RESPONSE TO COMMENTS FROM NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION FOR VANADIUM CORPORATION OF AMERICA SITE NO. 932001, OU NO. 2 AIRCO PROPERTIES INTERIM REMEDIAL MEASURE REPORT, WITMER ROAD LANDFILL, NIAGARA FALLS, NEW YORK

COMMENTOR: Michael Hinton **DATED: 12 January 2001**

As-Built Drawings

1. All final As-Built Drawings must have the stamp and signature of a New York State licensed and registered Professional Engineer or Land Surveyor as appropriate.

   Response—Comment noted. It is understood that the final drawings and report must be stamped. The drawings and report submitted for review were noted as "Draft," and were, therefore, not signed and sealed by a New York State licensed and registered professional engineer.

2. A final site plan clearly showing the final site conditions, e.g. access road location, contours, monitoring wells etc, must be provided. Drawing C-5 appears to have the necessary information but is difficult to read due to the spot elevations provided to document final topsoil elevation.

   Response—Comment noted. As per our phone conversation, a subsequent drawing, Sheet C-5a will be added to the As-Built drawing set, which details the final conditions with more clarity. To achieve this, drawing C-5 will be used. Some of the layers that are required for depicting compliance with the closure plan (topsoil thickness) will be turned off prior to printing the drawing. This will enable the reader to see the access roads, monitoring wells, and other site details with more clarity.

3. ***Drawing C-5***—Cap Termination Detail "A" is on drawing C-8.

   Response—Comment noted. The drawing reference has been changed accordingly.

4. ***Drawing C-8***—Cap Termination Detail "A & B", must indicate geo-textile under stone perimeter road. Cap Termination "B", must add notes for topsoil layer on right side of detail and correct arrow for common fill.

   Response—Comment noted. The geotextile fabric has been added. The common borrow fill notation and topsoil notations have been modified as requested.

5. ***Drawing C-9***—Perimeter Access Road Culverts plan and elevation drawings do not reflect as-built construction. New Monitoring well detail concrete collar is actually sloped away from the casing and is covered by fill and topsoil. The arrows for the drain hole and hydrated bentonite chips are not correct. Correct spelling for Well Marker. Also, well markers were not in place as of the last inspection.

Response—Comment noted. The perimeter access road culvert detail will be changed to reflect stone backfill, not common borrow fill. The monitoring well detail will be modified as noted. Well markers were not installed until the 11-13 December 2000 sampling event.

Interim Remedial Measure Report

6. Final report must have the stamp and signature of a New York State licensed and registered Professional Engineer.

   Response—Refer to response to Comment No. 1.

7. ***Section 2.3.1, Requested Variances to Final Cover System***—Last bullet, why include the clay reference here?

   Response—Comment noted. The reference to clay in the last bullet will be removed from this section. The following paragraph will be added to a new section, Section 2.3.2.6, outlining the use of impermeable clay within the closure design:

   > *Impermeable clay with a minimum permeability of 1×10^{-7} cm/sec was used in areas outside the limits of the LLDPE cap and within the Airco parcel. This design element was incorporated to allow for "tie-in" into the cap system from abutting properties.*

8. ***Section 3, Engineering Certification***—Please provide reference to the various Appendices in the text. An additional section must be included that discusses the perimeter fence.

   Response—Comment noted. Within the opening paragraph under Section 3, the following text has been added outlining the various appendixes available for review on CD-ROM:

   > *Construction-related quality assurance/quality control and photographic documentation are provided electronically on a CD-ROM in Appendix B. The electronic field construction data include borrow source quality assurance/quality control documentation for the bedding, barrier, clay, and topsoil sources. Appendix B also contains the geosynthetic material, quality assurance/quality control documentation, monitoring well construction diagrams, air quality monitoring data, and the resident engineer's field notes and daily quality control reports.*

   Section 3.1.12, Perimeter fence, has been added to describe the installation of the fence as follows:

   > *A perimeter site security fence was installed to prevent unauthorized access to the site. The fence was installed with a 1-ft offset from the property line. Approximately 4,510 linear ft of fence, and one 30-ft double swing fence gate, were installed. The fence was installed in accordance with the approved plans and specifications. Some issues were raised during installation with regards to the height of the fence fabric in relationship to the ground surface. These issues were resolved during the engineering inspection performed in December 2000.*

9. ***Section 3.1.2, Bedding Layer***—Add discussion on source of material and estimate of quantity used.

   Response—Comment noted. The following text has been added to Section 3.1.2:

   The bedding material was supplied from the Bewley pit in Lockport, New York. In total, approximately 20,000 yd^3 of bedding sand was imported for use as the 6-in. bedding layer.

10. ***Section 3.1.8.5, Southwestern Airco Drainage Swale Grade Changes***—Phreatic is spelled wrong.

    Response—Comment noted, the text has been revised accordingly.

11. ***Section 3.1.8.6, Southwestern Relief Pipe***—Add statement regarding permanent plugging of relief pipe in the future.

    Response—Comment noted. The following text has been added:

    The relief pipe will remain operational until the pressure under the cap has equilibrated. At that time, the relief pipe will be abandoned in accordance with Section 3.11 of the Post-Closure Monitoring and Facility Maintenance Plan.

12. ***Section 4.1.1, Up-Wind Monitoring***—The demolition activity referenced here took place at the nearby Stollberg facility not the adjacent SKW property.

    Response—Comment noted. The following text was changed to reflect demolition that occurred on the Stollberg property, not the SKW parcel:

    However, one instance was noted where the upwind monitoring indicated high background concentrations due to the demolition of a building on the Stollberg property, which abuts the SKW parcel to the west.

13. ***Section 5.1.1, Changes to the Approved Plan***—Add closure procedures for the relief pipe.

    Response—Comment noted. No change to the text in Section 5.1.1 is necessary, however, Section 3.11 Relief Pipe Abandonment Procedures has been added to the Post-Closure Monitoring and Facility Maintenance Plan. This section describes abandonment of the relief pipe by filling the pipe with a concrete and bentonite slurry as follows:

    The relief pipe was installed to allow positive drainage of pore water pressure from under the cap. The discharge from the relief pipe is a temporary condition that should subside after closure, since precipitation is prevented from entering the waste via the cap system. After equilibrium has been achieved, the relief pipe will be filled with a concrete and bentonite mixture to effectively seal the conduit and prevent water from backflowing under the cap.

14. ***Figures 4 and 5***—Indicate geo-textile fabric under perimeter access road, add notes for topsoil layers and correct arrow for the common fill. Show distance from fence to edge of clay in Figure 5.

Response—Comment noted. The geotextile fabric has been denoted on both figures. The distance to clay, common borrow notation, and topsoil notations has been modified as requested.

15. ***Figure 6***—Label topsoil layer on left side of detail and correct relief pipe not by adding "Figure 8" to See relief pipe detail.

Response—Comment noted. The topsoil has been labeled, and the notation includes "Figure 8" when referring readers to the additional detail sheet.

16. ***Figure 7***— Indicate approximate distance from the fence line to the relief pipe and remove "proposed" from note showing pipe location.

Response—Comment noted. Proposed has been removed from the title, and the distance to the fence (approximately 10 ft) has been added.

Appendix A – Post Closure Monitoring and Facility Maintenance Plan

17. ***Section 3.2, Ground-water Gauging***—Depth of wells to be measured at each sampling event and compared to installed depth. When sediment depth covers 10% of the well screen that the well must be redeveloped to remove the collected sediment.

Response—Comment noted. The following text has been added as requested to Section 3.2:

During each gauging event, the depth to the bottom of the well will be determined, and compared to the original depth determined from well installation. If sediment is observed in the well casing, the sediment will be removed via well development when the depth of sediment is greater than 10 percent of the well screen.

18. ***Section 3.10, Location Survey***—Monitoring well reference point elevations must be re-surveyed every 5 years.

Response—Under Part 360-2.11(a)(8)(iv), entitled Survey, no repetitive surveying of monitoring wells is required. Therefore, mandatory re-surveying of monitoring wells every 5 years will not be performed. However, if during monitoring sampling events or engineering inspections, a monitoring well is determined to be suspect (i.e., differential settlement, significant concrete cracking, significant variations in water level readings), a supplemental survey would be conducted for the suspect well to determine if changes to the elevation of the casing have occurred. Text has been added to Section 3.10 as follows:

A supplemental survey will be performed if, during monitoring sampling events or engineering inspections, a monitoring well is determined to be suspect (i.e., differential settlement, significant concrete cracking, and significant variations in water level readings).

Interim Remedial Measure Report Documenting Closure of the Witmer Road Landfill Niagara Falls, New York

Prepared for

The BOC Group
100 Mountain Avenue
Murray Hill, New Jersey 07974

Prepared by

EA Engineering, P.C. and Its Affiliate
EA Engineering, Science, and Technology
3 Washington Center
Newburgh, New York 12550
(845) 565-8100

Revision: FINAL
January 2001
Project No. 12040.68

Interim Remedial Measure Report
Documenting Closure of the
Witmer Road Landfill
Niagara Falls, New York

Prepared for

The BOC Group
100 Mountain Avenue
Murray Hill, New Jersey 07974

Prepared by

EA Engineering, P.C. and Its Affiliate
EA Engineering, Science, and Technology
3 Washington Center
Newburgh, New York 12550

1/31/01

David S. Santoro, P.E., L.S. — Date
President, EA Engineering, P.C.

1/31/01

Charles E. McLeod, Jr., P.E. — Date
Project Manager/Resident Engineer
EA Engineering, Science, and Technology

Revision: FINAL
January 2001
Project No. 12040.68

INTERIM REMEDIAL MEASURE REPORT
WITMER ROAD LANDFILL SITE CLOSURE
NIAGARA FALLS, NEW YORK

ENGINEERING CERTIFICATION STATEMENT

I hereby certify[1] under penalty of law as a Professional Engineer licensed in the State of New York that this document and all attachments were prepared by EA Engineering, P.C. and its affiliate, EA Engineering, Science, and Technology under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who managed the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

The purpose of this document, the Interim Remedial Measures Report, is to present documentation that the combined interim remedial measure for the Witmer Road Landfill Site (NYSDEC Site No. 9-32-001) was completed in general conformance with the New York State Department of Environmental Conservation (NYSDEC) Order on Consent (Index No. B9-0470-94-12), and the NYSDEC-approved closure plan for the Witmer Road Landfill (EA, April 2000). The EA resident engineer was present daily during each construction phase, and documented the observations and data that are presented in this Interim Remedial Measure Report.

STATE OF NEW YORK
DAVID S. SANTORO
No. 59302
LICENSED PROFESSIONAL ENGINEER

David S. Santoro, P.E., L.S.
New York State Professional Engineer
No. 059302

EA Engineering P.C. and Its Affiliate
EA Engineering, Science, and Technology
3 Washington Center
Newburgh, New York 12550

1. Certification/Certify means to state or declare a professional opinion of conditions whose true properties cannot be known at the time such certification is made, despite appropriate professional evaluation. The professional opinion made is based on limited observations and widely spaced tests. This certification of conditions in no way relieves any other party from meeting requirements imposed by contract or other means, nor does it warranty/guarantee the conditions of the constructed product.

CONTENTS

Page

LIST OF FIGURES

1. INTRODUCTION

1.1 STATEMENT OF PURPOSE

EA Engineering, P.C., and its affiliate EA Engineering, Science, and Technology, were retained by The BOC Group (BOC) to implement the approved Closure Plan for the Witmer Road Landfill parcel in Niagara Falls, New York (Figure 1). The Witmer Road Landfill is part of the Vanadium Corporation of America (Vanadium) site, which was placed on the New York State Department of Environmental Conservation (NYSDEC) Registry of Inactive Hazardous Waste Disposal sites. The Vanadium site includes three separate landfilling areas, and three different Potentially Responsible Party groups have been identified by NYSDEC. The three separate landfilled areas are aligned in a roughly west to east fashion (Figure 2), and are commonly known (from west to east) as SKW Metals and Alloys, Inc.; the Airco property; and the New York Power Authority ([NYPA], formerly Power Authority of the State of New York), and Niagara Mohawk Power Corporation (NMPC). The closure of the Airco property was performed under Order on Consent No. B9-0470-94-12 as an Interim Remedial Measure (IRM). This IRM report addresses only the Airco property, hereafter referred to as the Airco parcel, or Witmer Road Landfill.

1.2 ORGANIZATION

Section 1 outlines the purpose of this IRM Report. Section 2 includes a discussion of the site setting, site history, and site closure design. Section 3 presents a discussion of the landfill cap as-built features, and identifies variances to the original design, which were requested and approved by NYSDEC during construction, including the final engineering report as required by the Order on Consent, which outlines compliance with NYSDEC approved detailed documents and specifications. Results of the continuous air monitoring program are detailed in Section 4. The post-closure monitoring and facility maintenance activities are presented in Section 5. Appendix A contains the Revised Final Post-Closure Monitoring and Facility Maintenance Plan; Appendix B presents data generated during construction in an electronic CD-ROM format. This electronic format was chosen for the complete dataset due to the relatively large quantity of quality assurance/quality control data generated during construction-related activities. The as-built design drawing set is provided under separate cover.

2. SITE INFORMATION

2.1 SITE SETTING

The Vanadium site in Niagara Falls, New York is currently listed as a Class 2 site in the New York State Registry of Inactive Hazardous Waste Sites (Site No. 932001). This classification indicates a significant threat to public health or the environment, and requires remedial action. The site consists of three separate properties, as shown on Figure 2:

1. 25-acre parcel (Witmer Road Landfill) owned by Airco, Inc. (known as BOC Group after 1994)

2. 37-acre parcel owned by SKW Metals and Alloys, Inc. (SKW)

3. 53-acre parcel owned by NMPC/NYPA.

The Airco parcel is the middle of three parcels that comprise the Vanadium site, and direct access to a public road did not exist, therefore, site access agreements and/or easements with NMPC were obtained prior to construction activities to allow construction of a 24-ft wide gravel access road. The design included construction of the access road from Witmer Road, northwest of the Airco parcel on NMPC property. In addition, it was necessary to obtain a construction easement to allow access along the eastern, southern, and northern property boundaries for execution of construction-related activities.

2.2 SITE HISTORY

The Airco parcel was owned and used by the Vanadium Corporation of America from 1920 to 1964 for disposal of the following materials: stainless steel (lime) slag, ferromanganese slag, ferrochrome silicon slag and dust, and ferrosilicon dust. It is estimated that during the 44 years of operation by Vanadium, 600,000 tons of slag and dust and 90,000 tons of wood, brick, and ash refuse were dumped throughout the Airco parcel and adjacent SKW and NMPC/NYPA subsites.

In 1964, the subsite was sold to Airco Inc., and operated by the Airco Alloys Division. At the time of purchase, the majority of slags onsite were sold to an independent contractor and removed from the parcel. Wastes similar to the Vanadium wastes were generated and disposed onsite from 1964 to 1971. In 1971, the disposal of slurried baghouse dusts was also initiated at the parcel.

Reportedly, between 1971 and 1979, up to 5,600 tons per year of slurried ferrochromium silicon dust and an unknown quantity of other slags and dusts were deposited on the Airco parcel and adjacent SKW subsite. From 1976 to 1979, an additional 8,000 tons per year of slurried ferrosilicon dusts were also disposed on two subsites. From 1979 to 1981, no wastes were disposed on the Airco parcel.

From 1981 to 1988, the parcel was operated as an NYSDEC-permitted landfill by the Airco Carbon Division of Airco, Inc. During this period, inert firebricks, concrete blocks, coke, and graphite wastes were deposited on the parcel in an effort to obtain a final grade for capping and closure. By 1988, 4 acres in the southern portion of the parcel had been capped through this approach.

In August 1988, Airco, Inc. sold its Niagara Falls production facilities, but not the landfill, to the Carbide/Graphite Group. From 1988 to 1990, no wastes from the Carbide/Graphite Group production facilities were deposited at the parcel, and the landfill permit lapsed. Attempts by Carbide/Graphite Group in 1990 to renew the landfill permit were unsuccessful and, therefore, no waste disposal has occurred at the parcel since 1988. The parcel is currently owned by The BOC Group. In 1994, Airco changed its name to The BOC Group to match the parent company. Prior to closure, approximately 670,000 yd^3 of waste occupied the Witmer Road Landfill.

2.3 LANDFILL CAP DESIGN

This subsection discusses the design features of the landfill closure, which were prepared to meet the requirements set forth in 6 NYCRR Part 360, Subpart 2.15(d), Final Cover System. The regulations require the following capping components:

- Gas venting layer (12-in. minimum)
- Low permeability layer (18-in. 1×10^{-7} cm/sec clay layer or a 40-mil geomembrane)
- Barrier protection layer (24-in. minimum)
- Topsoil (6-in. minimum).

2.3.1 Requested Variances to Final Cover System

Two variances to the capping components listed above were requested and approved by NYSDEC, and incorporated into the Closure Plan. The first variance requested included elimination of the 12-in. gas vent layer and installation of a 6-in. bedding layer. Based upon the results of the soil gas monitoring performed during previous soil boring installations (EA 2000[1]), EA removed the gas vent layer from the design due to the absence of landfill gases. The installation of the 6-in. bedding layer was to meet the standard of care within the industry for protection of the linear low density polyethylene (LLDPE) geomembrane. The second variance involved reducing the 24-in. barrier protection layer to a 12-in. layer and adding a geocomposite drainage layer. Therefore, the proposed final capping components are as follows:

- Bedding layer (6-in.)
- 40-mil LLDPE
- Drainage layer (geocomposite drainage net)
- Barrier protection layer (12-in.)
- Topsoil (6-in.).

1. EA Engineering, Science, and Technology. 2000. Summary Report, Pre-Design Investigation Performed from 6 to 15 December 1999, Witmer Road Landfill, Niagara Falls, New York. 15 February.

Subparts 360-2.15(d)(1) and (d)(2), and Subparts 360-2.15(e) through (h) did not apply because variances have been requested for the gas venting layer and barrier protection layer.

2.3.2 Landfill Cap Components

2.3.2.1 Bedding Layer

Due to the inorganic nature of the waste at this site, a gas venting layer was not required beneath the LLDPE membrane. The waste is primarily slag and dust from the Vanadium and Airco operations. Inert fire bricks, concrete blocks, coke, and graphite wastes were also landfilled at the site. Since none of these wastes produce organic gases due to degradation, a variance was granted to eliminate the 12-in. gas venting layer but to include a 6-in. bedding layer to protect the LLDPE membrane.

2.3.2.2 Linear Low Density Polyethylene Liner

An economic analysis was performed on four low permeability layer alternatives that met 6 NYCRR Part 360 requirements, and one that was a variance to the Part 360 requirements. An LLDPE geomembrane was selected as the low permeability layer based on cost effectiveness and compliance with 6 NYCRR Part 360.

The use of a 40-mil LLDPE geomembrane as the low permeability layer met the requirements of Subpart 360-2.15(d)(3), and is the current industry standard for closure caps. Installation of a membrane liner eliminated approximately 60,000 yd^3 of clay that would have be required to meet the Part 360 regulations, and reduced the required construction time by approximately 60 working days. The time savings in utilizing the LLDPE membrane allowed for completion of the cap system within one construction season.

2.3.2.3 Drainage Layer

The drainage layer consists of a high density polyethylene (HDPE) drainage net-geotextile geocomposite. A drainage net is manufactured by extruding two sets of strands to form a 3-dimensional structure to provide planar water flow. By design, these nets carry large amounts of liquid within their structure and are often called sheet drains. Geotextile filter fabric is heat bonded to both sides of the HDPE drainage net to inhibit soil intrusion into the drainage net. The material purchase, transportation, and installation costs of geocomposites are considerably less than for an equivalent sand or gravel drainage system.

2.3.2.4 Barrier Protection Layer

The barrier protection layer normally consists of a 24-in. layer of 1 in. minus well-graded fill. EA was granted a variance to allow installation of a 12-in. barrier protection layer for the following reasons:

- Significant reduction in the amount of material that must be hauled onsite, in turn reducing the use of local natural resources, disruptive truck traffic on the local roads and businesses, and potential dust problems caused by placing the fill

- Significant acceleration of the cap closure schedule that will more quickly reduce potential environmental impacts from the uncapped waste site

- Reduction in total cost of the final cover system without compromising cap integrity.

The 12-in. barrier protection layer, in lieu of the 24-in. barrier protection layer required under Subpart 360-2.15(d)(4), will provide suitable cover to protect the geocomposite drainage layer and 40-mil very flexible polyethylene geomembrane from surface loading and allow for a stable condition on the final slopes, including an adequate zone for supporting the vegetative layer. It will be sufficient to protect the geomembrane from root penetration without adversely impacting the efficiency of the final cover system.

2.3.2.5 Topsoil Layer

The required 6-in. topsoil layer is included in the landfill cap design. No deviations from 6 NYCRR Part 360 were proposed for this layer. The topsoil was to be free of deleterious material and with a sufficient organic content to support vegetative growth.

2.3.2.6 Impermeable Clay Layer

Impermeable clay with a minimum permeability of 1×10^{-7} cm/sec was used in areas outside the limits of the LLDPE cap and within the Airco parcel. This design element was incorporated to allow for "tie-in" into the cap system from abutting properties.

3. ENGINEERING CERTIFICATION

This section discusses the activities surrounding the implementation of the IRM program. Each design component is briefly discussed to outline compliance with the approved plans and specifications. Approved changes incorporated during construction are provided in detail. Construction-related quality assurance/quality control and photographic documentation are provided electronically on a CD-ROM in Appendix B. The electronic field construction data include borrow source quality assurance/quality control documentation for the bedding, barrier, clay, and topsoil sources. Appendix B also contains the geosynthetic material quality assurance/quality control documentation, monitoring well construction diagrams, air quality monitoring data, and the resident engineer's field notes and daily quality control reports.

3.1 AS-BUILT LANDFILL CAP COMPONENTS

3.1.1 Waste Relocation

Waste relocation involved excavation of waste materials from the NMPC parcel to the east to eliminate the pathway for surface water and sediment to be transported onto the Airco parcel. Approximately 17,000 yd^3 of waste material was removed from the eastern property line and placed within the limits of the cap on the Airco parcel. Waste relocation also included an estimated 63,000 yd^3 of waste from stockpiles located on the Airco parcel, and from construction of the perimeter drainage swales. No unusual waste materials were discovered during waste relocation. Two large cast iron caldrons were unearthed during site grading. The caldrons were relocated to a portion of the site where large fills were required to make grade, and buried.

Minor changes to the limits of waste occurred during waste relocation. One area in the southwestern corner of the site waste relocation was determined to be impractical due to the proximity of the wetlands, and the depth to the waste. Therefore, in this area, the LLDPE liner was extended beyond the proposed limits of waste depicted in the contract drawings. The LLDPE liner was keyed into native clay and/or imported clay as appropriate to meet the requirements. No other occurrences of buried items were encountered, and no other significant variances to the approved plans and specifications were observed. The revised limits of waste are depicted on Figure 3.

3.1.2 Bedding Layer

The bedding material was supplied from the Bewley pit in Lockport, New York. In total, approximately 20,000 yd^3 of bedding sand was imported for use as the 6-in. bedding layer. The bedding layer was placed in accordance with contract documents and specifications. Compaction of the bedding layer was in conformance with the specifications. A total of 96 *in situ* density tests were performed. Compaction results ranged from 85.7 to 105.6 percent. Conformance testing was performed in accordance with the approved construction quality assurance/construction quality control plan. One initial sample was collected as part of the source location approval and analyzed for physical parameters, including soil classification, grain size distribution, plasticity, moisture content, and compaction. Additionally, the source location sample was chemically analyzed for volatile and semivolatile organic compounds and metals. Results indicated that the material was in compliance with the plans and specifications. Eight samples were collected during construction phase activities and analyzed for physical parameters, including soil classification, grain size distribution, plasticity, moisture content, and compaction. Results indicated that the material was in compliance with the plans and specifications. The as-built survey indicated that the required 6-in. layer was conformed to, and that no abnormalities were identified. The bedding material conformed to the requirements described in the Local Government Regulatory Relief Initiative (NYSDEC 1993[2]).

3.1.3 Linear Low Density Polyethylene Liner

The LLDPE liner was installed in accordance with contract documents and specifications. Quality control sampling indicated that the materials used were in conformance with the approved plans and specifications. Two rolls of smooth LLDPE were returned to the manufacturer and replaced due to excessive damage during delivery. Interface friction testing between the smooth and textured LLDPE to the bedding material was performed by a third party laboratory. The data indicated that the minimum interface friction angle was satisfied for the interfaces between the smooth and textured liner with the bedding material and geocomposite.

The installation of the LLDPE liner commenced on 4 August 2000, and was completed and accepted on 8 September 2000. A total of 956,516 ft^2 of LLDPE liner was installed. Excess liner (6,000 ft^2) was installed on the northwestern toe of slope beyond the contract limits. The excess was subsequently cut off prior to anchor trench completion. On the eastern toe of slope, the anchor detail was modified during construction to increase the efficiency of liner and cap termination. Approximately 8,000 ft^2 of liner was installed beyond the contract limits but was not included in the final area of cap installed. Additional details to the accepted changes in the cap termination are described in Subsection 3.1.10. Therefore, the actual limits of the cap were approximately 14,000 ft^2 less than measured, or a total of 942,516 ft^2.

During installation, 106 destructive seam samples were collected. The frequency of destructive samples collected conformed to the requirements. Of the 106 samples collected, 1 failure was observed. Destructive sample DS-68, an extrusion weld sample, failed third party testing for the peel adhesion test. Subsequent samples DS-68A and DS-68B were collected within 10 ft upseam and 10 ft downseam of the failed seam. The results from the subsequent samples indicate that the failure was isolated. The area of the failed test was removed and repaired to eliminate the chance of future failures. Inspection of the failed sample indicated that some dust was present and was the most likely cause for the failure. Non-destructive testing, including air pressure seam testing and vacuum box testing, was performed without incidence. Minor vacuum box failures of extrusion weld repairs were noted, immediately repaired, re-tested, and were observed to meet the requirements.

2. New York State Department of Environmental Conservation (NYSDEC). 1993. Local Government Regulatory Relief Initiative.

The subgrade was found to be acceptable prior to liner installation and was in compliance with the plans and specifications. However, the southwest corner of the site, which is the lowest point for stormwater runoff and any minor seeps, was found to have a soft subgrade after the liner was placed. Heavy runoff and minor seeps were determined to cause the change in the subgrade. Acceptance of this area was discussed in a letter dated 20 September 2000 to NYSDEC personnel. The area was covered with additional barrier protection to increase the stability of this area for access road placement. No long-term impact is anticipated due to these conditions. Complete liner documentation is available in Appendix B. The liner as-built drawing is included under a separate cover with the complete as-built drawing set.

3.1.4 Geocomposite Drainage Net

A total of 957,046 ft^2 of geocomposite was installed in accordance with contract documents and specifications. Quality control sampling indicated that the materials used were in conformance with the approved plans and specifications. Interface friction testing between the LLDPE, barrier protection material, and the geocomposite was performed. The data indicated that the minimum interface friction angles were satisfied for the interface between the smooth, textured, and barrier protection materials.

3.1.5 Barrier Protection Layer

The barrier protection layer was placed in accordance with contract documents and specifications. Compaction of the barrier layer was in conformance with the specifications. A total of 186 *in situ* density tests were performed. Compaction results ranged from 84 to 103.6 percent. Conformance testing was performed in accordance with the approved construction quality assurance/construction quality control plan. One initial sample was collected as part of the source location approval and analyzed for physical parameters, including soil classification, grain size distribution, plasticity, moisture content, and compaction. Additionally, the source location sample was chemically analyzed for volatile and semivolatile organic compounds and metals. Results indicated that the material was in compliance with the plans and specifications. Thirteen samples were collected and analyzed during construction phase activities for physical parameters, including soil classification, grain size distribution, plasticity, moisture content, permeability, and compaction. Results indicated that the material was in compliance with the plans and specifications. The as-built survey indicated that the required 12-in. layer was conformed to, and that no abnormalities were identified. Use of barrier protection material in the drainage swales was modified from the original approved plan. The design called for an 18-in. clay layer, followed by a 24-in. barrier protection layer. The barrier protection layer was completely removed and replaced with clay. A small amount of barrier protection material (approximately 3 in.) was used to establish final grades in the swales prior to stone placement.

3.1.6 Topsoil Layer

The topsoil layer was placed in accordance with contract documents and specifications. Conformance testing was performed in accordance with the approved construction quality assurance/construction quality control plan. Two initial samples were collected from the borrow sources as part of the source location approval and analyzed for physical parameters, including grain size distribution and organic content. Additionally, the source location samples were chemically analyzed for volatile and semivolatile organic compounds, metals, pH, and organic content. Results indicated that the material was in compliance with the plans and specifications. Nine samples were collected and analyzed during construction phase activities for physical parameters including grain size distribution and organic content. Results indicated that the material was in compliance with the plans and specifications. The as-built survey indicated that the required 6-in. layer was conformed to, and that no abnormalities were identified.

3.1.7 Low Permeability Clay Placement

Low permeability clay was placed in areas outside the limits of the LLDPE cap where waste materials were still present. This design element was chosen to allow adjacent property owners the ability to tie into this low permeability clay layer and allow for additional monitoring well installations without costly liner penetrations and repairs.

The low permeability clay was placed in accordance with contract documents and specifications. Compaction of the clay layer was in conformance with the specifications. A total of 53 *in situ* density tests was performed. Compaction results ranged from 90 to 97.5 percent. Conformance testing was performed in accordance with the approved construction quality assurance/ construction quality control plan. Two initial samples were collected from two borrow sources as part of the source location approval and analyzed for physical parameters, including soil classification, grain size distribution, plasticity, moisture content, permeability, and compaction. Additionally, the source location samples were chemically analyzed for volatile and semivolatile organic compounds and metals. Results indicated that the material was in compliance with the plans and specifications. Five samples were collected and analyzed during construction phase activities for physical parameters, including soil classification, grain size distribution, plasticity, moisture content, permeability, and compaction. Results indicated that the material was in compliance with the plans and specifications. The as-built survey indicated that the required 42-in. layer was conformed to, and that no abnormalities were identified.

3.1.8 Drainage Structures

The following subsections discuss the changes to various drainage structures across the site. Each design component is briefly discussed to outline the approved changes incorporated during construction.

3.1.8.1 Southern Niagara Mohawk Power Corporation Swale and Culvert

The culvert that conveys surface water from the eastern NMPC swale to the southern NMPC swale was modified from the original approved plans and specifications. The plans called for a layer of crushed stone to provide proper bedding for the 24-in. diameter HDPE culvert. However, placement of a high permeable layer under the pipe would act as a conduit for contaminated surface water flow, allowing the Airco parcel to be impacted by high pH water with dissolved heavy metals. In an effort to minimize the potential for migration of contaminants from the NMPC parcel onto the Airco parcel, the stone was removed from the profile and replaced with clay. The culvert was backfilled with clay to maintain surface flow through the culvert.

The southern NMPC swale was to be completed with 3-in. of topsoil and seeded accordingly. However, due to the fast growing wetland vegetation, placement of topsoil in half of the swale was not possible. The remainder of the swale received approximately 6 in. of New York State Department of Transportation No. 3A stone. The stone will allow wetlands vegetation to easily reroute and flourish, while minimizing the potential for erosion.

3.1.8.2 Southeastern Airco Culvert

Installation of a 24-in. diameter HDPE culvert was required to convey stormwater runoff from the eastern Airco swale to the southern Airco swale. This change was dictated by the relocation of the eastern access road from the toe of slope on the cap system, to the berm outside the drainage swale. The culvert was added to convey water under the re-aligned access road.

3.1.8.3 Northwestern Airco Culvert

The culvert in the northwest corner of the Airco parcel was changed from the original approved plans and specifications. The original design called for an elliptical 17-in. × 13-in. coated, corrugated metal culvert. The specified pipe required significant lead time for materials purchase, and the contractor had additional 24-in. HDPE culvert onsite. The additional culvert was surplus from the installation in the southeast NMPC culvert. The slightly larger diameter culvert required the access road to be slightly higher, and thicker in some locations, to accommodate this change.

3.1.8.4 Standard Cap Termination Details

The standard cap termination depicted in the original design drawings was modified at some locations around the base of the landfill. Modifications to the cap termination details were necessitated by field conditions encountered during construction. Approval to change the standard cap terminations was granted by NYSDEC on 17 August 2000. The approved changes included use of clay as the barrier protection layer, and anchoring the liner between the 18-in. clay layer and the 24-in. clay barrier protection layer. Figures 4 through 6 depict the as-built cap termination details. Additionally, these as-built details are provided in the as-built drawing set.

3.1.8.5 Southwestern Airco Drainage Swale Grade Changes

The southwestern drainage swale from the outlet to the first property line corner was modified from the original plans and specifications. The original design called for a 1 percent grade the entire length of the swale. However, the final invert elevation of the swale would have been lower than the existing phreatic water surface in the wetland. To raise the final elevation of the invert at the outlet point 1 ft required changing the swale grade to a ¾ percent grade for the final 400 ft. No other changes to the swale grades were noted.

3.1.8.6 Southwestern Relief Pipe

The southwest corner of the Airco parcel historically exhibited minor leachate seeps that varied in intensity based upon season fluctuations. During the design of the cap system, consideration to the seeps was given, and an underdrain system was included as part of the construction details. The underdrain system was designed to convey surface and/or perched water from low areas into the wetland. The intent was that after completion of site grading and drainage swale construction, the underdrain system would not be required, and would be removed from service. However, during drainage swale grading and waste relocation, it became apparent that the seeps were more significant than originally considered, and additional planning for this area was required. Therefore, in an effort to maintain stability of the cap system by allowing the pore water pressure to vent without the potential for compromising the cap integrity, a relief pipe was added. As depicted on Figures 7 through 9, the pipe consist of a 4-in. perforated HDPE drainage line, placed in clean crushed stone, and capped by a 42-in. layer of low permeability clay. The outlet is a 4-in. solid polyvinyl chloride riser, which discharges into the Airco swale in the southwest corner of the site. If the pore water pressure under the cap builds to greater than approximately 2 lb/in.^{2}, the relief pipe discharges water into the swale. The relief pipe will continue to provide relief of pore water pressure until the water elevation under the cap equilibrates to the relief pipe riser elevation (600 ft mean sea level). The pipe has been added as a monitoring point as part of the Revised Final Post-Closure Monitoring and Facility Maintenance Plan and will be sampled concurrently with the other surface water discharge points and monitoring wells. The relief pipe will remain operational until the pressure under the cap has equilibrated. At that time, the relief pipe will be abandoned in accordance with Section 3.11 of the Post-Closure Monitoring and Facility Maintenance Plan.

3.1.9 Site Grading

Site grading was performed in accordance with contract documents and specifications. The as-built survey indicated that minor changes to the design grades for the waste layer were identified. These minor differences did not result in noticeable changes to the slopes of the cap. The slopes conformed to the requirements and varied between the minimum 4 percent and maximum 33 percent allowable grades.

3.1.10 Access Road Alignment and Details

The eastern, northern, and western access road alignment, and materials of construction, was modified from the approved plans and specifications. The southern access road remains unchanged from the approved plans and specifications.

The eastern access road originating in the southeast corner was relocated to the top of the berm, outside the drainage swale. This was done to facilitate access to the monitoring wells, and to reduce vehicular traffic on the cap system.

The northern access road was similarly re-aligned off the cap, and onto the exterior berm. The access road connects to the existing routed access road at the cross over point onto the cap in the northwest corner of the site.

The western access road was re-aligned from the toe of slope, to the top of slope. The road crosses onto the cap in the vicinity of monitoring well MW-6B, and runs up-slope to the top of slope. From there, the access road would continue along the top of slope with a spur access road diverging to MW-7B for access to that location.

An additional spur runs from the cross-over point onto the cap in the northwest corner of the site to monitoring well MW-8B for access to that location.
Materials of construction for the eastern and northern access roads were modified from New York State Department of Transportation No. 3A stone to 2-in. crusher run. No other design changes to access roads were noted.

3.1.11 Monitoring Well Construction Details

Installation of the monitoring wells commenced on 21 August 2000 and was completed on 29 August 2000. The well construction details varied slightly for 3 of the wells (MW-4B, MW-5B, and MW-8B). The changes were due to bedrock refusal at shallow depths. The original design of the monitoring wells required advancing the augers to an approximate depth of 15.5 ft below ground surface. However, bedrock refusal in MW-4B, MW-5B, and MW-8B was encountered at 11, 13, and 13.4 ft below ground surface, respectively. The bedrock refusal in the remaining monitoring wells ranged from 15.5 (MW-3B) to 27 ft below ground surface (MW-2B). Variations from the design included reductions in thickness of the various layers. Individual boring logs and well construction diagrams are included in Appendix B (CD-ROM).

3.1.12 Perimeter Fence Installation

A perimeter site security fence was installed to prevent unauthorized access to the site. The fence was installed with a 1-ft offset from the property line. Approximately 4,510 linear ft of fence, and one 30-ft double swing fence gate, were installed. The fence was installed in accordance with the approved plans and specifications. Some issues were raised during installation with regards to the height of the fence fabric in relationship to the ground surface. These issues were resolved during the engineering inspection performed in December 2000.

4. CONTINUOUS AIR MONITORING PROGRAM

This section discusses the results of the continuous air monitoring program employed during construction-related activities.

4.1 RESULTS OF CONTINUOUS AIR MONITORING PROGRAM

Continuous air monitoring for particulates was required throughout the waste relocation phase of the project. Compliance with the New York State Department of Health Services Community Air Monitoring Plan (CAMP), and NYSDEC Technical Air Guidance Memorandum (TAGM) No. 4031 was required. Air monitoring commenced on 23 May 2000 and was completed on 5 August 2000 after waste relocation ceased. Air monitoring during the remainder of construction-related activities defaulted to normal construction-related activities, and nuisance dust abatement. During waste relocation activities, two meters were deployed for data collection purposes and to maintain compliance with the CAMP and TAGM.

4.1.1 Upwind Monitoring

The upwind station was established at the beginning of each scheduled work day based upon prevailing wind direction and planned activities. Primarily, the upwind meter was located on the western property line in a grove of trees. This corresponded to the prevailing westerly wind flow. During the period of performance, instances where the upwind meter readings exceeded the CAMP and TAGM were noted. These related to periods of high humidity or rain events. During threatening weather, the upwind meter would be removed from service to prevent damage to the meter. In these instances, downwind conditions were continuously monitored to show compliance. The upwind meter was used to calibrate the allowable dust concentration based upon baseline background conditions. However, one instance was noted where the upwind monitoring indicated high background concentrations due to the demolition of a building on the Stollberg property, which abuts the SKW parcel to the west.

4.1.2 Downwind Monitoring

The downwind monitoring station was not located in a permanent position during the entire work day. The downwind station was continuously monitoring downwind air quality, however, it was also used for worker protection during waste relocation activities and thus situated in various locations throughout the work day. Routinely, the meter was used to monitor air quality within the excavation equipment to determine worker exposure. The downwind meter was routinely used at the downwind property line, which was the most conservative location, and within the work zone. There are many instances identifiable within the vast amount of data where a spike in the measured concentration may have occurred. However, there were no documented instances where air quality at the property line exceeded the CAMP or TAGM. There was one documented instance where dust monitoring indicated the concentrations exceeded the Site-Specific Safety and Health Plan. Consequently, work activities were stopped until dust suppression was successful at eliminating the threat.

5. POST-CLOSURE MONITORING AND FACILITY MAINTENANCE

This section discusses the Post-Closure Monitoring and Facility Maintenance Plan. Cost estimates associated with post-closure activities, as referenced in Subpart 360-2.15(c)(1), are included in the Plan. Accordingly, financial assurance for post-closure activities (Subpart 360-2.19[b]) will be provided after acceptance of the Plan and prior to commencement of post-closure activities.

5.1 OPERATION, MONITORING, AND MAINTENANCE

A comprehensive Post-Closure Monitoring and Facility Maintenance Plan has been developed in accordance with Subpart 360-2.15(k) for the site, and is included as Appendix A. Landfill maintenance requirements are briefly summarized in this section and in Appendix A. The monitoring requirements are summarized in Appendix A.

5.1.1 Changes to the Approved Plan

One change to the approved Post-Closure Monitoring and Facility Maintenance Plan has been incorporated into the revised Plan provided in Appendix A. The relief pipe discussed in Subsection 3.1.8.6 has been added to the sampling program. The frequency and analysis will be consistent with samples collected from the 8 monitoring wells and 2 surface water locations.

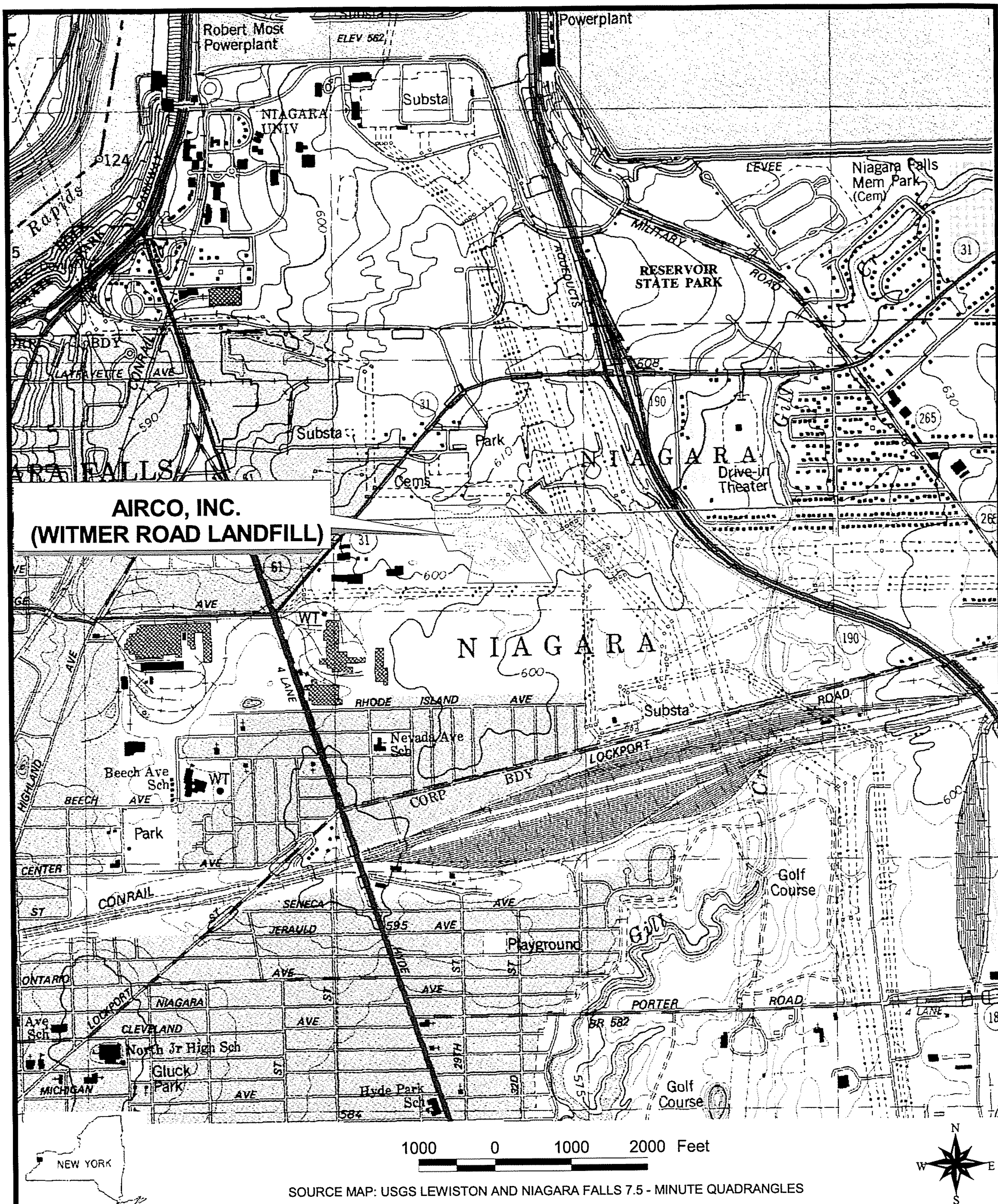
5.1.2 Landfill Maintenance

In accordance with Subpart 360-2.15(k)(3), site inspections will be performed on a quarterly basis to ensure that the final landfill cover and drainage structures are functioning within accepted design standards. The inspections will include visual checks of all culverts, rip-rap, swales, and berms to ensure erosion problems are not occurring. Erosion occurrences associated with drainage will be repaired and restored. Eroded soil or displaced rip-rap will be replaced. Exposed or unvegetated soil will be reseeded, fertilized, and mulched.

The presence of any vectors (e.g., rodents, burrowing animals, etc.) on the site will be noted during the routine inspection. Extermination or treatment that will remove the vecting population(s) will be implemented, as appropriate.

Monitoring well casings, locks, fences, and gates will be inspected to ensure that they are undamaged and functional. Damaged components will be repaired immediately and all structures will be re-secured.

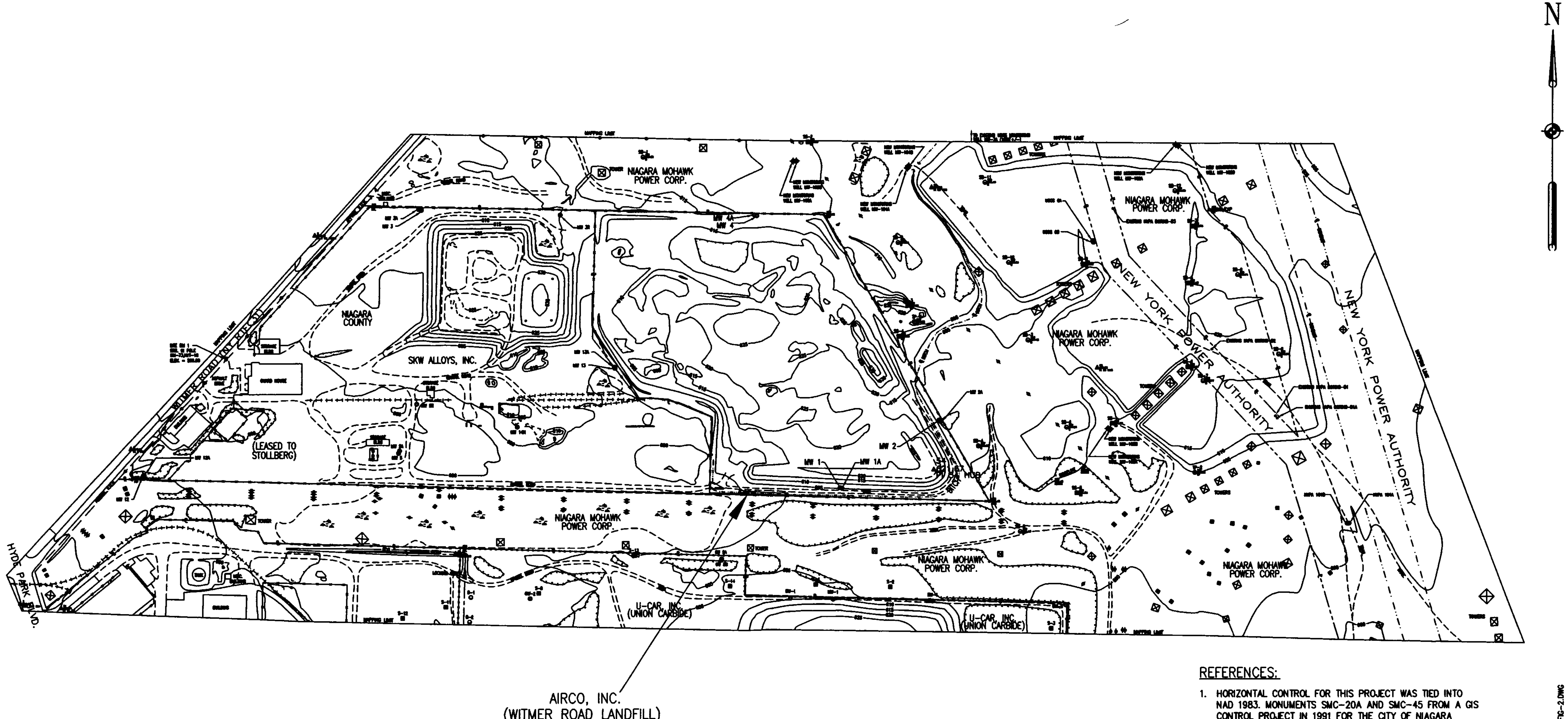
Following each inspection, a report will be prepared. The inspection report will include, at a minimum, the date and time of the inspection, personnel conducting the inspection, visual observations of items inspected, and a brief description of any repair work, if required, including the nature of the damage, the repairs completed, and the estimated cost of the repairs. The report will also describe any items that will need future attention or repairs not completed during the course of the inspection, along with other pertinent comments.



SOURCE MAP: USGS LEWISTON AND NIAGARA FALLS 7.5 - MINUTE QUADRANGLES

EA ENGINEERING, SCIENCE, AND TECHNOLOGY	WITMER ROAD LANDFILL DESIGN-BUILD SITE CLOSURE NIAGARA FALLS, NEW YORK	FIGURE 1 SITE LOCATION MAP

PROJECT MGR	DESIGNED BY	DRAWN BY	CHECKED BY	SCALE	DATE	PROJECT No	FILE No
CEM	BT	BT	CEM	AS SHOWN	13 DEC. 2000	12040.68	I:\BOC-NIAGARA -GIS\BOC.APR



REFERENCES:

1. HORIZONTAL CONTROL FOR THIS PROJECT WAS TIED INTO NAD 1983. MONUMENTS SMC-20A AND SMC-45 FROM A GIS CONTROL PROJECT IN 1991 FOR THE CITY OF NIAGARA FALLS WAS USED.
2. VERTICAL CONTROL FOR THIS PROJECT WAS TIED INTO NGVD 1929. MONUMENT SMC-20A WITH AN ELEVATION OF 588.52 WAS USED. A SECONDARY BENCHMARK (RAILROAD SPIKE IN POLE NM-73, NYT-10) WAS SET BY LU ENGINEERS WITH AN ELEVATION OF 599.00.
3. TOPOGRAPHIC MAPPING AND 5-FT CONTOURS FOR THIS PROJECT WERE BASED ON 1"=500' PHOTOGRAPHY OBTAINED IN THE SPRING OF 1992.
4. ALL PROPERTY LINE LOCATIONS ARE APPROXIMATE. NO BOUNDARY SURVEY WAS DONE. EXISTING SURVEYS WERE UTILIZED FROM SKW ALLOYS, INC. DATED 18 FEBRUARY 1988, UNION CARBIDE LANDFILL SITE PLAN DATED 30 DECEMBER 1993, AND NEW YORK STATE POWER AUTHORITY DRAWING "NPPSKW.DWG."

LEGEND

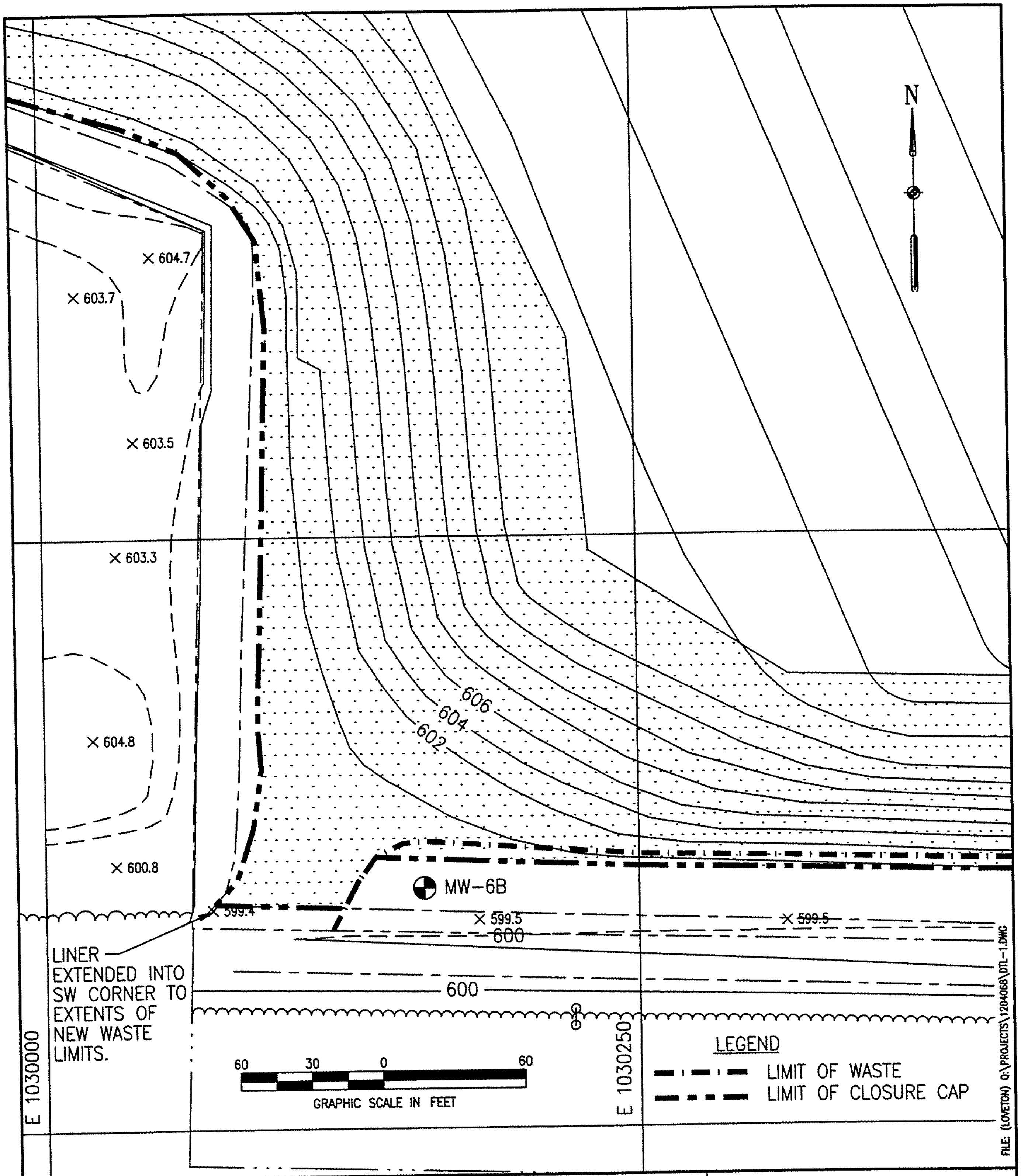
- UTILITY POLE
- PROPERTY IRON PIN
- TREE LINE
- APPROXIMATE PROPERTY LINE
- JCL SURVEY CONTROL POINT
- x—x—x CHAIN LINK FENCE

400 200 0 400

GRAPHIC SCALE IN FEET

FILE: F:\INDUSTRIAL&OTHER\BOC GASES\1204068\IRM REPORT\IRM REPORT\FIG-2.DWG

EA ENGINEERING, SCIENCE, AND TECHNOLOGY	WITMER ROAD LANDFILL DESIGN-BUILD SITE CLOSURE NIAGARA FALLS, NEW YORK	FIGURE 2 VANADIUM SITE	DESIGNED BY MJG	DRAWN BY JBS	DATE 12-15-00	PROJECT NO. 12040.68
			CHECKED BY PAP	PROJECT MGR. CEM	SCALE AS SHOWN	FIGURE 2

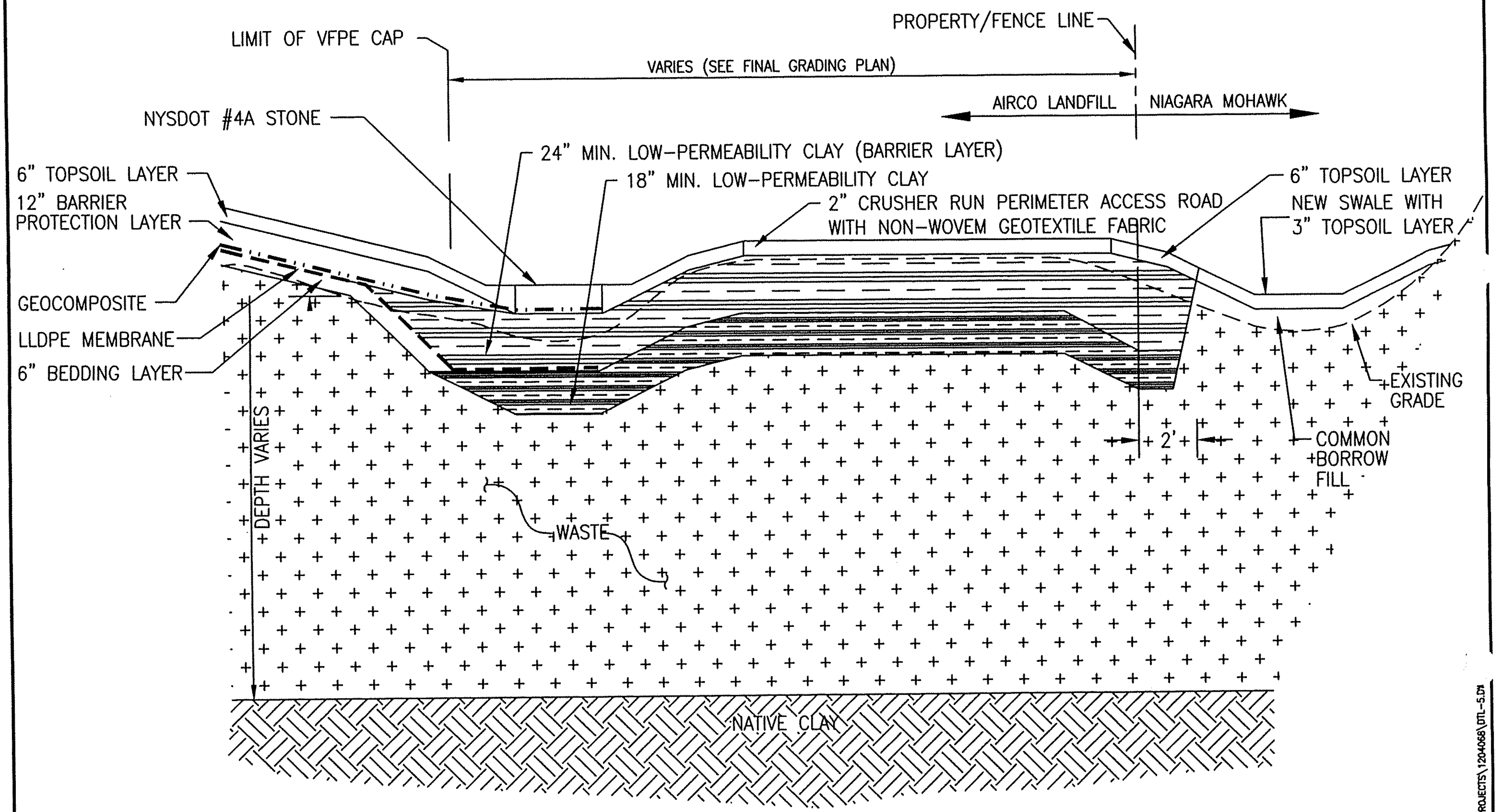


EA ENGINEERING, SCIENCE, AND TECHNOLOGY

WITMER ROAD LANDFILL
DESIGN-BUILD SITE CLOSURE
NIAGARA FALLS, NEW YORK

FIGURE 3
SOUTHWEST CORNER
REVISED LIMITS OF WASTE

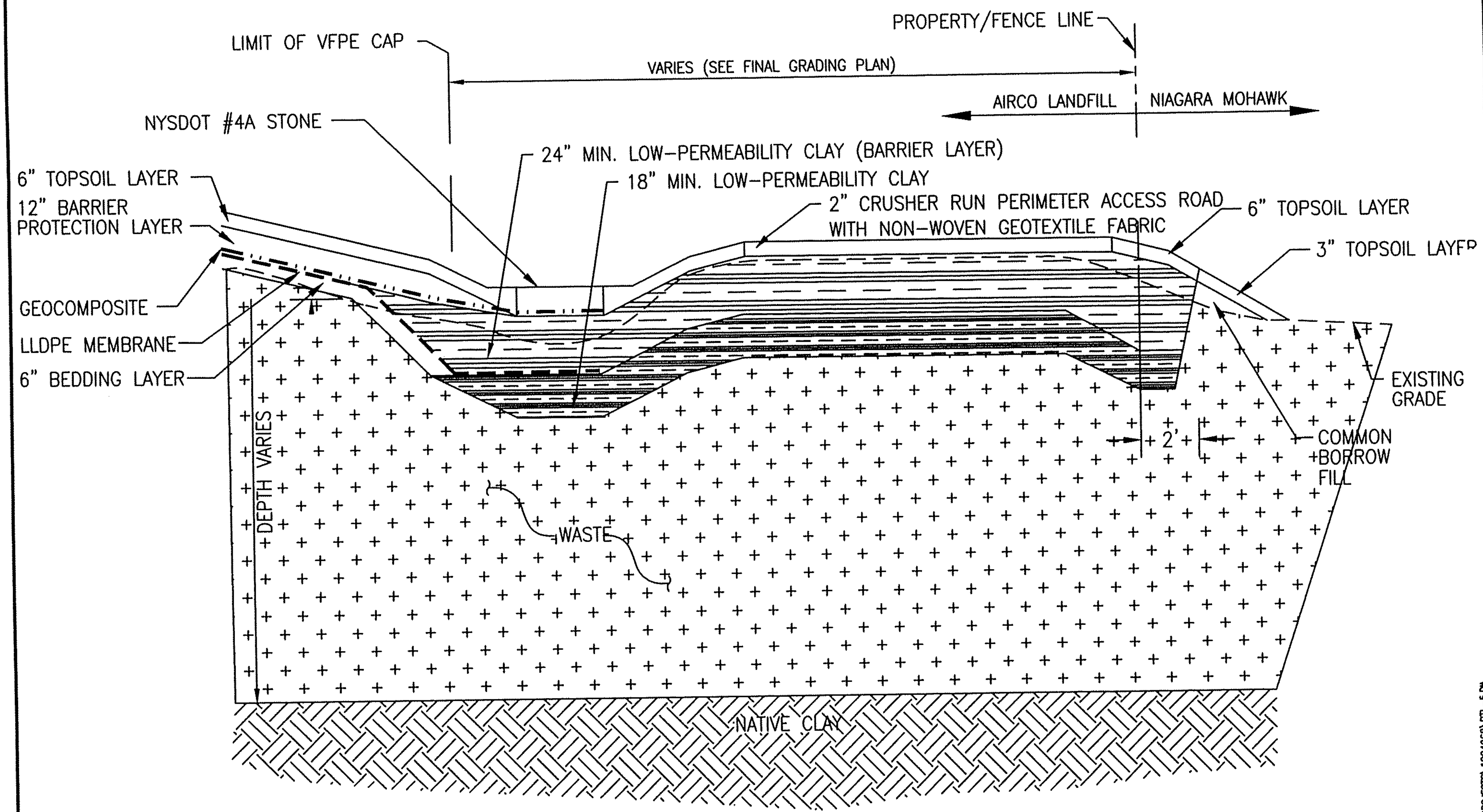
PROJECT MGR	DESIGNED BY	DRAWN BY	CHECKED BY	SCALE	DATE	PROJECT NO	FIGURE
CEM	CEM	FDV	MRG	AS SHOWN	8-14-00	12040.68	3



CAP TERMINATION DETAIL 'A'

SCALE: 1"=5'

EA® EA ENGINEERING, SCIENCE, AND TECHNOLOGY	WITMER ROAD LANDFILL DESIGN-BUILD SITE CLOSURE NIAGARA FALLS, NEW YORK	FIGURE 4 AS-BUILT CAP TERMINATION DETAIL "A"	DESIGNED BY CEM	DRAWN BY FDV	DATE 1-18-01	PROJECT NO. 12040.68
			CHECKED BY CEM	PROJECT MGR. MRG	SCALE AS SHOWN	FIGURE 4

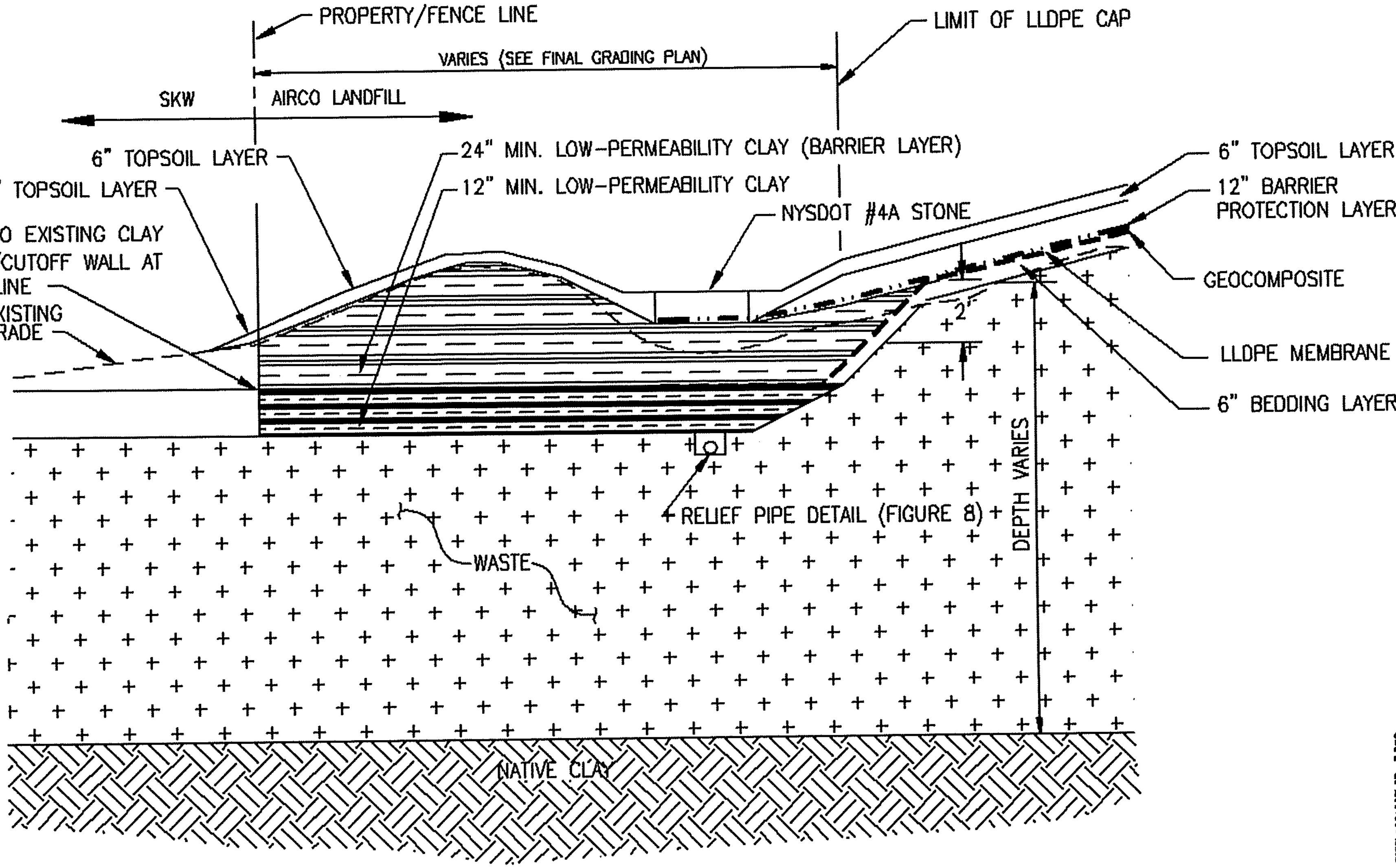


CAP TERMINATION DETAIL 'B'

SCALE: 1"=5'

FILE: (LOVETON) Q:\PROJECTS\1204068\DTL-5.DW

EA ENGINEERING, SCIENCE, AND TECHNOLOGY	WITMER ROAD LANDFILL DESIGN-BUILD SITE CLOSURE NIAGARA FALLS, NEW YORK	FIGURE 5 AS-BUILT CAP TERMINATION DETAIL "B"	DESIGNED BY CEM	DRAWN BY FDV	DATE 1-18-01	PROJECT NO. 12040.68
			CHECKED BY CEM	PROJECT MGR. MRG	SCALE AS SHOWN	FIGURE 5



NOTE:

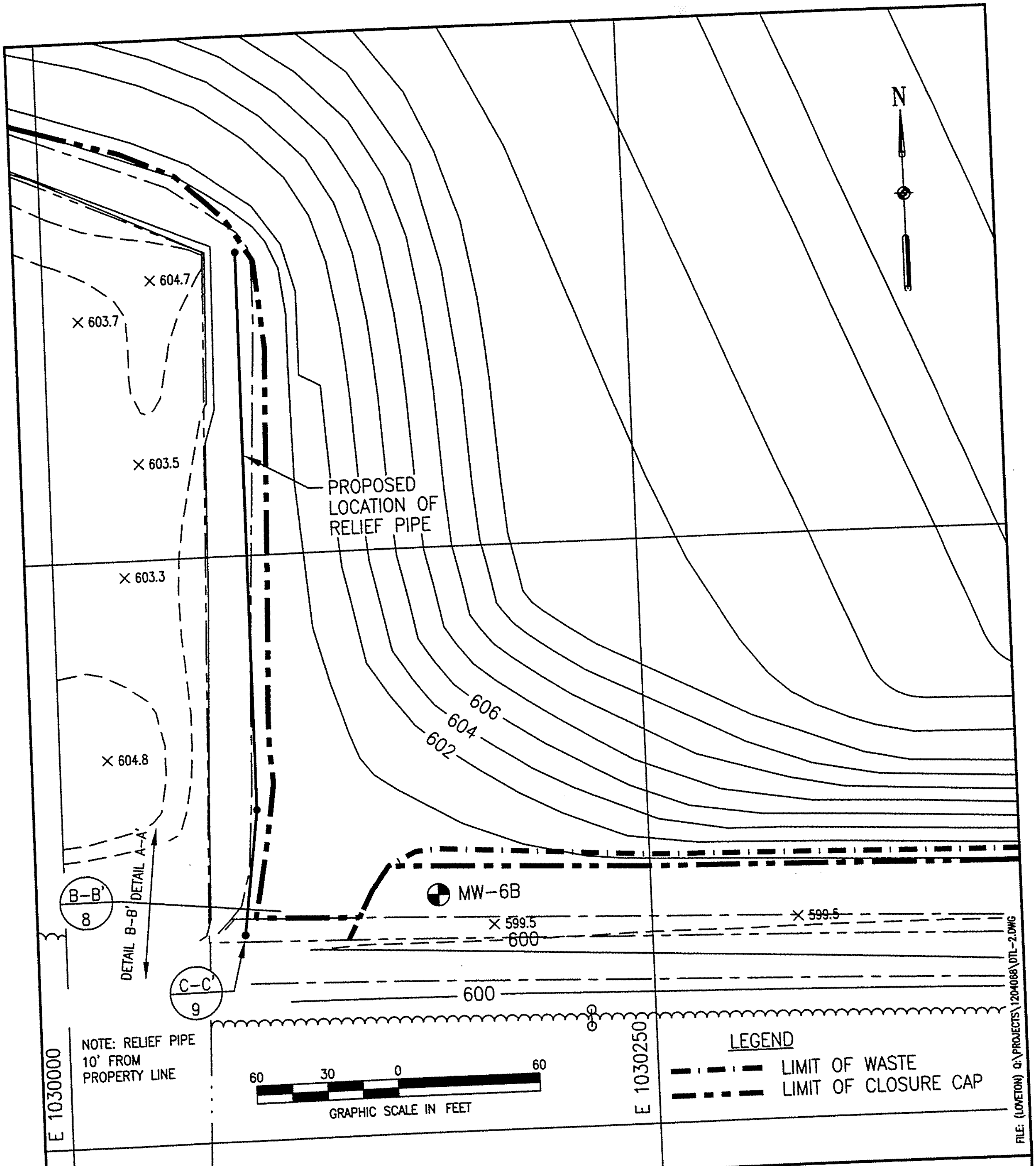
EXCAVATION SHALL BE AS NEAR VERTICAL AS PRACTICAL WITHOUT DESTABILIZING SKW PROPERTY.

CAP TERMINATION DETAIL 'D'

SCALE: 1"=5'

EA ENGINEERING, SCIENCE, AND TECHNOLOGY	WITMER ROAD LANDFILL DESIGN-BUILD SITE CLOSURE NIAGARA FALLS, NEW YORK	FIGURE 6 AS-BUILT CAP TERMINATION DETAIL "D"	DESIGNED BY CEM	DRAWN BY FDV	DATE 1-18-01	PROJECT NO. 12040.68
			CHECKED BY CEM	PROJECT MGR. MRG	SCALE AS SHOWN	FIGURE 6

FILE: (LOVETON) O:\PROJECTS\1204068\DTL-7.DWG

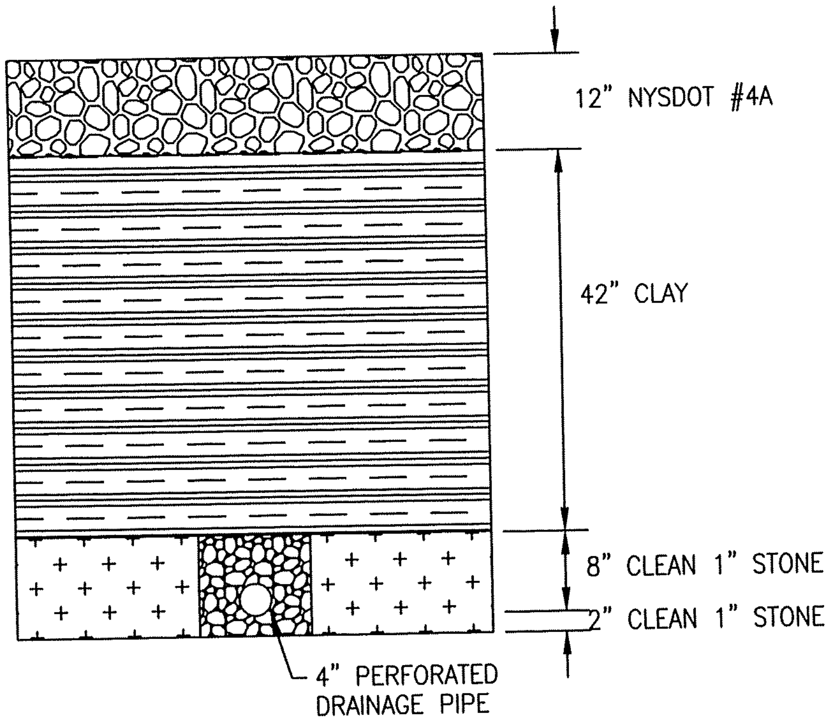


EA ENGINEERING, SCIENCE, AND TECHNOLOGY

WITMER ROAD LANDFILL
DESIGN–BUILD SITE CLOSURE
NIAGARA FALLS, NEW YORK

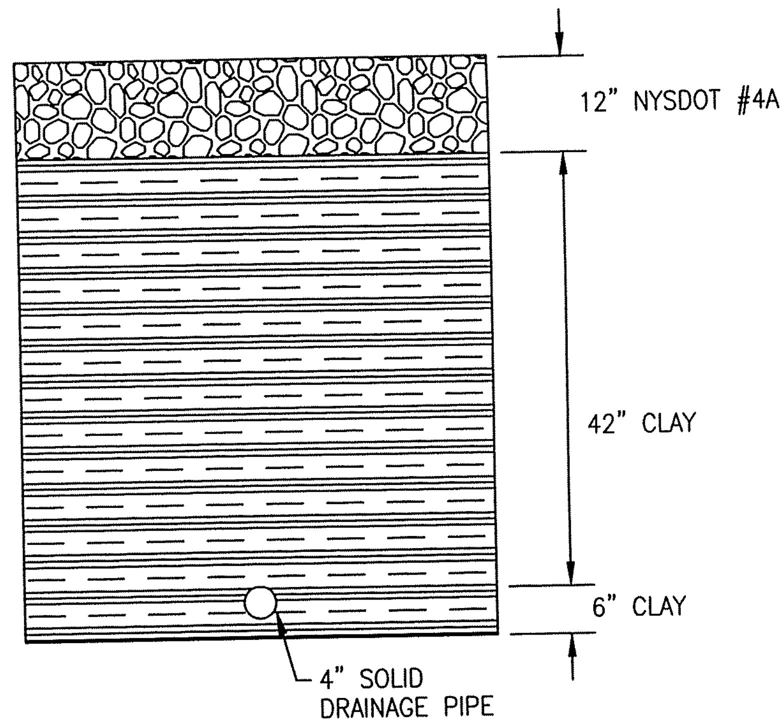
FIGURE 7
PLAN VIEW
RELIEF PIPE SYSTEM

PROJECT MGR	DESIGNED BY	DRAWN BY	CHECKED BY	SCALE	DATE	PROJECT NO	FIGURE
CEM	CEM	FDV	MRG	AS SHOWN	1–18–01	12040.68	7



DETAIL "A-A"

NOT TO SCALE

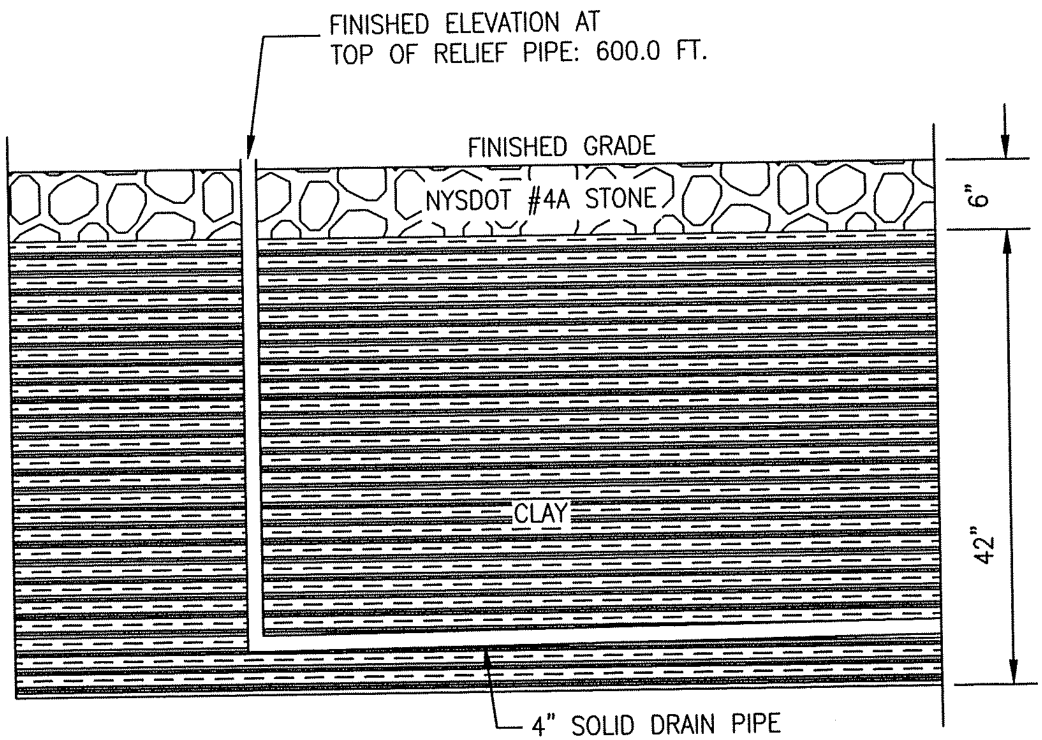


DETAIL "B-B"

NOT TO SCALE

FILE: (LOVETON) Q:\PROJECTS\1204068\DTL-3.DWG

EA® ENGINEERING, SCIENCE, AND TECHNOLOGY	WITMER ROAD LANDFILL DESIGN-BUILD SITE CLOSURE NIAGARA FALLS, NEW YORK	FIGURE 8 RELIEF PIPE DETAILS	DESIGNED BY CEM	DRAWN BY FDV	DATE 8-14-00	PROJECT NO. 12040.68
			CHECKED BY MRG	PROJECT MGR. CEM	SCALE NONE	FIGURE 8



DETAIL "C-C"

NOT TO SCALE

EA ENGINEERING, SCIENCE, AND TECHNOLOGY	WITMER ROAD LANDFILL DESIGN-BUILD SITE CLOSURE NIAGARA FALLS, NEW YORK	FIGURE 9 RELIEF PIPE DETAIL AT THE OUTLET POINT	DESIGNED BY CEM	DRAWN BY FDV	DATE 8-14-00	PROJECT NO. 12040.68
			CHECKED BY MRG	PROJECT MGR. CEM	SCALE NONE	FIGURE 9

FILE: (LOVETON) Q:\PROJECTS\1204068\DTL-4.DWG

Appendix A

Post-Closure Monitoring and Facility Maintenance Plan

Post-Closure Monitoring and Facility Maintenance Plan for the Witmer Road Landfill Niagara Falls, New York

Prepared for

The BOC Group
100 Mountain Avenue
Murray Hill, New Jersey 07974

Prepared by

EA Engineering, P.C. and Its Affiliate
EA Engineering, Science, and Technology
3 Washington Center
Newburgh, New York 12550
(845) 565-8100

January 2001
Revision: REVISED FINAL
Project No. 12040.68

Post-Closure Monitoring and Facility Maintenance Plan for the Witmer Road Landfill Niagara Falls, New York

Prepared for

The BOC Group
100 Mountain Avenue
Murray Hill, New Jersey 07974

Prepared by

EA Engineering, P.C. and Its Affiliate
EA Engineering, Science, and Technology
3 Washington Center
Newburgh, New York 12550

1/31/01
Date

David S. Santoro, P.E., L.S.
President, EA Engineering, P.C.

1/31/01
Date

Charles E. McLeod, Jr., P.E.
Project Manager/Resident Engineer
EA Engineering, Science, and Technology

January 2001
Revision: REVISED FINAL
Project No. 12040.68

CONTENTS

Page

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

1.1 STATEMENT OF PURPOSE

This Post-Closure Monitoring and Facility Maintenance Plan has been prepared for the Witmer Road Landfill located on Witmer Road in the Town of Niagara Falls, New York. This plan describes the tasks necessary for maintenance of the site, periodic inspections, and the monitoring of ground water and surface water at the facility. The intended use for this plan is to provide a guide to the current landfill owners for maintenance and facility monitoring for a period of 30 years. The plan will be re-evaluated within the first 5 years of quarterly monitoring.

In general, the following is required as part of the Post-Closure Monitoring and Facility Maintenance Plan:

- All drainage structures and ditches must be maintained to prevent ponding and erosion of the final landfill soil cap.
- Soil cover integrity, slopes, cover vegetation, drainage structures, and the perimeter road must be maintained during the post-closure monitoring and maintenance period.
- Environmental monitoring points must be maintained and sampled during the post-closure period. Quarterly and annual summary reports must be submitted to Ms. Mary E. McIntosh, Engineering Geologist II, Division of Solid and Hazardous Materials, New York State Department of Environmental Conservation (NYSDEC) Division of Solid Waste, Region 9.
- A vegetative cover must be established and maintained on all exposed final cover material, and adequate measures must be taken to ensure the integrity of the final vegetated cover, topsoil layer, and underlying barrier protection layer.
- Records must be maintained of all sampling and analysis results.

1.2 ORGANIZATION

Section 1 outlines the purpose of this Post-Closure Monitoring and Facility Maintenance Plan, and identifies applicable regulatory provisions. Section 2 includes a discussion of the maintenance inspections. Section 3 outlines the environmental monitoring program. The proposed sampling frequency and data reporting are presented in Section 4. Attachments A.1 and A.2 contain the field forms (Field Record of Well Gauging, Purging, and Sampling; and Landfill Cap Inspection Checklist), and Attachment B outlines the standard operating procedures for low flow and sampling method. Attachment C includes the cost estimates for the Post-Closure Monitoring and Facility Maintenance Plan.

2. MAINTENANCE INSPECTIONS

Quarterly landfill inspections, and inspections after major rainfall events (5-year storms), shall be performed at the facility during the minimum 30-year post-closure period, unless specific approval is given by NYSDEC to eliminate some or all of these requirements. The inspections shall be performed on the facility to ensure that the final landfill cover materials, the site drainage structures, and onsite monitoring wells are maintained and functioning within the design standards. Advance notification of inspections will be made to NYSDEC 72 hours prior to commencement of inspection-related activities in the event NYSDEC attendance is desired. An example of the inspection checklist is provided in Attachment A.2. The quarterly landfill inspection reports will be submitted to NYSDEC along with the quarterly ground-water and surface water monitoring reports.

2.1 DRAINAGE STRUCTURES

The inspections will include visual checks of culverts, drainage swales, and berms/benches, if present, to ensure erosion problems are not occurring. Any material defects and erosion occurrences discovered at the facility will be repaired immediately and restored to "new" condition. Eroded soil or cover material will be replaced as soon as possible. Exposed or unvegetated soil will be re-seeded, fertilized, and mulched.

2.2 COVER SYSTEM

Areas of concern within the final landfill cover system could include erosion, exposure, loss of vegetative cover, settlement, gravity sliding, or cracking on the top or side slopes of the landfill. Each quarter, the cover system, including topsoil layer and barrier protection layer, the geocomposite drainage layer, and the 40-mil linear low density polyethylene (LLDPE) membrane, will be inspected and records will be maintained.

Minor repairs to the cover system will be done by hand, utilizing materials from the original borough source or newly approved borough source. The areas of minor erosion, sloughing, or cracking will be excavated by hand to allow for a concise repair. Materials will be placed, compacted appropriately by hand, and re-seeded. Additional erosion control measures, such as straw or hay bales, will be used accordingly to prevent future damage to the repaired areas.

In the event that major erosion, sloughing, or slumping is noted during an inspection, NYSDEC personnel will be notified within 48 hours of the problems observed. An action plan detailing the remedial measures to be taken to rectify the problem will be developed and submitted to NYSDEC for approval, prior to implementation of the remedy. Any repairs requiring patching or seaming of the LLDPE membrane or geocomposite drainage layer will be conducted in accordance with manufacturers' construction specifications and outlined in the action plan.

2.3 VECTORS

The vector inspection in December 1999 indicated that vectors do not appear to pose a threat to the proposed landfill cap section. However, it is recognized that the habitat will be significantly improved after closure has been completed. The presence of any vectors (e.g., rodents, flies, etc.) on the site will be determined during the quarterly inspection. If present, extermination or treatment that will remove the vecting population(s) shall be implemented.

2.4 OTHER FACILITIES AND STRUCTURES

All monitoring well casings, casing locks, concrete aprons, site fences, and gates will be inspected to ensure that they are undamaged and functional. Damages will be repaired immediately and structures re-secured. Mowing of the cap system will occur twice during the first growing season to allow for re-germination of the vegetative cover, and annually thereafter. Annual mowing will be performed after 1 September to allow for enhancement of avian wildlife habitat.

2.5 QUARTERLY INSPECTION REPORTS

After each quarterly inspection, a report will be prepared and submitted to NYSDEC Division of Solid and Hazardous Materials Region 9 office. The inspection report will include, at a minimum, the date and time of the inspection, personnel conducting the inspection, visual observations of the inspectors, a list of items inspected, and a brief description of any repair work, if required, including the nature of the damage, the repairs completed, and the estimated cost of the repairs. The report will also describe any items that will need future attention or repairs not completed during the course of the inspection, along with any other pertinent comments. Three copies of the quarterly inspection and quarterly monitoring reports will be submitted to NYSDEC Region 9; one copy to the State of New York Department of Health in Albany, New York; and one copy included in the document repository located at the Town of Niagara Town Clerk's Office at 7105 Lockport Road, Niagara Falls, New York.

2.6 ANNUAL INSPECTION REPORTS

A brief summary report will be prepared annually and submitted outlining the previous year's monitoring and maintenance activities. The report will describe the previous year's trends with regards to constituents of concern, inspection report findings, and associated remedies, if required. Three copies of the quarterly inspection and quarterly monitoring reports will be submitted to NYSDEC Region 9; one copy to the State of New York Department of Health in Albany, New York; and one copy included in the document repository located at the Town of Niagara Town Clerk's Office at 7105 Lockport Road, Niagara Falls, New York.

3. ENVIRONMENTAL MONITORING PROGRAM

This section provides a summary of the field activities that will be conducted during the post-closure period at the Witmer Road Landfill. During the construction of the landfill closure system, the 8 existing monitoring wells were abandoned, and 8 new monitoring wells installed, in accordance with the approved plans and specifications. The environmental monitoring points at the facility will continue to be sampled and analyzed on a quarterly basis. This quarterly sampling schedule will take place for a maximum initial period of 5 years. During the first 5-year period, the analytical results will be evaluated and, in conjunction with the NYSDEC Division of Environmental Remediation and Division of Solid and Hazardous Materials Region 9 Office, a more appropriate monitoring frequency and monitoring plan will be developed for the site. Currently, monitoring to be conducted during the post-closure period will include:

- Ground-water sampling
- Ground-water gauging
- Surface water sampling
- Relief pipe sampling.

3.1 GROUND-WATER SAMPLING

The new ground-water monitoring wells at the site (MW-1B through MW-8B) will be sampled and analyzed for two rounds of baseline parameters. Sampling for baseline parameters will be performed in accordance with NYSDEC NYCRR Part 360-2.11(d)(6), including volatile organic compounds by U.S. Environmental Protection Agency Method 8260B, metals by U.S. Environmental Protection Agency Series 6010/7000, and additional parameters provided in *Methods for Chemical Analysis of Water and Wastes* (EPA-600/4-79-020), including total organic carbon, total dissolved solids, chemical oxygen demand, specific conductivity, and pH. In addition, because of the presence of silica slag and dust in the landfill, silica will be included in the inorganic parameter list. Table 1 includes a list of baseline parameters that will be analyzed.

The first round of baseline parameter sampling will take place during the fourth quarter of 2000 (between October and December 2000), after closure activities have been completed. The second round of baseline parameter sampling will be conducted in the Spring 2001. The monitoring wells at the site will be sampled using the low-flow sampling methods, presented in Attachment B. Prior to sampling, each well will be monitored until temperature, pH, specific conductivity, and turbidity parameters have stabilized. Results will be logged on the Field Record of Well Gauging, Purging, and Sampling included in Attachment A.1.

The initial baseline parameter sampling results will be evaluated and a modified parameter list will be developed in conjunction with the NYSDEC Division of Environmental Remediation and Division of Solid and Hazardous Materials Region 9 Office. As the ground water beneath the

Witmer Road Landfill has been sampled and analyzed for the past 20 years, the current parameter list includes:

- pH
- Specific conductivity
- Total dissolved solids
- Chemical oxygen demand
- Total organic carbon
- Barium
- Hexavalent chromium
- Total chromium
- Iron
- Manganese
- Silica
- Zinc.

Of the above list, metals are currently analyzed and reported in both the total and soluble phase concentrations. The new ground-water monitoring program may include these parameters (listed above); however, additional parameters may be added on the basis of the results of the two rounds of baseline parameter sampling. If constituents of concern are reported in the overburden monitoring wells, then the installation of at least 1 bedrock well may be required to determine if impacts to the bedrock aquifer have occurred. An addendum to this plan will be issued detailing the necessary information for bedrock well installation, if required.

3.2 GROUND-WATER GAUGING

In order to evaluate the ground-water flow direction at the site, ground-water level gauging will be performed on the onsite wells prior to sample collection. An electronic water level meter will be used for this field task capable of recording water elevations to within +/- 0.01-in. accuracy. A complete round of water elevation measurements will also be recorded 1 day following completion of well installation activities. During each gauging event, the depth to the bottom of the well will be determined, and compared to the original depth determined from well installation. If sediment is observed in the well casing, the sediment will be removed via well development when the depth of sediment is greater than 10 percent of the well screen.

3.3 SURFACE WATER SAMPLING

Surface water sampling is designed to evaluate the chemical quality surface water runoff which may collect in the drainage swales prior to exiting the site to the southwest. Surface water samples will be collected at two locations (Figure 1), if surface water is present during sampling events. The first location noted is the confluence point for the southern and western drainage swales. The second location is immediately downstream of the discharge point of the relief pipe. Samples will be collected using a decontaminated stainless steel or Teflon dipper.

During the first two quarters, the surface water sample will be analyzed for Part 360 Baseline parameters plus silica. Unlike ground water, surface water has the ability to transport suspended material, therefore, surface water samples will be collected for total metals only. This will provide a more realistic scenario when determining impact to human health and the environment.

During the second two quarters, analytical requirements may be modified slightly based on the data collected during the first two quarters. It is anticipated that after the first two baseline sampling rounds, future samples will be analyzed for the following parameters:

- pH
- Specific conductivity
- Total dissolved solids
- Chemical oxygen demand
- Total organic carbon
- Barium
- Hexavalent chromium
- Total chromium
- Iron
- Manganese
- Silica
- Zinc.

3.4 RELIEF PIPE SAMPLING

Field parameters will be recorded at the relief pipe sampling location (Figure 1), including pH, turbidity, Eh, and specific conductivity. A single leachate sample will be collected and field parameters recorded during the four rounds of sampling. During the first two rounds, the leachate sample will be analyzed for baseline parameters noted in the ground-water sampling section above.

During the first two quarters, the surface water sample will be analyzed for Part 360 baseline parameters plus silica. During the second two quarters, analytical requirements may be modified slightly based on the data collected during the first two quarters. It is anticipated that, after the first two baseline sampling rounds, future samples will be analyzed as noted under surface water sampling.

3.5 FIELD QUALITY CONTROL SAMPLES

These samples are not included specifically as laboratory quality control samples but are analyzed when submitted. Data for these quality control samples are reported with associated samples.

3.5.1 Water Source Sample

Water source samples are samples of water used for field decontamination purposes. Specifically, water source samples will include potable, site-supplied water used in decontamination activities and laboratory-supplied, reagent-grade, de-ionized water used for final rinse in decontamination activities. Water source samples will be analyzed for the parameters sampled during the field mobilization period. One water source sample will be collected from the source of potable water used for equipment decontamination per sampling event. The water source sample will be collected early in the field effort to assess the quality of this potable water supply.

3.5.2 Rinsate Blanks

A rinsate blank is a water sample collected after having been poured through or over a decontaminated piece of sampling equipment to assess and document the thoroughness of the decontamination process. At least one rinsate blank per sampling event will be collected.

3.5.3 Field Duplicates

Field duplicates are two samples of the same matrix which are collected, to the extent possible, from the same location at the same time using the same techniques. Field duplicates provide information on the precision of the sampling and analysis process. Field duplicates will be collected at a frequency of 1 duplicate per 20 sample media. Quality control samples will be filled from the same discrete sample or composite mixture as the field samples.

3.5.4 Trip Blanks

Trip blanks are samples used when shipping samples for volatile organic compound analysis, in order to determine if volatile organics were released during shipment. These samples consist of a 40-ml sample vial containing laboratory grade deionized water. One trip blank will accompany each sample shipment (cooler) containing volatile organic compounds.

3.5.5 Sample Labels

Field samples collected will each be assigned a unique sample tracking number. Sample designation will be an alpha-numeric code which will identify each sample by site and location.

Sample Codes:

WRL = Witmer Road Landfill
MW = Monitoring well
SS = Surface water
RB = Rinsate blank
TB = Trip blank
DUP = Duplicate
SWB = Source water blank.

For example, the ground-water sample from MW-1B will be labeled WRL-MW-1B. Quality control samples will be labeled by the type of sample followed by a sequential numerical identification. For example, the first trip blank will be named TB-01. In order to ensure blind laboratory analysis of duplicate samples from specific matrixes, "DUP" will replace the sample identification number. This will ensure that the laboratory cannot identify the location of the duplicate sample. For example, the first ground-water duplicate sample collected will be identified as DUP-01.

3.6 SAMPLE KITS AND HANDLING

Sample kits, which are coolers containing chain-of-custody forms, custody seals, sample containers (with preservatives), and packing material, are prepared by the laboratory. The chain-of-custody procedure begins with the preparation of sample containers and preservatives to be used in sample collection. Unless superseded by specific project requirements, the contracted laboratory purchases and distributes pre-cleaned sample containers. Vendors are required to provide documentation of analysis for each lot of containers, and the documentation is kept on file.

For the analyses specified for this project, Table 2 shows general guidelines for the type of sample container required, preservation techniques, and holding times for analytical samples collected. Preservatives will be added to the sample containers in the laboratory prior to shipment.

After the samples are collected, they are split as necessary among containers and preservatives appropriate to the parameters to be determined. Each container is provided with a sample label that is filled out at the time of collection. At this time, a chain-of-custody form is initiated. The collected samples are cooled, if necessary, and returned to the laboratory by the most expedient means to ensure that holding times will be met. The chain-of-custody form is signed and dated as necessary as the samples pass from the collectors to those persons responsible for their transportation.

3.7 SAMPLE DOCUMENTATION IN THE FIELD

Field personnel will be issued serialized weatherproof logbooks. Field personnel are responsible for recording all pertinent project information including, but not limited to, field work documentation; field instrumentation readings; calculations; calibration records; work plan distributions; photograph references; sample tag/label numbers; meeting information; and important times and dates of telephone conversations, correspondence, or deliverables. This field logbook will also contain an abbreviated version of notes listed in the team or individual field logbooks. The sample team or individual performing a particular sampling activity is required to maintain a field logbook that will be filled out at the location of sample collection immediately after sampling. It will contain sample particulars including sample number, sample collection time, sample location, sample descriptions, sampling methods used, daily weather conditions, field measurements, name of sampler, and other site-specific observations. The field logbook will also address deviations from this Plan or the Health and Safety Plan, including authorization obtained and the rationale for the deviation, visitor's names, or community contacts during sampling, and geologic and other site-specific information determined by field personnel as noteworthy. A sample log sheet will be filled out for each sample from the information recorded in the field logbook. In addition, field personnel will use appropriate forms applicable to field activities. These include boring logs, sampling data sheets, and calibration records.

3.8 DECONTAMINATION PROCEDURES

To minimize the potential for cross-contamination between sample locations, dedicated sampling equipment will be utilized. The procedure for decontaminating field measuring equipment, including stainless steel pumps, dippers, water quality measurement equipment, and water level/interface probes, is as follows:

- Wash with potable water and laboratory-grade detergent (e.g., Alconox® detergent)
- Rinse with potable water
- Rinse with deionized water
- Rinse with methanol
- Rinse with deionized water
- Air dry
- Wrap in aluminum foil if equipment will be stored.

The decontamination area will contain a wash solution collection system. The collected material will be contained in U.S. Department of Transportation-approved 55-gal drums.

3.9 SAMPLING-DERIVED WASTES

Waste materials generated during field investigation will include:

- Decontamination fluids
- Monitoring well purge water
- Used personal protective equipment.

These wastes will be contained, labeled, and handled in the following manner:

- All liquid and decontamination fluids will be collected and contained in U.S. Department of Transportation-approved 55-gal drums. Filled drums will be dated, labeled as "non-hazardous," and temporarily stored at an onsite staging area. Disposal options for the well development and purging fluids will be based on results of the analytical sampling program.

- All used personal protective equipment will be double-bagged and disposed offsite as general refuse.

Containerization of monitoring well purge water will continue until water quality has been established and documented. Future purge water containerization will be performed according to the established ground-water quality. If a monitoring well does not contain analytes or compounds in excess of applicable regulations, the purged water will be discharged to ground surface.

3.10 LOCATION SURVEYING

The new 8 monitoring well locations, and the designated surface water sampling locations were surveyed. At each monitoring well location, the ground surface elevation, along with the top of the metal casing and top of the inner polyvinyl chloride casing, was surveyed.

The surveyor marked the inner polyvinyl chloride casing with a black marker to designate the point on the casing that has been surveyed. This mark will act as a reference point during the well gauging events. Surveying was completed to provide as-built information for the landfill closure project and was performed by a State of New York Licensed Land Surveyor. A supplemental survey will be performed if, during monitoring sampling events or engineering inspections, a monitoring well is determined to be suspect (i.e., differential settlement, significant concrete cracking, and significant variations in water level readings).

3.11 RELIEF PIPE ABANDONMENT PROCEDURES

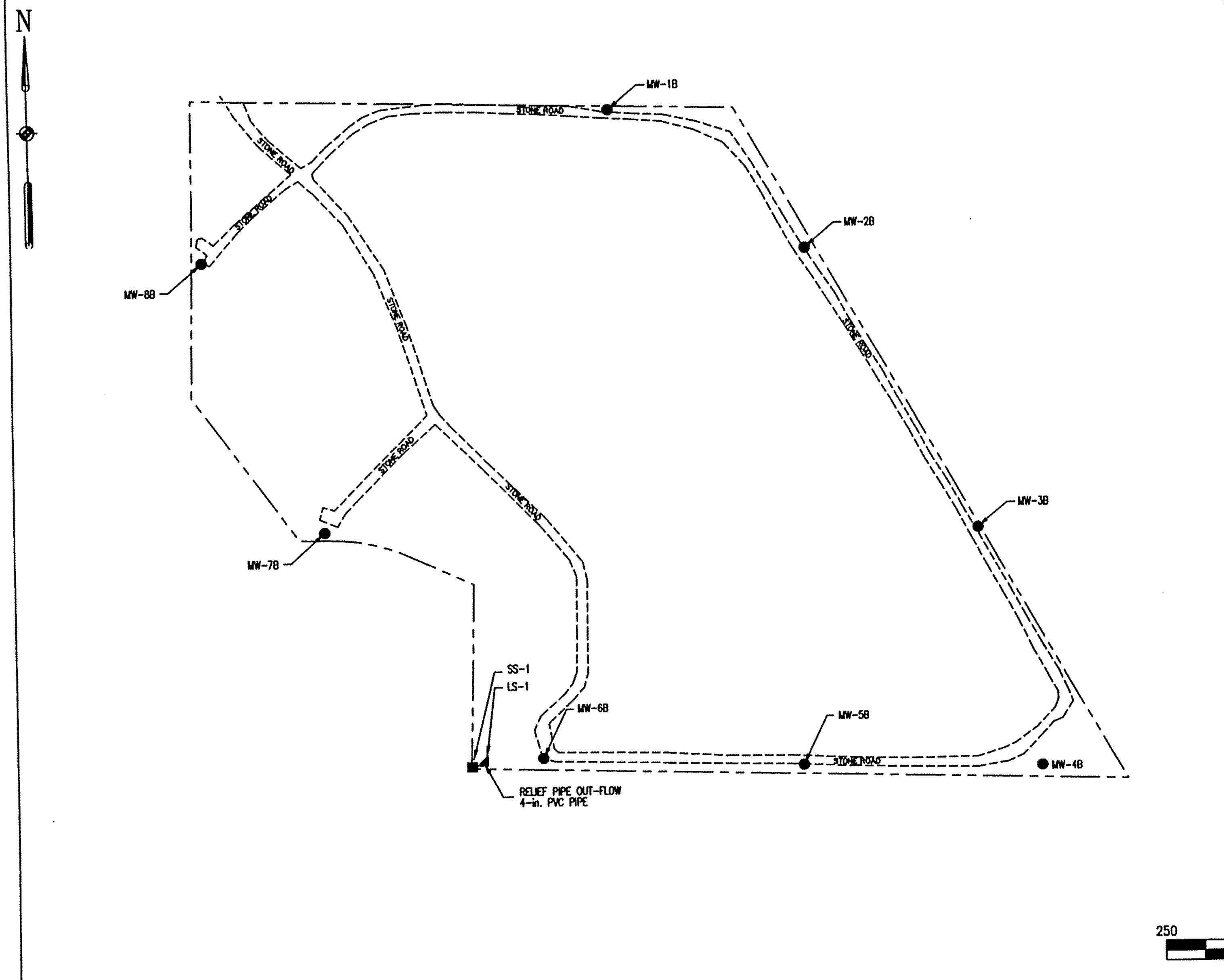
The relief pipe was installed to allow positive drainage of pore water pressure from under the cap. The discharge from the relief pipe is a temporary condition that should subside after closure, since precipitation is prevented from entering the waste via the cap system. After equilibrium has been achieved, the relief pipe will be filled with a concrete and bentonite mixture to effectively seal the conduit and prevent water from backflowing under the cap.

4. DATA REPORTING

The results of the two rounds of baseline parameter ground-water sampling and the subsequent quarterly site ground-water and surface monitoring will consist of the field data sheets, chain-of-custody forms, and the laboratory analysis results. Results will be sent to NYSDEC Division of Solid and Hazardous Materials Region 9 and The BOC Group. A New York State certified laboratory will be retained to analyze the ground-water and surface water samples. The laboratory will be determined prior to commencement of field activities associated with the fourth quarterly sampling event for 2000.

The results from the first two quarterly sampling events will be summarized in a letter report detailing the findings of the baseline sampling. This letter report will outline the revised parameter list recommended for future sampling events.

An annual report will be prepared that will summarize the analytical results and provide a discussion of the notable changes and trends in the ground-water and surface water quality that have occurred throughout the year. This annual report will also be sent to NYSDEC Division of Solid and Hazardous Materials Region 9.



LEGEND

- SS-1 ■ SURFACE WATER SAMPLING LOCATION
- LS-1 ◢ RELIEF PIPE SAMPLING LOCATION
- MW-2B ● MONITORING WELL SAMPLING LOCATION
- — - - — PROPERTY BOUNDARY

NOTE

1. SAMPLE LOCATIONS ARE APPROXIMATE.
2. BASE MAP GENERATED FROM WENDEL-DUCHSCHERER OCTOBER 2000 BASE MAP.
3. SECOND SURFACE WATER SAMPLING LOCATION TO BE DETERMINED ON A QUARTERLY BASIS AND DEPENDS ON AVAILABILITY AND LOCATION OF SURFACE WATER.

FILE: F:\INDUSTRIAL & OTHER\BOC GASES\1204068\RM REPORT\RM REPORT\POST CLOSURE O&M\FIG1-WQSL.DWG

EA ENGINEERING, SCIENCE, AND TECHNOLOGY	WITMER ROAD LANDFILL DESIGN-BUILD SITE CLOSURE NIAGARA FALLS, NEW YORK	FIGURE 1 WATER QUALITY SAMPLING LOCATION MAP	DESIGNED BY MJG	DRAWN BY JBS	DATE 03-21-00	PROJECT NO. 12040.68
			CHECKED BY PAP	PROJECT MGR. CEM	SCALE AS SHOWN	FIGURE 1

TABLE 1 SUMMARY OF ANALYTICAL METHODS, REPORTING LIMITS, AND STANDARDS FOR BASELINE PARAMETERS FOR GROUND-WATER SAMPLES COLLECTED AT WITMER ROAD LANDFILL, NIAGARA FALLS, NEW YORK

Parameter	Suggested Laboratory Method	Project Reporting Limit[a]	NYSDEC Ground-Water Standards for GA Classified Waters[b]
VOLATILE ORGANIC COMPOUNDS (μg/L)			
Acetone	8260B	5	50
Acrylonitrile	8260B	5	5
Benzene	8260B	1	1
Bromochloromethane	8260B	1	5
Bromodichloromethane	8260B	1	50
Bromoform	8260B	1	50
Carbon disulfide	8260B	1	---
Carbon tetrachloride	8260B	1	---
Chlorobenzene	8260B	1	5
Chloroethane	8260B	1	5
Chloroform	8260B	1	7
Dibromochloromethane	8260B	1	5
1,2-Dibromo-3-chloropropane	8260B	25	0.04
1,2-Dibromoethane	8260B	1	5
1,2-Dichloropropane	8260B	1	1
cis-1,3-Dichloropropene	8260B	1	<0.4[c]
trans-1,3-dichloropropene	8260B	1	<0.4[c]
0-Dichlorobenzene	8260B	1	3
p-Dichlorobenzene	8260B	1	3
trans-1,4-Dichloro-2-butene	8260B	5	5
1,1-Dichloroethane	8260B	1	5
1,2-Dichloroethane	8260B	1	0.6
1,1-Dichloroethene	8260B	1	5
1,2-Dichlorethene Total	8260B	1	5
1,2-Dichloropropene	8260B	1	1
Ethylbenzene	8260B	1	5
2-Hexanone	8260B	5	50
Iodomethane	8260B	5	5
Bromomethane	8260B	1	5
Chloromethane	8260B	1	---
Dibromomethane	8260B	1	5

(a) Project Reporting Limit is either the laboratory Reporting Limit or Method Detection Limit determined according to 40 CFR 136.
(b) NYSDEC standards for GA classified waters taken from NYCRR Title 6, Chapter X, Parts 700-705.
(c) This value represents the sum of *cis* and *trans* isomers.

NOTE: NYSDEC = New York State Department of Environmental Conservation.
Dashes (---) indicate no standards applicable.

Parameter	Suggested Laboratory Method	Project Reporting Limit[(a)]	NYSDEC Ground-Water Standards for GA Classified Waters[(b)]
VOLATILE ORGANIC COMPOUNDS (μg/L) (Continued)			
Dichloromethane	8260B	1	5
2-Butanone	8260B	5	---
Methyl isobutyl ketone	8260B	5	---
Styrene	8260B	1	5
1,1,1,2-Tetrachloroethane	8260B	1	5
1,1,2,2-Tetrachloroethane	8260B	1	5
Trichlorofluoromethane	8260B	1	5
Tetrachloroethene	8260B	1	5
Toluene	8260B	1	5
1,1,1, Trichloroethane	8260B	1	5
1,1,2 Trichloroethane	8260B	1	1
Trichloroethene	8260B	1	5
1,2,3-Trichloropropane	8260B	1	0.04
Vinyl acetate	8260B	1	---
Vinyl chloride	8260B	1	2
Xylenes	8260B	1	5
INORGANIC COMPOUNDS (μg/L)			
Aluminum	6010B	10	100
Antimony	6010B	3.4	3
Arsenic	6010B	2.6	25
Barium	6010B	20	1,000
Beryllium	6010B	3	3
Cadmium	6010B	0.4	5
Calcium	6010B	40	---
Chromium	6010B	0.5	50
Chromium (Hexavalent)	3500-CRB	0.4	50
Cobalt	6010B	70	---
Copper	6010B	60	200
Cyanide	4500-CNE	200	200
Iron	6010B	100	300
Lead	6010B	1.5	300
Magnesium	6010B	4	35,000
Manganese	6010B	40	300
Mercury	7470	0.2	0.7
Nickel	6010B	1.1	100
Potassium	6010B	40	---
Selenium	270.2	1.6	10
Silver	6010B	1.6	50
Sodium	6010B	8	20,000
Thallium	6010B	2.3	0.5
Vanadium	6010B	80	---
Zinc	6010B	20	2,000

Parameter	Suggested Laboratory Method	Project Reporting Limit[(a)]	NYSDEC Ground-Water Standards for GA Classified Waters[(b)]
LEACHATE INDICATORS			
Total Kjeldahl Nitrogen	LAC 107-06-2D	1.0	---
Ammonia	4500-NH3E	1.0	2,000
Nitrate	LAC 107-04-1	0.2	10,000
Chemical Oxygen Demand	HACH 8000	10	---
Biochemical Oxygen Demand	5210B	2.0	---
Total Organic Carbon	5310B	1.0	---
Total Dissolved Solids	160.1	2.0	---
Sulfate	375.4	5.0	250,000
Alkalinity	2320B	3.8	---
Phenols	LAC 210-00-1	0.01	1
Chloride	4500-CLB	5.0	250,000
Bromide	300	1.0	2,000
Total hardness as CaCO3	6010B	2.0	---
Color	110.1	2.5	---
Boron	6010B	50	1,000
FIELD PARAMETERS (μg/L)			
Eh	---	---	---
Dissolved Oxygen	---	---	---
Turbidity	---	---	---
pH[(d)]	150.1	2.0	6.5-8.5[(e)]
Specific Conductance	---	---	---

(d) pH to be measured in the field to determine stability of water quality. pH also to be tested by the laboratory for confirmation of field results.

(e) pH shall not be lower than 6.5 or the pH of the natural ground water, whichever is lower, nor shall be greater than 8.5 of the pH of the natural ground water, whichever is greater.

TABLE 2 SUMMARY OF SAMPLE CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES FOR GROUND-WATER SAMPLES COLLECTED AT WITMER ROAD LANDFILL, NIAGARA FALLS, NEW YORK

Suggested Laboratory Method	Sample Holding Time	Sample Preservation (cool to 4°C+/–2°C)	Type and Number of Containers[a]
Volatile Organic Compounds –			
Method 8260B	14 days	HCl	3, 40-ml glass
Inorganic Compounds –			
Method 6010B	6 months	HNO_3	1-L Plastic
Method 3500-CRB	24 hours	None	1-L Plastic
Method 4500-CNE	14 days	NaOH	1-L Plastic
Method 7470	28 days	HNO_3	1-L Plastic
Method 270.2	6 months	HNO_3	1-L Plastic
Leachate Indicators –			
Method LAC 107-06-2D	28 days	H_2SO_4	1-L Glass[b]
Method 4500-NH3E	28 days	H_2SO_4	1-L Glass[b]
Method LAC 107-04-1	28 days	H_2SO_4	1-L Glass[b]
Method HACH 8000	28 days	H_2SO_4	1-L Glass[b]
Method 5210B	48 hours	None	1-L Plastic
Method 5310B	28 days	H_2SO_4	2, 40-ml glass
Method 160.1	7 days	None	1-L Plastic
Method 375.4	28 days	None	1-L Plastic
Method 2320B	14 days	None	1-L Plastic
Method LAC 210-00-1	28 days	H_2SO_4	1-L Amber Glass
Method 4500-CLB	28 days	None	1-L Plastic
Method 300 (Br)	28 days	None	1-L Plastic
Method 200.7	6 months	HNO_3	1-L Plastic
Method 110.1	48 hours	None	1-L plastic
Additional Parameters –			
Method 9040	Immediate	None	Field Analysis
Method 9050	28 days	None	1-L Plastic
Method 410.1	28 days	H_2SO_4	1-L Glass[b]
Method 5310B	28 days	H_2SO_4	2, 40-ml glass

(a) All containers must have Teflon-lined lids.
(b) Multiple analysis can be completed utilizing (one) sample container.

Attachment A

Field Forms

A.1 Field Record of Well Gauging, Purging, and Sampling
A.2 Landfill Cap Inspection Checklist

Attachment A.1

Field Record of Well Gauging, Purging, and Sampling

EA Engineering, Science, and Technology

FIELD RECORD OF WELL GAUGING, PURGING, AND SAMPLING

Site Name: ____________ Project Number: ____________
Well ID: ____________ Well Lock Status: ____________
Well Condition: ____________ Weather: ____________

Gauge Date: ____________ Gauge Time: ____________
Sounding Method: ____________ Measurement Ref: ____________
Stick Up/Down (ft): Well Diameter (in.):

Purge Date: ____________ Purge Time: ____________
Purge Method: ____________ Field Personnel: ____________
Ambient Air VOCs (ppm): ____________ Well Mouth VOCs (ppm): ____________

WELL VOLUME

A. Well Depth (ft): ____________ D. Well Volume/ft (L): ____________
B. Depth to Water (ft): ____________ E. Well Volume (L) (C*D): ____________
C. Liquid Depth (ft) (A-B) ____________ F. Three Well Volumes (L) (E*3): ____________
G. Measurable LNAPL? Yes ________ /ft No ________

Parameter	Beginning	1	2	3	4	5
Time (min.)						
Depth to Water (ft)						
Purge Rate (gpm)						
Volume Purged (gal)						
PH						
Temperature (°C)						
Conductivity (μmhos/cm)						
Dissolved Oxygen (mg/L)						
Turbidity (NTU)						
eH (mV)						

Total Quantity of Water Removed (L): ____________
Samplers: ____________ Sampling Time (Start/End): ____________
Sampling Date: ____________ Decontamination Fluids Used: ____________
Sample Type: ____________ Sample Preservatives: ____________
Sample Bottle IDs: ____________
Sample Parameters: ____________

EA Engineering, Science, and Technology

FIELD RECORD OF WELL GAUGING, PURGING, AND SAMPLING (OVERFLOW PAGE)

Site Name: ____________ Project Number: ____________ Date: ____________

Well ID: Field Personnel:

Parameter	6	7	8	9	10	11
Time (min.)						
Depth to Water (ft)						
Purge Rate (gpm)						
Volume Purged (gal)						
pH						
Temperature (°C)						
Conductivity (μmhos/cm)						
Dissolved Oxygen (mg/L)						
Turbidity (NTU)						
eH (mV)						

Parameter	12	13	14	15	16	17
Time (min.)						
Depth to Water (ft)						
Purge Rate (gpm)						
Volume Purged (gal)						
pH						
Temperature (°C)						
Conductivity (μmhos/cm)						
Dissolved Oxygen (mg/L)						
Turbidity (NTU)						
eH (mV)						

Comments and Observations:

Attachment A.2

Landfill Cap Inspection Checklist

LANDFILL CAP INSPECTION CHECKLIST
WITMER ROAD LANDFILL, NIAGARA FALLS, NEW YORK

EA Personnel: ______________________________

Date: ______________________________

Weather: ______________________________

1. Inspection of ground surface for exposure of geotextile cover (cap erosion):

2. Inspection of ground surface for differential settlement resulting in soil cracking or ponded water:

3. Identification of stressed vegetation:

4. Identification of seeps, rooted vegetation (trees), and/or animal burrows:

5. Identification of deteriorating equipment (i.e., monitoring wells, fencing, or drainage structures):

6. Inspection of stormwater drainage swales for erosion, sloughing, or flow-through:

7. Inspection of east side of the landfill (Niagara Mohawk Power Corporation parcel) along the intermittent stream for the presence of erosion or sloughing:

8. Inspection of access roads:

Attachment B

Standard Operating Procedures for Low Flow and Sampling Method

ATTACHMENT B

STANDARD OPERATING PROCEDURES FOR LOW-FLOW AND SAMPLING METHOD

B.1 SCOPE OF APPLICATION

The purpose of this Standard Operating Procedure is to establish the protocol for collecting ground-water samples with minimum turbidity, and is also intended to be used in conjunction with the analyses for the most common types of ground-water contaminants (semivolatile organic compounds and inorganic compounds).

B.2 EQUIPMENT/MATERIALS

- Operations and Maintenance Plan.
- Well construction data and location map.
- Field logbook and Field Record of Well Gauging, Purging, and Sampling forms.
- Water level measuring device, 0.01 ft accuracy (electronic preferred) for monitoring water level during pumping operations.
- Pumps: adjustable rate, variable displacement submersible centrifugal pumps constructed of stainless steel and Teflon® or peristaltic pump.
- Tubing: Teflon or Teflon-lined polyethylene must be used to collect samples for organic analysis. For samples collected for inorganic analysis, Teflon or Teflon-lined polyethylene, polyvinyl chloride, Tygon, or polyethylene tubing may be used.
- Flow measurement supplies (e.g., graduated container and stopwatch).
- Power source (e.g., generator).
- Water quality indicator parameter monitoring instruments—pH, turbidity, specific conductances, temperature, oxidation-reduction potential, and dissolved oxygen. Water quality indicator parameters will be measured in the field in accordance with U.S. Environmental Protection Agency (EPA)-600/4-79-020 (1983) using the following methods: temperature (Method170.1), pH (Method 150.1), turbidity (Method 180.1), specific conductance (Method 120.1), and dissolved oxygen (Method 360.1).
- Decontamination supplies (for monitoring instruments).

- Sample bottles and sample preservation supplies (as required by the analytical method).
- Sample tags of labels.

B.3 PRELIMINARY ACTIVITIES

The following site activities are required prior to performing well purging and ground-water sampling. Field logbooks and sampling forms should be filled out as the procedure is being preformed, as noted:

- Enter the following information in the field logbook and sampling form, as appropriate: site name, project number, field personnel, well identification, weather conditions, date and time, equipment used, and quality assurance/quality control data for field instrumentation.
- Check well for damage or evidence of tampering; record pertinent observations in field logbook and on sample form.
- Lay out sheet of polyethylene for monitoring and sampling equipment.
- Unlock well and remove well cap (if applicable).
- If the well casing does not have a reference point (usually a v-cut or indelible mark in the well casing), make one.
- Measure and record the height of the protective casing above the concrete pad or ground surface, as appropriate. This reading is compared to that recorded during well installation as an indication of possible well damage or settling that may have occurred.
- Measure and record the depth to water (to 0.01 ft) in each well to be sampled before purging begins. Care should be taken to minimize disturbance of any particulate attached to the side or at the bottom of the well. The depth to well bottom should not be measured because of the potential to stir up sediment at the bottom of the well.

B.4 SAMPLING PROCEEDURE

The following general procedure will be followed to obtain representative ground-water samples. Field logbooks and sampling forms should be filled out as the procedure is being performed, as noted:

- Enter the following information in the field logbook and sampling form, as appropriate, prior to purging: purge date and time, purge method, and depth to water.

- Prepare the pump by checking electrical connections, discharge tubing, and motor. Locate the generator (if applicable) downwind of the well; connect the power converter to the generator.

- Connect the instrumentation header to the pump discharge and begin purging the well at 0.2-0.5 L/minute. Measure and record the water level and time with the pump in well before starting the pump. Continue pumping the well at 0.2-0.5 L/minute.

- Establish that the water level has not dropped significantly such that the pump is dry (bubbles in discharge) or water is heard cascading down the inside of the well. This may be accomplished by setting the sensor of the water level meter approximately 3-6 in. below the static water level and monitoring for a continuous audible alarm, which indicates the sensor is in water and the level has not dropped more than 6 in. Ideally, the pump rate should cause little or no water level drawdown in the well (>0.5 ft and the water level should stabilize). The water level should be monitored every 3-5 minutes (or as appropriate) during pumping. Care should be taken not to cause entrainment of air in the pump system. Record pumping rate adjustments and depths to water. Pumping rates should, if needed, be reduced to the minimum capabilities of the pump (e.g., 0.1-0.2 L/minute) to avoid pumping the well dry and/or to ensure stabilization of indicator parameters. The well will not be purged dry as this may affect analytical parameters.

- During purging of the well, monitor the water quality indicator parameters (turbidity, temperature, specific conductance, and pH) every 3-5 minutes. Record in the field logbook and on the Field Record of Well Gauging, Purging, and Sampling the pumping rate, drawdown, water quality indicator parameters values, and clock time at 3- to 5-minute intervals in the field logbook and sampling record. Purging of the standing well water is considered complete when three consecutive readings of the water quality indicator parameters agree within approximately 10 percent. Turbidity readings consistently below 10 nephelometric turbidity units (NTU) are considered to represent stabilization of discharge water for this parameter. If the parameters have stabilized, but the turbidity is not in the range of the 10 NTU goal, the pump flow rate should be decreased and measurement of the parameters should continue every 3-5 minutes. Measurements should be obtained using a flow-through cell.

- Reduce the pump flow rate to the lowest practical setting, usually about 0.1 L/minute. Remove the in-line sensor, if applicable. If the water discharged by the pump is silty, wait for the water to clear before sampling. Ensure that bubbles are not observed in the discharge tubing. Record pertinent observations in the field logbook and on sampling records.

- Begin filling sample containers from the pump discharge, allowing the water to fill the containers by allowing the pump discharge to flow gently down the inside of the container with as little agitation or aeration as possible. Collect the sample aliquots for the analytical parameter categories in the order below, as applicable:

  — Volatile organic compounds
  — Metals
  — All other analytes.

- Complete remaining portions of Field Record of Well Gauging, Purging, and Sampling Form after each well is sampled, including sample team members, sample date and time, total quantity of water removed, well sampling sequence and time of sample collection, types of sample bottles used, sample identification numbers, preservatives used, parameters requested for analysis, and field observations of sampling event.

Attachment C

Cost Estimates

COST ESTIMATE FOR CLOSURE AND POST-CLOSURE MONITORING AND FACILITY MAINTENANCE, WITMER ROAD LANDFILL, NIAGARA FALLS, NEW YORK

Item No.	Cost Categories and Items	Description	Unit Cost	Quantity	Total Cost
A. CAPITAL COSTS					
1	**Environmental Land Use Restriction**				
1.1	Land use restriction on Deed	Govern activities and use at site	$10,000	1	$10,000
	Subtotal				$10,000
1.2	Contingency			0%	$0
	Line Item Total				**$10,000**
2	**Landfill Closure**				
2.1	Pre-design Investigation, Permitting (12040.33)	Completed July 2000	$177,000	1	$177,000
2.2	Completion of Landfill Closure Plan, Final Approval (12040.65)	Completed May 2000	$182,235	1	$182,235
2.3	Closure Construction (12040.68)	Completed November 2000	$3,393,891	1	$3,393,891
2.3.1	VFPE Liner / Cap (12040.67)	Completed May 2000	$533,585	1	$533,585
2.4	Develop Database and Geographical Information System (% 12040.69)	Expected January 2001	$50,698	1	$50,698
2.5	DEC Oversight Charges	Oversight charges per Admin Order	$85,000	1	$85,000
2.6	Legal Fees	Philips, Lytle	$50,000	1	$50,000
	Line Item Total				**$4,472,409**
	Total Capital Costs				**$4,482,409**
B. OPERATION AND MAINTENANCE (O&M) COSTS					
3	**Quarterly Ground Water Monitoring (Years 1 - 5)**				
3.1	Sample collection - labor and equipment costs (% 12040.69)	Sample 8 locations 4 times per year	$2,500	4	$10,000
3.2	Analytical costs (% 12040.69)	Analyses of ground-water samples for COCs	$3,000	8	$24,000
3.3	Annual Misc Supplies (% 12040.69)	Gloves, PPE, rental equipment, drum disposal, etc.	$12,600	1	$12,600
3.4	Sampling preparation, mobilization, and demobilization (% 12040.69)	For each sampling event	$2,000	4	$8,000
3.5	Reports	Quarterly Summary Report of lab data	$10,000	4	$40,000
3.6	Quarterly Inspections and Mowing (% 12040.69)		$5,550	4	$22,200
3.7	DEC Oversight Fees	Annual Estimate	$2,500	1	$2,500
3.8	Financial Assurance Mechanism	Trust Agreement	$2,000	1	$2,000
	Annual O&M Costs (Years 1-5)				**$121,300**
4	**Annual Ground Water Monitoring (Years 6 - 30)**				
4.1	Sample collection - labor and equipment costs	Sample 8 locations once a year	$2,500	1	$2,500
4.2	Analytical costs	Analyses of soil samples for COCs	$750	8	$6,000
4.3	Annual Misc Supplies	Gloves, PPE, etc.	$3,500	1	$3,500
4.4	Sampling preparation, mobilization, and demobilization	For each sampling event	$2,500	1	$2,500
4.5	Reports	Annual Summary Report of lab data	$10,000	1	$10,000
4.6	Annual Inspections and Mowing		$5,550	1	$5,550
4.7	DEC Oversight Fees	Annual Estimate	$2,500	1	$2,500
4.8	Financial Assurance Mechanism	Trust Agreement	$2,000	1	$2,000
	Annual O&M Costs (Years 6-30)				**$34,550**
4	**Five-Year Review Meeting**				
4.1	Meetings	Meet once at the end of the 5-year period	$3,000	1	$3,000
4.2	Travel	Travel to the meeting site	$750	1	$750
4.3	Reports	Summary of data and site status	$15,000	1	$15,000
4.4	DEC Oversight Fees		$1,000	1	$1,000
	5-Year Review Costs				**$19,750**
C. COST SUMMARY					
	Capital Costs		$4,482,409		
	30-Year Present Worth of O&M= at 6% with 2% inflation		$1,057,576		
	30-Year Present Worth Costs		**$5,539,985**		

Appendix B

Electronic Field Construction Data (CD-ROM)

B.1 Borrow Source Quality Assurance/Quality Control Documentation

- B.1.1 Bedding Layer Quality Assurance/Quality Control Documentation
- B.1.2 Barrier Protection Layer Quality Assurance/Quality Control Documentation
- B.1.3 Impermeable Clay Layer Quality Assurance/Quality Control Documentation
- B.1.4 Compaction Results for the Bedding, Barrier Protection, and Clay Layers
- B.1.5 Topsoil Layer Quality Assurance/Quality Control Documentation
- B.1.6 Chemical Analysis for the Bedding, Barrier Protection, and Clay Layers
- B.1.7 Miscellaneous Stone Quality Assurance/Quality Control Documentation

B.2 Geosynthetic Material Documentation

- B.2.1 Subgrade Acceptance Forms
- B.2.2 Linear Low Density Polyethylene Liner Installation Documentation
- B.2.3 Linear Low Density Polyethylene Quality Assurance/Quality Control Documentation
- B.2.4 Geocomposite Drainage Layer Quality Assurance/Quality Control Documentation
- B.2.5 Miscellaneous Geotextile Documentation

B.3 Monitoring Well Construction Diagrams

B.4 Air Quality Monitoring Data and Graphs

B.5 Resident Engineers Documentation

- B.5.1 Daily Quality Control Reports
- B.5.2 Field Notes

B.6 Photographic Documentation