

B. After topsoil has been spread and the fertilizer applied, it shall be carefully prepared by scarifying or harrowing to a depth of 2 inches and left in a roughened condition for seeding. All stiff clods, lumps, roots, litter and other foreign material shall be removed from the area and disposed of by the Contractor.

3.04. SEEDING

A. The seed mixture shall be applied uniformly upon the prepared surface with a hand or mechanical spreader at a minimum rate of 100 lbs/acre. The seed shall be raked lightly into the surface and rolled. Seeding shall be conducted from April 1 to May 30 or from August 15 to October 1.

3.05. MULCH AND EROSION CONTROL FABRICS

A. Mulch or erosion control fabric shall be placed immediately after the application of fertilizer and seed.

B. Areas that have been seeded and have a slope less than or equal to 15 percent shall be protected from erosion by the placement of straw mulch or hydromulch. Straw mulch shall be applied with a mulch blower at a uniform rate of 1500 lbs/acre and anchored by use of a tackifier.

C. Natural erosion control fabrics shall be installed in lieu of the mulch in areas that have a slope greater than 15 percent or as indicated on the Drawings.

3.06. WATERING

A. Following applications of the mulch or erosion control fabric, the seed bed shall be moistened. A muddy soil condition will not be acceptable. Seeded areas shall be watered as often as required to

obtain germination and to obtain and maintain a satisfactory growth. Watering shall be done in such a manner to prevent washing out of seed.

B. The stand of grass resulting from the seeding shall not be considered satisfactory until accepted by the Owner. If areas are determined to be unacceptable, the remaining mulch or erosion control fabric will be removed and all areas shall be reseeded, refertilized and remulched and erosion control fabric replaced as per the above application procedures at the Contractor's expense.

3.07 MAINTENANCE

A. The Contractor shall begin a maintenance period immediately after planting of grass and landscape materials.

B. The Contractor shall maintain grass areas, for the periods required to establish an acceptable growth, but not less than 60 days, after seeding. If seeded in the fall and not given a full 60 days of maintenance, or if not considered acceptable by the Owner and the Engineer at that time, continue maintenance during following spring until acceptable grass stand is established.

C. Seeded areas shall be watered as often as required to obtain germination and to obtain and maintain a satisfactory sod growth. Watering shall be in such a manner as to prevent washing out of seed.

3.08 WARRANTY

A. The warranty period shall be one year from the date of substantial completion or correction period. Areas of erosion shall be immediately repaired, re-seeded, re-mulched and maintained until an acceptable grass stand is established. Areas to be repaired shall also include areas failing to produce a full, uniform strand of grass.

END OF SECTION 02990

SECTION 13290

PREFABRICATED GROUNDWATER TREATMENT SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

A. The item presented in this section is for treating deep groundwater to be pumped from two (2) recovery wells for a period of 25 years. The intent of the Owner is to have a system that has minimal operator attention requirement (on the order of 4 to 8 hours per week).

This treatment system will also be used for managing shallow groundwater generated during the remedial action. The following additional steps are needed to assure the treatment system would effectively manage shallow groundwater:

1. Bulk solids are removed in a temporary lined pond or equivalent water storage unit equipped with an oil skimmer or some equivalent means to remove any oil that may be floating on the water surface. Minimum hydraulic detention time (for sedimentation) will be 24 hours.
2. Inflows to the treatment process units are 10 gallons per minute or less.

B. Work Included in this Section:

1. This specification includes the furnishing, delivering, handling, and installing of a building, equipment and incidentals (as specified) to comprise a system capable of treating groundwater to the effluent discharge limitations specified in Part 2.01 of this specification.
2. The work under this specification consists of an integrated treatment system that is prefabricated, and can be set-up at the site with minimal fabrication. Include: building, labor, equipment, tools, materials, connecting piping and wiring; required to provide a complete and operational treatment system.
3. Figure XX is a process flow diagram that depicts the type of groundwater treatment system being designed for the treatment of deep (and shallow) groundwater at the York Oil site. The system is designed to remove: volatile organic compounds, iron, and semi-volatile organics. The bench-scale groundwater treatability work (Parsons ES, 1997c) completed in early 1997 provides much of the basis for the design information provided herein. A copy of the treatability study is available upon request from the Engineer.

1.02 SUBMITTALS

A. With bid, supply five (5) copies of each:

1. Provide plans, sections, details, and specifications for the supply of one prefabricated building that will house all equipment, incidentals, and supplies required to be supplied under this section. Complete information (materials, finishes, specifications) shall be provided for the following items: design loading, framing, exterior walls, interior walls, roofing, insulation, vapor barrier, electrical power supply and distribution, lighting, heating, ventilation, waterproof floor, doors, windows, and trim.
2. Provide plans, templates, and directions for the installation of foundations and anchorages required to support treatment system. Supply of the foundation will be by others.
3. Manufacturer's literature, illustrations, specifications, and engineering data including dimensions, materials, size, and weight of treatment system components and the operational (connected) package.
4. Fabrication, assembly and installation diagrams.
5. Complete dimensioned layout plans, sections and details of all equipment, piping, structures, and appurtenances furnished as part of the groundwater treatment system, including a complete list of materials and quantities.
6. Complete electrical and instrumentation drawings consisting of: one-line diagrams, electrical and instrumentation plans, piping and instrumentation diagrams (P&IDs), motor schematics, and control panel drawings. This shall be complete for the building (electrical power distribution, heating, ventilation, lighting) and the treatment system.
7. Specify voltage and current draw requirements for individual components, and for the total complete treatment system and building. If power with different voltage and phase from that specified in Part 2.02 of this specification, is required, it must be provided by the Bidder.
8. Detailed description of the treatment system operation (Sequence of Operation).
9. List of spare parts furnished.
10. Description and outline of operator training program to be provided by supplier to Owner.
11. Equipment and building warranty (see Part 1.04 of this specification).
12. Maintenance data and recommended maintenance schedule.
13. Sampling Plan for unit start-up (see Part 3.03 of this specification).

B. Following award of contract, supply five (5) copies of each:
1. Operations and maintenance manuals on the treatment system.
2. Complete and approvable building submittal complete with plans, and specifications that will be submitted to the local building inspector for approval. The submittal shall be prepared in accordance with all New York State and local Building Codes.

1.03 QUALITY ASSURANCE

A. Manufacturer's Qualifications: The manufacturer shall have experience in the production of substantially similar equipment, and shall show evidence of satisfactory operation in at least two installations for treatment of contaminated groundwater using the same or similar technology.

1.04 WARRANTY

A. All treatment system components and ancillary equipment supplied by the Bidder shall be guaranteed to be free from defective materials and workmanship (including installation) for a period of one year from the date of completion of start-up testing.

B. The building shell shall be provided with a warranty against failure of the exterior finish, and against perforation for a period of 20 years.

C. Building mechanical and electrical systems shall be provided with the manufacturer's standard warranty, but not less than 1 year, and shall not start until the date that start-up testing of the treatment system is completed by the bidder.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Shipping & Handling

All materials must be delivered to the York Oil Site in Moira, New York and placed into the final location by the Bidder. All system components delivered to the site shall be packaged to avoid damage to the equipment. Packaging shall be designed to allow for easy access for inspection and identification as well as provide protection of the materials and equipment from damage. All shipping and handling costs are to be included in the bid price.

B. Storage

Protect all materials from the weather and accidental damage during storage and staging until the system is installed and accepted. Keep materials free from dirt, grease, and other foreign matter during storage. Protect all exposed surfaces from corrosion. All expenses associated with storage of treatment system components/materials shall be included in the bid price.

1.06 SITE CONDITIONS

A. The following utilities will be available at the treatment building (provided by others): electrical power, influent pipeline, effluent discharge piping, and telephone service. Potable water nor natural gas will not be available at the site.

B. The prefabricated groundwater treatment system will be placed onto a concrete foundation that will be constructed in accordance with drawings supplied by the prefabricated groundwater treatment system supplier. The actual excavation and placement of concrete will not be performed by the supplier of the prefabricated treatment building.

C. The site is located in northern New York State.

1.07 GROUNDWATER CHARACTERISTICS

The major parameters of concern and their concentrations based on available data are presented in Table XX. The treatment plant is expected to operate continuously (24 hours per day, 7 days per week). New York State specified effluent limits are specified in Part 2.01 of this specification.

Groundwater samples are available to the Bidder for independent chemical analyses and/or treatability testing upon request. The bidder will be responsible for collection, transport, testing, and disposal of any samples collected.

PART 2 - PRODUCTS

2.01 SYSTEM PERFORMANCE

A. The treatment system shall be capable of treating groundwater generated from a pump and treat system. In addition, with sufficient pre-treatment will also be capable of treating water generated during construction. The characteristics of the groundwater are specified in Part 1.07 of this specification. The treatment system shall be capable of providing a treated effluent which can be discharged directly to a ditch which empties into Lawrence Brook in accordance with a SPDES discharge limits (to be provided).

B. The prefabricated building heating system shall be capable of maintaining indoor temperatures within the range of 60°F to 80°F during the heating months for any outdoor temperature. Air conditioning will not be provided. Ventilation shall be in accordance with New York State and Local code for an occupied building. Interior lighting shall provide 50 foot candles at 30 inches above the floor. A switch for all interior lights shall be located at each doorway. Exterior area lighting shall be provided on each of the four exterior walls . Exterior lighting will be controlled by a single on/off switch and by a single photo-electric eye.

2.02 POWER DISTRIBUTION

A. The Bidder will take power from a disconnect switch provided by others. Power supplied by the Owner will consist of 120/240 Volt. 200 amps of current is available. The amperage required by the Bidder must be specified in the Bidder's proposal. The Bidder will provide all necessary transformers, power distribution panels, motor starters, current overprotection devices, switches, etc. associated with the operation and control of the building and treatment system. Any exception to this section must be clearly stated in the bid.

B. All electrical equipment within the building shall be NEMA 12.

2.03 COMPONENTS

A. Groundwater Treatment System

Based on the required effluent discharge limits (see Part 2.01 of this specification), it is anticipated that the treatment system will require the following primary components:

- Influent Equalization;
- Pre-filtration;
- Air stripping;
- Granular activated carbon;
- Post Filtration;
- Effluent flow meter and composite sampler; and
- Granular activated carbon vapor phase treatment (optional).

Treatment systems which do not contain all of the above identified components will not be dismissed from consideration if the Owner determines that the system will still provide adequate treatment (as defined in this specification).

B. Pre-Fabricated Building

The building will be a metal prefabricated building complete with steel framing, structural steel floor system, exterior prefinished steel wall panels, and interior prefinished rigid water proof wall panels.

2.04 REQUIRED TREATMENT SYSTEM APPURTENANCES/INCIDENTAL EQUIPMENT

The groundwater treatment system shall include the following appurtenances/ incidental equipment:

A. **Influent Equalization.** The first unit process is equalization with air sparging. The equalization tank will dampen the hydraulic fluctuations inherent in groundwater recovery systems due to well pump cycling. In addition to providing hydraulic equalization, the tank will provide equalization of the groundwater constituent concentrations. The tank will be a closed-top vessel equipped with an air sparger to provide mixing and aeration. The air sparger will supply oxygen to oxidize iron and will also result in some stripping of volatile organics. A hydraulic retention time (HRT) of four hours will be provided to allow iron oxidation to occur. Ancillary facilities include an air compressor with a coarse bubble diffuser system and a recirculation pump with spray nozzle (coarse) system to control foam. Foaming observed during treatability testing could be controlled through the incorporation of a spray nozzle recirculation system. If this is ineffective, the use of anti-foaming agent may be required. In addition, an activated carbon canister will be provided for VOC removal from the process off-gas (if required). An antifoam reagent is expected to be required in the operation of the air stripping system. Addition of antifoam would occur in the equalization tank, and a metering pump should be provided for this purpose.

See the process description for off-gas treatment below. Process features include:

Influent Flow:	0 to 20 gpm based on the site groundwater flow analysis presented previously
Effluent Flow:	10 gpm based on groundwater flow modeling results presented previously. Provide duplex pumps that alternate operation.
Tank Size:	2,400 gallons
Tank Fittings:	Influent flow, forward flow pump suction line, recirculation pump suction line, bottom drain, air sparger and air vent inch).
HRT:	4 hours
Air Flow:	100 SCFM at 10 psi
Diffuser Type:	Coarse Bubble (rack mounted, serviceable by removing entire rack from tank)
Recirculation Flow:	5 gallons per minute

B. **Pre-Filtration** Pre-filtration will be provided to remove oxidized iron prior to the shallow tray air stripper. Pre-filtration will help prevent clogging and fouling of the air stripper trays. The filters will consist of bag filters that will be multi-plexed, in parallel, and sized to allow sufficient run-time between servicing. Assume four filters initially, but allow room for up to eight filters. Each filter will be equipped with an air release valve. There will be pressure gauges upstream and downstream of the bag filters. The bag filters will be changed based on the pressure differential measured across the filters as they become clogged. Pressure differential sensors

and control switches will also provide for emergency shutoff of the groundwater recovery system. There are no provisions for filter backwashing. Process features include:

Influent Flow:	10 gallons per minute
Operating Pressure:	0 to 75 psi
Solids Loading	20 mg/l of total suspended solids (2.5 pounds per day)

C. **Shallow Tray Air Stripper** The shallow tray air stripper is provided to air strip any remaining volatile organics. The process offgas from the air stripper will be passed through a granular activated carbon adsorber (if required). See the process description for off-gas treatment below. Provide duplex effluent pumps which alternate operation.

Air Stripper Process features include:

Influent Water Flow:	10 gallons per minute
Airflow:	150 SCFM (based on modeling results presented in Parsons ES, 1997b)
Effluent Flow:	Duplex pumps, 10 gallons per minute each.
Air to Liquid Ratio:	112 to 1
Number of Trays:	2

D. **Filtration** Filtration is provided to filter out any additional iron precipitant that is formed in the shallow tray air stripper, prior to the activated carbon adsorbers. Filtration will help prevent clogging and fouling of the activated carbon. The filters will consist of bag filters that will be multi-plexed in parallel and sized to allow sufficient run-time between servicing. Assume two filters initially, but allow room for up to four filters. Each filter will be equipped with an air release valve. There will be pressure gauges upstream and downstream of the bag filters. The bag filters will be changed when they are clogged. Pressure differential sensors and control switches will also provide for emergency shutoff capability of the groundwater recovery system. There are no provisions for filter backwashing. Process features include:

Influent Flow:	10 gallons per minute
Operating Pressure:	0 to 75 psi (maximum)
Solids Loading	Assumed to be less than 5 mg/l of total suspended solids (0.6 pounds per day)

E. **Granular Activated Carbon (GAC) Aqueous Phase Adsorption** Granular activated carbon aqueous phase adsorbers are provided to remove dissolved organic constituents, primarily VOCs (polishing), SVOCs, and any PCBs that may be present in the groundwater to be pumped. Each adsorber will be equipped with an

air release valve. There will be pressure gauges upstream and downstream of each adsorber. Three GAC cannisters will be employed in series operation. Piping connections and valving will be arranged to allow for intra-cannister sampling as well as the positioning of any cannister in the lead, mid, or lag treatment position. An empty bed contact time (EBCT) of 20 minutes has been specified based on the characteristics of the deep well pump test groundwater. If influent concentrations of PCB's increase during actual operation, a greater EBCT may be required based on our experience. If required, EBCT would be increased by the addition of modular GAC cannisters.

Process features include:

Influent Flow:	10 gallons per minute
Operating Pressure:	0 to 75 psi (maximum)
EBCT:	20 minutes
Canister Size:	High Pressure Filament Wound Cannister (22"-inch diameter by 48 inches high) with 200 pounds of GAC
Number of Canisters:	3 in series
Pressure Drop:	1.5 psi per canister maximum (clean water)

F. **Post-Filtration** Post filtration is provided to filter out any activated carbon fines that may carry over from the GAC adsorbers so that the GAC is not discharged to the drainage ditch. The post filter will consist of a single 25-micron bag filter. The filter will be equipped with an air release valve. There will be a pressure gauge upstream and downstream of the bag filter. The bag filters will be changed when it is clogged. There are no provisions for filter backwashing. Process features include:

Influent Flow:	10 gpm
Operating Pressure:	0 to 75 psi (maximum)
Solids Loading:	Negligible

Other ancillary features include:

G. **Effluent Flow Meter** The effluent flow will be monitored by an in-line magnetic flow meter with local display, and a totalizer to record the number of gallons of water discharged (used to pace the sampler).

H. **Effluent Sampler** The effluent flow will be sampled using an off-the-shelf flow - proportioned composite sampler. The sampler will be driven by the 4 to 20 mA output from the effluent flow meter by means of a 4 to 20 mA to pulse converter. The sampler will allow for fully programmed sample collection, and will have a refrigerated sample container compartment.

I. **Granular Activated Carbon Vapor Phase Adsorption** Separate vapor phase canisters of GAC can be provided, as needed, to meet air discharge requirements. One vapor phase canister would be for the equalization/aeration tank, and one for the air stripper offgas. Each canister will be used for VOC adsorption, as required. This item will be bid as an optional item.

Process features of vapor phase GAC system are as follows:

Aeration/Equalization Tank GAC Canister:

Influent Flow:	100 SCFM
Operating Pressure:	0 to 5 psi (maximum)
Canister Size:	Drum (24" diameter by 36" high) with 170 pounds of GAC
Number of Canisters:	1
Pressure Drop:	2 inches of water maximum (0.06 psi)

Air Stripper Off-Gas GAC Canister:

Influent Flow:	150 SCFM
Operating Pressure:	0 to 5 psi (maximum)
Canister Size:	Drum (24" diameter by 36" high) with 170 pounds of GAC
Number of Canisters:	1
Pressure Drop:	2 inches of water (maximum) (0.06 psi)

J. **Process Piping** Process piping in the building will be PVC SCH 80 solvent weld with full union couplers provided at all valves, pumps, equipment, instruments, etc. to allow for servicing. Provide valves where necessary at full union couplers to allow line breaks without leaking water onto the floor. High pressure air piping will be black iron pipe. Low pressure offgas vent piping will be PVC SCH 80.

K. **Process Pumps** Two sets of duplex centrifugal pumps will be used for forward flow. The pumps will be rated as needed to deliver the indicated flows and pressures. Pump construction will be compatible with low levels of organic contaminants and suspended solids. The pumps will be flooded suction and will be controlled by level controls in the pump wetwell. Diaphragm control valves to throttle the pump output will be provided on the discharge side of each centrifugal pump.

L. **Instrumentation** Instrumentation will be provided to indicate and control process operation both locally and from a remote terminal connected by telephone modem. Alarms will be indicated locally and will also activate a telephone auto-dialer. . The following instruments will be provided:

Aeration/Equalization Tank:

Level Controls:	Ultrasonic
Levels and Actions:	Low (turns off forward flow feed pump), High (turns on first forward flow feed pump), High-high (turns on second forward flow feed pump), High alarm (turns off all recovery wells and process equipment and autodials an alarm)
Alarm Reset:	Manually by operator
pH:	Display

Pre-Filtration:

Pressure Sensor:	High line pressure differential
Levels and Actions:	High Pressure differential (turns off all recovery wells and process equipment and autodials an alarm)
Alarm Reset:	Manually by operator

Shallow Tray Air Stripper:

Level Sensor:	Wet well sump will have an integral level sensor that actuates the forward flow pumps to the filtration process.
Levels and actions:	Low level (turns off forward flow pump), High (turns on first forward flow feed pump), High-high (turns on second forward flow feed pump), High alarm (turns off all recovery wells and process equipment and autodials an alarm)
Alarm Reset:	Automatically resets when alarm condition no longer exists
Pressure Sensor:	Low blower pressure
Levels and actions:	Low pressure (turns off all recovery wells and process equipment and autodials an alarm)
Alarm Reset:	Manually by operator
Temperature Sensors:	High air outlet temperature and low air inlet temperature
Levels and actions:	Low temperature, high temperature (turns off all recovery wells and process equipment and autodials an alarm)
Alarm Reset:	Manually by operator

Filtration:

Pressure Sensor:	High differential pressure
Levels and Actions:	High Differential Pressure (turns off all recovery wells and process equipment and autodials an alarm)

Alarm Reset:	Manually by operator

Post Filtration:

Pressure Sensor:	High Differential line pressure
Levels and Actions:	High Differential Pressure (turns off all recovery wells and process equipment and autodials an alarm)
Alarm Reset:	Manually by operator

Effluent Flow Meter:

Range:	0 to 20 gpm
Display:	Local flowrate (gpm), and totalizer (gallons)
Output:	4 to 20 ma

Building Environmental Monitors:

Temperature Sensor:	Low building temperature
Levels and Actions:	Low building temperature (turns off all recovery wells and process equipment and autodials an alarm)
Alarm Reset:	Manually by operator
Floor Sump Monitor:	Conductivity probe
Levels and Actions:	Water detected in the floor sump (turns off all recovery wells and process equipment and autodials an alarm)
Alarm Reset:	Manually by operator

M. **Control Panel and Remote Terminal:** A single control panel shall be provided to permit operation and control of the entire treatment system including all pumps, blowers, and instrumentation. A Programmable Logic Controller (PLC) shall be provided within the control panel to provide an indication of all process variables. Alarm conditions shall activate an automatic telephone dialer that is capable of telephoning up to four telephone numbers, and playing a prerecorded message. The PLC shall also be equipped with hardware/software that will enable remote access and control of the system via the same telephone line as the autodialer. The bidder shall supply a fully programmed remote terminal (PC) and printer that is capable of operating the system remotely via a telephone line connection

N **Winterization Package:** The treatment system shall be equipped with drains that will allow complete draining of the treatment system including all tanks, pipes, pumps, and appurtenances; to prevent freezing conditions from damaging the equipment.

O. **Access/Monitoring Structures:** All treatment system components/units shall be readily accessible for maintenance and monitoring through the incorporation of ladders, platforms, and/or catwalks. Access/monitoring structures shall be designed and constructed in accordance with all applicable OSHA requirements. Platform locations shall be indicated in the process submittal drawings (See Part 1.02 of this specification).

2.05 REQUIRED PREFABRICATED BUILDING EQUIPMENT

A. **Unit Heaters** Electrical unit heaters to maintain temperatures in all areas of building. Each unit heater should have its own variable thermostat.

B. **Exhaust Fans** Roof mounted exhaust fans and wall mounted electrical actuated inlet louvers to provide four air changes per hour. Equipment shall be controlled by an on/off/auto switch, with the automatic position controlled by a variable thermostat installed inside the building.

C. **Doors** Lockable man-doors with hydraulic closers. Door location and number is to be per code. Doors to be insulated steel doors with a single double glazed lite.

D. **Overhead Doors** Overhead door(s) sufficient to allow removal and replacement of all proposed equipment. Doors shall be manually operated, and will be insulated steel.

E. **Windows** Windows per codes. Windows to be double glazed, sealed, high performance windows.

F. **Desk** Desk sufficiently removed from areas of the building where water is handled so as to prevent water damage to the desk and its contents.

G. **Interior Lighting** Interior fluorescent lighting.

H. **Exterior Lighting** Exterior mercury vapor lighting.

I. **Grounding, Bonding, and Lightning Protection** Provide building grounding, bonding, and lightning protection systems.

J. **Building Floor and Sump** Building floor system shall be treated with a compatible epoxy coating system to prevent corrosion. The floor shall slope to a centrally located sump that is integral with the building. The sump shall be equipped with a sump pump that automatically pumps accumulated water into the influent tank. The sump pump shall be controlled by a hand/off/auto switch.

K. **Eye Wash and Emergency Shower** The building shall be equipped with a potable water storage tank and pump system that serves a safety shower and eyewash. The safety shower and eyewash shall be fully compliant with OSHA requirements.

L. **Electrical Area or Room** A separate area or room that houses the following electrical equipment including motor control center, starters, and panelboards.

PART 3 - EXECUTION

3.01 INSTALLATION/ERECTION

A. The prefabricated building and groundwater treatment system shall be installed/erected by the Bidder. The bid cost shall include all expenses (including material and equipment) associated with system installation. Building shall be appropriately anchored to the concrete foundation provided by others.

3.02 UTILITIES CONNECTIONS

A. Telephone and electricity service shall be supplied by the Owner. The Bidder will be responsible for connection to these services to render the complete building and treatment system operational.

B. The Bidder shall provide all required interior electrical wiring, interior process plumbing (including connection to discharge pipe), and incidental equipment as established in this specification.

C. Compressed air systems (as required for air sparger, air stripper, air-diaphragm pumps, etc.) shall be supplied by Bidder and included in the bid cost.

3.03 START-UP AND DEMONSTRATION

A. Following installation, the groundwater treatment system shall be tested at the design operating flow (10 gpm) to ensure proper operation. Testing shall be conducted for one week (168 continuous hours) utilizing groundwater extracted from the site. The system shall not be approved until it has been proven that the treatment system can meet the required treatment objectives. If the treatment system has to be shut down during the testing period to perform repairs or significant modifications, the 7 day test period shall be re-initiated.

Sampling shall be conducted during start-up period, for parameters specified in Part 2.01 of this specification). In addition, sampling shall include appropriate characterization of influent and in-process sampling locations to verify effectiveness of all unit operations. Analysis shall be conducted in accordance with the discharge

limits and the New York State Department of Environmental Conservation (NYSDEC) per 40 CFR 136, as amended. Analytical costs shall be included in the bid price.

B. All mechanical and electrical building systems shall be tested and verified to be operational.

3.04 TRAINING

After the equipment has been installed, tested, adjusted, and placed in satisfactory operating condition, the Bidder shall instruct the operating personnel (up to three individuals) in the use and maintenance of all equipment including the PLC and the remote terminal. The Bidder shall give the Owner formal written notice of the proposed instruction period at least one week prior to the commencement of the instruction period. The Bidder shall provide one week (5 working days) instruction by a competent factory representative. An appropriate allowance for this instruction shall be included by the Bidder in the price of the treatment system.

END OF SECTION 13290

ATTACHMENT A DISCHARGE LIMITS

(CURRENTLY UNDER DISCUSSION WITH THE FEDERAL AND STATE GOVERNMENT)

FIGURE XX PROCESS FLOW DIAGRAM

(SAME AS FIGURE 3.4 IN THE INTERMEDIATE (60%) DESIGN REPORT)

TABLE XX GROUNDWATER CHARACTERISTICS

(SAME AS TABLE 3.1 IN THE INTERMEDIATE (60%) DESIGN REPORT)