MALCOLM PIRNIE

8-51-014

OLD BATH LANDFILL
POST-CLOSURE MONITORING AND MAINTENANCE
OPERATIONS MANUAL

STEUBEN COUNTY DEPARTMENT OF PUBLIC WORKS
BATH, NEW YORK

REVISED OCTOBER 1997
JULY 1997

MALCOLM PIRNIE, INC.

P. O. Box 1938
Buffalo, New York 14219

1318-156-400/SCBOM

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.
ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

November 11, 1997

Mr. Jeffrey A. Konsella, P.E.
NY State Dept. of Environmental Conservation
Bureau of Western Remedial Action
Division of Environmental Remediation
50 Wolf Road
Albany, New York 12233-7010

Re: Old Bath Landfill Post-Closure Monitoring and Maintenance Operations Manual

Dear Mr. Konsella:

Enclosed is one copy of the final Old Bath Landfill Post-Closure Monitoring and Maintenance Operations Manual (O&M Manual) which has been revised to address changes requested by the NYSDEC in the October 2, 1997 NYSDEC comment letter and comments received from Steuben County on July 25, 1997. To assist the NYSDEC with the review of the revised O&M Manual, each comment has been reiterated followed by our response:

NYSDEC COMMENTS:

Comment 1: *Section 2.3: Please rename this section. We suggest changing "Responsible Parties" to "Site Contacts" to avoid any confusion.*

Response: As requested, the name of Section 2.3 has been changed to "Site Contacts."

Comment 2: *Section 5.0: Inspection reports, semi-annual reports, and annual Monitoring and Maintenance reports should be sent to ...*

Response: The first sentence of Section 5.1 has been revised to read, "All specified monitoring data (see the Old Bath Landfill Monitoring Plan included in Appendix E) will be submitted to the site contacts listed in Section 2.3..."

The first sentence of Section 5.2 has been revised to read, "An Annual Monitoring and Maintenance Summary Report, which will include the following, will be prepared and submitted to the site contacts listed in Section 2.3..."

In addition, Section 7.0 of the Old Bath Landfill Monitoring Plan (Appendix E) has been revised to indicate that the Semi-Annual and Annual Reports are to be sent to the NYSDEC and NYSDOH site contacts (listed in a new Section 7.3).

Comment 3: *Section 5.4: Please change all references to 1991 ASP to the updated 1995 ASP protocols.*

Response: References to the 1991 ASP protocols in the O&M Manual and the Old Bath Landfill Monitoring Plan (Appendix E) have been changed to the updated 1995 ASP protocols.

Comment 4: *General: Please include provisions for notification of the New York State Department of Health (DOH) within 14 days if the sampling results indicate exceedances of NYS drinking water standards. DOH staff will also coordinate with the County or its consultants to provide homeowners with the results of residential sampling.*

Response: The following paragraph has been added to the end of Section 5.1 of the O&M Manual: "In addition, the County will notify the NYSDOH of any results which indicate exceedances of NYS Drinking Water Standards within 14 days of receipt of validated analytical results. The NYSDOH will coordinate with the County to provide homeowners with the results of the residential well sampling."

In addition, Section 7.1.3 (NYSDOH Notification) has been added to the Old Bath Landfill Monitoring Plan (Appendix E): "The County will notify the NYSDOH of any results which indicate exceedances of NYS Drinking Water Standards within 14 days of receipt of validated analytical results. The NYSDOH will coordinate with the County to provide homeowners with a copy of the residential well sampling results."

STEUBEN COUNTY COMMENTS:

Comment 5: *Revise Figure 1-1 to show the Steuben County Leachate Treatment Facility site.*

Response: Figure 1-1 has been revised.

Comment 6: *Revise Section 2.1, DEED NOTICE, to indicate that the County has already filed a deed restriction with the County Clerk for the Bath Landfill Site.*

Response: Section 2.1 has been revised as requested.

Comment 7: *Revise the directions to the Ira Davenport Memorial Hospital to reflect that the hospital is on the left side of Route 54 and one must turn left into the hospital driveway and not right.*

Response: Step 5 of the directions to the hospital have been revised to read, "Ira Davenport Memorial Hospital is located approximately six (6) miles northeast of the Village of Bath on the left hand side of Route 54. Turn left into the driveway and follow signs to the Emergency Room."

The above-referenced changes should address all of the comments received from the NYSDEC and Steuben County. If you have any questions or need additional information, please contact us.

Very truly yours,

MALCOLM PIRNIE, INC.

Kent R. McManus, P.E.
Senior Associate

Enclosure
c: R. Dunn, Steuben County DPW
G. Rider, NYSDEC
M. J. Peachey, NYSDEC - Region 8
R. Tuers, NYSDOH
File: CC

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STEUBEN COUNTY DEPARTMENT OF PUBLIC WORKS
BATH, NEW YORK

REVISED OCTOBER 1997
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STEUBEN COUNTY OLD BATH LANDFILL
POST-CLOSURE MONITORING AND MAINTENANCE OPERATIONS

TABLE OF CONTENTS

MALCOLM PIRNIE

TABLE OF CONTENTS (continued)

LIST OF FIGURES

TABLE OF CONTENTS (continued)

LIST OF APPENDICES

MALCOLM PIRNIE

1.0 INTRODUCTION

1.1 GENERAL

The New York State Department of Environmental Conservation (NYSDEC) has determined that the Old Bath Landfill (the site) is an inactive hazardous waste site, as defined in ECL Section 27-130(2). Consequently, the site has been listed in the Registry of Inactive Hazardous Waste Disposal Sites in New York as Site Number 851014. The NYSDEC has classified the site as a classification "2" site pursuant to ECL Section 27-1305 (4)(b). As a result of the classification, Steuben County entered into an Order on Consent with the NYSDEC to remediate the Old Bath Landfill in exchange for funding under the 1986 Environmental Quality Bond Act (EQBA). The requirements of the Order on Consent included performance of a Remedial Investigation/Feasibility Study (RI/FS) and the design/-implementation of an Interim Remedial Measures (IRM) Program. The RI/FS has been completed and a Record of Decision (ROD) (NYSDEC, March 1995) has been issued for the site. The ROD states that no further remedial action beyond the following IRMs were required:

- Construction of a Leachate Treatment Plant (LTP).
- Installation of a retrofit leachate collection system.
- Enhancements to the existing landfill cover system.
- Remediation of the on-site sedimentation basin.

The Order on Consent and the ROD also requires preparation and implementation of a Post-Closure Montioring and Maintenance Plan.

1.2 BACKGROUND

1.2.1 Site Location and History

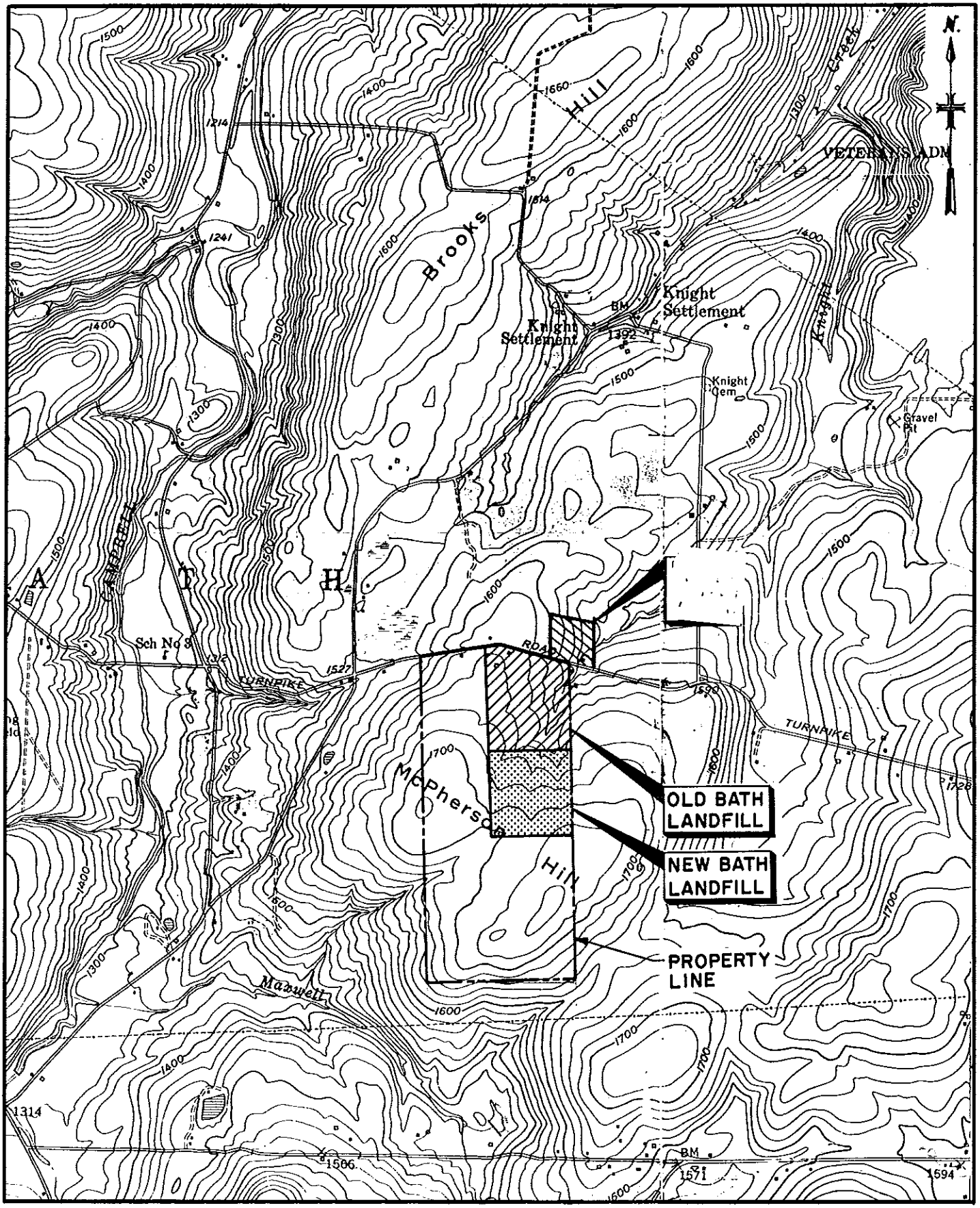
The Old Bath Landfill is approximately 28 acres in size and located on a 145-acre parcel of land three miles southwest of the Village of Bath, New York as shown on Figure 1-1.

Operation of the Old Bath Landfill began during 1978. The landfill was used by the Steuben County Highway Department for the disposal of both municipal and industrial wastes until its closure in November 1988. A 22-acre landfill expansion (New Bath Landfill) is presently operating on the south side of the Old Bath Landfill under a NYSDEC 6NYCRR Part 360 permit issued November 1988. Previous subsurface investigations (H&A, 1988) and quarterly groundwater quality monitoring results showed that the overburden and shallow bedrock groundwater contained volatile organic compounds and elevated metal concentrations.

An RI/FS Scoping Document was prepared and submitted to the NYSDEC in March 1991. The NYSDEC issued a comment letter on the Scoping Document on May 20, 1991. The Scoping Document was subsequently revised and presented in the RI/FS Work Plan in June 1991. On August 6, 1991 the NYSDEC presented comments to the Work Plan and in October 1991 a revised Final Work Plan was issued addressing the NYSDEC comments (Malcolm Pirnie, 1991).

Concurrent with the RI/FS work activities, IRM investigation activities were also completed. IRM design activities are ongoing. IRM investigation activities included installing piezometers, collecting and analyzing leachate samples, evaluating leachate treatability, and evaluating cover system performance. IRM design activities included designing cover system enhancements, designing a leachate collection/removal system, designing a leachate treatment system and effluent pipeline, and designing sedimentation basin excavation. Construction of the sedimentation basin improvements and the treated effluent pipeline have been completed and the construction of the leachate treatment system is currently underway. The design of the cover system enhancements and the leachate collection/removal system are nearly completed and construction will begin in 1996. IRM

FIGURE 1--1



MALCOLM PIRNIE

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OLD BATH LANDFILL
INTERIM REMEDIAL MEASURES
LOCATION OF OLD BATH LANDFILL

STEUBEN COUNTY
DEPT. OF PUBLIC WORKS

MARCH 1996

work activities are being performed in accordance with the approved Old Bath Landfill Interim Remedial Measures (IRM) Concept Design Report (Malcolm Pirnie, revised February 1994) and the Old Bath Landfill Interim Remedial Measures Leachate Treatability Work Plan (Malcolm Pirnie, May 1992).

The RI preliminary site characterization survey and the installation of the IRM piezometers began in January 1991. Results of the preliminary surveys were presented in the Preliminary Site Characterization Report (Malcolm Pirnie, March 1992). Leachate treatability study results are presented in the Old Bath Landfill Treatability Study and Design Report (Malcolm Pirnie, February 1993) and the Old Bath Landfill Treatability and Design Report Supplement (Malcolm Pirnie, December 1993). Remedial Investigation (RI) results were presented in the RI Report (Malcolm Pirnie, September 1993). The NYSDEC presented comments to the RI Report on November 23, 1993. A revised RI Report was issued in January 1994 addressing the NYSDEC comments. The RI Report identified organic and inorganic constituents in the leachate, sedimentation basin sediments, and surface water. In addition, organic constituents were detected in the overburden and upper bedrock groundwater.

A Supplemental RI was subsequently conducted to further characterize site groundwater conditions, specifically in the deep bedrock zone directly beneath the landfill. The investigation included installing a shallow (65 feet) and deep (131.5 feet) bedrock well couplet, sampling the new wells, and measuring water levels in all site wells and piezometers. These data are presented in the Old Bath Landfill Supplemental Remedial Investigation Report (Malcolm Pirnie, April 1994).

Potential remedial alternatives for the Old Bath Landfill site were identified, screened, and evaluated in a three-phase feasibility study. Based on the results of the RI/FS, the selected remedial alternative included:

- Implementation of the Interim Remedial Measures Program described in detail in Section 1.2.2.
- Development and implementation of long-term land use restrictions at the site.

- Providing periodic maintenance and repairs to the cover system, as necessary.
- Providing continued operation and maintenance of the LTP and treated effluent pipeline.
- Providing comprehensive long-term monitoring of nearby residential wells, groundwater, and surface water to evaluate the effectiveness of the IRM.
- Providing further actions to ensure continued protection of nearby residential wells.

1.2.2 Interim Remedial Measures (IRM) Program Activity

The IRM program included design and construction of leachate collection/removal, leachate pretreatment, and final cover systems. Each of these systems is described below.

1.2.2.1 Leachate Collection/Removal System

A perimeter leachate collection/removal system has been installed to remove leachate and minimize the potential for leachate breakouts. The leachate collection system is composed of perforated pipes installed along the perimeter of the landfill. Collected leachate flows via double-walled pipe to the new leachate treatment facility (LTF).

1.2.2.2 Leachate Treatment Facility (LTF)

Leachate treatability studies were conducted to evaluate leachate treatment and disposal options. Leachate treatability results were presented in the Steuben County - Old Bath Landfill Treatability Study and Design Report (Malcolm Pirnie, February 1993) and the Steuben County - Old Bath Landfill Leachate Treatability Study and Design Report Supplement (Malcolm Pirnie, December 1993). The studies included treatability testing and technical and cost evaluations of on-site and off-site treatment alternatives and management options.

The studies concluded that leachate pretreatment with final treatment at the Village of Bath Publicly-Owned Treatment Works (POTW) was the most cost-effective leachate management approach. Construction of the LTF was completed and made operational in

August 1996. Operations and maintenance requirements for the LTF are covered in the Steuben County Leachate Treatment Facility Operations and Maintenance Manual (Malcolm Pirnie, Inc., May 1997).

1.2.2.3 Final Cover System

Installation of the final cover system involved preparing landfill subgrades, constructing a gas venting system, constructing cover soil enhancements, and upgrading the existing storm water management system.

1.2.2.3.1 Subgrade Preparation

Landfill subgrades were prepared through grading portions of the existing cover and placing excavated soil and waste/fill material from the construction of the gas venting system and leachate collection/removal system.

1.2.2.3.2 Gas Venting System

Gas vents were installed within the final cover system to minimize human health hazards and to prevent cracks in the cover. The vents were keyed into a system of gas migration control trenches extending through the cover and connecting to the leachate collection system. These trenches provide a pathway for methane and carbon monoxide gases to vent to the atmosphere. The trenches also provide a pathway for perched leachate and condensate to migrate to the leachate collection system.

1.2.2.3.3 Final Cover System

A final cover system has been be installed to minimize infiltration of precipitation. The existing cover system was in areas with inadequate cover or topsoil thicknesses and/or documented leachate breakouts. A new 6NYCRR Part 360 final cover was constructed over the areas of the landfill heavily disturbed as a result of leachate collection and/or gas venting system construction activities.

1.2.2.3.4 Storm Water Management

The construction of the enhanced final cover system increased overland drainage through grading, diversion structures (berms and swales), cover soil management, seeding, and drainage facilities. The installed storm water management system including the sedimentation basin, drainage ditches, and culverts were designed to handle a 25-year, 24-hour storm.

1.2.2.4 Sedimentation Basin Excavation

The remediation of the on-site sedimentation basin was completed during the Summer of 1995. The remedial effort included removal of accumulated sediment with subsequent dewatering for use as daily cover on the New Bath Landfill. The sedimentation basin will serve to intercept storm water and as a result, will continue to accumulate solids. Thus, it is necessary to periodically dredge the basin to remove accumulated sediment and maintain the volume available for storm water collection.

1.3 GENERAL SITE CONDITIONS

1.3.1 Site Topography and Hydrology

The Old Bath Landfill site is located within the Allegheny Plateau physiographic province. There is significant topographic relief in this region; the highest elevation is 2,400 feet above mean sea level, and the lowest is 714 feet above mean sea level at Keuka Lake.

Major topographic features in the area are glacially derived landforms. These features include: stream valleys that are between 300 and 600 feet deep; two major river valleys each approximately one mile wide; and the Valley Heads moraine system located in the northwest corner of the County. Also present in the County are end moraines, till plains, glacial outwash deposits, and other types of glacial deposits.

The site is located near the top of McPherson Hill with the ground surface elevation ranging from 1,740 feet in the south to 1,550 feet in the northwest corner of the site and generally sloping to the northeast. The topography immediately adjacent to the site (within

one mile) drops off dramatically to the west, east, northeast, south and southwest to less than 1,300 feet above mean sea level.

The Old Bath Landfill site is located within the Susquehanna River Drainage Basin. The site is drained by two creeks adjacent to the property. Knight Creek drains the northeastern portion of the site, while the southern portion of the site drains into Campbell Creek via Maxwell Creek. Both Campbell Creek and Knight Creek drain into the Cohocton River.

1.3.2 Site Geology/Hydrogeology

The Preliminary Site Characterization, RI, and Supplemental RI characterized subsurface conditions at the site as a glaciated upland area sloping to the northeast. The subsurface materials in descending stratigraphic order include:

- Existing cover soils.
- Waste/fill consisting of paper, glass, plastic, cover material, etc. (within the limits of the landfill).
- Topsoil described as a silty loam derived from the underlying glacial till (outside the limits of the landfill).
- Basal till consisting of silt, clay, sand, gravel and boulders.
- Glaciolacustrine sediments consisting of stratified silt and clay (northeast section of site).
- Sandstone, siltstone and shale of the Wiscoy Sandstone (locally referred to as limestone).

The saturated units identified at the site included the waste/fill, overburden, and bedrock. The waste/fill and overburden are considered a single unit for the purpose of developing a site water balance. The characteristics of the bedrock groundwater system are similar throughout the investigated intervals (upper and deep) and are also categorized as a single unit. In general, the site hydrogeology is characterized as a typical groundwater recharge area with the potential for flow being essentially vertically downward to regional groundwater flow systems.

The conceptual site water balance predicted that groundwater flow is essentially vertically downward, and leakage through the existing landfill cover system and waste/fill layer is minimal. Under existing site conditions, there appears to be a very minor component of downward leachate leakage into the underlying bedrock (primarily in areas where the glacial till overburden is absent and waste/fill lies directly on top of bedrock), with a majority of the leachate migrating horizontally within the more permeable fill and daily cover soils. The relatively low permeability of the bedrock minimizes the potential for vertical migration. Groundwater quality data collected during RI and Supplemental RI sampling and monitoring events confirmed the conceptual site water balance. The installation of the leachate collection/removal system and enhancement of the existing cover system further reduced the potential for significant leakage into the upper bedrock zone.

1.4 PURPOSE

The purpose of this Post-Closure Monitoring and Maintenance Operations Manual (hereafter Operations Manual) is to provide information needed to effectively maintain and monitor the Old Bath Landfill site (i.e., final cover system, leachate collection system, gas venting system, storm water management system and sedimentation basin) for the duration of the post-closure period. Operations and maintenance requirements for the LTF are presented in the Steuben County Leachate Treatment Facility Operations and Maintenance Manual (May 1997).

2.0 POST-CLOSURE ACTIVITIES

2.1 DEED NOTICE

Steuben County has filed a deed restriction with the County Clerk for the Bath Landfill Site. The deed indicates the period of time during which the property was used as a landfill, briefly describing the types and amounts of wastes contained within it and noting that records of the facility have been filed with the NYSDEC. The deed also includes a map which clearly indicates the limits of the landfilled waste within the property boundary and indicates that transfer of, construction on or any change in use of the property requires prior NYSDEC approval.

2.2 FUTURE USE OF THE SITE

Steuben County has no immediate plans for future use of the property. Any future use, however, shall not disturb the integrity of the final cover, the function of the groundwater wells, the leachate collection, or the gas monitoring systems. Any potential threats to human health or the environment will be evaluated in proposed future uses of the property, and the use will be subject to approval by the NYSDEC.

2.3 SITE CONTACTS

Post-closure monitoring and maintenance and corrective measure concerns during the post-closure period are the responsibility of the Steuben County Department of Public Works. The contact person within the County is:

Commissioner of Public Works
Steuben County Department of Public Works
3 East Pulteney Square
Bath, New York 14810
(607) 776-9631

The NYSDEC should be contacted at the following address for information regarding regulatory issues or requirements:

Mr. Gerald J. Rider
Chief, O&M Section
Division of Environmental Remediation
NYSDEC
50 Wolf Road
Albany, New York 12233-7010
(518) 457-0927

Ms. Mary Jane Peachey
Regional Hazardous Waste Engineer
NYSDEC
6274 East Avon-Lima Road
Avon, New York 14414
(716) 226-2466

Mr. Richard E. Tuers
Bureau of Environmental Exposure Investigation
NYSDOH
2 University Place
Albany, New York 12203-3399

2.4 INSPECTION AND MAINTENANCE

2.4.1 Site Inspections

Steuben County will be responsible for site inspection and maintenance. The inspections will be performed by persons experienced in landfill construction. The site will be inspected a minimum of four (4) times per year and after major rainfall events throughout the entire post-closure period. The results of the inspections shall be submitted to the NYSDEC along with the Annual Monitoring and Maintenance Summary Report. The landfill site will be inspected for:

- Visible debris, litter and waste as a result of illegal dumping activities.
- Loss of vegetative cover or growth of undesirable species, such as trees or brush.

- Integrity of drainage ditches including:
  - Sediment buildup,
  - Pooling or ponding, and
  - Slope integrity.
- Integrity of the on-site sedimentation basin including sediment buildup and slope integrity.
- Integrity of gas venting system and make observations of potential gas migration problems as evidenced by stressed vegetation spots or odors.
- Condition of access roads and gates.
- Integrity of leachate collection system and cleanout pipes and manholes. Make observations from top of manholes to determine whether leachate is flowing through pipes.
- Integrity of landfill cap including erosion or settling of cap material and/or leachate breakthroughs.
- Integrity of the TCE Area groundwater collection system and cleanout pipes and manholes. Make observations from the top of the manhole to determine whether groundwater is flowing through pipes.

A sample post-closure site inspection form is included in Appendix A.

2.4.2 Cover Maintenance

Cover maintenance will be performed as necessary by the County over the post-closure care period. Any signs of erosion or other site maintenance problems detected during routine site inspections will be corrected as soon as possible. All eroded areas will be brought back to original grade according to the procedures originally used to construct the final cover. All bare spots in the final cover will be reseeded and fertilized as necessary. Seed and fertilizer will be of the same general type and quality as originally specified and included as Appendix B. Vegetative growth will be mowed at least twice a year (with the first mowing after the grass has gone to seed and the second mowing in the fall) to prevent the development of deep-rooted vegetation. Any plant species (trees/brush) will be removed if their presence is suspected to deteriorate the integrity of the final cover.

The need for cover repairs due to subsidence and/or settling will be determined each time the site is inspected. Areas of subsidence will be repaired to ensure that the integrity of the final cover is maintained. These repair actions may include, but will not be limited to:

- Stripping and stockpiling topsoil and barrier protection layer material from the affected area.
- Regrading the affected area in accordance with the original grading plan.
- Repairing the 40-mil textured LLDPE geomembrane liner in accordance with the specifications in Appendix C and the manufacturer's manufacturing and installation QC/QA manual in Appendix D.
- Using clay or a bentonite-soil admixture, fill any cracks or depressions and re-establish the recompacted low permeability soil layer to a minimum thickness of eighteen inches at a maximum permeability of 1×10^{-7} cm/s.
- Replacing the topsoil and barrier protection layer material and revegetating the affected area in accordance with the specifications in Appendix B.

2.4.3 Maintenance of Site Structures

Maintenance of structures for surface water control, gas control, leachate collection, and site access control will also be performed by the County as necessary over the 30-year post-closure period. Benchmarks used during construction will be maintained throughout the post-closure period.

All eroded areas in the drainage ditches will be repaired and regraded. Reseeding will be carried out using the recommended seed mixture given in Appendix B. Sediment build-up in the road side ditches will be removed if it restricts flow in the ditch. Any other areas in the ditches where the cross-section or slope has been altered to the extent that flow does not occur as desired will be reworked and regraded as necessary.

The access roads to the landfill site will be maintained in good condition so that routine inspections and required maintenance activities can be carried out. Gates will be kept in good repair to prevent unauthorized access onto the landfill site.

Each of the manholes incorporated in the leachate and groundwater collection systems will be inspected on a quarterly basis (a visual inspection from the ground surface) to check for blockages in the lines. If the collection pipe appears to be plugged, the cleanouts will be utilized to flush the lines. If serious blockages exist which cannot be cleaned from the surface, a sewer cleaner will be utilized. As part of routine maintenance on the collection system, each section of collection pipe will be flushed on an annual basis by County personnel to ensure a properly functioning system. Gas vents which may become damaged will be repaired or rebuilt to restore them to original design configuration.

Sediment build-up will be removed from the on-site storm water sedimentation basin if the sediment depth exceeds one foot. Additionally, all areas of the storm water sedimentation basin will be repaired and the sedimentation basin outfall structure will be maintained to assure flow from the basin.

No personnel shall enter leachate or groundwater collection system manholes without instituting proper health and safety procedures as required by:

1. Safety and Health Regulations, 29 CFR Part 1926 and all subsequent amendments as promulgated by the U.S. Department of Labor, June 24, 1974 and 29 CFR Part 1910, General Industry Safety and Health Regulations.

2. Department of Labor Safety and Health Regulations for construction promulgated under the Occupational Safety and Health Act (OSHA) of 1970 (PS-19-596) and under Section 107 of the Contract Work Hours and Safety Standards Act (PS-91-54).

The secondary containment pipe for the leachate main leading to the leachate treatment plant will be monitored for leakage on a quarterly basis through inspections of the secondary containment pipe where the pipe enters the leachate treatment plant. If leakage is detected, corrective actions will be taken as soon as possible.

2.5 ENVIRONMENTAL MONITORING

Post-closure environmental monitoring will be performed at the Old Bath Landfill site to monitor the effectiveness of the site remedial measures. Post-closure monitoring

requirements such as sample locations, sample collection procedures, analytical parameters, analytical methods, and monitoring frequency are detailed in the Old Bath Landfill Montioring Plan included in Appendix E.

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3.0 CONTINGENCY PLAN

3.1 GENERAL

The objective of this contingency plan is to establish procedures for handling events which occur outside the scope of the routine maintenance.

Natural occurrences such as storms, drought and subsidence should be considered "expected occurrences" and are addressed under the routine maintenance program. Certain problems which cannot be reasonably expected to occur, such as earthquakes, are not addressed in this contingency plan.

The following problems are examples of occurrences which are not expected to occur, but may be discovered during a routine post-closure inspection:

- Degradation of the cap integrity which may be a result of or indicated by the following:
  - Waste/contaminated soil protruding through the cover system.
  - Soil erosion or other drainage problems.
  - Uncontrolled burrowing by pests.
- Accumulation of sediment in the sedimentation basin.
- Vegetative cover missing despite repeated efforts at revegetation.

The following guidelines are offered to determine when the contingency plan should be implemented and to determine possible corrective actions when responding to a contingency. All corrective actions, where appropriate, will be executed in a timely fashion after notifying the appropriate regulatory agencies.

3.2 EMERGENCY PHONE NUMBERS

The following telephone numbers should be used in the event of an emergency:

Ira Davenport Memorial Hospital	(607) 776-2141
Fire Department	(607) 776-2180

Ambulance	(607) 776-2141
Police	(607) 776-2175

Emergency Coordinator:

Rich Dunn - Assistant Commissioner, Landfills (607) 776-9631

Office: Steuben County DPW
3 East Pulteney Square
Bath, New York 14810

The site location is: Bath Landfill
Turnpike Road (East of Rte. 15)
Bath, New York

3.3 EMERGENCY PROCEDURES AND EVACUATION ROUTE

County employees, local fire, police, emergency response teams, hospitals, contractors who may be working at the site will be informed of the site location, facility layout, and potential site safety hazards. In case of an emergency, all employees will meet at the Scale House and await further instruction. Directions to the hospital are as follows:

1) From the Site, turn left onto Turnpike Road and proceed to Route 15.

2) Turn right (north) onto Route 15 and proceed north to Route 415.

3) Turn right onto Liberty Street (Route 415/54) and follow signs to Route 54.

4) Proceed on Route 54 (heading northeasterly toward Hammondsport).

5) Ira Davenport Memorial Hospital is located approximately six (6) miles northeast of the Village of Bath on the left hand side of Route 54. Turn left into the driveway and follow signs to the Emergency Room.

Note: The hospital does not have a street address.

3.4 LEACHATE BREAK OUT REPAIR PROCEDURE

Leachate breakouts through the landfill cover system will be discovered during regularly scheduled site inspections. Should such a breakout occur, the damage will be repaired as quickly as possible. Repairs will be made with materials and methods as specified in previous sections of this Plan. Areas where leachate breakouts have occurred will receive additional cover material which shall be compacted and overlaid with topsoil for vegetative growth. Any cover system materials saturated with leachate shall be excavated and replaced.

If Steuben County believes a substantial threat of water pollution exists as a result of leachate draining from the site, Steuben County will prepare a work plan, for submittal to and approval by NYSDEC, to determine appropriate response efforts including:

- Whether leachate should be contained and treated in the on-site Leachate Treatment Facility.
- Whether leachate should be collected and transported to an off-site treatment facility.
- Actions to control, minimize or eliminate the conditions which are contributing to leachate production.

3.5 FIRE

If practical, any fires at the site will be extinguished using landfill equipment by covering the area with soil. If the fire is too widespread or of such a nature that landfill equipment is inappropriate, it will be immediately reported to the local fire department. Fires will be quenched according to approved fire department protocol. Damage to the gas vents, surface drainage system, or cap will be repaired where these systems have been compromised.

3.6 VANDALISM

Vandalism will be reported to the local law enforcement authorities. If vandals have gained entry to the disposal site, appropriate measures will be taken to eliminate or restrict future access. Vandalism to site structures including gas and leachate collection, groundwater monitoring and surfacing water management systems will be repaired as appropriate on a case specific basis. Damage to the cap caused by off-road vehicles will be repaired where the damage is determined to have compromised the integrity of the cap or the function of the surface drainage system.

3.7 SEVERE EROSION AND COMPROMISE OF COVER SYSTEM INTEGRITY

Severe erosion of the disposal area cap, as well as the storm water management system will be repaired to original specifications. The cause of severe erosion will be investigated and remedial measures, if needed, will be developed and implemented accordingly.

3.8 UNAUTHORIZED DUMPING OR DISPOSAL

Unauthorized dumping or waste disposal will be reported to the New York State Department of Environmental Conservation (NYSDEC), and local law enforcement officials. Appropriate measures will be taken to determine the waste characteristics, containment requirements and the necessary removal techniques. The waste will be removed and disposed of at an approved disposal facility. Efforts will be taken to eliminate further dumping and to restrict subsequent entry to the site. Persons found in the act of illegal dumping will be prosecuted according to the law and will be held responsible for all costs incurred in removing the waste.

3.9 LEAKAGE IN SECONDARY CONTAINMENT PIPING

In the event that liquid is discovered in the secondary containment piping of the leachate removal system, Steuben County will immediately initiate corrective measures.

The County will first determine the nature of the liquid (i.e., leachate or ground/surface water). If the liquid proves to be leachate, the suspect piping section will be located, isolated, and immediately repaired in accordance with the original project specifications. Should the liquid not be leachate, the source of the water will be determined and appropriate measures will be taken to mitigate the problem.

3.10 VECTORS

During regularly scheduled site inspections the presence of any vector problems will be identified. Vectors include but are not limited to rodents, insects and birds. If a vector problem is present a remediation program will be implemented to mitigate the problem.

3.11 AIR CONTAMINATION

Methane gas venting to the atmosphere should not present a risk to human health due to the rural nature and the relative lack of human population adjacent to the landfill.

Should it be suspected that methane gas generation may be presenting an explosion or human health hazard, Steuben County will notify the NYSDEC. If it is determined that such a hazard is present, a work plan will be developed, for submission to and approval by the NYSDEC, to determine if the venting system is functioning properly and to determine the appropriate response actions. Possible response actions include replacing portions of the venting system, adding new vents, or installing an active gas withdrawal system. Any proposed remedial actions would be approved through the NYSDEC prior to implementation.

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4.0 HEALTH AND SAFETY PLAN

The full Health and Safety Plan (HASP) for the Old Bath Landfill is presented as Appendix F. It addresses those site-specific hazards which at the time of this post-closure monitoring plan development, may potentially be encountered while performing the post-closure maintenance and monitoring tasks described herein. Neither Steuben County nor Malcolm Pirnie accept responsibility for the Health and Safety of any individuals other than their own employees. Site representatives, contractors, and any other persons performing work at the site shall be required to provide their own site-specific HASP covering their employees and subcontractors.

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5.0 RECORDKEEPING AND REPORTING REQUIREMENTS

5.1 SEMI-ANNUAL REPORTING

All specified monitoring data (see the Old Bath Landfill Monitoring Plan included in Appendix E) will be submitted to the site contacts listed in Section 2.3 on a semi-annual basis approximately 60 days after completion of sampling activities unless otherwise agreed to with the NYSDEC. This information will be accompanied by a brief cover letter from the County which summarizes the enclosed data, describes the reporting period and notifies the State of any problems/corrective measures taken. The letter will be signed by an authorized representative of the County.

In addition, the County will notify the NYSDOH of any results which indicate exceedances of NYS Drinking Water Standards within 14 days of receipt of validated analytical results. NYSDOH staff will coordinate with the County to provide homeowners with the results of residential well sampling.

5.2 ANNUAL REPORTING

An Annual Monitoring and Maintenance Summary Report, which will include the following, will be prepared and submitted to the site contacts listed in Section 2.3:

- Results of post-closure site inspections.
- A discussion of site maintenance activities.
- A summary of groundwater elevations measurements. These results will be tabulated and used to prepare groundwater isopotential contour maps.
- A summary of semi-annual monitoring results including contraventions of New York State Water Quality Standards.
- A discussion of sample analytical results, including elevations of parameters above background concentrations, and a discussion of the results of statistical analyses discussed in the Old Bath Landfill Monitoring Plan (Appendix E).

- A discussion of changes in leachate or water quality that has occurred throughout the year.
- Any proposed changes to the Old Bath Landfill Monitoring Plan.

5.3 CLOSURE/POST-CLOSURE REGISTRATION REPORT

The County will register with the NYSDEC, on a form prescribed by the NYSDEC, upon final closure of the site. The registration report will include the following information:

- The facility's name and address.
- The County's name, address and telephone number and the name address and telephone number of the person who will be responsible for closure and post-closure of the landfill.
- A certification that the facility complies with all closure and post-closure criteria and corrective measures report criteria contained in this Closure Construction Maintenance Plan.
- Any other information which the NYSDEC determines to be necessary to protect the public health and welfare and the environment or natural resources.

This registration report will be renewed every five years until the department determines that the post-closure monitoring and maintenance period for the facility has ended. The registration is transferable to another party only upon prior written approval of the department and a demonstration that the prospective transferee will be able to comply with all applicable laws, regulations and requirements to which the site is subject.

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6.0 REFERENCES

1. Malcolm Pirnie, Inc., February 1994, ***Old Bath Landfill, Interim Remedial Measures (IRM), Concept Design,*** Steuben County, New York.

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APPENDIX A

POST-CLOSURE INSPECTION REPORT

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SAMPLE FORM

STEUBEN COUNTY
OLD BATH LANDFILL

POST-CLOSURE INSPECTION REPORT

DATE:_____
WEATHER:_____
PERSONNEL:_____

Instructions: Complete the checklist of visual evaluation items and then complete specific data items. Field measurements should be made with a cloth tape, provided instrumentation on equipment or other suitable means. Estimated measurements shall be so noted. Attach hand sketches or photographs to further define conditions or problems.

	CONDITION (Check)				
I. VISUAL EVALUATION ITEMS	Acceptable	Not Acceptable	Not Present	Present	Remarks
1. Vegetative Cover					
a. Within Landfill Disposal Area					
b. Around Landfill Perimeter					
2. Integrity of Roadside Drainage Ditches					
a. Sediment Build-up					
b. Pooling or Ponding					
c. Slope Integrity					
d. Overall Adequacy					
3. Integrity of Gas Vents					
4. General Condition of Site					
a. Road Condition					
b. Gates/Locks					
c. Grass Height					
5. Integrity of Groundwater Monitoring Wells					
6. Integrity of Gas Monitoring Wells					
7. Integrity of Landfill Cap					
a. Erosion Damage					
b. Leachate Breakthrough					
c. Settlement					
d. Cracking					
8. Leachate Collection System					
a. Manhole Integrity					

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SAMPLE FORM (continued)

II. SPECIFIC DATA ITEMS (Write N.A. if not applicable)

A. Erosion and Settlement (Include a description of problem location):

1. Approximate size in feet of cap eroded area(s). (List separately)
   a. ___ feet by ___ feet
   b. ___ feet by ___ feet
   c. ___ feet by ___ feet

2. How deep is the most extreme point of erosion when measured from the adjacent surface. (List separately)
   a. ___ feet
   b. ___ feet
   c. ___ feet

3. Approximate size in feet of eroded areas outside the soil cap area such as drainage ditches, roads or slopes.

4. Attach a hand sketch or photograph showing the location of the eroded area(s). Identify each area by using the letter a, b, c, etc. from Question 1.

5. Approximate size in feet of leachate breakouts. (List separately).
   a. ___ feet by ___ feet
   b. ___ feet by ___ feet
   c. ___ feet by ___ feet

6. Approximate size in feet of any settlement areas within the soil cap area. (List separately).
   a. ___ feet by ___ feet
   b. ___ feet by ___ feet
   c. ___ feet by ___ feet

7. Approximate depth of each settlement area when measured from the adjacent surface (List separately).
   a. ___ feet
   b. ___ feet
   c. ___ feet

8. Attach a hand sketch or photograph showing the location of the settlement area(s). Identify each area by using the letter a, b, or c, etc. from Question 6.

B. Corrective Actions:

1. Describe corrective actions taken (write NA if not appropriate).

2. Date of corrective action: _____

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APPENDIX B

LANDSCAPING SPECIFICATIONS

- Section 02921, Topsoil
- Section 02930, Turf

SECTION 02921

TOPSOIL

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install topsoil Work.
   2. The types of topsoil Work required include the following:
      a. Topsoil stockpiled for reuse under Section 02220, Excavation and Backfill.
      b. Topsoil from off-site sources.
      c. Topsoil testing to provide certified acceptability of topsoil for landscape Work.
      d. Topsoil amendments, as may be required by test results to provide topsoil acceptable for landscape Work.
      e. Spreading topsoil.
      f. Maintenance Work.

B. Coordination:
   1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the topsoil.

C. Related Sections:
   1. Section 02220, Excavation and Backfill.
   2. Section 02224, Final Cover Construction.
   3. Section 02930, Turf.

1.2 QUALITY ASSURANCE

A. Source Quality Control:
   1. Off-Site Topsoil: Obtain topsoil only from naturally well-drained sites; do not obtain from bogs or marshes.
   2. Topsoil Stockpiled for Reuse: Topsoil will be inspected by ENGINEER before reuse. At the time of inspection ENGINEER shall require representative soil samples to be tested as specified under Part 2 - Products, of this Section. The CONTRACTOR will not be permitted to use the topsoil for construction until after QA testing has been completed and approved by the ENGINEER. The CONTRACTOR shall pay for the cost of laboratory testing.

B. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified:
   1. ASTM C 602, Agricultural Liming Materials.
   2. ASTM D 2487, Classifications of Soils for Engineering Purposes.
   3. Association of Official Analytical Chemists, Official Methods of Analysis.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval the following:
   1. Before delivery of off-site topsoil, written statement giving the location of the properties from which the topsoil is to be obtained, the names and address of the suppliers, the depth to be stripped and the crops grown during the past 2 years.
   2. Manufacturer's specifications and application instructions for all soil amendments required.

B. Certificates: Submit for approval certificates of inspection as may be required by governmental authorities to accompany shipments, and manufacturer's or vendors certified analysis for soil amendments. For standard products submit other data substantiating that materials comply with specified requirements.

1.4 JOB CONDITIONS

A. Environmental Requirements: Do not spread topsoil if condition is unsuitable due to frost, excessive moisture or other conditions. Cease Work until the topsoil is in a suitable condition as determined by ENGINEER.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Topsoil:
   1. Fertile, friable, natural loam, surface soil, capable of sustaining vigorous plant growth, free of any clods of hard earth, plants or roots, sticks or other extraneous material harmful to plant growth. Supply topsoil with the following analysis:
      a. 3-inch mesh: 100 passing by weight
         1-inch mesh: 100 percent passing by weight
         #4 sieve: 90 to 100 percent passing by weight
         #200 sieve: 0 - 10 percent passing by weight
      b. Clay content of material passing #200 sieve not greater than 60 percent, as determined by hydrometer tests.
      c. pH 5.0 to pH 6.5. If approved by ENGINEER, natural topsoil not having the hydrogen-ion value specified may be amended by CONTRACTOR as his own expense.
      d. Organic content not less than 5 percent, as determined by ignition loss.
      e. Free of pests and pest larvae.
   2. Before delivery, assist the ENGINEER in collecting soil samples for every 5,000 cubic yards of Grade A topsoil provided by CONTRACTOR.

B. Soil Amendments:
   1. Lime: Natural limestone containing not less than 85 percent of total carbonates, ground so that not less than 90 percent passes a 10-mesh sieve and not less than 50 percent passes a 100-mesh sieve.
   2. Ferrous Sulfate: Commercial grade and unadulterated.

PART 3 - EXECUTION

3.1 INSPECTION

A. CONTRACTOR and his installer shall examine the subgrade, verify the elevations, observe the conditions under which Work is to be performed, and notify ENGINEER of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 PREPARATION

A. Remove existing grass, vegetation and turf. Dispose of such material outside of OWNER'S property in a legal manner; do not turn over into soil being prepared for topsoiling.

B. Loosen subgrade of areas to receive topsoil to a minimum depth of 2 inches by discing, harrowing or other approved method to permit bonding of the topsoil to the subgrade. Operate the equipment used to scarify the subsoil so the ridges and depressions are parallel to the contours.

C. Remove stones over 2 inches in any dimension and sticks, roots, rubbish and other extraneous matter.

3.3 INSTALLATION

A. Place and spread topsoil, over the areas shown, to a minimum depth of 6 inches and a maximum depth of 7 inches after natural settlement and light rolling, in a manner that the completed work conforms to the lines and grades shown.

B. Do not spread topsoil while in a frozen condition or when moisture content is so great that excessive compaction will occur nor when so dry that dust will form in the air or that clods will not break readily.

C. Do not compact topsoil.

D. After the topsoil is spread, remove all large, stiff clods, rocks, roots or other foreign matter over 2-inches.

E. Apply soil amendments, as required by machine over all areas receiving topsoil, to bring the soil to a neutral pH. Work lightly into the top 3 inches of topsoil.

F. Manipulate topsoil to attain a properly drained surface.

G. Grade topsoil areas to smooth, even surface with loose, uniform, fine texture.

H. Roll and rake and remove ridges and fill all depressions, ruts, low spots or unsuitable areas which result after settlement so that the area is suitable for subsequent work.

3.4 THICKNESS VERIFICATION

A. Topographic surveys will be performed by a licensed land surveyor to verify the thickness of each topsoil layer using the same grid system and requirements specified in Sections 01050, 01025, 01720, and 02250.

B. Minimum thickness of each topsoil layer shall be 0.5 feet and maximum shall be 0.6 feet as measured perpendicular to the slope. Placement of material in excess of the maximum thickness shall be at no extra cost to the OWNER.

3.5 MAINTENANCE

A. Maintain topsoiled areas by filling in erosion channels and correcting drainage as required.

B. Maintain the topsoil in a loose, friable condition until the Work under other Sections begins.

3.6 CLEAN UP AND PROTECTION

A. During topsoiling Work, store materials and equipment where directed. Keep pavements clean and areas in an orderly condition.

B. Protection includes all temporary fences, barriers and signs and other Work incidental to proper protection.

3.7 INSPECTION AND ACCEPTANCE

A. When the topsoiling Work is completed, including maintenance, ENGINEER will make an inspection to determine acceptability.

B. Where inspected topsoil Work does not comply with the requirements, regrade rejected Work and maintain until reinspected by ENGINEER and found to be acceptable.

+ + END OF SECTION + +

SECTION 02930

TURF

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install turf Work.
   2. The types of turf Work required include the following.
      a. Seeding all areas within project boundaries (the entire Old Bath Landfill and all other areas disturbed by construction activities).
      b. Erosion control fabric.
      c. Soil amendments.
      d. Mulch.
      e. Replant unsatisfactory or damaged turf.
      f. Guarantees.
      g. Maintenance for one (1) year from date of acceptance.

B. Related Sections:
   1. Section 02250, Final Cover Construction.
   2. Section 02921, Topsoil.

1.2 QUALITY ASSURANCE

A. Landscape Subcontractor Qualifications: If a Subcontractor is utilized, he shall have a minimum of five years of experience of producing substantially similar Work and shall show evidence of at least five satisfactory installations. Provide adequate supervision by a qualified foreman.

B. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified:
   1. Association of Official Analytical Chemists, Official Methods of Analysis.
   2. American Joint Committee on Horticultural Nomenclature, Standardized Plant Names.
   3. ASTM D 977, Emulsified Asphalt.
   4. ASTM C 602, Agricultural Liming Materials.
   5. ASTM D 2487, Classification of Soils for Engineering Purposes.
   6. FSO-F-241D, Fertilizer, Mixed, Commercial.
   7. FSO-P-166E, Peat Moss; Peat, Humus; and Peat, Reed-sedge.
   8. Official Seed Analysists of North America, Standards of Quality.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval the following:
   1. Planting schedule for turf installation showing, scheduled planting dates for each type of turf.
   2. Manufacturer's specifications and installation instructions for all materials required.

B. Samples: Submit for approval 12-inch by 12-inch sheet of erosion control fabric with manufacturers selections of standard biograde-able filler papers, and yarns.

C. Certificates: Submit for approval the following:
   1. Certificates of inspection as may be required by governmental authorities to accompany shipments, and manufacturer's or vendors certified analysis for soil admendments and fertilizer materials. For standard products submit other data substantiating that materials comply with specified requirements.
   2. Certificates from seed vendors for each seed mixture required, stating botanical and common name, percentage by weight and percentages of purity, germination, and weed seed for each species.
   3. The CONTRACTOR shall provide a written certification for each separate source of soil material provided stating that the material does not originate from any NYSDEC listed inactive hazardous waste disposal site and that the soil material contains no known or suspected soil contaminants. Provide certification prior to transporting any material to the project site.

D. Operation and Maintenance Data: Submit for approval typewritten instructions recommending procedures to be established by OWNER for the maintenance of turf for one full year. Submit prior to expiration of required maintenance period.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials:
   1. Do not deliver seed until site conditions are ready for planting.
   2. Deliver packaged materials in containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery.
   3. Furnish seed in sealed, standard containers.
   4. Notify ENGINEER of delivery schedule in advance so turf material may be inspected upon arrival at job site.
   5. Remove unacceptable material immediately from job site.

B. Storage of Materials:
   1. Store and cover materials to prevent deterioration. Remove packaged materials which have become wet or show deterioration or water marks from the project site.

2. Seed that is wet or moldy or that has been otherwise damaged in transit or storage is not acceptable. Replace at no further cost to OWNER.

1.5 JOB CONDITIONS

A. Environmental Requirements:
   1. Proceed with and complete the turf Work as rapidly as portions of the site become available, working within the seasonal limitations for each type of turf required.
   2. Do not spread seed when wind velocity exceeds 5 miles per hour.
   3. Do not plant turf when drought, or excessive moisture, or other unsatisfactory conditions prevail.

1.6 ALTERNATIVES

A. Do not make substitutions. If specified turf material is not obtainable, submit to ENGINEER proof of non-availability and proposal for use of equivalent material.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Grass Materials:
   1. Grass Seed Mixture: Provide fresh, clean, new-crop seed complying with the tolerance for purity and germination established by the Official Seed Analysts of North America. Provide seed of the grass species, proportions and minimum percentages of purity, germination, and maximum percentage of weed seed, as specified.
   2. The entire surface of the landfill (including drainage ditches) shall be seeded with 100 lbs/acre of seed conforming to the following:

Name of Grass	Application Rate	Purity	Germination
Perennial Ryegrass	10 lbs/acre	95%	85%
Kentucky Bluegrass	20 lbs/acre	85%	75%
Strong Creeping Red Fescue	20 lbs/acre	95%	80%
Chewings Fescue	20 lbs/acre	95%	80%
Hard Fescue	20 lbs/acre	95%	80%
White Clover	10 lbs/acre	98%	75%

   a. Germination and purity percentages should equal or exceed the minimum seed standards listed. If it is necessary to use seed with a germination percentage less than the minimum recommended above, increase the seeding rate accordingly to compensate for the lower germinations.
   b. Weed seed content not over 0.25 percent and free of noxious weeds.

c. All seed shall be rejected if the label lists any of the following grasses:
   1) Timothy.
   2) Orchard.
   3) Sheep Fescue.
   4) Meadow Fescue.
   5) Canada Blue.
   6) Alta Fescue.
   7) Kentucky 31 Fescue.
   8) Bent Grass.

3. The following species (in addition to the mix to be spread over the entire landfill surface) shall be sowed specifically in the drainage ditches to minimize ditch erosion.

Name of Grass	Application Rate	Purity	Germination
Tall Fescue (Kentucky 32)	20 lbs/acre	95%	80%
Creeping Red Fescue	20 lbs/acre	95%	80%
Red Top	4 lbs/acre	92%	80%
Empire Birdsfoot Trefoil	8 lbs/acre	98%	80%
Garrison Creeping Foxtail	10 lbs/acre	85%	75%
	62 lbs/acre		

   a. Germination and purity percentages should equal or exceed minimum seed standards listed.

4. In addition to the seed mixtures listed above, one bushel per acre of oats or rye seed shall be sowed over the entire area, including drainage ditches, to provide a quick shade cover and to prevent erosion during turf establishment.

B. Fertilizers:
   1. Commercial Fertilizer: Complete fertilizer of neutral character, with a minimum of 75 percent nitrogen derived from natural organic sources or ureaform; 40-50 percent of the nitrogen shall be water soluble. Available phosphoric acid derived from superphosphate, bone, or tankage. Potash derived from muriate of potash, containing 60 percent potash. Uniform in composition, freeflowing and suitable for application with approved equipment. Provide fertilizer with the following percentages of available plant nutrients:
      a. Not less than 4 percent phosphoric acid and not less than 2 percent potassium, and the percentage of nitrogen required to provide not less than 0.7 pounds of actual nitrogen per 1000 square feet of lawn area. Provide nitrogen in a form that will be available to the lawn during the initial period of growth.
   2. Hydroseeding (Starter) Fertilizer:
      a. Commercial designation of 18-24-6. Provide a complete fertilizer of neutral character with a minimum of 75 percent nitrogen derived from natural organic sources.
      b. Minimum 40-50 percent of nitrogen shall be water soluble.

c. Uniform in composition, free-flowing, and suitable for application with approved equipment.
d. Product and Manufacturer: Provde one of the following:
1) Scotts Starter Fertilier by Scott and Sons Incorporated.
2) Or approved equal.

C. Mulch:
1. Anti-Erosion Mulch: Provide clean, threshed straw of wheat, rye, oats or barley, free from noxious weeds. Materials which are low grade and unfit for farm use such as "U.S. Sample Grade" are acceptable.
2. Wood Cellulose Fiber Pulp (Hydromulch):
a. Provide specially prepared wood cellulose fiber, processed to contain no growth or germination inhibiting factors, and dyed an appropriate color to facilitate visual metering of application of the materials.
b. Supply in packages having a gross weight not in excess of 60 pounds.
c. Moisture content not to exceed 10 percent air dry weight, manufactured so that after addition and agitation in slurry tank the fibers become uniformly suspended to form a homogeneous slurry that when hydraulically sprayed on the ground the material will form a blotter like ground cover impregnated uniformly with seed and which after application allows the absorbtion of moisture, either rainfall or mechanical watering, to percolate to the underlying soil.
d. Product and Manufacturer: Provide one of the following:
1) Conwed Virgin Wood Fiber Mulch by Conwed Incorporated.
2) Silva Fiber by Weyerhaeuser Company.
3) Or approved equal.

D. Mulch Adhesives/Tackifiers:
1. Straw Mulch Adhesive:
a. Provide a mulch adhesive for all areas and slopes mulched with straw to control excessive effects of high winds, heat and torrential rain. The adhesive, when mixed with water, will form a slurry which is non-toxic to plants, grass and other living organisms when applied in accordance with manufacturer recommendations.
b. Apply mulch adhesive as a tackifier when sprayed simultaneously through straw blowers or as an overspray after straw application.
c. Products: Provide one of the following:
1) Emulsified Asphalt
a) Supply a homogenous material which shows no separation of asphalt after thorough mixing. Provide the slow-setting variety for fine graded aggregate mixer, conforming to ASTM D 977, Grade SS-1.
2) Agro Tack MP by Agro-Dynamics, Inc.
3) Or approved equal.

2. Hydromulch Adhesive (Tackifier):
   a. On areas and slopes graded between 1:3 and 1:5 provide 8.25 pounds of adhesive per 1000 square yards of seedbed incorporated into the hydroseed slurry.
   b. Provide the following:
      1) A non-ionic galatomannan polysaccharide that forms a colloidal dispersion. Once adhesive film is formed and has been allowed to dry or cure, its resistance to solubility increases. Adhesive film shall be biodegradable, so that it eventually is broken down by water and/or by microbial action.
      2) Color: Off-white with orange specks dispersed throughout.
      3) Viscosity: 3000 CPS +/- 500 1 percent Sol. 25 degrees C 24 hours. Brookfield Viscometer #3 Spindle, 20 rpm.
      4) pH: 6 to 7.

E. Erosion Control Fabric: On areas and slopes graded between 1:3 and 1:5 provide erosion control fabric fabricated from 840 denier polypropylene yarn interwoven with paper strips. Provide hold down staples 6-inches long by 1-inch wide at the throat. Provide a complete selection of manufacturers standard biodegradable filler papers and yarns. Areas will be seeded before placement of erosion control fabrics.

F. Water: Potable.

PART 3 - EXECUTION

3.1 INSPECTION

A. CONTRACTOR and his installer shall examine the topsoil, verify the elevations, and depth of topsoil, observe the conditions under which Work is to be performed, and notify ENGINEER of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 SOIL PREPARATION

A. Apply commercial fertilizers in the following quantities:
   1. For grass apply only at a rate sufficient to supply 0.7 pounds of nitrogen per 1000 square feet (300 pounds per acre). For 10-20-10 use 7 pounds per 1000 square feet.

B. Apply commercial fertilizers within 10 days of seeding.

C. Thoroughly and evenly incorporate commercial fertilizers with the soil to depth of 3 inches by discing, or other approved method.
   1. In areas inaccessible to power equipment, use hand tools.
   2. Adjacent to existing trees, adjust depth to avoid disturbing roots.

D. Grade turf bed areas to smooth, even surface with loose, uniformly fine texture. Remove all stones and extraneous foreign material in excess of 3-inches in diameter. Roll and rake and remove ridges and fill depressions, as required to meet finish grades. Limit fine grading to areas which can be seeded immediately after grading.

E. Moisten prepared turf bed areas before seeding, if soil is dry. Water thoroughly and allow surface moisture to dry before seeding. Do not create a muddy soil condition.

F. Restore turf bed areas to specified condition if eroded or otherwise disturbed after fine grading and prior to seeding.

3.3 INSTALLATION

A. General: Maintain grade stakes until removal is mutually agreed upon by all parties concerned.

B. Seeding By Dry Method:
   1. Sow seed using a spreader or seeding machine.
   2. Distribute seed evenly over entire area by sowing equal quantity in 2 directions at right angles to each other.
   3. Sow not less than the quantity of seed specified.
   4. Cultipacker, or approved similar equipment, may be used to cover the seed and to firm the seedbed in one operation. In areas inaccessible to cultipacker:
      a. Rake the seed lightly into top 1/8 inch of soil, roll in two directions with a water ballast roller, weighing not less than 100 pounds per linear foot.
      b. Take care during raking that seed is not raked from one spot to another.
   5. Sow quick shade cover (oats or rye) using similar equipment and procedures specified above. All conservation seed and cover seed must be in contact with soil to germinate.
   6. Protect seeded areas against erosion by spreading specified straw mulch after completion of seeding operations.
      a. For slopes no greater than 1:5 spread anti-erosion mulch to form a continuous blanket not less than 1-1/2-inch loose measurement over seeded areas. Provide mulch with a partial coating of emulsified asphalt or adhesive. Place mulch using either of the following methods:
         1) Anchor straw mulch by spraying with asphalt or adhesive emulsion at the rate of 10 to 13 gallons per 1000 square feet.
         2) Place straw mulch with equipment that will blow or eject, by means of a constant air stream, controlled quantities of the mulch and asphalt/adhesive in a uniform pattern over the specified area. If the straw mulch is excessively cut or broken take measures to reduce the cutting or breakage to a limit approved by ENGINEER. Introduce the asphalt/adhesive into the air stream by means of a spray arranged so that it will partially coat the straw mulch with a spotty asphalt/ adhesive tack prior to the

depositing of the mulch covering. Rate of application for asphalt adhesive shall not be less than 75 gallons per ton of mulch. The application rate for other synthetic adhesives shall be in accordance with manufacturer's recommendations.

b. For slopes graded between 1:3 and 1:5 install erosion control fabric as follows:
   1) Vertically down slope without stretching fabric.
   2) Install hold down staples 3 per square yard minimum in center of fabric or as required to hold and shape the fabric to the contours of the slope. Install hold down staples along edges and overlaps of fabric at 9 inches on centers minimum, or as required to hold and shape the fabric to the contours of the slope.
   3) Lap fabric 4 inches minimum and turn edges of fabric into 8 inch deep by 16 inch wide earth trench and fill trench with earth.

7. Do not leave seeded areas unmulched for longer than 3 days. Reseed areas which remain without mulch for longer than 3 days.
8. The straw mulch blanket should contain void spaces such that 10 to 25 percent of the covered turf bed should be visible.
9. Prevent damage or staining of construction or other plantings adjacent to mulched areas.
10. Prevent foot or vehicular traffic, or the movement of equipment, over the mulched area. Reseed areas damaged as a result of such activity.
11. Water seeded and mulched areas thoroughly with a fine spray.

C. Seeding By Hydroseed Method:
1. Prepare seedbed as described for turfbed under 3.2 above.
2. Hydraulic seeding equipment shall arrive on the site empty and clean. Use hydraulic equipment with a power-driven built-in paddle agitation system with an operating capacity sufficient to agitate, suspend and homogenously mix the following slurry:
   a. 3000 gallons of water.
   b. Add sufficient amounts of the final seed mixture and quick shade cover to the slurry to satisfy the application rates specified in Section 2K, Paragraph 2.1.A.
   c. 3 - 44-lb. bags of 18-24-6 starter fertilizer.
   d. 21 - 60-lb. bags wood fiber pulp (1800 pounds per acre).
   e. 6 - 15-lb. bags tackifier (adhesive).
   f. Depending on installation conditions encountered, as specified, add an approved hydromulch adhesive.
3. Immediately before seeding, rework the seedbed areas until they provide a finely pulverized smooth seedbed, varying not more than 1/2-inch in ten feet. All inequities and soft spots shall be corrected before seeding.
4. With water filling the tank and equipment power at 1/3 to full throttle, begin agitation and load fertilizer, seed and mulch in that order.
5. When tank is half full, add tackifier (adhesive), pouring sowly into tank into the area of most agitation.
6. Continue to fill with water until all components are loaded.

7. Spray the slurry over the area covering a "marked seedbed area", using a properly chosen nozzle, to ensure correct rate of application. Start spraying with power and agitation on full, then throttle down to proper rate of application.
8. Prevent damage or staining of construction or other planting adjacent to hydro seeded areas.
9. Prevent foot or vehicular traffic, or the movement of equipment over the seeded areas. Reseed areas damaged as a result of such activity.
10. Prevent the seeded areas from drying out. After seedlings appear in about 2-3 weeks, reseed all bare spots larger than 18-inches in diameter. Areas to be reseeded shal be hand raked to scarify the surface and seed shall be applied by cyclone spreader. Lightly rake the seed into the soil.

D. Reconditioning Existing Turf:
1. Recondition existing turf areas damaged by CONTRACTOR'S operations including storage of materials or equipment and movement of vehicles. Also recondition existing turf areas where minor regrading is required.
2. Recondition other existing turf areas as shown.
3. Provide fertilizer, seed or sod and soil amendments as specified for new turf and as required to provide a satisfactorily reconditioned turf. Provide new planting soil as required to fill low spots and meet new finish grades.
4. Cultivate bare and compacted areas thoroughly to provide a good, deep planting bed.
5. Remove diseased or unsatisfactory turf areas; do not bury into soil. Remove topsoil containing foreign materials resulting from CONTRACTOR'S operations including oil drippings, stone, gravel and other construction materials.
6. In areas approved by ENGINEER, where substantial turf remains (but is thin), mow, rake, aerate if compacted, fill low spots, remove humps and cultivate soil, fertilize, and seed. Remove weeds before seeding or if extensive, apply selective chemical weed killers as required. Apply a seedbed mulch, if required, to maintain moist condition.
7. Water newly planted areas and keep moist until new turf is established.

3.4 MAINTENANCE

A. Begin maintenance immediately after planting.

B. Maintain turf for not less than the period stated below, and longer as required to establish an acceptable stand, as determined by ENGINEER.
1. Not less than 60 days.
2. If planted in fall and not given full 60 days of maintenance, or if not considered acceptable at that time, continue maintenance the following spring until acceptable turf is established.

C. Maintain seeded areas by watering, fertilizing, weeding, mowing, trimming and other operations such as rolling regrading and replanting as required to establish a smooth, acceptable turf area, free of eroded or bare areas.
   1. Cutting Height: Mow as soon as there is enough top growth to cut with mower set at the specified height for the principal species planted. Repeat mowing as required to maintain specified height. Do not remove more than 1/3 of grass height. Do not mow when grass is wet. Time initial and subsequent mowings as required to maintain the following grass height:
      a. Mow grass at 2-inch to 6-inch height. Do not mow lower than 2 inches.
   2. Apply fertilizer after first mowing and when the grass is dry. Use fertilizer which will provide not less than 1.0 pound of actual nitrogen per 1000 square feet of lawn area.
   3. Maintain grass for at least one mowing.
   4. After grass has started, reseed repeatedly all areas greater than 8 inches square which fail to show a uniform stand of grass for any reason whatsoever until all areas are covered with a satisfactory stand of grass is achieved, as determined by ENGINEER.

D. Watering: Provide and maintain temporary piping hoses and watering equipment as required to convey water from water sources and to keep turf areas uniformly moist as required for proper growth.

3.5 CLEANUP AND PROTECTION

A. During turf Work, store materials and equipment where directed. Keep pavements clean and work area in an orderly condition.

B. Protect turf Work and materials from damage due to operations by other contractors and trades and trespassers. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged turf Work as directed.

C. Take all precautions to insure that hydroseed slurry, is only placed on the areas designated. Completely clean any overspray, on areas not designated to receive slurry, to the satisfaction of ENGINEER.

D. Remove all rubbish, equipment and rejected materials from the project site.

E. Protection includes all temporary fences, barriers and signs and other work incidental to proper maintenance.

3.6 INSPECTION AND ACCEPTANCE

A. When the turf Work is completed, including maintenance, ENGINEER will, make an inspection to determine acceptability.

B. Seeded areas will be acceptable provided all requirements, including maintenance, have been complied with, and a healthy, uniform, close stand of the specified grass is established, free of weeds, bare spots and surface irregularities.

C. Where inspected turf Work does not comply with the requirements, replace rejected Work and continue specified maintenance until reinspected by ENGINEER and found to be acceptable.

D. CONTRACTOR shall be responsible for turf areas for one full year after substantial completion of the project. Any areas damaged by erosion or areas devoid of vegetation shall be repaired by the CONTRACTOR at no additional expense to the OWNER.

+ + END OF SECTION + +

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APPENDIX C

GEOMEMBRANE SPECIFICATIONS

SECTION 02274

GEOMEMBRANE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall furnish all labor, materials, equipment, and incidentals required to supply, install, and test 40 mil textured linear low density polyethylene (LLDPE) geomembrane as shown on the Drawings and specified herein.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:
   1. Standards of American Society for Testing and Materials (ASTM); and
   2. National Sanitation Foundation, Standard 54 for Flexible Membrane Liners.
   3. Inspection Techniques for the Fabrication of Geomembrane Field Seams (EPA/530/SW-91/051/May 1991).

B. Single Source:
   1. All liner material shall be obtained from a single material supplier and all geomembrane sheets shall be manufactured by a single geomembrane manufacturer.

C. Manufacturer's Qualifications and Experience:
   1. CONTRACTOR shall provide the following information on the manufacturer of the geomembrane:
      a. Corporate background and information.
      b. Manufacturing capabilities:
         1) Information on plant size, equipment, personnel, number of shifts per day, and capacity per shift.
         2) Daily production quantity available for this contract.
         3) Quality control manual for manufacturing.
         4) List of material properties including notarized certified test results, to which are attached geomembrane samples.
      c. A list of at least ten completed facilities totaling a minimum of 5,000,000 square feet for which the Manufacturer has manufactured and installed polyethylene geomembrane. For each facility, the following information shall be provided:
         1) Name and purpose of facility, its location, and date of installation.
         2) Name of owner and phone number, project manager and phone number, designer and phone number, fabricator (if any), and installer.

3) Thickness of polyethylene geomembrane, surface area of geomembrane manufactured.
4) Available information of the performance of the lining system and the facility.

d. Quality control during manufacturing:
1) Prior to the installation of any geomembrane material, the CONTRACTOR shall submit for approval to the ENGINEER information obtained from the manufacturer:
a) Origin (Resin Supplier's name, resin production plant), identification (brand name, number) and production date of the LLDPE resin.
b) Copy of quality control certificates issued by the LLDPE Resin Supplier.
c) Reports on the test conducted by the Manufacturer to verify the quality of the LLDPE resin used to manufacture the geomembrane rolls tests shall include, specific gravity (ASTM D1505) and melt index (ASTM D1238 condition E), percent carbon (ASTM D1603) and carbon dispersion (ASTM D3015).

2. Random sampling shall be performed by the Manufacturer, at no additional cost to the OWNER, throughout the production run to assure proper quality control. The minimum frequency of such sampling shall be as follows:
a. One (1) sample per roll, or
b. Other sampling as proposed by the CONTRACTOR and approved by the ENGINEER.

3. The samples shall be tested for the following properties:
a. Uniformity: Visual inspection to assure the material is free of holes, blisters, undispersed raw material, or foreign matter.
b. Thickness: Measurement along the sample to assure that the sheet is within the specified tolerances (ASTM D751).
c. Carbon Black: The proper amount, grade, and degree of dispersion are imperative to assure proper U.V. radiation protection (ASTM D1238E).
d. Tensile Properties: One (1) dimensional tensile testing which measures tensile strength at yield and at break and elongation at yield and at break shall be made (ASTM D638).

4. All pre-assembled panel seams shall be tested at the factory in accordance with the destructive and nondestructive testing as specified herein.
5. The CONTRACTOR shall provide the OWNER and ENGINEER with notarized certified copies of the Manufacturer's test results.
6. The OWNER and ENGINEER, at their discretion, may employ and pay for an independent testing laboratory to perform additional testing of the liner materials. This testing may also include all properties specified herein and need not be limited to the testing performed by the Manufacturer. The CONTRACTOR shall, at no additional cost, provide samples to the OWNER or ENGINEER as required.
7. The CONTRACTOR shall be solely responsible to the OWNER for the quality of the material provided. Should any of the tests performed on the material yield unsatisfactory results, the CONTRACTOR will be responsible for

replacing the material with satisfactory material without delaying the total project time and without any cost to the OWNER.

D. Installer's Qualifications and Experience:
   1. CONTRACTOR shall provide the following information on the installer of the geomembrane:
      a. Corporate background and information.
      b. If installer is not the geomembrane manufacturer, the CONTRACTOR shall provide information on the installer's history with the manufacturer product including:
         1) Authorization of the installer as an "approved" or "licensed" installer of the manufacturer's product.
         2) List of similar projects completed using the manufacturer's product and total amount of manufacturer's materials installed to date.
      c. A list of projects totaling a minimum of 10,000,000 square feet of successfully-installed manufacturer's geomembrane. For each project, the following information shall be provided:
         1) Name and location of facility.
         2) Name, address and phone number of an appropriate party to be used as a reference of the installer's performance on the project.
         3) Thickness and type of polyethylene geomembrane and surface area of geomembrane installed.
      d. Installer's Quality Assurance Representative shall be a representative of the sheet manufacturer who will represent the installer on QA/QC issues. The CONTRACTOR shall submit documented qualifications of the Installer's Quality Assurance Representative which will at minimum document QA/QC experience of the individual on a minimum of 5,000,000 square feet of polyethylene geomembrane. Installers Quality Assurance Representative shall be qualified by knowledge, experience and passed at a minimum the first level of NICET Certification with regards to liner installation. The quality assurance representative shall be independent of and not related in any manner to the geomembrane installer; however, the two may be employed by the same firm.
      e. All installer's personnel performing seaming operations shall be qualified by experience and shall have experience seaming a minimum of 5,000,000 square feet of polyethylene geomembrane being installed and using the same seaming procedures. The CONTRACTOR shall submit documented experience of all installer's seaming personnel to be used on this project meeting the above qualifications prior to any personnel or liner arriving on-site.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Drawings showing layout of each individual liner sheets, gas vent details and pipe penetration details. Layout diagram shall indicate the location of pre-assembled panels and identify each sheet.

2. Complete description of field seaming procedures.
3. Work plan for geomembrane installation including manpower and equipment requirements.
4. Detailed description of field testing methods to be performed.
5. Samples of QA/QC documentation to be completed and submitted to the ENGINEER by the Installer's Quality Assurance Representative.
6. Notarized certification that the resins in the extrusion welding process is the same resin used in the manufacture of the sheets.
7. Notarized certification that the site manager, master seamer and quality assurance representative have reviewed the plans and specifications prior to pre-installation meeting.
8. A sample of the proposed warranties.
9. Notarized certification that the geomembrane is manufactured from virgin polyethylene resins.
10. Geomembrane manufacturer shall provide a notarized certification, on an individual basis, that each specific roll delivered to the site has a uniform distribution of texturing and the adhesion of the texturing is sufficient to provide the required interface properties and meet the intent of the specifications.

B. Affidavit of Compliance:
1. Provide six (6) copies of an affidavit, certifying that all geomembrane materials furnished for this project (reference project title and number) comply with all requirements specified in the Contract Documents, note all deviations from specifications.
2. No geomembrane material shall be shipped until the affidavits are submitted to the ENGINEER.

C. Test Reports: Provide six (6) notarized copies of all factory, Field Quality Control Testing Reports and QA/QC field documentation completed by the Installer's Quality Assurance Representative.

D. As-Built: CONTRACTOR shall submit six (6) copies of the liner as-built conditions and one (1) reproducible copy having a scale of 1 inch equal to 50 feet including but not limited to actual layout of liner sheets, location and types of seams, sheet and panel numbers, location and designation of destructive samples, location and reason for any repairs and patches and all other information as required by the ENGINEER.

1.4 WARRANTY

A. Material Warranty:
1. The membrane manufacturer shall warrant the membrane against manufacturing defects and material degradation in the proposed environment for a period of 20 years, commencing from the date of final acceptance of the project.

2. The membrane manufacturer shall provide new material, equipment and labor to replace the membrane which fails from the above causes within the warranty period at no additional cost to the OWNER.
3. The membrane manufacturer shall submit a written warranty upon final acceptance of the project.

B. Installation Warranty:
1. The membrane installer shall warranty the installation against defects in the workmanship for a period of five years, commencing from the date of final acceptance of the project.
2. The membrane installer shall provide new material, equipment and labor required to repair any defects in the liner installation at no additional cost to the OWNER.
3. The membrane installer shall submit a written warranty upon final acceptance of the project.

1.5 PRODUCT PACKAGING, DELIVERY, STORAGE, and HANDLING

A. The manufacturer shall identify all membrane rolls with the following information:
- Manufacturer's Name
- Product Identification
- Date of Manufacture
- Lot Number
- Roll Number
- Roll Dimensions
- Directions for unrolling

B. Delivery including unloading, storage and handling shall be performed in accordance with the liner manufacturer's recommendations and shall be done in such a manner as to prevent damage to the geomembrane.

C. CONTRACTOR shall provide all labor and equipment required to assist ENGINEER in inspection of geomembrane materials upon delivery to the site.

D. Upon delivery at the site, the CONTRACTOR, Installer's Quality Assurance Representative, and the ENGINEER shall conduct a visual inspection of all materials for defects and for damage. This inspection shall be conducted without unrolling rolls unless defects or damages are found or suspected. The ENGINEER will note all:
1. Rolls, or portions thereof, which should be rejected and removed from the site because they have severe flaws.
2. Rolls which include minor repairable flaws.

E. The geomembrane shall be stored under the responsibility of the CONTRACTOR. Storage space should be protected from theft, vandalism, passage of vehicles, etc.

F. The Installer's Quality Assurance Representative shall collect an 18-inch by 48-inch sample of each roll of geomembrane as it is delivered to the site. On each sample the roll number and date of delivery shall be recorded. The samples shall be archived at room temperature in a light free environment for possible future testing and analysis. Upon completion of the installation, the Installer's Quality Assurance Representative shall submit all archived samples to the Quality Assurance Engineer.

G. CONTRACTOR shall be responsible for replacing all unacceptable or damaged material at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 LLDPE RESIN

A. The LLDPE geomembrane shall be manufactured from virgin polyethylene resins meeting the following minimum properties:

Property	Test Method	Value	Units
Specific Gravity	ASTM D1505	0.915	g/cm^3
Melt Flow Rate	ASTM D1238E	0.60 (max)	g/10 Min
Percent Carbon Black	ASTM D1603	2-3	%
Carbon Dispersion	ASTM D3015	A-1, A-2, B-1	Rating

B. The resins used in manufacturing of the geomembrane shall be identical in all properties to the resin used to manufacture the extrusion welding "weld material".

C. The resin shall be from one source and supplied for all the material incorporated into this project.

2.2 LLDPE SHEET MANUFACTURING

A. The LLDPE geomembrane materials shall be formulated from the appropriate polymers and compounding ingredients to form LLDPE sheet material that meets all requirements for use as a geomembrane for a landfill containing municipal solid waste (MSW). The sheet material shall be capable of being bonded to itself by thermal bonding in accordance with the sheet manufacturer's recommendations and instructions.

B. The geomembrane shall be manufactured to a minimum thickness of 36 mil (40 mil nominal) when measured at **ANY POINT** of the cross section of the sheet, after application of an embossed, blown or spray texturing process.

C. Sheets which have repair patches upon delivery to the site shall not be accepted.

D. Extruded sheets shall be at least 14 feet in width. Individual geomembrane sheets may be pre-assembled at the factory into larger panels to minimize field seams. Sheet and pre-assembled panel sizes shall consider access to site and materials handling constraints.

E. Each roll shall be identified by a number and date of manufacture.

F. The completed textured sheet, upon thorough quality control testing specified herein, must demonstrate the following minimum average roll values (MARV):

Property	Test Method	Value	Units
1. Thickness (min inches)	ASTM D751	0.036	Inches
2. Density	ASTM D1505	0.915	g/cm^{-3}
3. Melt Flow Rate	ASTM D1238 Condition E	0.6 (max)	g/10 Min
4. Carbon Black Content	ASTM D1603	2-3	%
5. Coefficient of Linear Thermal Expansion	ASTM D696	2.0 (max)	$°c^{-1}$
6. Tear Resistance	ASTM D1004	23	lb (min)
7. Dimensional Stability	ASTM D1204 212°F 1 hour	± 3	%
8. Percent Elongation at Break	ASTM D638*	300	%
9. Tensile Strength at Break	ASTM D638*	72	(lbs/in)
10. Puncture Resistance	FTMS 101B Method 2065	48	lbs

* Speed 2.0 ipm, Test Specimen, Type IV.

G. Textured LLDPE geomembrane shall be used in all areas.

H. The LLPE geomembrane shall be manufactured by:
1. Polyflex.
2. GSE Lining Technology, Inc.
3. National Seal Company.
4. Or approved equal.

2.3 GAS VENT, MONITORING WELL, CLEANOUT AND PIPE BOOTS

A. Extrusion Joining Resin: Resin used for extrusion joining sheets and sheet to pipe shall be the same resin used to produce the LLDPE sheets. Physical properties

shall be the same as those of the resin used in the manufacture of the LLDPE geomembrane.

B. Sponge Rubber Sheeting: Sponge rubber sheeting shall be type SCE-41, Neoprene/EPT/SBR, Closed Cell Medium, 1/4-inch thick, one side adhesive.

C. Neoprene Adhesive: Neoprene adhesive such as PYTHON shall be used for gluing sponge rubber sheeting to LLDPE surfaces.

D. Stainless Steel Strapping: Strapping shall be 1-inch wide stainless steel banding.

PART 3 - EXECUTION

3.1 PREPARATION FOR GEOMEMBRANE INSTALLATION

A. Prepare base material to receive the geomembrane in accordance with geomembrane manufacturer's recommendations.

B. The geomembrane Manufacturer shall certify in writing that the surface on which the geomembrane will be installed is acceptable on a daily basis. This certificate of acceptance shall be given to the ENGINEER prior to commencement of geomembrane installation for each individual day.

3.2 GEOMEMBRANE PLACEMENT

A. Panel Identification: A panel is the unit area of geomembrane which is to be seamed in the field. A panel is a roll or a portion of roll cut in the field. Each panel shall be given an "identification code" (number or letter-number) consistent with the layout plan. This identification code shall be agreed upon by the ENGINEER and CONTRACTOR. This identification code shall be as simple and logical as possible. The CONTRACTOR shall establish a table or chart showing correspondence between roll numbers and identification codes. The identification code shall be used for all quality assurance records.

B. Panel Placement:
   1. The CONTRACTOR shall verify that panels are installed at the location indicated on the drawings.
   2. Panels placed with "shingle" overlaps to facilitate drainage.
   3. CONTRACTOR shall record on an as-built drawing the identification code, roll number, date and time of installation panel length and location of each panel.
   4. The CONTRACTOR shall immediately notify the ENGINEER of any deviations in panel placement inconsistent with the approved panel layout drawings and revise the panel layout drawings to reflect the change and resubmit the revised panel layout to the ENGINEER.

5. The CONTRACTOR shall mark at the beginning and end of each panel placed the panel number, roll number, date of placement, time of placement and length.

C. Weather Conditions:
   1. Geomembrane placement shall not proceed at an ambient temperature below 0°C (32°F) or above 40°C (104°F) measured one foot above the liner, unless otherwise specified or approved by the ENGINEER. Geomembrane placement shall not be done during any precipitation, in the presence of excessive moisture (e.g., fog or dew), in an area of ponded water, or in the presence of winds in exceedance of 20 miles per hour, as determined by the ENGINEER.
   2. CONTRACTOR shall verify that the above conditions are fulfilled. Additionally, the CONTRACTOR shall verify that the supporting soil has not been damaged by weather conditions.
   3. CONTRACTOR shall provide acceptable instruments to accurately measure and record the weather conditions as specified.

D. Method of Placement: CONTRACTOR shall comply with the following:
   1. Any equipment used shall not damage the subgrade or geomembrane by handling, trafficking, leakage of hydrocarbons, or other means (i.e., by use of rub sheets or other suitable materials).
   2. All personnel working on the geomembrane shall not smoke, wear damaging shoes, or engage in other activities which could damage the geomembrane.
   3. The method used to unroll the panels shall not cause scratches or crimps in the geomembrane and shall not damage the supporting soil.
   4. The method used to place the panels shall minimize wrinkles (especially differential wrinkles between adjacent panels).
   5. Adequate loading (e.g., sand bags), not likely to damage the geomembrane, shall be placed to prevent uplift by wind.
   6. Direct contact with the geomembrane shall be minimized (i.e., the geomembrane in traffic areas shall have a minimum of 12 inches of protective soil and also be protected by geotextiles, extra geomembrane, or other suitable materials).
   7. No motorized vehicles shall be allowed to operate directly on the liner (including low ground pressure ATV's).
   8. Rub sheets shall be provided of sufficient size below any equipment that has the potential to leak hydrocarbons.

E. Damage: The ENGINEER and Installer's Quality Assurance Representative will inspect each panel, after placement and prior to seaming, for damage. The ENGINEER will advise the installer which panels, or portions of panels, should be rejected, repaired, or accepted. Damaged panels or portions of damaged panels which have been rejected shall be marked and removed from the work area. The damaged materials will become the property of the CONTRACTOR and shall be removed from the site at the expense of the CONTRACTOR.

F. The geomembrane shall be installed in a relaxed (non-stressed) state and shall be free of tension or stress upon completion of that installation under the temperature conditions which range from 0°F to 100°F, with the geomembrane fully exposed to the environment.

G. Geomembrane placed on the Waste Redisposal Area shall overlap the existing soil cover along the perimeter of the Waste Redisposal Area a minimum of 3-feet.

H. CONTRACTOR shall seam two adjacent panels immediately after placement. CONTRACTOR shall not roll panels out in advance of the seaming process.

I. Any bridging of the geomembrane at any change in grade or at penetrations will not be accepted under any condition.

J. The CONTRACTOR shall be solely responsible for ensuring that the geomembrane is placed in accordance with the above criteria.

3.3 FIELD SEAMING

A. Seam Layout: CONTRACTOR shall provide the ENGINEER with a drawing of the facility to be lined showing fabricated seams and field seams in a manner which differentiates the seam types. Seams should be oriented parallel to the line of maximum slope (e.g, oriented along, not across, the slope). In corners and odd-shaped geometric locations, the number of field seams should be minimized. No horizontal seam should be less than five (5) feet from the toe of the slope. Where possible, seams shall be oriented to result in a "shingle" effect.

B. Requirements of Personnel: All personnel performing seaming operations shall be qualified by experience or by successfully passing seaming tests. All seamers shall have experience seaming a minimum of 5,000,000 square feet of polyethylene geomembrane using the same type of seaming apparatus in use at the site. The most experienced seamer, the "master seamer", shall provide direct supervision, as required, over less experienced seamers. No field seaming shall take place without the master seamer and Quality Assurance Representative being present.

C. A field seam is defined as any approved method of joining one piece of liner to another regardless of the length or quantity of the weld. Both extrusion and fusion welds are considered seams.

3.4 OVERLAPPING AND TEMPORARY BONDING

A. Panels of LLDPE geomembrane shall be overlapped by a minimum of three (3) inches for extrusion welding and four (4 inches) for fusion welding.

B. CONTRACTOR shall assure that the procedure used to temporarily bond adjacent panels together does not damage the geomembrane; in particular, the temperature

of hot air at the nozzle of any spot welding apparatus is controlled such that the geomembrane is not damaged.

C. No solvent or adhesive shall be used to temporarily bond two seams together.

3.5 SEAM PREPARATION

A. Prior to seaming, the seam area shall be clean and free of moisture, dust, dirt, debris of any kind, and foreign material. The installer personnel shall clean area to be seamed, in advance of the welder. If required, grinding shall be completed within 10 minutes of the welding of the panels.

B. Where seam overlap bonding is required, the process shall be according to the Manufacturer's instructions and in a way that does not damage the geomembrane.

C. Seams shall be aligned with the fewest possible number of wrinkles and "fishmouths".

3.6 SEAMING EQUIPMENT AND PRODUCTS

A. General:
   1. Approved processes for field seaming are extrusion welding and fusion welding. Only apparatus which have been specifically approved by the liner manufacturer by make and model shall be used.

B. Extrusion Process:
   1. Welding apparatus shall be equipped with gauges giving the temperature in the apparatus and at the nozzle. Installer shall provide documentation regarding the LLDPE extrudate to the ENGINEER and shall log the extrudate temperatures, pre-heat temperatures, machine number and welder's initials.
   2. Installer shall comply with the following:
      a. Spare operable seaming apparatus is maintained on-site
      b. Equipment used for seaming is not likely to damage the geomembrane.
      c. The extruder is purged prior to beginning a seam until all heat degraded extrudate has been removed from the barrel.
      d. The electric generator is placed on a rub sheet such that no damage occurs to the installed geomembrane.
      e. A smooth, insulating plate or fabric is placed beneath the welding apparatus after usage.
      f. The geomembrane is protected from damage in heavily trafficked areas.
      g. When grinding is required, no sand paper with a grit coarser than #80 size shall be used.
      h. Extrusion welds that exhibit excessive "penetration" shall be deemed as unacceptable unless the installer can demonstrate quantitatively that the seam strength meets the requirements as specified.

C. Fusion Process:

1. Fusion-welding apparatus shall be automated, vehicular-mounted devices which produce a double seam with an enclosed space. The seaming apparatus shall be equipped with gauges giving the applicable temperatures and speeds. The installer shall log ambient, seaming apparatus, and geomembrane surface temperatures, speed, machine number and welder's initials.
2. Installer shall comply with the following:
   a. Spare operable seaming apparatus are available.
   b. Equipment used for seaming is not likely to damage the geomembrane.
   c. For cross seams, the edges of cross seams are ground to a smooth incline (top and bottom) prior to welding.
   d. The electric generator is placed on a rub sheet smooth base such that no damage occurs to the installed geomembrane.
   e. A smooth insulating plate or fabric is placed beneath the hot welding apparatus after usage.
   f. The geomembrane is protected from damage in heavily trafficked areas.
   g. When grinding is required, no sand paper with a grit coarser than #80 size shall be used.

D. Weather Conditions for Seaming:

1. Unless authorized in writing by the ENGINEER, no seaming shall be attempted below 0°C (32°F) nor above 40° C(104°F).
2. Between 0°C (32°F) and 10°C (50°F), seaming is possible if the geomembrane is preheated by either sun or hot air device, and if there is not excessive cooling resulting from wind (as determined by the ENGINEER).
3. Above 10°C (50°F), no preheating is required.
4. In all cases, the geomembrane shall be dry and protected from wind damage.
5. If approved by the ENGINEER, CONTRACTOR may perform seaming when the ambient temperature is below 0°C (32°F) by using shelters. CONTRACTOR shall demonstrate to the ENGINEER that the low temperature seaming procedure does not cause any physical or chemical modification to the geomembrane that will generate any short- or long-term damage.

E. Test Seams:

1. Test seams shall be made on fragment pieces of geomembrane liner to verify that seaming conditions are adequate. Such test seams shall be made at the beginning of each seaming period, at the ENGINEER'S discretion, and at least once each four (4) hours, for each seaming apparatus and type of material seamed that day. Each seamer shall perform a test seam on the specific seaming apparatus that the seamer intends to use and shall not use any other seaming apparatus without running a test seam. A test seam shall also be performed whenever a welding apparatus has been repaired or has not been used within the last hour, prior to returning the apparatus to service.
2. Test seam sample shall be at least ten (10) feet long by one (1) foot wide with the seam centered lengthwise for fusion welded seams and five (5) feet by one (1) foot for extrusion welded seams. Six (6) randomly spaced specimens, each one (1) inch wide, shall be cut from the test seam sample by the installer.

Three specimens shall be tested in the field in peel and three in shear by tensiometer, and shall not fail in the seam. If a single specimen fails, then the entire operation shall be repeated. If the additional test seam fails, the seaming apparatus or seamer shall not be accepted and shall not be used for seaming until the deficiencies are corrected and two (2) consecutive, successful, full test seams are achieved.

3. ENGINEER will observe all test seam procedures. The remainder of the successful test seam sample shall be assigned a number and marked accordingly by the installer, who shall log the date, time, ambient temperature, number of seaming unit, the settings on the welding apparatus, name of seamer, and pass or fail description. The sample itself shall be labeled and submitted to the ENGINEER.
4. All field tested specimens shall be cut using a sample die.
5. The Installer's Quality Assurance Representative shall conduct the testing of test seams.

F. General Seaming Procedure:
   1. Seaming shall extend to the outside edge of panels.
   2. As required, a firm substrate shall be provided by using a flat board, or similar hard surface directly under the seam overlap to achieve proper support.
   3. Fishmouths or wrinkles at the seam overlaps shall be cut along the ridge of the wrinkle in order to achieve a flat overlap. The cut fishmouths or wrinkles shall be seamed and any portion where the overlap is inadequate shall then be patched with an oval or round patch of the same geomembrane extending a minimum of six (6) inches beyond the cut in all directions.
   4. If grinding is required, grinding of the area to be seamed shall be completed no more than 10 minutes prior to seaming.
   5. All tee seams, or where two or more seams are joined, the intersection shall have a round patch of material extending six inches beyond the intersection in all directions welded into place.
   6. Installer shall mark each seam with the date, seamer's name, equipment number, start and end times, and seam number.
   7. When grinding, the orientation of the grinding marks shall be perpendicular to the seam and shall not be parallel to seam.
   8. The depth of the grind marks shall be less than five percent of the sheet thickness and shall remove 100 percent of the surface oxides and waxes (surface sheen).
   9. The grind marks shall not appear more than a 1/4 inch on each side beyond the extrudate after it has been placed.
   10. The leading edge of the liner shall be beveled at a 45-degree angle prior to the tacking of the liner for extrusion welding.

3.7 NON-DESTRUCTIVE SEAM TESTING

A. General:
   1. Installer shall non-destructively test all field seams over the full length using a vacuum test unit or air pressure (fusion process) to verify the continuity of

seams. Continuity testing shall be done as the seaming work progresses, not at the completion of all field seaming. All testing shall be witnessed by the ENGINEER.

2. Installer shall record location, date, start time and pressure, ending time and pressure, test unit number, name of tester, and outcome of all testing including starting and ending pressures and inform the ENGINEER of any required repairs.
3. Any seams requiring repairs shall be retested and the location marked and documented on the As-Built Drawings.
4. All locations where seams cannot be non-destructively tested shall be cap-stripped with the same geomembrane.
5. If the seam is accessible to testing equipment prior to final installation, the seam shall be non-destructively tested prior to final installation.
6. Installer shall field demonstrate the air pressure testing method and vacuum box testing method to verify to the ENGINEER that the test procedures are valid. Non-destructive tests shall be performed by experienced personnel thoroughly familiar with the specified test methods and equipment to be used.
7. All inadequate seams or portions thereof shall be corrected in accordance with the approved method. Should differences of opinion between the installer and the ENGINEER develop during the installation relevant to seam integrity, the ENGINEER may, at his discretion, obtain samples of the seams in dispute for field and/or laboratory testing by and independent testing laboratory. The installer shall be responsible for providing samples and patching the resulting void in accordance with the previously approved testing procedures at no additional cost.
8. The installer shall mark near the seam the starting time and pressure, ending time and pressure, tester name, and outcome of the test.

B. Vacuum Box Testing:
   1. All field seams shall be inspected for unbonded areas by applying a vacuum to a soaped section of seam.
   2. The vacuum shall be applied by a vacuum box equipped with a vacuum gage, a clear glass view panel in the top, and a soft rubber gasket on the periphery of the open bottom. The vacuum box shall be similar to the Series A 100 Straight Seam Tester as supplied by the American Parts and Service Company, 2201 West Commonwealth Avenue, P.O. Box 702, Alhambra, California 91802.
   3. A section of the seam shall be soaped thoroughly and the inspection box shall be placed over the soaped seam section and the gasket sealed to the liner.
   4. A vacuum of 5 psig or ten (10) inches of mercury (Hg) shall be applied to the box for not less than fifteen (15) seconds by use of a gasoline or electric driven power-vacuum pump apparatus. The applied vacuum will show bubbles over unbonded areas and the unbonded areas will then be marked by the CONTRACTOR for repair by the CONTRACTOR.
   5. Box shall have a minimum overlap of three (3) inches when advancing to the next test.

C. Air Pressure Testing: CONTRACTOR shall test all double fusion seams with an air pressure test by sealing both ends and applying air to a pressure between twenty-seven (27) and thirty (30) psi. Seam failure will be determined if loss of pressure exceeds three (3) psi over 5 minutes or the pressure does not stabilize. Upon completion of air pressure testing, the end of the air channel opposite of the air gauge shall be released from pressure first and the ends of the air channel will be patched and welded as required. Vacuum box testing shall be performed on the patches to verify the integrity of the patches. Double fusion seams that are unable to be pressure tested shall have flap extruded and then be vacuum tested.

3.8 DESTRUCTIVE SEAM TESTING

A. Location and Frequency of Samples:
   1. Installer shall submit to the ENGINEER a list of proposed locations where seam samples shall be cut out for laboratory testing. Samples shall be taken at a minimum frequency of one test location per 500 feet of seam length. A maximum frequency of one test location per 300 feet seam. In addition, extrusion welds may be sampled at the discretion of the ENGINEER at the maximum frequency of one sample per seam per day. The sample location will be determined in the field by the ENGINEER.
   2. Additional test locations shall be determined during seaming at the ENGINEER'S discretion. Selection of such locations may be prompted by visual appearance of the weld, suspicion of excess crystallinity, contamination, offset welds, or any other potential cause of imperfect welding. The installer shall not be informed in advance of the additional locations where the seam samples will be taken.
   3. Samples shall be cut by the CONTRACTOR as the seaming progresses in order to have laboratory test results before completion of geomembrane installation. CONTRACTOR shall assign a number to each sample, mark it accordingly, record sample location on as-built drawing, and record reason for taking the sample at this location.
   4. ENGINEER will witness all field tests and mark all samples and portions with their number. CONTRACTOR shall log the date and time, ambient temperature, number of seaming unit, name of seamer, welding apparatus temperatures and pressures, and pass or fail description, and attach a copy to each sample portion.
   5. Samples shall be twelve (12) inches wide by forty (40) inches long with the seam centered lengthwise. Two 1-inch wide strips shall be cut from each end of the sample and these shall be tested in the field, by tensiometer, for peel and shear and shall not fail in the seam. The remaining sample shall be cut into two (2) parts and distributed as follows:
      a. One portion to the Quality Assurance Engineers, 12 inches x 18 inches.
      b. One portion, 12 inches x 18 inches, shall be archived by OWNER.
   6. In addition to the above testing, at the ENGINEER's discretion, CONTRACTOR shall take and field test one (1) sample from the start and stop of each seam welded. Samples shall be one (1) inch wide and tested in peel and shear. Any failed seam shall be reconstructed.

B. Laboratory Testing:
   1. Installer shall forward test samples to the Quality Assurance Engineer's laboratory. Testing shall include "Seam Strength" (ASTM D4437 as modified in NSF Appendix A) and "Peel Adhesion" (ASTM D4437 as modified in NSF Appendix A).

C. Procedures for Destructive Test Failure:
   1. The installer's sample will fail when:
      a. The specimen fails by any other method than a film tear bond (FTB) (i.e., failure of the parent material)
      b. The bonded seam strength peel values are less than the published values as provided in the material manufacturer's documentation.
      c. The bonded seam strength shear values are less than the published values as provided in the material manufacturer's documentation.
      d. More than one (1) out of five (5) specimen meets the above criteria.
   2. The following procedures shall apply whenever a sample fails a destructive test. The installer shall reconstruct the seam between the failed location and any passed test location. The installer shall retrace the welding path to a location at twenty (20) feet minimum from either side of the location of the failed test and take two samples (each side) for additional field tests. If these additional samples pass the test, then the seam shall be reconstructed between the test locations. If this sample fails, then the process shall be repeated. In any case, all acceptable seams must be bounded by two passed test locations and one (1) test must be taken within the reconstructed area at the discretion of the ENGINEER.
   3. Where samples fail a laboratory destructive test the above procedures shall be followed, considering laboratory tests exclusively. Since the final seam must be bounded by two (2) passed test locations, it may then be necessary to take one or more new samples for laboratory testing in addition to the one required in the reconstructed seam area at no additional cost to the Owner.
   4. If the length between the passing test locations exceeds 100 feet, the entire length of the seam welded by the specific apparatus for that given day shall either be cut out and reconstructed or a cap strip shall be constructed over the entire length.

3.9 DEFECTS AND REPAIRS

A. The geomembrane surface shall be broomed or washed by the installer prior to inspection. All seams and non-seam areas of the geomembrane shall be inspected for identification of defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. No walk-downs or inspections of geomembrane will be conducted after sundown. Each suspect location, both in seam and non-seam areas, shall be non-destructively tested using the methods specified herein. If the ENGINEER has reason to question the seam strength, a destructive sample shall be taken through the area in question. Each location which fails the non-destructive testing shall be marked and repaired by the installer.

All locations of destruction tests shall be repaired in accordance with the specifications at no additional cost to the OWNER.

B. Repair procedures shall be as follows:
   1. Defective seams shall be repaired by reconstruction as described below.
   2. Tears or pinholes shall be repaired by seaming or patching.
   3. Blisters, larger holes, undispersed raw materials, and contamination by foreign matter shall be repaired by patches.
   4. Surfaces of LLDPE geomembrane which are to be patched shall be abraded no more than 10 minutes prior to the repair.
   5. All seams used in repairing procedures must be approved, extrusion welded seams and shall be subjected to the same destructive and non-destructive test procedures as outlined for all other seams.
   6. Each patch shall be numbered and logged. Patches shall be round or oval in shape, and made of the same geomembrane, and extend a minimum of six (6) inches beyond the edge of defects.
   7. Patches shall be applied using approved methods only.
   8. Where excessive penetration occurs, the affected seam length shall be cap-stripped.
   9. The installer may propose an alternate method for repairs in writing to the ENGINEER. A minimum of two (2) weeks prior to starting field installation activities.

C. Each repair shall be non-destructively tested using the methods specified herein, as appropriate. Repairs which pass the non-destructive test shall be taken as an indication of an adequate repair. Failed tests indicate that the repair shall be redone and retested until a passing test results. The ENGINEER shall observe all non-destructive testing of repairs and the installer shall record the number of each patch, date, name of patcher, and test outcome.

3.10 DOCUMENTATION

A. At a minimum, the liner installer shall complete the following reports:
   1. A daily report detailing the quantity, type and location of materials installed. The personnel seaming and the apparatus used. The location and results of all testing. Daily reports shall be submitted prior to work commencing on the following work day.
   2. Subgrade acceptance report shall be submitted to the ENGINEER prior to the deployment of liner over the area the acceptance report covers.
   3. Liner acceptance reports by the general contractor shall be submitted when the liner is accepted.
   4. A cumulative installation report covering the following:
      a. Panel placement logs.
      b. Non-destructive test logs.
      c. Destructive test logs.
      d. Repair logs.
      e. Seam logs.

f. Trial weld logs.
g. Daily production logs.

3.11 GEOMEMBRANE ACCEPTANCE

A. At the conclusion of placement of geomembrane liner, installer shall prepare and submit six (6) copies of a written report of the work bound with a spiral binder or notebook which includes the following:
   1. Complete identification of flexible membrane liner, including, but not limited to, resin type, physical properties and other pertinent data.
   2. Complete description of seaming system used including material, method, temperatures and seam overlap width.
   3. Complete description of field sampling and testing including test equipment used, location of field tests, copy of test results, conditioning procedure prior to destructive seam testing, method of recording loading and determining average load for destructive test methods, and type of failure in tests (i.e., within the seam, within the sheet material, clamp edge, seam edge).
   4. "As-built" drawings drawn at 1-inch equal to 50-foot, showing actual layout of liner sheets, monitoring well, pipe and gas vent penetrations, destructive samples, patches, machine welds, hand welds, and construction details.
   5. An affidavit of compliance from the liner manufacturer, containing the following wording:
      "I (name and title), as the duly authorized representative of (Company name), hereby certify that the installation of the (40 mil textured) LLDPE geomembrane has been completed in accordance with the terms and conditions of the Contract Documents entitled Old Bath Landfill Interim Remedial Measures Final Cover and Leachate Collection System Construction Contract 3.

By: _____
(signature)

(Corporate Seal) Witness: _____
(signature)

Date: _____

B. CONTRACTOR shall retain all ownership and responsibility for the geomembrane until acceptance by the Owner.

3.13 PROTECTION OF WORK

A. CONTRACTOR shall install barrier protection layer and topsoil layer over geomembrane to provide protection to the geomembrane. In no case shall the geomembrane be left exposed to winter weather between construction seasons.

+ + END OF SECTION + +

MALCOLM PIRNIE

APPENDIX D

GEOMEMBRANE MANUFACTURER'S QA/QC MANUAL

POLY-FLEX, INC.

GEOMEMBRANE MANUFACTURING & INSTALLATION QC/QA MANUAL

An Engineering Approach to Groundwater Protection.

POLY-FLEX
POLYETHYLENE GEOMEMBRANES

TABLE OF CONTENTS

GEOMEMBRANE MANUFACTURING QUALITY CONTROL & QUALITY ASSURANCE

GEOMEMBRANE INSTALLATION QUALITY CONTROL & QUALITY ASSURANCE

TABLE OF CONTENTS

POLY-FLEX
POLYETHYLENE GEOMEMBRANES

POLY-FLEX
POLYETHYLENE GEOMEMBRANES

TABLE OF CONTENTS

GEOMEMBRANE INSTALLATION QUALITY ASSURANCE FORMS

POLY-FLEX
POLYETHYLENE GEOMEMBRANES

GEOMEMBRANE MANUFACTURING QUALITY CONTROL & QUALITY ASSURANCE

POLY-FLEX
POLYETHYLENE GEOMEMBRANES

1. MANUFACTURING QUALITY ASSURANCE PROGRAM

1.1 Raw Material

Poly-Flex, Inc.'s quality control and quality assurance for HDPE and LLDPE geomembrane manufacturing starts with the testing of the raw materials. The resin manufacturers provide documentation confirming that the raw materials comply with Poly-Flex, Inc. specifications.

Resin manufacturers report the following properties with each resin shipment:

Density	This property is a measure of unit weight and is an indicator of the degree of crystallinity and can be related to the material's chemical resistance, rigidity, permeability, tensile strength, and deformation characteristics.
Melt Index	This property is an indication of the molecular weight and rheological properties of the polymer and can be related to the processability.
Carbon Black Content (pre compounded only)	The carbon black content is an important property to ensure protection against ultraviolet radiation. The raw materials may be pre-compounded with the carbon black. However, if resins are not pre-compounded, Poly-Flex, Inc. will supplement them with the appropriate quantity of carbon black before manufacturing liner.

1.1.1 Geomembrane Material Railcar Acceptance

All resins, additives and concentrates used in Poly-Flex geomembranes must have their physical integrity validated before they can be released into the production material stream. All incoming railcars are sampled by compartment; incoming materials not delivered by railcar are statistically sampled. These measures insure that the resin Poly-Flex received meets the specifications promised by the manufacturer.

1. Resin samples are taken from the top and bottom of each of the four payload compartments in an incoming railcar.
2. Resin samples are sent to the laboratory. Using state of the art equipment, highly trained Quality Assurance personnel test the resin to ensure that it meets the specifications for producing Poly-Flex geomembranes. The following tests are performed and compared against Poly-Flex specifications:

Property	Resins	Additives & Concentrates
Density (ASTM D 1505)	•	
Melt Index (ASTM D 1238)	•	
Carbon Black Content (ASTM D 1603)		•
Oxidative Induction Time (ASTM D 3895)	•	•
Infrared (IR) Spectroscopy	•	

3. After meeting production specifications, the resin is pumped from its railcar into a silo dedicated to that material.
4. Off-spec material is returned to the vendor.

Applicable Test Methods

ASTM D 638	Tensile properties of plastic
ASTM D 746	Brittleness temperature of plastics and elastomers by impact
ASTM D 751	Coated fabrics
ASTM D 1004	Initial tear resistance of plastic sheeting
ASTM D 1204	Linear dimensional changes of nonrigid thermoplastic sheeting or film at elevated temperature
ASTM D 1238	Flow rates of thermoplastics by extrusion plastometers
ASTM D 1505	Density of plastics by the Density-Gradient technique
ASTM D 1593	Nonrigid vinyl chloride plastic sheeting
ASTM D 1603	Carbon black in olefin plastics
ASTM D 1693	Environmental stress-crack of ethylene plastics
ASTM D 2663	Standard test methods for Carbon Black Dispersion in Rubber
ASTM D 3015	Microscopic examination of pigment dispersion in plastic compounds
ASTM D 3895	Thermal stability (oxidative induction time)
ASTM D 4437	Determining the integrity of field seams used in joining flexible polymeric sheet geomembranes
ASTM D 4833	Index Puncture Resistance of geotextiles, geomembranes and related products
FTMS 101 C 2065	Federal Text Method Standard for puncture resistance
NSF Standard 54	National Sanitation Foundation, Standard 54 for Flexible Membrane Liners

Addendum to Test Procedures

The following are modifications or clarifications to test procedures.

1. All modifications to test procedures by NSF Std. 54 will apply.
2. Specifications are based on the average of Machine Direction (MD) and Cross Direction (CD) values.
3. Specimens shall be taken uniformly across the width of the sheet as stated in ASTM D 1898.
4. Thickness per ASTM D 1593 states that a micrometer may be used to determine sheet thickness, but the default method of measurement is gauge by weight.
5. Samples of carbon black dispersion are prepared by ASTM D 3015 which requires samples to be pressed out by a hot plate. Dispersion ratings are done per ASTM D 2663. The field of view is selected at random from 5 locations. Tables 1 and 2 of ASTM D 2663 are used for classifying particles.

2. MANUFACTURING

2.1 Blown Sheet Process

Polyethylene resin is pumped directly from storage silos or from totes on the floor to hoppers above the extruder.

Hoppers feed resin into the extruder. The resin is heated to the melting point in the extruder barrel. It is conveyed through the barrel by the rotation of a specially designed screw which, in conjunction with heating elements along the barrel, provides consistency to produce a molten polymer stream.

The molten material is forced through a screen pack, which act as a final filter for impurities or contaminants, and up through a die. It extrudes from the circular die as a film tube ("bubble"), pulled vertically by a set of nip rollers located at the top of a cooling tower. An IBC (Internal Bubble Cooling) unit, part of the extruder, maintains consistent bubble diameter. Material gauge is monitored and maintained by a computer system which controls the operation of the extruder.

At the top of the tower the bubble passes through a collapsing frame and is pulled through the nip rollers. The material is directed back toward the ground, and continues cooling as it approaches a winding machine. Before being taken up by the winder, the tube is split and spread to its deployable width. The winder rolls the finished geomembrane onto a specially made heavy-duty core.

2.2 Process Quality Control

Poly-Flex geomembranes are manufactured via the blown sheet process. This is a continuous process. The key elements to successfully producing a high quality liner is to maintain consistency in both the raw material and the process. As described above raw material consistency is established in the laboratory when the resin is initially received. Consistency during the processing is assured by an on-line quality control monitor. This representative of the quality department has been specially trained to monitor the process and the liners during the manufacturing process.

The extrusion process starts with the verification of the formulation. This is done at the beginning of each order or blend change by the extrusion manager and then is continuously monitored by the on-line quality control representative.

The process conditions during manufacturing have been optimized for each resin formulation. These conditions are kept in a log book which is available to the line operator. These process conditions must be maintained

throughout the production run. Any variation of process parameters from the set point range recorded on the process log book are immediately reported to the production supervisor by the on-line quality control representative. If the variation exceeds the control range, the quality control representative places the material being produced on hold. Materials are placed on hold until the process is brought under control.

The on-line quality monitor can also place material on hold if the material has any visual defect (holes, water spots, or scratches) or dimensional abnormalities (width, length, and thickness).

All materials placed on hold will be further inspected and tested. If the material passes specification and is approved by the quality control manager and/or production manager, the material will then be release into stock. If the material fails to pass specification or does not get approval of either the quality control or production manager then the material will be reclassified or scraped. In either case it can not be sold as a prime Poly-Flex geomembrane.

After a roll of material has been produced it is labeled and a retain is cut for laboratory evaluations.

2.3 Roll Labeling

A roll is given three labels. The quality control inspector controls all paperwork, including roll tags.

1. One label on the inside of the geomembrane core.
2. One label on the roll surface.
3. One label on the lab sample.

2.4 Storage, Staging and Shipping of Geomembrane Rolls

Finished rolls (verified and labeled) are moved to the storage area using a specially designed cart and remain in storage until a Purchase Order is issued. Rolls selected for shipment are moved to a staging area, where they are held for a truck. Before loading the order for shipment, all documentation is checked against the information on the roll labels. Rolls are lifted and moved using a loading arm equipped with rigging and hooks. Fork-lifting machinery are never be used to lift or move geomembrane rolls.

2.5 Laboratory Quality Assurance

Based on the philosophy that quality can not be inspected into a product and that a consistent raw material and a consistent process will yield a consistent liner, laboratory testing of Poly-Flex geomembrane is provided primarily for roll certification. Poly-Flex roll certification meets or exceeds all NSF Std. 54 quality control testing frequencies.

A retain from each roll is provided for the laboratory. Testing is conducted on the retains as indicated below.

Thickness	ASTM D1593	Every roll (by on-line Q.C.)
Carbon Black Content	ASTM D1603	50,000 sq ft
Tensile Properties	ASTM D638	50,000 sq ft
Tear Strength	ASTM D1004	50,000 sq ft
Puncture Resistance	FTMS 101- 2065 ASTM D4833	50,000 sq ft Once per day
Modulus of Elasticity	ASTM D638	Once per day
Dimensional Stability	ASTM D1204	Once per day
Carbon Black Dispersion	ASTM D3015	Once per day
Density	ASTM D1505	Once per day
Melt Index	ASTM D1238	Once per day
Oxidative Induction Time	ASTM D3895	Once per day
Low Temp Brittleness	ASTM D746	Once per railcar or lot
Environmental Stress Crack Resistance	ASTM D1693	Once per railcar or lot

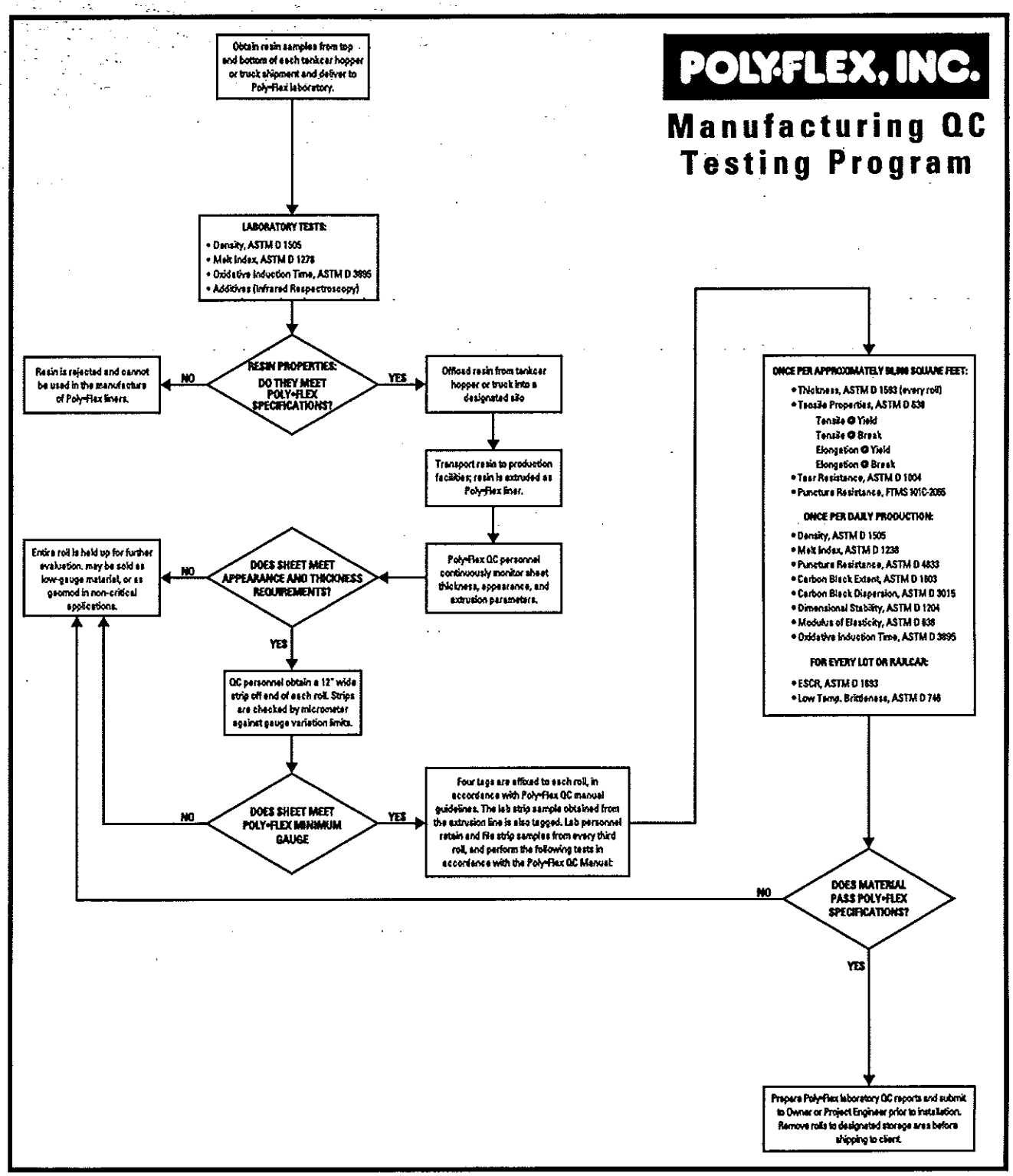
A sample of welding rod is tested once per 25 rolls. The following tests are be performed on the sample:

Thickness	ASTM D 751
Density	ASTM D 1505
Melt Index	ASTM D 1238
Carbon Black Content	ASTM D 1603

After the testing has been completed, the data is reviewed by the quality control manager. If any rolls do not meet specifications additional testing is conducted on that roll. If the roll still does not meet specifications the production manager is notified and the roll is placed on hold.

After the data has been reviewed it is entered into a product file which is used for roll certification.

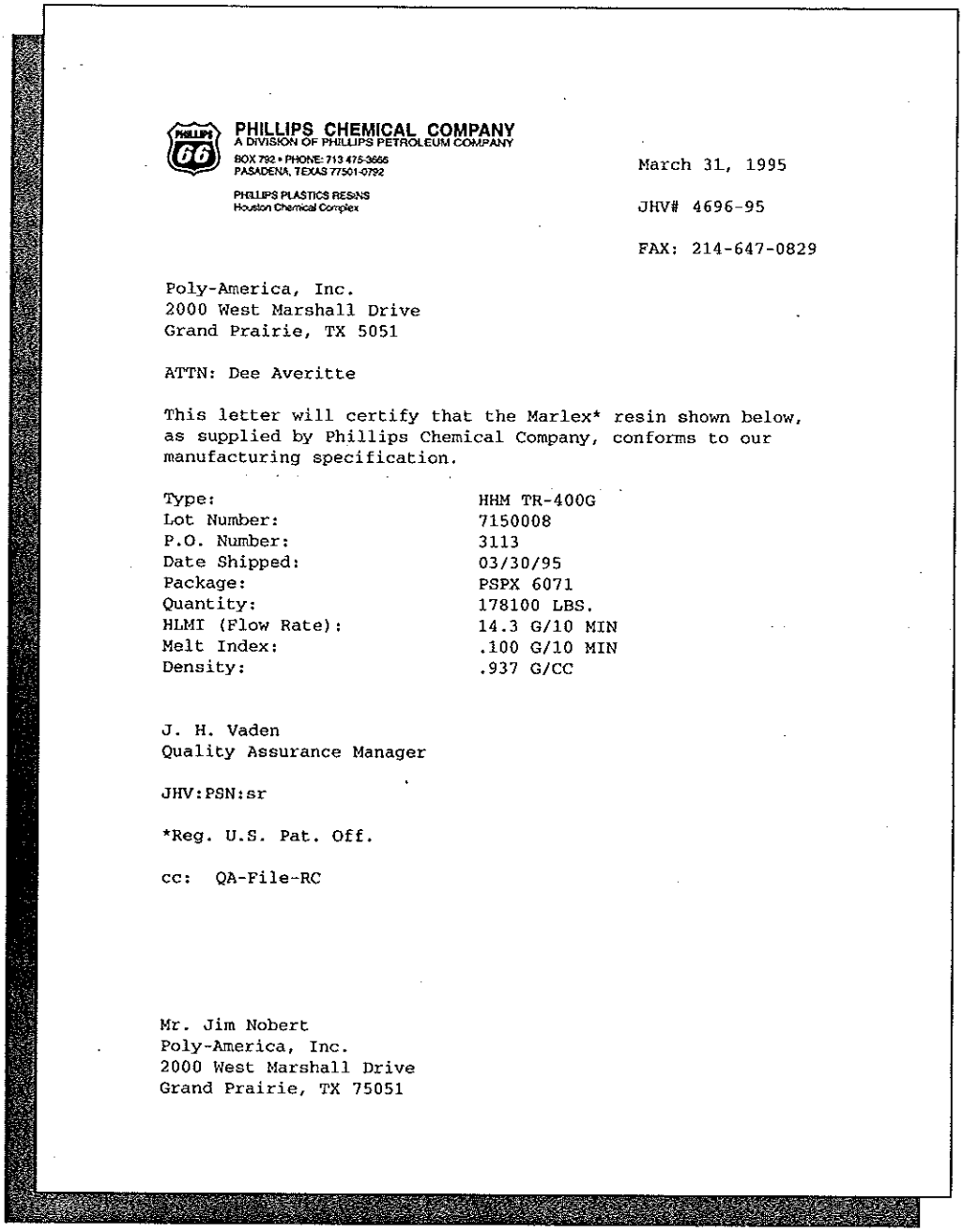
3. MANUFACTURING QUALITY CONTROL PROGRAM FLOW CHART



4. PAPER FLOW FORMS

4.1 Product Quality Report

This report documents the raw material manufacturer's test results for the physical properties of the incoming resin. Each incoming shipment to Poly-Flex is accompanied by such a report. A copy of this report is sent to the engineer/client with the finished product.



PHILLIPS CHEMICAL COMPANY
A DIVISION OF PHILLIPS PETROLEUM COMPANY
BOX 792 • PHONE: 713 475-3665
PASADENA, TEXAS 77501-0792

PHILLIPS PLASTICS RESINS
Houston Chemical Complex

March 31, 1995

JHV# 4696-95

FAX: 214-647-0829

Poly-America, Inc.
2000 West Marshall Drive
Grand Prairie, TX 5051

ATTN: Dee Averitte

This letter will certify that the Marlex* resin shown below, as supplied by Phillips Chemical Company, conforms to our manufacturing specification.

Type:	HHM TR-400G
Lot Number:	7150008
P.O. Number:	3113
Date Shipped:	03/30/95
Package:	PSPX 6071
Quantity:	178100 LBS.
HLMI (Flow Rate):	14.3 G/10 MIN
Melt Index:	.100 G/10 MIN
Density:	.937 G/CC

J. H. Vaden
Quality Assurance Manager

JHV:PSN:sr

*Reg. U.S. Pat. Off.

cc: QA-File-RC

Mr. Jim Nobert
Poly-America, Inc.
2000 West Marshall Drive
Grand Prairie, TX 75051

4.2 Railcar Resin Report

This report is used by Poly-Flex's laboratory to document results of tests performed on incoming raw material. These results are checked against Poly-Flex's raw material specifications and the Product Quality Report issued by the material manufacturer.

RAILCAR RESIN REPORT

P.O. # 3413 Location: Bldg I ____ Bldg IV ____
Date Rec'd 4/17/95 Weight: ____

BUY INFORMATION

Railcar# PSPX-6955
Vendor Phillips
Lot# 7150006
Blend ____
Type: LDPE ____ LLDPE ____
Other GHDPE
Pressure High ____ Low ____

Melt Index .103
Density .937
Film Rating ____
Comments: ____

Slip ø
Antiblock ø
Antioxidant ✓
Copolymer ____ ____
Other ____ ____

CAR CAPACITY

Pellets ____ Granular ____ Car Size ____ Track ____

Measurements N ____ S ____
Inches A 4 CA 6 CB 5 B 4 TOTAL WT. 182,000

Release Information:

	Date	Time	Initials
Released to the Railroad			

Comments: ____

LABORATORY TESTING REPORT

Resin Evaluation
Melt Index: A .11 CA .10 CB .11 B .10 Avg .104 R 100
Bottom: A .10 CA .10 CB .11 B .10 Avg ____ R ____
Density: A .935 CA .936 CB .937 B .936 Avg .936 +.003+= .939
Bottom: A .935 CA .934 CB .935 B .936 Avg ____ +.003+= ____

Film Evaluation
Gauge: Range: ____ - ____ Average ____
Width: NA Dart Impact: NA gm/mil
COF: NA MD Tear: NA gm/mil

IR Analysis:
Slip: ø AB: ____ Polymer: PE ____ Other: ____ ____
CB: NA % Ash: ____ OIT: 45

Comments: HDPE Poly-Flex
Film Use: ____ Approved By: JN 4/18/95

PUMPING INFORMATION

Released for Pumping: ____ (Where) ____ (Date) ____ (Approved)

	Time Started	Time Finished
Compartment A:		
Compartment CA:		
Compartment CB:		
Compartment B:		

Comments: ____

RPM 25 Temp 192 Torque 12,050 Pres 5100

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4.3 Quality Control Report - During Production

This report is sent to the engineer/client as Poly-Flex Inc.'s standard quality control report. It documents the property values of the specific rolls shipped to a project.

CERTIFICATION SHEET

PROJECT NO:_____ DATE:_____

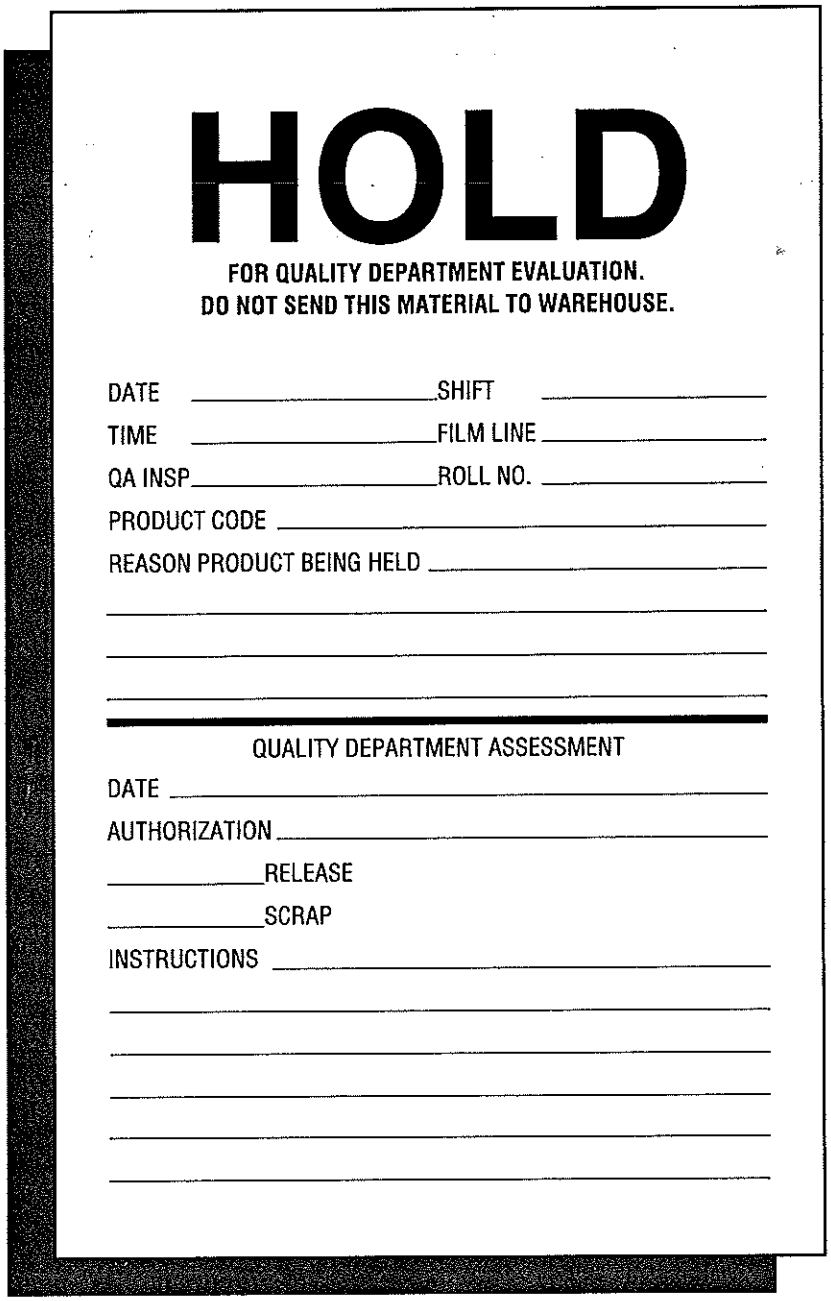
TRIP NO:_____ CERTIFIED BY:_____

POLY-FLEX, INC.
2000 W. Marshall Drive
Grand Prairie, Texas 75051

TEST DESCRIPTION		THICKNESS	CARBON BLACK	C-TEAR	PUNCTURE 2065	TENSILE YIELD	ELONG @ YIELD	TENSILE BREAK	ELONG @ BREAK	ELASTIC MODULUS	PUNCTURE 4833	DIMENSION STABILITY	CAR. BLK. DISPERSION	MELT INDEX	DENSITY	OXIDATIVE INDUCTION TIME	LOW TEMP IMPACT	ESCR (cond. B)
ASTM METHOD		D1593	D1603	D1004	FTMS 101	D638	D638	D638	D638	D638	D4833	D1203	D3015	D1238	D1505	D3895	D746	D1693
(modifications)		min/avg															-70° C	2000 hrs
UNITS		mils	%	lb	lb	ppi	%	ppi	%	psi	lbs	%		gm/ 10 min	gm/cc	min.	PASS	PASS
SPECIFICATION																		
ROLL NUMBER	LOT																	

4.4 Hold Tag

During production, any roll found to be non-conforming in the production process is tagged and immediately removed. The roll will not be released for shipment, but it will be studied to determine the cause of the defect.



HOLD

FOR QUALITY DEPARTMENT EVALUATION.
DO NOT SEND THIS MATERIAL TO WAREHOUSE.

DATE _____ SHIFT _____
TIME _____ FILM LINE _____
QA INSP _____ ROLL NO. _____
PRODUCT CODE _____
REASON PRODUCT BEING HELD _____

QUALITY DEPARTMENT ASSESSMENT

DATE _____
AUTHORIZATION _____
_____ RELEASE
_____ SCRAP
INSTRUCTIONS _____

POLY-FLEX
POLYETHYLENE GEOMEMBRANES

POLY-FLEX LINER MATERIAL DATA SHEETS

POLY-FLEX
POLYETHYLENE GEOMEMBRANES

SMOOTH HDPE GEOMEMBRANE DATA SHEET

Property	Test Method	Nominal Values 20 Mil	30 Mil	40 Mil	60 Mil	80 Mil	100 Mil
Thickness, mils	ASTM D 1593	20	30	40	60	80	100
Sheet Density, g/cc	ASTM D 1505	0.95	0.95	0.95	0.95	0.95	0.95
Melt Index, g/10 minutes	ASTM D 1238	0.2	0.2	0.2	0.2	0.2	0.2
Carbon Black Content, %	ASTM D 1603	2.5	2.5	2.5	2.5	2.5	2.5
Carbon Black Dispersion	ASTM D 3015	A2	A2	A2	A2	A2	A2
Tensile Properties	ASTM D 638 (Mod. per NSF Std. 54)						
1. Tensile Strength at Yield, ppi		55	82	110	165	220	275
2. Elongation at Yield, %		15	15	15	15	15	15
3. Tensile Strength at Break, ppi		95	142	190	285	380	475
4. Elongation at Break, (2.0" G.L.) %		900	900	900	900	900	900
(2.5" G.L.) %		720	720	720	720	720	720
5. Modulus of Elasticity, psi		110,000	110,000	110,000	110,000	110,000	110,000
Tear Strength, lbs.	ASTM D 1004	17	25	33	50	66	83
Puncture Resistance, lbs.	FTMS 101 - 2065	32	48	64	96	128	160
	ASTM D 4833	42	63	84	126	168	210
Low Temperature Brittleness	ASTM D 746	<-112°F	<-112°F	<-112°F	<-112°F	<-112°F	<-112°F
Environmental Stress Crack Resistance, hours	ASTM D 1693 (Cond. B)	2,000+	2,000+	2,000+	2,000+	2,000+	2,000+
Dimensional Stability, %	ASTM D 1204	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5
Roll Dimensions							
1. Width (feet):		22.5	22.5	22.5	22.5	22.5	22.5
2. Length (feet)		1000	800	600	400	300	250
3. Area (square feet):		22,500	18,000	13,500	9,000	6,750	5,625
4. Weight (pounds, approx.)		2,260	2,710	2,710	2,710	2,710	2,820

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SMOOTH HDPE GEOMEMBRANE DATA SHEET

POLY-FLEX
POLYETHYLENE GEOMEMBRANES

Property	Test Method	Minimum Values 20 Mil	30 Mil	40 Mil	60 Mil	80 Mil	100 Mil
Thickness, mils	ASTM D 1593	18	27	36	54	72	90
Sheet Density, g/cc	ASTM D 1505	0.940	0.940	0.940	0.940	0.940	0.940
Melt Index, g/10 minutes (max.)	ASTM D 1238	0.40	0.40	0.40	0.40	0.40	0.40
Carbon Black Content, %	ASTM D 1603	2 -3	2 -3	2 -3	2 -3	2 -3	2 -3
Carbon Black Dispersion	ASTM D 3015	A1, A2, B1	A1, A2, B1	A1, A2, B1	A1, A2, B1	A1, A2, B1	A1, A2, B1
Tensile Properties	ASTM D 638 (Mod. per NSF Std. 54)						
1. Tensile Strength at Yield, ppi		46	69	92	138	184	230
2. Elongation at Yield, %		13	13	13	13	13	13
3. Tensile Strength at Break, ppi		80	120	160	240	320	400
4. Elongation at Break, (2.0" G.L.) %		750	750	750	750	750	750
(2.5" G.L.) %		600	600	600	600	600	600
5. Modulus of Elasticity, psi		80,000	80,000	80,000	80,000	80,000	80,000
Tear Strength, lbs.	ASTM D 1004	14	21	28	42	56	70
Puncture Resistance, lbs.	FTMS 101 - 2065	30	45	60	90	120	150
	ASTM D 4833	40	60	80	120	160	190
Low Temperature Brittleness	ASTM D 746	<-94°F	<-94°F	<-94°F	<-94°F	<-94°F	<-94°F
Environmental Stress Crack Resistance, hours	ASTM D 1693 (Cond. B)	2,000	2,000	2,000	2,000	2,000	2,000
Dimensional Stability, %	ASTM D 1204	+/- 1	+/- 1	+/- 1	+/- 1	+/- 1	+/- 1
Seam Properties	ASTM D 4437 (Mod. per NSF Std. 54)						
1. Shear Strength, ppi		44	66	87	131	175	218
2. Peel Strength, ppi		29 & FTB	43 & FTB	57 & FTB	86 & FTB	114 & FTB	143 & FTB

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POLY-FLEX
POLYETHYLENE GEOMEMBRANES

TEXTURED HDPE GEOMEMBRANE DATA SHEET

Property	Test Method	Nominal Values 40 Mil	60 Mil	80 Mil
Thickness, mils	ASTM D 1593	40	60	80
Sheet Density, g/cc	ASTM D 1505	0.95	0.95	0.95
Melt Index, g/10 minutes	ASTM D 1238	0.3	0.3	0.3
Carbon Black Content, %	ASTM D 1603	2.5	2.5	2.5
Carbon Black Dispersion	ASTM D 3015	A2	A2	A2
Tensile Properties	ASTM D 638 (Mod. per NSF Std. 54)			
1. Tensile Strength at Yield, ppi		100	140	180
2. Elongation at Yield, %		15	15	15
3. Tensile Strength at Break, ppi		95	135	175
4. Elongation at Break, (2.0" G.L.) %		350	350	350
Tear Strength, lbs.	ASTM D 1004	32	45	60
Puncture Resistance, lbs.	FTMS 101 - 2065	62	85	115
	ASTM D 4833	85	110	145
Low Temperature Brittleness	ASTM D 746	<-112°F	<-112°F	<-112°F
Environmental Stress Crack Resistance, hours	ASTM D 1693 (Cond. B)	2,000+	2,000+	2,000+
Dimensional Stability, %	ASTM D 1204	+/- 0.5	+/- 0.5	+/- 0.5
Roll Dimensions				
1. Width (feet):		23	23	23
2. Length (feet):		450	350	250
3. Area (square feet):		10,350	8,050	5,750
4. Weight (pounds, approx.):		2,330	2,520	2,380

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TEXTURED HDPE GEOMEMBRANE DATA SHEET

POLY-FLEX
POLYETHYLENE GEOMEMBRANES

Property	Test Method	Minimum Values 40 Mil	60 Mil	80 Mil
Thickness, mils	ASTM D 1593	36	54	72
Sheet Density, g/cc	ASTM D 1505	0.940	0.940	0.940
Melt Index, g/10 minutes	ASTM D 1238	0.40 (max.)	0.40 (max.)	0.40 (max.)
Carbon Black Content, %	ASTM D 1603	2 -3	2 -3	2 -3
Carbon Black Dispersion	ASTM D 3015	A1, A2, B1	A1, A2, B1	A1, A2, B1
Tensile Properties	ASTM D 638 (Mod. per NSF Std. 54)			
1. Tensile Strength at Yield, ppi		90	126	160
2. Elongation at Yield, %		13	13	13
3. Tensile Strength at Break, ppi		80	100	155
4. Elongation at Break, (2.0" G.L.) %		200	200	200
Tear Strength, lbs.	ASTM D 1004	30	42	52
Puncture Resistance, lbs.	FTMS 101 - 2065	55	75	95
	ASTM D 4833	80	95	120
Low Temperature Brittleness	ASTM D 746	<-94°F	<-94°F	<-94°F
Environmental Stress Crack Resistance, hours	ASTM D 1693 (Cond. B)	2,000	2,000	2,000
Dimensional Stability, %	ASTM D 1204	+/- 1	+/- 1	+/- 1
Seam Properties	ASTM D 4437 (Mod. per NSF Std. 54)			
1. Shear Strength, ppi		85	120	152
2. Peel Strength, ppi		56 & FTB	78 & FTB	99 & FTB

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POLY-FLEX
POLYETHYLENE GEOMEMBRANES

SMOOTH LLDPE GEOMEMBRANE DATA SHEET

Property	Test Method	Nominal Values 30 Mil	40 Mil	60 Mil
Thickness, mils	ASTM D 1593	30	40	60
Resin Density, g/cc	ASTM D 1505	0.92	0.92	0.92
Melt Index, g/10 minutes	ASTM D 1238	0.2	0.2	0.2
Carbon Black Content, %	ASTM D 1603	2.5	2.5	2.5
Carbon Black Dispersion	ASTM D 3015	A2	A2	A2
Tensile Properties	ASTM D 638 (Mod. per NSF Std. 54)			
1. Tensile Strength at Yield, ppi		57	76	114
2. Elongation at Yield, %		18	18	18
3. Tensile Strength at Break, ppi		150	188	282
4. Elongation at Break, (2.0" G.L.) %		1,000	1,000	1,000
(2.5" G.L.) %		800	800	800
5. Modulus of Elasticity (2% secant), psi		45,000	45,000	45,000
Tear Strength, lbs.	ASTM D 1004	22	30	45
Puncture Resistance, lbs.	FTMS 101 - 2065	48	64	96
	ASTM D 4833	60	80	120
Low Temperature Brittleness	ASTM D 746	<-112°F	<-112°F	<-112°F
Environmental Stress Crack Resistance, hours	ASTM D 1693 (Cond. B)	2,000+	2,000+	2,000+
Dimensional Stability, %	ASTM D 1204	+/- 1	+/- 1	+/- 1
Roll Dimensions				
1. Width (feet):		22.5	22.5	22.5
2. Length (feet):		800	600	400
3. Area (square feet):		18,000	13,500	9,000
4. Weight (pounds, approx.):		2,680	2,680	2,680

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SMOOTH LLDPE GEOMEMBRANE DATA SHEET

POLY-FLEX
POLYETHYLENE GEOMEMBRANES

Property	Test Method	Minimum Values 30 Mil	40 Mil	60 Mil
Thickness, mils	ASTM D 1593	27	36	54
Resin Density, g/cc	ASTM D 1505	0.915	0.915	0.915
Melt Index, g/10 minutes	ASTM D 1238	0.60 (max.)	0.60 (max.)	0.60 (max.)
Carbon Black Content, %	ASTM D 1603	2 -3	2 -3	2 -3
Carbon Black Dispersion	ASTM D 3015	A1, A2, B1	A1, A2, B1	A1, A2, B1
Tensile Properties	ASTM D 638 (Mod. per NSF Std. 54)			
1. Tensile Strength at Yield, ppi		48	64	96
2. Elongation at Yield, %		13	13	13
3. Tensile Strength at Break, ppi		127	170	255
4. Elongation at Break, (2.0" G.L.) %		800	800	800
(2.5" G.L.) %		640	640	640
5. Modulus of Elasticity (2% secant), psi		30,000	30,000	30,000
Tear Strength, lbs.	ASTM D 1004	16	22	33
Puncture Resistance, lbs.	FTMS 101 - 2065	37	52	75
	ASTM D 4833	51	68	102
Low Temperature Brittleness	ASTM D 746	<-94°F	<-94°F	<-94°F
Environmental Stress Crack Resistance, hours	ASTM D 1693 (Cond. B)	2,000	2,000	2,000
Dimensional Stability, %	ASTM D 1204	+/- 3	+/- 3	+/- 3
Seam Properties	ASTM D 4437 (Mod. per NSF Std. 54)			
1. Shear Strength, ppi		45	60	90
2. Peel Strength, ppi		37 & FTB	50 & FTB	75 & FTB

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POLY-FLEX
POLYETHYLENE GEOMEMBRANES

TEXTURED LLDPE GEOMEMBRANE DATA SHEET

Property	Test Method	Nominal Values 40 Mil	60 Mil
Thickness, mils	ASTM D 1593	40	60
Resin Density, g/cc	ASTM D 1505	0.92	0.92
Melt Index, g/10 minutes	ASTM D 1238	0.2	0.2
Carbon Black Content, %	ASTM D 1603	2.5	2.5
Carbon Black Dispersion	ASTM D 3015	A2	A2
Tensile Properties	ASTM D 638 (Mod. per NSF Std. 54)		
1. Tensile Strength at Yield, ppi		76	100
2. Elongation at Yield, %		18	18
3. Tensile Strength at Break, ppi		90	126
4. Elongation at Break, (2.0" G.L.) %		450	450
Tear Strength, lbs.	ASTM D 1004	28	40
Puncture Resistance, lbs.	FTMS 101 - 2065	58	78
	ASTM D 4833	76	107
Low Temperature Brittleness	ASTM D 746	<-112°F	<-112°F
Environmental Stress Crack Resistance, hours	ASTM D 1693 (Cond. B)	2,000+	2,000+
Dimensional Stability, %	ASTM D 1204	+/- 1	+/- 1
Roll Dimensions			
1. Width (feet):		23	23
2. Length (feet):		450	350
3. Area (square feet):		10,350	8,050
4. Weight (pounds, approx.):		2,300	2,520

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TEXTURED LLDPE GEOMEMBRANE DATA SHEET

POLY-FLEX
POLYETHYLENE GEOMEMBRANES

Property	Test Method	Minimum Values 40 Mil	60 Mil
Thickness, mils	ASTM D 1593	36	54
Resin Density, g/cc	ASTM D 1505	0.915	0.915
Melt Index, g/10 minutes	ASTM D 1238	0.60 (max.)	0.60 (max.)
Carbon Black Content, %	ASTM D 1603	2 -3	2 -3
Carbon Black Dispersion	ASTM D 3015	A1, A2, B1	A1, A2, B1
Tensile Properties	ASTM D 638 (Mod. per NSF Std. 54)		
1. Tensile Strength at Yield, ppi		60	90
2. Elongation at Yield, %		13	13
3. Tensile Strength at Break, ppi		72	95
4. Elongation at Break, (2.0" G.L.) %		300	300
Tear Strength, lbs.	ASTM D 1004	23	34
Puncture Resistance, lbs.	FTMS 101 - 2065	48	70
	ASTM D 4833	54	81
Low Temperature Brittleness	ASTM D 746	<-94°F	<-94°F
Environmental Stress Crack Resistance, hours	ASTM D 1693 (Cond. B)	2,000	2,000
Dimensional Stability, %	ASTM D 1204	+/- 3	+/- 3
Seam Properties	ASTM D 4437 (Mod. per NSF Std. 54)		
1. Shear Strength, ppi		53	79
2. Peel Strength, ppi		44 & FTB	66 & FTB

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POLY-FLEX
POLYETHYLENE GEOMEMBRANES

GEOMEMBRANE INSTALLATION QUALITY CONTROL & QUALITY ASSURANCE

1. DEFINITIONS

Construction Quality Control (CQC) is a planned system of routine inspections that is used to directly monitor and control the quality of a material or a construction project.

Construction Quality Assurance (CQA) is independent of the CQC and includes inspections, verifications, audits, and evaluations of materials and workmanship necessary to determine and document the quality of the constructed project.

2. PARTIES

This manual references different parties which may be involved in the installation process. A successful liner installation depends on the responsible and timely interaction of all involved parties and coordination of all installation, inspection, testing, and documentation.

Owner .....Owner of the property and/or facility; responsible for the final acceptance of the work done on his property/facility.

Designer.....Architectural and/or engineering entity responsible for project planning, design, specifications, and drawings. The designer may also be the project manager.

Project Manager.....Authorized representative of the owner; in charge of project scheduling and coordination of construction activities.

General Contractor.....Prime contractor for the project; may delegate specific tasks in a contractual agreement to one or more subcontractors. The general contractor is sometimes the liner system installer and/or the earthwork contractor.

Liner System Installer .....(Poly-Flex Construction, Inc. or an approved contractor) subcontractor for the complete installation of the synthetic liner system; must perform according to its contract with the owner or the general contractor.

Liner Manufacturer.....(Poly-Flex, Inc.) manufacturer of the geomembrane from raw material (resin).

Soil CQA Consultant.....Party, independent of the general contractor and the liner installer, in charge of monitoring, testing, inspecting, and documenting all earthwork. Also called soil inspector.

Geosynthetic CQA Consultant ..Party, independent of the general contractor and the liner installer, who monitors, tests, inspects, and documents the installation of all geosynthetic materials, i.e. geomembranes, geotextiles, geonets, and geogrids. Also called third party CQA or liner inspector.

Independent Laboratory.....Testing laboratory unaffiliated with the geosynthetic material manufacturer, installer, or the general contractor for a project.

3. PERSONNEL QUALIFICATIONS

The CQA plan should identify the required qualifications of the CQA officer and the CQA inspection personnel and describe their expected duties.

3.1 Construction Quality Assurance Officer

The CQA officer is assigned singular responsibility for all aspects of the CQA plan implementation. The CQA officer is responsible to the facility owner/operator, and should function independently of the owner/operator, design engineer, and the general contractor. The CQA officer's position within the project's overall organizational structure should be clearly described within the CQA plan.

The CQA officer should possess adequate formal academic training in engineering, engineering geology, or other closely related disciplines. He must also possess sufficient practical, technical, and administrative experience to successfully oversee and implement CQA activities for land disposal facilities. The responsibilities of a CQA officer may require his or her formal registration as a Professional Engineer or equivalent. Because a CQA officer must communicate at all project personnel levels, communication skills of a high order are essential.

3.2 CQA Inspection Personnel

CQA inspection personnel should possess adequate formal training and sufficient practical, technical and administrative experience to successfully execute and document inspection activities. Such personnel must demonstrate knowledge of specific field practices relating to techniques used in the construction of waste land disposal facilities, and of all codes/regulations concerning material and equipment installation, observation and testing procedures, equipment, documentation procedures, and site safety.

3.3 Consultants

Authorities in geology, geotechnical engineering, civil or environmental engineering, or other technical disciplines may be called in from external organizations in the event of unusual site conditions or inspection results. The CQA plan should stipulate in detail the qualifications of such consultants, in the event that it becomes necessary to obtain and use an outside opinion as the basis for a decision implicating construction quality assurance. Consultants should not be used to collect and interpret data when suitable objective observations and test procedures are readily available.

4. MEETINGS

A preconstruction meeting shall be held at the work site prior to commencing the liner installation to discuss work activities, quality control and quality assurance procedure.

A daily meeting shall be held at the work site just prior to commencing the work day. The meeting must include the installer and the liner inspector and will include discussion of both recently completed and imminent activities.

4.1 Preconstruction Meetings

A meeting should be held after the award of the contract and prior to starting the construction of the facility to resolve any uncertainties and review construction objectives. The owner, designer, CQA personnel, general contractor, and the subcontractors should attend this meeting to discuss the following topics:

1. The familiarization of all parties with the site-specific CQA plan and its role relative to the design criteria, plans, and specifications.

2. The responsibilities of each party.
3. The chain of command and communication protocols.
4. The merits of established procedures/protocols for observations and tests (including sampling strategies).
5. The merits of established procedures/protocols regarding construction deficiencies, repairs, and retesting.
6. Methods for documenting and reporting inspection data.
7. Security and safety protocols for the work area.

This meeting should conclude with a walk around the site to review construction material and inspect equipment storage locations. A designated person should document the meeting, and minutes should be distributed to all parties.

4.2 Daily Progress Meetings

A daily meeting shall be held at the work site just prior to commencing the work day. The meeting must include the installer and the liner inspector. The purpose of the meeting is to:

1. Review the previous day's activity.
2. Agree on measurements and specific areas of the previous day's approved work.
3. Review the work schedule.
4. Review work activity and location for the day.
5. Discuss the installer's personnel assignments for the day.
6. Discuss possible problem areas and situations.

5. MATERIAL LOGISTICS

5.1 Transportation

Geomembrane rolls or panels are packaged and shipped in a manner that will protect them from damage. Transportation is the responsibility of the liner manufacturer or the installer.

5.2 Delivery

Off-loading and storage of the geomembrane is the responsibility of the installer, or of the general contractor if delivery precedes the job site arrival of installer personnel. The installer is responsible for replacing any damaged or unacceptable material at no cost to the owner. No off-loading shall be done unless the liner inspector is present. Damage during off-loading shall be documented by the inspector and the installer. All damaged rolls must be separated from the undamaged rolls until the proper disposition of that material has been determined.

5.3 On-Site Storage

Stored geomembrane shall be safely protected against puncture, dirt, grease, moisture, mud, excessive heat and other undesirable conditions.

Geomembrane rolls shall be stored on a prepared smooth surface (not wooden pallets), and shall not be stacked more than two high on soil subgrades. This requirement does not necessarily apply where a concrete pad or warehouse is available for storage purposes.

6. EARTHWORK

The owner or his representative (soil quality assurance inspector) shall inspect the subgrade preparation. Prior to liner installation the subgrade shall be compacted according to the project specifications. Weak or compressible areas which cannot be satisfactorily compacted should be removed and replaced with properly compacted fill. All surfaces to be lined shall be smooth, free of all foreign and organic material, sharp objects, or debris of any kind. The subgrade shall provide a firm, unyielding foundation with no sharp changes or abrupt breaks in grade. Standing water or excessive moisture shall not be allowed. Stones or rocks over 3/8 inch diameter are not allowed in the top 6 inches of soil.

The installer, on a daily basis, shall approve the surface on which the geomembrane will be installed. After the supporting soil surface has been approved, it shall be the installer's responsibility to indicate to the inspector any changes to its condition that may require repair work.

6.1 Vegetation Control

The general contractor, if necessary, shall sterilize the liner installation area using an effective soil sterilant specifically formulated for vegetation present in the area. The sterilant shall not be harmful to the liner and shall be applied according to its manufacturer's recommendations.

6.2 Anchor Trench

The anchor trench shall be excavated to the line, grade, width and depth shown on the construction drawings, prior to liner system placement. The soil inspector shall verify that the anchor trench has been constructed according to construction drawings.

If the anchor trench is located in a clay susceptible to desiccation, no more than the amount of trench required for the base geomembrane to be anchored in one day shall be excavated to minimize desiccation of the anchor trench soils.

Slightly rounded corners shall be provided in the trench where the geomembrane adjoins the trench so as to avoid sharp bends in the geomembrane.

7. LINER DEPLOYMENT

The rolls shall be deployed using a spreader bar assembly attached to a loader bucket or by other methods approved by the project engineer.

The liner installer is responsible for the following:

1. Equipment or tools shall not damage the geomembrane by handling, trafficking, or other means.
2. Personnel working on the geomembrane shall not smoke or wear damaging shoes.
3. The method used to unroll the panels shall not score, scratch or crimp the geomembrane, or damage the supporting soil.
4. The method used to place the panels shall minimize wrinkles.
5. Adequate loading (e.g., sand bags or similar items that will not damage the geomembrane) shall be placed to prevent uplift by wind. In cases of high wind, continuous loading is recommended along edges of panels to minimize risk of wind flow under the panels.

6. Direct contact with the geomembrane shall be minimized; i.e., the geomembrane in traffic areas shall be protected by geotextiles, extra geomembrane, or other suitable materials.

7.1 Field Seaming

Approved seaming processes are hot shoe fusion and extrusion welding. On side slopes, seams shall be oriented in the general direction of maximum slope, i.e., oriented down, not across the slope. In corners and odd-shaped geometric locations, the number of field seams shall be minimized.

No base T-seam shall be closer than 5 feet from the toe of the slope. Seams shall be aligned with the least possible number of wrinkles and "fishmouths." If a fishmouth or wrinkle is found, it shall be relieved and cap-stripped.

7.2 Seam Overlap

Geomembrane panels must have a finished minimum overlap of 4 inches for hot shoe fusion welding and 3 inches for extrusion welding.

Cleaning solvents may not be used unless the product is approved by the liner manufacturer.

7.3 Field Seam Testing

Field test seams shall be conducted on the liner to verify that seaming conditions are satisfactory. Test seams shall be conducted at the beginning of each seaming period and at least once each 4 hours, for each seaming apparatus and personnel used that day.

All test seams shall be made in contact with the subgrade. Welding rod used for extrusion welding shall have the same properties as the resin used to manufacture the geomembrane. The test seam samples shall be 10 feet long for hot shoe welding and 3 feet long for extrusion welding with the seam centered lengthwise. Five specimens shall be cut from each end of the test seams by the inspector. The inspector shall use a tensiometer to test 5 specimens for shear and 5 specimens for peel. Each specimen shall be one inch wide with a grip separation of 4 inches plus the width of the seam. The seam shall be centered between the clamps. The rate of grip separation shall be 2 inches per minute. Test results for seam strength properties shall be the average of five specimens. Four out of five specimens shall pass seam acceptance criteria. Shear and peel tests shall result in Film Tearing Bond (FTB) as defined by NSF Std. 54, which is a failure in ductile mode of one of the bonded sheets by tearing prior to complete separation in the bonded area. If a test seam fails to meet field seam specifications, the seaming apparatus and/or seamer shall not be accepted and shall not be used for seaming until the deficiencies are corrected and a successful test seam is achieved.

8. WEATHER CONDITIONS

Liner deployment shall proceed between ambient temperatures of 32° F to 104° F. Placement can proceed below 32° F only after the installer demonstrates to the inspector that the material can be seamed to meet the project specifications. Geomembrane shall not be placed during precipitation or moisture of any type (e.g. fog, rain, dew), or in the presence of excessive winds, as determined by the installation supervisor. Observation of temperature, humidity, precipitation, and wind should be noted to ensure that weather conditions are acceptable prior to liner placement.

9. SEAMING EQUIPMENT AND ACCESSORIES

Approved equipment for field seaming are hot shoe fusion welders and extrusion fillet welders.

1. Hot Shoe Welder, 110 Volt (220 Volt).
2. Extrusion Welder, 220 Volt.
3. 7.5 KW Generator, single-phase with 110/220 Volt Outputs.

10. HOT WEDGE WELDING

10.1 Hot Wedge Welding System

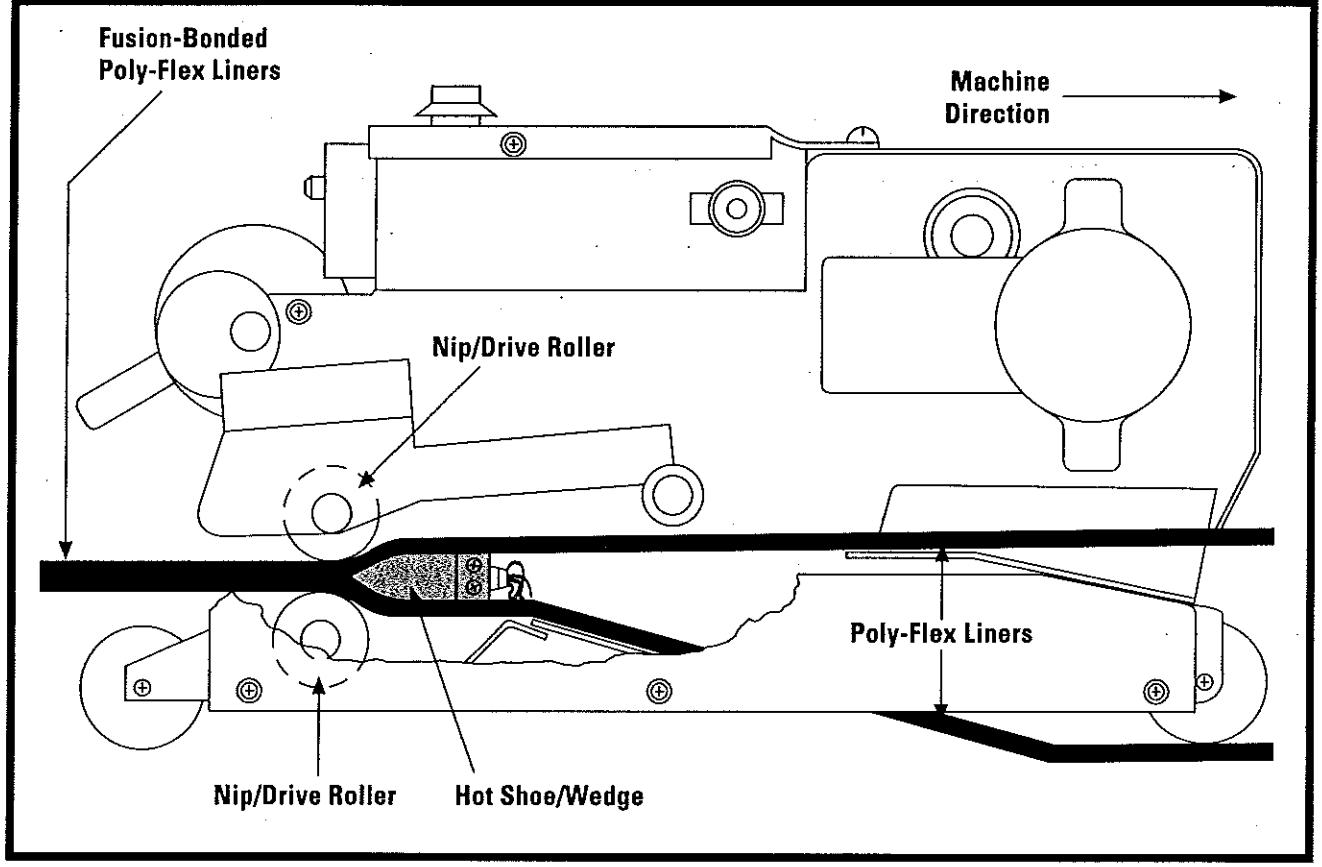
Hot wedge welding represents the primary seaming method for Poly-Flex liners. The hot wedge seaming device is a completely self-contained system. The hot wedge system (Figure 1) produces a bonded seam by running a hot metal wedge between the overlapped area of the Poly-Flex liners. The hot wedge melts the facing surfaces of the two liners and creates a permanent bond between them using controlled heat and pressure. The wedge is square at the leading end and tapered at the trailing end. The heated geomembrane overlaps come together at the tapered end of the hot wedge, under pressure from two nip/drive rollers, and are permanently fused together. Hot air tacking (as employed in extrusion fillet seaming) is not necessary.

The dual hot wedge has a central, canal-like recession along its length. This type of wedge creates a channel in the liner seam between two parallel bonds.

Knurled rollers are used to apply pressure to the sheets where they have just passed over the taper of the hot wedge and been bonded. These rollers should have smooth surfaces and beveled edges.

As the liners pass through the welder, they must contact the full length and width of the hot wedge, or the facing surfaces will not be equally hot. Contour rollers or similar pressure devices, which press the liners against both sides of the hot wedge, must be adjusted so that material of any thickness conforms to the wedge's taper while passing through the welder. Such adjustments should be made while the wedge is cold.

Figure 1 **Hot Wedge Welder**



This seaming method is designed to:

1. Monitor operating temperatures via digital readout.
2. Form uniform bonds by applying uniform and consistent pressure to the seam area.
3. Reduce surface tension and remove surface contamination without grinding, which improves bond strength.
4. Ensure high reliability, which results in consistent seam integrity.
5. Minimize operator error, as the machine is semi-automatic.

10.2 Liner Preparation for Hot Wedge Welding

The following steps shall be taken to prepare the liner for hot shoe seaming:

1. The two liners to be joined must be positioned to create an overlap of 4-6 inches.
2. If the overlap is not substantially wide to contain the wedge, "float" the liner into better position by lifting it high enough to draw air beneath it, guiding it upon this air to an improved position. Avoid dragging the liner, particularly across rough soil subgrades.
3. If the overlap between the liners is excessive, the excess must be trimmed away. This should be done by trimming the lower sheet. If this is not possible and the upper sheet must be trimmed, use

a knife with a shielded or hook blade. An unshielded, downward-facing blade cutting from above can easily scratch the liner in a vulnerable location.

4. All cutting and preparation of odd-shaped sections or small fitted pieces must be completed ahead of the seaming operation, so that seaming may be conducted with no interruptions.
5. Before joining the two contiguous liners, make sure they are not excessively scratched, blemished or flawed, and are visually acceptable.
6. If the Plans require panels to be shingled in a particular direction, make sure this is being done.
7. Excessive undulations (waves) along the seams during the seaming operation should be avoided. These occur when the upper and lower sheets have unequal slack between them. This condition can lead to the undesirable formation of "fishmouths," which must be trimmed, laid flat and patched.
8. Polyethylene liners need slack to account for expansion and contraction caused by weather changes.
9. Sheets which are overlapped and ready for seaming must be clean. If dirty, they must be wiped clean with dry rags.
10. The seam area must be completely free of moisture before the overlapping sheets can be properly seamed. Dry rags can be used to wipe any such moisture up from the seam surface. If a sufficient quantity of dry rags is unavailable for this purpose, air blowers can be used.
11. Seaming is not to be performed during rain or snow unless measures are taken to allow the seam to be made on dry liner materials, e.g., within an enclosure or shelter.
12. Seaming is not to be performed when the soil surface beneath the liners is saturated because the hot seaming apparatus will draw moisture into the ongoing seam. Seaming activity on frozen soil is unacceptable for the same reason. Puddled water on the soil's surface beneath the liner is unacceptable.
13. Seaming should only be conducted when ambient temperatures are 32-104° F (0-40° C), unless it can be proven via test strips that good seams can be fabricated at such temperatures.
14. When seaming in cold weather, it is advisable to preheat the sheets with a hot air blower, to conduct seaming activity within a portable tent, to help prevent heat loss. Extra test welds can be used to make any necessary adjustments to the seaming activity.

10.3 Hot Wedge Equipment Preparation

1. A generator must be kept in the proximity of the seaming area with enough extension cord to range the length of the seam. It must either be fitted with rubber tires or be placed on a stable and smooth moveable base, such as an excess of liner, so that no damage will be inflicted upon the liner or subgrade by its movement. The generator's fuel (gasoline or diesel) must be stored off the liner.
2. Surface grinding before application of the hot wedge is not necessary and shall not be done.
3. The hot wedge, or "anvil," should be inspected to see that it is symmetrically balanced and gradually tapered. It is imperative that a wedge has no sharp edges on any surface that contacts the liner during the welding process.
4. The chain drive powering any portion of the welder should be synchronized, properly lubricated, and physically sound.

Contour roller heights are adjustable to allow for varying liner thicknesses. Normal adjustments are made while the welder is at ambient temperature. The procedure is as follows:

1. Take two material samples and insert them into the nip drive rollers.
2. Place two other material samples above and below the wedge.
3. Lock the wedge into its operating position. This is done by shifting the wedge forward, into the clutch of the upper and lower nip rollers.
4. Adjust the contour rollers until they are snug against the liners, which sandwich the wedge.
5. Set the maximum distance that the wedge can move into the nip rollers. Unsecured, the wedge might make direct contact with the nip rollers when the machine has no liner material running through it and damage the machine.
6. The wedge and surrounding rollers are now set for seaming the liner. Remember to disengage the hot wedge from its forward position in the roller apparatus as the machine reaches the end of a seam. This will keep the wedge from advancing into the nip rollers and damaging them.
7. The forward face of the welding machine should be inspected for sharp corners and irregular details which may damage the liner as it advances during the seaming process.
8. Temperature controllers on the wedge device should be set according to liner thickness, ambient temperature, and seaming rate. The "test strip" helps determine these settings. Temperature gauges should be checked for accuracy and repeatability.

10.4 Hot Wedge Seaming Process

Polyethylene liners can be seamed by the hot wedge method, but temperature settings will vary according to the grade of polyethylene used. Typical wedge temperature ranges for hot wedge seaming is as follows:

Liner Type	Minimum[1] °F (°C)	Maximum[2] °F (°C)
HDPE	600 (315)	752 (400)
LLDPE	600 (315)	716 (380)

[1]For dry, warm weather seaming conditions
[2]For damp, cold weather seaming conditions

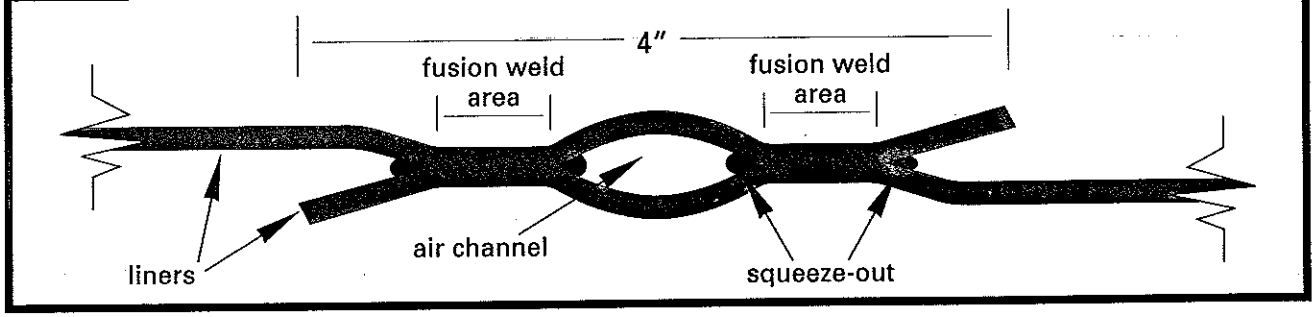
1. The hot wedge system should be properly positioned for making the desired dual (split) seam.
2. Ambient variables such as temperature, cloud cover, and wind speed may make it necessary to adjust the wedge temperature. It may be useful to document wedge temperatures used successfully in a variety of ambient conditions, so that the hot wedge can be more accurately adjusted to new conditions.
3. The drive motor should be off when positioning the welding machine to seam. Guide the overlapped material between the contour rollers and the wedge and into the drive/nip rollers. When the nip rollers engage and the wedge is in position, turn on the drive motor. Move the hot wedge into position and lock it.
4. The operator must constantly monitor the temperature controls, as well as the completed seam passing through the machine. Occasional adjustments in speed may be necessary to maintain a consistent weld.

5. On soft soils, the device tends to "bulldoze" into the ground as it travels, causing soil to enter the weld. A contaminated weld is unacceptable. To avoid this, the operator should slightly lift the front of the machine. Alternatively, a movable base can be used. Strips of geomembrane have proven to be effective materials on which the welder can maintain traction. It is recommended that at least two people work together in making hot wedge seams: one as operator and one as helper.

10.5 After Hot Wedge Seaming

1. A small amount of "squeeze-out" is a reliable indication that proper seaming temperatures have been achieved (Figure 2). The melted polymer will laterally extrude out of the seam area in properly welded seams. An excessive amount of extruded hot melt indicates that excessive heat or pressure, or both, was applied. Reduce the temperature and/or pressure to correct the situation.

Figure 2 **Cross-Section of Dual (Split) Hot Wedge Seam**



2. The 20 mil, 30 mil and 40 mil Poly-Flex liners show a long, low, sinusoidal wavelength pattern in the direction of the seam which indicates a proper weld. If the wave peaks are too close together, machine speed should be increased until a satisfactory pattern appears. The absence of this wavelength pattern indicates that machine speed should be decreased. No wavy pattern will occur on liners thicker than 40 mil due to the inherent stiffness of the thicker liners.
3. Nip/drive roller marks will always show on the surface when using knurled rollers. They should be noticeable to the eye, but just barely to the touch.
4. The hot wedge device has adjustable parts. It is critical that they be checked after a day of seaming. The machine should also be cleaned.

11. EXTRUSION FILLET WELDING

11.1 Extrusion Fillet Welding System

Extrusion fillet welding is used for patches and around details such as pipes and sumps. An extrusion weld is produced by using a 4 or 5 mm diameter welding rod. The welding rod is applied as a "welded bead" at the edge of two overlapped Poly-Flex liners, resulting in an extrusion seam.

11.2 Liner Preparation for Extrusion Fillet Seaming

The two liners to be joined must be positioned to create an overlap of at least 3 inches. Follow the same guidelines as specified for liner preparation for hot wedge welding, page 7 and 8 of this manual.

11.3 Extrusion Equipment Preparation

1. A generator must be kept in the proximity of the seaming area. It must either be fitted with rubber tires, or be placed on a stable and smooth moveable base, such as an excess of liner, so that no damage will be inflicted upon the liner or subgrade by its movement. The generator's fuel (gasoline or diesel) must be stored off the liner.
2. A hand-held electric rotary grinder having a circular disk grinding plate approximately 4 inches in diameter and adequate #80 grit paper must be available. #100 grit paper, which is finer than #80, is preferable. Sandpaper coarser than #80, e.g. #60, is not acceptable for smooth liners.
3. A hot air welder capable of 600° C must be available to tack the liner after they are properly positioned.
4. All extrusion fillet seaming devices must be equipped with a properly functioning temperature controller which displays the extrusion temperature.
5. All types of extrusion fillet seaming devices have teflon dies, varied in shape and size, through which the extrudate passes onto the liner These dies must be inspected for wear, sharp notches and creases, and for their appropriateness to the application at hand.

11.4 Extrusion Fillet Seaming Process

1. Surfaces shall be clean and dry.
2. For liners 50 mils and thicker, the upper sheet's leading edge must be ground to a 45° bevel (Figure 3). It is imperative that the sheet be lifted up and away from the lower sheet during the beveling so that no deep gouges are cut in the lower sheet. Beveling should therefore be done before tack welding.
3. A hot air device should be used to "tack" the two sheets together. The hot air gun prepares the seam for the extrusion welder by creating a light bond between the two sheets, securing their position. The hot air gun is not meant to create a primary seam. No heat distortion should be evident on the surface of the upper sheet.
4. The area which is to receive the extrusion bead shall be ground to remove surface contamination and surface tension. Grind marks should not be deeper than 10% of the sheet thickness. Optimally, they should be about 5% of the sheet thickness (Figure 4). The only purpose of grinding is the removal of oxide layers and dirt from the liner surfaces and the roughening of their interface for the extrudate. All material dust generated by grinding the liner sheets must be blown away from the seaming area.
5. Grinding marks should not extend beyond 1/4 inch of either side of the extrudate after its placement. For example, if the final extrudate bead width is 1 1/2 inches, the width of the grinding trail should not exceed 2 inches.
6. Seaming must take place no more than 10 minutes after grinding, so that surface oxide layers do not reappear where the extrudate must be placed.
7. The welding rod shall be free from dirt, dust, moisture and tangles at all times.

Figure 3 Beveling Upper Liner

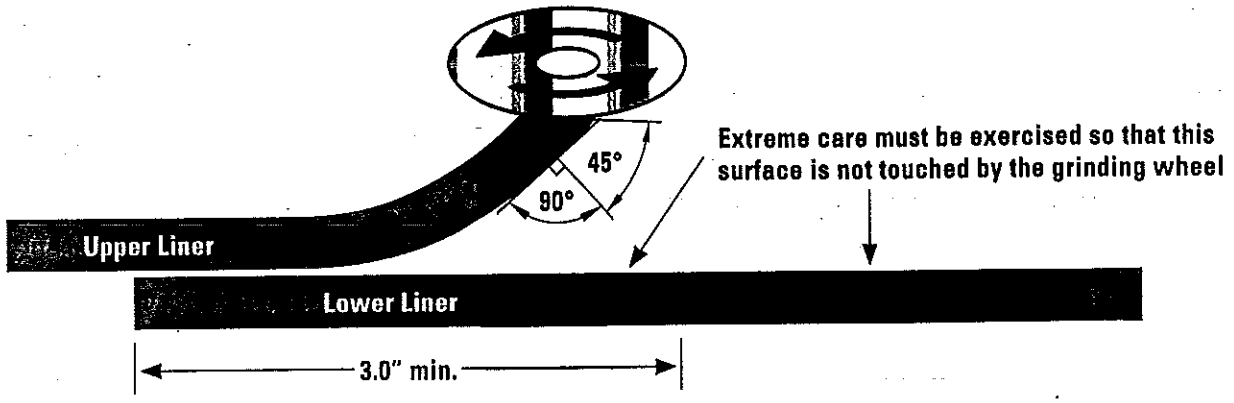
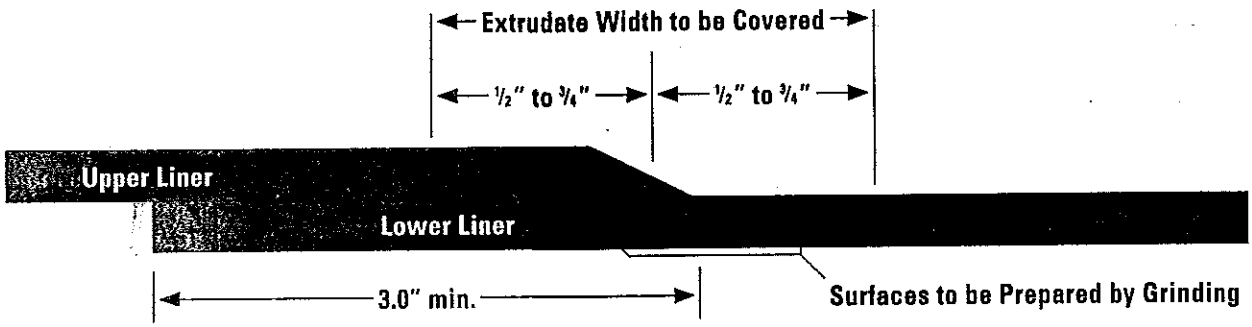


Figure 4 Grinding Seam Area Prior to Extrustion Fillet Welding



8. The extrusion welder's barrel shall be purged of all heat-degraded extrudate for approximately 30 seconds before starting a seam. This must be done every time the extruder is restarted after two or more minutes of inactivity. The purged extrudate shall not be discharged on the surface of the liner or on prepared subgrade, where it could damage the liner.

9. Molten extrudate is deposited along the overlapped seam. The center of the extrudate passes directly along the edge of the upper liner, at sufficient width to completely cover the edge and most of the outlying grind marks, at least to within 1/4 inch of their extremity.

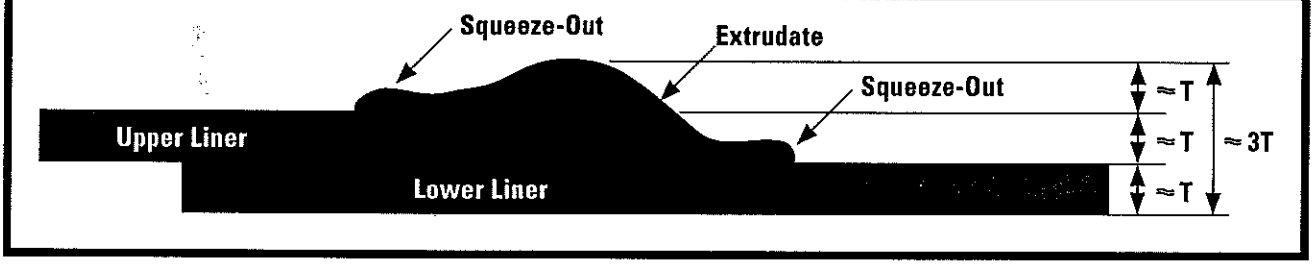
10. The bottom portion of the welding die shall stay in intimate contact with the sheet surface and conform to various seam angles and configurations.

11. The extrudate should be approximately twice the specified sheet thickness, measured from the top of the bottom sheet to the top or "crown" of the extrudate (Figure 5). Excessive squeeze-out (or "flashing"), as illustrated, is acceptable, if it is equal on both sides and will not interfere with subsequent vacuum box testing. If, however, the extrudate can be pulled by its squeeze-out off the seam,

the extrudate is unacceptable. The presence of squeeze-out may indicate that the extrusion die was not riding directly against the liner, that the extrudate temperature was improper for adequate flow, or that the seaming rate was too slow.

12. Where possible, inspect the underside of the lower liner for heat distortion. This can be done at the end of seams, and wherever samples are cut out of the seam. A slight amount of thermal "puckering" on relatively thin liners (less than 50 mil) is acceptable. It indicates that heat penetrated entirely through the sheet. However, if the underside is greatly distorted, either lower the temperature or increase the rate of seaming. For liners 80 mil and greater, no thermal "puckering" should take place.
13. If the seaming process must be interrupted at mid-seam, the extrudate should trail off gradually, not terminate in a large mass of solidified extrudate. Where such welds are abandoned long enough to cool, they must be ground prior to continuing with new extrudate over the remainder of the seam. Grind where the extrudate trail-off begins. This restart procedure must be followed for patches, pipes, fittings, appurtenances and "T" and "Y" shaped seams.

Figure 5 **Extrusion Fillet Seam Cross-Sections**



11.5 After Extrusion Fillet Seaming

1. A smooth insulating plate or heat insulating fabric is to be placed beneath the hot welding apparatus after usage. The tip die and barrel must not be placed on any liner or other geosynthetic surface, as it is extremely hot and can cause severe damage.
2. The extrudate bead should be visually inspected for alignment, height, and surface texture uniformity. No bubbles or pock marks should appear in the extrudate, which indicate the undesirable presence of air, water or debris within the extrudate rod or pelletized polymer.
3. Grind marks should not be visible more than 1/4 inch beyond the extrudate. These should be very light and not contain heavy gouges. Grinding is considered excessive when it is deeper than 10% of the liner thickness. It is unacceptable to apply additional extrudate over the original extrusion fillet seam in an area of excessive grinding. A cap strip shall be placed over the entire portion of the seam where excessive grinding is located.

12. UNUSUAL CONDITIONS

Seaming should proceed when ambient air temperature is between 32 -104°F (0-40° C). At temperatures below freezing, special precautions must be taken. Shielding, preheating, increasing extrudate temperature, and/or decreasing the rate of seaming rate may be necessary strategies. Thawed subgrade moisture in the seam area shall not be tolerated. Frozen irregularities in the subgrade could cause problems. Temperatures outside the given range generally necessitate more frequent test stripping and more diligent nondestructive testing.

High winds, or gusts of wind, always pose problems for liners. After unrolling the liner, the panels must be securely ballasted with sandbags. The seaming process, however, will necessitate the removal of some of the sandbags, which will leave any windward edge vulnerable to wind uplift. Properly orient the overlap to prevent wind uplift. Additional labor may be needed for the sole purpose of removing the sandbags immediately ahead of the seaming operation as it moves along, and immediately replacing them as the welder passes. Any dirt and moisture left behind during the movement of sandbags must be cleaned away.

13. SEAM PROPERTIES AND FIELD TEST PROCEDURES

13.1 Seam Properties

Minimum seam values based on ASTM D4437, as modified in Annex A of NSF Std. 54-1993 shall be as follows:

Shear Strength,ppi	20 mil	30 mil	40 mil	60 mil	80 mil	100 mil
Smooth HDPE	44	66	87	131	175	218
Textured HDPE			85	120	152	
Smooth LLDPE		45	60	90		
Textured LLDPE			53	79		
Peel Strength,ppi	**20 mil**	**30 mil**	**40 mil**	**60 mil**	**80 mil**	**100 mil**
Smooth HDPE	29	43	57	86	114	143
Textured HDPE			56	78	99	
Smooth LLDPE		37	50	75		
Textured LLDPE			44	66		

13.2 Non-Destructive Seam Testing

The installer shall non-destructively test every field seam over its full length. All test equipment shall be furnished by the installer.

13.2.1 Vacuum Box Testing

Equipment for testing extrusion seams shall be comprised of the following:

1. A vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft rubber gasket attached to the bottom, port hole or valve assembly, and a vacuum gauge.
2. Soapy solution in a plastic bucket with a mop.

The following procedures shall be followed by the installer:

1. Excess sheet overlap shall be trimmed away.

2. Wet a strip of geomembrane approximately 12 inches by the length of box with the soapy solution.
3. Place the box over the wetted area and compress.
4. Create a vacuum of 3 - 5 psi.
5. Ensure that a leak tight seal is created.
6. For a period of approximately 15 seconds, examine the geomembrane through the viewing window for the presence of animated soap bubbles.
7. If no animated bubbles appear after 15 seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum 3 inches overlap and repeat the process.
8. All areas where animated soap bubbles appear shall be marked, repaired and then retested.

The following procedures shall apply to locations where seams cannot be non-destructively tested.

1. If the seam is accessible to testing equipment prior to final installation, the seam shall be non-destructively tested prior to final installation.
2. If the seam cannot be tested prior to final installation, the seams shall be spark tested according to the spark tester manufacturer's procedures.

13.2.2 Air Pressure Testing (For Double Fusion Seams Only)

Equipment for testing double fusion seams shall be comprised of the following:

1. An air pump equipped with pressure gauge capable of generating and sustaining a pressure between 25 and 30 psi.
2. A pressure gauge equipped with a sharp hollow needle.

The following procedures shall be followed by the installer:

1. Seal one end of the seam to be tested.
2. Insert needle or other approved pressure feed device through the sealed end of the channel created by the double wedge fusion weld.
3. Energize the air pump to verify the unobstructed passage of air through the channel.
4. Seal the other end of the channel.
5. Energize the air pump to a pressure between 25 and 30 psi, close valve, allow 2 minutes for the injected air to come to equilibrium in the channel, and sustain pressure for approximately 5 minutes.
6. If pressure loss exceeds 4 psi, or pressure does not stabilize, locate faulty area, repair and retest.
7. If pressure does not drop below the acceptable value after five minutes, cut the air channel open at the opposite end from the pressure gauge. The air channel should deflate immediately indicating that the entire length of the seam has been tested.

13.3 Destructive Seam Testing

Destructive seam testing should be minimized to preserve the integrity of the liner. The installer shall provide

the inspector with one destructive test sample per project specifications (usually once per 500 feet of seam length) from a location specified by the inspector.

13.3.1 Sampling Procedure

In order to obtain test results prior to completion of liner installation, samples shall be cut and marked by the installer as the seaming progresses. The installer shall also record the date, location, and pass or fail description. All holes in the geomembrane resulting from obtaining the seam samples shall be immediately repaired and vacuum tested.

13.3.2 Size and Disposition of Samples

The samples shall be 12 inches wide by 36 inches long with the seam centered lengthwise. The sample shall be cut into three equal-length pieces, one to be given to the inspector, one to be given to the owner's representative and one to the installer.

13.3.3 Field Laboratory Testing

The inspector shall test ten 1 inch wide specimens from his sample, five specimens for shear strength and five for peel strength. To be acceptable, four out of the five specimens must pass.

13.3.4 Independent Laboratory Testing

The owner, at his discretion and expense, may send seam samples to a laboratory for testing. The test method and procedures to be used by the independent laboratory shall be the same as used in field testing.

13.3.5 Procedures for Destructive Test Failure

The following procedures shall apply whenever a sample fails the field destructive test:

1. The installer shall cap strip the seam between the failed location and any passed test locations.
2. The installer can retrace the welding path to an intermediate location (usually 10 feet from the location of the failed test), and take a sample for an additional field test. If this test passes, then the seam shall be cap stripped between that location and the original failed location. If the test fails, then the process is repeated.
3. Over the length of seam failure, the installer shall either cut out the old seam, reposition the panel and reseam, or add a cap strip.

13.4 Defects and Repairs

All seams and non-seam areas of the geomembrane shall be inspected by the inspector for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. The surface of the geomembrane shall be clean at the time of inspection.

13.4.1 Evaluation

Each suspect location in seam and non-seam areas shall be non-destructively tested as appropriate in the presence of the inspector. Each location that fails the non-destructive testing shall be marked by the inspector, and repaired accordingly.

13.4.2 Repair Procedures

1. Defective seams shall be cap stripped or replaced.
2. Small holes shall be repaired by extrusion welding. If the hole is larger than 1/4 inch, it shall be patched.

3. Tears shall be repaired by patching. Where the tear is on a slope or an area of stress and has a sharp end it must be rounded prior to patching.
4. Blisters, large cuts and undispersed raw materials shall be repaired by patches.
5. Patches shall be done by extrusion welding. The weld area shall be cleaned no more than 10 minutes prior to the repair. No more than 10% of the thickness shall be removed by grinding. Welding shall commence where the grinding started and must overlap the previous seam by at least 2 inches. Reseaming over an existing seam without regrinding shall not be permitted. The welding shall restart by grinding the existing seam and rewelding a new seam.

Patches shall be round or oval in shape, made of the same geomembrane, and extend a minimum of 6 inches beyond the edge of defects. All patches shall be of the same material and thickness as the geomembrane.

13.4.3 Verification of Repairs

Each repair shall be non-destructively tested. Repairs that pass the non-destructive test shall be taken as an indication of an adequate repair. Failed tests indicate that the repair shall be repeated and retested until passing test results are achieved.

Daily documentation of all non-destructive and destructive testing shall be provided to the inspector by the installer. This documentation shall identify all seams that initially failed the test and include evidence that these seams were repaired and successfully retested.

13.4.4 Cover Soil Replacement

The earthwork contractor shall place the soil cover layer over the liner system on a daily basis as soon as a lined area of the facility has been completed and accepted by the owner.

Extreme care shall be taken by the earthwork contractor not to damage the liner system during the cover soil placement. A minimum of 12 inches of cover soil is needed prior to placing any earth-moving machinery over the liner system. The soil and rock particles of the cover material shall be of such size and shape as not to damage the liner. The upper particles' size limit is usually 3/8 inch. Angular or sharp rock fragments are not allowed.

The earthwork contractor should conduct a test on the job site simulating field subgrade, liner system, and cover soil placement. The earthwork contractor should use the proposed method of cover soil placement and equipment to verify the integrity of the liner. The liner installer is not responsible for damage to the liner as a result of using unsuitable cover material or improper methods of cover placement over the liner. That is the responsibility of the earthwork contractor.

Cover soil shall be placed on side slopes from the bottom to the top of the slope. During the cover soil placement, the driver shall not make sharp turns or sudden starts and stops. The machinery speed shall be slow. Frozen soils are not to be used as cover material unless screened prior to placement.

Cover soils shall be placed during the coolest time of the day to prevent folds in the liner. Special techniques shall be implemented to isolate small liner ripples and prevent the liner from folding over itself during cover soil placement.

13.4.6 Pipe Penetrations

Pipe boots should be isolated from the seasonal effects of liner expansion and contraction. Such penetrations should allow for reasonable access by extrusion welding and testing equipment.

14. BACKFILLING OF ANCHOR TRENCH

Unless otherwise specified, the anchor trench shall be backfilled and compacted by the earthwork contractor. Trench backfill material shall be placed and compacted according to project specifications.

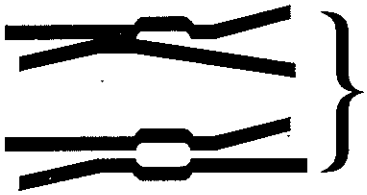
Care shall be taken when backfilling the trenches to prevent any damage to the geomembrane.

15. GEOMEMBRANE ACCEPTANCE

The liner installer shall retain ownership and responsibility for the liner until installation is finished and verification of the adequacy of all field seams and repairs, including associated testing, is complete, upon which time the owner shall accept the liner and assume ownership and full responsibility for it.

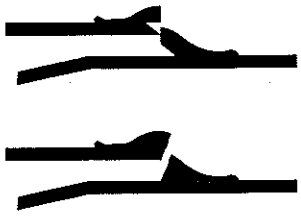
POLY-FLEX
POLYETHYLENE GEOMEMBRANES

Locus-of-Break Codes and Descriptions of Breaks for Dual Wedge-Weld Seams*

Type of Break	Code	Break Description	Classification
	AD	Adhesion Failure. Complete separation on one or both sides of the air channel.	Non-FTB
	BRK	Break in Sheeting.	FTB
	SE-1	Break at outer edge of seam. Break can be either top or bottom sheet.	FTB
	SE-2	Break at inner edge of seam.	FTB
	AD-BRK	Break in first seam after some adhesion failure. Break can be either top or bottom sheet.	FTB

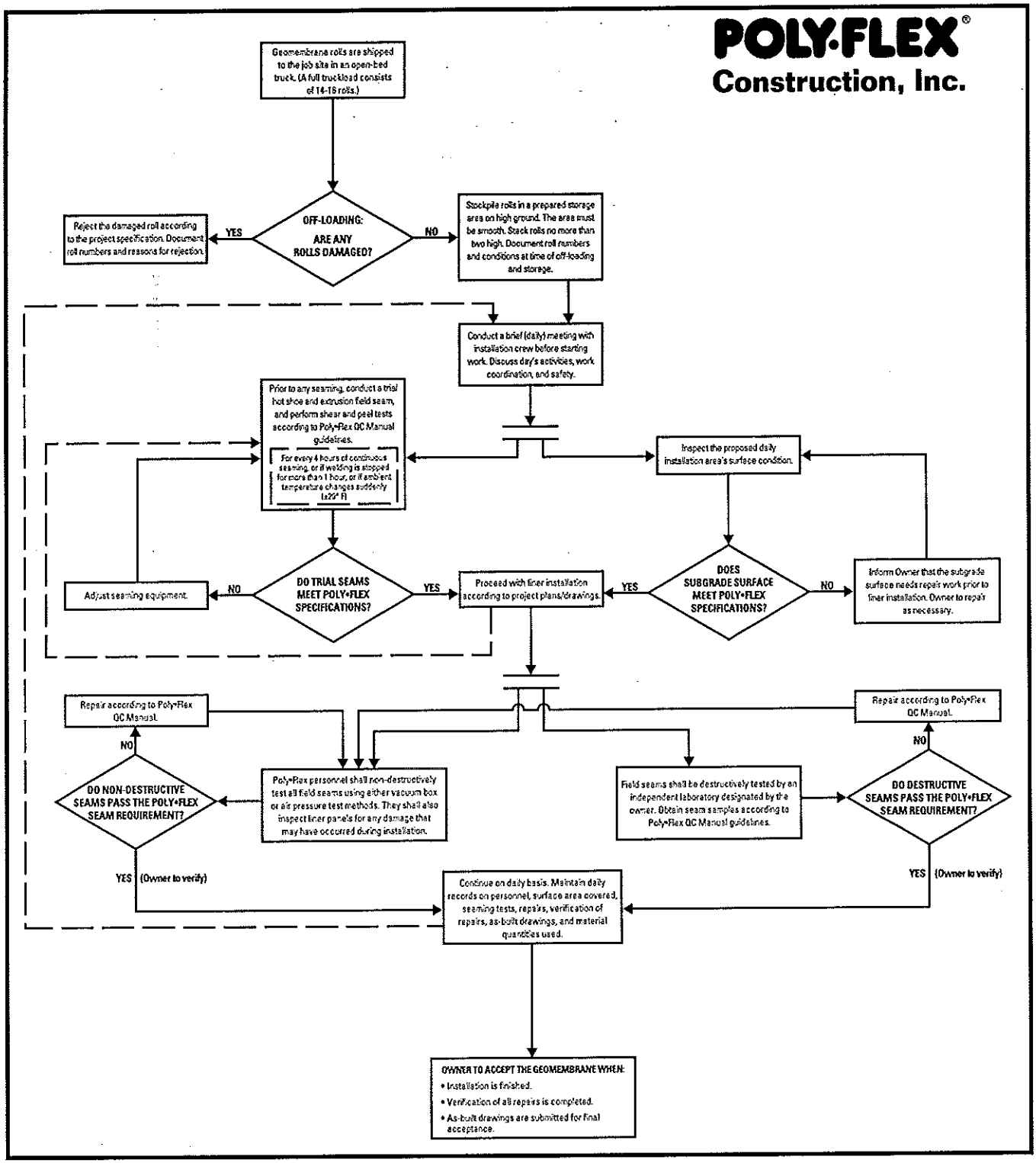
*Henry Haxo, Matrecon Inc., Alameda, CA.
Lining of Waste Containment and Other Impoundment Facilities
EPA/600/2-88/052

Locus-of-Break Codes and Descriptions of Breaks for Extrusion Fillet-Weld Seams*

Type of Break	Code	Break Description	Classification
	AD-1	Failure in adhesion. Specimens may also delaminate under the bead and break through the thin extruded material in the outer area.	Non-FTB
	AD-2	Failure in adhesion.	Non-FTB
	AD-WLD	Break through the fillet. Such breaks range from those that start at the edge of the top sheet to those that run through the fillet after some adhesion failure between the fillet and the bottom sheet.	FTB
	SE-1	Break at seam edge. Specimens may break anywhere from bead/outer area edge to the outer area/buffed area edge. (Applicable to shear only.)	FTB
	SE-2	Break at seam edge. Specimens may break anywhere from bead/outer area edge to the outer area/buffed area edge.	FTB
	SE-3	Break at seam edge. (Applicable to peel only.)	FTB
	BRK-1	Break in sheeting. A "B" in parenthesis after the code means the specimen broke in the buffed area. (Applicable to shear only.)	FTB
	BRK-2	Break in sheeting. A "B" in parenthesis after the code means the specimen broke in the buffed area.	FTB
	AD-BRK	Break in sheeting after some adhesion failure between the fillet and the bottom sheet. (Applicable to peel only.)	FTB
	HT	Break at the edge of the hot tack for specimens which could not be delaminated in the hot tack. (Applicable to shear tests only.)	FTB

*Henry Haxo, Matrecon Inc., Alameda, CA.
Lining of Waste Containment and Other Impoundment Facilities
EPA/600/2-88/052

GEOMEMBRANE INSTALLATION FLOW CHART



POLY-FLEX
POLYETHYLENE GEOMEMBRANES

WORKMANSHIP WARRANTY

POLY·FLEX CONSTRUCTION, INC.
LIMITED WORKMANSHIP WARRANTY

Warranty No: _____
Project No: _____
Effective Date: _____

PURCHASER NAME: _____

ADDRESS: _____

CITY, STATE, ZIP _____

PROJECT NAME: _____

DESCRIPTION: _____

ADDRESS: _____

CITY, STATE, ZIP _____

POLY-FLEX CONSTRUCTION, INC. (PFCI) warrants each POLY-FLEX LINER SYSTEM installed by PFCI to be free from defects in workmanship. This "Workmanship Warranty" shall be in effect from the date the installation of the Poly-Flex Liner System is completed and accepted by the Owner for a period of one year of normal use in approved applications.

This Limited Warranty does not include damages or defects in Poly-Flex Liner System resulting from acts of God, casualty or catastrophe including but not limited to: earthquakes, floods, piercing hail, tornadoes or force majeure. The term "normal use" as used herein does not include, among other things, the exposure of Poly-Flex Liner System to harmful chemicals, abuse of Poly-Flex Liner System by machinery, equipment or people, excessive pressures or stress from any source, subsurface or overburdened soil conditions, and total or differential soil settlements and the effect these may have on the liner system.

Should defects or premature loss of use within the scope of the above Limited Workmanship Warranty occur, PFCI will, at its option, repair or replace the Poly-Flex Liner on a pro-rata basis at the then current price in such manner as to charge the Purchaser/User only for that portion of the warranted life which has elapsed since purchase of the material. PFCI will have the right to inspect and determine the cause of any alleged defect in the Poly-Flex Liner and to take appropriate steps to repair or replace the Poly-Flex Liner if a defect exists and is within the term of this Limited Warranty.

Any claim for any alleged breach of this warranty must be made in writing, by certified mail, to the President of PFCI within thirty (30) days after the alleged defect is first noticed. Should the required notice not be given, the defect and all warranties shall be deemed to have been waived by the Purchaser, and Purchaser shall have no right of recovery against PFCI. In the event repairs and/or replacements are to be effected, said repairs and/or replacements shall not become due until the area subject to repair and/or replacement of Poly-Flex Liner is available to PFCI in a clean, dry, unencumbered condition. This includes, but is not limited to, the area made available for repair and/or replacement of Poly-Flex Liner to be free from all water, dirt, sludge, residuals, and liquids of any kind.

PFCI's liability under this warranty shall in no event exceed the replacement cost of the material and installation sold to the Purchaser for the particular installation in which it failed. Further, under no circumstances shall PFCI be liable for any special, direct, indirect, or consequential damages arising from loss of production or any other losses including losses due to personal injuries and product liability owing to the failure of the material or installation and no allowance will be made for repairs, replacements, or alterations made by the Purchaser without the express written consent of PFCI.

PFCI neither assumes nor authorizes any person other than an officer of PFCI to assume for it any other or additional liability in connection with the Poly-Flex Liner System made the basis of the Limited Warranty. The Limited Workmanship Warranty on the Poly-Flex Liner herein is given in lieu of all other possible material warranties, either express or implied, and by accepting delivery of the material, Purchaser waives all other possible workmanship warranties, except those specifically given.

The parties expressly agree that the sale hereunder is for commercial or industrial use only.

PFCI Limited Warranty is extended to the purchaser/owner and is non-transferable and non-assignable.

Purchaser acknowledges by acceptance that the Limited Workmanship Warranty given herein is accepted in preference to any and all other possible workmanship warranties.

PFCI MAKES NO WARRANTY OF ANY KIND OTHER THAN THAT GIVEN ABOVE AND HEREBY DISCLAIMS ALL WARRANTIES, BOTH EXPRESS OR IMPLIED, OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

WARRANTY BECOMES EFFECTIVE UPON RECEIPT OF FINAL PAYMENT

I hereby state I have read and understood the above and foregoing Limited Warranty and agree to such by signing hereunder.

PURCHASER NAME: _____

SIGNATURE: _____

TITLE: _____

DATE: _____

POLY-FLEX CONSTRUCTION, INC.

_____
President

Sworn before me this _____day of _____, 19__.

_____

POLY-FLEX
POLYETHYLENE GEOMEMBRANES

GEOMEMBRANE INSTALLATION QUALITY ASSURANCE FORMS

POLY-FLEX CONSTRUCTION, INC.

2000 W. MARSHALL DR., GRAND PRAIRIE, TEXAS 75051
214-647-4374 Fax 214-988-8331

Daily Personnel Activity

Project No. _____ Date _____

Project Name _____ Project Location _____

Personnel	Installer Manager	Deployment Supervisor	Quality Control Inspector	Master Seamer	Welder	Grinder	Seam Tester	Laborer
1	☐	☐	☐	☐	☐	☐	☐	☐
2	☐	☐	☐	☐	☐	☐	☐	☐
3	☐	☐	☐	☐	☐	☐	☐	☐
4	☐	☐	☐	☐	☐	☐	☐	☐
5	☐	☐	☐	☐	☐	☐	☐	☐
6	☐	☐	☐	☐	☐	☐	☐	☐
7	☐	☐	☐	☐	☐	☐	☐	☐
8	☐	☐	☐	☐	☐	☐	☐	☐
9	☐	☐	☐	☐	☐	☐	☐	☐
10	☐	☐	☐	☐	☐	☐	☐	☐
11	☐	☐	☐	☐	☐	☐	☐	☐
12	☐	☐	☐	☐	☐	☐	☐	☐
13	☐	☐	☐	☐	☐	☐	☐	☐
14	☐	☐	☐	☐	☐	☐	☐	☐
15	☐	☐	☐	☐	☐	☐	☐	☐
16	☐	☐	☐	☐	☐	☐	☐	☐
17	☐	☐	☐	☐	☐	☐	☐	☐
18	☐	☐	☐	☐	☐	☐	☐	☐
19	☐	☐	☐	☐	☐	☐	☐	☐
20	☐	☐	☐	☐	☐	☐	☐	☐

Form 1

POLY-FLEX CONSTRUCTION, INC.

2000 W. MARSHALL DR., GRAND PRAIRIE, TEXAS 75051
214-647-4374 Fax 214-988-8331

Equipment List

Project No. _____ **Date** _____

Project Name _____ **Project Location** _____

Type	Manufacturer	Serial No.	Status	Date In Use

POLY-FLEX CONSTRUCTION, INC.

2000 W. MARSHALL DR., GRAND PRAIRIE, TEXAS 75051

214-647-4374 — Fax 214-988-8331

Certificate of Acceptance of Soil Subgrade

Project No. _____ **Date** _____

Project Name _____ **Project Location** _____

Area to Be Accepted _____

_____

_____

I, the undersigned, the authorized representative of Poly-Flex Construction, Inc., do hereby accept the soil subgrade surface conditions and shall be responsible for maintaining its integrity and suitability in accordance with the project specifications. I do not accept any responsibility for the conditions or character of the subsurface soil, or any effects the soil might have on the liner system.

_____ _____ _____

Signature **Title** **Date**

POLY-FLEX CONSTRUCTION, INC.

2000 W. MARSHALL DR., GRAND PRAIRIE, TEXAS 75051
214-647-4374 Fax 214-988-8331

Panel Placement Log

Project No. _____ Date _____

Project Name _____ Project Location _____

Liner _____ Page _____ of _____

Panel No.	Date	Time Deployed	Roll No.	Width (FT)	Length (FT)	Area (SQ. FT)

Form 4

POLY-FLEX CONSTRUCTION, INC.
2000 W. MARSHALL DR., GRAND PRAIRIE, TEXAS 75051
214-647-4374 Fax 214-988-8331

Geomembrane Field Trial Seam Log

Project No. ______________________

Project Name ______________________

Date ______________________

Project Location ______________________

Page __________ of __________

❑ HDPE ❑ LLDPE

❑ Smooth ❑ Textured

Thickness ______

Project Seam Requirements: (Fusion) Peel __________ppi Shear __________ ppi
Project Seam Requirements: (Extrusion) Peel __________ppi Shear __________ ppi

Sample	Date	Time	Ambient Temp.	Welder ID		Wedge	Extruder	Seam Strength		Pass/ Fail	Insp. ID	Remarks
				Machine	Operator	Temp/ Speed	Temp/ Pre-Heat	Peel (ppi) IN | OUT	Shear(ppi)			

Supervisor's Initials________ Form 5

POLY-FLEX CONSTRUCTION, INC.

2000 W. MARSHALL DR., GRAND PRAIRIE, TEXAS 75051
214-647-4374 Fax 214-988-8331

Geomembrane Seaming Record

Project No. _____

Project Name _____

Date _____

Project Location _____

Page _____ of _____

❑ HDPE ❑ LLDPE

❑ Smooth ❑ Textured

Thickness _____

Seam # = Panel #/ Panel #	Seaming Record							
	Length Welded	Date/ Time	Welder Operator ID	Machine Number	Temperature		Machine Speed	Non Destructive Test Pass/Fail
					Machine	Ambient		

Supervisor's Initials_____ Form 6

POLY-FLEX CONSTRUCTION, INC.

2000 W. MARSHALL DR., GRAND PRAIRIE, TEXAS 75051
214-647-4374 Fax 214-988-8331

Geomembrane Seam Air Pressure Test Log

Project No. _____

Project Name _____

Date _____

Project Location _____

Page _____ of _____

❑ HDPE ❑ LLDPE

❑ Smooth ❑ Textured

Thickness _____

Seam # = Panel #/ Panel #	Start Location	End Location	Pressure Test			
			Pressure	Tester ID	Pass/Fail	Date/Time Tested

Supervisor's Initials_____ Form 7

POLY-FLEX CONSTRUCTION, INC.

2000 W. MARSHALL DR., GRAND PRAIRIE, TEXAS 75051
214-647-4374 Fax 214-988-8331

Repair Log

Project No. _____

Project Name _____

Date _____

Project Location _____

Page _____ **of** _____

❑ **HDPE** ❑ **LLDPE**

❑ **Smooth** ❑ **Textured**

Thickness _____

Repair #	Defect Code	Repair Date	Location/Panels	Approx Time	Repair Type	Approx Dimensions	Repair Tech	Inspector	Vacuum Test	
									P/F	Date

Defect Code:
- BO - Burn Out
- CR - Crease
- DS-1 - Destructive Test Number
- EE - Earthwork Equipment Damage
- FM - Fishmouth
- FT - Pressure Test Cut
- SI - Soil Surface Irregularity
- T- Joint
- VL - Vacuum Test Leak
- WR - Wrinkle
- WS - Welder Restart
- Other

Repair Type:
- C: Cap Strip
- P: Patches
- B: Extrudate Bead

Supervisor's Initials_____ **Form 8**

POLY-FLEX CONSTRUCTION, INC.

2000 W. MARSHALL DR., GRAND PRAIRIE, TEXAS 75051
214-647-4374 Fax 214-988-8331

Geomembrane Seam Destructive Sample Log

Project No. _____ ❑ HDPE ❑ LLDPE

Project Name _____ ❑ Smooth ❑ Textured

Date _____ Thickness _____

Project Location _____

Page _____ of _____

Project Seam Requirements: (Fusion) Peel _____ ppi Shear _____ ppi
Project Seam Requirements: (Extrusion) Peel _____ ppi Shear _____ ppi

Sample	Seam # = Panel #/ Panel #	Date Removed	Insp. ID	Field Test Results			Lab Test Results Pass/Fail	Remarks
				Peel (ppi) In | Out	Shear (ppi)	Pass/ Fail		
Describe Sample Location								
Describe Sample Location								
Describe Sample Location								
Describe Sample Location								
Describe Sample Location								
Describe Sample Location								

Supervisor's Initials_____ Form 9

POLY-FLEX CONSTRUCTION, INC.

2000 W. MARSHALL DR., GRAND PRAIRIE, TEXAS 75051
214-647-4374 Fax 214-988-8331

Certificate of Acceptance

Project No. _____ **Date** _____

Project Name _____ **Project Location** _____

Page _____ **of** _____

Details of Work Completed and Measured _____

I, the undersigned, the authorized representative of _____

accept and assume responsibility for the work described above from this date, subject to the exceptions detailed below, and confirm that the work has been completed in accordance with the specifications and the terms and conditions of the contract. There is no apparent damage to the plastic lining, nor has there been any interference within or without the surrounding works.

I have evaluated and measured the work together with the Poly-Flex Construction, Inc. representative, and agree that the measurements shown above are true and correct, and that the installation has met our approval.

Exceptions _____

Authorized Representative

Name	Signature	Title	Date

Poly-Flex Construction, Inc. Representative

Name	Signature	Title	Date

MALCOLM PIRNIE

APPENDIX E

OLD BATH LANDFILL MONITORING PLAN

MALCOLM PIRNIE

OLD BATH LANDFILL MONITORING PLAN

STEUBEN COUNTY DEPARTMENT OF PUBLIC WORKS
BATH, NEW YORK

JULY 1997
REVISED OCTOBER 1997

MALCOLM PIRNIE, INC.

P. O. Box 1938
Buffalo, New York 14219

1318-156/MP

MALCOLM PIRNIE

OLD BATH LANDFILL
MONITORING PLAN

TABLE OF CONTENTS

MALCOLM PIRNIE

TABLE OF CONTENTS (Continued)

MALCOLM PIRNIE

TABLE OF CONTENTS (Continued)

LIST OF TABLES

MALCOLM PIRNIE

TABLE OF CONTENTS (Continued)

LIST OF FIGURES

LIST OF ATTACHMENTS

MALCOLM PIRNIE

1.0 INTRODUCTION

1.1 GENERAL

The New York State Department of Environmental Conservation (NYSDEC) has determined that the Old Bath Landfill (the site) is an inactive hazardous waste site, as defined in ECL Section 27-130(2). Consequently, the site has been listed in the Registry of Inactive Hazardous Waste Disposal Sites in New York as Site Number 851014. The NYSDEC has classified the site as a classification "2" site pursuant to ECL Section 27-1305 (4)(b). As a result of the classification, Steuben County entered into an Order on Consent with the NYSDEC to remediate the Old Bath Landfill in exchange for funding under the 1986 Environmental Quality Bond Act (EQBA). The requirements of the Order on Consent include performance of a Remedial Investigation/Feasibility Study (RI/FS) and the design/-implementation of an Interim Remedial Measures (IRM) Program. The RI/FS has been completed and a Record of Decision (ROD) (NYSDEC, March 1995) has been issued for the site. The ROD document stated that no further remedial action beyond the following IRMs are required:

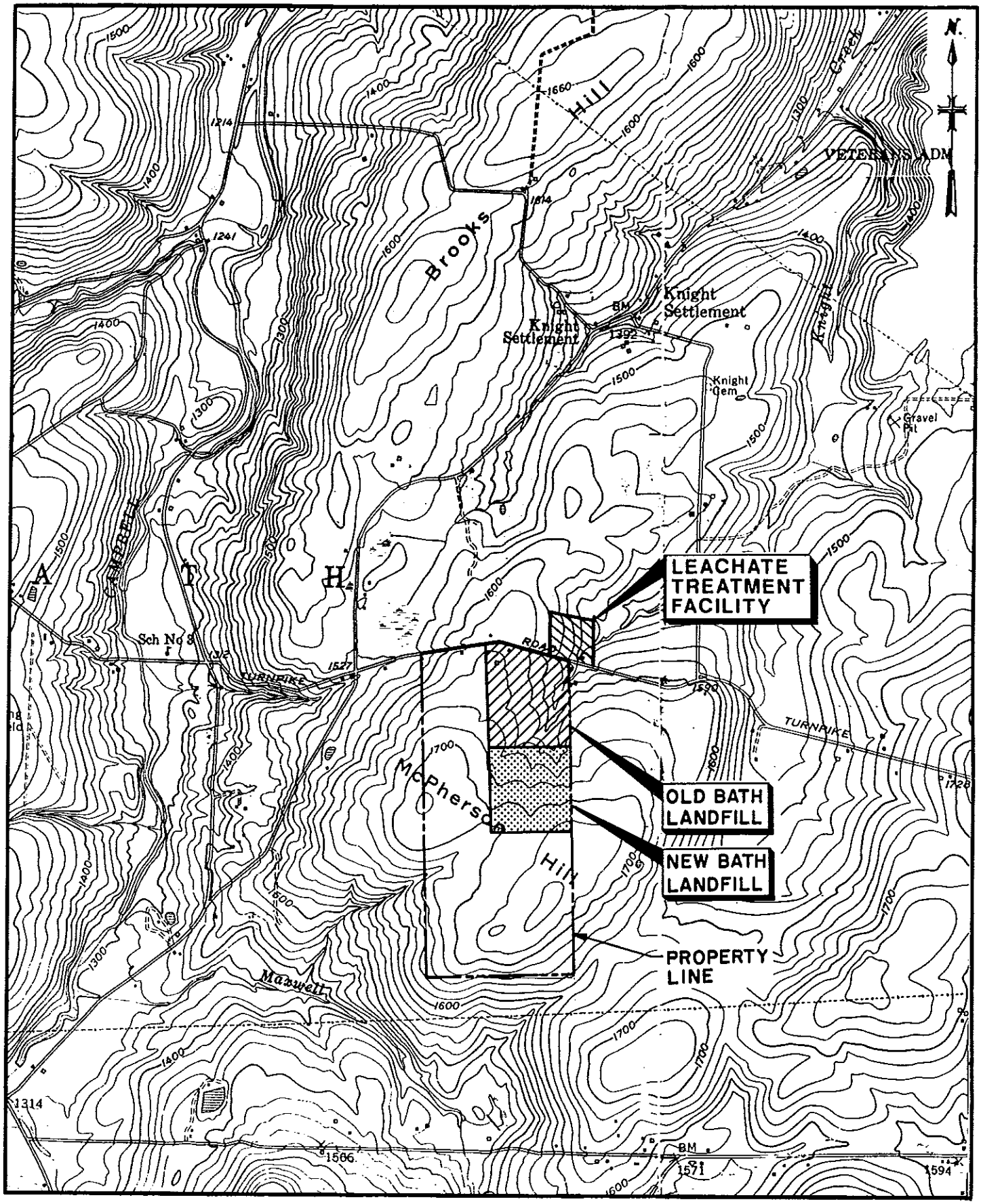
- Construction of a Leachate Treatment Facility (LTF).
- Installation of a retrofit leachate collection system.
- Enhancements to the existing landfill cover system.
- Remediation of the on-site sedimentation basin.

1.2 BACKGROUND

1.2.1 Site Location and History

The Old Bath Landfill is approximately 28 acres in size and located on a 145-acre parcel of land three miles southwest of the Village of Bath, New York as shown on Figure 1-1.

Operation of the Old Bath Landfill began during 1978. The landfill was used by the Steuben County Highway Department for the disposal of both municipal and industrial



MALCOLM PIRNIE

1318F1_1

OLD BATH LANDFILL
INTERIM REMEDIAL MEASURES
LOCATION OF OLD BATH LANDFILL

STEUBEN COUNTY
DEPT. OF PUBLIC WORKS

MARCH 1996

wastes until its closure in November 1988. A 22-acre landfill expansion (New Bath Landfill) is presently operating on the south side of the Old Bath Landfill under a NYSDEC 6NYCRR Part 360 permit issued November 1988. Previous subsurface investigations (H&A,1988) and quarterly groundwater quality monitoring results showed that the overburden and shallow bedrock groundwater contained volatile organic compounds and elevated metal concentrations.

An RI/FS Scoping Document was prepared and submitted to the NYSDEC in March 1991. The NYSDEC issued a comment letter on the Scoping Document on May 20, 1991. The Scoping Document was subsequently revised and presented in the RI/FS Work Plan in June 1991. On August 6, 1991 the NYSDEC presented comments to the Work Plan and in October 1991 a revised Final Work Plan was issued addressing the NYSDEC comments (Malcolm Pirnie, 1991).

Concurrent with the RI/FS work activities, IRM investigation activities were also completed. IRM investigation activities included installing piezometers, collecting and analyzing leachate samples, evaluating leachate treatability, and evaluating cover system performance. IRM work activities were performed in accordance with the approved Old Bath Landfill Interim Remedial Measures (IRM) Concept Design Report (Malcolm Pirnie, revised February 1994) and the Old Bath Landfill Interim Remedial Measures Leachate Treatability Work Plan (Malcolm Pirnie, May 1992).

The RI preliminary site characterization survey and the installation of the IRM piezometers began in January 1991. Results of the preliminary surveys were presented in the Preliminary Site Characterization Report (Malcolm Pirnie, March 1992). Leachate treatability study results are presented in the Old Bath Landfill Treatability Study and Design Report (Malcolm Pirnie, February 1993) and the Old Bath Landfill Treatability and Design Report Supplement (Malcolm Pirnie, December 1993). Remedial Investigation (RI) results were presented in the RI Report (Malcolm Pirnie, September 1993). The NYSDEC presented comments to the RI Report on November 23, 1993. A revised RI Report was issued in January 1994 addressing the NYSDEC comments. The RI Report identified organic and inorganic constituents in the leachate, sedimentation basin sediments, and

surface water. In addition, organic constituents were detected in the overburden and upper bedrock groundwater.

A Supplemental RI was subsequently conducted to further characterize site groundwater conditions, specifically in the deep bedrock zone directly beneath the landfill. The investigation included installing a shallow (65 feet) and deep (131.5 feet) bedrock well couplet, sampling the new wells, and measuring water levels in all site wells and piezometers. These data are presented in the Old Bath Landfill Supplemental Remedial Investigation Report (Malcolm Pirnie, April 1994).

Potential remedial alternatives for the Old Bath Landfill site were identified, screened, and evaluated in a three-phase feasibility study. Based on the results of the RI/FS, the selected remedial alternative included:

- Implementation of the Interim Remedial Measures Program described in detail in Section 1.2.2.
- Development and implementation of long-term land use restrictions at the site.
- Providing periodic maintenance and repairs to the cover system, as necessary.
- Providing continued operation and maintenance of the LTP and treated effluent pipeline.
- Providing comprehensive long-term monitoring of nearby residential wells, groundwater, and surface water to evaluate the effectiveness of the IRM.
- Providing further actions to ensure continued protection of nearby residential wells.

1.2.2 Interim Remedial Measures (IRM) Program Activity

The IRM program included design and construction of leachate collection/removal system, sedimentation basin excavation, leachate pretreatment system, and a final cover system (including gas venting and storm water management). Each of these systems is described below.

1.2.2.1 Leachate Collection/Removal System

A perimeter leachate collection/removal system was designed and installed to remove leachate and minimize the potential for leachate breakouts. The leachate collection system is composed of perforated pipes installed along the perimeter of the landfill. A double-walled pipe removes collected leachate to the new leachate pretreatment system.

1.2.2.2 Leachate Treatment Facility (LTF)

Leachate treatability studies were conducted to evaluate leachate treatment and disposal options. Leachate treatability results were presented in the Steuben County - Old Bath Landfill Treatability Study and Design Report (Malcolm Pirnie, February 1993) and the Steuben County - Old Bath Landfill Leachate Treatability Study and Design Report Supplement (Malcolm Pirnie, December 1993). The studies included treatability testing and technical and cost evaluations of on-site and off-site treatment alternatives and management options.

The studies concluded that leachate pretreatment with final treatment at the Village of Bath Publicly-Owned Treatment Works (POTW) was the most cost-effective leachate management approach. The recommended leachate management approach includes:

- Construction of a leachate treatment facility across from the Old Bath Landfill on Turnpike Road.
- Collection and piping of Old Bath Landfill leachate to the leachate treatment facility.
- Discharging pretreated leachate to the Village of Bath POTW via a treated effluent pipeline where it will receive final treatment before discharge to the Cohocton River.

Construction of the LTF was completed and made operational in August 1996. Operations and maintenance for the Leachate Treatment Facility are covered in the Steuben County Leachate Treatment Facility Operations and Maintenance Manual (Malcolm Pirnie, Inc., May 1997).

1.2.2.3 Final Cover System

Installation of the final cover system involved preparing landfill subgrades, constructing a gas venting system, constructing cover soil enhancements, and upgrading the existing storm water management system.

1.2.2.3.1 Subgrade Preparation

Subgrades of the landfill were prepared through grading portions of the existing cover and placing excavated soil and waste/fill material from the construction of the gas venting system and leachate collection/removal system.

1.2.2.3.2 Gas Venting System

Gas vents were installed within the final cover system to minimize human health hazards and to prevent cracks in the cover system. The vents are keyed into a system of gas migration control trenches extending through the cover and connecting to the leachate collection system. These trenches provide a pathway for methane and carbon monoxide gases to vent to the atmosphere. The trenches also provide a pathway for perched leachate and condensate to migrate to the leachate collection system.

1.2.2.3.3 Final Cover System

A final cover system has been installed to minimize infiltration of precipitation. The existing cover system was enhanced to achieve the final cover system over portions of the landfill surface. The enhancements were completed in areas with inadequate cover or topsoil thicknesses and/or documented leachate breakouts. A new 6NYCRR Part 360 final cover composed of 18 inches of barrier layer (10^{-7} cm/s) or a 40-mil linear low density polyethylene (LLDPE) liner, 24 inches of barrier protection, and 6 inches of topsoil were constructed over the areas of the landfill heavily disturbed as a result of leachate collection and/or gas venting system construction activities.

1.2.2.3.4 Storm Water Management

The construction of the final cover system enhanced overland drainage through grading, diversion structures (berms and swales), cover soil management, seeding, and drainage facilities. The storm water management system including the sedimentation basin, drainage ditches, and culverts was designed to handle a 25-year, 24-hour storm.

1.2.2.4 Sedimentation Basin Excavation

Sediment samples collected during the RI from the bottom of the on-site sedimentation basin indicated elevated metals concentrations. The RI Report recommended the sediment be removed. The sediment was dredged and dewatered for use as daily cover on the New Bath Landfill. The sedimentation basin will serve to intercept storm water and accumulate solids. Thus, it will be necessary to periodically dredge the basin to remove accumulated sediment and maintain the volume available for storm water collection.

1.3 GENERAL SITE CONDITIONS

1.3.1 Site Topography and Hydrology

The Old Bath Landfill site is located within the Allegheny Plateau physiographic province. There is significant topographic relief in this region; the highest elevation is 2,400 feet above mean sea level, and the lowest is 714 feet above mean sea level at Keuka Lake.

Major topographic features in the area are glacially derived landforms. These features include: stream valleys that are between 300 and 600 feet deep; two major river valleys each approximately one mile wide; and the Valley Heads moraine system located in the northwest corner of the County. Also present in the County are end moraines, till plains, glacial outwash deposits, and other types of glacial deposits.

The site is located near the top of McPherson Hill with the ground surface elevation ranging from 1,740 feet in the south to 1,550 feet in the northwest corner of the site and generally sloping to the northeast. The topography immediately adjacent to the site (within one mile) drops off dramatically to the west, east, northeast, south and southwest to less than 1,300 feet above mean sea level.

The Old Bath Landfill site is located within the Susquehanna River Drainage Basin. The site is drained by two creeks adjacent to the property. Knight Creek drains the northeastern portion of the site, while the southern portion of the site drains into Campbell Creek via Maxwell Creek. Both Campbell Creek and Knight Creek drain into the Cohocton River.

1.3.2 Site Geology/Hydrogeology

The Preliminary Site Characterization, RI, and Supplemental RI characterized subsurface conditions at the site as a glaciated upland area sloping to the northeast. The subsurface materials in descending stratigraphic order include:

- Existing cover soils.
- Waste/fill consisting of paper, glass, plastic, cover material, etc. (within the limits of the landfill).
- Topsoil described as a silty loam derived from the underlying glacial till (outside the limits of the landfill).
- Basal till consisting of silt, clay, sand, gravel and boulders.
- Glaciolacustrine sediments consisting of stratified silt and clay (northeast section of site).
- Sandstone, siltstone and shale of the Wiscoy Sandstone (locally referred to as limestone).

The saturated units identified at the site included the waste/fill, overburden, and bedrock. The waste/fill and overburden are considered a single unit for the purpose of developing a site water balance. The characteristics of the bedrock groundwater system are similar throughout the investigated intervals (upper and deep) and are also categorized as a single unit. In general, the site hydrogeology is characterized as a typical groundwater recharge area with the potential for flow being essentially vertically downward to regional groundwater flow systems.

The conceptual site water balance predicted that groundwater flow is essentially vertically downward, and leakage through the existing landfill cover system and waste/fill

layer is minimal. Under existing site conditions, there appears to be a very minor component of downward leachate leakage into the underlying bedrock (primarily in areas where the glacial till overburden is absent and waste/fill lies directly on top of bedrock), with a majority of the leachate migrating horizontally within the more permeable fill and daily cover soils. The relatively low permeability of the bedrock minimizes the potential for vertical migration. Groundwater quality data collected during RI and Supplemental RI sampling and monitoring events confirmed the conceptual site water balance. The planned installation of the leachate collection/removal system and enhancement of the existing cover system will further reduce the amount of leakage into the upper bedrock zone.

1.4 PURPOSE AND OBJECTIVES

The purpose of this Monitoring Plan is to identify and document sampling locations, sample collection procedures, the analytical parameters, and the analytical methods that will be employed to monitor the effectiveness of the Old Bath Landfill remediation.

1.5 PLAN ORGANIZATION

This Plan is organized into eight sections as follows:

- **Section 1.0** provides background information on the Old Bath Landfill and a description of the general site conditions.
- **Section 2.0** provides a description of the site monitoring network.
- **Section 3.0** provides a summary of the monitoring strategy, a description of the facility and environmental monitoring plans, and a discussion of how the results of the monitoring will be evaluated.
- **Section 4.0** provides a summary of groundwater, surface water, leachate, and landfill gas sampling procedures.
- **Section 5.0** describes the sample analytical program.

- **Section 6.0** describes the statistical methods that will be used to evaluate the monitoring results.
- **Section 7.0** describes the elements of the semi-annual and annual monitoring reports.
- **Section 8.0** lists the references cited in the Monitoring Plan.

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2.0 DESCRIPTION OF THE MONITORING NETWORK

2.1 FACILITY MONITORING LOCATIONS

2.1.1 Leachate Collection System

The flow rate of leachate from the Old Bath Landfill leachate collection system will be continuously monitored at the Leachate Treatment Plant (LTP) site. Old Bath Landfill leachate samples will be collected from the leachate conveyance pipe at the LTP building before the connection with the leachate conveyance pipe from the New Bath Landfill.

2.1.2 Leachate Level Monitoring

Leachate levels in the Old Bath Landfill will be monitored to determine if the leachate collection system is effectively drawing down the leachate levels in the landfill. Leachate levels in the leachate collection trench along the northern, eastern, and western perimeters of the landfill will be monitored at the following locations, as shown on Attachment A, Plate 1:

- The leachate collection system cleanouts.
- The leachate monitoring piezometers located 10 feet from the leachate collection trench.
- The leachate monitoring piezometers located 25 feet from the leachate collection trench.

2.2 ENVIRONMENTAL MONITORING LOCATIONS

The environmental monitoring network is designed to monitor potential contaminant migration pathways. The pathways include surface water flow, air flow (via landfill gas emissions), and groundwater flow in the overburden, upper bedrock, and deep bedrock.

2.2.1 Groundwater Monitoring System

Groundwater in the overburden occurs within saturated landfill waste materials and the surrounding glacial sediments. Although the depth and composition of the overburden varies across the site, aquifer properties within the overburden are similar. The overburden aquifer is characterized by interspersed zones of perched saturated materials in the upper more permeable zones with overall saturation of all materials increasing with depth.

In general, horizontal groundwater flow within the overburden is highly influenced by the topography of the site. There is also a strong vertical downward component of groundwater flow from the overburden groundwater system to the underlying bedrock groundwater system.

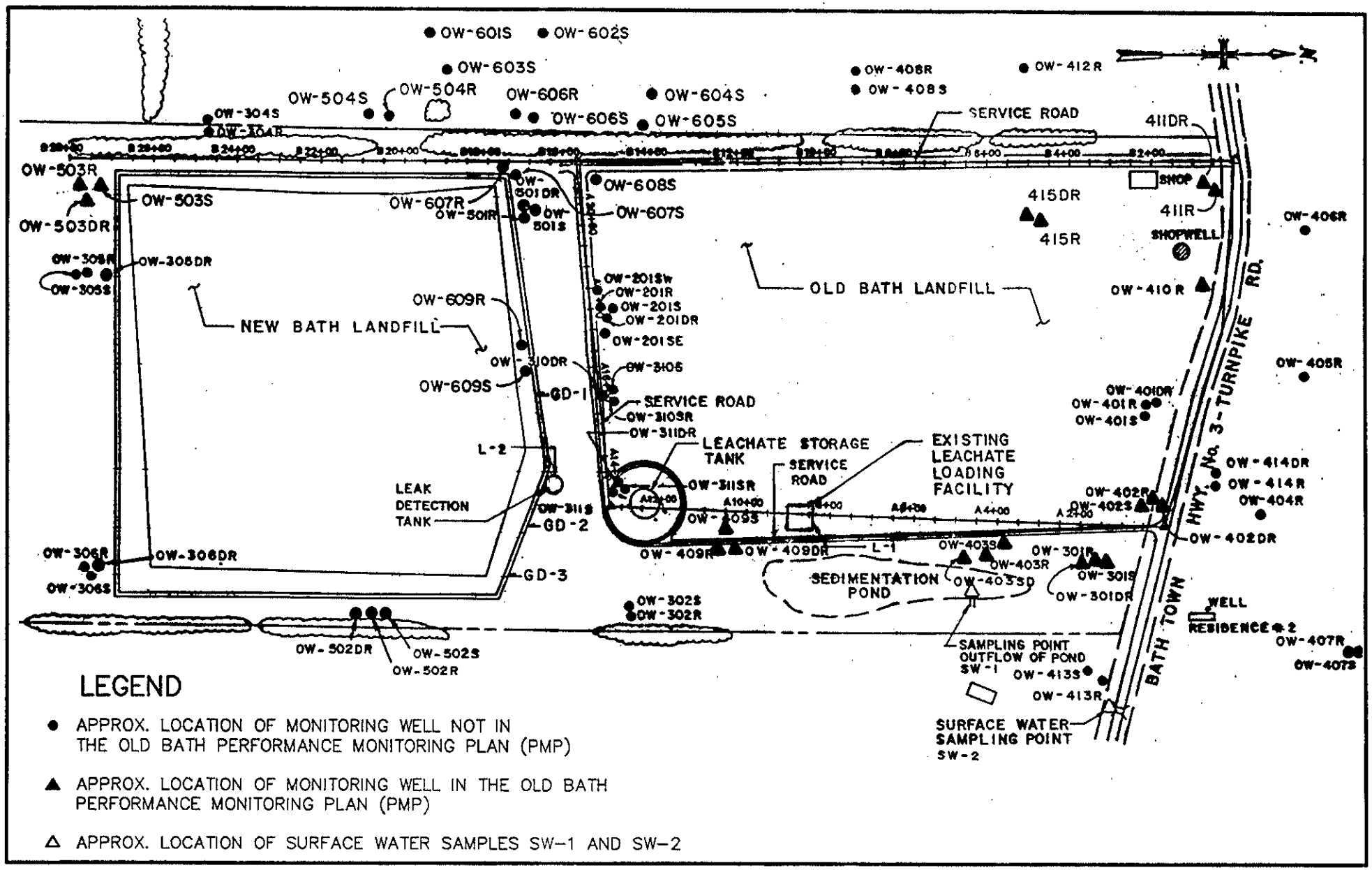
The bedrock monitoring interval exhibits similar hydraulic conductivity values with no identifying confining layer. There is a strong downward vertical hydraulic gradient across the site, with groundwater flow controlled mainly by secondary porosity (fractures).

The apparent horizontal flow direction of the bedrock groundwater flow system follows the surface topography of the site with flow being to the north and northeast. During low groundwater conditions, a groundwater drainage divide between Campbell Creek and Knight Creek appears to establish itself under the site with flow being to both drainage systems.

Based on the hydrogeologic analyses of the site, contaminants originating from within the Old Bath Landfill have the potential to migrate vertically downward into the bedrock groundwater system. The postulated contaminant plume would move downward until the regional groundwater flow systems are encountered, where the plume would then take on a more horizontal configuration.

<u>Monitoring Locations</u> - Groundwater monitoring will be performed at the following locations (shown on Figure 2-1):

- Upgradient monitoring well cluster 503 (503S, 503R, 503DR).



LEGEND

- ● APPROX. LOCATION OF MONITORING WELL NOT IN THE OLD BATH PERFORMANCE MONITORING PLAN (PMP)
- ▲ APPROX. LOCATION OF MONITORING WELL IN THE OLD BATH PERFORMANCE MONITORING PLAN (PMP)
- △ APPROX. LOCATION OF SURFACE WATER SAMPLES SW-1 AND SW-2

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STE-162-SL

OLD BATH LANDFILL
INTERIM REMEDIAL MEASURES
GROUNDWATER MONITORING &
SURFACE WATER SAMPLING LOCATIONS

STEUBEN COUNTY, NEW YORK MARCH 1996

FIGURE 2-1

- Perimeter downgradient monitoring wells listed in Table 2-1.
- The shop well.
- The LTF well.

In addition to the groundwater monitoring locations listed above, groundwater monitoring will be performed at the LTF well and the five residential wells located closest to the landfill. A total of six potential residential wells are listed in Table 2-2 in the event that a well is not accessible. The designation provided in Table 2-2 will be used on sampling paperwork for each sampling event to avoid the name of the homeowner on future reporting. The six residential well locations are shown on Figure 2-2. Borehole logs for the groundwater monitoring wells are included in Attachment B.

2.2.2 Surface Water

Surface water flow from the Old Bath Landfill will be directed to the sedimentation basin located east of the Old Bath Landfill. Discharge from the sedimentation basin is to a tributary of Knight Creek.

Monitoring Points - Surface water samples will be collected from the following locations:

- The outfall of the sedimentation basin (SW-1).
- The tributary of Knight Creek where it passes under Turnpike Road (SW-2).

Locations of the monitoring points are shown on Figure 2-1.

2.2.3 Landfill Gas

The impacts of the landfill on the air will be assessed through the analysis of samples collected from three vents located at the high points on the landfill. In addition,

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TABLE 2-1

STEUBEN COUNTY OLD BATH LANDFILL
MONITORING PLAN

PERIMETER MONITORING WELL SAMPLING LOCATIONS

Location	Shallow Overburden	Deep Overburden	Shallow Bedrock	Deep Bedrock
301	S		R	DR
402	S		R	DR
403	S	SD	R	
409	S		R	DR
410			R	
411			R	DR
415			R	DR

S = Shallow Overburden Soil
SD = Deep Overburden Soil
R = Rock
DR = Deep Rock

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TABLE 2-2

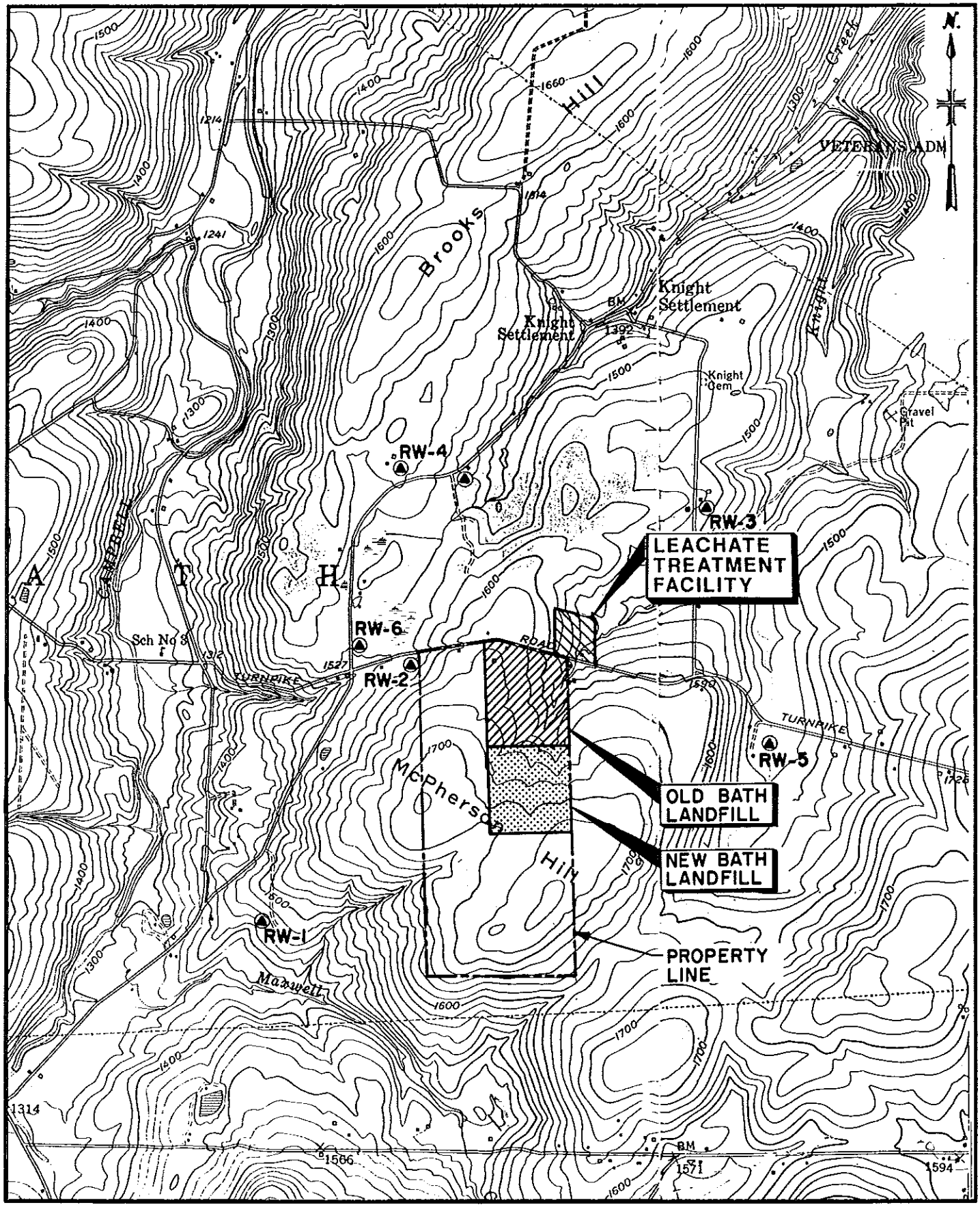
STEUBEN COUNTY OLD BATH LANDFILL MONITORING PLAN

RESIDENTIAL WELL SAMPLING LOCATIONS

Residential Well Sample Designation	Owner of Property	Address	Telephone No.
RW-1	Hokula	owner resides in Rochester	(716) 621-5827
RW-2	Divens	5562 Turnpike Road	(607) 776-3635
RW-3	Knowles	6802 Shannon Road	(607) 776-9380
RW-4	Baker, Jerry	6815 Knights Settlement Road	(607) 776-7419
RW-5	Property unoccupied at this time	5860 Turnpike Road	—
RW-6	Wirth ** (or Buchanan)	6674 Knight Settlement Road	(607) 776-9154

** This homeowner indicated that he did not own a well; however a survey performed in 3/92 reveals that a well is present on the property (Malcolm Pirnie, January 1994).

FIGURE 2-2



RW-3 RESIDENTIAL WELL

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1318F2_2

OLD BATH LANDFILL

RESIDENTIAL WELL SAMPLING LOCATIONS

STEUBEN COUNTY
DEPT. OF PUBLIC WORKS

MARCH 1996

flow measurements will obtained from each vent. The location of the three gas vents located at the high points of the landfill are shown on Attachment A, Plate 1.

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3.0 MONITORING PLAN

3.1 SUMMARY OF MONITORING STRATEGY

The objective of the Old Bath Landfill Monitoring Plan is to provide a strategy for evaluating the effectiveness of the IRMs constructed at the Old Bath Landfill as determined by the results of the monitoring program. Landfill monitoring will be conducted on the leachate collection system and piezometers. Environmental monitoring will be conducted on specific upgradient and downgradient groundwater monitoring wells, residential wells, the shop well, the LTP well, two surface water locations, and the landfill gas vents. Table 3-1 summarizes the monitoring strategy. Groundwater elevation data for all on-site monitoring wells and piezometers (including New Bath wells) will be used to construct the isopotential maps.

3.2 LANDFILL (FACILITY) MONITORING

Details of the sampling and analysis for the landfill are described below.

3.2.1 Leachate Collection System

3.2.1.1 Location

Leachate flow rate from Old Bath Landfill will be measured and leachate quality samples will be collected at the location listed in Table 3-1.

3.2.1.2 Frequency

The flow rate of Old Bath Landfill leachate to the LTP site will be measured continuously. Old Bath Landfill leachate quality samples will be sampled semi-annually (i.e., approximately every six months).

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TABLE 3-1

STEUBEN COUNTY OLD BATH LANDFILL
MONITORING PLAN

CLOSURE MONITORING REQUIREMENTS

Sample Description	Sample Locations	Number of Samples Per Event	Parameters	Frequency
Groundwater Level and Quality	Monitoring Wells[1]	22	Leachate Indicator Parameters[3] TCL Volatiles and Semivolatiles	Semi-annually
Surface Water Quality	Surface Water[2]	2	[5]	[5]
Off-site Groundwater Quality	Residential Wells[7]	5	TCL Volatile Organic Compounds, TAL Metals	Annually
Landfill Gas Quality	Gas Vents	3	Air Guide 1 Pollutants[4]	Semi-annually for 1st Year
Leachate Flow Rate	LTF Basement Mechanical Room	—	Flow Rate	Continuously
Leachate Quality	LTF Basement Mechanical Room	2	Leachate Indicator Parameters [3] TCL Volatiles and Semivolatiles, TAL Metals	Semi-annually
Leachate Level	Landfill Piezometers and Cleanouts[6]	24	Leachate Level	Monthly for 1st Year

Notes:

(1) Wells 503S, 503R, 503DR, 301S, 301R, 301DR, 402S, 402R, 402DR, 403S, 403SD, 403R, 409S, 409R, 409DR, 410R, 411R, 411DR, 415R, 415DR, Shop Well, LTP Well.

(2) Outfall of Sedimentation Basin and the tributary of Knight Creek where it crosses Turnpike Road.

(3) Leachate indicator parameters include total kjeldahl nitrogen, ammonia, nitrate, chemical oxygen demand, biological oxygen demand (BOD_5), total organic carbon, total dissolved solids, sulfate, alkalinity, phenols, chloride, bromide, total hardness as $CaCO_3$.

(4) See Table 3-3.

(5) Two surface water samples will be analyzed quarterly. Three quarters will be sampled for analysis of 6NYCRR Part 360 routine parameters plus any TAL metals not included in the routine parameters and 1 quarter for analysis for 6NYCRR Part 360 baseline parameters.

(6) L1-1, L1-2, CO-1, L2-1, L2-2, CO-2, L3-1, L3-2, CO-3, L4-1, L4-2, CO-4, L5-1,L5-2, CO-5, L6-1, L6-2, CO-6, L7-1, L7-2, CO-7, L8-1, L8-2, CO-8.

(7) See Table 2-2.

3.2.1.3 Parameters

During each sampling event, leachate will be analyzed for leachate indicator parameters [i.e., total Kjeldahl nitrogen, ammonia, nitrate, chemical oxygen demand, biological oxygen demand (BOD_5), total organic carbon, total dissolved solids, sulfate, alkalinity, phenols, chloride, bromide, and total hardness as [$CaCO_3$], TCL volatile and semivolatile organic compounds, and TAL metals. Table 3-2 provides the TCL volatile and semi-volatile compounds and TAL metal parameters.

3.2.1.4 Modification to Analytical Requirements

Leachate analytical results will be reviewed annually to determine whether modifications to the analytical requirements are appropriate. Recommendations for changes to the monitoring program will be submitted to the NYSDEC for review and approval in the annual monitoring report.

3.2.2 Leachate Level Monitoring

3.2.2.1 Location

Old Bath Landfill leachate levels will be measured at the landfill piezometer and cleanout locations listed in Table 3-1.

3.2.2.2 Frequency

During the first year of operation of the leachate collection system, leachate levels in the leachate collection trench will be measured monthly. At the end of the first year of operation, recommendations for changes to the frequency of leachate level monitoring will be submitted to the NYSDEC for review and approval in the annual monitoring report.

3.3 ENVIRONMENTAL MONITORING

Details of the sampling and analysis plan for environmental monitoring are described below.

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TABLE 3-2

STEUBEN COUNTY OLD BATH LANDFILL
MONITORING PLAN

TAL METALS				
Aluminum	Cadmium	Cyanide	Mercury	Thallium
Antimony	Calcium	Iron	Nickel	Vanadium
Arsenic	Chromium	Lead	Potassium	Zinc
Barium	Cobalt	Magnesium	Selenium	
Beryillium	Copper	Manganese	Sodium	

TCL VOLATILE COMPOUNDS			
Chloromethane	1,2-Dichloroethene (total)	cis-1,3-Dichloropropene	2-Hexanone
Bromomethane	Chloroform	Trichloroethene	Tetrachloroethene
Vinyl Chloride	1,2-Dichloroethane	Dibromochloromethane	1,1,2,2-Tetrachloroethane
Chloroethane	2-Butanone	1,1,2-Trichloroethane	Toluene
Methylene Chloride	1,1,1- Trichloroethane	Benzene	Chlorobenzene
Acetone	Carbon Tetrachloride	trans-1,3-Dichloropropene	Ethylbenzene
Carbon Disulfide	Bromodichloromethane	Bromoform	Styrene
1,1-Dichloroethene	1,2-Dichloropropane	4-Methyl-2-Pentanone	Xylenes (total)
1,1-Dichloroethane			

TCL SEMIVOLATILE COMPOUNDS			
Phenol	2,4-Dichlorophenol	Acenaphthene	Carbazole
bis (2-Chloroethyl)ether	1,2,4-Trichlorobenzene	2,4-Dinitrophenol	Di-n-butylphthalate
2-Chlorophenol	Napthalene	4-Nitrophenol	Fluoranthene
1,2-Dichlorobenzene	4-Chloroaniline	Dibenzofuran	Pyrene
1,3-Dichlorobenzene	Hexachlorobutadiene	2,4-Dinitrotoluene	Butyl benzylphthalate
1,4-Dichlorobenzene	4-Chloro-3-methylphenol	Diethylphthalate	3,3-Dichlorobenzidine
2-Methylphenol	2-Methyl napthalene	4-Chlorophenyl-phenylether	Benzo [a]anthracene
2,2-Oxybis (1-Chloropropane)	Hexachlorocyclopentadiene	Flourene	Chrysene
4-Methylphenol	2,4,6-Trichlorophenol	4-Nitroaniline	bis (2-Ethylhexyl) phthalate
n-Nitroso-di-n-propylamine	2,4,5-Trichlorophenol	4,6-Dinitro-2-methylphenol	Di-n-octylphthalate
Hexachloroethane	2-Chloronaphthalene	N-Nitrosodiphenylamine	Benzo (b) fluoranthene
Nitrobenzene	2-Nitroaniline	4-Bromophenyl-phenylether	Benzo (k) fluoranthene
Isophorone	Dimethylphthalate	Hexachlorobenzene	Benzo (a) pyrene
2-Nitrophenol	Acenaphthylene	Pentachlorophenol	Indeno [1,2,3-cd] pyrene
2,4 Dimethylphenol	2,6-Dinitrotoluene	Phenanthrene	Dibenz [a,h] anthracene
bis (2-Chloroethoxy) methane	3-Nitroaniline	Anthracene	Benzo [g,h,i] perylene

3.3.1 Groundwater Monitoring System

Groundwater monitoring will include both water quality and water level monitoring. Water level monitoring is intended to detect seasonal changes in the groundwater flow direction.

3.3.1.1 Locations

Groundwater samples will be collected at the locations summarized in Table 3-1. Groundwater levels will be recorded from each well prior to well purging.

3.3.1.2 Frequency

Groundwater level monitoring will be conducted on a quarterly basis (i.e., approximately every three months) when groundwater level monitoring is performed for the New Bath Landfill.

Groundwater quality monitoring of the groundwater monitoring wells, the shop well, and the LTP well will be conducted on a semi-annual basis (i.e., approximately every six months). Groundwater quality monitoring from the residential wells will be conducted annually (i.e., one time per year). If there is a significant change in residential groundwater quality, as determined using the statistical methods presented in Section 3.4, the frequency of residential groundwater quality monitoring will be increased to a semi-annual basis.

3.3.1.3 Parameters

Groundwater samples collected from the groundwater monitoring wells, the shop well, and the LTP well will be analyzed for leachate indicator parameters [i.e., total Kjeldahl nitrogen, ammonia, nitrate, chemical oxygen demand, biochemical oxygen demand (BOD_5), total organic carbon, total dissolved solids, sulfate, alkalinity, phenols, chloride, bromide, and total hardness as $CaCO_3$], and TCL volatile and semivolatile organic compounds.

Groundwater samples collected from the residential wells will be analyzed for TCL volatile organic compounds and TAL metals.

3.3.2 Surface Water

3.3.2.1 Location

Surface water will be sampled at the locations summarized in Table 3-1 and shown on Figure 2-1.

3.3.2.2 Frequency

Surface water samples will be collected on a quarterly basis (i.e., approximately every three months) as part of the New Bath Landfill quarterly groundwater monitoring.

3.3.2.3 Parameters

Surface water samples will be analyzed for TAL metals in addition to the parameters analyzed for during the New Bath Landfill quarterly groundwater monitoring.

3.3.3 Landfill Gas

3.3.3.1 Locations

Landfill derived gas will be sampled to assess the impacts of the Old Bath Landfill on air at the locations summarized in Table 3-1 and shown on Plate 1, included as Attachment A.

3.3.3.2 Frequency

Landfill gas will be monitored on a semi-annual basis (i.e., every six months) for the first year. At the end of the first year of operations assuming Air Guide-1 limits are not exceeded, recommendations for changes to the frequency of landfill gas monitoring will be submitted to the NYSDEC for review and approval in the annual monitoring report.

3.3.3.3 Parameters

Landfill gas monitoring from three vents located at the high points of the landfill will be performed with a dual range natural gas indicator that measures concentration as percent by volume of methane equivalents. Samples from the three vents will be collected in tedlar

bags and analyzed for the Air Guide-1 pollutants shown in Table 3-3. In addition, landfill gas flow measurements will be obtained at each vent.

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TABLE 3-3

STEUBEN COUNTY OLD BATH LANDFILL
MONITORING PLAN

AIR GUIDE - 1 POLLUTANTS

Methylene Chloride
Acetone
2-Butanone
Toluene
m/p-Xylene
o-Xylene
Vinyl Chloride
Tetrachloroethene
4-methyl-2-pentanone
Chloroethane
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Benzene
Ethylbenzene
1,1-Dichloroethane
1,2-Dichloroethane
1,2-Dichloroethene
Methyl Isobutyl Ketone

4.0 SAMPLING PROCEDURES

4.1 PRE-SAMPLING PREPARATION

Prior to any sampling event, the following steps will be taken by personnel responsible for sampling:

- Review the sampling procedures.
- Assemble and inspect all field equipment necessary for sample collection.
- Verify that equipment is clean and in proper working order.
- Note and replace any items that are in short supply or that are showing indications of wear; maintain an adequate supply of spare parts for all sampling equipment.
- Calibrate all equipment to manufacturer's specifications.
- Examine shuttles, bottles, labels, and preservatives; contact laboratory immediately if any problems are discovered.
- Confirm sample delivery time and method of shipment with the laboratory.
- Establish a sampling team of at least two people.
- Establish monitoring well evacuation and sampling schedule for the activities of each day.

4.2 GROUNDWATER SAMPLING

Sample collection equipment (disposable bailers) will be constructed of polyethylene designed to obtain samples with minimal agitation and contact with the atmosphere. Bailers will be cleaned and protected during transport to and from the sampling destination to avoid contamination, and will be checked for integrity before use. Monitoring well purging bailers will be constructed of polyvinylchloride (PVC).

Groundwater samples will be collected and stored in the order of the volatilization sensitivity of the analytical parameter. Applicable guidelines to be employed for collecting representative groundwater samples from monitoring wells are provided in Attachment C. Applicable guidelines include :

- Water Level Monitoring
- Monitoring Well Purging Prior to Sampling
- Groundwater Sampling

The types and frequency of field QA/QC samples to be collected are discussed in Section 5.0. To ensure sample integrity, monitoring well sampling techniques will be consistently performed each time a particular well is sampled and sampling will comply with the following:

- Before the monitoring well is evacuated, ambient air will be checked for the presence of explosive or organic vapors if they are expected.

- For wells with documented contamination or where NAPL may be present, a Hunter-Keck oil/water interface probe or a clean PVC bailer will be used to identify immiscible layers or other contaminants that are lighter or heavier than water ("floaters" or "sinkers"). If present, NAPL must be sampled and analyzed. Procedures for NAPL detection and sampling are included in Attachment C.

- Evacuation of the well will replace stagnant water in the well and the sand pack with fresh water representative of the formation. Evacuation of the well will be conducted so as to create the least possible turbidity in the well and will not lower the water in the well below the top of the sand pack. Well evacuation procedures will be conducted in accordance with the applicable guideline for well purging (see Attachment C).

- Samples intended for volatile organic compound analysis will be collected immediately after well evacuation.

- Field analysis will be performed on a sample collected from the well after the sample for volatile organics analysis has been collected.

- Field test equipment will be calibrated at the beginning of each sampling day and checked and recalibrated according to manufacturer's specifications. Calibration data will be reported with the analytical results. Field measure-

ments including pH, Eh, specific conductivity, temperature and turbidity will be measured in the field using calibrated instrumentation. Field instrumentation will be maintained and operated according to the applicable guidelines presented in Attachment C.

- Groundwater samples will not be filtered unless otherwise approved by the NYSDEC. If filtration is required, the following procedure will be used:

For monitoring wells with turbidity readings greater than 50 NTU, two sets of samples will be collected for metals analysis; one unfiltered and one field-filtered. The purpose of filtering is to remove suspended particulate matter which has been drawn through the well screen from the surrounding geologic materials during the process of evacuating and sampling the well. These particulates may include naturally occurring constituents that may desorb into the sample once an acid preservative is added. The applicable guideline for field filtration is (see Attachment C) is:

- Procedure for Field Filtration of Aqueous Metals Samples

Samples will be preserved and will be delivered to the laboratory within proper holding times (see Section 5.2) and with proper chain-of-custody documentation. A chain-of-custody form (see Figure 4-1) will be completed for each bulk container (i.e., cooler) of collected samples. The chain-of-custody form will be signed and dated by the person who collected the samples, the person the samples were relinquished to for transport to the laboratory, and the laboratory sample custodian who receives the samples.

Applicable Guidelines (see Attachment C)

- Sample Labeling
- Sample Shipping

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CHAIN OF CUSTODY RECORD

PROJECT NO.:	SITE NAME:	NO. OF CONTAINERS								REMARKS
SAMPLERS (SIGNATURE):										
STATION NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION					

RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE/TIME:	REMARKS:	

Distribution: Original accompanies shipment, copy to coordinator field files

FIGURE 4-1

4.3 SURFACE WATER SAMPLING

Surface water sampling techniques must be consistently applied to all samples and must conform to the following:

Surface water will be collected using direct grab sampling methods (using precleaned sample jars) at each specific sample location (i.e., SW-1 and SW-2). Surface water samples will be collected at downstream locations first and then from upstream locations so that disturbance caused by sampling does not affect downstream sample quality. Surface water samples will be collected by directly filling each appropriate sample container. Surface water sampling procedures are included in Attachment C.

Samples collected from shallow water must not include bottom sediment. Each water body greater than three feet deep will be checked for stratification. Each stream exhibiting evidence of contamination using field instrumentation (dissolved oxygen meter, photoionization detector) will be separately analyzed. If no stratum exhibits such evidence, a composite sample having equal parts of water from each stratum will be analyzed.

4.4 LEACHATE SAMPLING TECHNIQUES

Leachate samples from the Old Bath Landfill leachate collection system will be collected by placing a large precleaned container under the sample spigot/tap located at the LTP site and transferring the sample into the appropriate sample containers.

4.5 LANDFILL GAS SAMPLING TECHNIQUES

Landfill gas sampling techniques must be consistently applied to all samples and must conform to the following.

Landfill gas will be collected using a purge pump attached to the gas vents at each of the three sampling locations. The purge and sampling system will include a flow control valve, rotameter to measure the air flow rate, sampling valve, and a purge pump.

Prior to sample collection, the gas vent and sample system will be purged of two sample volumes at a flow rate of 500 ml/min. or less. The sampling valve will be closed and

purge pump replaced with the 1 liter tedlar bag to collect the air sample. The sampling valve will then be opened and a sample will be collected at a flow rate of 500 ml/min. or less until the tedlar bag is full.

4.6 FIELD MEASUREMENTS

Field measurements including pH, Eh, specific conductivity, temperature, turbidity and natural gas will be measured in the field using calibrated instrumentation. Field parameter samples will be collected immediately following the collection of volatile organic samples or first if no volatile organics are being analyzed. Field instrumentation will be operated and maintained according to the following applicable guidelines (see Attachment C):

- Calibration and Maintenance of Portable Field pH/Eh Meter
- Calibration and Maintenance of Portable Conductivity Meter
- Calibration and Maintenance of Portable Field Turbidity Meter
- Calibration and Maintenance of Portable Dissolved Oxygen Meter

4.7 FIELD EQUIPMENT CLEANING

Purging equipment, leachate collection equipment and water level monitoring probes will be cleaned before each use in accordance with procedures presented in Attachment C:

- Sampling Equipment Decontamination

Sampling bailers will be dedicated to each monitoring well and will not require cleaning.

4.8 DOCUMENTATION OF FIELD ACTIVITIES

The results of all field measurements and associated calculations will be recorded on standard forms included with the guidelines presented in Attachment C. During all activities, the following general information will be recorded in each log book:

- Date.
- Crew members.
- Meteorological conditions.
- Brief description of field activities planned for date indicated.
- Location where work is performed.
- Problems encountered and corrective actions taken.
- All field measurements or descriptions made.
- Any modifications made to sampling procedures.

The following information will be recorded by the sampling team leader and/or field technicians during the collection of all environmental samples:

- Sample locations and summary of the samples collected.
- Completeness of the sampling effort.
- Sample descriptions.
- Results of all field measurements.
- Results of field instrument calibrations.
- Sample preservation used (if applicable).
- Chain-of-custody information.

All original forms and field notebooks will be placed in the project record file that will be maintained at the Malcolm Pirnie, Inc. Buffalo, NY office location.

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5.0 SAMPLE ANALYTICAL PROGRAM

5.1 PARAMETERS FOR PHYSICAL/CHEMICAL ANALYSIS

The analytical parameters that will be analyzed in the monitoring programs discussed in this Plan are listed in Table 5-1.

5.2 ANALYTICAL METHODS/PROTOCOLS

The methods that will be used for chemical analysis of all samples collected during this monitoring program are presented in Table 5-2. The sampling holding times, preservation and container requirements are also presented.

The following analytical method references are to be followed for any samples not specifically covered in this Plan:

a) Test Methods for Evaluating Solid Waste, SW-846, November 1986

b) Standard Methods for the Examination of Water and Wastes, (most recent edition

c) EPA Methods for Chemical Analysis of Water and Wastes, EPA 600/ 4-69-020, March 1983

d) 40 CFR Part 136

The procedure should be listed in the NYSDEC Analytical Services Protocol Manual, September 1989, Revised 1995.

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TABLE 5-1

STEUBEN COUNTY OLD BATH LANDFILL
MONITORING PLAN

LEACHATE, GROUNDWATER, RESIDENTIAL WELL, AND SURFACE WATER ANALYTICAL PARAMETERS

	Leachate Parameters	Groundwater Parameters	Residential Well Parameters	Surface Water Parameters
Field Parameters: (1)				
Specific Conductance	X	X	X	X
Temperature	X	X	X	X
Turbidity	X	X	X	X
pH	X	X	X	X
Eh	X	X	X	X
Dissolved Oxygen				X
Leachate Indicators:				
Total Kjeldahl Nitrogen (TKN)	X	X		(2)
Ammonia	X	X		(2)
Nitrate	X	X		(2)
Chemical Oxygen Demand	X	X		(2)
Biochemical Oxygen Demand (BOD_5)	X	X		(2)
Total Organic Carbon (TOC)	X	X		(2)
Total Dissolved Solids (TDS)	X	X		(2)
Sulfate	X	X		(2)
Alkalinity	X	X		(2)
Phenols	X	X		(2)
Chloride	X	X		(2)
Bromide	X	X		(2)
Total Hardness $CaCO_3$	X	X		(2)
TAL Metals:				
Aluminum	X		X	X
Antimony	X		X	X
Arsenic	X		X	X
Barium	X		X	X
Cadmium	X		X	X
Calcium	X		X	X
Chromium	X		X	X
Cobalt	X		X	X

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TABLE 5-1

STEUBEN COUNTY OLD BATH LANDFILL
MONITORING PLAN

LEACHATE, GROUNDWATER, RESIDENTIAL WELL, AND SURFACE WATER ANALYTICAL PARAMETERS

	Leachate Parameters	Groundwater Parameters	Residential Well Parameters	Surface Water Parameters
TAL Metals (continued):				
Copper	X		X	X
Iron	X		X	X
Lead	X		X	X
Magnesium	X		X	X
Manganese	X		X	X
Mercury	X		X	X
Nickel	X		X	X
Potassium	X		X	X
Selenium	X		X	X
Silver	X		X	X
Sodium	X		X	X
Thallium	X		X	X
Vanadium	X		X	X
Zinc	X		X	X
TCL Volatile Organic Compounds	X	X	X	X
TCL Semivolatile Organic Compounds	X	X		(2)

Notes:
(1) All field parameters (i.e., pH, Eh, D.O., Specific Conductance, Temperature and Turbidity) shall be measured in the field by the sampling team. No analysis of these parameters shall be required by the laboratory. Dissolved oxygen shall be analyzed in surface water only.
(2) Surface water samples shall be analyzed for TAL Metals in addition to parameters analyzed for during the New Bath Landfill Quarterly Groundwater Monitoring.

TABLE 5-2

STEUBEN COUNTY - OLD BATH LANDFILL
MONITORING PLAN

ANALYTICAL PARAMETERS METHODS/PROTOCOLS FOR SURFACE WATER, GROUNDWATER, AND LEACHATE SAMPLES

Parameter	Method	Method Reference	Maximum Detection Limits (mg/L) (6)	Holding Time	Preservation (3)	Container (4)
Leachate Indicators:						
Total Kjeldahl Nitrogen (TKN)	Note 5			26 days	Cool to 4° C H_2SO_4 to pH <2	500 ml plastic or glass
Ammonia	Note 5		2.0	26 days	Cool to 4° C H_2SO_4 to pH <2	500 ml plastic or glass
Nitrate	Note 5		10	24 hours	Cool to 4° C H_2SO_4 to pH <2	100 ml plastic or glass
Chemical Oxygen Demand (COD)	410.1	2		26 days	Cool to 4° C H_2SO_4 to pH <2	50 ml plastic or glass
Biochemical Oxygen Demand (BOD_5)	405.1	2		24 hour	Cool to 4° C	1000 ml plastic or glass
Total Organic Carbon (TOC)	9060	1		26 days	Cool to 4° C H_2SO_4 to pH <2	50 ml plastic or glass
Total Dissolved Solids (TDS)	160.1	2		7 days	Cool to 4° C	100 ml plastic or glass
Sulfate	Note 5	1	250	26 days	Cool to 4° C	50 ml plastic or glass
Alkalinity	Note 5	2		12 days	Cool to 4° C	100 ml plastic or glass
Phenols	Note 5	1	.001	26 days	Cool to 4° C H_2SO_4 to pH <2	500 ml amber glass
Chloride	Note 5	2	250	26 days	Cool to 4° C	50 ml plastic or glass
Total Hardness as ($CaCO_3$)	Note 5	2		6 mos.	H_2SO_4 to pH <2	100 ml plastic or glass
Bromide	Note 5	2	2.0	26 days	Cool to 4° C	500 ml plastic or glass

TABLE 5-2

STEUBEN COUNTY - OLD BATH LANDFILL
MONITORING PLAN

ANALYTICAL PARAMETERS METHODS/PROTOCOLS FOR SURFACE WATER, GROUNDWATER, AND LEACHATE SAMPLES

Parameter	Method	Method Reference	Maximum Detection Limits (mg/L) (6)	Holding Time	Preservation (3)	Container (4)
Metals:						
Arsenic	7060	1	0.025	Note 2	HNO_3 to pH <2	500 ml plastic or glass
Potassium	7610	1		Note 2	HNO_3 to pH <2	500 ml plastic or glass
Sodium	7770	1	20	Note 2	HNO_3 to pH <2	500 ml plastic or glass
Iron	7380	1	0.30	Note 2	HNO_3 to pH <2	500 ml plastic or glass
Manganese	7460	1	0.30	Note 2	HNO_3 to pH <2	500 ml plastic or glass
Magnesium	7450	1		Note 2	HNO_3 to pH <2	500 ml plastic or glass
Lead	7421	1	0.025	Note 2	HNO_3 to pH <2	500 ml plastic or glass
Cadmium	7131	1	0.010	Note 2	HNO_3 to pH <2	500 ml plastic or glass
Aluminum	7020	1		Note 2	HNO_3 to pH <2	500 ml plastic or glass
Calcium	7140	1		Note 2	HNO_3 to pH <2	500 ml plastic or glass
Cobalt	7200	1	0.005	Note 2	HNO_3 to pH <2	500 ml plastic or glass
Vanadium	7910	1	0.014	Note 2	HNO_3 to pH <2	500 ml plastic or glass
Antimony	Note 5		0.003	Note 2	HNO_3 to pH <2	500 ml plastic or glass
Beryllium	Note 5		0.003	Note 2	HNO_3 to pH <2	500 ml plastic or glass
Barium	7080	1	1.0	Note 2	HNO_3 to pH <2	500 ml plastic or glass
Chromium (Total)	7191	1	0.050	Note 2	HNO_3 to pH <2	500 ml plastic or glass
Copper	7210	1	0.20	Note 2	HNO_3 to pH <2	500 ml plastic or glass
Mercury	7470	1	.002	Note 2	HNO_3 to pH <2	500 ml plastic or glass
Nickel	7520	1		Note 2	HNO_3 to pH <2	500 ml plastic or glass
Selenium	Note 5		0.010	Note 2	HNO_3 to pH <2	500 ml plastic or glass
Silver	7760	1	0.050	Note 2	HNO_3 to pH <2	500 ml plastic or glass

TABLE 5-2

STEUBEN COUNTY - OLD BATH LANDFILL
MONITORING PLAN

ANALYTICAL PARAMETERS METHODS/PROTOCOLS FOR SURFACE WATER, GROUNDWATER, AND LEACHATE SAMPLES

Parameter	Method	Method Reference	Maximum Detection Limits (mg/L) (6)	Holding Time	Preservation (3)	Container (4)
Thallium	Note 5	1,2	0.004	Note 2	HNO_3 to pH <2	500 ml plastic or glass
Zinc	6950	1	0.30	Note 2	HNO_3 to pH <2	500 ml plastic or glass
Volatile Organics	8015, 8260	1		Note 1	Cool to 4° C	2-40 ml glass VOA bottles with Teflon septums.
Semivolatile Organics	8270	1		Note 7	Cool to 4° C	2-1,000 ml glass amber bottles with Teflon-lined cap.

References:

(1) Test Methods for Evaluating Solid Wastes, USEPA SW-846, 3rd Edition, Revised 1991, as contained in the NYS Analytical Services Protocol, 1991.

(2) Methods for Chemical Analysis of Water and Wastes. USEPA, Cincinnati, Ohio. EPA 6600/4-69-020, Revised March 1983, as contained in the NYS Analytical Services Protocol, 1995.

Notes:

(1) All field samples will be delivered to the lab within one (1) day of their collection. VOA analysis of water samples must be completed within 7 days of VTSR (Validated Time of Sample Receipt). The VTSR shall be the date on which a sample is received at the laboratory, as recorded on the chain-of-custody form and the lab's central sample log.

(2) Analysis of water for all metals must be completed within 180 days of the VTSR.

(3) Preservatives will be added to the sample bottles in the field immediately after sample has been collected. Ice will be used to cool samples n the field and in transit to the laboratory.

(4) Containers shown are those necessary to satisfy volume requirements for water analysis.

(5) Any EPA-approved method published in References 1 and 2 above may be used. The laboratory shall identify the method to be used and the method detection limit for each parameter.

(6) The concentrations given are the NYSDEC Ground Water Quality Regulation (GQR) (6NYCRR, Part 703) limits for the parameters indicated. The laboratory shall make every reasonable effort to achieve analytical detection limits that are less than the (GQR) limits. If a GQR is not cited, then the analytical quantitation limits shall be in conformance with SW-846, third edition.

(7) Five (5) days to extraction, 40 days to analysis.

5.3 FIELD QUALITY CONTROL SAMPLES

The following field quality control samples will be analyzed:

- **Equipment blanks** will be prepared daily by running ASTM Type I water through any nondedicated sampling and filtration (if appropriate) devices and filling a complete set of sample bottles. If the equipment is dedicated, no equipment blank will be prepared. The results of the equipment blank(s) will be reviewed to monitor the effectiveness of the equipment decontamination procedures.

- A sufficient number of **trip blanks** for volatile organic compound analysis will be prepared by the laboratory and delivered to the sampling team prior to a sampling event. One sealed blank will be carried into the field per day along with the sample containers for each day that volatile organic samples are collected. Trip blanks will be transported and handled in the same manner as the actual samples. The results of the trip blank analysis will be reviewed to evaluate if the potential for sample contamination during transportation and handling exists.

- One **blind duplicate** will be collected and analyzed per sampling event. The field sample containers will be returned to the laboratory identified only as the "blind duplicate". The well or sample location will be recorded in the field notebook and the results will be compared to review analytical precision.

- A sufficient volume of sample will be collected at one sampling location per sampling event for **matrix spike/matrix spike duplicate (MS/MSD)** analysis. The laboratory will report the results of the MS/MSD analysis which will be reviewed for sampling and analysis precision and accuracy.

5.4 LABORATORY QUALITY CONTROL/REPORTING REQUIREMENTS

Laboratory quality control and reporting requirements will be as identified below.

5.4.1 General

- The laboratory will perform all standard in-house QA/QC necessary to control the introduction of contamination in the lab and to insure the accuracy and precision of the data.

- The laboratory will strictly adhere to the quality control requirements specified in the analytical method references given in Table 5-2.

- All laboratories involved in the monitoring program must be certified in the New York State Department of Health Environmental Laboratory Approval Program (ELAP). Sampling and analytical procedures must conform to the New York State Department of Environmental Conservation Analytical Services Protocol Manual (NYSDEC ASP), Revised 1995. The laboratory(ies) must also maintain NYSDEC ASP Contract Laboratory Program (CLP) certification status if applicable to the analytical methods being performed.

5.4.2 Quality Control Analyses

The laboratory will analyze the following quality control samples:

Matrix Spikes (MS) - Matrix spikes will be prepared and analyzed at least once per batch of collected analytical samples so that accuracy can be evaluated. The MS results also indicate the extent of matrix bias or interference on analyte recovery and sample-to-sample recovery. A field blank will not be used for this purpose.

Matrix Spike Duplicate (MSD) - A matrix spike duplicate will be prepared and analyzed at least once per batch to determine the extent of matrix bias or interference on analyte recovery and sample-to-sample recovery. MSD results are compared to MS results as an indicator of precision. Field blanks may not be used for this purpose.

Matrix Spike Blank (MSB) - The laboratory will supply an MSB for each set of investigative samples submitted for analysis according to Category B reporting and deliverable requirements. The MSB will consist of analyte-free water spiked with some of the compounds-of-interest to evaluate the integrity of the spiking solution.

Method Blanks - Method blanks will be analyzed at least once per batch. If a particular reagent or piece of analytical equipment used is changed during preparation of a sample batch, additional testing will be required. The results of the method blanks are to be reported according to Category B reporting and deliverable requirements.

Surrogates - For volatile and semi-volatile organic analyses, surrogate standards are added to each sample and recoveries are calculated for method performance accuracy.

Surrogate standard recoveries will be reported according to Category B reporting and deliverable requirements.

5.4.3 Reporting and Deliverable Requirements

The laboratory(ies) must adhere to NYSDEC ASP Category B reporting and deliverable requirements unless otherwise directed by the County. The laboratory will submit two (2) copies of the analytical report within 30 business days of receipt of the last batch of investigative samples. The analytical report submitted by the laboratory will conform to Category B reporting and deliverable requirements specified in the NYSDEC ASP. The analytical report will also include for each sample:

- Sample location/sample number
- Date collected
- Date extracted or digested
- Date analyzed
- Analytical methodology (including preparation methodology)
- Method detection limits
- Sample dilution factor (if applicable)
- Chain-of-Custody forms

The analytical report also must contain a case narrative which will describe any and all QA/QC problems encountered during sample analysis. For each sample for which QA/QC problems are encountered, the following specific information will be reported in the case narrative:

- Sample identification number
- Sample matrix
- Parameters analyzed
- Data acceptance criteria exceeded
- Specific analytical problems that occurred
- Corrective action taken or attempted to resolve the problem(s)

6.0 EVALUATION OF RESULTS

Analytical data that is generated as part of the Old Bath Landfill Monitoring program will be entered into a computer spreadsheet. The spreadsheet will be used for performing statistical calculations on the data and for generating graphs showing the status and history of individual sampling points and compounds. These graphs will also be used for trend analysis.

Any analytical results which is returned as "Not Detected" will be recorded in the spreadsheet at the detection limit of the analytical method used with a footnote indicating that the compound was not detected at the detection limit. For the purposes of calculating the two year moving average, the detection limit shall be used for samples which have "Not Detected" as the analytical result in the calculation of the average footnote indicating the number of samples for which this was done. If all four sample results are "not detected," then the average will be reported as "less than (detection limit).

If a compound is detected but is at a level below the quantitation limit, the analytical result will be recorded in the table with a descriptive footnote stating "compound detected below accurate quantification limit." These results will be incorporated into the moving average in a manner similar to those which are "not detected" with a footnote describing the number of samples included in the average.

6.1 FACILITY MONITORING

6.1.1 Leachate Quality Moving Average

The Leachate Quality Moving Average for any constituent will be calculated using the results of the current leachate sampling event and the results of the three previous leachate sampling events. The moving average will provide information on the long-term trend of constituent concentrations while smoothing the normal fluctuations which may occur from sampling event to sampling event.

6.1.2 Trend Analysis

The trend analysis will involve charting the change of both the individual sample results and the moving average with respect to time. This will be evaluated to determine the long-term trend of the constituent concentrations at the various sample locations. The data will be presented on a graph of concentration vs. time.

6.2 ENVIRONMENTAL MONITORING

The following statistical analyses will be used to assess the performance of the IRM.

6.2.1 Moving Average

The moving average (two year moving average for groundwater samples, one year moving average for the surface water samples) of the four most recent monitoring data for each constituent will be compared to the New York State Class "GA" or Class "C" (for groundwater and surface water samples, respectively) Water Quality Standards to determine the status of each constituent. The moving average for any constituent is the arithmetic average of the current monitoring data and the three previous monitoring data. The comparison of the moving average to the New York State Class "GA" or Class "C" Water Quality Standards will be comprised of the arithmetic difference between the two values. The moving average will provide information on the long-term trend of constituent concentrations in relation to the New York State Class "GA" or Class "C" Water Quality Standards while smoothing the normal fluctuations which may occur from sampling event to sampling event.

6.2.2 Variation of Water Quality

To determine the variation of the water quality data from one sampling period to the next and to evaluate whether a substantial improvement or degradation in groundwater quality has occurred, the Student's t analysis will be performed. After each sampling event, the sample results will be compared to the sampling results from the four previous

sampling events. The calculated mean and standard deviation of these four sampling events will be used with the appropriate t-statistic to determine 99 percent confidence limits of the sample concentrations. This would be equivalent to the possibility of a type I error in a two-tailed test at a 0.01 level of significance.

6.2.3 Confidence Interval

The confidence interval defines limits within a new piece of data cannot be statistically different from the initial data used to define them. If the new piece of data falls outside those limits then there is a 99 percent probability that the new data is significantly different than the original data from which the confidence limits were derived. In this case, it would imply that there has been a significant change in the groundwater quality, either for the better or the worse, depending on which side of the confidence limits the new data falls. If a sample result from a residential well falls outside the confidence limits and indicates a significant increase in concentration, an additional sample may be taken within one week and analyzed for all constituents to verify that a significant increase in the groundwater concentration has actually occurred, and that a type I error has not been made.

6.2.4 Trend Analysis

The trend analysis will involve charting the change of both the individual sample results and the moving average with respect to time. This will be evaluated to determine the long-term trend of the constituent concentrations at the various sample locations. The data will be presented on a graph of concentration vs. time.

7.0 MONITORING REPORT REQUIREMENTS

7.1 SEMI-ANNUAL REPORTS

7.1.1 Analytical Results

A letter report which includes a summary of all groundwater, surface water, landfill gas, and leachate quality monitoring data will be submitted to the NYSDEC and NYSDOH on a semi-annual basis. Information which will be submitted includes:

- Sample collection date
- Analytical results
- Upgradient well designation
- Sample location number
- Applicable Water Quality Standards and NYSDOH Guidance Values
- QA/QC Values
- Method Detection Limits
- CAS Numbers
- Field sampling notes
- Chain-of-Custody forms

7.1.2 NYSDEC Notification

A semi-annual letter report will be submitted to NYSDEC no later than 60 days after the completion of sampling activities. The letter will include a summary of contraventions of New York State Water Quality Standards. Any determination of contamination detected in the residential wells will be reported to the NYSDEC within 14 days of this determination.

7.1.3 NYSDOH Notification

A semi-annual letter report will be submitted to the NYSDOH no later than 60 days after the completion of sampling activities. The letter will include a summary of contraventions of New York State Water Quality Standards. In addition, the County will notify the NYSDOH of any results which indicate exceedences of New York State Drinking Water Standards within 14 days of receipt of validated analytical results. NYSDOH will coordinate with the County to provide homeowners with a copy of the residential well sampling analytical results.

7.2 ANNUAL MONITORING AND MAINTENANCE SUMMARY REPORT

An Annual Monitoring and Maintenance Summary Report, which includes the following, will be prepared and submitted to the NYSDEC and NYSDOH site contacts:

- A summary of groundwater elevation measurements. These results will be tabulated and used to prepare groundwater isopotential contour maps.
- A summary of semi-annual monitoring results including contraventions of New York State Quality Standards.
- A discussion of sample analytical results including elevations of parameters above background concentrations, and a discussion of the results of statistical analyses discussed in Section 6.0.
- A discussion of changes in leachate or water quality that has occurred throughout the year.
- A discussion of any proposed changes to the Old Bath Landfill Monitoring Plan.
- Results of Post-Closure site inspections.
- A discussion of site maintenance activities.

7.3 SITE CONTACTS

Semi-Annual Monitoring Reports and annual Monitoring and Maintenance Summary Reports will be submitted to the following:

Mr. Gerald J. Rider
Chief, O&M Section
Div. of Environmental Remediation
NYSDEC
50 Wolf Road
Albany, NY 12233-7010

Ms. Mary Jane Peachey
Regional Hazardous Waste Engineer
NYSDEC
6274 East Avon-Lima Road
Avon, NY 14414

Mr. Richard E. Tuers
Bureau of Environmental Exposure Investigation
NYSDOH
2 University Place
Albany, NY 12203-3399

MALCOLM PIRNIE

8.0 REFERENCES

Malcolm Pirnie, Inc., 1991. RI/FS Work Plan; Old Bath Landfill Site.

Malcolm Pirnie, Inc., 1992a. Preliminary Site Characterization Report; RI/FS For The Old Bath Landfill.

Malcolm Pirnie, Inc., 1992b. Old Bath Landfill Interim Remedial Measures Leachate Treatability Study Work Plan.

Malcolm Pirnie, Inc., 1993a. Steuben County - Old Bath Landfill Treatability Study and Design Report, Volume I.

Malcolm Pirnie, Inc., 1993b. Steuben County - Old Bath Landfill Treatability Study and Design Report Supplement.

Malcolm Pirnie, Inc., 1994a. Old Bath landfill Interim Remedial Measures Concept Design Report.

Malcolm Pirnie, Inc., 1994b. Remedial Investigation Report For The Old Bath Landfill.

Malcolm Pirnie, Inc., 1994c. Supplemental Remedial Investigation Report For The Old Bath Landfill.

New York Department of Environmental Conservation, "Old Bath Landfill, Inactive Hazardous Waste Site, Record of Decision;" March 8, 1995.

MALCOLM PIRNIE

ATTACHMENT A

PLATE 1

OLD BATH SANITARY LANDFILL
(INACTIVE)

ENTRANCE ROAD

LEACHATE COLLECTION MANHOLE SEE DETAIL 1/2,10

PROPOSED 18" CORRUGATED HDPE CULVERT

APPROXIMATE LANDFILL CELL (TYP.)

SCALE HOUSE

8" STEEL CULVERT

36" STEEL CULVERT

18" CMP CULVERT

24" CMP CULVERT

MAINTENANCE SHOP

ACCESS ROAD SEE DETAIL 1/2,7

ROCK

SHOP WELL

GAS COLLECTION TRENCH SEE DETAIL 4/2,7

GAS VENT SEE DETAIL 3/2,7

SEE NOTE 2

SEE DETAIL FOR INTERSECTION OF GAS VENTING SYSTEM AND LEACHATE COLLECTION SYSTEM 1/2,10

TRANSITION MANHOLE SEE DETAIL 6/2,9

6" DIA. LEACHATE CLEANOUT SEE DETAIL 2/2,8

LEACHATE COLLECTION TRENCH SEE DETAIL 3/2,7

LEACHATE MONITORING PIEZOMETER SEE DETAIL 6/2,8

LEACHATE CONVEYANCE MANHOLE SEE DETAIL 2/2,9

30" CMP CULVERT

LEACHATE CONVEYANCE PIPE SEE DETAIL 1/2,8

LEACHATE HAULER ACCESS ROAD

15" CONCRETE CULVERT

CONNECT TO EXISTING LEACHATE CONVEYANCE MANHOLE TO LEACHATE TREATMENT PLANT SEE PROFILE ON SHEET 3

CELL #1 · CELL #2 · CELL #3 · CELL #4 · CELL #5 · CELL #6 · CELL #7 · CELL #8 · CELL #9 · CELL #10 · CELL #11

MH-1 · MH-2 · MH-3 · MH-4 · MH-5 · MH-6

L8-1 · L8-2 · L7-1 · L7-2 · L6-1 · L6-2 · L5-1 · L5-2 · L4-1 · L4-2 · L3-1 · L3-2 · L2-1 · L2-2 · L1-1 · L1-2

B-1 · B-2 · B-3 · B-4 · B-5 · B-6 · B-7 · B-8 · B-8A · B-8B · B-8C · B-8D · B-9 · B-11 · B-11A · B-12 · B-13 · B-15 · B-17 · B-18 · B-19

RDD4 · RDD5 · RDD6 · RDD7

TW1 · TW2 · TW3 · TW4

WELL 7 · WELL 8 · WELL 9

VP-1 · VP-2

EXISTING LEACHATE STORAGE TANK

LEAK DETECTION TANK

ACCESS ROAD

E 102,500 · N 99,500 · E 103,000 · N 99,000

1550 · 1560 · 1570 · 1580 · 1590 · 1600 · 1610 · 1620 · 1630 · 1640 · 1650 · 1660 · 1670 · 1680

LEGEND

- PROPOSED MANHOLE
- GAS VENT
- LEACHATE CLEANOUT
- SOLID LEACHATE COLLECTION PIPE
- PERFORATED LEACHATE COLLECTION PIPE
- PERFORATED GAS COLLECTION PIPE
- APPROXIMATE LIMIT OF EXISTING LANDFILL CELL
- EXISTING 10' CONTOUR
- PROPOSED 10' CONTOUR
- DOUBLE-WALLED LEACHATE CONVEYANCE SEWER
- B-11 BEDROCK MONITORING WELL
- L1-1 EXISITNG LEACHATE MONITORING PIEZOMETER
- PROPOSED LEACHATE MONITORING PIEZOMETER

0 50 100

SCALE IN FEET

WARNING - IT IS A VIOLATION OF NEW YORK EDUCATION LAW, SECTION 7209.2, FOR ANY PERSON, UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER OR LAND SURVEYOR, TO ALTER THIS DOCUMENT IN ANY WAY. IF ALTERED, THE ALTERING PERSON SHALL COMPLY WITH THE REQUIREMENTS OF NEW YORK LAW, SECTION 7209.2.

5972 : \1318\2101\V\LACAD\PROJ\STE_1318\STE_RM_1318G03 SCALE: 1:1 09/27, 1995 at 10:39

MALCOLM PIRNIE

STATE OF NEW YORK · PAUL H. WERTHMAN · 57621 · LICENSED PROFESSIONAL ENGINEER

NO.	BY	DATE	REVISIONS

DES TJR
DWN HMF
CKD TJR

STEUBEN COUNTY DEPT. OF PUBLIC WORKS
BATH, NEW YORK
OLD BATH LANDFILL
INTERIM REMEDIAL MEASURES
CONTRACT NO. 3

OLD BATH LANDFILL
FINAL COVER AND LEACHATE COLLECTION SYSTEM CONSTRUCTION
PROPOSED LEACHATE COLLECTION AND GAS VENTING SYSTEM
1"=50'

DATE FEBRUARY 1996

G SHEET 2 OF 9

CAD REF. NO. 1318G03

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ATTACHMENT B

BOREHOLE LOGS

H&A of New York
Consulting Geotechnical Engineers, Geologists and Hydrogeologists

OVERBURDEN OBSERVATION WELL REPORT

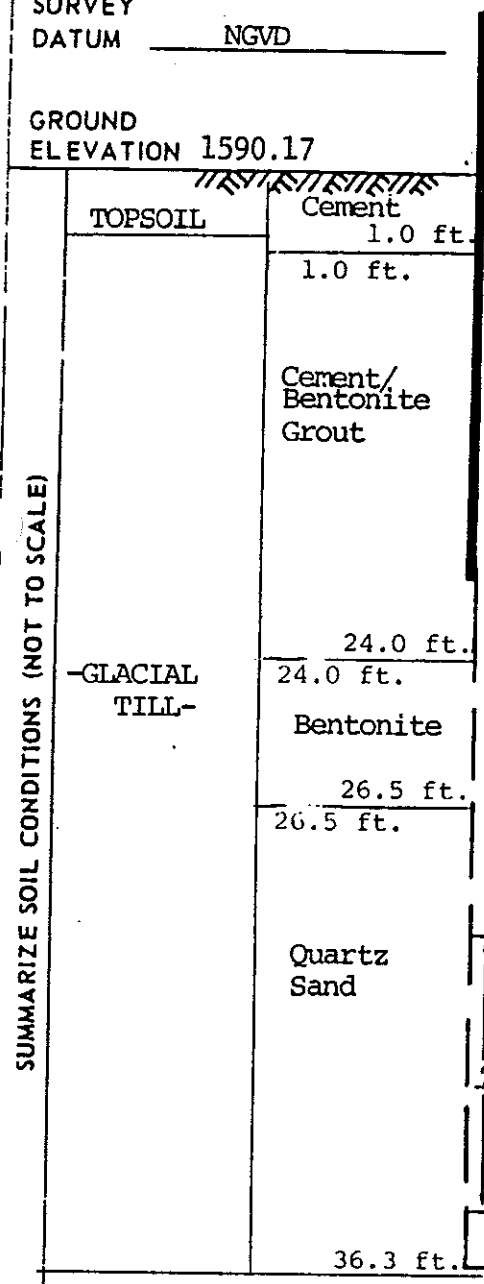
PROJECT: STEUBEN COUNTY LANDFILL - BATH
LOCATION: BATH, NEW YORK
CLIENT: LARSEN ENGINEERS/ARCHITECTS
CONTRACTOR: EMPIRE SOILS INVESTIGATIONS INC.
DRILLER: J. Jensen INSPECTOR: S.J.DeMeo
INSTALLATION DATE 2 October 1986

FILE NO. 752920
WELL NO. OW301S
BORING NO. B301R
LOCATION
SHEET 1 OF 2

SURVEY DATUM NGVD

GROUND ELEVATION 1590.17

SUMMARIZE SOIL CONDITIONS (NOT TO SCALE)



ELEVATION OR STICKUP ABOVE/BELOW GROUND SURFACE OF CASING OR ROADWAY BOX	2.0 ft.
ELEVATION OR STICKUP ABOVE/BELOW GROUND SURFACE OF RISER PIPE.	1.8 ft.
THICKNESS OF SURFACE SEAL	1.0 ft.
TYPE OF SURFACE SEAL	cement
[INDICATE ALL SEALS SHOWING DEPTH, THICKNESS AND TYPE]	
TYPE OF CASING	steel pipe
INSIDE DIAMETER OF CASING	6.0 in.
ELEVATION/DEPTH OF BOTTOM OF CASING	3.0 ft.
INSIDE DIAMETER OF RISER PIPE	2.0 in.+
TYPE OF BACKFILL AROUND RISER	Cement/Fentonite Grout
DIAMETER OF BOREHOLE	8 in.+
ELEVATION/DEPTH OF BOTTOM OF RISER	31.0 ft.
TYPE OF POINT OR MANUFACTURER	slotted PVC
SCREEN GAUGE OR SIZE OF OPENINGS	0.01 in.
DIAMETER OF WELLPOINT	2.0 in.
TYPE OF BACKFILL AROUND POINT	Quartz sand
ELEVATION/DEPTH OF BOTTOM OF POINT	35.9
ELEVATION/DEPTH OF BOTTOM OF BOREHOLE	36.3

[FIGURES REFER TO: EL. ____ DEPTH X]

[LENGTH OF CASING L_3] [LENGTH OF RISER PIPE (L_1) + LENGTH OF POINT (L_2) = PAY LENGTH]

H&A of New York
Consulting Geotechnical Engineers, Geologists and Hydrogeologists

BEDROCK OBSERVATION WELL REPORT

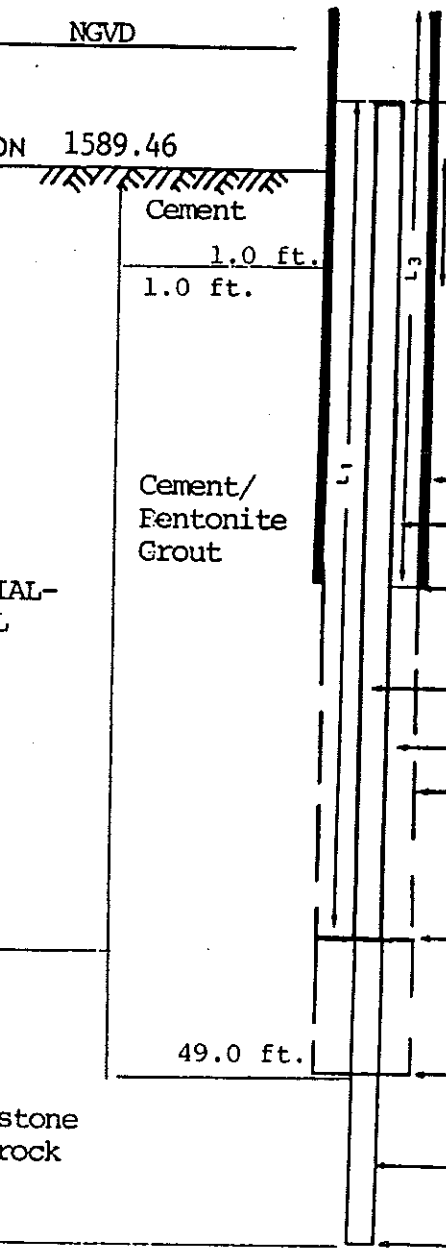
PROJECT: STEUBEN COUNTY LANDFILL-BATH
LOCATION: BATH, NEW YORK
CLIENT: LARSEN ENGINEERS/ARCHITECTS
CONTRACTOR: EMPIRE SOILS INVESTIGATIONS, INC.
DRILLER: J. Jensen INSPECTOR: S.J. DeMeo
INSTALLATION DATE 2 October, 1986

FILE NO. 752920
WELL NO. OW 301 R
BORING NO. B301R
LOCATION
SHEET 1 OF 2

SURVEY DATUM NGVD

GROUND ELEVATION 1589.46

SUMMARY OF SUBSURFACE CONDITIONS (NOT TO SCALE)



ELEVATION OR STICKUP ABOVE/BELOW GROUND SURFACE OF CASING OR ROADWAY BOX	2.2 ft.
ELEVATION OR STICKUP ABOVE/BELOW GROUND SURFACE OF CASING	1.8 ft.
THICKNESS OF SURFACE SEAL	1.0 ft.
TYPE OF SURFACE SEAL	cement
[INDICATE ALL SEALS SHOWING DEPTH, THICKNESS AND TYPE]	
TYPE OF PROTECTIVE CASING	steel pipe
INSIDE DIAMETER OF PROTECTIVE CASING	6.0 in.
ELEVATION/DEPTH OF BOTTOM OF PROTECTIVE CASING	2.8 ft.
INSIDE DIAMETER OF CASING	4.0 in.
TYPE OF BACKFILL AROUND CASING	Cement/ Bentonite grout
DIAMETER OF BOREHOLE	8.0 in±
ELEVATION/DEPTH OF TOP OF BEDROCK	43.0 ft.
ELEVATION/DEPTH OF BOTTOM OF CASING	49.0 ft.
DIAMETER OF ROCK HOLE	3.0 in.±
ELEVATION/DEPTH OF BOTTOM OF ROCK HOLE	59.0 ft.

[FIGURES REFER TO: EL. ____ DEPTH X]

____ (CASING LENGTH) + ____ (LENGTH OF ROCK HOLE) = ____ (TOTAL LENGTH)

H&A

BOREHOLE LOG 301DR

PROJECT: Old Bath Landfill RI/FS
PROJECT NO.: 1318-11-1
LOCATION: Bath,New York
SURVEY COORDINATES: N 100087.0 E 103204.5
SURVEY DATUM:

CLIENT: Steuben County
DRILLING DATES: APRIL 23,1992
DRILLING METHOD: 4.25-inch ID HSA
LOGGED/CHECKED BY: RHO/RLD
SURFACE ELEVATION: 1589.5ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2in.ID)
SS3 Split Spoon (3in.ID)
ST Shelby Tube (2.8in.ID)
WH Weight of Hammer
WR Weight of Rods
NR No Recovery

GSD Grain Size Dist.
ATT Atterberg Limit

SHS Total VOC Detected in the Sampler Head Space (ppm)

JHS Total VOC Detected in the Sample Jar Head Space (ppm)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL/ROCK DESCRIPTION	SOIL DATA: GRAPHIC LOG	SOIL DATA: SAMPLE NO. / RUN NO.	SOIL DATA: BLOWS / 6"	SOIL DATA: RECOVERY (in)	SOIL DATA: 'N'-VALUE	ROCK DATA: FROM/TO	ROCK DATA: DRILL RATE MIN./FT.	ROCK DATA: % REC.	ROCK DATA: % RQD.	WELL DIAGRAM	COMMENTS
1	1588.5	Overburden description -See 301R boring log (H&A Groundwater Remedial Measures Investigation Report October, 1988)											
2	1587.5												
3	1586.5												
4	1585.5												
5	1584.5												
6	1583.5												
7	1582.5												
8	1581.5												
9	1580.5												
10	1579.5												
11	1578.5												
12	1577.5												
13	1576.5												
14	1575.5												
15	1574.5												
16	1573.5												
17	1572.5												
18	1571.5												
19	1570.5												
20	1569.5												

BOREHOLE LOG 301DR

PROJECT: Old Bath Landfill RI/FS
PROJECT NO.: 1318-11-1
LOCATION: Bath,New York
SURVEY COORDINATES: N 100087.0 E 103204.5
SURVEY DATUM:

CLIENT: Steuben County
DRILLING DATES: APRIL 23,1992
DRILLING METHOD: 4.25-inch ID HSA
LOGGED/CHECKED BY: RHO/RLD
SURFACE ELEVATION: 1589.5ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2in.ID)
SS3 Split Spoon (3in.ID)
ST Shelby Tube (2.8in.ID)
WH Weight of Hammer
WR Weight of Rods
NR No Recovery

GSD Grain Size Dist.
ATT Atterberg Limit

SHS Total VOC Detected in the Sampler Head Space (ppm)

JHS Total VOC Detected in the Sample Jar Head Space (ppm)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL/ROCK DESCRIPTION	SOIL DATA: GRAPHIC LOG	SOIL DATA: SAMPLE NO. / RUN NO.	SOIL DATA: BLOWS / 6"	SOIL DATA: RECOVERY (in)	SOIL DATA: 'N'-VALUE	ROCK DATA: FROM/TO	ROCK DATA: DRILL RATE MIN./FT.	ROCK DATA: % REC.	ROCK DATA: % RQD.	WELL DIAGRAM	COMMENTS
21	1568.5	Overburden description - See 301R boring log (H&A Groundwater Remedial Measures Investigation Report October,1988)											
22	1567.5												
23	1566.5												
24	1565.5												
25	1564.5												
26	1563.5												
27	1562.5												
28	1561.5												
29	1560.5												
30	1559.5												
31	1558.5												
32	1557.5												
33	1556.5												
34	1555.5												
35	1554.5												
36	1553.5												
37	1552.5												
38	1551.5												
39	1550.5												
40	1549.5												

BOREHOLE LOG 301DR

PROJECT: Old Bath Landfill RI/FS
PROJECT NO.: 1318-11-1
LOCATION: Bath,New York
SURVEY COORDINATES: N 100087.0 E 103204.5
SURVEY DATUM:

CLIENT: Steuben County
DRILLING DATES: APRIL 23,1992
DRILLING METHOD: 4.25-inch ID HSA
LOGGED/CHECKED BY: RHO/RLD
SURFACE ELEVATION: 1589.5ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2in.ID)
SS3 Split Spoon (3in.ID)
ST Shelby Tube (2.8in.ID)
WH Weight of Hammer
WR Weight of Rods
NR No Recovery

GSD Grain Size Dist.
ATT Atterberg Limit

SHS Total VOC Detected in the Sampler Head Space (ppm)

JHS Total VOC Detected in the Sample Jar Head Space (ppm)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL/ROCK DESCRIPTION	SOIL DATA: GRAPHIC LOG	SOIL DATA: SAMPLE NO. / RUN NO.	SOIL DATA: BLOWS / 6"	SOIL DATA: RECOVERY (in)	SOIL DATA: 'N'-VALUE	ROCK DATA: FROM/TO	ROCK DATA: DRILL RATE MIN./FT.	ROCK DATA: % REC.	ROCK DATA: % RQD.	WELL DIAGRAM	COMMENTS
41	1548.5	Top of Bedrock @ 41.0 ft											
42	1547.5												
43	1546.5	Shallow bedrock description -See 301R boring log (H&A Groundwater Remedial Measures Investigation Report October,1988)											
44	1545.5												
45	1544.5												
46	1543.5												
47	1542.5												
48	1541.5												
49	1540.5												
50	1539.5												
51	1538.5												
52	1537.5												
53	1536.5												
54	1535.5												
55	1534.5												
56	1533.5												
57	1532.5												
58	1531.5												
59	1530.5												
60	1529.5												

BOREHOLE LOG 301DR

PROJECT: Old Bath Landfill RI/FS
PROJECT NO.: 1318-11-1
LOCATION: Bath,New York
SURVEY COORDINATES: N 100087.0 E 103204.5
SURVEY DATUM:

CLIENT: Steuben County
DRILLING DATES: APRIL 23,1992
DRILLING METHOD: 4.25-inch ID HSA
LOGGED/CHECKED BY: RHO/RLD
SURFACE ELEVATION: 1589.5ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2in.ID)
SS3 Split Spoon (3in.ID)
ST Shelby Tube (2.8in.ID)
WH Weight of Hammer
WR Weight of Rods
NR No Recovery

GSD Grain Size Dist.
ATT Atterberg Limit

SHS Total VOC Detected in the Sampler Head Space (ppm)

JHS Total VOC Detected in the Sample Jar Head Space (ppm)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL/ROCK DESCRIPTION	SOIL DATA: GRAPHIC LOG	SOIL DATA: SAMPLE NO. / RUN NO.	SOIL DATA: BLOWS / 6"	SOIL DATA: RECOVERY (in)	SOIL DATA: 'N'-VALUE	ROCK DATA: FROM/TO	ROCK DATA: DRILL RATE MIN./FT.	ROCK DATA: % REC.	ROCK DATA: % RQD.	WELL DIAGRAM	COMMENTS
61	1528.5												
62	1527.5	60.8-66.0 SANDSTONE, lt gray, vf-fine grain w/variable silt component, medium hard, laminated w/thin bedded argillaceous partings at 61.2, 63.5 and 64.5-64.8, calcareous fossiliferous parting @ 61.5, fractured											
63	1526.5												
64	1525.5												
65	1524.5							60.0/70.0		88	47		
66	1523.5	66.0-66.9 SHALE, black, soft, fractured thin silty- sandstone parting 66.6-66.7											
67	1522.5	66.9-67.8 SANDSTONE, lt gray calcarous, fossiliferous, soft sediment deformation											
68	1521.5	67.8-69.2 SANDSTONE, gray, vf grain, silty, argillaceous partings at 68.2, 68.6 & 68.8											
69	1520.5	69.2-71.2 SANDSTONE, lt gray, calcareous w/interbedded black shaley siltstone and fossiliferous limestone partings, bedding plane joints at lithlologic contacts											
70	1519.5												4" Open hole construction @ 70.0'
71	1518.5												
72	1517.5	71.2-76.0 SANDSTONE, hard, micaceous, silty, microlaminated w/argillaceous partings and clay filled bedding plane joints											
73	1516.5												
74	1515.5												
75	1514.5							70.0/80.0		97	80		
76	1513.5	76.0-79.4 SANDSTONE, interbedded calcareous, fossiliferous partings, few clay filled fractures, moderately weathered 79.3-79.4											
77	1512.5												
78	1511.5												
79	1510.5												
80	1509.5	End of boring @ 80.0 ft											

BOREHOLE LOG 301DR

PROJECT: Old Bath Landfill RI/FS
PROJECT NO.: 1318-11-1
LOCATION: Bath,New York
SURVEY COORDINATES: N 100087.0 E 103204.5
SURVEY DATUM:

CLIENT: Steuben County
DRILLING DATES: APRIL 23,1992
DRILLING METHOD: 4.25-inch ID HSA
LOGGED/CHECKED BY: RHO/RLD
SURFACE ELEVATION: 1589.5ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2in.ID)
SS3 Split Spoon (3in.ID)
ST Shelby Tube (2.8in.ID)
WH Weight of Hammer
WR Weight of Rods
NR No Recovery

GSD Grain Size Dist.
ATT Atterberg Limit

SHS Total VOC Detected in the Sampler Head Space (ppm)

JHS Total VOC Detected in the Sample Jar Head Space (ppm)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL/ROCK DESCRIPTION	SOIL DATA: GRAPHIC LOG	SOIL DATA: SAMPLE NO. / RUN NO.	SOIL DATA: BLOWS / 6"	SOIL DATA: RECOVERY (in)	SOIL DATA: 'N'-VALUE	ROCK DATA: FROM/TO	ROCK DATA: DRILL RATE MIN./FT.	ROCK DATA: % REC.	ROCK DATA: % RQD.	WELL DIAGRAM	COMMENTS
81	1508.5	WELL CONSTRUCTION DETAILS:											
82	1507.5	4" open hole monitoring interval 80.0'-70.0'											
83	1506.5												
84	1505.5	4" diameter stainless steel riser 70.0'-surface, w/2.0' stickup. Hydrated 1/4" bentonite pellet seal 70.0'- 68.7'. cement/bentonite grout 68.7-surface, w/2'X 2'x 1" thick concrete surface pad and a 6" diameter x 5' long locking steel protective casing.											
85	1504.5												
86	1503.5												
87	1502.5												
88	1501.5												
89	1500.5												
90	1499.5												
91	1498.5												
92	1497.5												
93	1496.5												
94	1495.5												
95	1494.5												
96	1493.5												
97	1492.5												
98	1491.5												
99	1490.5												
100	1489.5												

H&A of New York
Consulting Geotechnical Engineers, Geologists and Hydrogeologists

OVERBURDEN OBSERVATION WELL REPORT

PROJECT: STEUBEN COUNTY LANDFILL -- BATH
LOCATION: BATH, NEW YORK
CLIENT: LARSEN ENGINEERS/ARCHITECTS
CONTRACTOR: PARRATT-WOLFF, INC.
DRILLER: M. BECK H&A REPRESENTATIVE: N. REIGLE
INSTALLATION DATE 27 OCTOBER - 28 OCTOBER 1987

FILE NO. 752930
WELL NO. OW402S
BORING NO. B402R
LOCATION See Plan
SHEET 1 OF 2

SURVEY DATUM NGVD
GROUND ELEVATION 1602.77

SUMMARIZE SOIL CONDITIONS (NOT TO SCALE)

PORTLAND CEMENT
-GLACIAL TILL-
16.7 ft.
BENTONITE
18.2 ft.
QUARTZ SAND
25.0 ft.

~~ELEVATION OR~~ STICKUP ABOVE/~~BELOW~~ GROUND SURFACE OF CASING OR ROADWAY BOX	2.5 ft.
~~ELEVATION OR~~ STICKUP ABOVE/~~BELOW~~ GROUND SURFACE OF RISER PIPE.	2.3 ft.
THICKNESS OF SURFACE SEAL	16.7 ft.
TYPE OF SURFACE SEAL	Portland Cement
[INDICATE ALL SEALS SHOWING DEPTH, THICKNESS AND TYPE]	
TYPE OF CASING	Iron
INSIDE DIAMETER OF CASING	4.0 in.
~~ELEVATION OR~~ DEPTH OF BOTTOM OF CASING	0.5 ft.
INSIDE DIAMETER OF RISER PIPE	2.0 in.
TYPE OF BACKFILL AROUND RISER	Portland Cement
DIAMETER OF BOREHOLE	8.0 in.±
TYPE OF COUPLING (THREADED, SOLVENT WELDED, WELDED, ETC.)	Threaded
~~ELEVATION OR~~ DEPTH OF BOTTOM OF RISER	20.0 ft.
TYPE OF WELLSCREEN OR MANUFACTURER	Stainless Steel
SCREEN SLOT SIZE	0.01 in.
DIAMETER OF WELLSCREEN	2.0 in.
TYPE OF BACKFILL AROUND WELLSCREEN	Quartz Sand
~~ELEVATION OR~~ DEPTH OF BOTTOM OF WELLSCREEN	25.0 ft.
~~ELEVATION OR~~ DEPTH OF BOTTOM OF BOREHOLE	25.0 ft.

[FIGURES REFER TO: EL. ____ DEPTH X]

WELL SUMMARY: 22.3 ft. (LENGTH OF RISER PIPE) + 5.0 ft. (LENGTH OF WELLSCREEN) = 27.3 ft. (TOTAL LENGTH)

H&A of New York
Consulting Geotechnical Engineers, Geologists and Hydrogeologists

BEDROCK OBSERVATION WELL REPORT

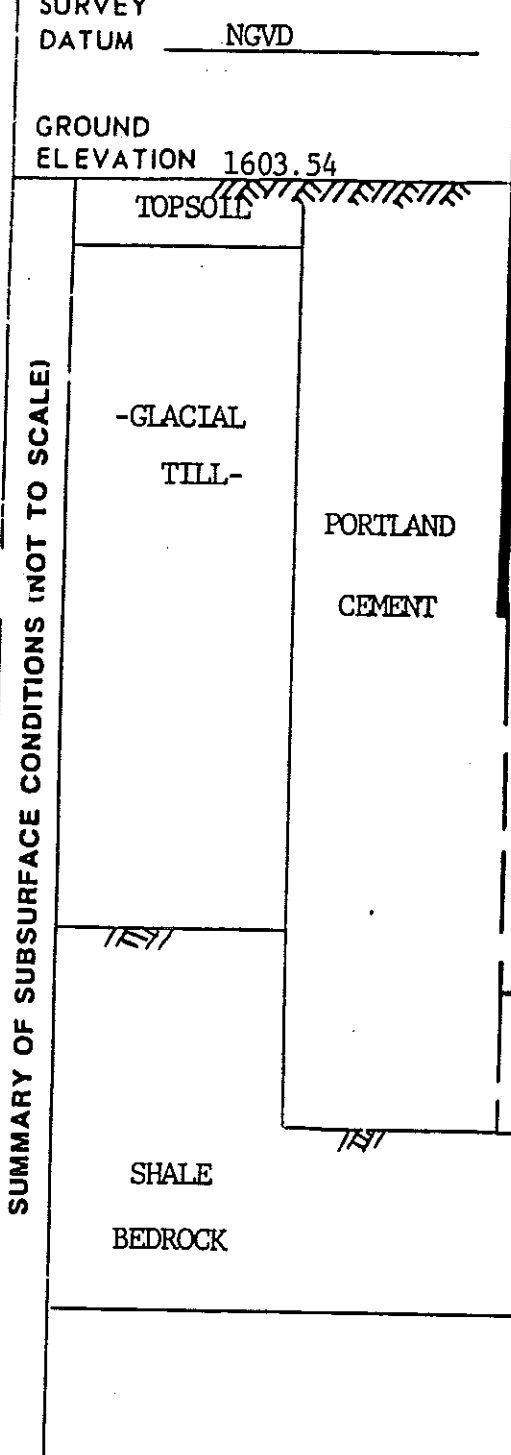
PROJECT: STEUBEN COUNTY LANDFILL -- BATH
LOCATION: BATH, NEW YORK
CLIENT: LARSEN ENGINEERS/ARCHITECTS
CONTRACTOR: PARRATT-WOLFF, INC.
DRILLER: M. BECK H&A REPRESENTATIVE: N. REIGLE
INSTALLATION DATE 27 OCTOBER - 2 NOVEMBER 1987

FILE NO. 752930
WELL NO. OW402R
BORING NO. B402R
LOCATION See Plan
SHEET 1 OF 2

SURVEY DATUM NGVD

GROUND ELEVATION 1603.54

SUMMARY OF SUBSURFACE CONDITIONS (NOT TO SCALE)



~~ELEVATION OR~~ STICKUP ABOVE/~~BELOW~~ GROUND SURFACE OF CASING OR ROADWAY BOX	NA
~~ELEVATION OR~~ STICKUP ABOVE/~~BELOW~~ GROUND SURFACE OF CASING	2.5 ft.
THICKNESS OF SURFACE SEAL	43.0 ft.
TYPE OF SURFACE SEAL	Portland Cement
[INDICATE ALL SEALS SHOWING DEPTH, THICKNESS AND TYPE]	
TYPE OF PROTECTIVE CASING	NA
INSIDE DIAMETER OF PROTECTIVE CASING	NA
ELEVATION/DEPTH OF BOTTOM OF PROTECTIVE CASING	NA
INSIDE DIAMETER OF CASING	4.0 in.
TYPE OF BACKFILL AROUND CASING	Portland Cement
DIAMETER OF BOREHOLE	8.0 in.±
~~ELEVATION~~/DEPTH OF TOP OF BEDROCK	39.5 ft.
~~ELEVATION~~/DEPTH OF BOTTOM OF CASING	43.0 ft.
DIAMETER OF ROCK HOLE	3.0 in.
~~ELEVATION~~/DEPTH OF BOTTOM OF ROCK HOLE	73.5 ft.

[FIGURES REFER TO: EL. ____ DEPTH X]

WELL SUMMARY: 45.5 ft. (CASING LENGTH) + 30.5 ft. (LENGTH OF ROCK HOLE) = 76.0 ft. (TOTAL LENGTH)

BOREHOLE LOG 402DR

PROJECT: Old Bath Landfill RI/FS
PROJECT NO.: 1318-11-1
LOCATION: Bath,New York
SURVEY COORDINATES: N 100263.3 E 103077.6
SURVEY DATUM:

CLIENT: Steuben County
DRILLING DATES: MAY 12, 1992
DRILLING METHOD: 4.25-inch ID HSA
LOGGED/CHECKED BY: RHO/RLD
SURFACE ELEVATION: 1601.7ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2in.ID)
SS3 Split Spoon (3in.ID)
ST Shelby Tube (2.8in.ID)
WH Weight of Hammer
WR Weight of Rods
NR No Recovery

GSD Grain Size Dist.
ATT Atterberg Limit

SHS Total VOC Detected in the Sampler Head Space (ppm)

JHS Total VOC Detected in the Sample Jar Head Space (ppm)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL/ROCK DESCRIPTION	SOIL DATA: GRAPHIC LOG	SOIL DATA: SAMPLE NO. / RUN NO.	SOIL DATA: BLOWS / 6"	SOIL DATA: RECOVERY (in)	SOIL DATA: 'N'-VALUE	ROCK DATA: FROM/TO	ROCK DATA: DRILL RATE MIN./FT.	ROCK DATA: % REC.	ROCK DATA: % ROD.	WELL DIAGRAM	COMMENTS
1	1600.7	Overburden description -See 402R boring log (H&A Groundwater Remedial Measures Investigation Report October, 1988)											
2	1599.7												
3	1598.7												
4	1597.7												
5	1596.7												
6	1595.7												
7	1594.7												
8	1593.7												
9	1592.7												
10	1591.7												
11	1590.7												
12	1589.7												
13	1588.7												
14	1587.7												
15	1586.7												
16	1585.7												
17	1584.7												
18	1583.7												
19	1582.7												
20	1581.7												

BOREHOLE LOG 402DR

PROJECT: Old Bath Landfill RI/FS
PROJECT NO.: 1318-11-1
LOCATION: Bath,New York
SURVEY COORDINATES: N 100263.3 E 103077.6
SURVEY DATUM:

CLIENT: Steuben County
DRILLING DATES: MAY 12, 1992
DRILLING METHOD: 4.25-inch ID HSA
LOGGED/CHECKED BY: RHO/RLD
SURFACE ELEVATION: 1601.7ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2in.ID)
SS3 Split Spoon (3in.ID)
ST Shelby Tube (2.8in.ID)
WH Weight of Hammer
WR Weight of Rods
NR No Recovery

GSD Grain Size Dist.
ATT Atterberg Limit

SHS Total VOC Detected in the Sampler Head Space (ppm)

JHS Total VOC Detected in the Sample Jar Head Space (ppm)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL/ROCK DESCRIPTION	SOIL DATA: GRAPHIC LOG	SOIL DATA: SAMPLE NO. / RUN NO.	SOIL DATA: BLOWS / 6"	SOIL DATA: RECOVERY (in)	SOIL DATA: 'N'-VALUE	ROCK DATA: FROM/TO	ROCK DATA: DRILL RATE MIN./FT.	ROCK DATA: % REC.	ROCK DATA: % ROD.	WELL DIAGRAM	COMMENTS
21	1580.7	Overburden description -See 402R boring log (H&A Groundwater Remedial Measures Investigation Report October, 1988)											
22	1579.7												
23	1578.7												
24	1577.7												
25	1576.7												
26	1575.7												
27	1574.7												
28	1573.7												
29	1572.7												
30	1571.7												
31	1570.7												
32	1569.7												
33	1568.7												
34	1567.7												
35	1566.7												
36	1565.7												
37	1564.7												
38	1563.7												
39	1562.7	Top of Bedrock @ 39.0 ft											
40	1561.7												

BOREHOLE LOG 402DR

PROJECT: Old Bath Landfill RI/FS
PROJECT NO.: 1318-11-1
LOCATION: Bath,New York
SURVEY COORDINATES: N 100263.3 E 103077.6
SURVEY DATUM:

CLIENT: Steuben County
DRILLING DATES: MAY 12, 1992
DRILLING METHOD: 4.25-inch ID HSA
LOGGED/CHECKED BY: RHO/RLD
SURFACE ELEVATION: 1601.7ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2in.ID)
SS3 Split Spoon (3in.ID)
ST Shelby Tube (2.8in.ID)
WH Weight of Hammer
WR Weight of Rods
NR No Recovery

GSD Grain Size Dist.
ATT Atterberg Limit

SHS Total VOC Detected in the Sampler Head Space (ppm)

JHS Total VOC Detected in the Sample Jar Head Space (ppm)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL/ROCK DESCRIPTION	SOIL DATA: GRAPHIC LOG	SOIL DATA: SAMPLE NO. / RUN NO.	SOIL DATA: BLOWS / 6"	SOIL DATA: RECOVERY (in)	SOIL DATA: 'N'-VALUE	ROCK DATA: FROM/TO	ROCK DATA: DRILL RATE MIN./FT.	ROCK DATA: % REC.	ROCK DATA: % RQD.	WELL DIAGRAM	COMMENTS
41	1560.7	Shallow bedrock description -See 402R boring log (H&A Groundwater Remedial Measures Investigation Report October, 1988)											
42	1559.7												
43	1558.7												
44	1557.7												
45	1556.7												
46	1555.7												
47	1554.7												
48	1553.7												
49	1552.7												
50	1551.7												
51	1550.7												
52	1549.7												
53	1548.7												
54	1547.7												
55	1546.7												
56	1545.7												
57	1544.7												
58	1543.7												
59	1542.7												
60	1541.7												

BOREHOLE LOG 402DR

PROJECT: Old Bath Landfill RI/FS
PROJECT NO.: 1318-11-1
LOCATION: Bath,New York
SURVEY COORDINATES: N 100263.3 E 103077.6
SURVEY DATUM:

CLIENT: Steuben County
DRILLING DATES: MAY 12, 1992
DRILLING METHOD: 4.25-inch ID HSA
LOGGED/CHECKED BY: RHO/RLD
SURFACE ELEVATION: 1601.7ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2in.ID)
SS3 Split Spoon (3in.ID)
ST Shelby Tube (2.8in.ID)
WH Weight of Hammer
WR Weight of Rods
NR No Recovery

GSD Grain Size Dist.
ATT Atterberg Limit

SHS Total VOC Detected in the Sampler Head Space (ppm)

JHS Total VOC Detected in the Sample Jar Head Space (ppm)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL/ROCK DESCRIPTION	SOIL DATA: GRAPHIC LOG	SOIL DATA: SAMPLE NO. / RUN NO.	SOIL DATA: BLOWS / 6"	SOIL DATA: RECOVERY (in)	SOIL DATA: 'N'-VALUE	ROCK DATA: FROM/TO	ROCK DATA: DRILL RATE MIN./FT.	ROCK DATA: % REC.	ROCK DATA: % RQD.	WELL DIAGRAM	COMMENTS
61	1540.7												
62	1539.7												
63	1538.7												
64	1537.7												
65	1536.7												
66	1535.7												
67	1534.7												
68	1533.7												
69	1532.7												
70	1531.7												
71	1530.7												
72	1529.7												
73	1528.7	73.0-74.7 SANDSTONE, gray, fine grain, silty, hard, micaceous (@ 73.8,74.8 shale parting)						73.0/83.0		90	55		
74	1527.7												
75	1526.7	74.7-75.3 SANDSTONE, fine grain, buff colored, slightly weathered, shale parting @ 74.7											
76	1525.7	75.3-81.3 SANDSTONE, fine grain, gray fractured w/some clay filling, weathering and iron staining associated w/fracturing, few black shale and calcareous fossilferous partings, @ 75.8-76.2 SHALE, black, soft, @ 77.9-78.9 calcareous cemented sandstone											
77	1524.7												
78	1523.7												
79	1522.7												
80	1521.7												

BOREHOLE LOG 402DR

PROJECT: Old Bath Landfill RI/FS
PROJECT NO.: 1318-11-1
LOCATION: Bath,New York
SURVEY COORDINATES: N 100263.3 E 103077.6
SURVEY DATUM:

CLIENT: Steuben County
DRILLING DATES: MAY 12, 1992
DRILLING METHOD: 4.25-inch ID HSA
LOGGED/CHECKED BY: RHO/RLD
SURFACE ELEVATION: 1601.7 ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2in.ID)
SS3 Split Spoon (3in.ID)
ST Shelby Tube (2.8in.ID)
WH Weight of Hammer
WR Weight of Rods
NR No Recovery

GSD Grain Size Dist.
ATT Atterberg Limit

SHS Total VOC Detected in the Sampler Head Space (ppm)

JHS Total VOC Detected in the Sample Jar Head Space (ppm)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL/ROCK DESCRIPTION	SOIL DATA: GRAPHIC LOG	SOIL DATA: SAMPLE NO. / RUN NO.	SOIL DATA: BLOWS / 6"	SOIL DATA: RECOVERY (in)	SOIL DATA: 'N'-VALUE	ROCK DATA: FROM/TO	ROCK DATA: DRILL RATE MIN./FT.	ROCK DATA: % REC.	ROCK DATA: % RQD.	WELL DIAGRAM	COMMENTS
81	1520.7	81.3-81.8 SHALE, black, silty, soft, slightly weathered						73.0/83.0		90	55		
82	1519.7	81.8-84.1 SANDSTONE, gray, fine grain, silty, micaceous, hard, vf laminated w/thin shale partings @ 83.4, 83.6											4" Open hole construction @ 82.8'
83	1518.7												
84	1517.7	84.1-84.6 SANDSTONE, fine grain, light gray calcareous cement											
85	1516.7	84.6-84.9 SANDSTONE, fine grain, red-tan, micaceous, silty-gray											
86	1515.7	84.9-87.7 SANDSTONE, gray-dk gray, vf grain,finely laminated w/slight weathering and associated bedding fractures along thin shale partings											
87	1514.7												
88	1513.7	86.7-88.4 SANDSTONE, fine grain, light gray, hard fossilferous w/calcareous cement						83.0/93.0		79	74		
89	1512.7	88.4-89.1 SANDSTONE,fine grain,gray, silty, micaceous finely laminated											
90	1511.7	89.1-90.9 SANDSTONE, red-tan, silty, fine grain,w/moderately weathered fracture											
91	1510.7												
92	1509.7												
93	1508.7	End of Boring @ 93.3 ft											
94	1507.7	WELL CONSTRUCTION DETAILS.											
95	1506.7	4" open hole monitoring interval 93.3'-82.8'											
96	1505.7	4" diameter stainless steel riser 82.8-surface, w/2.0' stickup. Hydrated 1/4" diameter bentonite pellet seal 82.8-82.3. cement/bentonite grout 82.3-surface, w/ 2'x 2'x 1" thick concrete surface pad and a 6"diameter x 5'long locking steel protective casing.											
97	1504.7												
98	1503.7												
99	1502.7												
100	1501.7												

H&A of New York
Consulting Geotechnical Engineers, Geologists and Hydrogeologists

OVERBURDEN OBSERVATION WELL REPORT

PROJECT: STEUBEN COUNTY LANDFILL -- BATH
LOCATION: BATH, NEW YORK
CLIENT: LARSEN ENGINEERS/ARCHITECTS
CONTRACTOR: PARRATT-WOLFF, INC.
DRILLER: M. BECK H&A REPRESENTATIVE: N. REIGLE
INSTALLATION DATE 5 NOVEMBER - 6 NOVEMBER 1987

FILE NO. 752930
WELL NO. OW403S
BORING NO. B403R
LOCATION See Plan
SHEET 1 OF 2

SURVEY DATUM NGVD
GROUND ELEVATION 1586.50

SUMMARIZE SOIL CONDITIONS (NOT TO SCALE)

TOPSOIL
PORTLAND CEMENT
-GLACIAL TILL-
10.0 ft.
BENTONITE
13.0 ft.
QUARTZ SAND
29.0 ft.

~~ELEVATION OR~~ STICKUP ABOVE/~~BELOW~~ GROUND SURFACE OF CASING OR ROADWAY BOX	3.0 ft.
~~ELEVATION OR~~ STICKUP ABOVE/~~BELOW~~ GROUND SURFACE OF RISER PIPE.	2.0 ft.
THICKNESS OF SURFACE SEAL	29.0 ft.
TYPE OF SURFACE SEAL	Portland Cement
[INDICATE ALL SEALS SHOWING DEPTH, THICKNESS AND TYPE]	
TYPE OF CASING	Iron
INSIDE DIAMETER OF CASING	4.0 in.
~~ELEVATION~~/DEPTH OF BOTTOM OF CASING	0.3 ft.
INSIDE DIAMETER OF RISER PIPE	2.0 in.
TYPE OF BACKFILL AROUND RISER	Portland Cement
DIAMETER OF BOREHOLE	8.0 in.±
TYPE OF COUPLING (THREADED, SOLVENT WELDED, WELDED, ETC.)	Threaded
~~ELEVATION~~/DEPTH OF BOTTOM OF RISER	14.0 ft.
TYPE OF WELLSCREEN OR MANUFACTURER	Stainless Steel
SCREEN SLOT SIZE	0.01 in.
DIAMETER OF WELLSCREEN	2.0 in.
TYPE OF BACKFILL AROUND WELLSCREEN	Quartz Sand
~~ELEVATION~~/DEPTH OF BOTTOM OF WELLSCREEN	29.0 ft.
~~ELEVATION~~/DEPTH OF BOTTOM OF BOREHOLE	29.0 ft.

[FIGURES REFER TO: EL. ____ DEPTH X]

WELL SUMMARY: 16.0 ft. (LENGTH OF RISER PIPE) + 15.0 ft. (LENGTH OF WELLSCREEN) = 31.0 ft. (TOTAL LENGTH)

H&A FORM 59 5/84 72

H&A of New York
Consulting Geotechnical Engineers, Geologists and Hydrogeologists

BEDROCK OBSERVATION WELL REPORT

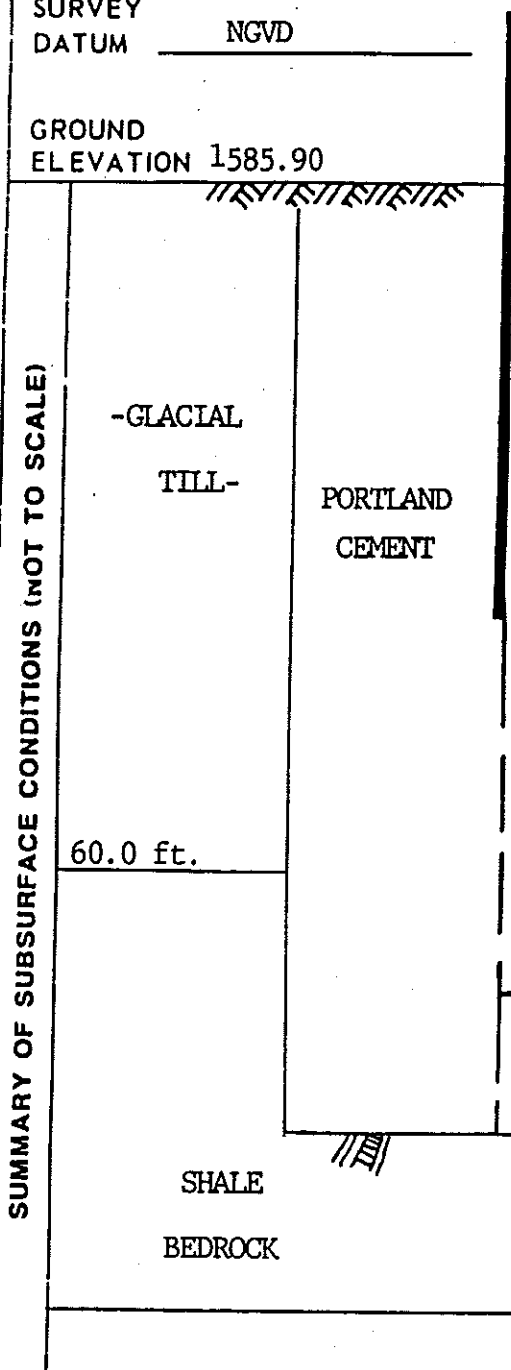
PROJECT: STEUBEN COUNTY LANDFILL -- BATH
LOCATION: BATH, NEW YORK
CLIENT: LARSEN ENGINEERS/ARCHITECTS
CONTRACTOR: PARRATT-WOLFF, INC.
DRILLER: M. BECK H&A REPRESENTATIVE: N. REIGLE
INSTALLATION DATE 2 NOVEMBER - 7 NOVEMBER

FILE NO. 752930
WELL NO. OW403R
BORING NO. B403R
LOCATION See Plan
SHEET 1 OF 2

SURVEY DATUM NGVD

GROUND ELEVATION 1585.90

SUMMARY OF SUBSURFACE CONDITIONS (NOT TO SCALE)



ELEVATION OR STICKUP ABOVE/BELOW GROUND SURFACE OF CASING OR ROADWAY BOX	NA
~~ELEVATION OR~~ STICKUP ABOVE/~~BELOW~~ GROUND SURFACE OF CASING	2.5 ft.
THICKNESS OF SURFACE SEAL	71.0 ft.
TYPE OF SURFACE SEAL	Portland Cement
[INDICATE ALL SEALS SHOWING DEPTH, THICKNESS AND TYPE]	
TYPE OF PROTECTIVE CASING	NA
INSIDE DIAMETER OF PROTECTIVE CASING	NA
ELEVATION/DEPTH OF BOTTOM OF PROTECTIVE CASING	NA
INSIDE DIAMETER OF CASING	4.0 in.
TYPE OF BACKFILL AROUND CASING	Portland Cement
DIAMETER OF BOREHOLE	8.0 in.±
~~ELEVATION~~/DEPTH OF TOP OF BEDROCK	68.0 ft.
~~ELEVATION~~/DEPTH OF BOTTOM OF CASING	71.0 ft.
DIAMETER OF ROCK HOLE	3.0 in.
~~ELEVATION~~/DEPTH OF BOTTOM OF ROCK HOLE	101.0 ft.

[FIGURES REFER TO: EL. ____ DEPTH X]

WELL SUMMARY: 73.5 ft. (CASING LENGTH) + 30.0 ft. (LENGTH OF ROCK HOLE) = 103.5 ft. (TOTAL LENGTH)

BOREHOLE LOG 403SD

PROJECT: Old Bath Landfill RI/FS
PROJECT NO.: 1318-11-1
LOCATION: Bath,New York
SURVEY COORDINATES: N 99838.4 E 103176.1
SURVEY DATUM:

CLIENT: Steuben County
DRILLING DATES: APRIL 28,1992
DRILLING METHOD: 4.25-inch ID HSA
LOGGED/CHECKED BY: RHO/RLD
SURFACE ELEVATION: 1586.8ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2in.ID)
SS3 Split Spoon (3in.ID)
ST Shelby Tube (2.8in.ID)
WH Weight of Hammer
WR Weight of Rods
NR No Recovery

GSD Grain Size Dist.
ATT Atterberg Limit

SHS Total VOC Detected in the Sampler Head Space (ppm)

JHS Total VOC Detected in the Sample Jar Head Space (ppm)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL/ROCK DESCRIPTION	SOIL DATA: GRAPHIC LOG	SOIL DATA: SAMPLE NO. / RUN NO.	SOIL DATA: BLOWS / 6"	SOIL DATA: RECOVERY (in)	SOIL DATA: 'N'-VALUE	ROCK DATA: FROM/TO	ROCK DATA: DRILL RATE MIN./FT.	ROCK DATA: % REC.	ROCK DATA: % ROD.	WELL DIAGRAM	COMMENTS
1	1585.8	Overburden description (0-50.0') -See 403R boring log (H&A Groundwater Remedial Measures Investigation Report October, 1988)											
2	1584.8												
3	1583.8												
4	1582.8												
5	1581.8												
6	1580.8												
7	1579.8												
8	1578.8												
9	1577.8												
10	1576.8												
11	1575.8												
12	1574.8												
13	1573.8												
14	1572.8												
15	1571.8												
16	1570.8												
17	1569.8												
18	1568.8												
19	1567.8												
20	1566.8												

BOREHOLE LOG 403SD

PROJECT. Old Bath Landfill RI/FS
PROJECT NO.: 1318-11-1
LOCATION: Bath,New York
SURVEY COORDINATES: N 99838.4 E 103176.1
SURVEY DATUM:

CLIENT: Steuben County
DRILLING DATES: APRIL 28,1992
DRILLING METHOD: 4.25-inch ID HSA
LOGGED/CHECKED BY: RHO/RLD
SURFACE ELEVATION: 1586.8ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2in.ID)
SS3 Split Spoon (3in.ID)
ST Shelby Tube (2.8in.ID)
WH Weight of Hammer
WR Weight of Rods
NR No Recovery

GSD Grain Size Dist.
ATT Atterberg Limit

SHS Total VOC Detected in the Sampler Head Space (ppm)

JHS Total VOC Detected in the Sample Jar Head Space (ppm)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL/ROCK DESCRIPTION	SOIL DATA: GRAPHIC LOG	SOIL DATA: SAMPLE NO. / RUN NO.	SOIL DATA: BLOWS / 6"	SOIL DATA: RECOVERY (in)	SOIL DATA: 'N'-VALUE	ROCK DATA: FROM/TO	ROCK DATA: DRILL RATE MIN./FT.	ROCK DATA: % REC.	ROCK DATA: % RQD.	WELL DIAGRAM	COMMENTS
21	1565.8	Overburden description (0-50.0') -See 403R boring log (H&A Groundwater Remedial Measures Investigation Report October, 1988)											
22	1564.8												
23	1563.8												
24	1562.8												
25	1561.8												
26	1560.8												
27	1559.8												
28	1558.8												
29	1557.8												
30	1556.8												
31	1555.8												
32	1554.8												
33	1553.8												
34	1552.8												
35	1551.8												
36	1550.8												
37	1549.8												
38	1548.8												
39	1547.8												
40	1546.8												

BOREHOLE LOG 403SD

PROJECT: Old Bath Landfill RI/FS
PROJECT NO.: 1318-11-1
LOCATION: Bath,New York
SURVEY COORDINATES: N 99838.4 E 103176.1
SURVEY DATUM:

CLIENT: Steuben County
DRILLING DATES: APRIL 28,1992
DRILLING METHOD: 4.25-inch ID HSA
LOGGED/CHECKED BY: RHO/RLD
SURFACE ELEVATION: 1586.8ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2in.ID)
SS3 Split Spoon (3in.ID)
ST Shelby Tube (2.8in.ID)
WH Weight of Hammer
WR Weight of Rods
NR No Recovery

GSD Grain Size Dist.
ATT Atterberg Limit

SHS Total VOC Detected in the Sampler Head Space (ppm)

JHS Total VOC Detected in the Sample Jar Head Space (ppm)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL/ROCK DESCRIPTION	SOIL DATA: GRAPHIC LOG	SOIL DATA: SAMPLE NO. / RUN NO.	SOIL DATA: BLOWS / 6"	SOIL DATA: RECOVERY (in)	SOIL DATA: 'N'-VALUE	ROCK DATA: FROM/TO	ROCK DATA: DRILL RATE MIN./FT.	ROCK DATA: % REC.	ROCK DATA: % ROD.	WELL DIAGRAM	COMMENTS
41	1545.8												
42	1544.8												
43	1543.8												
44	1542.8												
45	1541.8												
46	1540.8												
47	1539.8												
48	1538.8												
49	1537.8												HNu bkgd 0.2 ppm
50	1536.8	50.0-54.0 olive-brown very hard SILT, some fine sand, little gravel, moderately to serverly weathered, Dry-Wet (TILL)											
51	1535.8			1 SS	40 97 32 46	.6	129						JHS 3.0 ppm
52	1534.8												
53	1533.8			2 SS	6 10 13 16	.3	16						JHS 1.2 ppm
54	1532.8												
55	1531.8	54.0-56.0 brown SILT, some fine sand, little gravel, tr clay and rounded gravel moderate to serverly weathered Wet (TILL)		3 SS	10 16 11 21	1.3	28						JHS 1.0 ppm
56	1530.8												
57	1529.8	-56.0-60.0 Not sampled		NS		NS	NS						NA
58	1528.8												
59	1527.8			NS		NS	NS						NA
60	1526.8												

BOREHOLE LOG 403SD

PROJECT: Old Bath Landfill RI/FS
PROJECT NO.: 1318-11-1
LOCATION: Bath,New York
SURVEY COORDINATES: N 99838.4 E 103176.1
SURVEY DATUM:

CLIENT: Steuben County
DRILLING DATES: APRIL 28,1992
DRILLING METHOD: 4.25-inch ID HSA
LOGGED/CHECKED BY: RHO/RLD
SURFACE ELEVATION: 1586.8ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2in.ID)
SS3 Split Spoon (3in.ID)
ST Shelby Tube (2.8in.ID)
WH Weight of Hammer
WR Weight of Rods
NR No Recovery

GSD Grain Size Dist.
ATT Atterberg Limit

SHS Total VOC Detected in the Sampler Head Space (ppm)

JHS Total VOC Detected in the Sample Jar Head Space (ppm)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL/ROCK DESCRIPTION	SOIL DATA: GRAPHIC LOG	SOIL DATA: SAMPLE NO. / RUN NO.	SOIL DATA: BLOWS / 6"	SOIL DATA: RECOVERY (in)	SOIL DATA: 'N'-VALUE	ROCK DATA: FROM/TO	ROCK DATA: DRILL RATE MIN./FT.	ROCK DATA: % REC.	ROCK DATA: % ROD.	WELL DIAGRAM	COMMENTS
61	1525.8	@ 60.0-62.0 platy black shale fragments in silt till matrix		4 SS	16 97 100	.12	197						JHS 0.6 ppm
62	1524.8	62.0-65.0 Not sampled											
63	1523.8			NS		NS	NS						NA
64	1522.8												
65	1521.8	@ 65.0-66.0 dk gray shaley siltstone fragments embedded in silt till matrix, Moist		5 SS	29 41 64 100	1.3	105						JHS 1.4 ppm
66	1520.8	End of boring @ 65.0 ft. split spoon sampled to 66.0 ft											
67	1519.8												
68	1518.8	WELL CONSTRUCTION DETAILS:											
69	1517.8	screened interval 64.3'- 54.3'											
70	1516.8	2" diameter 0.006" wire wound stainless steel screen 64.3'-54.3' 2" diameter stainless steel riser 54.3'- surface, w/ 2.0' stickup 20 size graded quartzite sand 65.0'-52.6'. Hydrated 1/4" diameter bentonite pellet seal 52.6'-49.5'. cement/bentonite grout 49.5- surface, w/2'x 2'x 1" thick concrete surface pad and a 4" diameter x 5' long locking steel protective casing.											
71	1515.8												
72	1514.8												
73	1513.8												
74	1512.8												
75	1511.8												
76	1510.8												
77	1509.8												
78	1508.8												
79	1507.8												
80	1506.8												

BOREHOLE LOG 409S

PROJECT: Old Bath Landfill RI/FS
PROJECT NO.: 1318-11-1
LOCATION: Bath,New York
SURVEY COORDINATES: N 99265.2 E 103128.9
SURVEY DATUM:

CLIENT: Steuben County
DRILLING DATES: APRIL 15,1992
DRILLING METHOD: 6.25-inch ID HSA
LOGGED/CHECKED BY: JPH/RLD
SURFACE ELEVATION: 1599.7ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2in.ID)
SS3 Split Spoon (3in.ID)
ST Shelby Tube (2.8in.ID)
WH Weight of Hammer
WR Weight of Rods
NR No Recovery

GSD Grain Size Dist.
ATT Atterberg Limit

SHS Total VOC Detected in the Sampler Head Space (ppm)

JHS Total VOC Detected in the Sample Jar Head Space (ppm)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL/ROCK DESCRIPTION	SOIL DATA: GRAPHIC LOG	SAMPLE NO. / RUN NO.	BLOWS / 6"	RECOVERY (in)	'N'-VALUE	ROCK DATA: FROM/TO	DRILL RATE MIN./FT.	% REC.	% RQD.	WELL DIAGRAM	COMMENTS
1	1598.7	0-4.0 ft brown SILT, tr very fine sand, tr-little fine gravel, Dry-Moist (FILL/TILL)		1 SS	2 2 6 10	.5	8						HNu bkgd 0.2 ppm
2	1597.7												JHS 0.3 ppm
3	1596.7			2 SS	8 10 11 13	.4	21						JHS 0.8 ppm
4	1595.7	4.0-20.0 medium brown- gray mottled SILT, tr very fine sand, little fine sub-rounded gravel, and crs gravel to 1"dia Moist (TILL)											
5	1594.7			3 SS	6 100	.6	—						JHS 0.3 ppm
6	1593.7	@ 6.0-7.4 iron staining on large gravel surfaces, Dry											
7	1592.7			4 SS	11 27 51 54	1.4	88						JHS 1.2 ppm
8	1591.7												
9	1590.7			5 SS	16 36 57 85	1.3	93						JHS 0.5 ppm
10	1589.7	@ 10.0-11.2 extensive brown iron stained mottling along gravel-silt interfaces, Moist											
11	1588.7			6 SS	14 65 50 32	1.2	115						JHS 0.4 ppm
12	1587.7												
13	1586.7			7 SS	11 28 25 28	1.3	53						JHS 0.4 ppm
14	1585.7												
15	1584.7	TILL cont'd, Wet		8 SS	10 12 19 100	1.3	31						JHS 0.3 ppm
16	1583.7												
17	1582.7			9 SS	31 100	.6	—						JHS 52.0 ppm
18	1581.7												JHS 2.4 ppm
19	1580.7			10 SS	53 40 78 100	1.5	118						
20	1579.7												Native Silt/ Sand

BOREHOLE LOG 409S

PROJECT: Old Bath Landfill RI/FS
PROJECT NO.: 1318-11-1
LOCATION: Bath,New York
SURVEY COORDINATES: N 99265.2 E 103128.9
SURVEY DATUM:

CLIENT: Steuben County
DRILLING DATES: APRIL 15,1992
DRILLING METHOD: 6.25-inch ID HSA
LOGGED/CHECKED BY: JPH/RLD
SURFACE ELEVATION: 1599.7ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2in.ID)
SS3 Split Spoon (3in.ID)
ST Shelby Tube (2.8in.ID)
WH Weight of Hammer
WR Weight of Rods
NR No Recovery

GSD Grain Size Dist.
ATT Atterberg Limit

SHS Total VOC Detected in the Sampler Head Space (ppm)

JHS Total VOC Detected in the Sample Jar Head Space (ppm)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL/ROCK DESCRIPTION	SOIL DATA: GRAPHIC LOG	SOIL DATA: SAMPLE NO. / RUN NO.	SOIL DATA: BLOWS / 6"	SOIL DATA: RECOVERY (in)	SOIL DATA: 'N'-VALUE	ROCK DATA: FROM/TO	ROCK DATA: DRILL RATE MIN./FT.	ROCK DATA: % REC.	ROCK DATA: % ROD.	WELL DIAGRAM	COMMENTS
21	1578.7			11 SS	36 30 40 44	0.8	70						JHS 12.2 ppm
22	1577.7	20.0-30.0 very hard gray, mottled brown SILT, some fine sand, little gravel, Wet (TILL)											
23	1576.7			12 SS	10 55 65 100	1.2	120						JHS 15 ppm
24	1575.7												
25	1574.7			13 SS	30 56 100 -	1.0	156						JHS 19.8 ppm
26	1573.7	TILL cont'd, Dry											
27	1572.7			14 SS	33 100 - -	0.4	-						JHS 46 ppm
28	1571.7												
29	1570.7			15 SS	10 38 48 58	1.6	86						JHS 9 ppm
30	1569.7	30.0-38.0 TILL cont'd trace clay, Dry											
31	1568.7			16 SS	11 26 32 46	1.0	58						NA
32	1567.7												
33	1566.7			17 SS	16 45 100 -	1.2	145						JHS 56 ppm
34	1565.7												
35	1564.7			18 SS	15 40 50 100	1.4	90						JHS=240 ppm
36	1563.7												
37	1562.7			19 SS	36 75 100 -	1.0	175						
38	1561.7	38.0-40.0 very hard SILT, some fine sand, tr gravel, abundant sandy siltstone fragments (TILL)											
39	1560.7			20 SS	6 75 100 -	0.6	175						
40	1559.7												

BOREHOLE LOG 409S

PROJECT: Old Bath Landfill RI/FS
PROJECT NO.: 1318-11-1
LOCATION: Bath,New York
SURVEY COORDINATES: N 99265.2 E 103128.9
SURVEY DATUM:

CLIENT: Steuben County
DRILLING DATES: APRIL 15,1992
DRILLING METHOD: 6.25-inch ID HSA
LOGGED/CHECKED BY: JPH/RLD
SURFACE ELEVATION: 1599.7ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2in.ID)
SS3 Split Spoon (3in.ID)
ST Shelby Tube (2.8in.ID)
WH Weight of Hammer
WR Weight of Rods
NR No Recovery

GSD Grain Size Dist.
ATT Atterberg Limit

SHS Total VOC Detected in the Sampler Head Space (ppm)

JHS Total VOC Detected in the Sample Jar Head Space (ppm)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL/ROCK DESCRIPTION	SOIL DATA: GRAPHIC LOG	SOIL DATA: SAMPLE NO. / RUN NO.	SOIL DATA: BLOWS / 6"	SOIL DATA: RECOVERY (in)	SOIL DATA: 'N'-VALUE	ROCK DATA: FROM/TO	ROCK DATA: DRILL RATE MIN./FT.	ROCK DATA: % REC.	ROCK DATA: % RQD.	WELL DIAGRAM	COMMENTS
41	1558.7	40.0-43.0 very hard brown mottled gray SILT, some fine sand tr fine gravel, abundant sandy siltstone brown to gray, variably weathered (extreme to moderate) Moist		21 SS	11 52 100 -	1.0	152						
42	1557.7												
43	1556.7	End of Boring @ 43.0 ft		22 SS	32 65 100 -	0.3	165						
44	1555.7												
45	1554.7	WELL CONSTRUCTION DETAILS:											
46	1553.7	screened interval 18.0'-13.0'											
47	1552.7	2" diameter 0.006" wire wound stainless steel screen 13.0'-18.0' 2" diameter stainless steel riser 13.0'-surface, w/2.0'stickup. 20 size graded quartzite sand 18.9'-10.9'. Hydrated 1/4" diameter bentonite pellet seal 10.9'- 8.0'. cement/bentonite grout 8.0'- surface, w/2'x 2'x 1" thick concrete surface pad and a 4" diameter x 5'long locking protective steel casing.											
48	1551.7												
49	1550.7												
50	1549.7												
51	1548.7												
52	1547.7												
53	1546.7												
54	1545.7												
55	1544.7												
56	1543.7												
57	1542.7												
58	1541.7												
59	1540.7												
60	1539.7												

BOREHOLE LOG 409R

PROJECT: Old Bath Landfill RI/FS
PROJECT NO.: 1318-11-1
LOCATION: Bath,New York
SURVEY COORDINATES: N 99259.3 E 103169.9
SURVEY DATUM:

CLIENT: Steuben County
DRILLING DATES: MAY 5,1992
DRILLING METHOD: 4.25-inch ID HSA
LOGGED/CHECKED BY: RHO/RLD
SURFACE ELEVATION: 1597.5ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2in.ID)
SS3 Split Spoon (3in.ID)
ST Shelby Tube (2.8in.ID)
WH Weight of Hammer
WR Weight of Rods
NR No Recovery

GSD Grain Size Dist.
ATT Atterberg Limit

SHS Total VOC Detected in the Sampler Head Space (ppm)

JHS Total VOC Detected in the Sample Jar Head Space (ppm)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL/ROCK DESCRIPTION	SOIL DATA: GRAPHIC LOG	SOIL DATA: SAMPLE NO. / RUN NO.	SOIL DATA: BLOWS / 6"	SOIL DATA: RECOVERY (in)	SOIL DATA: 'N'-VALUE	ROCK DATA: FROM/TO	ROCK DATA: DRILL RATE MIN./FT.	ROCK DATA: % REC.	ROCK DATA: % RQD.	WELL DIAGRAM	COMMENTS
1	1596.5	overburden description 0-43.0 ft -See 409S boring log											
2	1595.5												
3	1594.5												
4	1593.5												
5	1592.5												
6	1591.5												
7	1590.5												
8	1589.5												
9	1588.5												
10	1587.5												
11	1586.5												
12	1585.5												
13	1584.5												
14	1583.5												
15	1582.5												
16	1581.5												
17	1580.5												
18	1579.5												
19	1578.5												
20	1577.5												

BOREHOLE LOG 409R

PROJECT: Old Bath Landfill RI/FS
PROJECT NO.: 1318-11-1
LOCATION: Bath,New York
SURVEY COORDINATES: N 99259.3 E 103169.9
SURVEY DATUM:

CLIENT: Steuben County
DRILLING DATES: MAY 5,1992
DRILLING METHOD: 4.25-inch ID HSA
LOGGED/CHECKED BY: RHO/RLD
SURFACE ELEVATION: 1597.5ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2in.ID)
SS3 Split Spoon (3in.ID)
ST Shelby Tube (2.8in.ID)
WH Weight of Hammer
WR Weight of Rods
NR No Recovery

GSD Grain Size Dist.
ATT Atterberg Limit

SHS Total VOC Detected in the Sampler Head Space (ppm)

JHS Total VOC Detected in the Sample Jar Head Space (ppm)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL/ROCK DESCRIPTION	SOIL DATA: GRAPHIC LOG	SOIL DATA: SAMPLE NO. / RUN NO.	SOIL DATA: BLOWS / 6"	SOIL DATA: RECOVERY (in)	SOIL DATA: 'N'-VALUE	ROCK DATA: FROM/TO	ROCK DATA: DRILL RATE MIN./FT.	ROCK DATA: % REC.	ROCK DATA: % RQD.	WELL DIAGRAM	COMMENTS
21	1576.5												
22	1575.5												
23	1574.5												
24	1573.5												
25	1572.5												
26	1571.5	overburden description 0-43.0 ft -See 409S boring log											
27	1570.5												
28	1569.5												
29	1568.5												
		Top of Bedrock @ 29.5 ft											
30	1567.5												
31	1566.5	31.5-40.4 SANDSTONE, gray vf grain, thin silty laminae occasionally distorted w/small 1mm-1cm black shale clasts, broken along numerous slightly weathered fractures and bedding planes, occasional clay filled fractures and secondary porosity						31.5/41.5		95	49		4" Open hole construction @ 31.5'
32	1565.5												
33	1564.5												
34	1563.5												
35	1562.5												
36	1561.5												
37	1560.5												
38	1559.5												
39	1558.5	40.4-40.8 SANDSTONE, lt gray, vf grain, hard, calcareous cement w/shell and shale clasts											
40	1557.5												

BOREHOLE LOG 409R

PROJECT: Old Bath Landfill RI/FS
PROJECT NO.: 1318-11-1
LOCATION: Bath,New York
SURVEY COORDINATES: N 99259.3 E 103169.9
SURVEY DATUM:

CLIENT: Steuben County
DRILLING DATES: MAY 5,1992
DRILLING METHOD: 4.25-inch ID HSA
LOGGED/CHECKED BY: RHO/RLD
SURFACE ELEVATION: 1597.5ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2in.ID)
SS3 Split Spoon (3in.ID)
ST Shelby Tube (2.8in.ID)
WH Weight of Hammer
WR Weight of Rods
NR No Recovery

GSD Grain Size Dist.
ATT Atterberg Limit

SHS Total VOC Detected in the Sampler Head Space (ppm)

JHS Total VOC Detected in the Sample Jar Head Space (ppm)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL/ROCK DESCRIPTION	SOIL DATA: GRAPHIC LOG	SOIL DATA: SAMPLE NO. / RUN NO.	SOIL DATA: BLOWS / 6"	SOIL DATA: RECOVERY (in)	SOIL DATA: 'N'-VALUE	ROCK DATA: FROM/TO	ROCK DATA: DRILL RATE MIN./FT.	ROCK DATA: % REC.	ROCK DATA: % RQD.	WELL DIAGRAM	COMMENTS
41	1556.5	40.8-41.0 Sandstone,gray,silty, hard, weathered w/ secondary porosity						31.5/41.5		95	49		
42	1555.5												
43	1554.5	End of boring @ 41.5 ft											
44	1553.5												
45	1552.5	WELL CONSTRUCTION DETAILS:											
46	1551.5	4" open hole monitoring interval 41.0'-31.5'											
47	1550.5	4" diameter stainless riser 31.5'- surface, w/2.0' stickup. Hydrated 1/4" diameter bentonite pellet seal 31.5'-29.4', cement/bentonite grout 29.4-surface, w/2'x 2'x 1" thick concrete surface pad and a 6" diameter x 5.0' long locking steel protective casing.											
48	1549.5												
49	1548.5												
50	1547.5												
51	1546.5												
52	1545.5												
53	1544.5												
54	1543.5												
55	1542.5												
56	1541.5												
57	1540.5												
58	1539.5												
59	1538.5												
60	1537.5												

BOREHOLE LOG 409DR

PROJECT: Old Bath Landfill RI/FS
PROJECT NO.: 1318-11-1
LOCATION: Bath,New York
SURVEY COORDINATES: N 99269.7 E 103173.0
SURVEY DATUM:

CLIENT: Steuben County
DRILLING DATES: MAY 5,1992
DRILLING METHOD: 4.25-inch ID HSA
LOGGED/CHECKED BY: RHO/RLD
SURFACE ELEVATION: 1596.8ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2in.ID)
SS3 Split Spoon (3in.ID)
ST Shelby Tube (2.8in.ID)
WH Weight of Hammer
WR Weight of Rods
NR No Recovery

GSD Grain Size Dist.
ATT Atterberg Limit

SHS Total VOC Detected in the Sampler Head Space (ppm)

JHS Total VOC Detected in the Sample Jar Head Space (ppm)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL/ROCK DESCRIPTION	SOIL DATA: GRAPHIC LOG	SOIL DATA: SAMPLE NO. / RUN NO.	SOIL DATA: BLOWS / 6"	SOIL DATA: RECOVERY (in)	SOIL DATA: 'N'-VALUE	ROCK DATA: FROM/TO	ROCK DATA: DRILL RATE MIN./FT.	ROCK DATA: % REC.	ROCK DATA: % RQD.	WELL DIAGRAM	COMMENTS
1	1595.8	overburden description 0-20 ft - See 409S boring log											
2	1594.8												
3	1593.8												
4	1592.8												
5	1591.8												
6	1590.8												
7	1589.8												
8	1588.8												
9	1587.8												
10	1586.8												
11	1585.8												
12	1584.8												
13	1583.8												
14	1582.8												
15	1581.8												
16	1580.8												
17	1579.8												
18	1578.8												
19	1577.8												
20	1576.8												

BOREHOLE LOG 409DR

PROJECT: Old Bath Landfill RI/FS
PROJECT NO.: 1318-11-1
LOCATION: Bath,New York
SURVEY COORDINATES: N 99269.7 E 103173.0
SURVEY DATUM:

CLIENT: Steuben County
DRILLING DATES: MAY 5,1992
DRILLING METHOD: 4.25-inch ID HSA
LOGGED/CHECKED BY: RHO/RLD
SURFACE ELEVATION: 1596.8ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2in.ID)
SS3 Split Spoon (3in.ID)
ST Shelby Tube (2.8in.ID)
WH Weight of Hammer
WR Weight of Rods
NR No Recovery

GSD Grain Size Dist.
ATT Atterberg Limit

SHS Total VOC Detected in the Sampler Head Space (ppm)

JHS Total VOC Detected in the Sample Jar Head Space (ppm)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL/ROCK DESCRIPTION	SOIL DATA: GRAPHIC LOG	SOIL DATA: SAMPLE NO. / RUN NO.	SOIL DATA: BLOWS / 6"	SOIL DATA: RECOVERY (in)	SOIL DATA: 'N'-VALUE	ROCK DATA: FROM/TO	ROCK DATA: DRILL RATE MIN./FT.	ROCK DATA: % REC.	ROCK DATA: % RQD.	WELL DIAGRAM	COMMENTS
21	1575.8												
22	1574.8												
23	1573.8												
24	1572.8												
25	1571.8												
26	1570.8												
27	1569.8												
28	1568.8												
29	1567.8												
30	1566.8												
31	1565.8	Top of Bedrock @ 31.5 ft											
32	1564.8												
33	1563.8												
34	1562.8												
35	1561.8												
36	1560.8												
37	1559.8	shallow bedrock description 31.5-41.5 ft- See 409R boring log											
38	1558.8												
39	1557.8												
40	1556.8												

BOREHOLE LOG 409DR

PROJECT: Old Bath Landfill RI/FS
PROJECT NO.: 1318-11-1
LOCATION: Bath,New York
SURVEY COORDINATES: N 99269.7 E 103173.0
SURVEY DATUM:

CLIENT: Steuben County
DRILLING DATES: MAY 5,1992
DRILLING METHOD: 4.25-inch ID HSA
LOGGED/CHECKED BY: RHO/RLD
SURFACE ELEVATION: 1596.8ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2in.ID)
SS3 Split Spoon (3in.ID)
ST Shelby Tube (2.8in.ID)
WH Weight of Hammer
WR Weight of Rods
NR No Recovery

GSD Grain Size Dist.
ATT Atterberg Limit

SHS Total VOC Detected in the Sampler Head Space (ppm)

JHS Total VOC Detected in the Sample Jar Head Space (ppm)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL/ROCK DESCRIPTION	SOIL DATA: GRAPHIC LOG	SOIL DATA: SAMPLE NO. / RUN NO.	SOIL DATA: BLOWS / 6"	SOIL DATA: RECOVERY (in)	SOIL DATA: 'N'-VALUE	ROCK DATA: FROM/TO	ROCK DATA: DRILL RATE MIN./FT.	ROCK DATA: % REC.	ROCK DATA: % RQD.	WELL DIAGRAM	COMMENTS
41	1555.8	41.5-47.7 SANDSTONE, gray fine grain, silty, micaceous matrix w/ calcareous cemented partings containing fossil and shale clasts, laminated bedding fabric, slight weathering associated w/irregular and horizontal bedding fractures, shale partings						41.5/45.0		91	74		
42	1554.8												
43	1553.8												
44	1552.8												
45	1551.8												
46	1550.8												
47	1549.8												
48	1548.8	47.7-54.8 SILTSTONE, Dk gray-black, shaley, laminated to very thin bedding w/thin interbedded sandstone and black shale, some weathering and staining associated w/clay filled fractures within shale partings						45.0/55.0		98	79		
49	1547.8												
50	1546.8												
51	1545.8	55.0-57.6 SANDSTONE, light gray, fine grain, silty, micaceous, hard w/calcareous cement, weathering associated w/ fracturing, some clay filling and secondary porosity											
52	1544.8												
53	1543.8	57.6-58.3 SILTSTONE, gray sandy, hard micaeous, extensive fracturing along bedding planes associated weathering and clay filling											
54	1542.8												
55	1541.8	58.3 58.8 SHALE, Dk gray to black, soft, silty, disseminated pyrite, massive to finely laminated, clay filled fracture						55.0/65.0		94	62		
56	1540.8												0.010" S/S SCREEN
57	1539.8	58.8-59.6 SANDSTONE, gray, fine grain, silty, micaceous, hard, very broken, slightly weathered w/ some clay coated surfaces											
58	1538.8												
59	1537.8	59.6-60.1 SILTSTONE, Dk gray shaley laminated, soft, clay filled fractures, weathered											
60	1536.8												

BOREHOLE LOG 409DR

PROJECT: Old Bath Landfill RI/FS
PROJECT NO.: 1318-11-1
LOCATION: Bath,New York
SURVEY COORDINATES: N 99269.7 E 103173.0
SURVEY DATUM:

CLIENT: Steuben County
DRILLING DATES: MAY 5,1992
DRILLING METHOD: 4.25-inch ID HSA
LOGGED/CHECKED BY: RHO/RLD
SURFACE ELEVATION: 1596.8ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2in.ID)
SS3 Split Spoon (3in.ID)
ST Shelby Tube (2.8in.ID)
WH Weight of Hammer
WR Weight of Rods
NR No Recovery

GSD Grain Size Dist.
ATT Atterberg Limit

SHS Total VOC Detected in the Sampler Head Space (ppm)

JHS Total VOC Detected in the Sample Jar Head Space (ppm)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL/ROCK DESCRIPTION	SOIL DATA: GRAPHIC LOG	SOIL DATA: SAMPLE NO. / RUN NO.	SOIL DATA: BLOWS / 6"	SOIL DATA: RECOVERY (in)	SOIL DATA: 'N'-VALUE	ROCK DATA: FROM/TO	ROCK DATA: DRILL RATE MIN./FT.	ROCK DATA: % REC.	ROCK DATA: % RQD.	WELL DIAGRAM	COMMENTS
61	1535.8	60.1-63.4 gradational to silty very fine grain SANDSTONE, severely weathered, clay filled fractures						55.0/65.0		94	62		
62	1534.8												
63	1533.8	63.4-64.4 SHALE, Dk gray- black grading to shaley SILTSTONE, soft severely weathered w/clay filled fractures											
64	1532.8												
65	1531.8	End of boring @ 65.0 ft											
66	1530.8												
67	1529.8	WELL CONSTRUCTION DETAILS:											
68	1528.8	screened interval 64.4'- 54.4'											
69	1527.8	2" diameter 0.010" wire wound stainless steel screen 64.4-54.4 2" diameter stainless steel well riser 54.4'- surface, within a 4" stainless steel diameter riser 54.4'-surface, w/2.0'stickup. 40 size graded quartzite sand 65.0'-54.4'. Bentonite slurry between 2" & 4" riser 52.5'-surface. Hydrated 1/4" diameter bentonite pellet seal 45.0'-44.0', cement/bentonite grout 52.5'-surface, w/2'x 2'x 1" thick concrete surface pad and a 6" diameter x 5.0'long locking steel protective casing.											
70	1526.8												
71	1525.8												
72	1524.8												
73	1523.8												
74	1522.8												
75	1521.8												
76	1520.8												
77	1519.8												
78	1518.8												
79	1517.8												
80	1516.8												

BOREHOLE LOG 410R

PROJECT: Old Bath Landfill RI/FS
PROJECT NO.: 1318-11-1
LOCATION: Bath,New York
SURVEY COORDINATES: N 100376.2 E 102604.1
SURVEY DATUM:

CLIENT: Steuben County
DRILLING DATES: May 6,1992
DRILLING METHOD: 4.25-inch ID HSA
LOGGED/CHECKED BY: JPH/RLD
SURFACE ELEVATION: 1634.5ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2in.ID)
SS3 Split Spoon (3in.ID)
ST Shelby Tube (2.8in.ID)
WH Weight of Hammer
WR Weight of Rods
NR No Recovery

GSD Grain Size Dist.
ATT Atterberg Limit

SHS Total VOC Detected in the Sampler Head Space (ppm)

JHS Total VOC Detected in the Sample Jar Head Space (ppm)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL/ROCK DESCRIPTION	SOIL DATA: GRAPHIC LOG	SAMPLE NO. / RUN NO.	BLOWS / 6"	RECOVERY (in)	'N'-VALUE	ROCK DATA: FROM/TO	DRILL RATE MIN./FT.	% REC.	% RQD.	WELL DIAGRAM	COMMENTS
1	1633.5	0-0.4 Dk brown organic SILT, little vf sand (TOPSOIL)		1 SS	2 9 8 10	1.4	17						HNu bkgd 0.2 ppm
2	1632.5	0.4-2.0 ft brown SILT and vf SAND, tr clay, little fine gravel, Moist (TILL)											JHS 1.4 ppm
3	1631.5			2 SS	8 11 13 17	1.6	24						JHS 1.4 ppm
4	1630.5	2.0-15.0 ft brown SILT, tr vf sand, tr clay, little-some fine gravel, crs gravel to 1/2" dia, Damp (TILL)											
5	1629.5			3 SS	11 11 14 100	.6	25						JHS 0.3 ppm
6	1628.5	@ 4.0-5.0 Spoon refusal due to cobble at 5.5 ft											
7	1627.5	No sample at 6-8' interval (augered through cobble)		4 SS	- - - -	0							NA
8	1626.5												
9	1625.5	@ 8.0-10.0 Cobbles >3" dia, extensive iron staining on numerous horizontal dessication fracture surfaces. Wet		5 SS	14 18 26 45	1.9	44						JHS 1.2 ppm
10	1624.5												
11	1623.5			6 SS	36 50 50 64	1.9	100						JHS 1.5 ppm
12	1622.5												
13	1621.5	@ 14.0-14.9' gray SILT w/brown mottling tr vf sand, some fine gravel to 3/4" dia, Dry-Damp (TILL)		7 SS	34 75 100 -	1.3	175						JHS 0.9 ppm
14	1620.5												
15	1619.5	Top of Bedrock at 14.9 ft		8 SS	70 100 - -	.9							JHS 1.2 ppm
16	1618.5												
17	1617.5												
18	1616.5	18.0-40.0' SANDSTONE vf grain w/tr silt, lt gray, medium hard to hard, some calcareous cemented intervals, microlaminated to thick bedded.						18/23.5		86	44		4" Open hole well construction @ 18.0'
19	1615.5												
20	1614.5												

BOREHOLE LOG 410R

PROJECT: Old Bath Landfill RI/FS
PROJECT NO.: 1318-11-1
LOCATION: Bath,New York
SURVEY COORDINATES: N 100376.2 E 102604.1
SURVEY DATUM:

CLIENT: Steuben County
DRILLING DATES: May 6,1992
DRILLING METHOD: 4.25-inch ID HSA
LOGGED/CHECKED BY: JPH/RLD
SURFACE ELEVATION: 1634.5ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2in.ID)
SS3 Split Spoon (3in.ID)
ST Shelby Tube (2.8in.ID)
WH Weight of Hammer
WR Weight of Rods
NR No Recovery

GSD Grain Size Dist.
ATT Atterberg Limit

SHS Total VOC Detected in the Sampler Head Space (ppm)

JHS Total VOC Detected in the Sample Jar Head Space (ppm)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL/ROCK DESCRIPTION	SOIL DATA: GRAPHIC LOG	SOIL DATA: SAMPLE NO. / RUN NO.	SOIL DATA: BLOWS / 6"	SOIL DATA: RECOVERY (in)	SOIL DATA: 'N'-VALUE	ROCK DATA: FROM/TO	ROCK DATA: DRILL RATE MIN./FT.	ROCK DATA: % REC.	ROCK DATA: % RQD.	WELL DIAGRAM	COMMENTS
21	1613.5	@ 20.4-21.8 bioturbated fossiliferous bedded calcareous sand						18/23.5		86	44		
22	1612.5												
23	1611.5												
24	1610.5												
25	1609.5												
26	1608.5	@ 26.1-27.1 dark-black mineralization on fracture surfaces						23.5/32		85	33		
27	1607.5												
28	1606.5												
29	1605.5												
30	1604.5	@ 29.8-30.6 contorted bedding fabric associated w/soft sediment dewatering											
31	1603.5												
32	1602.5												
33	1601.5												
34	1600.5												
35	1599.5												
36	1598.5							32/40		86	64		
37	1597.5	@ 37.8-38.5 bioturbated w/ slight iron staining											
38	1596.5	@ 38.5 clay filled bedding fracture											
39	1595.5												
40	1594.5	End of boring @ 40.0 ft											

BOREHOLE LOG 410R

PROJECT: Old Bath Landfill RI/FS
ROJECT NO.: 1318-11-1
LOCATION: Bath,New York
SURVEY COORDINATES: N 100376.2 E 102604.1
SURVEY DATUM:

CLIENT: Steuben County
DRILLING DATES: May 6,1992
DRILLING METHOD: 4.25-inch ID HSA
LOGGED/CHECKED BY: JPH/RLD
SURFACE ELEVATION: 1634.5ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2in.ID)
SS3 Split Spoon (3in.ID)
ST Shelby Tube (2.8in.ID)
WH Weight of Hammer
WR Weight of Rods
NR No Recovery

GSD Grain Size Dist.
ATT Atterberg Limit

SHS Total VOC Detected in the Sampler Head Space (ppm)

JHS Total VOC Detected in the Sample Jar Head Space (ppm)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL/ROCK DESCRIPTION	SOIL DATA: GRAPHIC LOG	SOIL DATA: SAMPLE NO. / RUN NO.	SOIL DATA: BLOWS / 6"	SOIL DATA: RECOVERY (in)	SOIL DATA: 'N'-VALUE	ROCK DATA: FROM/TO	ROCK DATA: DRILL RATE MIN./FT.	ROCK DATA: % REC.	ROCK DATA: % RQD.	WELL DIAGRAM	COMMENTS
41	1593.5	WELL CONSTRUCTION DETAILS:											
42	1592.5	4" open hole monitoring interval 40.0'-18.0'											
43	1591.5	4"diameter stainless steel riser 18.0'-surface. w/2.0'stickup. Hydrated 1/4" diameter bentonite pellet seal 18.0'-16.5'. cement/ bentonite grout 18.0'- surface w/2'x 2'x 1" thick concrete surface pad and a 6" diameter x 5.0' long locking steel protective casing.											
44	1590.5												
45	1589.5												
46	1588.5												
47	1587.5												
48	1586.5												
49	1585.5												
50	1584.5												
51	1583.5												
52	1582.5												
53	1581.5												
54	1580.5												
55	1579.5												
56	1578.5												
57	1577.5												
58	1576.5												
59	1575.5												
60	1574.5												

BOREHOLE LOG 411R

PROJECT: Old Bath Landfill RI/FS
PROJECT NO.: 1318-11-1
LOCATION: Bath,New York
SURVEY COORDINATES: N 100411.9 E 102301.3
SURVEY DATUM:

CLIENT: Steuben County
DRILLING DATES: APRIL 27,1992
DRILLING METHOD: 6.25-inch ID HSA
LOGGED/CHECKED BY: JPH/RLD
SURFACE ELEVATION: 1637.7ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2in.ID)
SS3 Split Spoon (3in.ID)
ST Shelby Tube (2.8in.ID)
WH Weight of Hammer
WR Weight of Rods
NR No Recovery

GSD Grain Size Dist.
ATT Atterberg Limit

SHS Total VOC Detected in the Sampler Head Space (ppm)

JHS Total VOC Detected in the Sample Jar Head Space (ppm)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL/ROCK DESCRIPTION	SOIL DATA: GRAPHIC LOG	SOIL DATA: SAMPLE NO. / RUN NO.	SOIL DATA: BLOWS / 6"	SOIL DATA: RECOVERY (in)	SOIL DATA: 'N'-VALUE	ROCK DATA: FROM/TO	ROCK DATA: DRILL RATE MIN./FT.	ROCK DATA: % REC.	ROCK DATA: % RQD.	WELL DIAGRAM	COMMENTS
1	1636.7	0-0.2' Dk brown SILT, tr vf sand. Moist (TOPSOIL)		1 SS	2 3 3 6	1.2	6						HNu bkgd 0.2ppm
		0.2-2.0' lt brown vf SAND and SILT, tr-little fine gravel. Moist (FILL)											JHS 0.2 ppm
2	1635.7												
3	1634.7			2 SS	5 15 18 20	.5	33						JHS 0.4 ppm
4	1633.7												
5	1632.7	2.0-8.0' lt brown vf SAND, tr silt, little fine gravel to 1" dia, Moist (FILL)		3 SS	12 21 16 21	1.2	37						JHS 0.4 ppm
6	1631.7												
7	1630.7			4 SS	11 11 12 15	1.1	23						JHS 0.4 ppm
8	1629.7												
9	1628.7	8.0-10.6' lt brown SILT and vf SAND, little fine gravel, occasional cobble >3" dia, Moist (TILL)		5 SS	11 23 23 52	1.6	46						JHS 0.4 ppm
10	1627.7												
11	1626.7	10.0-10.6' Staining on gravel surfaces, weathered Dk brown SANDSTONE, Moist-Dry.		6 SS	39 100 - -	.8	-						JHS 0.4 ppm
12	1625.7	Top of weathered Bedrock @ 10.6 ft											
13	1624.7	Augered to 13.2' prior to coring											
14	1623.7	13.5-40.0' SANDSTONE, vf- fine grain, oxidized brown to medium Dk gray, moderately hard, microlaminated to massive bedding						13.5/17		57	23		S/S Screen .010" slot
15	1622.7												
16	1621.7	@13.5-14.3 tr fossils and calcite filled fossil molds, calcareous cement associated w/fossiliferous partings											
17	1620.7												
18	1619.7	@ 14.3-14.7 minor fracturing & associated weathered staining, very broken						17/26		97	58		
19	1618.7	@ 17.0- 20.5 some bioturbation & slightly weathered iron stained fractures											
20	1617.7												

BOREHOLE LOG 411R

PROJECT: Old Bath Landfill RI/FS
PROJECT NO.: 1318-11-1
LOCATION: Bath,New York
SURVEY COORDINATES: N 100411.9 E 102301.3
SURVEY DATUM:

CLIENT: Steuben County
DRILLING DATES: APRIL 27,1992
DRILLING METHOD: 6.25-inch ID HSA
LOGGED/CHECKED BY: JPH/RLD
SURFACE ELEVATION: 1637.7ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2in.ID)
SS3 Split Spoon (3in.ID)
ST Shelby Tube (2.8in.ID)
WH Weight of Hammer
WR Weight of Rods
NR No Recovery

GSD Grain Size Dist.
ATT Atterberg Limit

SHS Total VOC Detected in the Sampler Head Space (ppm)

JHS Total VOC Detected in the Sample Jar Head Space (ppm)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL/ROCK DESCRIPTION	SOIL DATA: GRAPHIC LOG	SOIL DATA: SAMPLE NO. / RUN NO.	SOIL DATA: BLOWS / 6"	SOIL DATA: RECOVERY (in)	SOIL DATA: 'N'-VALUE	ROCK DATA: FROM/TO	ROCK DATA: DRILL RATE MIN./FT.	ROCK DATA: % REC.	ROCK DATA: % RQD.	WELL DIAGRAM	COMMENTS
21	1616.7	@ 22.5-22.8 iron stained & clay filled fractures, some dissolved, severely weathered fossil casts						17/26		97	58		
22	1615.7												
23	1614.7												
24	1613.7												
25	1612.7	@ 25.1-25.7 massive bedding, broken, moderate to severely weathered & stained fractures											
26	1611.7												
27	1610.7												
28	1609.7	@ 26.0-30.1 high angle cross-bedded partings & fractures very broken w/associated severe weathering & iron stained fractures						26/31		82	42		
29	1608.7												
30	1607.7												
31	1606.7												
32	1605.7												
33	1604.7							31/36		64	16		
34	1603.7												
35	1602.7	@ 31.0-36.9 very broken, extensive fracturing & iron staining w/precipitate on fracture surfaces											
36	1601.7												
37	1600.7												
38	1599.7							36/40		23	0		
39	1598.7	End of boring @ 40.0 ft											
40	1597.7												

BOREHOLE LOG 411R

PROJECT: Old Bath Landfill RI/FS
PROJECT NO.: 1318-11-1
LOCATION: Bath,New York
SURVEY COORDINATES: N 100411.9 E 102301.3
SURVEY DATUM:

CLIENT: Steuben County
DRILLING DATES: APRIL 27,1992
DRILLING METHOD: 6.25-inch ID HSA
LOGGED/CHECKED BY: JPH/RLD
SURFACE ELEVATION: 1637.7ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2in.ID)
SS3 Split Spoon (3in.ID)
ST Shelby Tube (2.8in.ID)
WH Weight of Hammer
WR Weight of Rods
NR No Recovery

GSD Grain Size Dist.
ATT Atterberg Limit

SHS Total VOC Detected in the Sampler Head Space (ppm)

JHS Total VOC Detected in the Sample Jar Head Space (ppm)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL/ROCK DESCRIPTION	SOIL DATA: GRAPHIC LOG	SOIL DATA: SAMPLE NO. / RUN NO.	SOIL DATA: BLOWS / 6"	SOIL DATA: RECOVERY (in)	SOIL DATA: 'N'-VALUE	ROCK DATA: FROM/TO	ROCK DATA: DRILL RATE MIN./FT.	ROCK DATA: % REC.	ROCK DATA: % RQD.	WELL DIAGRAM	COMMENTS
41	1596.7	WELL CONSTRUCTION DETAILS:											
42	1595.7	screened interval 38.15'- 13.15'											
43	1594.7												
44	1593.7	4"diameter 0.010" wire wound stainless steel screen 38.15'-13.15' 4"diameter stainless steel riser 13.2'-surface, w/2.0' stickup. Hydrated 1/4" bentonite pellet seal 13.2'-12.5'. cement/bentonite grout 12.5'-surface, w/2'x 2'x 1" thick concrete surface pad and a 6" diameter x 5.0' long locking steel protective casing.											
45	1592.7												
46	1591.7												
47	1590.7												
48	1589.7												
49	1588.7												
50	1587.7												
51	1586.7												
52	1585.7												
53	1584.7												
54	1583.7												
55	1582.7												
56	1581.7												
57	1580.7												
58	1579.7												
59	1578.7												
60	1577.7												

BOREHOLE LOG 411DR

PROJECT: Old Bath Landfill RI/FS
PROJECT NO.: 1318-11-1
LOCATION: Bath,New York
SURVEY COORDINATES: N 100403.9 E 102298.7
SURVEY DATUM:

CLIENT: Steuben County
DRILLING DATES: MAY 1,1992
DRILLING METHOD: 6.25" HSA
LOGGED/CHECKED BY: JPH/RLD
SURFACE ELEVATION: 1638.1ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2in.ID)
SS3 Split Spoon (3in.ID)
ST Shelby Tube (2.8in.ID)
WH Weight of Hammer
WR Weight of Rods
NR No Recovery

GSD Grain Size Dist.
ATT Atterberg Limit

SHS Total VOC Detected in the Sampler Head Space (ppm)

JHS Total VOC Detected in the Sample Jar Head Space (ppm)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL/ROCK DESCRIPTION	SOIL DATA: GRAPHIC LOG	SOIL DATA: SAMPLE NO. / RUN NO.	SOIL DATA: BLOWS / 6"	SOIL DATA: RECOVERY (in)	SOIL DATA: 'N'-VALUE	ROCK DATA: FROM/TO	ROCK DATA: DRILL RATE MIN./FT.	ROCK DATA: % REC.	ROCK DATA: % RQD.	WELL DIAGRAM	COMMENTS
1	1637.1												
2	1636.1												
3	1635.1												
4	1634.1												
5	1633.1	overburden description 0-10.6 ft -See 411R boring log											
6	1632.1												
7	1631.1												
8	1630.1												
9	1629.1												
10	1628.1												
11	1627.1	Top of Bedrock @ 10.6 ft											
12	1626.1												
13	1625.1												
14	1624.1												
15	1623.1												
16	1622.1												
17	1621.1												
18	1620.1												
19	1619.1												
20	1618.1												

BOREHOLE LOG 411DR

PROJECT: Old Bath Landfill RI/FS
PROJECT NO.: 1318-11-1
LOCATION: Bath,New York
SURVEY COORDINATES: N 100403.9 E 102298.7
SURVEY DATUM:

CLIENT: Steuben County
DRILLING DATES: MAY 1,1992
DRILLING METHOD: 6.25" HSA
LOGGED/CHECKED BY: JPH/RLD
SURFACE ELEVATION: 1638.1ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2in.10)
SS3 Split Spoon (3in.10)
ST Shelby Tube (2.8in.10)
WH Weight of Hammer
WR Weight of Rods
NR No Recovery

GSD Grain Size Dist.
ATT Atterberg Limit

SHS Total VOC Detected in the Sampler Head Space (ppm)

JHS Total VOC Detected in the Sample Jar Head Space (ppm)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL/ROCK DESCRIPTION	SOIL DATA: GRAPHIC LOG	SOIL DATA: SAMPLE NO. / RUN NO.	SOIL DATA: BLOWS / 6"	SOIL DATA: RECOVERY (in)	SOIL DATA: 'N'-VALUE	ROCK DATA: FROM/TO	ROCK DATA: DRILL RATE MIN./FT.	ROCK DATA: % REC.	ROCK DATA: % RQD.	WELL DIAGRAM	COMMENTS
21	1617.1												
22	1616.1												
23	1615.1												
24	1614.1												
25	1613.1	shallow rock description 10.6-40.0 ft -See 411R boring log											
26	1612.1												
27	1611.1												
28	1610.1												
29	1609.1												
30	1608.1												
31	1607.1												
32	1606.1												
33	1605.1												
34	1604.1												
35	1603.1												
36	1602.1												
37	1601.1												
38	1600.1												
39	1599.1												
40	1598.1												

BOREHOLE LOG 411DR

PROJECT: Old Bath Landfill RI/FS
PROJECT NO.: 1318-11-1
LOCATION: Bath,New York
SURVEY COORDINATES: N 100403.9 E 102298.7
SURVEY DATUM:

CLIENT: Steuben County
DRILLING DATES: MAY 1,1992
DRILLING METHOD: 6.25" HSA
LOGGED/CHECKED BY: JPH/RLD
SURFACE ELEVATION: 1638.1ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2in.ID)
SS3 Split Spoon (3in.ID)
ST Shelby Tube (2.8in.ID)
WH Weight of Hammer
WR Weight of Rods
NR No Recovery

GSD Grain Size Dist.
ATT Atterberg Limit

SHS Total VOC Detected in the Sampler Head Space (ppm)

JHS Total VOC Detected in the Sample Jar Head Space (ppm)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL/ROCK DESCRIPTION	SOIL DATA: GRAPHIC LOG	SOIL DATA: SAMPLE NO. / RUN NO.	SOIL DATA: BLOWS / 6"	SOIL DATA: RECOVERY (in)	SOIL DATA: 'N'-VALUE	ROCK DATA: FROM/TO	ROCK DATA: DRILL RATE MIN./FT.	ROCK DATA: % REC.	ROCK DATA: % RQD.	WELL DIAGRAM	COMMENTS
41	1597.1	40.0-50.6 SANDSTONE, very fine- fine grain, lt to Dk gray, moderatly hard, occasional siltstone clasts, calcareous parting w/ fossils at approx 42.0-42.2,						40/43.5		94	94		
42	1596.1												
43	1595.1	@ 42.2-42.35, Dk gray-black silty partings											
44	1594.1							43.5/50		92	80		
45	1593.1												
46	1592.1	@ 45.8-46.2, bioturbated partings											
47	1591.1	@ 46.6-48.2, few weathered and clay filled fractures											
48	1590.1												
49	1589.1												
50	1588.1												
51	1587.1	50.6-59.6 SILTSTONE, lt to Dk gray, microlaminatrd w/ trace Dk shale laminae and thin partings less than 0.1",						50.5/60.5		91	81		4" Open hole well contruction @ 50.5'
52	1586.1												
53	1585.1	moderately hard, bioturbated intervals at 50.8-52.5, 54.9-55.8, 58.0-58.9, some weathered iron stained fractures varying in orientation and length											
54	1584.1	@ 54.0-54.2, light sandstone parting											
55	1583.1												
56	1582.1												
57	1581.1												
58	1580.1												
59	1579.1												
60	1578.1												

BOREHOLE LOG 411DR

PROJECT: Old Bath Landfill RI/FS
ROJECT NO.: 1318-11-1
LOCATION: Bath,New York
SURVEY COORDINATES: N 100403.9 E 102298.7
SURVEY DATUM:

CLIENT: Steuben County
DRILLING DATES: MAY 1,1992
DRILLING METHOD: 6.25" HSA
LOGGED/CHECKED BY: JPH/RLD
SURFACE ELEVATION: 1638.1ft.AMSL

SYMBOLS AND DEFINITIONS

SS Split Spoon (2in.ID)
SS3 Split Spoon (3in.ID)
ST Shelby Tube (2.8in.ID)
WH Weight of Hammer
WR Weight of Rods
NR No Recovery

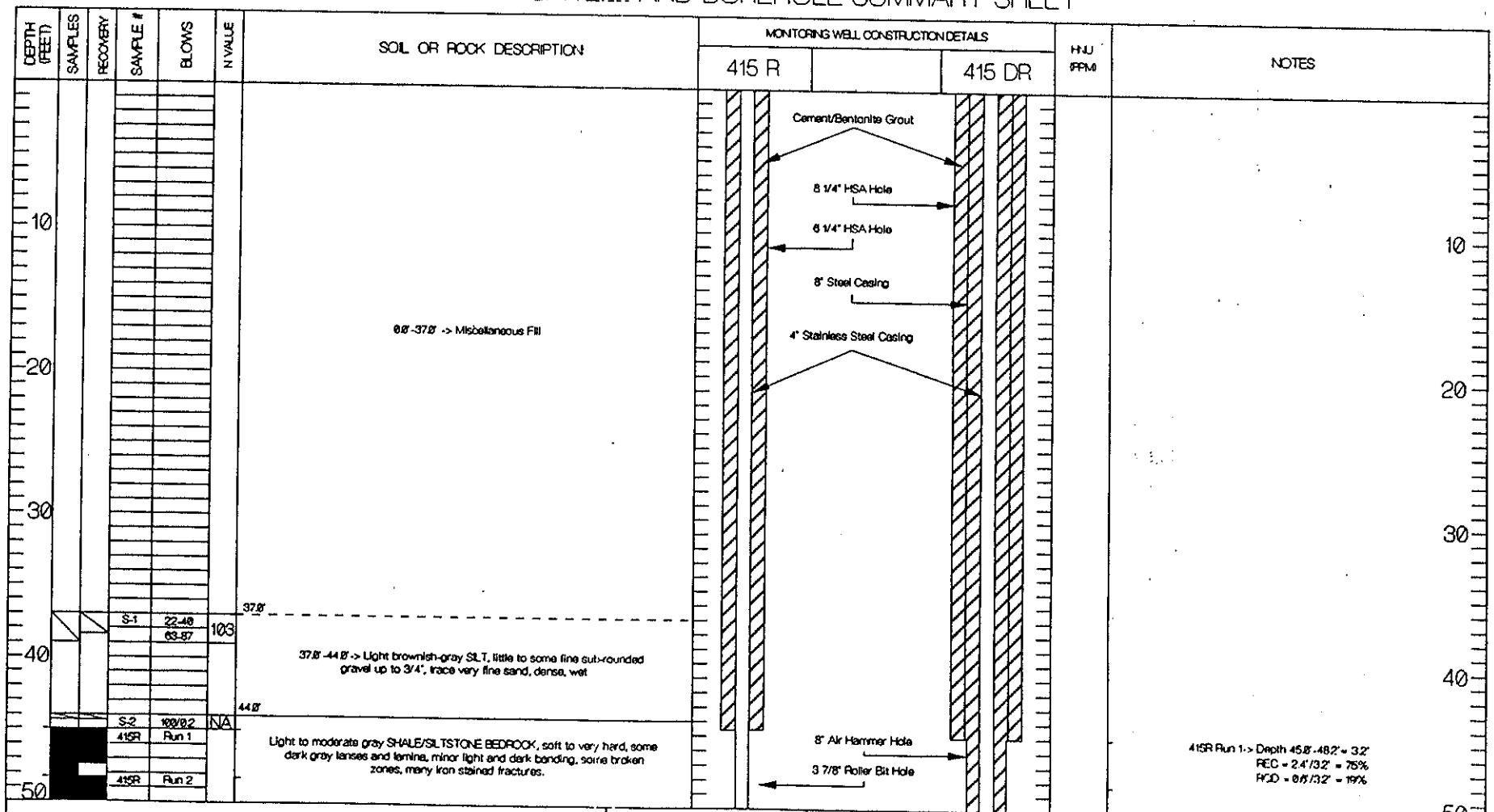
GSD Grain Size Dist.
ATT Atterberg Limit

SHS Total VOC Detected in the Sampler Head Space (ppm)

JHS Total VOC Detected in the Sample Jar Head Space (ppm)

DEPTH (ft.BGS)	ELEVATION (ft AMSL)	SOIL/ROCK DESCRIPTION	SOIL DATA: GRAPHIC LOG	SOIL DATA: SAMPLE NO. / RUN NO.	SOIL DATA: BLOWS / 6"	SOIL DATA: RECOVERY (in)	SOIL DATA: 'N'-VALUE	ROCK DATA: FROM/TO	ROCK DATA: DRILL RATE MIN./FT.	ROCK DATA: % REC.	ROCK DATA: % RQD.	WELL DIAGRAM	COMMENTS
								V		91	81		
61	1577.1	End of Boring @ 60.5 ft											
62	1576.1												
63	1575.1	WELL CONSTRUCTION DETAILS:											
64	1574.1	4" open hole monitoring interval 60.5'-50.5'											
65	1573.1	4" diameter stainless steel riser 50.5'-surface, w/2.0' stickup. Hydrated 1/4" diameter bentonite pellet seal 46.2'-43.5'. cement/bentonite grout 43.5'-surface w/ 2'x 2'x 1" thick concrete surface pad and a 6" diameter x 5.0' long locking steel proctective casing.											
66	1572.1												
67	1571.1												
68	1570.1												
69	1569.1												
70	1568.1												
71	1567.1												
72	1566.1												
73	1565.1												
74	1564.1												
75	1563.1												
76	1562.1												
77	1561.1												
78	1560.1												
79	1559.1												
80	1558.1												

MONITORING WELL AND BOREHOLE SUMMARY SHEET



Surface Elevation _____ Classified By JOHN P. HILTON / DAVID M. STREET

Date Installed 415R - 12/28/93, 415DR - 1/11/94 MPI Inspector JOHN P. HILTON / DAVID M. STREET

Driller EARTH DIMENSIONS DRILLING CO.

Method HOLLOW-STEM AUGERS, ROLLER BIT, NX CORE

MALCOLM PIRNIE

CLIENT: STEUBEN COUNTY

PROJECT: OLD BATH LANDFILL

PROJECT NO.: 1318-151

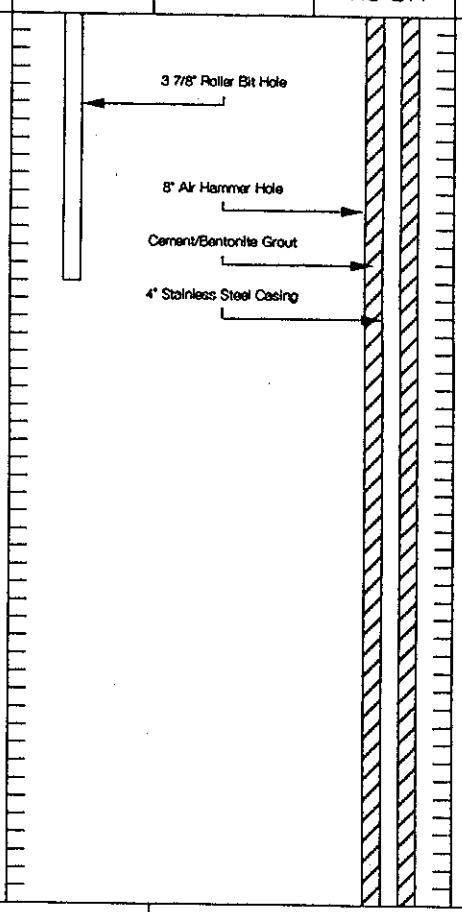
LOCATION NO. 415 R, DR

SHEET 1 OF 3

MONITORING WELL AND BOREHOLE SUMMARY SHEET

DEPTH (FEET)	SAMPLES	RECOVERY	SAMPLE #	BLOWS	N-VALUE	SOIL OR ROCK DESCRIPTION
			415R	Run 2		See Description on Sheet 1
			415R	Run 3		
			415DR	Run 1		
			415DR	Run 2		
			415DR	Run 3		
			415DR	Run 4		
			415DR	Run 5		

MONITORING WELL CONSTRUCTION DETAILS



HNU (PPM)

NOTES

415R Run 2-> Depth = 48.2' - 58.2' = 10.0'
REC = 10.0'/10.0' = 100%
RQD = 9.3'/10.0' = 93%

415R Run 3-> Depth = 58.2' - 65.0' = 6.8'
REC = 6.1'/6.8' = 90%
RQD = 4.3'/6.8' = 63%

415DR Run 1-> Depth = 65.0' - 69.0' = 4.0'
REC = 4.0'/4.0' = 100%
RQD = 2.7'/4.0' = 68%

415DR Run 2-> Depth = 69.0' - 79.0'
REC = 10.0'/10.0' = 100%
RQD = 8.0'/10.0' = 80%

415DR Run 3-> Depth = 79.0' - 89.0' = 10.0'
REC = 9.9'/10.0' = 99%
RQD = 7.4'/10.0' = 74%

415DR Run 4-> Depth = 89.0' - 99.0' = 10.0'
REC = 9.85'/10.0' = 99%
RQD = 8.9'/10.0' = 89%

Surface Elevation _____ Classified By JOHN P. HILTON / DAVID M. STREET

Date Installed 415R - 12/28/93, 415DR - 1/11/94 MPI Inspector JOHN P. HILTON / DAVID M. STREET

Driller EARTH DIMENSIONS DRILLING CO.

Method HOLLOW-STEM AUGERS, ROLLER BIT, NX CORE

MALCOLM PIRNIE

CLIENT: STEUBEN COUNTY
PROJECT: OLD BATH LANDFILL
PROJECT NO.: 1318-151

LOCATION I.D. 415 R, DR

SHEET 2 OF 3

MONITORING WELL AND BOREHOLE SUMMARY SHEET

DEPTH (FEET)	SAMPLES	RECOVERY	SAMPLE #	BLOWS	N VALUE	SOIL OR ROCK DESCRIPTION	MONITORING WELL CONSTRUCTION DETAILS	HNU (PPM)	NOTES
			415 DR	Run 5		See Description on Sheet 1	415 DR		415DR Run 5 -> Depth = 99.8'-109.3' = 10.3' REC = 10.2' / 10.3' = 99% RQD = 9.8' / 10.3' = 95%
110			415 DR	Run 6			Cement / Bentonite Grout 8" Air Hammer Hole 4" Stainless Steel Casing		415DR Run 6 -> Depth = 109.3'-110.3' = 1.0' REC = 0.9' / 1.0' = 90% RQD = 0.85' / 1.0' = 85% 415DR Run 7 -> Depth = 111.5'-121.0' = 9.5' REC = 8.9' / 9.5' = 94% RQD = 7.3' / 9.5' = 77%
			415 DR	Run 7					
120			415 DR	Run 8			3 7/8" Roller Bit Hole		415DR Run 8 -> Depth = 121.0'-131.5' = 10.5' REC = 9.8' / 10.5' = 93% RQD = 8.4' / 10.5' = 80%
130									
140									
150									

Surface Elevation _____ Classified By JOHN P. HILTON / DAVID M. STREET

Date Installed 415R - 12/28/93, 415DR - 1/11/94 MPI Inspector JOHN P. HILTON / DAVID M. STREET

Driller EARTH DIMENSIONS DRILLING CO.

Method HOLLOW-STEM AUGERS, ROLLER BIT, NX CORE

MALCOLM PIRNIE

CLIENT: STEUBEN COUNTY

PROJECT: OLD BATH LANDFILL

PROJECT NO.: 1318-151

LOCATION NO. 415 R, DR

SHEET 3 OF 3

MONITORING WELL AND BOREHOLE SUMMARY SHEET

DEPTH (FEET)	ELEVATION (MSL)	SAMPLES	SAMPLE #	BLOWS	SOIL OR ROCK DESCRIPTION	UNIFIED SOIL CLASS.	MONITORING WELL CONSTRUCTION DETAILS 503S	HYDRAULIC CONDUCTIVITY (CM/SEC)	HNU (PPM)	NOTES
0–25					For overburden description see Well 503R log		Grout; Bentonite; #00 Sand; #0 Sand			Augered to 16.5' Set 2-inch continuous-wrapped, 0.01"-slot PVC screen from 6-16' #0 Sand from 4.5-16.5 #00 Sand from 4-4.5 Bentonite slurry from 3-4 Grout from 3 to surface

Surface Elevation 1690.64 Classified By D.V.F.

Date Installed 02/17/95 MPI Inspector D.V.F.

Driller Parratt-Wolff, Inc., Syracuse, NY

Method 6-1/4" HSA

PROJECT: New Bath Landfill Phase II Hydro. Job#: 1318-155

MALCOLM PIRNIE

LOCATION NO. 503S

SHEET 1 OF 1

MONITORING WELL AND BOREHOLE SUMMARY SHEET

DEPTH (FEET)	ELEVATION (MSL)	SAMPLES	SAMPLE #	BLOWS	SOIL OR ROCK DESCRIPTION	UNIFIED SOIL CLASS.	MONITORING WELL CONSTRUCTION DETAILS 503R	HYDRAULIC CONDUCTIVITY (CM/SEC)	HNU (PPM)	NOTES
0			1	15 12 6 7	Brown SILT, some CLAY and crushed stone (fill)				0.0	Set 4" stainless steel casing to 22.5' through 6-1/4-inch HSA and grout to surface with cement/bentonite grout
			2	10 6 5 6	Orange brown and blue gray SILT, some CLAY and fine GRAVEL, moist		Grout		0.0	NX core hole from 22.5-42.5 reamed with 3-7/8-inch roller bit
5			3	13 8 8 15	Same, grading to wet				0.0	
			4	12 12 23 25	Brown SILT and fine GRAVEL (shale chips), trace CLAY, wet		4"-SS Casing		0.0	
			5	7 13 20 25	Same, trace coarse SAND, wet				0.2	
10			6	14 16 15 17	Brown and orange brown mottled SILT and fine GRAVEL (shale chips), trace CLAY, moist				0.0	
			7	15 15 23 24	Highly weathered brown and gray SHALE with seams of SILT and CLAY, moist				0.0	
			8	44 46 47 50					0.0	
15			9	12 35 50	17.0'				0.0	
					Machias Formation					
			10	157	Gray SHALE					
20										Run #1: 22.5-27.5 Recovery = 4.7' RQD = 0% Lost 50 gal. water
		R-1								
25										

Surface Elevation 1690.31 Classified By D.V.F.

Date Installed 02/15/95 MPI Inspector D.V.F.

Driller Parratt-Wolff, Inc., Syracuse, NY

Method 6-1/4" HSA, NX core, 3-7/8-inch roller bit

PROJECT: New Bath Landfill Phase II Hydro. Job#: 1318-155

MALCOLM PIRNIE

LOCATION NO. 503R

SHEET 1 OF 2

MONITORING WELL AND BOREHOLE SUMMARY SHEET

DEPTH (FEET)	ELEVATION (MSL)	SAMPLES	SAMPLE #	BLOWS	SOIL OR ROCK DESCRIPTION	UNIFIED SOIL CLASS	MONITORING WELL CONSTRUCTION DETAILS	HYDRAULIC CONDUCTIVITY (CM/SEC)	HNU (PPM)	NOTES
							503R			

22.5-42.5: Black/dark gray SHALE interbedded w/thin (<0.1") seams gray SILTSTONE. Numerous bedding-plane fractures. Highly weathered w/iron staining along bedding planes

Broken zones: 23.8-25.5
32.5-33.1
37.0-37.5

Vertical fractures at: 34.5-35.0
34.2-34.4
39.5-39.7
40.4-40.6
41.8-42.0

R-2

R-3

R-4

4" Open-rock hole

Run #2: 27.5-32.5
Recovery = 4.7'
RQD = 15%
Lost 50 gal. water

Run #3: 27.5-32.5
Recovery = 5.0'
RQD = 0%
Lost 20 gal. water

Run #4: 37.5-42.5
Recovery = 5.0'
RQD = 7%
Lost 20 gal. water

30 35 40 45 50

Surface Elevation 1690.31 Classified By D.V.F.

Date Installed 02/15/95 MPI Inspector D.V.F.

Driller Parratt-Wolff, Inc., Syracuse, NY

Method NX core

PROJECT: New Bath Landfill Phase II Hydro. Job#: 1318-155

MALCOLM PIRNIE

LOCATION NO. 503R

SHEET 2 OF 2

MONITORING WELL AND BOREHOLE SUMMARY SHEET

DEPTH (FEET)	ELEVATION (MSL)	SAMPLES	SAMPLE #	BLOWS	SOIL OR ROCK DESCRIPTION	UNIFIED SOIL CLASS.	MONITORING WELL CONSTRUCTION DETAILS 503DR	HYDRAULIC CONDUCTIVITY (CM/SEC)	HNU (PPM)	NOTES
0					For overburden description, see Well 503R Log		Grout; 4"-SS Casing			4" Stainless Steel Casing set at 53.0'
5										NX Core 53.0 - 85.0'; reamed with 3-7/8" roller bit.
10										
15					Top of Rock at 17.0'					
20										
25										

Surface Elevation 1690.66 Classified By D.V.F.

Date Installed 02/23/95 MPI Inspector D.V.F.

Driller Parratt-Wolff, Inc., Syracuse, NY

Method 6-1/4" HSA, NX core, 3-7/8-inch roller bit

PROJECT: New Bath Landfill Phase II Hydro. Job#: 1318-155

MALCOLM PIRNIE

LOCATION NO. 503DR

SHEET 1 OF 5

MONITORING WELL AND BOREHOLE SUMMARY SHEET

DEPTH (FEET)	ELEVATION (MSL)	SAMPLES: SAMPLE #	BLOWS	SOIL OR ROCK DESCRIPTION	UNIFIED SOIL CLASS.	MONITORING WELL CONSTRUCTION DETAILS: 503DR	HYDRAULIC CONDUCTIVITY (CM/SEC)	HNU (PPM)	NOTES
30				For rock description to 42.5', see Well 503R Log		Grout; 4"-SS Casing			30
35									35
40				Machias Formation					40
45				42.5-52.5' Black/dark gray SHALE, interbedded with some thin (< 0.1') seams gray SILTSTONE. Fractures along bedding planes, highly weathered with iron staining along bedding planes, some clay seams.					RUN #1 42.5-47.5' Recov. 3.0' RQD 0% No water loss RUN #2 47.5-52.5' Recov. 5.0' RQD 0% No water loss 45
50									50

Surface Elevation 1690.66 Classified By D.V.F.

Date Installed 02/23/95 MPI Inspector D.V.F.

Driller Parratt-Wolff, Inc., Syracuse, NY

Method 6-1/4" HSA, NX core, 3-7/8-inch roller bit

PROJECT: New Bath Landfill Phase II Hydro. Job#: 1318-155

MALCOLM PIRNIE

LOCATION NO. 503DR

SHEET 2 OF 5

MONITORING WELL AND BOREHOLE SUMMARY SHEET

DEPTH (FEET)	ELEVATION (MSL)	SAMPLES	SAMPLE #	BLOWS	SOIL OR ROCK DESCRIPTION	UNIFIED SOIL CLASS.	MONITORING WELL CONSTRUCTION DETAILS — 503DR	HYDRAULIC CONDUCTIVITY (CM/SEC)	HNU (PPM)	NOTES
55					53.0-55.2 Black SHALE/SILTSTONE interbedded with seams (0.1-0.3') of gray siltstone/sandstone. 55.2-55.7 Gray SANDSTONE/SILTSTONE 55.7-57.8 Black SHALE/SILTSTONE		4"-SS Casing; Grout			RUN #3 53.0-58.0' Recov. 5.0' RQD 30% Water loss 30 gal
60					WISCOY SANDSTONE 57.8-63.0' Dark gray and gray SANDSTONE, fossiliferous.		3-7/8" Open Rock Hole			RUN #4 58.0-63.0' Recov. 4.9' RQD 87% Water loss 120 gal
65					63.0-63.2' Gray SHALE 63.2-73.0' Gray and dark gray SANDSTONE/SILTSTONE, fossiliferous; iron staining in broken zones.					RUN #5 63.0-68.0' Recov. 5.0' RQD 43% Water loss 100 gal
70										RUN #6 68.0-73.0' Recov. 5.0' RQD 25% Water loss 200 gal
75					73.0-74.5' Alternating seams (0.1-0.3') dark gray SILTSTONE/SANDSTONE, and gray SANDSTONE.					

Surface Elevation 1690.66 Classified By D.V.F.

Date Installed 02/23/95 MPI Inspector D.V.F.

Driller Parratt-Wolff, Inc., Syracuse, NY

Method 6-1/4" HSA, NX core, 3-7/8-inch roller bit

PROJECT: New Bath Landfill Phase II Hydro. Job#: 1318-155

MALCOLM PIRNIE

LOCATION NO. 503DR

SHEET 3 OF 5

MONITORING WELL AND BOREHOLE SUMMARY SHEET

DEPTH (FEET)	ELEVATION (MSL)	SAMPLES	SAMPLE #	BLOWS	SOIL OR ROCK DESCRIPTION	UNIFIED SOIL CLASS.	MONITORING WELL CONSTRUCTION DETAILS 503DR	HYDRAULIC CONDUCTIVITY (CM/SEC)	HNU (PPM)	NOTES
80					76.6-76.8' Dark gray SILTSTONE 76.8-79.2' Gray SANDSTONE, some bioturbation and isolated shell fragments. 79.2-79.4' Dark gray SILTSTONE 79.4-79.7' Dark gray SHALE 79.7-80.6' Alternating seams dark gray SILTSTONE and gray SANDSTONE. 80.6-80.9' Gray SANDSTONE with clast of dark gray siltstone. 80.9-81.2' Dark gray SILTSTONE 81.2-81.6' Gray SANDSTONE 81.6-81.8' Dark gray SILTSTONE 81.8-85.0' Gray SANDSTONE with laminae of dark gray SILTSTONE.		3-7/8" Open Rock Hole			RUN #7 73.0-75.0' Recov. 1.7' RQD 20% No water loss RUN #8 75.0-85.0' Recov. 9.9' RQD 39% No water loss
85										
90										
95										
100										

Surface Elevation 1690.66 Classified By D.V.F.

Date Installed 02/23/95 MPI Inspector D.V.F.

Driller Parratt-Wolff, Inc., Syracuse, NY

Method 6-1/4" HSA, NX core, 3-7/8-inch roller bit

PROJECT: New Bath Landfill Phase II Hydro. Job#: 1318-155

MALCOLM PIRNIE

LOCATION NO. 503DR

SHEET 4 OF 5

MONITORING WELL AND BOREHOLE SUMMARY SHEET

DEPTH (FEET)	ELEVATION (MSL)	SAMPLES	SAMPLE #	BLOWS	SOIL OR ROCK DESCRIPTION	UNIFIED SOIL CLASS.	MONITORING WELL CONSTRUCTION DETAILS	HYDRAULIC CONDUCTIVITY (CM/SEC)	HNU (PPM)	NOTES
							503DR			

Vertical Fractures

49.9-50.2'
56.7-57.2'
59.2-60.2'
68.5-69.1'
72.6-72.8'

70 degree Fractures

58.8-59.2'
65.8-66.2'

Broken Zones

42.6-47.5' (only shale chips in this zone)
53.6-53.7'
67.0-68.5' (highly brecciated)
70.6-70.9'

Surface Elevation 1690.66 Classified By D.V.F.

Date Installed 02/23/95 MPI Inspector D.V.F.

Driller Parratt-Wolff, Inc., Syracuse, NY

Method 6-1/4" HSA, NX core, 3-7/8-inch roller bit

PROJECT: New Bath Landfill Phase II Hydro. Job#: 1318-155

MALCOLM PIRNIE

LOCATION NO. 503DR

SHEET 5 OF 5

MALCOLM PIRNIE

ATTACHMENT C

STANDARD OPERATING PROCEDURES

C-1: Water Level Monitoring
C-2: Well Purging Prior to Sampling
C-3: Groundwater Sampling
C-4: Non-Aqueous Phase Liquid Detection
C-5: Non-Aqueous Phase Liquid Sampling
C-6: Field Filtration of Aqueous Metals Samples
C-7: Sample Labeling
C-8: Sample Shipping
C-9: Surface Water Sampling
C-10: Calibration and Maintenance of Portable Field pH/Eh Meter
C-11: Calibration and Maintenance of Portable Conductivity Meter
C-12: Calibration and Maintenance of Portable Field Turbidity Meter
C-13: Calibration and Maintenance of Portable Dissolved Oxygen Meter
C-14: Sampling Equipment Decontamination Protocols

Appendix ___: Item _____ - WATER LEVEL MONITORING

Applicability: GENERAL Revision No.: ___ Date: _____

Prepared By: MKR Date: 11/20/89 Approved By: GHF Date: 11/22/89

1.0 INTRODUCTION

This guideline presents a method for obtaining water levels from monitoring wells/piezometers. The ground water levels measured in the monitoring wells can be used to determine ground water flow directions and when combined with hydraulic conductivity data, flow rates.

Water levels in monitoring wells should be measured using an electronic water level indicator which has been checked to ensure it is operational, prior to mobilizing to the field.

2.0 METHODOLOGY

1. Pre-clean water level probe and lower portion of cable following appropriate decontamination procedures.

2. Lower probe slowly into the monitoring well until the audible alarm, which indicates water, sounds.

3. Read depth from the graduated cable, to the nearest 100th (0.01) of a foot using either the v-notched reference point on the well riser or the highest point on the well riser as a reference. Repeat the measurement for confirmation and record the water level in the Project Field Book or on a "Ground Water Levels" form (attached).

4. Remove the probe from the well slowly, drying the cable and probe with a clean tissue.

5. Replace well cap and lock protective cap in place. Repeat decontamination procedures if additional measurements are to be taken.

3.0 EQUIPMENT REQUIREMENTS

- personal protective garment and gear (if applicable)
- water level indicator
- tissues
- Project Field Book

4.0 REFERENCES

USEPA, September 1986, RCRA Ground Water Monitoring Technical Enforcement Guidance Document, 9950.1

033

GROUND WATER LEVEL LOG

	DATE											
WELL / BOREHOLE NO.	REFERENCE POINT (RP)	RP ELEV. (ft. AMSL)	DEPTH BRP (ft.)	ELEV. (ft. AMSL)	DEPTH BRP (ft.)	ELEV. (ft. AMSL)	DEPTH BRP (ft.)	ELEV. (ft. AMSL)	DEPTH BRP (ft.)	ELEV. (ft. AMSL)	DEPTH BRP (ft.)	ELEV. (ft. AMSL)

BRP = BELOW REFERENCE POINT TOC = TOP OF CASING TOR = TOP OF RISER GS = GROUND SURFACE

MALCOLM PIRNIE

Appendix ____: Item _____ - WELL PURGING PRIOR TO SAMPLING

Applicability: GENERAL Revision No.: ____ Date: _____

Prepared By: MKR Date: 11/28/89 Approved By: GHF Date: 12/6/89

1.0 INTRODUCTION

This guideline presents methods for well purging prior to ground water sample collection in order to collect representative ground water samples. Purging involves the removal of at least three to five volumes of water in wells with moderate yields and at least one volume from wells with low yields (slow water level recovery). Sampling should commence as soon as the well has adequately recharged.

2.0 WELL PURGING METHODOLOGY

1. Unlock and carefully remove the well cover to avoid introducing foreign material into the well. Monitor the well for organic vapors using a photoionization detector (HNu), if applicable. If a reading of greater than 5 ppm is recorded, the well should be allowed to vent until levels drop below 5 ppm before proceeding with purging.

2. Calculate the volume of water in the well based on the water level below top of casing and the total depth of well using the following equation:

$$V = 5.825\ I^2\ (D-W)$$

V = one well volume (gallon)
I = inside diameter of well casing (feet)
D = Well Depth (feet)
W = Depth to Water from Top of Casing (feet)

3. For wells where the water level is 20 feet or less below the top of casing, use a suction-lift pump to purge the well. Measure the purged volume using a calibrated container and record measurements in a field notebook. Use dedicated new low density polyethylene tubing for each well. During this evacuation of shallow wells, the intake opening of the pump tubing should be positioned just below the surface of the water. As the water

level drops, lower the tubing as needed to maintain flow. The intake level should not be lowered past the top of the screen. Pumping from the top of the water column will ensure proper flushing of the well. Continue pumping until the required volumes are removed. Adjust the purging rate to maintain the water level above the screen. For wells where the screen straddles the water table, maintain purging at a rate which matches the rate of recovery of the well (well yield). If the well purges to dryness and is slow to recharge (greater than 15 minutes), terminate evacuation.

4. For wells where the water level is initially below about 20 feet, or draw down to this level because of a slow recharge rate, conduct purging using one of three (3) devices:

   - Bailer - A bottom filling bailer with a leader made of teflon stainless steel wire or single strand polypropylene monofilament of at least 10-feet long which is attached to a dedicated 1/4-inch nylon rope, should be used.

   - Well Wizard Purge Pump - This is a pneumatic pump that uses compressed air to push water to the surface. Ground water is in contact with the drive air during the pumping process, therefore the pump is not used for sampling. Drive air is fully contained within the pump apparatus.

   - Waterra™ pump - This is a manually operated pump which uses dedicated polyethylene tubing and a check valve, and can be used as an optional method for purging deeper wells. The pump and tubing should be removed prior to sampling.

Prior to use in a well, the bailer, exterior pump bodies, and pump tubing should be cleaned using decontamination protocols specified for the program.

5. Purging will continue until a predetermined volume of water has been removed. Measurements for pH, temperature, conductivity and turbidity should be recorded during purging. The stability of these measurements with time can be used to guide the decision to discontinue purging.

6. Well purging data should be recorded in the Project Field Book or on the attached "Well Development/Purging Log" form.

034

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: _____

PROJECT NO.: _____

STAFF: _____

DATE: _____

WELL NO.: _____

① TOTAL CASING AND SCREEN LENGTH (FT.): _____

② CASING INTERNAL DIAMETER (in.): _____

③ WATER LEVEL BELOW TOP OF CASING (FT.) _____

④ VOLUME OF WATER IN CASING (GAL.) _____

$V = 0.0408 (②)^2 \times (① - ③) =$ _____ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										

COMMENTS:

MALCOLM PIRNIE

Appendix ____: Item _____ - GROUND WATER SAMPLING

Applicability: GENERAL Revision No.: ____ Date: _____

Prepared By: MKR Date: 11/27/89 Approved By: GHF Date: 12/6/89

1.0 INTRODUCTION

This guideline presents a method for collecting a ground water sample after the monitoring well has been purged and has sufficiently recovered. Sampling should be carried out according to the following protocol:

2.0 METHODOLOGY

1. Perform sampling as soon as practical after purging at any time after the well has recovered sufficiently to sample, or within 24 hours after evacuation, if the well recharges slowly. If the well does not yield sufficient volume for all required laboratory analytical testing (including quality control), a decision should be made to prioritize analyses based on contaminants of concern at the site. Analyses will be prioritized in the order of the parameters volatilization sensitivity. After volatile organics have been collected, field parameters must be measured from the next sample collected. If a well takes longer than 24 hours to recharge, the Project Manager should be consulted.

2. Following purging and recharging the well, collect samples into appropriate containers using a stainless steel or polytetrafluoroethylene (PTFE) bailer. The bailer should be equipped with a leader made of Teflon, stainless steel wires or single strand polypropylene monofilament of at least ten feet long which is attached to a new, dedicated 1/4-inch nylon rope. The bailer should be lowered slowly below the surface of the water so as to allow the water to touch only the "leader" and not the nylon rope. Prior to its use in the field, the stainless steel bailer and "leader" should be cleaned according to decontamination protocols specified for the program.

3. Prelabel all sample bottles in the field using a waterproof permanent marker. The following information should be included on the label:

- Sample identification code
- Project number
- Date/time of sample collection (month, day, year)
- Sampler's initials
- Preservation added (if any)
- Analysis to be performed

4. Collect samples into pre-cleaned bottles provided by the analytical laboratory with the appropriate preservative(s) added, and the samples placed in coolers for shipment to the designated laboratory. Chain of custody procedures should be adhered to upon sample collection.

5. Collect a separate sample of approximately 200 mls into an appropriate container to measure pH, conductivity, temperature and turbidity in the field.

6. Record well sampling data in the Project Field Book or on the attached "Water Sampling Field Data Sheet."

3.0 REFERENCES

(a) USEPA, September 1986, RCRA Groundwater Monitoring Technical Enforcement Guidance Document.

035

WATER SAMPLING FIELD DATA SHEET

PROJECT: _____ TYPE OF SAMPLE: _____

CLIENT: _____ LOCATION NO.: _____

JOB NO.: _____ LAB SAMPLE NO.: _____

WELL DATA: DATE: _____ TIME: _____

Casing Diameter (inches): _____ Casing Material: _____

Screened Interval (ft BGS): _____ Screen Material: _____

Static Water Level Below TOR (ft): _____ Bottom Depth (ft): _____

Elevation Top of Well Riser: _____ Datum Ground Surface: _____

PURGING DATA: DATE: _____ TIME: Start: _____ Finish: _____

Method: _____ Pumping Rate (gal/min): _____

Well Volumes Purged ($V=\pi R^2H/231$): _____ Was well purged dry? _____ Yes _____ No

Standing Volume (gal): _____ Was well purged below sand pack? ____ Yes ____ No

Volume Purged (gal): _____

Well I.D. (inches)	Volume (gal/ft)
2	0.17
4	0.66
6	1.50

Is purging equipment dedicated to sample location?

Yes _____ No _____

Field Personnel: _____

SAMPLING DATA: DATE: _____ TIME: Start: _____ Finish: _____

Method: _____ Sampler: _____

Present Water Level (ft): _____ Air Temperature (°F): _____

Depth of Sample (ft): _____ Weather Conditions: _____

Is sampling equipment dedicated to sample location? Yes _____ No _____

PRESERVATION DATA: DATE: _____ TIME: Start: _____ Finish: _____

Filtered: _____ Yes _____ No Cool to 4°C: _____

Preservative: _____ H_2SO_4 _____ HNO_3 _____ NaOH _____ Other

PHYSICAL AND CHEMICAL DATA:

Appearance: Clear: _____ Turbid: _____ Color: _____

Contains Sediment: _____ Odor: _____ Other: _____

Temperature (°C): _____ pH: _____ Specific Conductivity (µmhos/cm): _____

Turbidity (NTU): _____ Other: _____

REMARKS:

MALCOLM PIRNIE

Appendix ____: Item _____ - NON-AQUEOUS PHASE LIQUID DETECTION

Applicability: HAZARDOUS WASTE Revision No.: ____ Date: _____

Prepared By: NWT Date: 10/24/89 Approved By: GHF Date: 3/8/90

1.0 INTRODUCTION

This guideline presents a method to detect the presence of Non-Aqueous Phase Liquid (NAPL) in ground water monitoring wells. If NAPL is suspect, all activities should be performed with proper personal protective clothing.

2.0 METHODOLOGY

1. Remove the locking and protective caps from the well suspected of containing NAPL.

2. Screen the air in the well headspace for organic vapors using either a photoionization analyzer (e.g. HNU) or an organic vapor analyzer (e.g. OVA), and record measurements.

3. Slowly lower an interface probe down the well, avoiding contact with the well casing.

   Upon contact with the static liquid level in the well, the interface probe will signal contact with an audible tone and/or a visible light mounted inside the reel.

   NOTE:

   - If the signal is constant, the probe is in contact with ground water; and
   - if the signal oscillates, the probe is in contact with NAPL.

   Record the depth and the type of liquid encountered.

4. Slowly lower the interface probe to the well bottom. Record the depth(s) and type(s) of any additional phases encountered.

5. Slowly raise the interface probe to the surface, avoiding contact with the well casing.

6. Place the interface probe and storage reel in a plastic bag for subsequent decontamination.

3.0 REFERENCES

U.S. Environmental Protection Agency, 1986, "RCRA Ground Water Monitoring Technical Enforcement Guidance Document"; 316p.

006

Appendix ____: Item _____ - NON-AQUEOUS PHASE LIQUID SAMPLING

Applicability: Hazardous Waste Revision No.: 1 Date: 10/26/89

Prepared By: NWT Date: 10/24/89 Approved By: GHF Date: 10/26/89

1.0 INTRODUCTION

This guideline presents a method for collecting samples of Non-Aqueous Phase Liquid (NAPL) from monitoring wells prior to purging.

2.0 SITE PREPARATION

1. Place plastic sheeting on the ground around the well to prevent equipment from coming in contact with the soil.
2. Measure the static water level and NAPL level(s) using an interface probe.
3. Determine NAPL depth and thickness and record appropriate data in the field notebook.

3.0 METHODOLOGY

The following procedure should be used in sampling dense, heavier than water NAPL (i.e., with a high specific gravity).

1. Collect samples using a translucent double check valve bailer constructed from polytetrafluoroethylene (PTFE) (i.e., a bailer with a ball valve on both the top and bottom) which is connected to a leader/cable for lowering. Bailer and leader/cable should be decontaminated prior to use and wrapped in aluminum foil.
2. Remove wrapping, attach bailer to new polypropylene cord and slowly lower the bailer until it contacts the well bottom.
3. Slowly raise and lower the bailer to create a gently surging action thereby inducing dense NAPL into the bailer past the bottom ball valve.
4. Slowly raise the bailer to the surface. Avoid contact of the bailer line with the well casing and/or ground.

5. Observe the NAPL through the translucent wall of the bailer and check if the immiscible phases have separated. If not, allow the bailer to stand upright until the phases have separated.

6. Carefully attach a PTFE bottom emptying device with stopcock to the bottom of the bailer and discharge the dense immiscible layer of NAPL gently down the side of the sample bottle to minimize turbulence.

7. Repeat steps 2 through 6 until a sufficient sample volume is obtained.

8. Cap the sample bottle and follow procedures for preservation and transport.

9. Place the used bailer and leader/cable in a plastic bag for subsequent decontamination, and dispose of polypropylene cord and plastic sheeting.

The following procedure should be used in sampling lighter than water NAPL (i.e., with a low specific gravity).

1. Collect samples using a translucent double check valve bailer constructed from polytetrafluoroethylene (PTFE) (i.e., a bailer with a ball value on both the top and bottom) which is connected to a leader/cable for lowering. Bailer and leader/cable should be decontaminated prior to use and wrapped in aluminum foil.

2. Remove wrapping, attach bailer to new polypropylene cord and slowly lower the bailer down the well into the immiscible phase of NAPL. Care should be taken to lower the bailer just through the NAPL layer, but not significantly down into the underlying ground water.

3. Slowly raise the bailer to the surface. Avoid contact of the bailer line with the well casing and/or ground.

4. Observe the NAPL through the translucent wall of the bailer and check if the immiscible phases have separated. If not, allow the bailer to stand upright until the phases have separated.

5. Carefully attach a PTFE bottom emptying device with stopcock to the bottom of the bailer and decant the denser ground water portion of the bailer into a waste-water barrel.

6. Discharge the less dense immiscible layer of NAPL gently down the side of the sample bottle to minimize turbulence.

7. Repeat steps 2 through 6 until a sufficient sample volume is obtained.

8. Cap the sample bottle and follow procedures for preservation and transport.

9. Place the used bailer and leader/cable in a plastic bag for subsequent decontamination, and dispose of polypropylene cord and plastic sheeting.

4.0 EQUIPMENT REQUIREMENTS

- personal protective garment and gear
- plastic sheeting
- plastic garbage bags
- knife
- interface probe
- translucent PTFE double check valve bailer
- PTFE bottom emptying device with stopcock
- PTFE coated stainless steel leader/cable or braided polypropylene cord
- waste-water barrel
- sample bottle(s)
- sample cooler and ice packs

- Projet Field Notebook

5.0 REFERENCES

Feenstra, S. and J.A. Cherry, 1988, Subsurface Contamination by - Dense Non-Aqueous Phase Liquid (DNAPL) Chemicals: Presented at The International Groundwater Symposium/International Association of Hydrogeologists, Halifax, Nova Scotia, 15 p.

New Jersey Department of Environmental Protection, 1988, Field Sampling Procedures Manual: Bureau of Environmental Measurements and Quality Assurance CN 028, 414 p.

Appendix ____: Item _____ - PROCEDURE FOR FIELD FILTRATION OF AQUEOUS METALS SAMPLES

Applicability: GENERAL Revision No.: 2 Date: 02/23/90

Prepared By: AJM Date: 02/23/90 Approved By: KLB Date: 02/23/90

1.0 INTRODUCTION

This guideline presents a method for filtering aqueous samples in the field for dissolved metals analyses. Filtering of the samples may be performed on-site provided the sample is filtered immediately after sample collection.

2.0 METHODOLOGY

1. Filter aqueous metals samples using a filter flask and funnel made out of polyethylene or boroscillicate glass. Pre-clean both the flask and the funnel by rinsing with a ten (10) percent nitric acid (HNO_3) solution followed by a thorough rinsing of demonstrated analyte-free deionized water. Use this cleaning procedure prior to filtration of all samples.

2. Use a cellulose based membrane filter with a pore size of 0.45 microns (mm). Since the ultimate effect of the introduction of air to a water sample can be a change in the valence state of some cations which in turn could lead to the loss of analytes through precipitation (e.g., oxidation of ferrous ion to ferric ion after aeration), filter samples immediately after their collection. Pass samples through the filtration apparatus once. Repeated filtration of the sample to accommodate turbidity criteria is not allowed. Preserve samples immediately with undiluted ultra pure HNO_3 and check the pH to ensure that a reading of less than 2 is attained. Add only enough HNO_3 to lower the pH to less than 2.

3.0 REFERENCES

New York State Department of Environmental Conservation (NYSDEC), Division of Hazardous Substance Regulation, August 1989, RCRA Quality Assurance Project Plan Guidance.

Appendix ___: Item _____ - SAMPLE LABELLING

Applicability: GENERAL Revision No.: 1 Date: 11/9/89

Prepared By: THF Date: 11/9/89 Approved By: KLB Date: 10/10/89

1.0 INTRODUCTION

This guideline presents a method for sample labelling in order to properly identify environmental samples collected during the field investigation.

2.0 METHODOLOGY

1. Assign each sample of each matrix a unique identification alpha-numeric code. An example of this code and a description of its components is presented on the following page.

2. Affix a non-removable (when wet) label to each sample container. The following information should be written on the label with permanent marker:

   - Site name
   - Sample identification
   - Project number
   - Date/time of sample collection (month, day, year)
   - Sampler's initials
   - Sample preservation
   - Analysis required

3. Wrap the label with 2-inch cellophane tape such that the label is completely covered and the tape wraps around the entire perimeter of the bottle.

Appendix ____: Item _____ - SAMPLE LABELLING

Applicability: GENERAL Revision No.: 1 Date: 11/9/89

Prepared By: THF Date: 11/9/89 Approved By: KLB Date: 10/10/89

Example of Sample ID: CM-MW1D

CM
(Site Code)
Columbus McKinnon

D
(Monitor/Sample Type)

(S) Shallow

(I) Intermediate

(D) Deep

MW1
(Sample Location)

MW = Ground Water Installation (Well Location No. 1)

SP = Sampling Point

SW = Surface Water

SB = Soil Boring (depth designation follows alpha code)

SS = Stream Sediment (water depth designation follows alpha code).

TB = Trip Blank

RB = Field (Rinse) Blank

055

Appendix ___: Item _____ - SAMPLE SHIPPING

Applicability: GENERAL Revision No.: 2 Date: 02/21/89

Prepared By: THF Date: 11/9/89 Approved By: KLB Date: 10/10/89

1.0 INTRODUCTION

This guideline presents a method for chain-of-custody procedures to track sample shipments, to minimize loss or misidentification of samples, and to ensure that unauthorized persons do not tamper with collected samples.

2.0 METHODOLOGY

1. Fill out the chain-of-custody form completely (see attached example) with all relevant information (the white original goes with the samples and should be placed in a "ziploc" plastic bag and taped inside the sample cooler lid; the yellow copy should be retained by the sampler).

2. Mark liquid volume and solids levels on sample bottles with grease pencil.

3. Place about 3 inches of inert cushioning material such as styrofoam peanuts or bubble pack in bottom of cooler. Place bottles in cooler with VOA vials (in a "ziploc" bag) in the center of the cooler.

4. Cover pack bottles, especially VOA vials, with ice in plastic bags. Pack cooler with blue ice in "ziploc" plastic bags and additional cushioning material.

5. Tape drain shut and wrap cooler completely with strapping tape to secure lid.

6. Place lab address on top of cooler. To protect the shipping coolers against tampering during shipment, the cooler lid will be taped to the cooler body. A chain-of-custody seal will be placed over the tape. A broken seal will indicate that the contents may have been tampered with.

MALCOLM PIRNIE, INC.

CHAIN OF CUSTODY RECORD

PROJECT NO.:	SITE NAME:
SAMPLERS (SIGNATURE):	

STATION NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CON-TAINERS							REMARKS

RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE/TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE/TIME:	REMARKS:	

Distribution: Original accompanies shipment, copy to coordinator field files

7. For out-of-town laboratory shipments, specify that the contents are "Fragile" and place "This Side Up" labels on all four sides of the cooler. "This Side Up" labels are yellow labels with a black arrow with the arrow head pointing toward the cooler lid. "This Side Up" labels should not be affixed to the cooler lid or the cooler bottom.

Appendix ____: Item _____ - SURFACE WATER SAMPLING

Applicability: GENERAL Revision No.: ____ Date: _____

Prepared By: MKR Date: 1/18/90 Approved By: KLB Date: 2/2/90

1.0 INTRODUCTION

This guideline presents a method for the collection of surface water samples. The most widely used method for collection involves a sampler consisting of an adjustable clamp attached to the end of a two or three piece telescoping aluminum tube that serves as the handle. The clamp is used to secure a precleaned laboratory sample bottle. Using the sample bottle for actual sampling eliminates the need for other equipment. This method also reduces the risk of introducing other variables into a sampling event.

2.0 METHODOLOGY

1. Assemble the sampler. Make sure that the sample bottle and the bolts and nuts that secure the clamp to the pole are tightened properly.

2. With proper protective garment and gear, take a grab sample by slowly submerging the sample bottle with minimal surface disturbance.

3. Collect samples from near shore unless boats are feasible and permitted.

4. Retrieve the sampler from the surface water with minimal disturbance. (If sample bottles were not used for sample collection, carefully transfer the water samples to appropriate precleaned sample bottles).

5. Cap the sample bottle and remove from the sampler. Follow procedures for preservation, if required, and sample handling.

6. Dismantle the sampler and store in plastic bags for subsequent decontamination.

7. Record available information for the pond, stream or other body of water that was sampled, such as its size, location and depth in the Project Field Book. Approximate sampling points should be identified on a sketch of the water body.

3.0 REFERENCES

New Jersey Department of Environmental Protection, 1988, Field Sampling Procedures Manual: Bureau of Environmental Measurements and Quality Assurance CN 028, 414 p.

042

Appendix ____: Item _____ - CALIBRATION AND MAINTENANCE OF PORTABLE FIELD pH/Eh METER

Applicability: GENERAL Revision No.: ____ Date: _____

Prepared By: THF Date: 12/22/89 Approved By: KLB Date: 12/22/89

1.0 INTRODUCTION

This guideline presents a method for calibration of a portable pH/Eh meter. The pH/Eh meter measures and provides a log scale reading of the hydrogen ion concentration of a water sample (pH function) or of the oxidation/reduction potential of a water sample (Eh function). In order to ensure an accurate reading, the pH/Eh meter must be calibrated prior to use in the field.

2.0 ACCURACY

The calibrated accuracy of the pH/Eh meter will be:

pH - 0.1 pH unit, over the temperature range of -2°C to 40°C.

Eh - -1 to +1 millivolts over the range of -700 to +700 millivolts.

3.0 CALIBRATION

Calibrate all field test equipment at the beginning of each sampling day and check and recalibrate according to the manufacturer's specifications. Calibrate the pH/Eh meter by immersing the sensing probe in a container of certified pH buffer solution traceable to the National Bureau of Standards, and compare the meter reading to the known value of the buffer solution, which is stirred. If the reading obtained by the meter does not agree with the known value of the buffer solution, adjust the "standardize" control until the desired reading is obtained. In addition,

measure the temperature of the buffer solutions, and adjust the temperature setting of the meter accordingly. Typically, pH 4.0, 7.0 and 10.0 buffers will be used for calibration purposes. Two-point calibrate the meter in the field at the beginning and end of each group of measurements. Select the two points to bracket the range of expected field measurements. The narrowest range possible is desired to maximize accuracy. This procedure will apply to both the pH and Eh functions of the meter, since there is no need to standardize the Eh function to any additional buffer or to compensate for solution temperature.

4.0 MAINTENANCE

1. When not in use or between measurements, keep the pH/Eh probe immersed in or moist with buffer solution.

2. Check the meter batteries at the end of each day and recharge when needed.

3. Replace the pH/Eh probe any time that the meter response time becomes greater than two minutes or the metering system consistently fails to retain its calibrated accuracy for a minimum of ten sample measurements.

4. If a replacement of the pH/Eh probe fails to resolve instrument response time and stability problems, the equipment officer will send the instrument to its manufacturer for maintenance and repair.

5. Maintain a log for each monitoring instrument. Record all maintenance performed on the instrument on this log with date and name of the organization performing the maintenance.

5.0 DATA VALIDATION

Document all instrument calibrations in the field notebook, indicating the meter readings before and after the meter has been adjusted. Also document the pH buffers used to calibrate the meter. This is important, not only for data validation, but also to establish maintenance schedules and component replacement.

Appendix ____: Item _____ - CALIBRATION AND MAINTENANCE OF PORTABLE CONDUCTIVITY METER

Applicability: GENERAL Revision No.: 1 Date: 12/29/89

Prepared By: THF Date: 12/29/89 Approved By: KLB Date: 12/29/89

1.0 INTRODUCTION

This guideline presents a method for checking the calibration of a portable field conductivity meter. The conductivity meter is factory calibrated and measures and provides a direct reading of the conductivity of a water sample. In order to ensure an accurate reading, the calibration of the conductivity meter must be checked prior to use in the field.

2.0 ACCURACY

The calibrated accuracy of the specific-conductance meter is within three percent of full-scale over the temperature range of -2°C to 40°C.

3.0 CALIBRATION

The instrument has been calibrated by the manufacturer according to factory specifications. All test equipment must be field checked at the beginning of each sampling day [6NYCRR 360-2-11(a)(12)(v)(a)] using a calibration solution having a known specific conductivity and salinity. Check the factory calibration by immersing the sensor probe in a container of manufacturer-prepared standard solution of known specific conductivity. Turn the meter on and allow approximately 30 seconds for response. If the reading obtained does not agree with the known specific conductivity of the solution, proceed as follows:

- Turn the instrument off, and mechanically zero the meter in accordance with the instruction manual (if possible).

- Turn the instrument on and check the battery power. If necessary, place the meter on charge for several hours.

- Clean and dry the probe thoroughly. With the probe not in the solution, turn the meter on and adjust the range selector to the lowest range available. The meter reading should be within two minor divisions of zero. If the response is outside this range, return the meter to the manufacturer for repair.

- Place the electrode in the manufacturer-prepared solution of known salinity. Adjust the "salinity" control to match that of the standard solution.

- If the above steps fail to adequately calibrate the meter, consult the manufacturer.

4.0 MAINTENANCE

1. Check the meter batteries at the end of each day and recharge when needed.

2. Track the meter response time and stability to determine the need for instrument maintenance. When response time becomes greater than two minutes and the meter must be recalibrated more than once per day, send the instrument to the manufacturer for maintenance and repair.

3. Maintain a log for each specific-conductance meter. Record all maintenance performed on the instrument on this log with date and name of organization performing the maintenance.

5.0 DATA VALIDATION

Document all instrument calibration checks, indicating the meter readings before and after the meter has been adjusted. The standard solution used to calibrate the meter will also be documented.

Appendix ____: Item _____ - CALIBRATION AND MAINTENANCE OF PORTABLE FIELD TURBIDITY METER

Applicability: GENERAL Revision No.: ____ Date: _____

Prepared By: THF Date: 2/9/90 Approved By: KLB Date: 2/9/90

1.0 INTRODUCTION

This procedure presents a method for calibration of the HACH Model 16800 portable field turbidity meter. The turbidity meter is used to measure and provide a direct reading of the cloudiness or clarity of water samples. The turbidity meter is factory calibrated. In order to ensure an accurate reading, the factory calibration must be checked prior to using the meter in the field.

2.0 ACCURACY

The calibrated accuracy of the turbidity meter will be within one percent of full-scale on all scale ranges.

3.0 CALIBRATION

All factory calibrated field test equipment must be checked at the beginning of each sampling day and recalibrated (if necessary) according to the manufacturer's specifications (Ref. 1). Check the factory calibration of the turbidity meter as follows:

1. With the instrument turned off, check the mechanical zero adjustment on the meter face. Adjust for a zero reading if necessary.

2. Turn the meter on and perform a battery check. Charge the batter pack if the meter indicates low battery charge.

3. Place the focusing template into the cell holder, press the 1.0 range switch, and adjust the ZERO control to obtain a zero NTU reading.

4. Remove the focusing template and insert a 0.9 NTU turbidity standard. Adjust the SPAN control for a corrected 0.9 NTU reading, if necessary.

5. Remove the 0.75 NTU standard and replace it with a 9 NTU standard. Press the 10 range switch. The meter should indicate 9 (± 0.02) NTU. If it does not, the 10 range potentiometer must be adjusted in accordance with the manufacturer's instructions. Adjust the SPAN control for a reading of exactly 9 NTU.

6. Remove the 9 NTU standard and replace it with the cell riser and 90 NTU standard. Press the 100 range switch. The meter should indicate 90 (± 2) NTU.

7. Remove the 90 NTU standard and cell riser and insert the 9 NTU standard. Press the 10 NTU range switch. Adjust the SPAN control for a reading of exactly 9 NTU.

8. Remove the 9 NTU standard and replace it with a 0.9 NTU standard. Press the 1.0 range switch. The meter should indicate the correct value for the 0.9 NTU standard (± 0.2). If it does not, the 1.0 range potentiometer must be adjusted in accordance with the manufacturer's instructions.

4.0 MAINTENANCE

1. Check the meter battery pack at the end of each day and recharge when needed.

2. When not in use, store the meter in a clean, dry area with the protective cover shut.

3. Clean the lens periodically with a dry cloth or tissue.

4. Maintain a log for each turbidity meter. All maintenance performed on the instrument will be recorded on this log with date and name of organization performing the maintenance.

5.0 DATA VALIDATION

Document all instrument calibrations, indicating the meter readings before and after adjustment. The calibration standard manufacturer and type will also be documented. Record any problems or malfunctions occurring during field use and present them with the instrument readings obtained.

6.0 REFERENCES

1. New York State Code of Rules and Regulations, 6NYCRR Part 360, Section 2.11(a)(12)(v)(a).

Appendix ____: Item _____ - CALIBRATION AND MAINTENANCE OF PORTABLE DISSOLVED OXYGEN METER

Applicability: GENERAL Revision No.: ____ Date: _____

Prepared By: EWM Date: 04/16/90 Approved By: KLB Date: 04/24/90

1.0 INTRODUCTION

This guideline presents a method for checking the calibration of a portable dissolved oxygen meter. The dissolved oxygen meter is to measure the dissolved oxygen content of surface water samples. In order to ensure an accurate reading, the calibration must be checked prior to using the meter in the field.

2.0 ACCURACY

The calibrated accuracy of the dissolved oxygen meter will be within ± one percent of full-scale over the temperature range of -5°C to +45°C.

3.0 CALIBRATION

The dissolved oxygen meter will be air calibrated based on probe temperature and true local atmospheric pressure conditions (or feet above sea level). Refer to the operation manual for detailed calibration procedures.

4.0 MAINTENANCE

1. When not in use or between measurements, the dissolved oxygen probe will be kept immersed in or moist with deionized water.

2. The meter batteries will be checked prior to each meter's use and will be replaced when the meter cannot be red-line adjusted.

3. The meter response time and stability will be tracked to determine the need for instrument maintenance. When response time becomes greater than two minutes, probe service is indicated. The probe will be cleaned, refilled with new KCL solution, and fitted with a new membrane. If the meter response and stability is not in accordance to manufacturer's specifications, the meter will be sent to the manufacturer for maintenance and repair.

4. A maintenance log will be kept for each dissolved oxygen meter. All maintenance performed on the instrument will be recorded on this log with date and name of the organization performing the maintenance.

5.0 DATA VALIDATION

All instrument calibrations will be documented, indicating the meter readings before and after the meter has been adjusted. Each preparation of probe and method of calibration will also be documented. This is important, not only for data validation, but also to establish maintenance schedules and component replacement.

052

Appendix ____: Item _____ - SAMPLING EQUIPMENT DECONTAMINATION PROTOCOLS

Applicability: NYSDEC-SPECIFICATION Revision No.: 2 Date: 12/5/89

Prepared By: AJM Date: 10/31/89 Approved By: KLB Date: 12/12/89

1.0 INTRODUCTION

This guideline presents a method for the decontamination of sampling equipment used in the collection of environmental samples.

2.0 HEALTH AND SAFETY

Nitric acid is a strong oxidizing agent as well as being extremely corrosive to the skin and eyes. Solvents such as acetone, methanl, hexane, and isopropanol are flammable liquids. Limited contact with skin can cause irritation, while prolonged contact may result in dermititis. Eye contact with the solvents may cause irritation or temporary corneal damage. Safety glasses with protective side shields, neoprene or nitrile gloves, and long-sleeve protective clothing must be worn whenever acids and solvents are being used.

3.0 METHODOLOGY

1. All equipment used in sampling must be clean and free from residue of any previous samples. To accomplish this, the following procedures are to be followed:

   a. wash equipment thoroughly with non-phosphate detergent and tap water[1] using a brush to remove any particulate matter or surface film;

   b. rinse with tap water[1];

   c. rinse with a 10% HNO_3 solution[2];

d. rinse with tap water[1];

e. rinse with pesticide grade acetone[3] or methanol[3];

f. rinse with pesticide grade-hexane[3];

g. rinse with deionized water (demonstrated-analyte-free)[4];

h. air dry; and

i. wrap in aluminum foil (shiny side out)

2. Well excavation equipment, such as submersible pumps and bailers, which are put into the borehole must be decontaminated following the procedures listed above. All excavation tubing must be dedicated to individual wells, (i.e., tubing cannot be reused).

3. Bailer cord must be cleaned with non-phosphate detergent and demonstrated analyte-free deionized water before use. Cord can be reused; it is not necessary to dedicate it to individual wells. If a ten (10) foot or greater length leader is being used, only the leader need be cleaned (assumes bailer cord is not allowed to contact water).

4. All unused sample bottles and sampling equipment must be maintained in such a manner that there is no possibility of casual contamination.

4.0 EQUIPMENT REQUIREMENTS

- personal protective garment and gear
- brush, buckets, and wash basins
- squirt bottles
- supply of solvents and water
- aluminum foil

5.0 REFERENCES

New York State Department of Environmental Conservation, Division of Hazardous Substances Regulation, August 1989, RCRA Quality Assurance Project Plan Guidance.

Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual, April 1, 1986. USEPA Region IV.

NOTES

(1) Tap water may be used from any municipal water treatment system. The use of an untreated potable water supply is not an acceptable substitute.

(2) Omit this step if metals are not being analyzed. For carbon steel split spoon samplers, a 1% rather than 10% HNO_3 solution should be used.

(3) This solvent rinse can be omitted if organics are not being analyzed. Alternatively, if approval from NYSDEC has been granted, use pesticide grade isopropanol as the cleaning solvent. Isopropanol is better suited as a cleaning solvent than acetone, methanol and hexane for the following reasons:

- Acetone is a parameter analyzed for on the Target Compound List (TCL); therefore the detection of acetone in samples collected using acetone rinsed equipment is suspect;
- Almost all grades of methanol contain 2-butanone (MEK) contamination. As for acetone, 2-butanone is a TCL compound. Thus, the detection of 2-butanone in samples collected using methanol rinsed equipment is suspect. In addition, methanol is much more hazardous than either isopropanol or acetone.
- Hexane is not miscible with water (hydrophobic) and therefore, is not an effective rinsing agent unless the sampling equipment is dry. Isopropanol is extremely miscible in water (amphoteric), making it an effective rinsing agent on either wet or dry equipment.

(4) Deionized water must be demonstrated to be analyte-free water. The criteria for analyte-free water are the Method Detection Limits (MDLs) for the analytes. Specifically for the common laboratory contaminants listed below, the allowable limits are set at three times the respective MDLs determined by the most sensitive analytical method:

1. Methylene Chloride
2. Acetone
3. Toluene
4. 2-Butanone
5. Phthalates

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APPENDIX F

HEALTH AND SAFETY PLAN

MALCOLM PIRNIE

HEALTH AND SAFETY PLAN
FOR
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
AT THE
OLD BATH LANDFILL

STEUBEN COUNTY DEPARTMENT OF PUBLIC WORKS
BATH, NEW YORK

JUNE 1991
REVISED OCTOBER 1991

MALCOLM PIRNIE, INC.

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Buffalo, New York 14219

MALCOLM PIRNIE

HEALTH AND SAFETY PLAN
FOR
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
OLD BATH LANDFILL

TABLE OF CONTENTS

MALCOLM PIRNIE

HEALTH AND SAFETY PLAN
FOR
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
OLD BATH LANDFILL

TABLE OF CONTENTS (continued)

LIST OF FIGURES

LIST OF TABLES

LIST OF ATTACHMENTS

MALCOLM PIRNIE

1.0 INTRODUCTION

1.1 GENERAL

In accordance with Malcolm Pirnie, Inc. corporate policies, this Health and Safety Plan (HASP) was prepared to address the specific health and safety practices and procedures associated with the remedial investigation/feasibility study (RI/FS) activities at the Old Bath Landfill, located in the Town of Bath, Steuben County, New York. The Plan presents information and procedures for Malcolm Pirnie and Steuben County employees who will be involved with field activities, including the assignment of responsibilities, personnel protection requirements, work practices and emergency response procedures. This document is based on an assessment of potential health hazards at the site, using available historical information. Environmental monitoring will be performed during the course of field activities to provide real-time data for an on-going assessment of potential hazards.

All Malcolm Pirnie and Steuben County personnel involved with geologic surveys, multi-media environmental sampling, and other remedial investigation activities will be required to comply with this Health and Safety Plan. Construction contractors and subcontractors involved with any drilling operations will be required to provide their own Health and Safety Plans. Site control during drilling activities will be the responsibility of the drilling contractor. Malcolm Pirnie, Inc. accepts no responsibility for the Health and Safety of drilling contractor personnel.

Enforcement and adherence to this Health and Safety Plan will minimize the potential for injury, loss of life, and exposure to health hazards. The Pirnie Project Manager, the Health and Safety Officer and the Site Health and Safety Coordinator (or his designee) identified below will determine and enforce compliance.

- PROJECT MANAGER

Name:	Kent R. McManus, P.E.	
Telephone:	Office:	(716) 667-0900
	Home:	(716) 667-3081

- CORPORATE HEALTH AND SAFETY MANAGER:

Name:	Mark McGowan	
Telephone:	Office:	(914) 641-2484
	Emergency:	(800) 478-6870

- SITE HEALTH AND SAFETY OFFICER

Name:	Judith Vangalio	
Telephone:	Office:	(716) 667-0900
	Home:	(716) 662-5404

- SITE HEALTH AND SAFETY COORDINATOR

Name:	Richard Dubisz	
Telephone:	Office:	(716) 667-0900
	Home:	(716) 655-7406

This Plan addresses the requirements set forth in the OSHA Health and Safety regulations contained in 29 CFR 1910 and 1926. An emergency response plan has been included as Attachment 2 to this HASP which can be readily detached for use in the event of an emergency requiring site evacuation, medical treatment, etc.

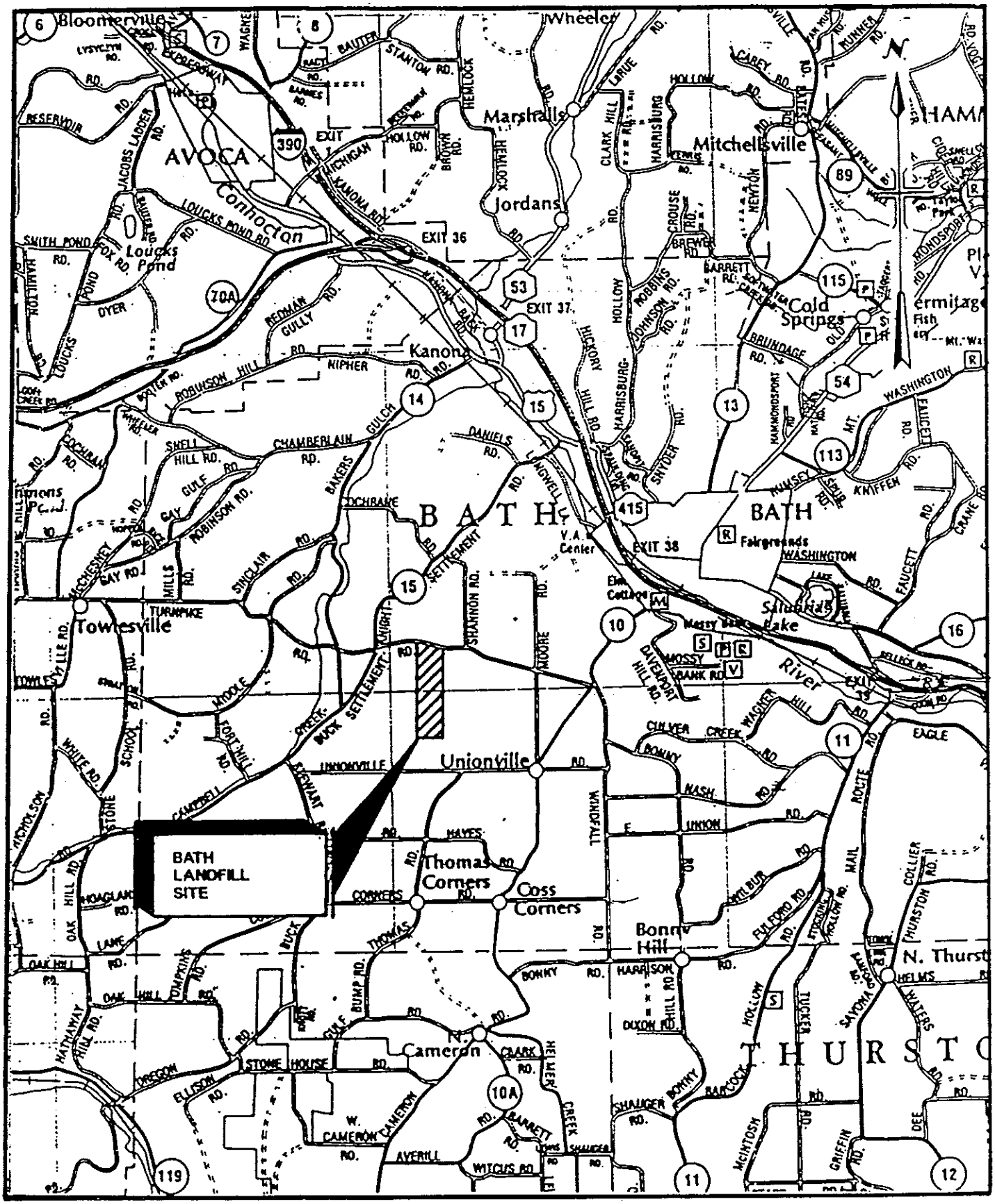
1.2 BACKGROUND

The Old Bath Landfill (the site) is approximately 30 acres in size and is located on a 145-acre parcel of land approximately three (3) miles southwest of the Village of Bath, New York atop McPherson Hill (see Figure 1-1). The site is bounded by Knight Creek to the north and east, Campbell creek to the west, and Maxwell Creek to the south.

Operation of the Old Bath Landfill began during 1978. The landfill was utilized by the Steuben County Highway Department for the disposal of both sanitary and industrial wastes until its closure in November 1988. A 22-acre landfill expansion (New Bath Landfill) is presently operating on the south side of the Old Bath Landfill under a NYSDEC permit issued November 1988.

Previous subsurface investigations and results of quarterly monitoring conducted at the Bath Landfill site have determined that the overburden and bedrock water-bearing zones are contaminated with volatile organic compounds as well as some metals at concentrations exceeding New York State Class "GA" Ground Water Quality Standards. To date, a total

FIGURE 1-1



MALCOLM PIRNIE

OLD BATH LANDFILL
RI/FS

VICINITY MAP

STE-11

STEUBEN COUNTY DEPT. OF PUBLIC WORKS APRIL 1991

of 44 ground water monitoring wells have been installed on the 145-acre parcel of land. A total of 32 wells are currently monitored on a quarterly basis as a condition of the NYSDEC Operations Permit.

The NYSDEC has determined that the Old Bath Landfill is an inactive hazardous waste site, as that term is defined at ECL Section 27-1301(2). Consequently, the site has been listed in the Registry of Inactive Hazardous Waste Disposal Sites in new York as Site Number 851014 and the DEC has classified the site as a classification "2" pursuant to ECL Section 27-1305(4)(b). Subsequently, Steuben County has entered into a Consent Order - effective February 19, 1991 - to undertake certain remedial activities, including an interim remedial measures (IRM) program and remedial investigation/feasibility study (RI/FS). A more detailed discussion of IRM Program activities is presented in the "Old Bath Landfill Interim Remedial Measures (IRM) Concept Design Report". A more detailed discussion of RI/FS activities is presented in the "Field Sampling and Quality Assurance/Quality Control Plan for the RI/FS at the Old Bath Landfill".

1.3 REMEDIAL INVESTIGATION/FEASIBILITY STUDY OBJECTIVES

Requirements of the Consent Order include performance of a Remedial Investigation/Feasibility Study (RI/FS) and design and implementation of the selected remedial alternative(s).

Primary objectives of the remedial investigation will be to identify flow characteristics within the landfill and to determine hydraulic and hydrogeologic conditions in the bedrock in the vicinity of the landfill to better define contaminant migration pathways. In addition, sediment, ground water and leachate will be characterized to more completely assess any risks to human health and the environment, and to evaluate the need for ground water/leachate treatment.

1.4 SCOPE OF RI/FS ACTIVITIES

Malcolm Pirnie, Inc. personnel will be responsible for the field sampling and survey monitoring portions of the remedial investigation/feasibility study. The major activities to be completed as part of the RI/FS include:

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- Electromagnetic Conductivity Survey
- Seismic Refraction Survey
- Borehole Drilling
- Installation of Monitoring Wells
- Ground Water Elevation Monitoring
- In-situ Hydraulic Conductivity Testing
- Surface Water/Sediment Sampling
- Ground Water/Leachate Sampling

2.0 HAZARD EVALUATION

2.1 CHEMICAL HAZARDS

As discussed in Section 1.2, waste handling activities conducted during the history of the site include the depositing of industrial and sanitary wastes. Previous field investigations have provided information concerning the types of contaminants which are likely to be encountered during the remedial investigation/feasibility study activities. Table 2-1 identifies contaminants determined present during previous field investigations at the site. Potential contaminants include volatile organics, phenol, and heavy metals. Heavy metals are generally not considered a health concern unless there is a potential for prolonged skin contact or ingestion. Since only limited potential exposure to heavy metals is anticipated during the course of RI/FS activities at the site, heavy metals are not considered "contaminants-of- concern". Table 2-2 lists toxicity and exposure data for the "contaminants of concern" identified in Table 2-1. Brief descriptions of the toxicology of these materials and related health and safety guidance and criteria are provided below.

- **Acetone** is a colorless liquid having a characteristic odor. In high concentrations, acetone vapors can irritate the eyes and skin. However, acetone has a very low skin toxicity rating. Prolonged inhalation of vapors may lead to headache or narcotic effects. Acetone is flammable, and explosion may occur if the vapors are exposed to flame.

- **Benzene** poisoning occurs most commonly through inhalation of the vapor, however, benzene can also penetrate the skin and poison in that way. Locally, benzene has a comparatively strong irritating effect, producing erythema and burning and, in more severe cases, edema and blistering. Exposure to high concentrations of the vapor (i.e. 3000 ppm or higher) may result in acute poisoning characterized by the narcotic action of benzene on the central nervous system. In acute poisoning, symptoms include confusion, dizziness, tightening of the leg muscles, and pressure over the forehead. Chronic exposure to benzene (i.e. long-term exposure to concentrations of 100 ppm or less) may lead to damage of the blood-forming system. Benzene is very flammable when exposed to heat or flame, and can react vigorously with oxidizing materials.

- **Chloroethane** is a colorless gas with an ethereal, pungent odor and is flammable at ordinary temperature and pressure. Slight symptoms of toxicity may be exhibited after inhalation of 13,000 ppm. Stomach cramps, stupor and eye irritation may occur at greater concentrations.

TABLE 2-1

HEALTH AND SAFETY PLAN FOR REMEDIAL INVESTIGATION ACTIVITIES AT THE OLD BATH LANDFILL POTENTIAL CONTAMINANTS[1]

Parameter	Ground Water Concentration Range	Leachate Concentration Range
Inorganics (ppm)		
Arsenic	<0.001 - 0.056	0.002 - 0.011
Barium	<0.1 - 5.4	<0.1 - 0.2
Cadmium	<0.01 - 0.27	
Chromium		<0.01 - 0.07
Copper	<0.02 - 0.12	<0.02 - 10
Iron	0.40 - 2000	3.9 - 68
Lead	<0.005 - 0.49	0.007 - 0.070
Magnesium	0.08 - 815	<0.05 - 24
Manganese	0.04 - 230	0.31 - 2.2
Nickel	<0.04 - 4.7	0.05 - 0.09
Organics (ppb)		
Acetone	<10 - 37,256	39 - 4000
1,1-dichloroethane	<5 - 113	-
1,2-dichloroethane	<5 - 29	-
2-hexanone	<10 - 215	-
Methylene Chloride	<5 - 1,603	3 - 2,500
Methyl Isobutyl Ketone	<10 - 13,392	<10 - 2
Methyl Ethyl Ketone	<10 - 7,574	<10 - 23
Trichloroethene	<5 - 31	-
Vinyl Chloride	<5 - 7	-
Benzene	<5 - 114	-
Ethylbenzene	<5 - 104	<5 - 5.8
Toluene	<5 - 1,987	<5 - 61
Xylenes	<5 - 276	<5 - 14
Total Phenols (ppm)	<0.001 - 6.32	<0.001 - 0.730

NOTE:

(1) This is a partial list of contaminants based on quarterly ground water monitoring studies conducted in 1990.

TABLE 2-2

HEALTH AND SAFETY PLAN FOR REMEDIAL INVESTIGATION ACTIVITIES AT THE OLD BATH LANDFILL TOXICITY AND EXPOSURE DATA

Contaminant of Concern	Inhalation Hazard		Dermal Hazard	LD_{50} mg/kg	Fire/Explosion Hazard
	TWA (ppm)	TLV (ppm)			
Acetone	1,000	750	Low	9,750	High/Mod
Benzene	10	10	High	3,800	High/Mod
1,1-Dichloroethane	100	200	Mod	1,120	-/-
1,2-Dichloroethane	100	200	Mod	1,120	-/-
Ethyl Benzene	100	100	Mod	3,500	High/-
2-Hexanone	100	5	Mod	2,590	High/Mod
Methylene Chloride	500	100	Mod	167	-/Low
Methyl Ethyl Ketone	-	200	Low	3,400	High/Mod
Methyl Isobutyl Ketone	-	50	-	-	-/-
Trichloroethene	100	50	High	4,920	Slight
Toluene	200	100	Low	5,000	Slight/Mod
Vinyl Chloride	1	5	High	500	High/High
Xylenes	100	100	-	5,000	High/Mod
Phenol	5	20	Mod	414	Mod/Slight

NOTES:

TWA = Time Weighted Average established by OSHA, equals the maximum exposure concentration allowable for 8 hours per day @ 40 hours per week.

TLV = Threshold Limit Value established by ACGIH, equals the maximum exposure concentration allowable for 8 hours per day @ 40 hours per week.

- **Chloromethane** is a colorless gas with an ethereal odor and sweet taste. Repeated exposure to low concentrations causes damage to the central nervous system and less frequently, to the liver, kidneys, bone marrow and cardiovascular system. Exposure to higher concentrations may cause dizziness, drowsiness and incoordination.

- **1,1-Dichloroethane** may be moderately toxic via oral or skin absorption routes. Upon heating to decomposition, toxic fumes of chlorine will be emitted.

- **1,2-Dichloroethene** is a colorless, volatile liquid which is highly toxic via oral or inhalation routes. 1,1-Dichloroethene is a carcinogen and can explode spontaneously. Violent reactions can occur when this substance is exposed to oxidizing materials.

- **Ethyl Benzene** is a colorless, aromatic liquid which can irritate the eyes, skin and mucous membranes at a concentration of 0.1% in air. Exposure to higher concentrations may cause dizziness and a sense of constriction of the chest. Ethyl benzene is flammable, and can react vigorously with oxidizing materials.

- **2-Hexanone** is a clear liquid which can irritate the skin and eyes. 2-Hexanone is flammable, and can explode when exposed to heat or flame.

- **Methane** is a colorless, odorless, tasteless gas which acts as an asphyxiant. Methane gas is very dangerous when exposed to heat or flame, and can explode under these conditions. Since methane does not retain any toxic effects other than the potential displace oxygen (i.e. act as an asphyxiant), no TWA or TLV data has been established for this gas.

- **Methylene chloride** is a colorless, volatile liquid which has been used as an anesthesia in Europe. Methylene chloride is very dangerous to the eyes, however, except for its property of inducing narcosis, it has very few other acute toxicity effects. The limit of perception by smell for methylene chloride is set at 25-50 ppm. Methylene chloride can decompose at elevated temperatures and yield toxic fumes.

- **Methyl ethyl ketone** (MEK) exerts low toxicity following acute and chronic exposures. High concentrations in air may be irritating to the eyes, nose and throat, and prolonged exposure may result in central nervous system depression and narcosis. Prolonged skin contact may result in defatting of the skin and produce dermatitis. Eye contact may produce painful irritation and cornea injury.

- **Methyl Isobutyl Ketone (MIBK)** is a colorless liquid with a characteristic sweet, sharp odor. MIBK is a skin and eye irritant and has a narcotic effect upon exposure to high concentrations. MIBK poses a moderate explosion hazard when exposed to heat or flame.

- **Phenolic** compounds are readily absorbed through the intact and abraded skin and from the stomach. Generally, phenolic vapors are readily absorbed into the pulmonary circulation. Local skin damage may include inflammation, excema, and discoloration. Following ingestion, the mucous membranes of the throat and esophagus may show swelling. Although phenolic compounds may vary widely in effect, in general, contact with the eyes or inhalation of dust or vapors, liberated particularly at elevated temperatures, must be avoided. The threshold limit value adopted by the American Conference of Governmental Industrial Hygienists (ACGIH) and the OSHA time-weighted average concentration standard for phenol in the atmosphere is 5 ppm.

- **Tetrachloroethene** is a colorless liquid having a chloroform-like odor. Tetrachloroethene may be toxic via inhalation routes, prolonged or repeated contact with the skin, or when ingested by mouth exposures to concentrations above 200 ppm can cause irritation and burning of the eyes, nose, and throat. There may be vomiting, nausea, drowsiness, an attitude of irresponsibility and even an appearance resembling alcoholic intoxication. This material acts as an anesthetic through the inhalation of excessive amounts within a short time. Tetrachloroethene can cause dermatitis, particularly after repeated or prolonged skin contact.

- **Trichloroethylene** (TCE) is a common industrial solvent used primarily in dry cleaning and metal degreasing. Trichloroethylene exposure at levels of 200 ppm has been associated with mild behavioral and psychomotor effects, including vertigo, fatigue and headache. TCE is a suspected human carcinogen. The principal routes of potential personnel exposure to TCE are through inhalation of volatized TCE and direct skin contact.

- **Toluene** is an organic liquid derived from coal tar. Exposure to toluene may cause narcotic effects (impairment of coordination and reaction time) loss of appetite, headache, nausea, and eye irritations. Generally, acute poisoning due to exposures to high concentrations are rare, and individuals recover easily when removed from the exposure.

- **Vinyl chloride** is a synthetic chlorinated organic chemical used in the manufacture of polyvinyl chloride (PVC). Its presence in site-specific circumstances may be attributable to breakdown of the halogenated aliphatic hydrocarbons TCE and 1,2-trans-dichloroethene to vinyl chloride. In high concentrations, vinyl chloride may cause reversible narcosis similar to alcohol intoxication. Skin contact with undiluted vinyl chloride results in frostbite by rapid evaporation and subsequent freezing. It is unlikely that these acute effects would be observed at the concentrations and site-specific exposure scenarios expected. Chronic exposure to vinyl chloride through inhalation has been associated with liver toxicity, fatty deposition in particular. Vinyl chloride is considered to be a suspect carcinogen.

- **Xylenes** are clear, colorless liquids which irritate the eyes at approximately 200 ppm. When exposed to heat or flame, these compounds may ignite or cause explosion. Upon heating to decomposition, acrid smoke and fumes may be emitted.

With respect to the anticipated RI/FS activities defined in Section 1.2, possible routes of exposure to the above-mentioned contaminants are presented in Table 2-3.

The use of proper respiratory equipment, as outlined in Section 7.0, will minimize the potential for exposure to airborne contamination. Further, exposure to contaminants through dermal and other routes will also be minimized through the use of protective clothing (Section 7.0), safe work practices (Section 6.0), and proper decontamination procedures (Section 11.0).

2.2 PHYSICAL HAZARDS

Installation of monitoring wells and borehole drilling at the Old Bath Landfill may present the following physical hazards:

- The potential for physical injury during heavy construction equipment use, such as drill rigs.
- The potential for heat/cold stress to employees during the summer/winter months.
- The potential for injury due to rough, uneven terrain.
- The potential for injury due to fire/explosion if methane gas is released during drilling operations.

These hazards represent only a portion of the possible means of injury which may be present during RI/FS activities at the Old Bath Landfill. Since it is impossible to list all potential sources of injury, it shall be the responsibility of each individual to exercise proper care and caution during all phases of the work.

2.3 SUMMARY OF PROJECTED RISKS

Due to the variety of potential contaminants at the site, the possibility exists that workers will be exposed to hazardous substances during field activities (see Table 2-3). The

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TABLE 2-3

HEALTH AND SAFETY PLAN
FOR
REMEDIAL INVESTIGATION/FEASIBILITY STUDY ACTIVITIES
AT THE OLD BATH LANDFILL

POTENTIAL ROUTES OF EXPOSURE TO CONTAMINANTS-OF-CONCERN

Activity	Direct Contact with Soil	Direct Contact with Surface Water	Direct Contact with Ground Water or Leachate	Inhalation of Vapors/Dust Particles
Perform Electromagnetic Conductivity Survey	X		X	X
Perform Seismic Refraction Survey	X		X	X
Drill Boreholes	X	X	X	X
Install Monitoring Wells	X		X	X
Record Ground Water/ Leachate Elevation			X	X
Conduct In-situ Hydraulic Conductivity Testing	X		X	X
Collect Surface Water/ Sediment Samples	X	X		X
Collect Ground Water/ Leachate Samples			X	X

principal points of exposure would be through direct contact with contaminated fill/soils and leachate, and through the inhalation of contaminated particles or vapors. Other points of exposure include direct contact with surface water and/or ground water. In addition, the use of drill rigs on-site will also present conditions for potential physical injury to workers. Further, since work will be performed during summer/winter time periods, the potential exists for heat/cold stress to impact workers especially those wearing protective equipment and clothing.

Although no work at a landfill site can be considered completely risk-free, logical and reasonable precautions can be implemented to provide an adequate level of protection for workers. The integration of medical evaluations, worker training relative to chemical hazards, safe work practices, proper personal protection, environmental monitoring, work zones and site control, appropriate decontamination procedures and contingency planning into the project approach minimizes the chances for unnecessary exposures and physical injuries.

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3.0 RESPONSIBILITIES OF SAFETY PERSONNEL

The following roles have been identified for Malcolm Pirnie project personnel:

Project Manager - The Project Manager has full responsibility for implementing and executing an effective program of employee protection and accident prevention. He may delegate authority to expedite and facilitate any application of the program.

Health and Safety Manager - The Health and Safety Manager serves as the administrator of the corporation's health and safety program. He is responsible for ensuring that Malcolm Pirnie field personnel are properly trained, that they have obtained medical clearance to wear respiratory protection (per 29 CFR Part 1910.134(b)(10)), and that they are properly trained in the selection, use and maintenance of personal protective equipment, including qualitative respirator fit testing.

The Health and Safety Manager will also serve as scientific advisor for the duration of the project, providing guidance on data interpretation and the determination of appropriate levels of worker protection.

Site Health and Safety Officer - The Site Health and Safety Officer is knowledgeable in safety and worker protection techniques as they relate to the project. Responsibilities include the development of the specific provisions of this HASP, including the level of personnel protection to be employed, identification of emergency procedures, and personnel/equipment decontamination procedures. This individual will provide technical assistance to project management on problems relating to industrial hygiene and work site safety.

Any health and safety briefings required during the course of the project will be conducted by the Site Health and Safety Officer. Examples of briefings might include accident prevention, respirator refresher courses or current issues. The frequency of safety briefings will be based upon the potential hazards specific to the designated work tasks and any new information relative to such hazards which are discovered during the project.

Site Health and Safety Coordinator - Malcolm Pirnie's Site Health and Safety Coordinator or his/her designee will be responsible for enforcement of this HASP for Malcolm Pirnie employees at the site and for monitoring the personal exposures of employees to hazardous substances contained in air, soil or water. This will consist of spot checking workplace air sampling performed by the contractor such as organic vapor monitoring and the documentation of such data. Malcolm Pirnie's Site Health and Safety Coordinator or his/her designee will communicate directly with Malcolm Pirnie's Site Health and Safety Officer on a regular basis to advise him of monitoring results and any unexpected conditions found at the site. As data are received and evaluated, the Site Health and Safety Officer will adapt this Health and Safety Plan to fit the current Malcolm Pirnie employee protection needs at the site. All Malcolm Pirnie employees and the contractor's designated Site Health and Safety Officer will be informed of the air sampling results.

When unsafe work conditions are identified, the Site Health and Safety Coordinator or his/her designee is authorized to order Malcolm Pirnie personnel to stop work. Resolution of all on-site health and safety problems will be coordinated through the Project Manager with assistance from the Health and Safety Manager and Site Health and Safety Officer as well as the contractor's designated Health and Safety personnel.

4.0 MEDICAL SURVEILLANCE

Medical monitoring, including initial employment, annual and employment termination examinations will be provided to Pirnie employees whose work may result in potential chemical exposure or present unusual physical demands. Medical evaluations will be performed by an occupational physician designated by Malcolm Pirnie, Inc. The medical evaluations will be conducted according to the Malcolm Pirnie, Inc. Medical Monitoring Program and include an evaluation of the workers' ability to use respirator protective equipment (as per 29CFR 1910). The examination will include:

- Occupational history;
- Medical history;
- Medical review;
- Medical surveillance examination with emphasis on organ systems potentially affected by toxic substances identified in the work environment;
- Medical certification of physical requirements (sight, hearing, musculoskeletal, cardiovascular) for safe job performance; and
- Laboratory testing to include a complete blood count, white cell differential count, serum multiphasic screening and urinalysis.

The purposes of the medical evaluation are to: (1) determine fitness for duty on hazardous waste sites (such an evaluation is based upon the employee's occupational and medical history, a comprehensive physical examination and an evaluation of the ability to work while wearing protective equipment); and (2) establish baseline medical data.

Supplemental examinations may be performed whenever there is an actual or suspected excessive exposure to chemical contaminants or upon experience of exposure symptoms, or following injuries or temperature stresses.

In conformance with OSHA regulations, Malcolm Pirnie will maintain and preserve medical records for a period of 30 years following termination of employment. Employees have access to the results of medical testing and to full medical records and analyses.

MALCOLM PIRNIE

5.0 EMPLOYEE TRAINING PROGRAM

All employees who may be exposed to hazardous substances, health hazards, or safety hazards shall be adequately trained prior to engaging in any on-site work activities. At a minimum, such training shall include an initial 40-hour Hazardous Waste Site Worker Protection Course, an 8-hour Annual Refresher Course subsequent to the initial 40-hour training, and 3 days of actual field experience under the direct supervision of a trained, experienced supervisor (i.e., the Health and Safety Coordinator or his/her designee). This training shall be conducted by a qualified instructor and shall be specifically designed to meet the requirements of OSHA Standard 29CFR 1910.120(e)(2). At a minimum, the initial 40-hour training course will include the following:

TOPICS

- OSHA/SARA/EPA/RCRA/HCS Requirements
- Decontamination of Personnel & Equipment
- Fire, Explosion & Accident Prevention
- Respiratory Protection Selection & Use
- Preparation of Health & Safety Plans
- Emergency Preparedness & Escape
- Protective Clothing Use & Selection
- Air Monitoring & Surveillance
- Work Practices to Minimize Risk
- Waste Site Safety
- Hazard Recognition
- Medical Surveillance
- Cold & Heat Stress
- Site Entry & Set-Up
- Permissible Exposure Limits
- Site Control & Work Zones
- Chemical & Physical Hazards
- Confined Space Entry

WORKSHOPS/EXERCISES

- Self-Contained Breathing Apparatus
- Air Monitoring Equipment Workshop
- Air Purifying Respirator Workshop
- Decontamination
- Qualitative/Quantitative Fit Test
- Level A/B Field Exercise
- Level B/C Field Exercise
- Air Tank Refilling Workshop

Records and certifications received from the course instructor documenting each employee's successful completion of the training identified above will be maintained on file

in Malcolm Pirnie's Buffalo and White Plains corporate headquarters offices. Subcontractors will be required to provide similar documentation of training for all their personnel who will be involved in on-site work activities.

Any employee who has not received adequate training and has been so certified shall be prohibited from engaging in on-site work activities that may involve exposure to hazardous substances, health hazards or safety hazards.

Periodic health and safety briefings will be conducted by Malcolm Pirnie's Site Health and Safety Officer for Malcolm Pirnie employees on an as-needed basis. Problems relative to respiratory protection, inclement weather, heat/cold stress or the interpretation of newly-available environmental monitoring data are examples of topics which might be covered during these briefings.

MALCOLM PIRNIE

6.0 SAFE WORK PRACTICES

All Malcolm Pirnie employees shall conform to the following safe work practices during all on-site work activities conducted within the exclusion zone:

- Eating, drinking, chewing gum or tobacco, smoking, or any practice which increases the probability of hand-to-mouth transfer of contaminated material is strictly prohibited;

- The hands and face must be thoroughly washed upon leaving the work area and prior to engaging in any activity indicated above. Each individual must shower at facilities provided by the Contractor as soon as possible after the removal of protective clothing and equipment after the completion of the daily field activities;

- Any required respiratory protective equipment and clothing **must** be worn by all personnel going on-site. Excessive facial hair (i.e., beards, long mustaches or sideburns), which interferes with the satisfactory respirator-to-face seal is prohibited;

- Contact with surfaces/materials either suspected or known to be contaminated will be avoided to minimize the potential for transfer to personnel, cross-contamination and need for decontamination;

- Medicine and alcohol can potentiate the effects of exposure to toxic chemicals. Due to possible contraindications, use of prescribed drugs should be reviewed with the Pirnie occupational physician. Alcoholic beverage and illegal drug intake are strictly forbidden during site work activities;

- All personnel shall be familiar with standard operating safety procedures and additional instructions contained in this Health and Safety Plan;

- On-site personnel shall use the "buddy" system. No one may work alone, i.e., out of earshot or visual contact with other workers in the exclusion zone;

- Personnel and equipment in the contaminated area shall be minimized, consistent with effective site operations;

- All employees have the obligation to correct or report unsafe work conditions;

- Use of contact lenses on-site will not be permitted. Spectacle kits for insertion into full-face respirators will be provided for MPI employees, as required.

The recommended general safety practices for working around the drilling contractor's equipment (i.e. drill rigs) are as follows:

- Although the drilling contractor is responsible for his equipment and the safe operation of the site, Malcolm Pirnie personnel are also responsible for their own safety. The drilling contractor's equipment should always be inspected prior to use to check for obvious structural damage, loose nuts and bolts, loose or missing guards, cable guides or protective covers, fluid leaks, damaged hoses, cables, pressure gauges or pressure relief valves, and damaged drilling tools and equipment. The equipment should also have a fire extinguisher. The drilling contractor shall report any potential problems with his equipment to the Malcolm Pirnie Site Health and Safety Coordinator or his/her designee. If the condition of the equipment is considered to be unsafe based on the drilling contractor's inspection, and/or the Malcolm Pirnie Site Health and Safety Coordinator's inspection, have the drilling contractor make the necessary repairs prior to beginning construction. If the drilling contractor refuses to fix the equipment or is not operating the equipment safely, the job site will be closed down and the Project Manager contacted for additional instructions.

- Drilling will not be initiated without first clearing underground services such as; hydro, gas, water, telephone, sewer and cable T.V.

- Drill rigs should not be operated within 20 feet of overhead wires. This distance may be increased if windy conditions are anticipated. The site should also be clear to ensure the project staff can move around the drill rig safely.

- A drill rig must not be moved from site to site with the drill mast in the raised position.

- Hard hats and safety boots must be worn at all times in the vicinity of the drill rig. Hearing protection is also recommended. Safety glasses are necessary.

- Slippage is one of the most common causes of accidents around drill rigs. Drainage should be provided to divert mud and water away from the construction site.

- The drilling contractor should keep the construction site tidy. This will prevent personnel from tripping and will allow for fast emergency exit from the site.

- The presence of combustible gases should be checked before igniting any open flame (e.g., during welding).

- Proper lighting will be provided if drilling at night.

- Drilling will be discontinued during an electrical storm.

MALCOLM PIRNIE

7.0 PERSONAL PROTECTIVE EQUIPMENT

7.1 PROTECTION LEVELS

Personnel must wear protective equipment when work activities involve known or suspected atmospheric contamination; when vapors, gases, or particulates may be generated; or when direct contact with dermally active substances may occur. Respirators can protect the lungs, the gastro-intestinal tract and the eyes against air toxicants. Chemical-resistant clothing can protect the skin from contact with skin-destructive and skin-absorbable chemicals. Good personal hygiene and safe work practices, as identified in Section 6.0, are also necessary to limit or prevent the ingestion of potentially harmful substances.

Based upon current information regarding both the contaminants suspected to be present at the Old Bath Landfill site and the various tasks that are included in the remedial investigation/feasibility study, the minimum required Levels of Protection shall be as identified in Table 7-1.

TABLE 7-1
HEALTH AND SAFETY PLAN FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY ACTIVITIES AT THE OLD BATH LANDFILL
REQUIRED LEVELS OF PROTECTION:(1)

Activity	Respiratory*	Clothing(2)	Gloves	Boots	Other Modifications(3)
Electromagnetic Conductivity Survey	D	T	L	L	Hard Hat, Dust Mask
Seismic Refraction Survey	D	T	L	L	Hard Hat, Dust Mask
Drill Boreholes	D/C	T	L/N	L	Hard Hat, Dust Mask
Install Monitoring Wells	D/C	T	L/N	L	Goggles, Hard Hat, Dust Mask
Monitor Ground Water/ Leachate Elevation	D/C	T	L/N	L	Goggles, Hard Hat, Dust Mask
In-situ Hydraulic Conductivity Testing	D/C	T	L	L	Hard Hat, Dust Mask
Collect Surface Water/ Sediment Samples	C/B	T	L/N	L	Goggles, Hard Hat,
Collect Ground Water/ Leachate Samples	C/B	T	L/N	L	Goggles, Hard Hat,

NOTES:
(1) T = Tyvek; L = Latex; N = Nitrile
(2) Tyvek uniforms will be worn when Level C conditions are present (mandatory) or when Level D conditions are present (optional). In the event that Level B conditions are present, work uniforms shall be upgraded to Saranex (see Attachment 1).
(3) At the discretion of the Site Health and Safety Officer, respirators will be donned whenever potentially contaminated airborne particulate (i.e., dust) are generated in significant amounts in the breathing zone.
* Respiratory protection shall correspond to guidelines presented in Section 8.2. The Level C requirement is an air-purifying cartridge respirator equipped with Organic Compound/Acid Gases/Dust cartridges.

8.0 ENVIRONMENTAL MONITORING

8.1 GENERAL APPROACH

8.1.1 On-site Monitoring

The level of protection established for Malcolm Pirnie and Steuben County employees will initially be based upon qualitative and quantitative determinations of the contaminants present in the work environment. Concentration of contaminants known to be present in the ground water at the site have been used to determine the minimum required levels of personal protection described in Section 7.0. Based upon the existing data base, organic vapors are anticipated during both intrusive investigations and sampling activities. Ambient breathing zone concentrations may, at times, exceed the permissible exposure limits (PEL) established by OSHA for the individual compounds (see Table 2-2), in which case respiratory protection will be required. Respiratory and dermal protection may be modified (upgraded or downgraded) based upon real-time field monitoring data.

Contaminated soil, leachate and ground water are most likely to be encountered during borehole drilling, monitoring well installation, and sampling activities. The real-time field monitoring program to be implemented by the drilling contractor will indicate the potential for the volatilization of contaminants as well as the presence of respirable dust when the soil is physically disturbed by drilling equipment. A combustible gas meter and total organic vapor analyzer may be utilized by Malcolm Pirnie's personnel to verify field conditions during drilling operations. Real time monitoring will be performed by Malcolm Pirnie personnel on a daily basis during all other on-site activities such as sample collection and reconnaissance surveys. The necessary level of respiratory protection will be based upon these monitoring results.

Monitoring instruments will be protected from surface contamination during use to allow for easy decontamination. The monitoring instruments will be placed on plastic sheeting to avoid surface contact. Additional monitoring instruments may be added if the situations or conditions change.

Prior to drilling activities, background instrumentation measurements will be established and recorded with all support equipment engines turned off to eliminate the interfering effect of exhaust. All field measurements of this nature will be obtained and

documented on the appropriate forms by the site Health and Safety Coordinator or his/her designee.

During drilling and soil examination operations, the work area surrounding the borehole will be monitored at regular intervals using an HNu photoionization detector, (or similar organic vapor monitoring device) as well as an explosimeter and a particulate meter. Observed values will then be recorded and maintained as part of the permanent field record. Breathing zone monitoring will be performed at on-hour intervals at a minimum. The actual frequency of breathing zone monitoring will be dependent primarily upon values generated by screening the cuttings and the proximity of the worker's breathing zones to the source of contamination. Contaminant values which are in excess of established action levels appropriate for the prescribed level of protection will be immediately addressed. These action levels are given in Section 8.2 of this HASP.

Any split-spoon samples which are collected will be surveyed with the HNu, or similar equipment as each sample is retrieved. These values will be recorded with the respective sample number and will assist in the determination of the adequacy of employee protective equipment.

8.1.2 Off-site Community Monitoring

In addition to on-site monitoring within the work zone(s), monitoring at the down-wind portion of the site perimeter may be required if the work zone air concentrations of organic vapors, explosive gases or particulates exceed established limits (see Section 8.2.2) for a sustained period of five (5) minutes or longer. This will provide a real-time method for determination of substantial vapor and/or particulate releases to the surrounding community as a result of intrusive investigations and/or sampling at the site.

In the event that work-zone conditions warrant perimeter monitoring, the monitoring will be performed at the downwind perimeter location at regular intervals (viz. at a minimum of once per half hour) until such time as work zone concentrations decrease to below the perimeter monitoring action levels. If sustained concentrations of organic vapors, explosive gas, or particulates are detected in excess of the threshold values identified in Section 8.2.2 at the downwind perimeter location for a period of five (5) minutes or longer, the local Fire Department shall be immediately notified. Pertinent information including

the telephone number and address of the Fire Department are included in Attachment No. 2 - Emergency Response Plan.

8.2 MONITORING ACTION LEVELS

8.2.1 On-site Levels

The Hnu or other appropriate instrument(s) will be used by either Malcolm Pirnie, Inc. personnel or the drilling contractor to monitor organic vapor concentrations as specified in this plan and in the contractor's Health and Safety Plan. Methane gas will be monitored with the "combustible gas" option on the explosimeter/tritector or other appropriate instrument(s) in accordance with the drilling contractor's Health and Safety Plan. In addition, fugitive dust/particulate concentrations will be monitored using a real-time particulate monitor as specified in this plan and in the contractor's Health and Safety Plan. Readings obtained in the breathing zone may be interpreted (with regard to other site conditions) as follows for on-site MPI/Steuben County personnel:

- Total atmospheric concentrations of unidentified vapors or gases ranging from 0 to background on the Hnu - Continue Operations Under Level D (see Attachment 1).
- Total atmospheric concentrations of unidentified vapors or gases yielding sustained readings above background to 5 ppm on the Hnu (vapors not suspected of containing high levels of chemicals toxic to the skin) - Continue Operations Under Level C (see Attachment 1).
- Total atmospheric concentrations of unidentified vapors or gases yielding sustained readings of 5 to 50 ppm above background on the Hnu - continue operations under Level B (see Attachment 1), re-evaluate and alter (if possible) Work Plan to achieve lower vapor concentrations.
- Total atmospheric concentrations of unidentified vapors or gases above 50 ppm on the Hnu - discontinue engineering operations and exit the work zone immediately.

The explosimeter will be used to monitor levels of both combustible gases and oxygen during construction activities. Action levels based on the instrument readings shall be as follows:

- Less than 10% LEL - Continue engineering operations with caution;

- 10-25% LEL - Continuous monitoring with extreme caution, determine source/cause of elevated reading;
- Greater than 25% LEL - Explosion hazard, evaluate source and leave the Work Zone;
- Less than 21% oxygen - leave Work Zone immediately;
- 21-25% oxygen - Continue engineering operations with caution; and
- Greater than 25% oxygen - Fire hazard potential, leave Work Zone immediately.

The particulate monitor will be used to monitor respirable dust concentrations during all intrusive activities. Action levels based on the instrument readings shall be as follows:

- Less than 50 ug/m^3 - Continue field operations
- 50-150 ug/m^3 - Don dust/particulate mask or equivalent. Initiate engineering controls (viz. wetting of excavated soils or tools at discretion of Site Health and Safety Officer.
- Greater than 150 ug/m^3 - Don dust/particulate mask or equivalent. Initiate engineering controls to reduce respirable dust concentration.

Readings with the explosimeter, particulate monitor and organic vapor analyzers will be recorded and documented in the field logbook. All instruments will be calibrated before use and the procedure will be documented in the field logbook.

8.2.2 Community Monitoring Levels

In addition to the action levels prescribed in Section 8.2.1 for Malcolm Pirnie and Steuben County personnel on-site, the following criteria shall also be adhered to for the protection of the nearby community:

Organic Vapors

- Sustained atmospheric concentrations of unidentified organic vapors above 25 ppm in the work area breathing zone - Initiate organic vapor monitoring at the downwind portion of the site perimeter.
- Sustained atmospheric concentrations of organic vapors of 5 ppm or greater at the downwind site perimeter - Contact local Fire Department.

Explosive Vapors

- Sustained atmospheric concentrations of greater than 10% LEL in the work area - Initiate combustible gas monitoring at the downwind portion of the site perimeter.

- Sustained atmospheric concentrations of greater than 10% LEL at the downwind site perimeter - Contact local Fire Department.

Airborne Particulates

- Sustained atmospheric concentrations of greater than 150 ug/m^3 in the work area - Initiate particulate monitoring at the downwind portion of the site perimeter.

- Sustained atmospheric concentrations of 150 ug/m^3 or greater at the downwind site perimeter - Contact local Fire Department.

MALCOLM PIRNIE

9.0 HEAT/COLD STRESS MONITORING

Since some of the work activities at the Old Bath Landfill will be scheduled for both the summer and winter months, measures will be taken to minimize heat/cold stress to Malcolm Pirnie employees. Malcolm Pirnie's Site Health and Safety Coordinator or his/her designee will be responsible for monitoring Malcolm Pirnie employees' for symptoms of heat/cold stress.

9.1 HEAT STRESS MONITORING

Personal protective equipment may place an employee at risk of developing heat stress, probably one of the most common (and potentially serious) illnesses encountered at hazardous waste disposal sites. The potential for heat stress is dependent on a number of factors, including environmental conditions, clothing, workload, physical conditioning and age. Personal protective equipment may severely reduce the body's normal ability to maintain equilibrium (via evaporation, convection and radiation), and by its bulk and weight increases energy expenditure.

The signs and symptoms of heat stress are as follows:

- Heat rash may result from continuous exposure to heat or humid air.
- Heat cramps are caused by heavy sweating with inadequate electrolyte replacement. Signs and symptoms include:
  - muscle spasms
  - pain in the hands, feet and abdomen
- Heat exhaustion occurs from increased stress on various body organs including inadequate blood circulation due to cardiovascular insufficiency or dehydration. Signs and symptoms include:
  - pale, cool, moist skin
  - heavy sweating
  - dizziness
  - nausea
  - fainting

- Heat stroke is the most serious form of heat stress. Temperature regulation fails and the body temperature rises to critical levels. Immediate action must be taken to cool the body before serious injury and death occur. Competent medical help must be obtained. Signs and symptoms are:

  - red, hot, usually dry skin
  - lack of or reduced perspiration
  - nausea
  - dizziness and confusion
  - strong, rapid pulse
  - coma

The monitoring of personnel wearing protective clothing should commence when the ambient temperature is 70 degrees Fahrenheit or above. For monitoring the body's recuperative ability to excess heat, one or more of the following techniques should be used as a screening mechanism.

- Heart rate may be measured by the radial pulse for 30 seconds as early as possible in the resting period. The rate at the beginning of the rest period should not exceed 110 beats per minute. If the rate is higher, the next work period should be shortened by 10 minutes (or 33%), while the length of the rest period stays the same. If the pulse rate is 100 beats per minute at the beginning of the next rest period, the following work cycle should be further shortened by 33%.

- Body temperature may be measured orally with a clinical thermometer as early as possible in the resting period. Oral temperature at the beginning of the rest period should not exceed 99.6 degrees Fahrenheit. If it does, the next work period should be shortened by 10 minutes (or 33%), while the length of the rest period stays the same. However, if the oral temperature exceeds 99.6 degrees Fahrenheit at the beginning of the next period, the following work cycle may be further shortened by 33%. Oral temperature should be measured again at the end of the rest period to make sure that it has dropped below 99.6 degrees Fahrenheit. No Malcolm Pirnie employee will be permitted to continue wearing semipermeable or impermeable garments when his/her oral temperature exceeds 100.6° Fahrenheit.

9.2 COLD STRESS MONITORING

Exposure to cold conditions may result in frostbite or hypothermia, each of which progresses in stages as shown below.

- **Frostbite** occurs when body tissue (usually on the extremities) begins to freeze. The three states of frostbite are:

1) **Frostnip** - This is the first stage of the freezing process. It is characterized by a whitened area of skin, along with a slight burning or painful sensation. Treatment consists of removing the victim from the cold conditions, removal of boots and gloves, soaking the injured part in warm water (102-108°F) and drinking a beverage containing alcohol or caffeine.

2) **Superficial Frostbite** - This is the second stage of the freezing process. It is characterized by a whitish-grey area of tissue which will be firm to the touch but will yield little pain. Treatment is identical to that for Frostnip.

3) **Deep Frostbite** - In this final stage of the freezing process the affected tissue will be cold, numb and hard, and will yield little to no pain. Treatment is identical to that for Frostnip.

- **Hypothermia** occurs when the body loses heat faster than it can produce it. The stages of hypothermia (which may not be clearly defined or visible at first) are the following:

1) Shivering
2) Apathy (a change to a disagreeable mood)
3) Unconsciousness
4) Bodily freezing
5) Death (if untreated)

Treatment of hypothermia is given below:

- Remove the victim from the cold environment and remove wet or frozen clothing. (Do this carefully as frostbite may have started.)

- Perform active re-warming with hot liquids for drinking (Note: do **not** give the victim any liquid containing alcohol or caffeine in this case) and a warm water bath (102-108°F)

- Perform passive re-warming with a blanket or jacket wrapped around the victim.

In any potential cold stress situation, it is the responsibility of the Site Health and Safety Officer to encourage the following:

- Workers should dress warmly, with more layers of thin clothing as opposed to one thick layer.

- Personnel should remain active and keep moving.

- Personnel should be allowed to take shelter in a heated area, as necessary.

- Personnel should drink warm liquids (no caffeine or alcohol if frostbite has set in).

10.0 WORK ZONES AND SITE CONTROL

Work zones around the areas designated for drilling, sample collection, and monitoring well installation will be established by the drilling contractor on a daily basis and communicated to all employees and other site users (i.e., fireman and police) by the Contractor's Site Health and Safety Officer. It shall be the contractor's Site Health and Safety Officer's responsibility to ensure that all site workers are aware of the work zone boundaries and to enforce proper procedures in each area. The zones will include:

- **Exclusion Zone ("Hot Zone")** - the area where contaminated materials may be exposed, excavated or handled and all areas where contaminated equipment or personnel may travel. The zone will be delineated by flagging tape. All personnel entering the Exclusion Zone must wear the prescribed level of personal protective equipment identified in Section 7.0;

- **Contamination Reduction Zone** - the zone where decontamination of personnel and equipment takes place. Any potentially contaminated clothing, equipment and samples must remain in the Contamination Reduction Zone until decontaminated;

- **Support Zone** - the part of the site which is considered non-contaminated or "clean". Support equipment will be located in this zone, and personnel may wear normal work clothes within this zone.

Access of non-essential personnel to the Exclusion and Contamination Reduction Zones will be strictly controlled by the contractor. Only personnel who are essential to the completion of the task will be allowed access to these areas and only if they are wearing the prescribed level of protection. Entrance of all personnel must be approved by the Contractor's Site Health and Safety Officer.

A log containing the names of workers and their level of protection will be maintained by the Contractor.

The zone boundaries may be changed by the Site Health and Safety Officer as environmental conditions warrant, and to respond to the necessary changes in work locations on-site.

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11.0 DECONTAMINATION PROCEDURES

11.1 PERSONAL DECONTAMINATION FOR MPI EMPLOYEES

The degree of decontamination required is a function of both a particular task and the physical environment within which it takes place. The following decontamination procedure, although somewhat specific to the tasks described herein, will remain flexible, thereby allowing the decontamination crew to respond appropriately to the changing environmental conditions which may arise at the site. The procedure shall be followed by all Malcolm Pirnie personnel who are on the site.

Station 1:	Equipment Drop	1.	Deposit equipment used on-site (tools, containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination.
Station 2:	Boots and Gloves Wash and Rinse	2.	Scrub outer boots and outer gloves with decon solution or detergent water. Rinse off using copious amounts of water.
Station 3:	Tape, Outer Boot and Glove Removal	3.	Remove tape, outer boots and gloves. Deposit tape and gloves in container provided by contractor.
Station 4:	Canister or Mask Change	4.	If worker leaves exclusive zone to change canister (or mask), this is the last step in the decontamination procedure. Worker's canister is exchanged, new outer gloves and boot covers donned, and worker returns to duty.
Station 5:	Outer Garment Removal	5.	Protective suit removed and deposited in separate container provided by contractor.
Station 6:	Face Piece, Hard Hat, Safety Goggles Removal	6.	Face piece or goggles removed (if used). Avoid touching face with fingers. Face piece and/or goggles deposited on plastic sheet. Hard hat removed and placed on plastic sheet.

Station 7:	Inner Glove Removal	7. Inner gloves are the last personal protective equipment to be removed. Avoid touching the outside of the gloves with bare fingers. Dispose of these gloves in container provided by contractor.
Station 8:	Field Wash	8. Proceed to personnel decontamination facility provided by Contractor. A shower will be required.

11.2 DECONTAMINATION FOR MEDICAL EMERGENCIES

In the event of a minor, non-life threatening injury, personnel should follow the decontamination procedures as defined, and then administer first-aid.

In the event of a major injury or other serious medical concern (i.e., heat stroke), immediate first-aid is to be administered and the victim transported to the hospital in lieu of further decontamination efforts unless exposure to a site contaminant would be considered "Immediately Dangerous to Life or Health."

11.3 DECONTAMINATION OF FIELD EQUIPMENT

Decontamination of heavy equipment will be conducted by the Contractor in accordance with his approved Health and Safety Plan in the Contamination Reduction Zone. Heavy equipment and tools utilized during drilling and monitoring well installation activities will be placed on a decontamination pad and cleaned with high-pressure water followed by steam. Decontamination water will be prevented from moving outside the decontamination pad and will be transferred to a holding tank. The Contractor's Health and Safety Officer will make daily inspections to determine that this procedure is being followed.

Decontamination of all tools used for sample collection purposes will be conducted by Malcolm Pirnie personnel. It is expected that all tools will be constructed of nonporous, nonabsorbent materials (i.e., metal) which will aid in the decontamination effort. Any tool or part of a tool which is made of porous, absorbent material (i.e., wood) will be placed into suitable containers and prepared for disposal.

Decontamination of all bailers, split-spoons, spatula knives, and other tools used for multi-media environmental sampling and examination shall be as follows:

- disassemble the equipment;
- water wash to remove all visible foreign matter;
- rinse equipment with clean water; and
- pressurized steam clean equipment (inside and outside).

If samples are to be collected for analytical purposes, each tool used for sampling shall be cleaned as follows:

- disassemble the equipment;
- water wash to remove all visible foreign matter;
- wash with detergent;
- rinse all parts with distilled-deionized water;
- rinse all parts with pesticide-grade isopropanol;
- rinse all parts with distilled-deionized water;
- allow to air dry; and
- wrap all parts in aluminum foil or polyethylene to prevent contamination of clean equipment.

12.0 FIRE PREVENTION AND PROTECTION

12.1 GENERAL APPROACH

Recommended practices and standards of the National Fire Protection Association (NFPA) and other applicable regulations will be followed in the development and application of Project Fire Protection Programs. When required by regulatory (DEC) authorities, the project management will prepare and submit a Fire Protection Plan for the approval of the contracting officers, authorized representative or other designated official. Essential considerations for the Fire Protection Plan will include:

- Proper site preparation and safe storage of combustible and flammable materials;
- Availability of coordination with private and public fire authorities;
- Adequate job-site fire protection and inspections for fire prevention; and
- Adequate indoctrination and training of employees.

12.2 EQUIPMENT AND REQUIREMENTS

- Fire extinguishers will be provided by the Contractor;
- Fire extinguishers will be inspected, serviced, and maintained in accordance with the manufacturer's instructions. As a minimum, all extinguishers shall be checked monthly and weighed semi-annually, and recharged if necessary; and
- Immediately after each use, fire extinguishers will be either recharged or replaced.

12.3 FLAMMABLE AND COMBUSTIBLE SUBSTANCES

- All storage, handling or use of flammable and combustible substances will be under the supervision of qualified persons; and
- All tanks, containers and pumping equipment, whether portable or stationary, which are used for the storage and handling of flammable and combustible liquids, will meet the recommendations of the National Fire Protection Association.

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13.0 EMERGENCY INFORMATION

In accordance with OSHA 29 CFR Part 1910, an Emergency Response Plan is attached to this HASP as Attachment 2.

ATTACHMENT 1
PROTECTION ENSEMBLES

ATTACHMENT 1

PROTECTION ENSEMBLES

Equipment designed to protect the body against contact with known or anticipated chemical hazards have been divided into four categories according to the degree of protection afforded:

- Level A: Should be selected when the highest level of respiratory, skin and eye protection is needed.
- Level B: Should be selected when the highest level of respiratory protection is needed, but a lesser level of skin protection is required; Level B protection is the minimum level recommended on initial site entries until the hazards have been further defined by on-site studies.
- Level C: Should be selected when the types of airborne substances are known, the concentrations have been measured and the criteria for using air-purifying respirators are met. In atmospheres where no airborne contaminants are present, Level C provides dermal protection only.
- Level D: Should not be worn on any site with respiratory or skin hazards. This is primarily a work uniform providing minimal protection.

The level of protection selected is based primarily on:

- Types and measured concentrations of the chemical substances in the ambient atmosphere and their associated toxicity; and
- Potential or measured exposure to substances in air, splashes of liquids or other indirect contact with material due to the task being performed.

In situations where the types of chemicals, concentrations, and possiblities of contact are not known, the appropriate level of protection must be selected based on professional experience and judgement until the hazards may be further characterized. The individual components of clothing and equipment must be assembled into a full protective ensemble to protect the worker from site-specific hazards, while at the same time minimizing hazards and drawbacks of the personal protective gear itself. Ensemble components based on the

widely used USEPA Levels of Protection are detailed below for levels B, C, and D protection.

Level B Protection Ensemble

Recommended

- Pressure-demand, full-facepiece self-contained breathing apparatus (MSHA/-NIOSH approved) or pressure-demand supplied-air respirator with escape SCBA;
- Chemical-resistant clothing (overalls and long-sleeved jacket; hooded one- or two-piece chemical splash suit; disposable chemical-resistant one-piece suit); disposable chemical-resistant one-piece suit);
- Inner and outer chemical resistant gloves;
- Chemical-resistant safety boots/shoes; and
- Hard hat.

Optional

- Coveralls.
- Disposable boot covers.
- Face shield.
- Long cotton underwear.

Meeting any one of the following criteria warrant the use of Level B protection:

The types and atmospheric concentrations of toxic substances have been identified and require the highest level of respiratory protection, but a lower level of skin and eye protection. These would be atmospheres:

- with concentrations Immediately Dangerous to Life and Health (IDLH)
- exceeding limits of protection afforded by a full-face air-purifying mask;
- containing substances for which air-purifying canisters do not exist or have low removal efficiency;

- containing substances requiring air-supplied equipment, but substances and/or concentrations do not represent a serious skin hazard;

- containing less than 19.5% oxygen; or

- with evidence of incompletely identified vapors or gases as indicated by direct reading organic vapor detectoin isntrument, but those vapors and gases are not suspected of containing high levels of chemicals harmful to skin or capable of being absorbed through the intact skin.

Level B equipment provides a high level of protection to the respiratory tract, but a somewhat lower level of protection to skin. The chemical-resistant clothing required in Level B is available in a wide variety of styles, materials, construction detail and permeability. These factors all affect the degree of protection afforded. Therefore, a specialist shoud select the most effective, chemical-resistant clothing based on the known or anticipated hazards and task. Level B skin protection is selected by:

- Comparing the concentrations of identified substances in the air with skin toxicity data;

- Assesing the effect of the substance (at its measured air concentrations or splash potential) on the small area of the head and neck unprotected by chemical-resistant clothing.

Level C Protection Ensemble

Recommended

- Full-facepiece, air-purifying respirator equipped with MSHA and NIOSH approved organic vapor/acid gas/dust/msit combination cartridges or as designated by the Health and Safety Manager;

- Chemical-resistant clothing (overalls and long-sleeved jacket, hooded, one- or two-piece chemical splash suit or disposable chemical-resistant one-piece suit);

- Inner and outer chemical-resistant gloves;

- Chemical-resistant safety boots/shoes; and

- Hardhat.

Optional

- Coverals;

- Disposal boot covers;
- Face shield;
- Escape mask;
- Long cotton underwear.

The use of Level C protection is permissible upon satifaction of these critera:

- Measured air concentrations of identified substances will be reduce by the respirator to below the substance's permissible exposure limit (PEL), threshold limit value (TLV), and/or the concentration is within the service limit of the cartridge;
- Atmospheric contaminant concentrations do not exceed IDLH levels; and
- Atmospheric contaminants, liquid splashes or other direct contact will not adversely affect the small area of skin left unprotected by chemical-resistant clothing.

Level C protection is distinguished from Level B by the equipment used to protect the respiratory system, assuming the same type of chemical-resistant clothing is used. The main selection criterion for Level C is that conditoins permit wearing an air-purifying device. The device (when required) mut be an air purifying respirator (MSHA/NIOSH approved) equipped with filter cartridges. Cartridges must be able to remove the substances encountered. Respiratory protection will be used only with proper fitting, training and the approval of a qualified individual. In addition, an air-purifying respirator can be used only if:

- Oxygen content of the atmosphee is at least 19.5% in volume;
- Substances are identified and concentrations measured;
- Substances have adequate warning properties;
- Individual passes a qualitative fit-test for the mask; and
- Appropriate cartridge/canister is used, and its service limit concentration is not exceeded.

An air monitoring program is part of all response operations when atmospheric contamination is known or suspected. It is particularly important that the air be monitored thoroughly when personnel are wearing air-purifying respirators. Continual surveillance using direct-reading instruments is needed to detect any changes in air quality necessitating a higher level of respiratory protection.

Level D Protection Ensemble

Recommended

- Coveralls;
- Safety boots/shoes;
- Safety glasses or chemical splash goggles;
- Hardhat.

Optional

- Gloves;
- Escape mask;
- Face shield.

The use of Level D protection is permissible upon satisfaction of these criteria:

- No hazardous air pollutants have been measured; and
- Work functions preclude splashes, immersion or the potential for unexpected inhalation of any chemicals; and
- Atmospheric contains at least 19.5% oxygen.

Level D protection is primarily a work uniform. It can be worn in areas where only boots can be contaminated, or where there are no inhalable toxic substances.

ATTACHMENT 2

EMERGENCY RESPONSE PLAN

ATTACHMENT 2

EMERGENCY RESPONSE PLAN

Personnel Exposure

- Skin contact: Use copious amounts of soap and water. Wash/rinse affected area for at least 15 minutes. Decontaminate and provide medical attention. Eyewash stations will be provided on site. If necessary, transport to Ira Davenport Memorial Hospital.
- Inhalation: Move to fresh air and, if necessary, transport to Ira Davenport Memorial Hospital.
- Ingestion: Decontaminate and transport to Ira Davenport Memorial Hospital.

Personal Injury

Minor first-aid will be applied on-site as deemed necessary. In the event of a life threatening injury, the individual should be transported to Ira Davenport Memorial Hospital via ambulance. The Malcolm Pirnie and contractor Health and Safety Officers will supply available chemical specific information to appropriate medical personnel as requested.

Malcolm Pirnie or contractor first aid kits will conform to Red Cross and other applicable good health standards, and shall consist of a weatherproof container with individually-sealed packages for each type of item. First aid kits will be fully equipped before being sent out on each job and will be checked weekly by the On-Site Health and Safety Coordinator to ensure that the expended items are replaced.

Communications

Internal emergency communication systems are used to alert workers to danger, convey safety information, and maintain site control. Any effective system can be employed. Two-way radio headsets or field telephones are often used when work teams are far from the command post. Hand signals and air-horn blasts are also commonly used. Every system must have a backup. It shall be the responsibility of the Contractor's Site Health and Safety Officer to ensure that an adequate method of internal communication is understood by all personnel entering the site. Unless all personnel are otherwise informed, the following signals shall be used.

1) Emergency signals by portable air horn, siren, or whistle: two short blasts, personal injury; continuous blast, emergency requiring site excavation.

2) Visual signals: hand gripping throat, out of air/cannot breathe; hands on top of head, need assistance; thumbs up, affirmative/ everything is OK; thumbs down, no/negative; grip partner's wrist or waist, leave area immediately.

Evacuation

In the event that an area must be evacuated due to an emergency, such as a chemical spill or a fire, workers shall exit upwind, if possible. Since work conditions and work zones within the site may be changing on daily basis, it shall be the responsibility of the Contractor's Site Health and Safety Officer to review evacuation routes and procedures as necessary and to inform all site workers of any changes.

Adverse Weather Conditions

In the event of adverse weather conditions, the Malcolm Pirnie Site Health and Safety Coordinator in conjunction with the Malcolm Pirnie Health and Safety Officer will determine if engineering operations can continue without sacrificing the health and safety of Malcolm Pirnie employees. Some of the items to be considered prior to determining if work should continue are:

- Potential for heat/cold stress;
- Inclement weather - related working conditions;
- Limited visibility; and
- Potential for electrical storms.

Emergency Telephone Numbers

PIRNIE PROJECT MANAGER:

Name:	Kent R. McManus, P.E.	
Telephone:	Office:	(716) 667-0900
	Home:	(716) 667-3081

PIRNIE CORPORATE HEALTH AND SAFETY MANAGER:

Name:	Mark McGowan	
Telephone:	Office:	(914) 641-2484
	Emergency:	(800) 478-6870

PIRNIE SITE HEALTH AND SAFETY OFFICER:

Name:	Judith Vangalio	
Telephone:	Office:	(716) 667-0900
	Home:	(716) 662-5404

SITE HEALTH AND SAFETY COORDINATOR:

Name:	Richard Dubisz	
Telephone:	Office:	(716) 667-0900
	Home:	(716) 655-7406

IRA DAVENPORT HOSPITAL	(607) 776-2141
FIRE	(607) 776-2180
AMBULANCE	(607) 776-2141
POLICE	(607) 776-2175
ON-SITE CELLULAR TELEPHONE	(716) 866-4367

The site location is:
Bath Landfill,
Turnpike Road (east of Route 15)
Bath, New York

Directions to Hospital

The following directions describe the best route to Ira Davenport Memorial Hospital (see Figure A-1):

(1) From the Site, turn right onto Turnpike Road and proceed to Route 10.

(2) Turn left (north) onto Route 10 and proceed for approximately three (3) miles, to downtown Bath (Pulteney Square).

(3) Turn left onto Liberty Street (Route 415/54) and follow signs to Route 54.

(4) Proceed on Route 54 (heading northeasterly toward Hammondsport).

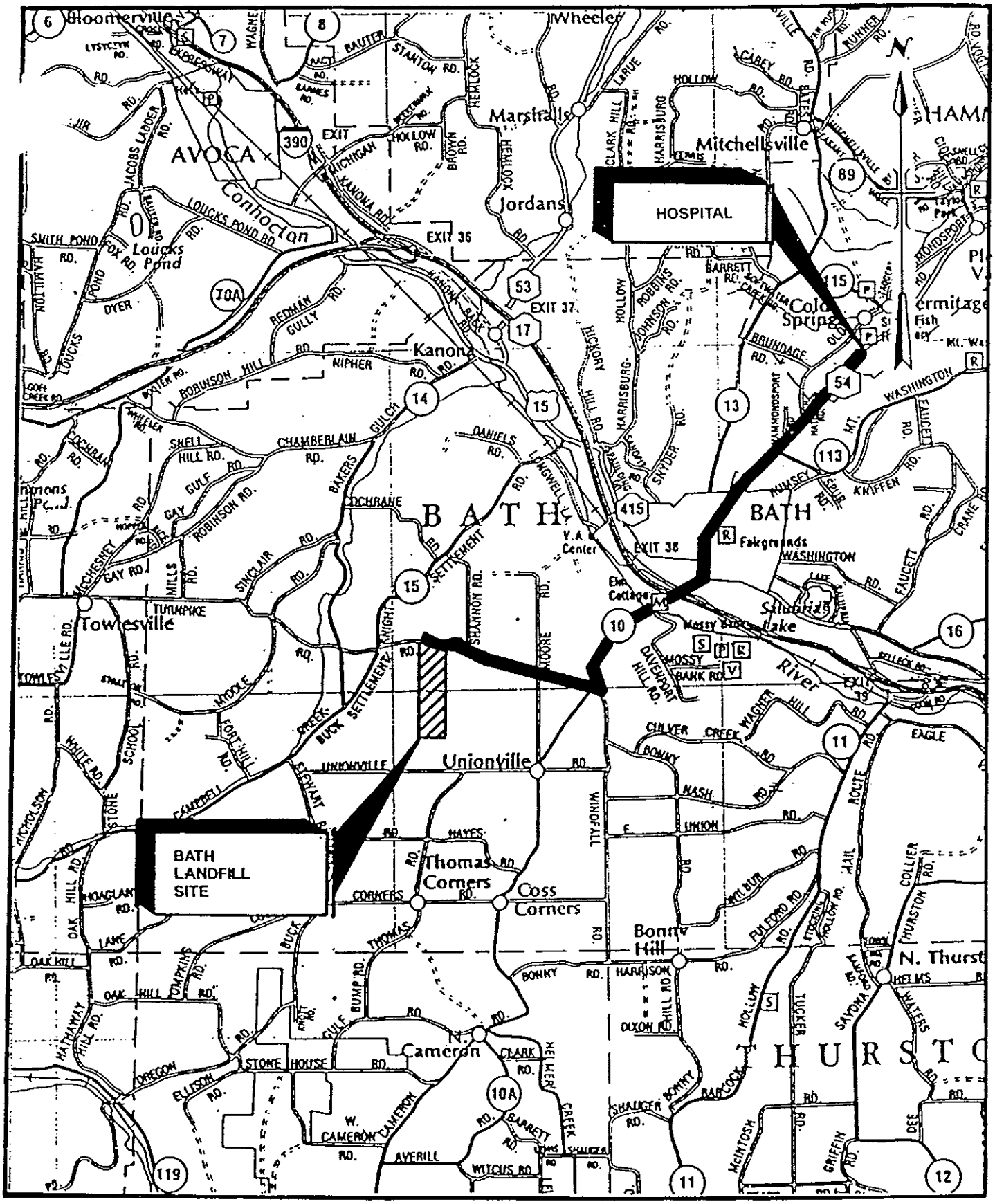
(5) Ira Davenport Memorial Hospital is located approximately 6 miles on Route 54. Turn right at the driveway and follow signs to the Emergency Room. **Note:** The hospital does not have a street address!

Records and Reporting

It shall be the responsibility of each employer to establish and assure adequate records of all:

- Occupational injuries and illnesses;
- Accident investigations;

FIGURE A-1



MALCOLM PIRNIE

STE-11

OLD BATH LANDFILL
RI / FS
HOSPITAL ROUTE

STEUBEN COUNTY DEPT. OF PUBLIC WORKS APRIL 1991

- Reports to insurance carrier or State compensation agencies;
- Reports required by client;
- Records and reports required by local, state, federal and/or international agencies;
- Property or equipment damage;
- Third party injury or damage claims;
- Environmental testing logs;
- Explosive and hazardous substances inventories and records;
- Records of inspections and citations;
- Related correspondence; and
- Safety training.