First Five-Year Review Report
For
Buckingham County Landfill Superfund Site

Dillwyn, Virginia

Prepared By:
U. S. Environmental Protection Agency
Region III

Philadelphia, Pennsylvania

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9/30/03
Date

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List of Acronyms

ARAR	Applicable or Relevant and Appropriate Requirement
BCL	Buckingham County Landfill
CD	Consent Decree
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations EPA Environmental Protection Agency
FS	Feasability Study
HRS	Hazard Ranking System
LTGMP	Long Term Groundwater Monitoring Program
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
NCP	National Contingency Plan NPL National Priorities List
O&M	Operation and Maintenance
PCOR	Preliminary Closeout Report
PRP	Potentially Responsible Party
RA	Remedial Action
RAO	Remedial Action Objective
RD	Remedial Design
RI	Remedial Investigation
ROD	Record of Decision
SDWA	Safe Drinking Water Act
VDEQ	Virginia Department of Environmental Protection
VOC	Volatile Organic Compound

Executive Summary

This is the first five-year review for the Buckingham County Landfill Site, The triggering action for this statutory review is the initiation of on-Site construction activities on April 13, 1998. The five-year review is required due to the fact that hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure.

The remedy for the Buckingham County Landfill Superfund Site in Dillwyn, Virginia included regrading and capping of the hazardous waste disposal area (Option 1 in the Record of Decision (ROD)), institutional controls, and quarterly groundwater monitoring. The Site achieved construction completion with the signing of the Preliminary Closeout Report (PCOR) dated September 21, 1998.

The remedy currently protects human health and the environment because none of the action levels identified in the ROD have been exceeded. Institutional controls as called for in the ROD are in place and are meant to prevent the installation of any wells in the area of the Site. Based upon available data, no human or environmental receptors are being exposed to Site contaminants. Institutional controls in the form of deed restrictions have been put in place by the County. However, in order for the remedy to be protective in the long-term uncertainties associated with the location and migration of the contaminant plume need to be further evaluated. Additional data is necessary to determine if contaminants are migrating toward human or ecological receptors and to determine if the remedy, as implemented, is fully protective of human health and the environment as required by the ROD.

Five-Year Review Summary Form

SITE IDENTIFICATION

Site name: Buckingham County Landfill

EPA ID: VAD089027973

Region: 3	**State:** VA	**City/County:** Dillwyn/Buckingham County

SITE STATUS

NPL status: Final ■ Deleted ❑ Other (specify)_____

Remediation Status *(choose all that apply)*: ❑ *Under Construction* ■ *Operating* ❑ *Complete*

Multiple OUs?* YES ❑ NO ■	**Construction completion date:** September 21, 1998

Has site been put into reuse? YES ❑ NO ■ NA ❑

REVIEW STATUS

Lead agency: EPA ■ State ❑ Tribe ❑ Other Federal Agency _____

Author name: *Christian Matta w/CDM Federal Programs Corporation technical assistance*

Author title: Remedial Project Manager	**Author Affiliation:** U.S. EPA - Region 3

Review period:** April 23, 2002 - September 30, 2003

Date(s) of site inspection: September 17, 2003

Type of review: ■ *Post-SARA* ❑ *Pre-SARA* ❑ *NPL-Removal only* ❑ *Non-NPL Remedial Action Site* ❑ *NPL State/Tribe-lead* ❑ *Regional Discretion*

Review number: 1 (first) ■ 2 (second) ❑ 3 (third) ❑ Other(specify)_____

Triggering action:

✓ Actual RA Onsite Construction ❑ Actual RA Start at OU# _____

❑ Construction Completion ❑ Previous Five-Year Review Report

❑ Other (specify)

Triggering action date: April 13, 1998

Due date (five years after triggering action date): April 13, 2003

* ("OU" referes to operable unit.)
** (If a contractor writes the report, the author name should be written as, "RPM w/ (contractor name) assistance.)
*** (Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.)

Five-Year Review Summary Form, cont'd

Issues

- The LTGMP may not be effectively monitoring groundwater contaminants. The remedy as implemented may not be preventing the migration of contaminant away from the Site
- Cap Erosion, control of vegetative growth and general cap maintenance.

Recommendations and Follow-up Actions

The following recommendations and follow-up actions are based upon EPA's review of related documents, the Site inspection and the conclusion and recommendations described in the COM report " Hydrogeological Analysis on the Effectiveness of Long Term Ground Water Monitoring", dated February 2003 (see Appendix A).

- Installation of additional monitoring wells.
- Perform cap maintenance

Protectiveness Statement(s)

The remedy currently protects human health and the environment because none of the action levels identified in the ROD have been exceeded. Institutional controls as called for in the ROD are in place and are meant to prevent the installation of any wells in the area of the Site. Based upon available data, no current human or environmental receptors have been exposed or currently are being exposed to Site contaminants. Institutional controls in the form of deed restrictions have been put in place by the County. However, in order for the remedy to be protective in the long-term uncertainties associated with the location and migration of the contaminant plume need to be further evaluated. Additional data is necessary to determine if contaminants are migrating toward human or ecological receptors and to determine if the remedy, as implemented, is fully protective of human health and the environment as required by the ROD.

Long-term Protectiveness

The long-term protectiveness of the remedial action will be verified by implementing the recommendations detailed in section 9 of the Five-Year Review Report. At this time it is not possible to determine if the remedy is providing long-term protection as called for the ROD. Current data indicate that groundwater contamination exists below the cap over the hazardous waste disposal area as well as outside the hazardous waste disposal area. Implementation of actions necessary to address these recommendation will begin within the next year.

Other Comments

No other comments.

Section 1

Introduction

The purpose of the five-year review is to determine whether the remedy at a site is protective ofhuman health and the environment. The methods, findings, and conclusions of reviews are documented in Five-Year Review Reports. In addition, Five- Year Review Reports identify issues found during the review, if any, and recommendations to address them.

The Environmental Protection Agency (EPA) is preparing this Five-Year Review Report pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §121 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). CERCLA §121states:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgement of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

The Agency interpreted this requirement further in the NCP; 40 CFR §300.430(f)(4)(ii) states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

EPA Region III, has conducted a five-year review of the Remedial Action (RA) implemented at the Buckingham County andfill Superfund Site ("the Site" or "Site") in Dillwyn, Buckingham County, Virginia, Technical support for this review was provided by CDM Federal Programs Corporation (CDM). This report documents the results of the five-year review.

This is the first five-year review for the Buckingham County Landfill Site. The triggering action for this statutory review is the initiation of on-Site construction activities on April 13, 1998. The five- year review is required due to the fact that hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure.

Section 2

Chronology

Table 2-1 lists the chronology of events for the Buckingham Site.

Table 2- 1: Chronology of Site Events

Event	Date
Site began operating as an open dump disposing municipal solid waste	1962
Virginia State Board of Health (VSBH) issues Sanitary Landfill Permit	November 1972
Sanitary landfill permit modified to allow for disposal of 50 gallons per week of industrial furniture making waste	1977
Municipal solid waste operations ceased and solid waste portion of landfill covered and closed under supervision of VSBH	1979
VSBH approved increase in the quantity of "special" waste to 30,000 to 40,000 gallons per month	1979
Site owner applies for interim status	1980
EPA performed a Preliminary Assessment of the Site	June 1, 1980
Buckingham County purchases Site and begins closure	April 1982
Hazardous waste portion of landfill closed	1983
EPA performed a Site Inspection	July l, 1983
Hazard Ranking System package completed	November 1984
Site proposed to the National Priorities List	April 10, 1985
First removal assessment completed	September 29, 1989
Finalization on the National Priorities List	October 4, 1989
Administrative Order on Consent issued for Remedial Investigation and Feasability Study (RI/FS)	January 31, 1991

Second Removal Assessment completed	March 26, 1991
Third Removal Assessment completed	June 28, 1991

Section 2

Chronology

Table 2-1: Chronology of Site Events (continued)

Event	Date
Human Health Risk Assessment completed	January 15, 1993
Ecological Risk Assessment completed	April 20, 1993
RI/FS completed	May 1993
EPA issues Proposed Plan	May 1993
Record of Decision (ROD) signature	September 30, 1994
EPA issued first Unilateral Administrative Order (UAO) to the PRPs to implement the September 30, 1994 ROD	September 29, 1995
De minimis Consent Decree for settlement with de minimis parties	December 13, 1995
PRPs complete Remedial Design	July 2, 1997
PRPs begin on-Site construction of Remedial Action	
PRPs initiate first round of sampling for the Lont-Term Groundwater Monitoring Program (LTGMP)	April 13, 1998
PRPs complete RA construction	September 1998
Preliminary Closeout Report (PCOR)	September 21, 1998
EPA issues second UAO to Buckingham County for implementation of institutional controls and minor Operation and Maintenance requirements	March 20, 2000

Section 3

Background

3.1 Physical Characteristics

The Site is located along County Road 640 in central Buckingham County, Virginia approximately 3.5 miles southeast of the town of Buckingham. The intersection of U.S. Route 60 and U.S. Route 15 is approximately 1.5 miles northeast of the Site.

The Site is located in the Appalachian Piedmont Physiographic Province. The surface topography of the area is gently rolling. Elevations in the Site area vary between approximately 540 and 660 feet above sea level. Elevations in the immediate vicinity of the landfill range from approximately 580 to 620 feet above sea level.

3.2 Land and Resource Use

The Site consists of a 2-acre hazardous waste disposal area. A 7-acre domestic waste landfill is located adjacent to the southern border of the Site. The Buckingham County dog pound is located at the entrance to the property on which the hazardous waste landfill and domestic landfill are located. The Site is fenced and is primarily grassy, surrounded by forest. The Horsepen Wildlife Management Area is located approximately three quarters of a mile west of the Site. The land and resource use in the immediate vicinity of the Site is unlikely to change from its current use as rural residential and farming property, Several companies, including Thomasville Furniture Industries, Inc., used the Site to dispose of various wastes between 1962 and 1983. As a result of these disposal activities, the Site groundwater is contaminated with volatile organic compounds (VOCs).

The area of Buckingham County totals 371,771 acres, of which 75,854 acres, or 20 percent, was farms in 1997. The general vicinity of the Site is primarily rural, with several residences near the Site property. The residences obtain their potable water from either private wells or from the Troublesome Creek Reservoir. Since there are no large urban centers in the County, the population is classified as mostly rural-urban, and in the 2000 census totaled 15,623.

Agriculture is an integral part of Buckingham County's economy, and cash farm income totaled $17.2 million in 1997. According to the 1997 Census of Agriculture, there were 370 farms in the county, averaging 205 acres in size.

Forestry is also important for the County economy. The production of saw timber, railroad ties, and other items provides an important source of income and employment. Other jobs are provided by the area's thriving mineral industry, as Buckingham County slate is well known throughout the country as superior roofing material.

3.3 History of Contamination

From 1962 to 1982, the area encompassing the Site was owned and operated by Joseph Love. Initially it was used for disposal of municipal solid waste and received a sanitary landfill permit by the VSBH. In 1977, the sanitary landfill permit was modified to allow for disposal of 50 gallons per week of industrial furniture-making waste. In 1979, the VSBH approved an increase in the quantity of "special" waste to 30,000 to 40,000 gallons per month.

The area known as the Site is comprised of a number of trenches known to include an evaporation trench, two disposal trenches, a barrel trench and a " barrow" pit. This approximately two acre area is identified in the ROD as the hazardous waste disposal area. In general, operations in the hazardous waste disposal area involved the receipt of drummed liquid wastes which were poured into the evaporation trench. The trench was periodically cleared of solid residues that remained after evaporation and/or percolation. These residues were transferred to one of the two disposal trenches. The empty drums were then crushed and placed in the barrel trench where they remain. The borrow pit supplied cover soil for the entire operation.

3.4 Initial Response

The solid waste landfill was covered and closed in 1979 under the supervision of the VSBH; however, the hazardous waste disposal operations continued. In April 1982, the County purchased the Site and contracted Schnabel Engineering Associates to close the hazardous waste disposal area.

In November 1984, the Hazard Ranking System scoring package was completed and the Site was finalized on the NPL on October 4,1989. On January 31, 1991, several Potentially Responsible Parties (PRPs) and EPA entered into an Administrative Order on Consent to conduct a Remedial Investigation and Feasability Study (RI/FS) at the Site. Field work for the Remedial Investigation (RI) was conducted March through July 1992. The RI was accepted on March 24, 1993. The FS was accepted on May 3, 1993.

3.5 Basis for Taking Action

Contaminants in groundwater are primarily volatile organic compounds, and include 1,2-bromoethane, l, 2-dibromo-3-chloropropane, 1,1-dichloroethylene, 1,2-dichloropropane, cis-and trans- l, 3-dichloropropylene, 1,1,2,2-tetrachloroethane, acetone, methylene chloride, tetrachloroethylene, trichloroethylene, vinyl chloride, 1,1,2-trichlorothane, and 1,2-dichloroethane.

As previously noted, contaminants in groundwater are primarily volatile organic compounds. The apparent source of contamination was the waste buried and dumped in the hazardous waste disposal area. Unacceptable cancer and systemic health risks were identified with respect to the future residential use scenario (i.e., hypothetical future residents living adjacent to the Site and using groundwater for drinking, or migration of contaminated groundwater to existing residential wells). The excess lifetime cancer risk determined under the future use exposure scenario from incidental inhalation, incidental ingestion, and dermal absorption of contaminants in groundwater was determined

to be 2.6xlO- 1. This exceeded EPA's target range of 1xlO- 1 to 1xlO- 6. Most of the risk was determined to be associated with the ingestion of VOCs in the contaminated groundwater.

With respect to noncarcinogenic systemic risks a total Hazard Index (HI) of greater than one was calculated based on a number of VOC's. The HI under a future residential exposure scenario for an adult was determined to be 58 and 112 for a child. The calculated Hazard Indices were based on a combined exposure due to the groundwater ingestion and volatile inhalation.

Section 4

Remedial Actions

4.1 Remedy Selection

The ROD for the Site was signed on September 30, 1994. The ROD specified the following components;

- Groundwater monitoring
- RCRA multilayer cap
- Optional excavation and off-Site incineration
- Preparation of a focused FS for the barrel trench
- A contingency provision for pump and treat with air stripping, if needed
- Perimeter fencing
- Deed notice

The Remedial Action Objectives (RAOs) for this Site were to protect human health and the environment from potential current and future risks associated with the following exposure scenarios:

- Exposure via incidental ingestion of surface soil and dermal absorption of contaminants from surface soil; "Incidental ingestion of surface water and dermal absorption of contaminants from surface water;
- Incidental ingestion of sediments and dermal absorption of contaminants from sediment;
- Incidental ingestion of groundwater, dermal absorption of contaminants from groundwater, and inhalation of VOCs from bathing in groundwater; and,
- Incidental ingestion of leachate and dermal absorption of contaminants from leachate.

4.2 Remedy Implementation

In September 1995, EPA issued a Unilateral Administrative Order (UAO), EPA Docket No. HI-95-65-DC to the PRPs after negotiations to implement the RD/RA were unsuccessful. The UAO required the PRPs to implement the remedy described in the ROD. The RD was approved by EPA in July 1997.

The Remedial Action (RA) began in April 13, 1998. The components of the constructed RA included the following:

- Regrading to achieve the grades and slopes for the acceptance of the

cover system and subgrade preparation which involved grading and placement of compacted general fill;
- Installation of the first geosynthetic element on the prepared landfill;
- Construction of a gas vent layer made of geocomposite drainage material on top of the hazardous waste disposal area. The passive gas venting layer consisted of installation of a peripheral gas collection trench just beyond the lateral extent of the hazardous waste disposal area. The trench is designed to minimize the subsurface lateral migration of any gas to areas outside the landfill limits;
- A geocomposite clay liner was placed, followed by a linear low density polyethylene liner;
- A geocomposite drainage layer was placed followed by an 18 inch thick protective layer of compacted general fill on the cover system with a 6-inch thick topsoil layer. The capped area was then planted with grass to keep the soil cover from eroding thereby protecting the cap components;
- Surface water diversion ditches were installed to convey surface water away from the hazardous waste disposal area;
- Perimeter fencing was installed around the edge of the cap to limit access.

The Site achieved construction completion status when the Preliminary Close Out Report was signed on September 21,1998. Initially the EPA tried to negotiate implementation of the institutional controls with Buckingham County, the owner of the Site. After over a year of failed negotiations aimed at agreement on the terms of a Consent Decree, a Unilateral Administrative Order (UAO) was issued to Buckingham County on March 20, 2000. The UAO required them to implement the deed restrictions called for in the ROD, conduct minor operation and maintenance activities such as mowing the cap and posting signs around the landfill. EPA received notification from Buckingham County that the deed restrictions had been entered into the County records and have received quarterly progress reports documenting activities associated with the operation and maintenance of the cap and associated drainage components and fence.

4.3 System Operation/Operation and Maintenance

The PRPs are conducting long-term monitoring and maintenance activities at the Site in accordance with the Long Term Groundwater Monitoring Program (LTGMP) Work Plan, submitted in February 1998 by Parsons Engineering Science. The LTGMP calls for quarterly groundwater monitoring, which includes monitoring of the landfill point of compliance wells and the two nearest downgradient private potable water supply wells.

In addition to the groundwater monitoring, operation and maintenance (O&M) activities are also being conducted. The primary activities include:

- Visual inspection of the cap with regard to vegetative cover, settlement, stability, and any need for corrective action;
- Periodic mowing of the vegetation on the cap surface;
- Inspection of the drainage swales for blockage, erosion and instability, and any need for corrective action, and; "Inspection of the condition of the groundwater monitoring wells.

There have been issues related to O&M for the hazardous waste disposal area. There has been limited maintenance of the cap, and there are erosion concerns at the northwestern corner of the capped area. Further information is presented in Section 6.5.

Groundwater monitoring is being conducted in accordance with the ROD. Samples have been collected on a quarterly basis from point of compliance wells located not farther, than 150 feet from the edge of the cap, a downgradient well located at a residence and a downgradient well located at a church. This quarterly sampling has been conducted by the PRPs, with split samples being accepted by EPA. To date, no VOC action level has been exceeded in groundwater samples collected from the point of compliance wells or the two downgradient wells. However, low levels of VOC contamination has been found in point of compliance wells with increasing concentration trends in VOC levels being identified.

Section 5

Progress Since Last Five-Year Review

This is the first five-year review for the Site.

Section 6

Five-Year Review Process

6.1 Administrative Components

The Buckingham Five-Year Review team was lead by the EPA Remedial Project Manager Christian W. Malta. Technical support was provided by COM Corporation. The EPA RPM conferred with the EPA Toxicologist, EPA hydrogeologist and Virginia Department of Environmental Quality Project Manger as needed.

The Site inspection occurred on September 17, 2003 and was conducted by the EPA RPM in conjunction with CDM personnel.

6.2 Community Involvement

A Fact Sheet was sent to residents of the community during September 2003, to inform them of the current status of the Site and to obtain their involvement in the five- year review process. The Fact Sheet updated the Site progress and announced the initiation of the Five-Year Review. Point of contact information was provided.

A public notice announcing the start of the Five-Year Review at the Buckingham County Landfill Superfund Site appeared in the Farmville Herald on August 7, 2003. The notice explained the Five-Year Review process, provided point of contact information, and identified the location of the information repository for the Site. In addition, notices announcing the Five-Year Review and seeking public comment were hand- delivered to several residences and two churches near the Site.

A second public notice will be run in the newspaper announcing the completion of the Five-Year Review and the availability of the Five-Year Review Report in the information repository at the Buckingham County Library. In addition, a fact sheet will be prepared and distributed summarizing the process and findings of the Five-Year Review.

No feedback from the community was received as a result of either the Fact Sheet or advertisement.

6.3 Document Review

The Five-Year Review consisted of a review of relevant documents including the FS, Proposed Plan, ROD, RD/ RA Report, the Long Term Ground Water Monitoring Work Plan, Quarterly Groundwater Monitoring Reports and the Hydrogeological Analysis on the Effectiveness of Long Term Ground Water Monitoring Report.

6.4 Data Review

An evaluation of the data collected during the LTGMP, relevant documents listed above as well as other historical Site data, was completed in the COM report "Hydrogeological Analysis on the Effectiveness of Long Term Ground Water Monitoring" (HA Report), dated February 2003. The HA Report is included as Appendix A.

The intent of the HA Report was to review all relevant documentation regarding the LTGMP and determine if it is performing as required to intercept any contamination that may be migrating away from the hazardous waste disposal area. The overall findings of this report suggest that there may be deficiencies in the LTGMP, and that contamination may be migrating to areas not being monitored by the LTGMP.

The State reviewed key data for this Five- Year Review and has concurred with EPA's findings.

6.5 Site Inspection

The EPA RPM directed CDM personnel to conduct a technical assessment of the Site on August 29, 2003, in order to assess the physical status of the capped area. On September 17, 2003, the EPA RPM in conjunction with CDM personnel conducted a follow-up Site inspection. The purpose of the Site inspection was to review the findings of the CDM assessment of the cap system and review the conclusions and recommendations of the CDM HA Report Analysis in relation to the physical setting of the Site.

The assessment concluded that the cap and associated drainage features had not been recently maintained by Buckingham County. Failure to perform the required maintenance activities can adversely impact the cap. During the assessment it was noted that:

- The vegetated cap has not been mowed recently; overgrowth is evident. Improperly maintained vegetation can cause a reduction in the drainage off the cap surface and may lead to infiltration under the cap. At the time of the Site inspection saplings were noted as being present on the

cap, indicating that the cap has not been mowed recently. However, the vegetation was not determined to be exceedingly overgrown and appeared to be preventing erosion of the soil cover except for the north west corner which has bare spots and evidence of erosion.

- The drainage swale running southeast to northwest on the cap is not adequately conveying water flow off the cap surface. Pools of water and saturated soil and vegetation due to ponding water was noted during the assessment. This condition may lead to infiltration of water through the cap and/or may indicate that the drainage layer is not properly conveying water off the cap. The condition was not observed during the follow-up Site Inspection.

- Riprap check dams located in the drainage swales are smothered with vegetation. This condition may impede drainage away from and off of the cap leading to areas of pending.

- Surface runoff from the landfill is directed to a perimeter drainage ditch, which then flows off-Site to the Warner Branch of Cooper Creek. Drainage features in place for runoff management include small riprap check dams, located at the entrance and exit points of the perimeter ditch. Although vegetative overgrowth is apparent on the perimeter ditch, the perimeter drainage features are in good condition.

- Due to soil erosion and/or animals burrowing over an extended time period, a gap between the bottom of the Site security fence and the ground surface has remained. At the time of the technical assessment numerous holes were noted in the security fence surrounding the cap. During the Site inspection it was noted that maintenance had been done on the fence and the holes were patched with wire.

6.6 Interviews

Interviews were conducted with a small number of residents near the Site. Additional residents and Buckingham County officials were also contacted, but declined the opportunity to meet with EPA as part of the Five-Year Review community involvement process.

Residents that were interviewed noted that there has not been much discussion about the Site in the community for several years. Concerns about the Site's potential impact on property values were conveyed. One of the residents interviewed, whose property had been for sale, was questioned about the Site by a potential buyer. No incidents of vandalism or trespassing at the Site were reported.

The cleanup implemented at the Site was not the remedy initially recommended by EPA. In response to extensive community comment on the Proposed Plan, EPA removed the excavation and groundwater treatment components of the remedy. Residents living downgradient of the Site expressed doubts about the protectiveness of the cleanup and concern about remaining health threats possibly posed by the Site. They referred to recent groundwater monitoring results when noting the opinion that monitoring wells may not be properly located to determine the location of the contaminant plume. The residents also believed that EPA's excavation remedy would have been better than the current

containment remedy.

The residents interviewed had mixed feelings about how well they have been kept informed about the Site during the past 5 years. One resident felt well informed and expressed confidence in EPA's management of the Site. Others did not feel that they had been provided the information they needed and requested. In particular, after having been warned not to drink their water in 1984, they were unsure if their well water was now safe to drink and have been awaiting a written response to this question. In response to these concerns, EPA explained that additional investigation at the Site would be done if determined necessary during the Five-Year Review.

All those interviewed felt that Buckingham County should take care of any additional work that might be needed at the Site, regardless of cost.

Information gathered during the interviews is included in Appendix B.

Section 7

Technical Assessment

7.1 Question A: Is the remedy functioning as intended by the decision documents?

Our review of the relevant documents and the results of the Site inspection indicate that the remedy is not currently functioning as intended by the ROD. The capping of the disposal areas have achieved the remedial objectives containing contaminated soil and waste material, preventing dermal contact and incidental ingestion, and preventing leaching of precipitation through the contaminated material. However, it is unclear if the cap has prevented the migration of contaminants from the source area (see Appendix A).

As part of the Five-Year Review effort CDM was tasked by the EPA RPM to analyze the effectiveness of the LTGMP and identify if the point of compliance monitoring wells are properly located to effectively monitor or intercept groundwater contaminants that may be migrating from beneath the landfill. CDM presented the analysis of the LTGMP in a February 2003 report entitled Hydrogeological Analysis on the Effectiveness of Long Term Groundwater Monitoring, Buckingham County Landfill, Buckingham, Virginia and it is provided in Appendix A. The overall conclusion of the report is that the LTGMP is not effective in monitoring groundwater contamination at the Site. Based on the data reviewed for the hydrogeological analysis, it appears that contamination is migrating to a location that is not being monitored by the LTGMP point of compliance wells. Furthermore, it appears no data are available that describes the location or movement of a contaminant plume or possible contaminant plume.

In addition, there are issues with the O&M of the cap and the drainage system. These issues include erosion underneath the security fence, lack of maintenance/mowing of the cap area, and brush growing on the cap. Due to the high level of vegetative overgrowth, drainage may be impeded which may lead to conditions that promote water infiltration underneath the cap. Tree roots may compromise the integrity of the cap. These conditions all contribute to

weakening the protectiveness of the remedy.

The institutional controls were put into place following issuance of the May 20, 2000, UAO to Buckingham County by EPA. The UAO called for implementation of deed restrictions as institutional controls to prevent exposure to, or ingestion of, contaminated groundwater, as outlined in the ROD. The UAO also required the County to perform minor operation and maintenance activities such as access control, posting of signs, mowing of the cap, maintaining locks on the wells and access gates, and providing inspection reports to the EPA.

The quarterly residential well sampling has been operating as intended. The remedial objective to prevent contact with contaminated groundwater has been met. No action levels, as determined in the ROD, have been exceeded in the residential well samples or in the point of compliance wells.

7.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?

There have been no major changes in the physical conditions of the Site that would affect the protectiveness of the remedy.

Changes in Standards and To be Considereds.
There are no changes to note.

Many of the Applicable or Relevan and Appropriate Regulations (ARARs) identified in the ROD have been complied with during the implementation of the work already conducted at the site. The remaining ARARs will be complied with during the ongoing monitoring and O&M activities, or during implementation of the contingent remedy.

Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics
There are no changes to note. Information to date indicates that the contaminants have remained within the 150 foot point of compliance.

7.3 Question C: Has any other information come to tight that could call into question the protectiveness of the remedy?

Analytical data that has been collected during the LTGMP was evaluated in conjunction with other historical analytical and hydrogeological data. The data review is presented in Appendix A. Based on the information, it can not be determined if the remedy will provide the long term protection required by the ROD. The remedy has been determined to be protective in the short term because no action levels identified in the ROD have been exceeded.

In summary, the functionality of the current compliance well network to monitor Site contaminant migration is uncertain and the position of the groundwater contaminant plume is unknown. While no ROD contaminant levels have been exceeded in either the point of compliance wells or the two downgradient residential wells, it can not be determined if this is due to remedy effectiveness, the contaminants migrating along pathways not being intercepted by the point of compliance wells, or simply because the contaminants have not had sufficient time to migrate to the point of compliance wells.

7.4 Technical Assessment

Based on review of the quarterly monitoring data gathered over the last five years, the HA Report and information identified in the RI/FS, adequate measures may not be in place to ensure that the point of compliance wells are actually monitoring the contaminated groundwater plume in a manner that would provide warning that the plume is moving off-Site. Data reviewed indicates that the groundwater plume is not fully delineated and the lack of sample collection from Site wells, other than those located 150 feet from the edge of the cap, has created a situation that does not allow tracking of the contaminated groundwater. Data presented in the HA Report indicates that the contaminated groundwater may be migrating to areas not monitored by the long term groundwater monitoring program and some point of compliance wells may not even be placed at a depth that will allow interception of contaminated groundwater because the well is not deep enough.

The recommendations identified in the Five- Year Review should be implemented as a first step toward achieving an effective LTGMP that will track the contaminated groundwater located on- Site. Adjustments to the LTGMP as well as additional data needs can then be identified and addressed as needed.

Section 8

Issues

Issue	Currently Affects Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
LTGMP may not be effectively monitoring groundwater contaminants. The remedy as implemented may not be preventing the migration of contaminant away from the Site.	N	Y
Erosion/vegetative growth/cap maintenance	N	Y

Section 9

Recommendations and Follow-Up Actions

The recommendations and follow-up actions are based upon our review of related documents, the Site inspection and the findings and conclusions described in the CDM report "Hydrogeological Analysis on the Effectiveness of Long Term Ground Water Monitoring", dated February 2003

(see Appendix A).

Issue	Recommendations/Follow-Up Actions	Party Responsible	Oversight Agency	Mile-stone Date	Affects Protectiveness (Y/N)	
					Current	Future

The functionality of the current compliance well network to monitor contaminant migration is uncertain and the position of the groundwater contaminant plume is unknown. Monitoring wells should be installed in areas where hydraulic gradients and/ or contaminant trends suggest the presence of additional groundwater contamination	-Installation of MW-4SL adjacent to MW-4S and screen immediately above bedrock (see figure in Appendix A for well locations) -Installation of MW-5BR and screen at a depth below MW-5B -Installation of MW-7B and screen in bedrock -Installation of MW-22BR and screen at a depth below MW-22B -Installation of MW-23BR and screen at a depth below MW-23B -Installation of MW-25SL and screen right above bedrock surface -During two quarterly events (a high-flow and low-flow period) within a 12-month period, groundwater samples should be collected from all	PRP	EPA	12/2004	N	Y

Section 10

Protectiveness Statement

The remedy currently protects human health and the environment because none of the action levels identified in the ROD have been exceeded. Institutional controls as called for in the ROD are in place and are meant to prevent the installation of any wells in the area of the Site. Based upon available data, no current human or environmental receptors have been exposed or currently are being exposed to Site contaminants. Institutional controls in the form of deed restrictions have been put in place by the County. However, in order for the remedy to be protective in the long-term uncertainties associated with the location and migration of the contaminant plume need to be further evaluated. Additional data is necessary to determine if contaminants are migrating toward human or ecological receptors and to determine if the remedy, as implemented, is fully protective of human health and the environment as required by the ROD.

Section 11

Next Review

The next five-year review for the Buckingham County Landfill Site is required by September 2008, five years from the date of this review.

APPENDIX A

Hydrogeological Analysis on the Effectiveness of Long Term Ground Water Monitoring Report

Response Action Contract
for Remedial Planning and Oversight Activities
in EPA Region III
U.S. EPA Contract No. 68-S7-3003

Final
Hydrogeological Analysis on the Effectiveness of Long Term Ground Water Monitoring

Buckingham County Landfill
Buckingham County, Virginia

Work Assignment No.: 029-ROME-03M8
Document Control No.: 3232-029-RT-OTHR-01702

February 2003

Prepared for:
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Section 1
Introduction

CDM Federal Programs Corporation (CDM) was tasked by the U.S. Environmental Protection Agency (EPA) under the Response Action Contract for Remedial Planning and Oversight Activities in EPA Region III (RAC III - Contract 68-S7-3003) to analyze the effectiveness of the long term groundwater monitoring program (LTGWMP) at the Buckingham County Landfill Site. The site is located in Buckingham County, Virginia.

1.1 Background

The Buckingham County Landfill Site, also known as the Love Container Site, is a former hazardous waste disposal area that was closed in 1982. The types of wastes allegedly disposed at the site include dried laquer, peel coating glues, reclaimed laquer thinner, and hundreds of drums of waste laquer still bottoms from solvent recovery plant.

During the remedial investigation (RI) performed during the early 1990s, elevated concentrations of groundwater contaminants were identified in site monitoring wells. The highest concentrations of contaminants were identified in wells that monitored groundwater directly beneath the hazardous waste disposal area (HWDA) of the landfill. The most dominant type of groundwater contaminants was (and still is) volatile organic compounds (VOCs). The remedy selected for the site included capping the HWDA and performing quarterly groundwater monitoring at the wells installed approximately 150 feet from the perimeter of the HWDA. In the mid-1990s the HWDA was capped and in September 1998 the LTGWMP began.

During the RI significantly elevated concentrations of VOCs were detected in the wells installed beneath the HWDA. For example, 15 VOC action levels were exceeded at well location MW-2SL, which is near the center of the landfill. Additionally, the concentrations of the VOCs were well above the action levels; for example, tetrachloroethene (PCE) was detected at a concentration of 1,800 micrograms per liter (ug/1), which is 360 times greater than the MCL (maximum contaminant level) of 5 ug/l.

1.2 Report Purpose and Organization

The purpose of this report is to analyze the effectiveness of the LTGWMP and identify if the compliance monitoring wells are properly located to effectively monitor or intercept groundwater contaminants that may be migrating from beneath the landfill. Although VOCs were detected at significantly elevated concentrations beneath the HWDA during the RI, no action levels have been exceeded for samples collected from the perimeter wells during the LTGWMP.

This report provides the results of CDM's hydrogeological analysis. The report is organized into the following sections:

Section 1 - Introduction
Section 2 - Site Description Summary
Section 3 - Groundwater Movement
Section 4 - Contamination Trends
Section 5 - Conclusions and Recommendations
Section 6 - References

The RI Report, the LTGWMP Work Plan, several quarterly reports, an analytical data summary package, a previous review document, and discussions with EPA personnel were used to prepare the analysis. The documents are listed in Section 6.

Section 2
Site Description Summary

This section contains background information to support the hydrogeological .analysis. The information was located in the Final Remedial Investigation Report (Engineering-Science, Inc. 1993) and the Long Term Groundwater Monitoring Program Work Plan (Parsons Engineering Science, Inc. 1998).

2.1 Location and Physiography

The site is located along County Road 640 in central Buckingham County, Virginia approximately 3.5 miles southeast of the town of Buckingham. The intersection of U.S. Route 60 and U.S. Route 15 is approximately 1.5 miles northeast of the site. The site location is shown in Figure 2-1.

The site is located in the Appalachian Piedmont Physiographic Province. The surface topography of the area is gently rolling. Elevations in the site area vary between approximately 540 and 660 feet above sea level. Elevations in the immediate vicinity of the landfill range approximately from 580 to 620 feet above sea level.

2.2 Geology

The geology of the site is typical to the Piedmont Province: bedrock overlain by saprolite and residuum.

The rocks of the Candler formation underlay the site. The Candler formation is predominantly phyllite although metagreywackes have also been encountered. The dip of the bedding appears to be toward the southeast at approximately 80 degrees. Overlying the bedrock is the unconsolidated saprolite and residuum. The unconsolidated materials have been described as silt, silt/clay, and silt/sand matrices. Generally the saprolite becomes more granular than the residuum and it contains some relict structures of the parent rock. The total thickness of these two units ranges from 65 to 140 feet. Generally, the thickness of the residuum is less than 20 feet.

2.3 Hydrology

At the surface, the site is drained by Cooper Creek to the north and by the Warner Branch of Cooper Creek to the south. A drainage ditch located west of the site discharges surface water into an unnamed tributary of the Warner Branch. The unnamed tributary flows south-southwest of the site.

In the subsurface, groundwater occurs in all three geologic units. From water levels collected in June 2002, depth to water near the unnamed tributary ranges from approximately 15 to 20 feet below ground surface (bgs), but at the upper elevations on the site, the depth to groundwater is approximately 40 to 45 feet bgs. These depth ranges compared to the depth ranges of the RI, summarize the water level decreases that have been experienced at the site and attributed to the long term drought. In the RI (water levels collected in 1992) the depth ranges were approximately 5-10 feet bgs near the tributary and approximately 25 to 30 feet in the upper elevations.

Bedrock groundwater occurrence and flow is controlled by secondary openings (or fractures). Foliation and lineament analyses have been performed in an attempt to identify the directional trend of the fractures. The average foliation strike is to N34ºE and dips 82º5E. Lineaments have also been identified to trend to the northeast with a second set that trends perpendicular (northwest). In the saprolite, groundwater flow may also be controlled by relict fractures. However, as the saprolite becomes more weathered and the relict structures are lost, groundwater occurrence and movement is between the grains of the weathered material.

Section 3
Groundwater Movement

This section describes groundwater movement at the site based on three concepts: horizontal hydraulic gradients, vertical hydraulic gradients and groundwater velocity. The purpose of conceptualizing the movement of groundwater is to aid in the analysis of the hydrogeological system and to help determine the effectiveness of the LTGWMP.

3.1 Horizontal Gradients

Groundwater elevations collected quarterly during the LTGWMP indicate that the horizontal gradient is, in general, to the northwest in the saprolite and to the west-northwest in the bedrock. Figures 3-1 and 3-2 illustrate the potentiometric surface of the saprolite and bedrock, respectively, for the June 2002 quarterly event, which was the most recent event conducted for which data was available. Similar potentiometric surfaces for these two units can be seen for the June 2001 quarterly event, which are presented in Appendix A. The June 2001 event is the most recent event in which water levels are available for all monitoring wells (except for MW-3S). Groundwater levels are provided in Table 3-1.

3.2 Vertical Gradients

Figure 3-3 provides a cross section location map and Figures 3-4 through 3-11 illustrate the hydrogeology in cross-sectional view for water levels collected in December 2000, June 2001, March 2002, and June 2002. The four dates represent the two earliest (December 2000 and June 2001) and two latest (March 2002 and June 2002) data sets that were made available to CDM. Proximal surface water bodies are included in the cross sections for comparison to the monitoring well zone depths. Groundwater elevations plotted in a cross-sectional view aid in providing an idea of the vertical gradients within a hydrogeological system.

Cross section A-A' is shown in Figures 3-4 through 3-7 for December 2000, June 2001, March 2002, and June 2002, respectively. The plane of Section A-A' is nearly parallel to the horizontal groundwater gradient. As shown in the figures, the gradient appears to be relatively consistent among the four time periods. Referring to Figure 3-5, southeast of the landfill and beneath the landfill’s southeast edge, the gradient is downward. Beneath the center of the landfill, the gradient is nearly horizontal. Then, near the landfill’s northwest edge, the gradient in the bedrock tums sightly downward and the gradient in the unconsolidated material turns slightly upward.

Cross section B-B' is shown in Figures 3-8 through 3-11 for December 2000, June 2001, March 2002, and June 2002, respectively. The plane of Section B-B’ is nearly parallel to the bedrock foliation trend. Arrows were placed to indicate the expected gradient direction based on the head potential measured. Equipotential lines were not drawn since the plane of the section is not parallel to the horizontal flow gradient. The gradients observed in this view are slightly more

complicated than in Section A-A'. However, the gradients appear to be consistent among the four dates examined. Beneath the landfill a gradient to the northeast (toward MW-4S) is detectable in the shallow depths of the saprolite. This gradient is opposite to that expected since the landfill is positioned on a southwest facing slope and shallow gradients typically follow surface topography (i.e., the gradient would be expected to be to the southwest). At depth, in the bedrock peak beneath the landfill, it appears the gradient is split; from MW-2B gradients exist to the northeast and southwest. Additionally, as noted in the A-A' sections, the gradient l is to the northwest at this location also. This nearly radial flow pattern is likely due to the bedrock peak occurring beneath the landfill.

In addition to cross sections A-A' and B-B', other hydrogeological cross sections have been developed for the site (Tetra Tech EM, Inc. 2001). These cross sections are shown in Appendix B. The historical sections focus on the vertical hydraulic gradients observed at wells that would be considered at the downgradient edge of the landfill. As observed in historical Section A-A', downward vertical gradients are detectable at the following well nests MW-24B/24SL; MW-3B/3S and MW-23SL/23B. As observed in historical Section B-B', downward vertical gradients are detectable at the following well nests: MW-5SL/5S/5B; MW-3S/3B; and MW-4S/4SL/4BR.

Lastly, the water levels that were collected in December 2000, June 2001, March 2002, and June 2002 were compared in Table 3-1 to develop an understanding of the persistence of the vertical gradients across the site. As shown in Table 3-1 downward vertical gradients are very common. Out of the 35 vertical gradients shown in the table 24 gradients are downward, 10 gradients are upward and two equal measurements suggest no gradient exists at one point. At only one well nest, MW-2, a vertical gradient has consistently been measured to be upward. Well MW-2 is located near the center of the HWDA.

3.3 Groundwater Velocity

A groundwater velocity of 0.0943 ft/day is reported for the saprolite (Engineering-Science, Inc, 1993). A groundwater velocity is not reported for the bedrock. However, velocity can be estimated using the equation

$$V = (K/n_e) \times (dh/dl);$$

where

K is the hydraulic conductivity (in feet/day) of the aquifer material, n_e is the effective porosity (unitless) of the aquifer material, and dh/dl is the hydraulic gradient (unitless).

Using the following values:

K = 0.71 ft/day (geometric average for four reported K values for MW-1B and MW-2B - Engineering-Science, Inc., 1993),

n_e = 0.01 (estimated for similar material - Domenico, P.A. and Schwartz, F.W., 1990), and

dh/dl = 0.015 (horizontal gradient from MW-2B to MW-5B for June 2002),

the groundwater velocity in bedrock is estimated to be 1.07 ft/day.

Groundwater velocity provides a tool in which advective travel times of a contaminant may be estimated. Advective travel considers only groundwater velocity in the movement of a contaminant although other factors (e.g. dispersion, sorption, and biodegradation) may influence the travel times. Advective movement provides a simple estimate on the time required for a contaminant to travel from one point to another.

The distance from saprolite well MW-2SL (location near the HWDA center where elevated concentrations of groundwater contaminants were identified during the RI) to saprolite well MW-23SL (a compliance well downgradient of MW-2SL) is 352 feet. At a velocity of 0.0943 ft/day, the advective travel time for a contaminant to move from MW-2SL to MW-23SL is estimated to be 10.2 years. In bedrock, the travel time from MW-2B to MW-23B is estimated to be 0.92 years (travel 358 feet at a velocity of 1.07 ft/day).

Based on the estimated groundwater velocity in the saprolite, contaminants detected in groundwater beneath the center of the HWDA in 1992 would be expected to reach downgradient well MW-23SL in the Year 2002 (assuming no retardation). With a retardation factor of 1.75 (an estimated average value for the group of VOC contaminants at the site), the contamination would be expected to reach the downgradient well in Year 2009. In bedrock, contaminants detected beneath the HWDA center in 1992 would be expected to reach downgradient well MW-23B in Year 1993. With an assumed retardation factor of 1.75, the VOC contamination detected in 1992 would be expected to reach the downgradient well in the 1993-1994 period.

Section 4
Contamination Trends

The concentrations of VOCs detected during the RI and the LTGWMP were compared in an attempt to identify trends that may provide clues regarding the movement of contaminants from the site and the effectiveness of the program. Exceedingly high concentrations of VOCs were detected in source area wells during the RI (e.g., PCE was detected at a concentration 360 times greater than the MCL). However, quarterly reports prepared for the LTGWMP have consistently noted that no VOC action levels have been exceeded in groundwater samples collected from the compliance wells.

Concentrations for six VOCs are shown in Figures 4-1 through 4-6 for the RI and several of the long term groundwater monitoring events. The six VOCs are acetone; 1,1,1 trichloroethane (1,1,1 TCA); PCE; trichlorethene (TCE); 1,1 dichloroethene (1,1 DCE); and methylene chloride. These six VOCs were selected to be evaluated since they were detected in groundwater beneath the HWDA at concentrations significantly above their respective action levels during the RI. Additionally, for 1,1 DCE, a detailed fate and transport analysis was performed in the RI.

VOCs can be considered the main contaminants of concern, although many different types of contaminants can be found in the site groundwater,. The VOCs are widespread in the saturated zone, have elevated concentrations in the source area and typically travel in groundwater with the least amount of retardation.

4.1 VOC Concentrations

The highest concentration of acetone detected during the RI at the three source area wells was 14,000 ug/1 at MW-2SL. Acetone has not been detected above the action level of 3,700 ug/1 during the LTGWMP. The highest concentration of acetone for the LTGWMP was detected in bedrock well MW-22B on September 1998 at a concentration of 310 ug/l. All other detected concentrations of acetone have been below 70 ug/l. Although acetone is not consistently detected at the compliance wells, the compound has been detected at 11 of the wells, which is the highest for the six VOCs considered. Within the LTGWMP time period, no increasing or decreasing concentration trends were noticeable for acetone.

The highest concentration of 1,1,1 TCA detected during the RI at the three source area wells (MW-2SU, MW-2SL, and MW-2B) was 10,000 ug/1 at MW-2SU. 1,1,1 TCA has not been detected above the action level of 200 ug/1 (an MCL) during the LTGWMP. The highest detected concentration of the compound for the LTGWMP is 3 ug/1, which has been detected six times at MW-4S. The compound has also been consistently detected at wells MW-7SL, 22SL and 22B in the range of 0.25 to 1.0 ug/1. The compound has been detected less consistently at MW-23B (0.1 to 0.3 ug/1) and only occasionally at MW-4B and 24B (0.2 to 0.9 ug/1). A slightly increasing trend is noticeable for 1,1,1 TCA at MW-22B. From September 1998 to June

2002 the concentration of the compound detected in groundwater at this bedrock location appears to have gradually increased from 0.3 ug/1 to 0.9 ug/1. No decreasing trends in the concentration of 1,1,1 TCA are detectable.

The highest concentration of PCE detected during the RI at the three source area wells was 3,700 ug/1 at MW-2SU. PCE has not been detected above the action level of 5 ug/1 (an MCL) during the LTGWMP. The highest detected concentration of PCE for the LTGWMP is 2 ug/1 which has been detected twice at MW-5SL. In addition to MW-5SL, PCE is detected relatively consistently in six other wells: MW-4B, 5B, 7SL, 22B, 22SL, and 23B. Additionally, a slight increase in the PCE concentration may be noticeable at MW-22B. At this location the compound was not detected during the first year of the LTGWMP. After the first year, starting in September 1999, the concentration appears to have slightly and steadily climbed to 0.4 ug/1 in June 2002. No PCE concentration increases are noticeable at other wells. Also, no concentration decreases are noticeable.

The highest concentration of TCE detected during the RI at the three source area wells was 800 ug/1 at MW-2SU. TCE has not been detected above the action level of 5 ug/1(an MCL) during the LTGWMP. The highest detected concentration of TCE for the LTGWMP is 1 ug/1, which has been detected three times at MW-5SL. In addition to MW-5SL, TCE is detected relatively consistently in two other wells: MW-5B and 7SL. In addition to the three previously mentioned wells, TCE has been detected in one other well, MW-4S. The concentration of TCE in groundwater at MW-5B appears to have slightly increased. During the RI (1992), the compound was not detected; then, increasing concentrations were detected from September 1998 (0.5 ug/1) to June 1999 (0.8 ug/1). Since June 1999 the concentration of TCE in groundwater at MW-5B has varied from 0.9. to 0.6 ug/l. No decreasing concentration trends are noticeable for TCE.

The highest concentration of 1,1 DCE detected during the RI at the three source area wells was 1,400 ug/1 at MW-2SU. 1,1 DCE has not been detected above the action level of 7 ug/1(an MCL) in the compliance wells during the LTGWMP.

The highest detected concentration of the compound for the LTGWMP is 3 ug/1, which has been detected twice at MW-4S. The concentration of 1,1 DCE at MW-4S appears to have increased gradually from non-detect in 1992 (the RI) to 3 ug/1 in March and June 2001. As evidenced in Figure 4-5, elevated concentrations of the compound are typically detected in MW-4S during the March sampling events, which are typically considered high flow periods. Lastly, the concentration of 1,1 DCE at location MW-22B appears to have increased from non-detect during the first five rounds of the LTGWMP to 0.9 ug/1 in June 2002. No decreasing trends in the concentration of 1,1, DCE are detectable.

The highest concentration of methylene chloride detected during the RI at the three source area wells was 14,000 ug/l at MW-2SL. However, methylene chloride has not been detected above

the action level of 5 ug/1 in the compliance wells during the LTGWMP. The highest detected concentration of the compound is 2 ug/1, which has been detected at MW-7SL four times. Three of the four times that the concentration was detected, it was during a March sampling event. March is typically considered a high-flow period. The compound was detected one time in one other saprolite well, MW-22SL, at a concentration of 0.2 ug/1. The compound has also been detected in three bedrock wells (MW-4B, MW-5B, and MW-23B). Within the LTGWMP time period, no increasing or decreasing concentration trends were noticeable for methylene chloride.

Section 5
Conclusions and Recommendations

Based on the data evaluated for this hydrogeological analysis, several conclusions can be drawn and recommendations made regarding whether wells are located properly to intercept contamination migrating from the site.

5.1 Conclusions

- Groundwater occurrence and flow in the shallow residuum is likely controlled by the openings (or pore spaces) between the grains and fragments of this very weathered material. The direction of groundwater flow likely follows the hydraulic gradient in the upper reaches of the residuum. At depth, in the bedrock and saprolite, the occurrence and flow of groundwater is likely controlled by fractures (in the rock) and relict fractures (in the saprolite). The direction of the groundwater flow paths are likely discrete and tortuous, which is typical to fractured bedrock hydrogeology.

- Horizontal groundwater gradients in the saprolite consistently appear to be to the northwest in the saprolite and to the west-northwest in bedrock. This direction is nearly perpendicular to the foliation trend of the bedrock.

- In a cross-sectional view that trends southeast-northwest (parallel horizontal to groundwater gradients), the groundwater gradients appear to be near horizontal with a vertical component. In a cross-sectional view that trends southwest-northeast (approximately parallel to the foliation trend), a gradient potential exists to the northeast in the upper reaches of the saturated system, but at depth, the potential gradient is to the southwest. If open pathways exist in the geologic matrix in these directions, then groundwater flow may follow these gradients identified.

- Although near-horizontal gradients have been identified beneath the site in cross-sectional view, on comparison of shallow water levels and deep water levels, downward vertical gradients are consistently detected at a majority of the monitoring well nests. Downward vertical gradients are consistently measured at well nests MW-5, MW-7, MW-22, MW-23, and MW-24. For the data sets reviewed for the analysis, all measured vertical gradients at these locations were downward except for one incident at the MW-5 nest. At one well nest location, MW-2, the vertical gradient has been measured to be consistently upward. If open pathways exist in the geologic matrix in these directions, then groundwater flow may follow these gradients.

- It appears no data are available that describes the location or movement of a contaminant plume or possible contaminant plume. However, contaminant concentrations do not appear to be decreasing in the groundwater monitored by the compliance wells. In three of the wells (MW-4S, MW-5B and MW-22B) contaminant concentrations appear to be increasing.

- An analysis of the advective movement of contaminants (with a general consideration for retardation) from beneath the HWDA suggests that contaminants should have been detected in downgradient bedrock well MW-23B at higher concentrations than detected, but may not yet have reached downgradient monitoring well MW-23SL, which is installed in the saprolite.

- Since, in some cases, elevated concentrations of contaminants have been detected during events that are typically considered high-flow periods, it is concluded that contaminant concentrations are influenced by the amount of water occurring in the subsurface.

- The LTGWMP is not effective in monitoring groundwater contamination at the Buckingham County Landfill site. Based on the data reviewed for this hydrogeological analysis, it is concluded that contamination is migrating to a location that is not being monitored by the LTGWMP compliance wells.

5.2 Recommendations

The following recommendations are proposed to make the LTGWMP effective:

- Monitoring wells should be installed in areas where hydraulic gradients and/or contaminant trends suggest the possible presence of additional groundwater contamination. The proposed well locations (with reasons for the proposal) are described in Table 5-1. The overburden wells (MW- 4SL and MW-25SL) should be screened immediately above the bedrock surface. The bedrock wells (MW-5BR, MW-7B, MW-22BR, and MW-23BR) should be installed in accordance with the following recommended procedure:

    - Install the four well borings, with surface casing keyed into the top of the bedrock, to an estimated depth of 300 feet bgs
    - Log the open boreholes with borehole geophysical tools (recommend caliper, acoustic tele-viewer, and borehole flow meter); use the data to help build a hydrogeologic framework and recommend zones to be tested with packers
    - Conduct pumping tests with packers at the selected zones of the four boreholes; monitor water levels in the test borehole and surrounding wells during the tests; collect water samples with the packer testing equipment; determine hydraulic conductivities of tested zones
    - Construct a well at each borehole that is screened in the most critical zone (i.e., high flow zones, interconnectedness with other zones, and/or elevated contamination)

- These six new wells in addition to the existing 15 compliance wells should be sampled during the quarterly groundwater monitoring events.

- Quarterly sampling should proceed at the 21 compliance wells.

- During two quarterly events (a high-flow period and a low flow period) within a 12 month period, groundwater samples should be collected from all site wells. The groundwater data should be used to delineate a groundwater contaminant plume.

Table 5-1
Recommended Changes to LTGWMP

Recommended Change	Reason for Recommendation
Monitoring wells should be installed in the following areas where hydraulic gradients and/or contaminant trends suggest the possible presence of additional groundwater contamination	
• MW-4SL: Adjacent to MW-4S and screened immediately above bedrock surface.	• Potential gradient from the HWDA to this location exists and increasing 1,1, DCE concentrations observed in MW-4S; well cluster 4 located along foliation from source area.
• MW-5BR: At the MW-5 cluster and screened at a depth below MW-5B	• Persistent downward vertical hydraulic gradient exists at this downgradient location and concentration of TCE appears to be increasing at MW-5B.
• MW-7B: At the MW-7 cluster and screened in bedrock	• Persistent downward vertical gradient exists at this location that is along foliation from source area.
• MW-22BR: At the MW-22 cluster and screened at a depth below MW-22B	• Persistent downward vertical gradient exists at this location and concentrations of PCE, 1,1 DCE and 1,1,1 TCA appears to be increasing at MW-22B.
• MW-23BR: At the MW-23 cluster and screened at a depth below MW-23B	• Downward vertical gradient exists at this downgradient location.
• MW-25SL: At the MW-25 cluster and screened immediately above the bedrock surface.	• Monitor groundwater immediately above the bedrock surface at this location.

Table 5-1
Recommended Changes to LTGWMP

Recommended Change	Reason for Recommendation
The monitoring wells should be installed in accordance with the following procedure: • Install the four well borings, with surface casing keyed into the top of the bedrock, to an estimated depth of 300 feet bgs • Log the open boreholes with borehole geophysical tools (recommend caliper, acoustic tele-viewer, and borehole flow meter); use the data to help build a hydrogeologic framework and recommend zones to be tested with packers. • Conduct pumping tests with packers at the selected zones of the four boreholes; monitor water levels in the test borehole and surrounding wells during the tests; collect water samples with the packer testing equipment; determine hydraulic conductivities of tested zones • Construct a well at each borehole that is screened in the most critical zone (i.e., high flow zones, interconnectedness with other zones, and/or elevated contamination)	Well installation procedure provides a logical method to collect data; construct a hydrogeological framework; and place wells at critical depths.
The six new wells in addition to the existing 15 compliance wells should be sampled during the quarterly groundwater monitoring events. Quarterly sampling should proceed at the 21 compliance wells.	Concentrations of some contaminants in some compliance wells appear to be increasing; continued monitoring of compliance well network is necessary in the event levels may increase to above action levels
During two quarterly events (a high-flow period and a low flow period) within a 12 month period, groundwater samples should be collected from all site wells. The groundwater data should be used to delineate a groundwater contaminant plume	Identifying a plume would aid in understanding the migration of contaminants from the source area. Data from the LTGWMP indicate that contaminant concentrations may vary depending on the amount of water occurring in the subsurface.

Section 6
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Tables and Figures

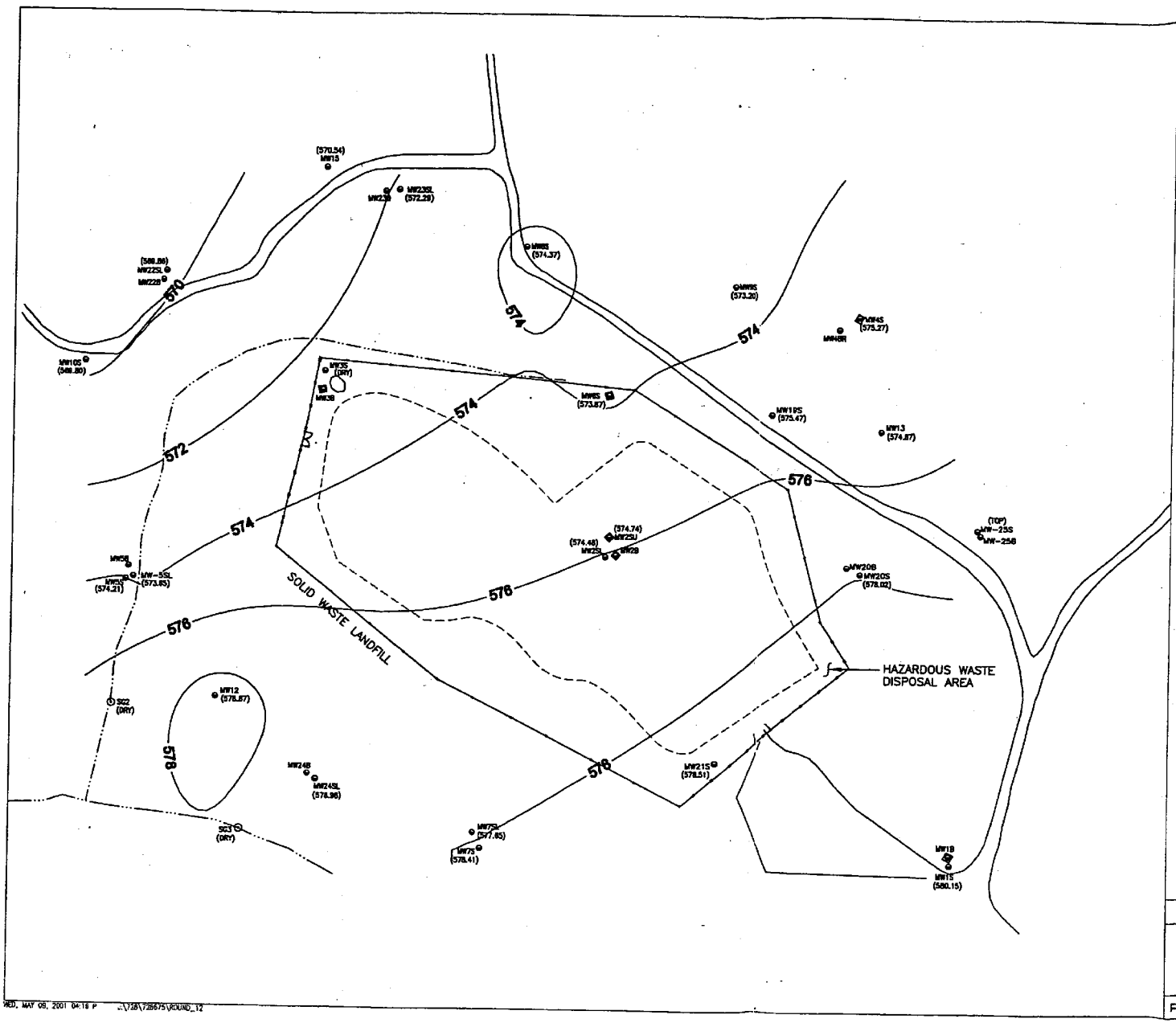
Table 3-1
Groundwater Levels and Vertical Gradients

	December 4, 2000		June 18, 2001		March 18, 2002		June 3, 2002	
Well ID	Water Level	Direction of Vertical Gradient	Water Level	Direction of Vertical Gradient	Water Level	Direction of Vertical Gradient	Water Level	Direction of Vertical Gradient
MW-1S	579.77		580.15	↓	NA		NA	
MW-1B	NA		579.59		NA		NA	
MW-2SU	575.7		575.82		572.2		571.84	
MW-2SL	575.85	↓	576.1	↓	572.34	↓	571.9	↓
MW-2B	575.9	↓	576.38	↓	572.56	↓	572.12	↓
MW-3S	NA		NA		576.05	↓	NA	
MW-3B	572.27		573.64		569.87		569.29	
MW-4S	NA		575.08		NA		NA	
MW-4BR	574.95		575.28	↓	571.31		570.96	
MW-5S	572.68	↓	574.21	↓	570.56	↓	570.06	↓
MW-5SL	572.17	↓	573.46		569.83	↓	569.14	↓
MW-5B	568.09		575.44	↓	566.44		566.1	
MW-6S	574.05		573.87		NA		NA	
MW-7S	576.29	↓	578.41	↓	573.39	↓	572.53	↓
MW-7SL	576.02		577.65		572.32		572.15	
MW-8S	575.15		574.37		NA		NA	
MW-9S	573.63		573.2		570.06		569.45	
MW-10S	569.25		569.8		565.38		565.17	
MW-12	575.97		578.87		577.74		573.85	
MW-13	574.76		574.87		571.52		571.23	
MW-15	570.36		570.54		566.44		566.1	
MW-19s	575.45		575.47		571.8		571.43	
MW-20S	577.32	↓	578.02		573.62	↓	573.36	N
MW-20B	577.24		578.1	↓	573.57		573.36	N
MW-21S	577.51		578.51		573.83		573.56	
MW-22SL	569.32	↓	569.67	↓	NA		NA	
MW-22B	569.25		569.64		NA		NA	
MW-23SL	571.79	↓	572.1	↓	NA		NA	
MW-23B	571.16		571.47		NA		NA	
MW-24SL	575.06	↓	576.79	↓	572.83	↓	571.92	↓
MW-24B	572.23		573.56		569.33		570.13	
MW-25S	NA		NA		NA		NA	
MW-25B	578.77		578.81		574.62		574.2	

Arrow direction indicates direction of vertical gradient
Empty cell indicates data is not available to determine direction.
Water levels in feet msl
NA- not applicable; no water level reported
N - no gradient exists between wells since water levels are equal
Source: Parsons Engineering Science, Inc. (2001a, 2001b, 2002b, 2002c)

ATTACHMENT A

Potentiometric Surface Maps June 2001



LEGEND

- DIRT ROAD
- FENCE
- EDGE OF RCRA CAP
- STREAM
- DRAINAGE CHANNEL
- 576 — GROUNDWATER ELEVATION CONTOUR (FT AMSL)
- EXISTING MONITORING WELL (MW-1S)
- STREAM ELEVATION GAUGE (SG-1)
- (TOP) — NOT MEASURED DUE TO PROBE HITTING THE TOP OF THE PUMP

NOTE:
WATER LEVEL MEASURMENTS WERE COLLECTED ON 6/18/01.

N

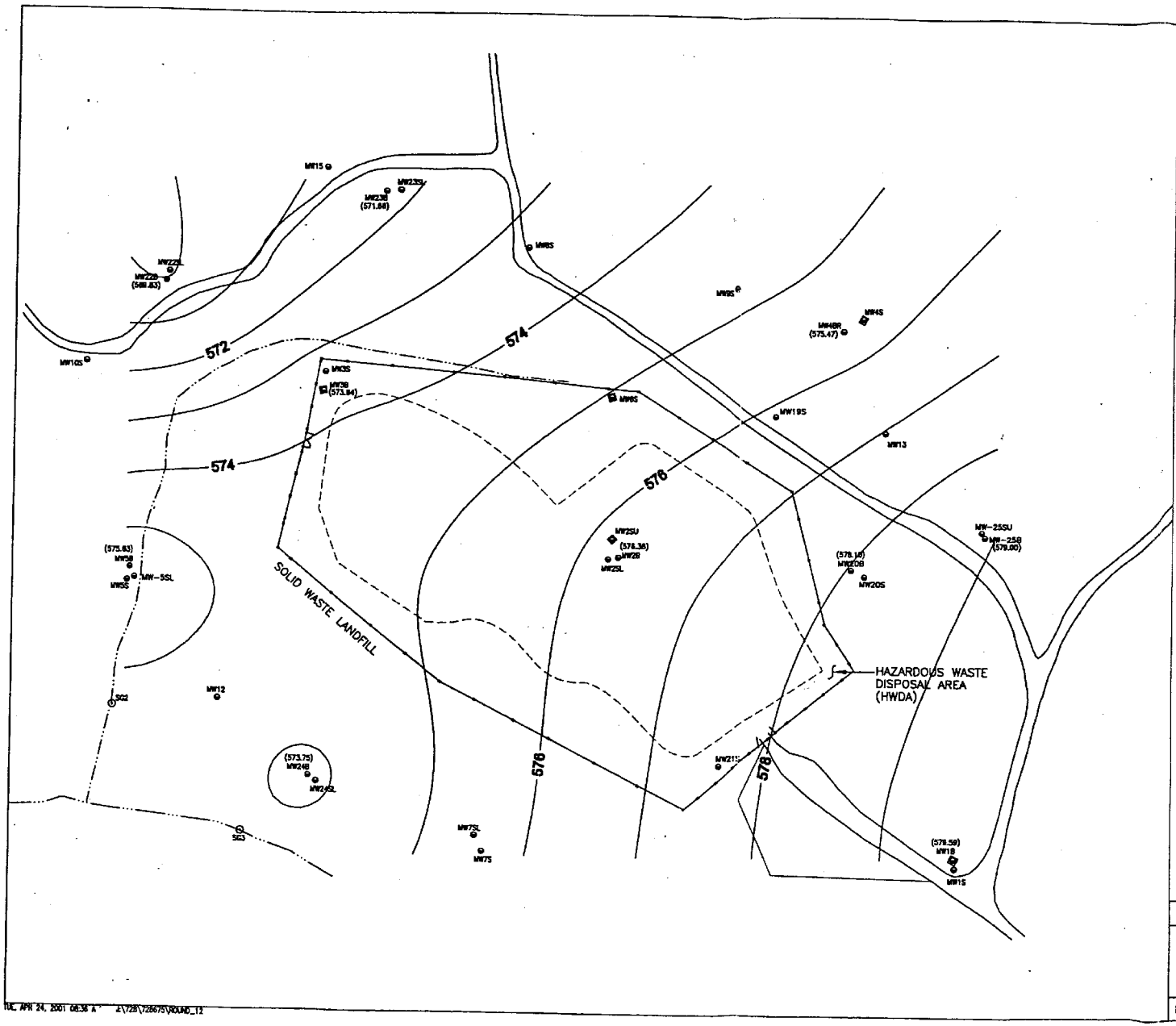
80' 40' 0 80'

Scale in Feet

FIGURE-3.1

GROUNDWATER POTENTIOMETRIC SURFACE MAP (SAPROLITE)
BUCKINGHAM COUNTY LANDFILL

PARSONS ENGINEERING SCIENCE, INC.



LEGEND

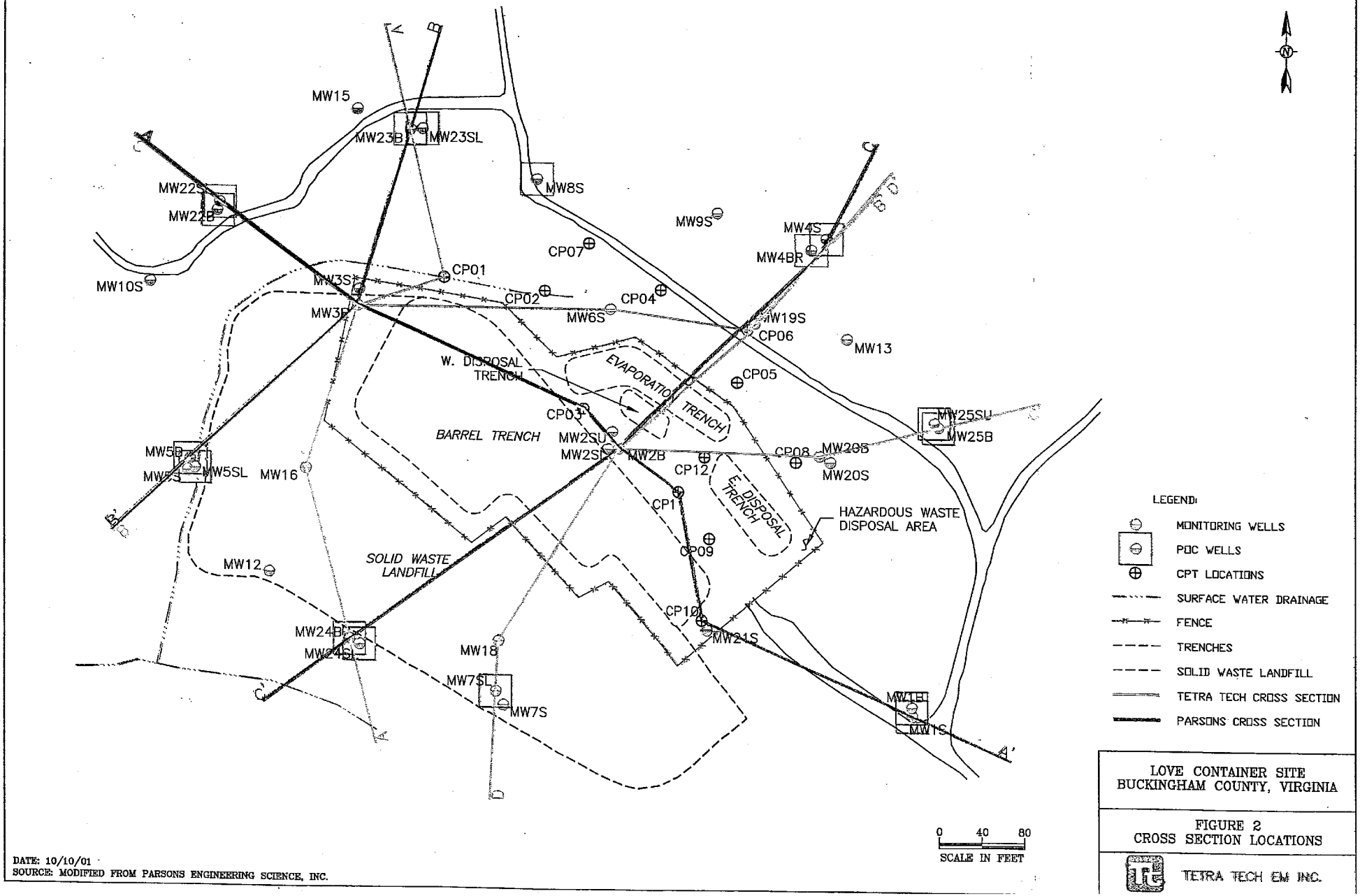
- DIRT ROAD
- FENCE
- EDGE OF RCRA CAP
- STREAM
- DRAINAGE CHANNEL
- 578 — GROUNDWATER ELEVATION CONTOUR (FEET ABOVE MEAN SEA LEVEL)
- EXISTING MONITORING WELL (MW-1S)
- STREAM ELEVATION GAUGE (SG-1)
- NM — NOT MEASURED
- (TOP) — NOT MEASURED DUE TO PROBE HITTING THE TOP OF THE PUMP

NOTE:
WATER LEVEL MEASUREMENTS WERE COLLECTED ON 6/18/01.

FIGURE-3.2

GROUNDWATER POTENTIOMETRIC SURFACE MAP (BEDROCK)
BUCKINGHAM COUNTY LANDFILL

PARSONS ENGINEERING SCIENCE, INC.



LEGEND:

- MONITORING WELLS
- POC WELLS
- CPT LOCATIONS
- SURFACE WATER DRAINAGE
- FENCE
- TRENCHES
- SOLID WASTE LANDFILL
- TETRA TECH CROSS SECTION
- PARSONS CROSS SECTION

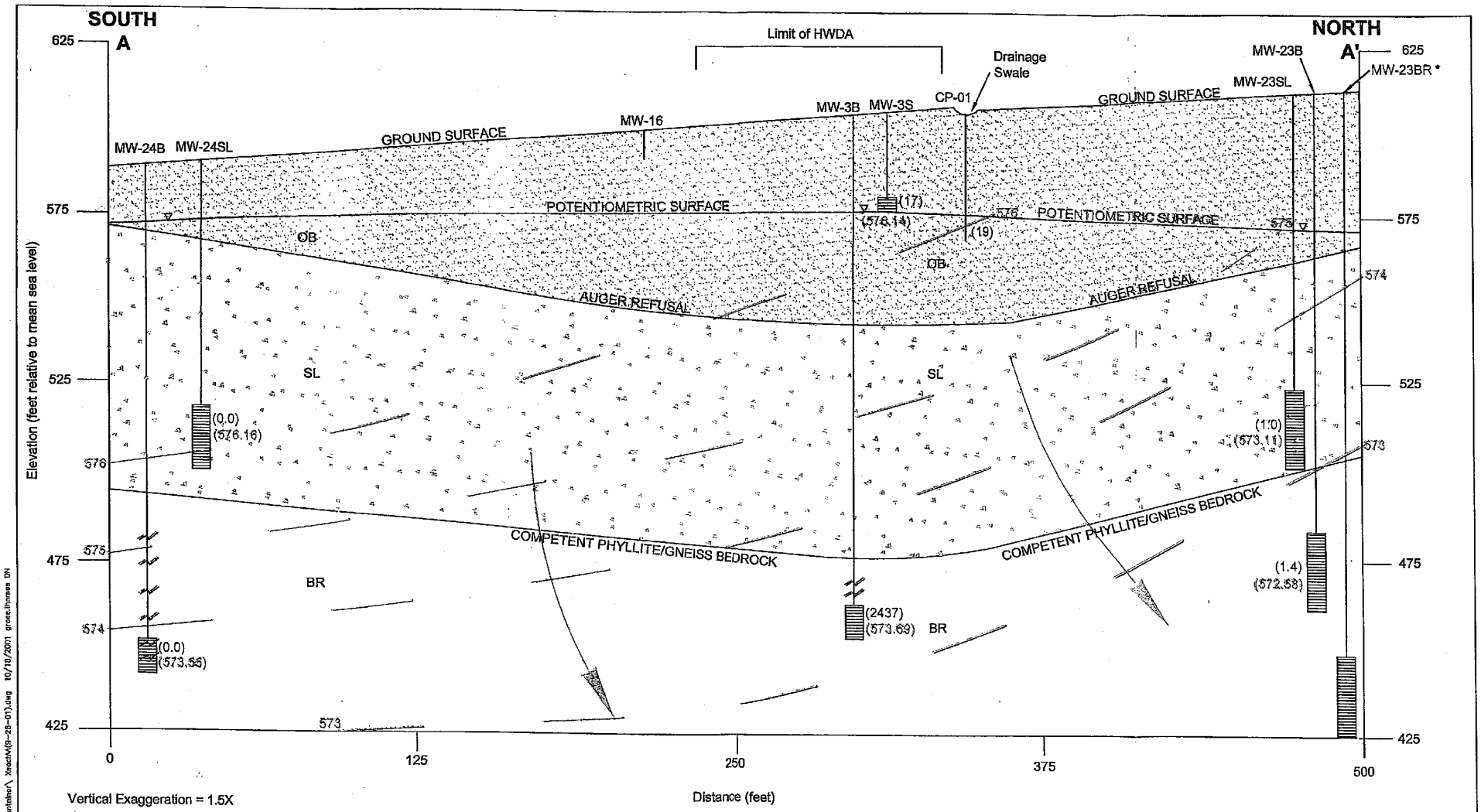
LOVE CONTAINER SITE
BUCKINGHAM COUNTY, VIRGINIA

FIGURE 2
CROSS SECTION LOCATIONS

TETRA TECH EM INC.

DATE: 10/10/01
SOURCE: MODIFIED FROM PARSONS ENGINEERING SCIENCE, INC.

F:\Projects\G00031F0007033-Love Container\ figure2.dwg 10/16/2001 gross.thomas DN



Notes:
1. Hazardous Waste Disposal Area (HWDA)
2. Geologic contacts inferred from previous investigations.
3. Water level measurements from 9/00.
4. Total VOCs from 9/00 for POC wells, and 1996-1997 for other locations.
5. NS - Not Sampled
6. *Actual depth to be based on field conditions and fractures encountered.

LEGEND

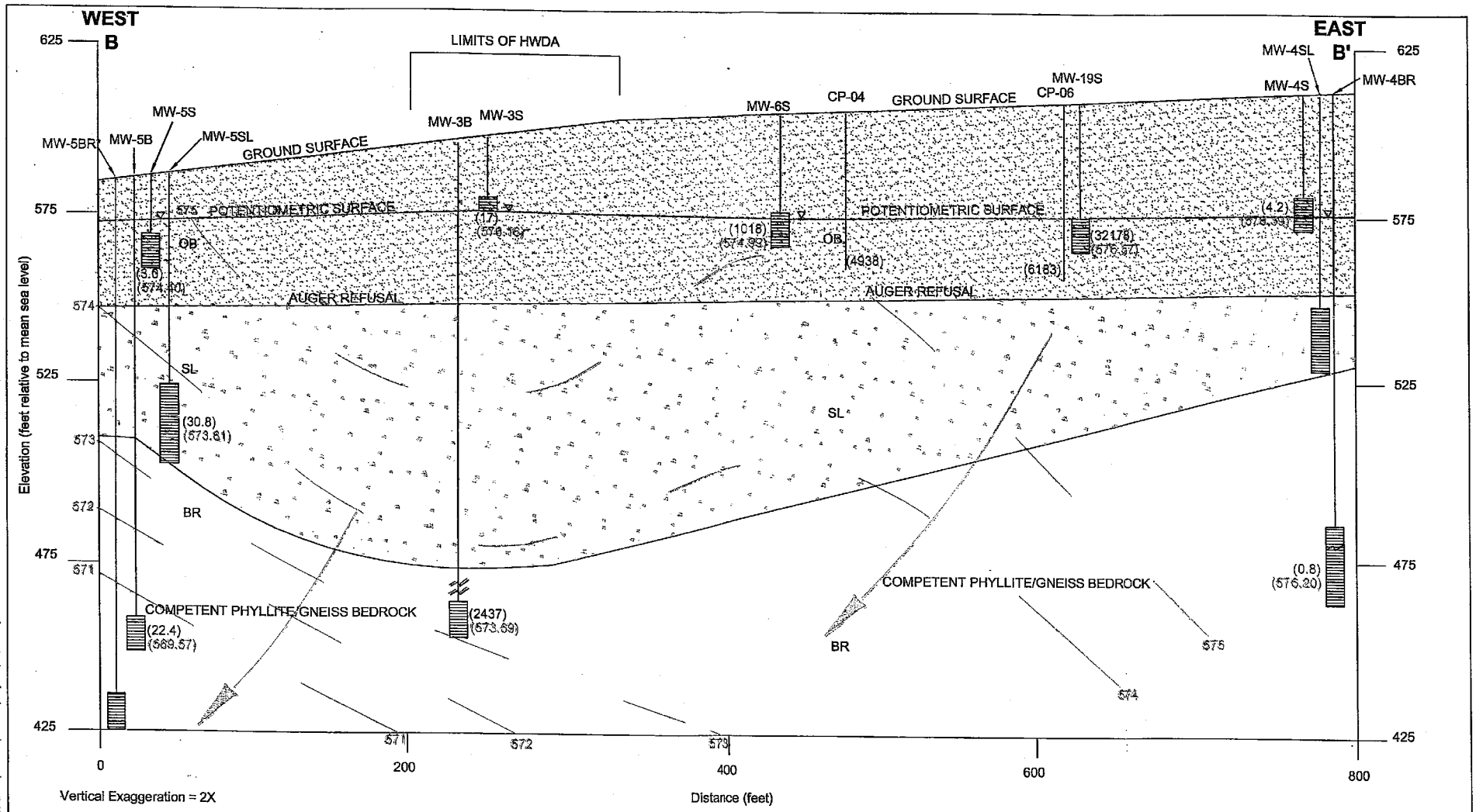
- Geologic Contact - Location inferred between wells
- Potentiometric Surface
- Well Screen Interval
- Fracture
- Potential Additional POC Well
- (#) Total VOC Concentration (ug/L)
- (#) Groundwater Elevation
- Vertical Hydraulic Gradient and Groundwater Flow Direction
- Overburden (OB)
- Saprolite (SL)
- Competent Bedrock (BR)

LOVE CONTAINER SITE
BUCKINGHAM COUNTY, VIRGINIA

FIGURE 3
HYDROGEOLOGIC CROSS SECTION A–A'

TETRA TECH EM INC.

F:\Projects\09003\f00037\031-Love Container_XsectMW(9-28-01).dwg 10/10/2001 grace.thomas DN



Notes:
1. Hazardous Waste Disposal Area (HWDA)
2. Geologic contacts inferred from previous investigations.
3. Water level measurements from 9/00.
4. Total VOCs from 9/00 for POC wells, and 1996-1997 for other locations.
5. NS - Not Sampled
6. *Actual depth to be based on field conditions and fractures encountered.

LEGEND

- Geologic Contact - Location inferred between wells
- Potentiometric Surface
- Well Screen Interval
- Fracture
- Potential Additional POC Well
- (#) Total VOC Concentration (ug/L)
- (#) Groundwater Elevation
- Vertical Hydraulic Gradient and Groundwater Flow Direction
- Overburden (OB)
- Saprolite (SL)
- Competent Bedrock (BR)

LOVE CONTAINER SITE
BUCKINGHAM COUNTY, VIRGINIA

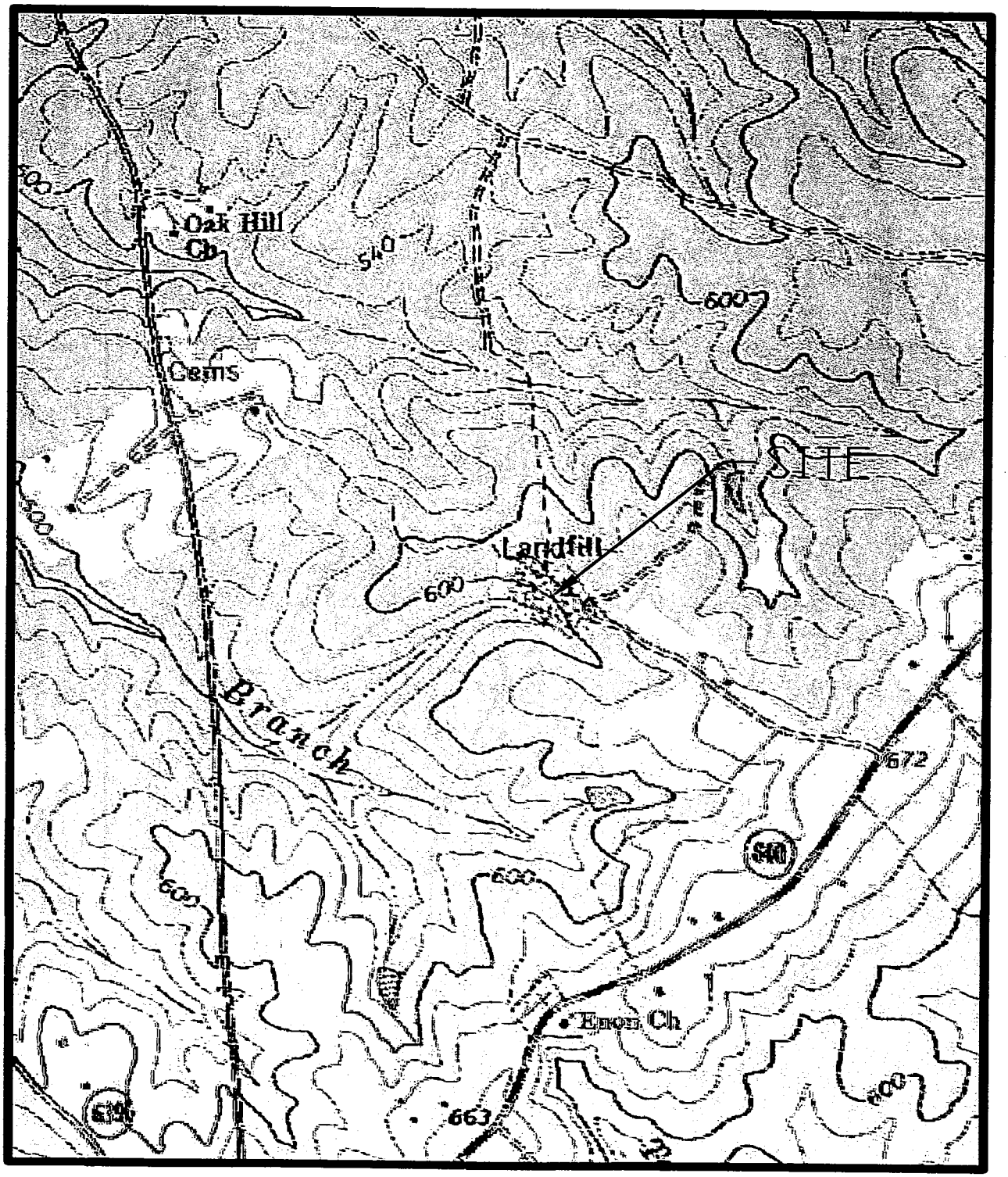
FIGURE 4
HYDROGEOLOGIC CROSS SECTION B-B'

TETRA TECH EM INC.

F:\Projects\G90031F0007031-Love Container_Xsect\BB(9-26-01).dwg 10/18/2001 grace.thomas DN

ATTACHMENT B

Historical Hydrogeological Cross Sections A-A′ and B-B′



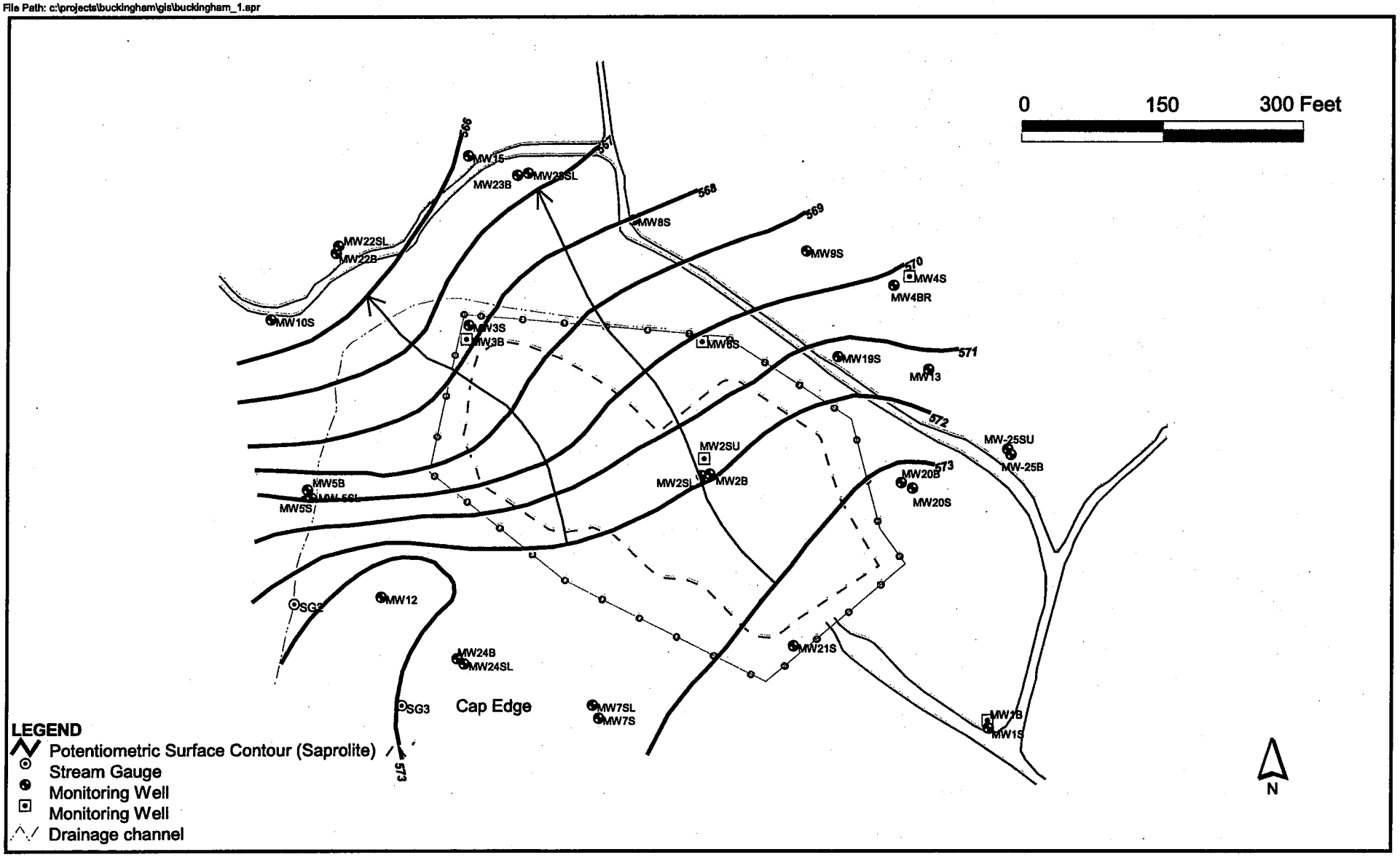
Source: US Geological Survey

Buckingham County Landfill Site
Buckingham County, Virginia

Figure 2-1
Site Location Map

CDM

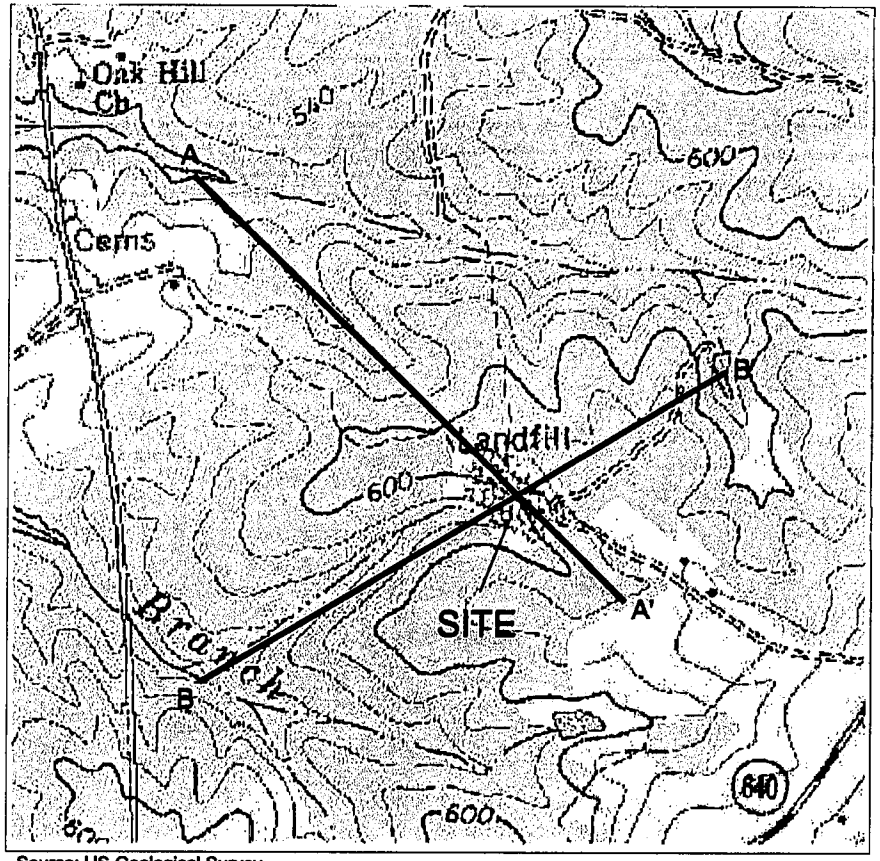
File Path: c:\projects\buckingham\gis\buckingham_1.apr

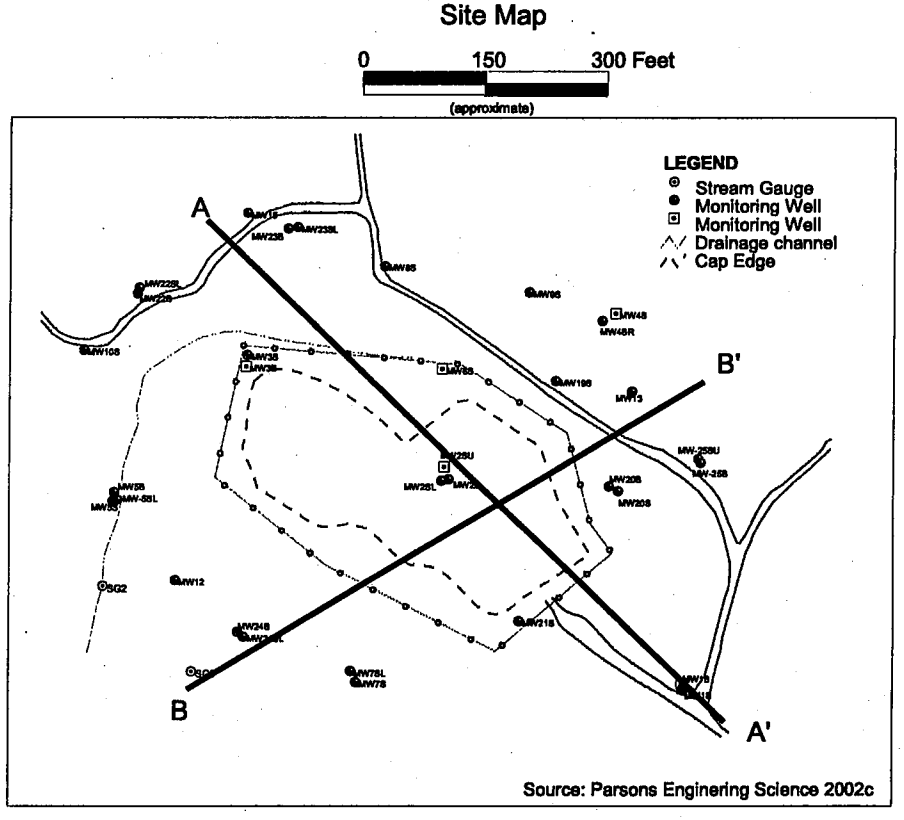


CDM

Buckingham County Landfill Superfund Site
Buckingham County, Virginia

Figure 3-1
Saprolite Potentiometric Surface for
June 30, 2002



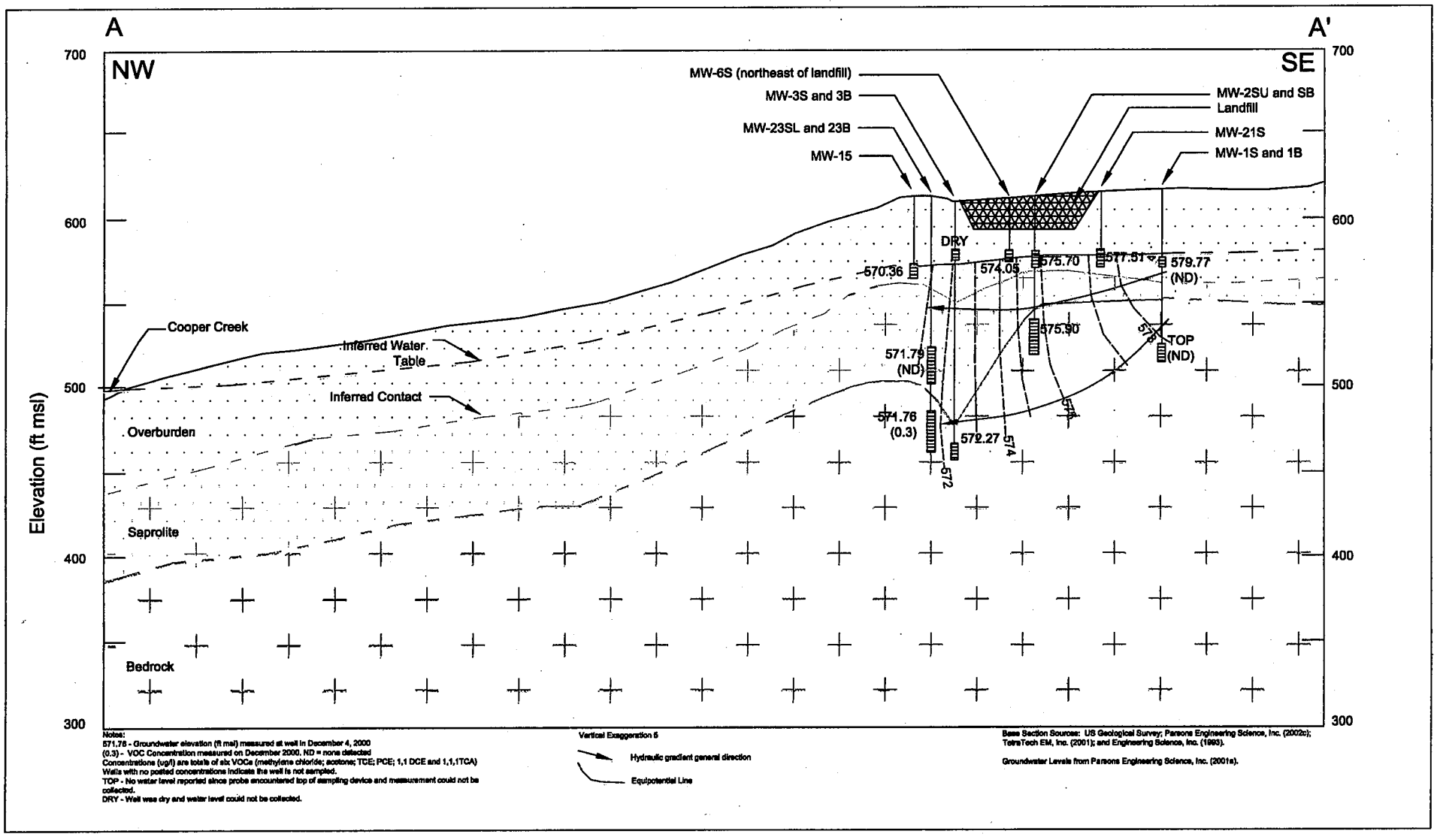


N

Buckingham County Landfill Site
Buckingham County, Virginia

Figure 3-3
Cross Section Location Map

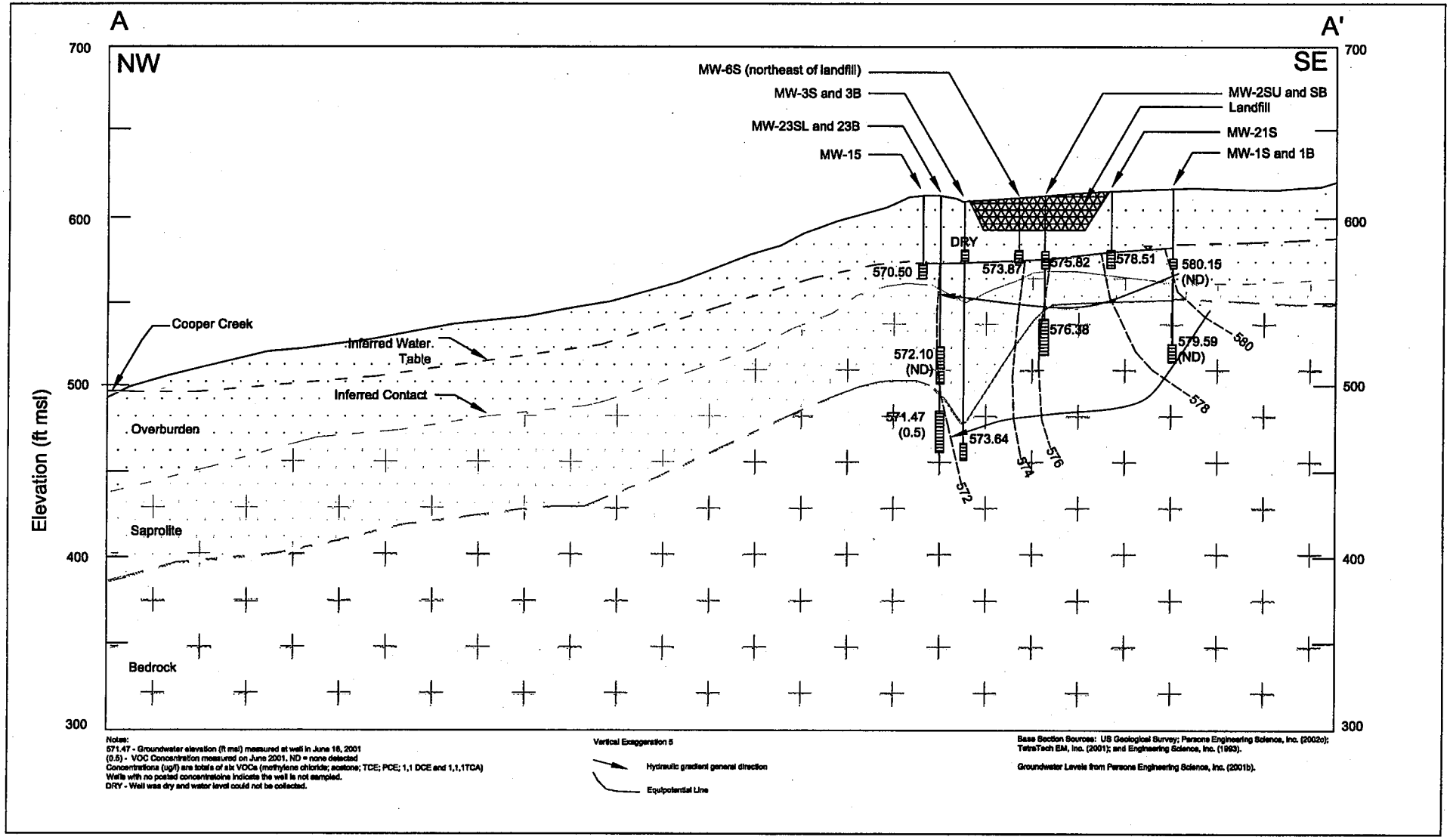
CDM



Buckingham County Landfill Superfund Site
Buckingham County, Virginia

Figure 3-4
Hydrogeological Section A-A'
for December 2000

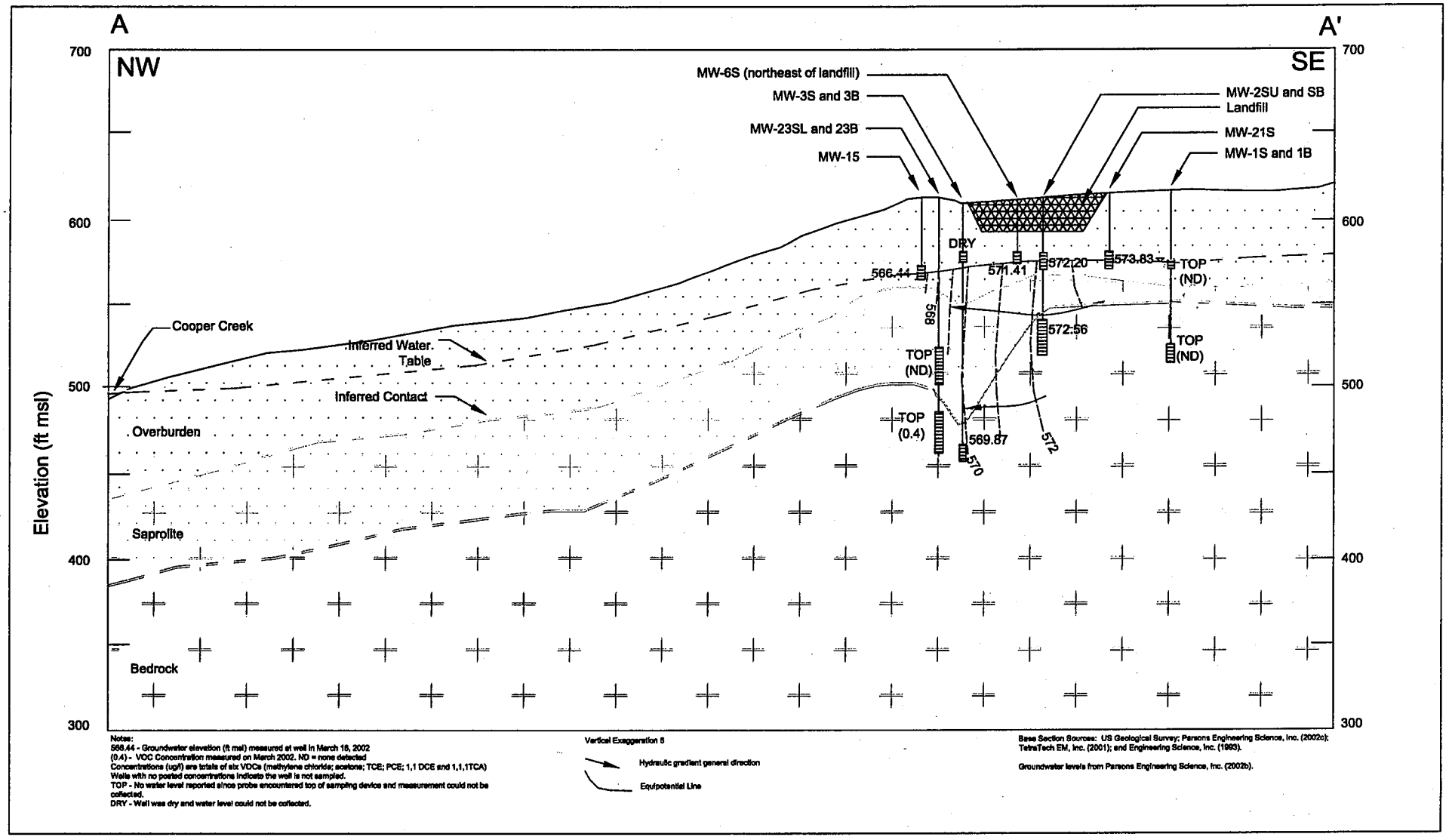
CDM



CDM

Buckingham County Landfill Superfund Site
Buckingham County, Virginia

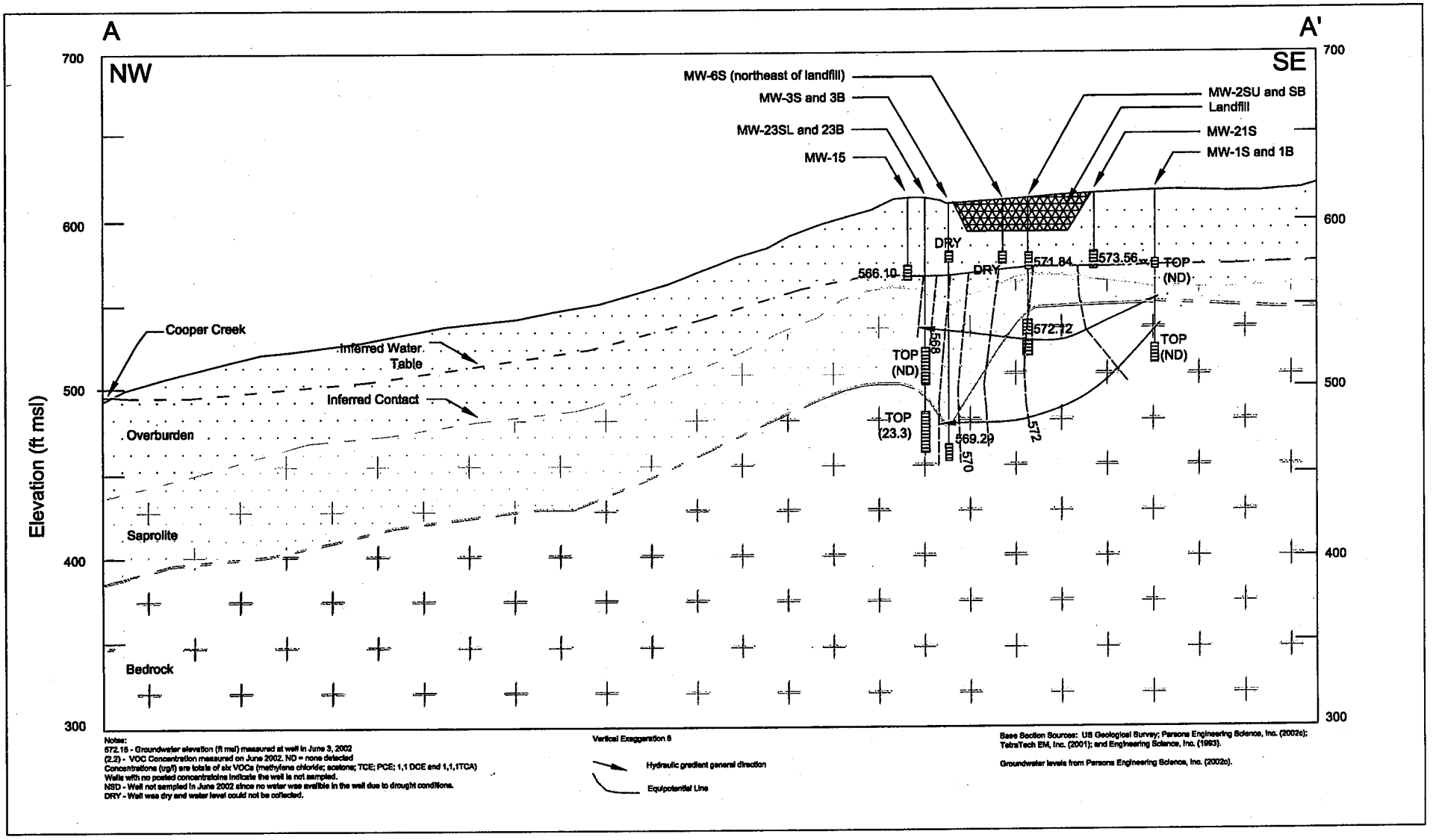
Figure 3-5
Hydrogeological Section A-A'
for June 2001



Buckingham County Landfill Superfund Site
Buckingham County, Virginia

Figure 3-6
Hydrogeological Section A-A'
for March 2002

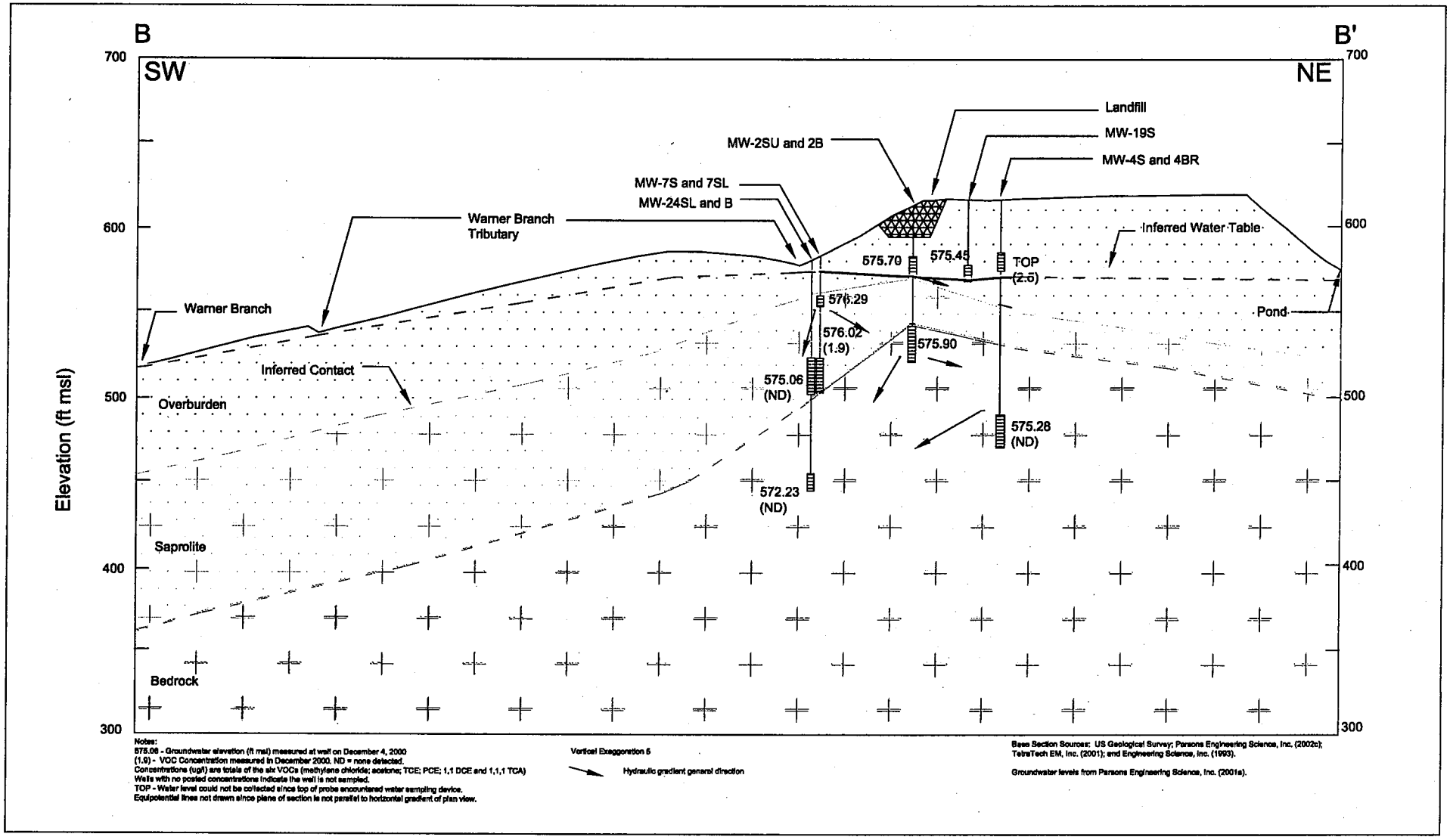
CDM



Buckingham County Landfill Superfund Site
Buckingham County, Virginia

Figure 3-7
Hydrogeological Section A-A'
for June 2002

CDM



Notes:
575.06 - Groundwater elevation (ft msl) measured at well on December 4, 2000
(1.9) - VOC Concentration measured in December 2000. ND = none detected.
Concentrations (ug/l) are totals of the six VOCs (methylene chloride; acetone; TCE; PCE; 1,1 DCE and 1,1,1 TCA)
Wells with no posted concentrations indicate the well is not sampled.
TOP - Water level could not be collected since top of probe encountered water sampling device.
Equipotential lines not drawn since plane of section is not parallel to horizontal gradient of plan view.

Vertical Exaggeration 5

Hydraulic gradient general direction

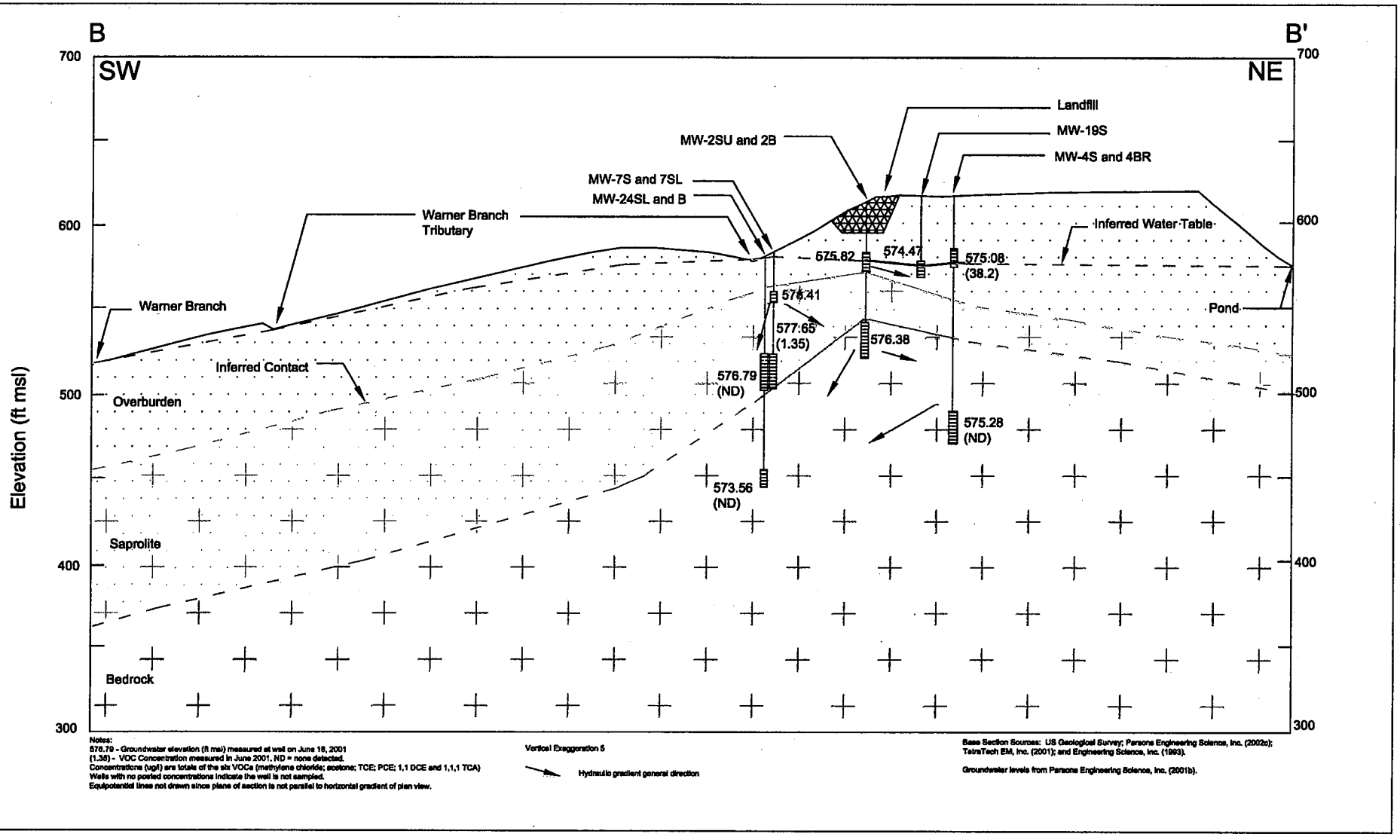
Base Section Sources: US Geological Survey; Parsons Engineering Science, Inc. (2002c); TetraTech EM, Inc. (2001); and Engineering Science, Inc. (1993).

Groundwater levels from Parsons Engineering Science, Inc. (2001a).

CDM

Buckingham County Landfill Superfund Site
Buckingham County, Virginia

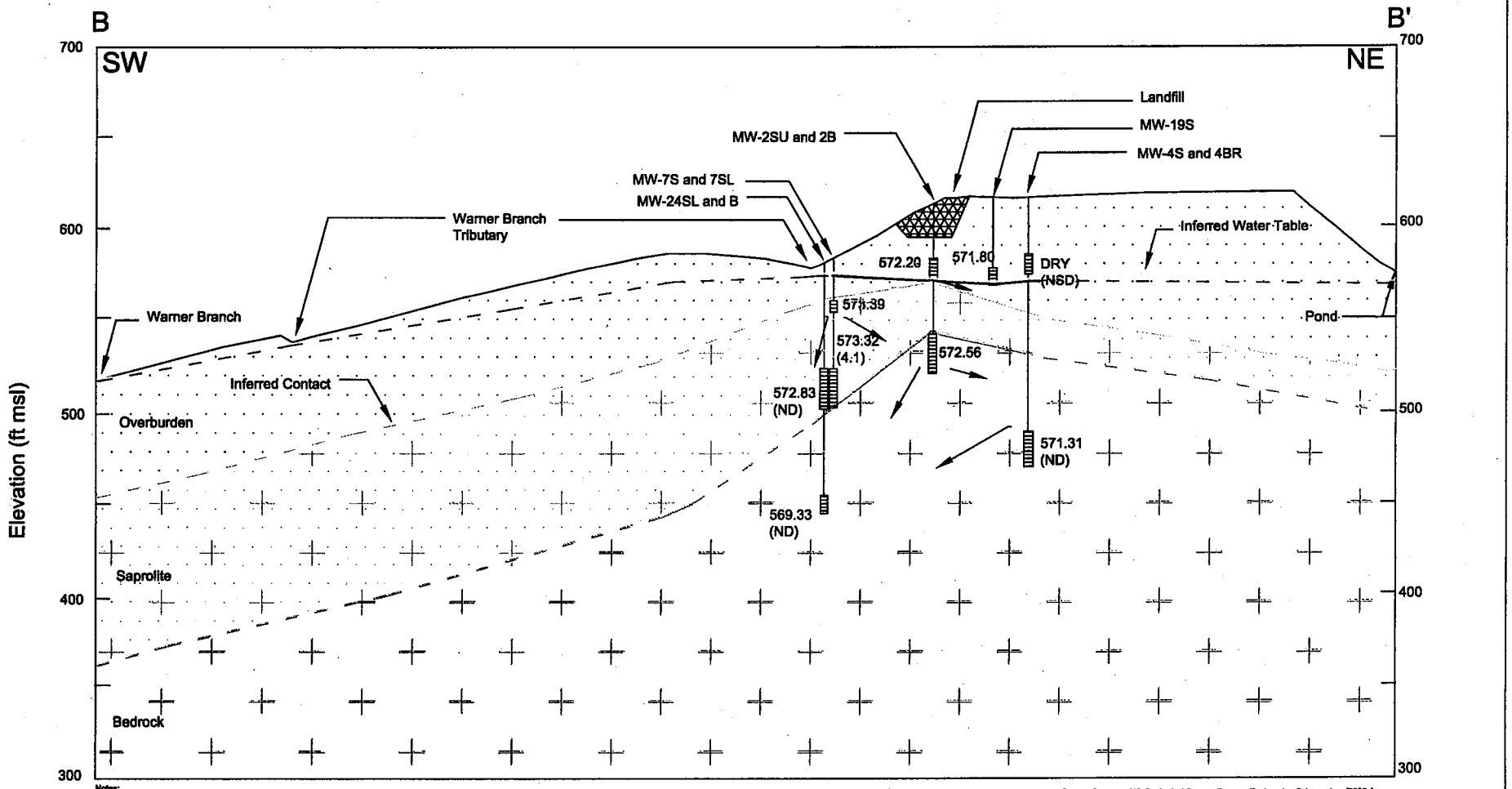
Figure 3-8
Hydrogeologic Section B - B'
for December 2000



Buckingham County Landfill Superfund Site
Buckingham County, Virginia

Figure 3-9
Hydrogeologic Section B - B'
for June 2001

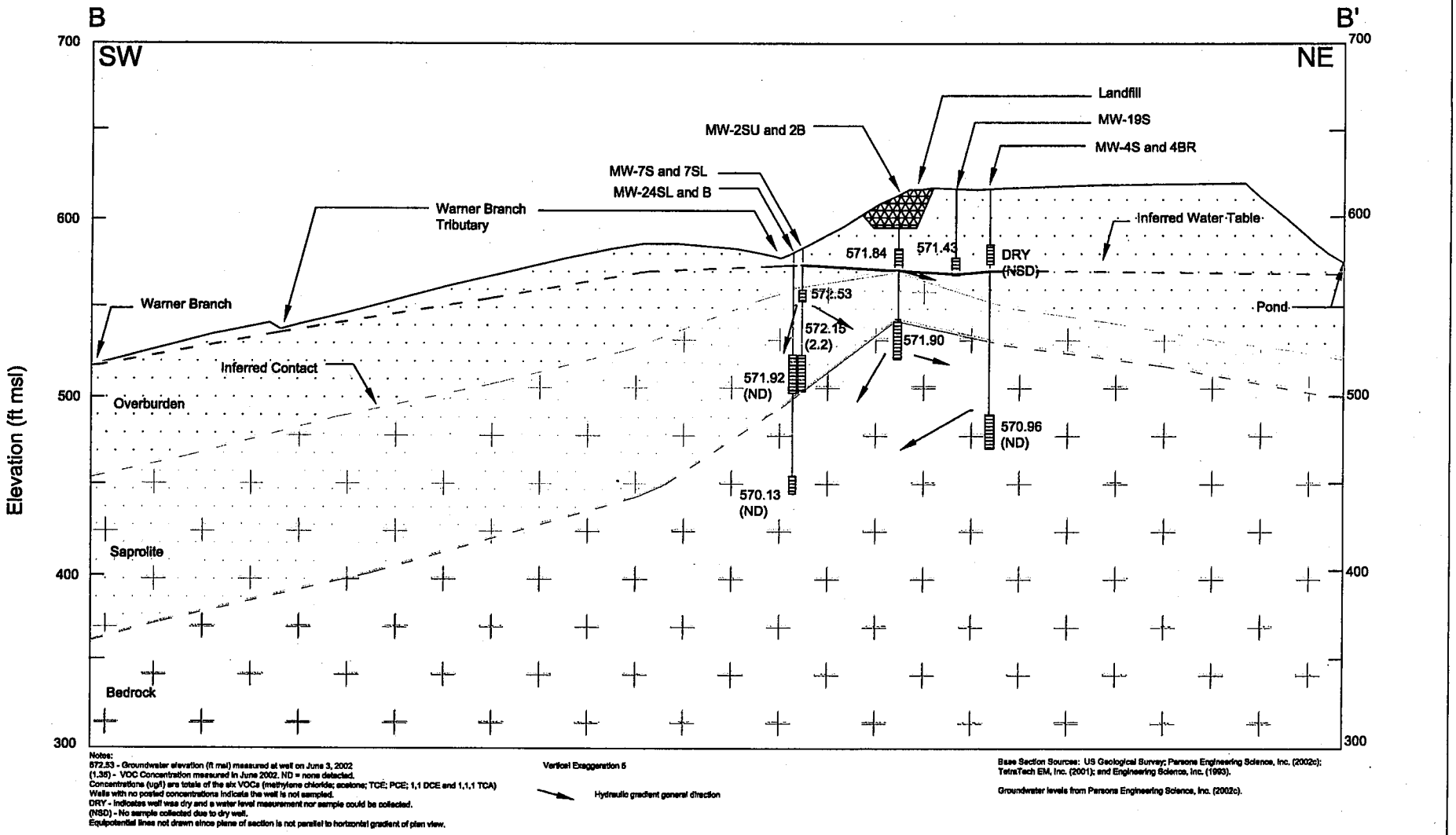
CDM



Buckingham County Landfill Superfund Site
Buckingham County, Virginia

Figure 3-10
Hydrogeologic Section B - B'
for March 2002

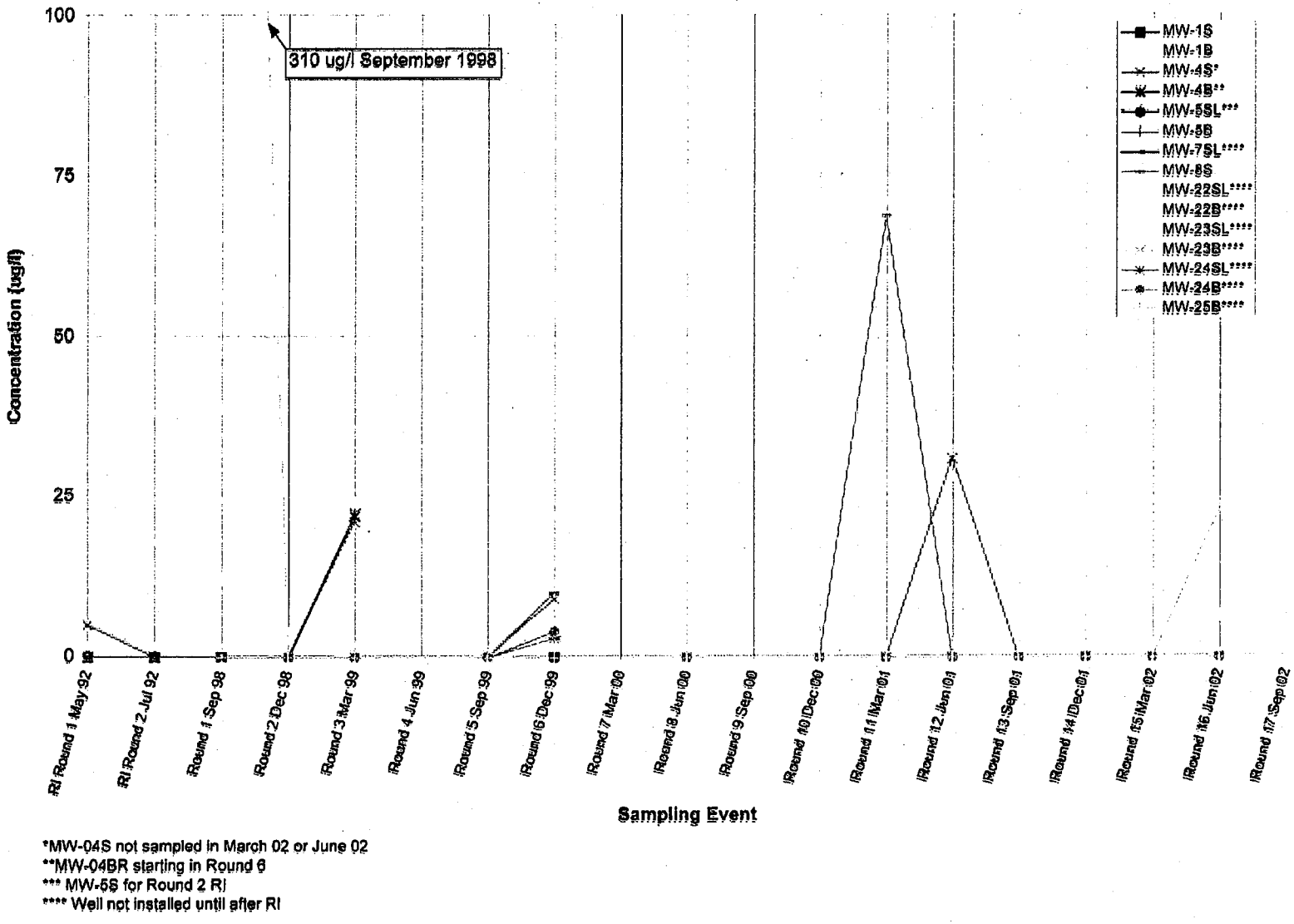
CDM



CDM

Buckingham County Landfill Superfund Site
Buckingham County, Virginia

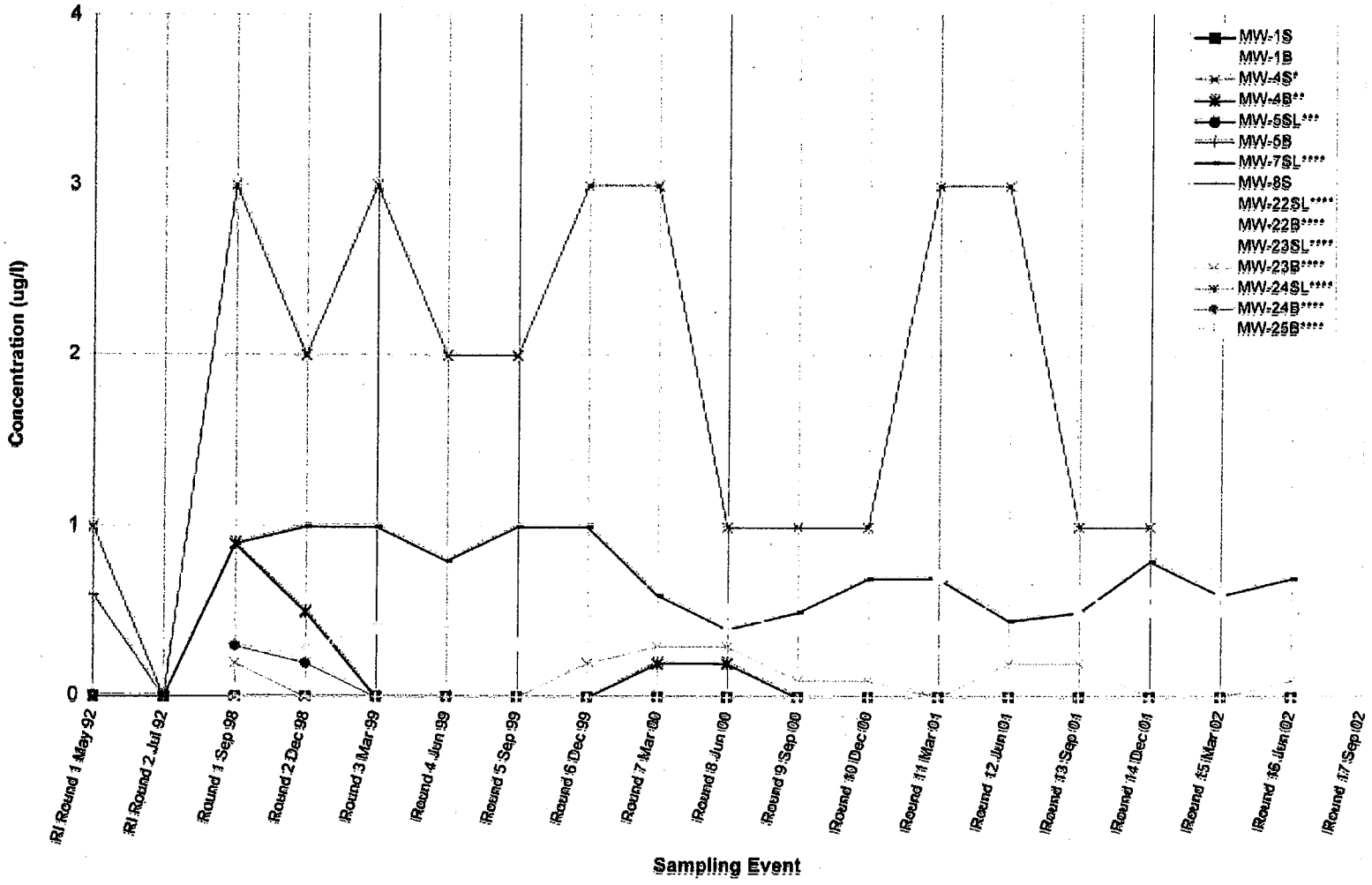
Figure 3-11
Hydrogeologic Section B - B'
for June 2002



Buckingham County Landfill Superfund Site
Buckingham County, Virginia

Figure 4-1
Acetone in Groundwater

CDM

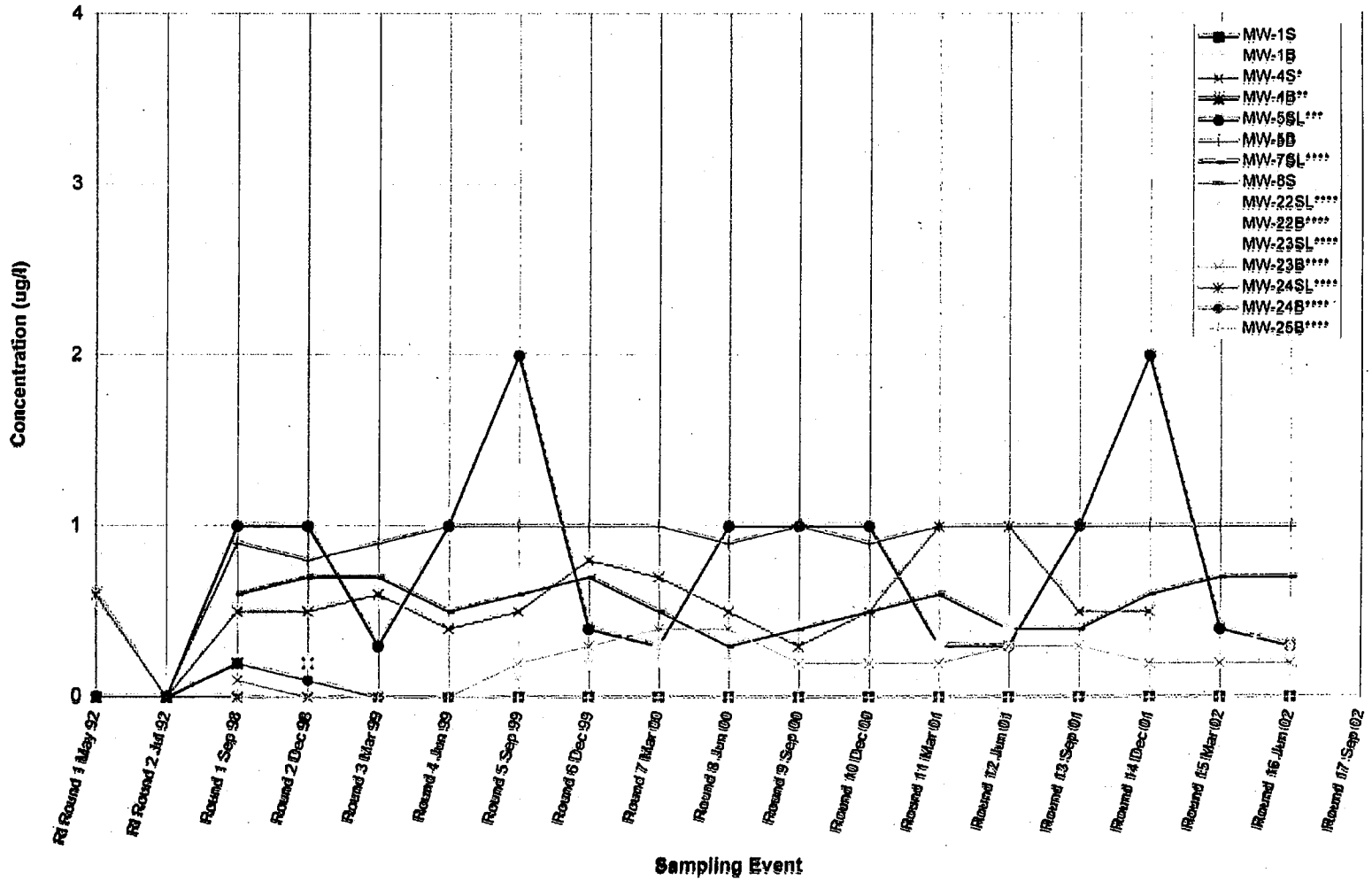


*MW-04S not sampled in March 02 or June 02
**MW-04BR starting in Round 6
*** MW-5S for Round 2 RI
**** Well not installed until after RI

Buckingham County Landfill Superfund Site
Buckingham County, Virginia

Figure 4-2
1,1,1 Trichloroethane in Groundwater

CDM

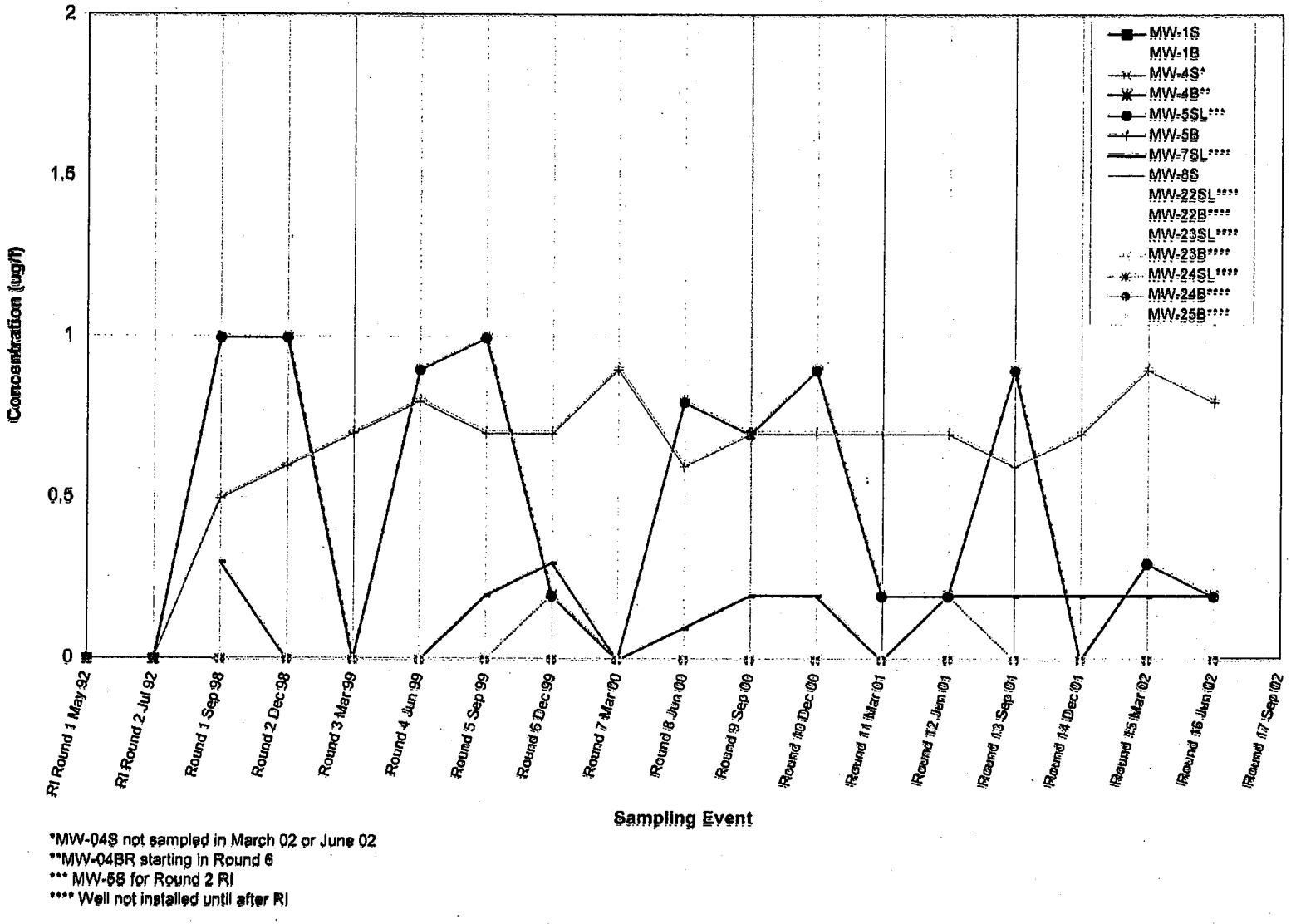


*MW-04S not sampled in March 02 or June 02
**MW-04BR starting in Round 6
*** MW-5S for Round 2 RI
**** Well not installed until after RI

Buckingham County Landfill Superfund Site
Buckingham County, Virginia

Figure 4-3
Perchloroethene in Groundwater

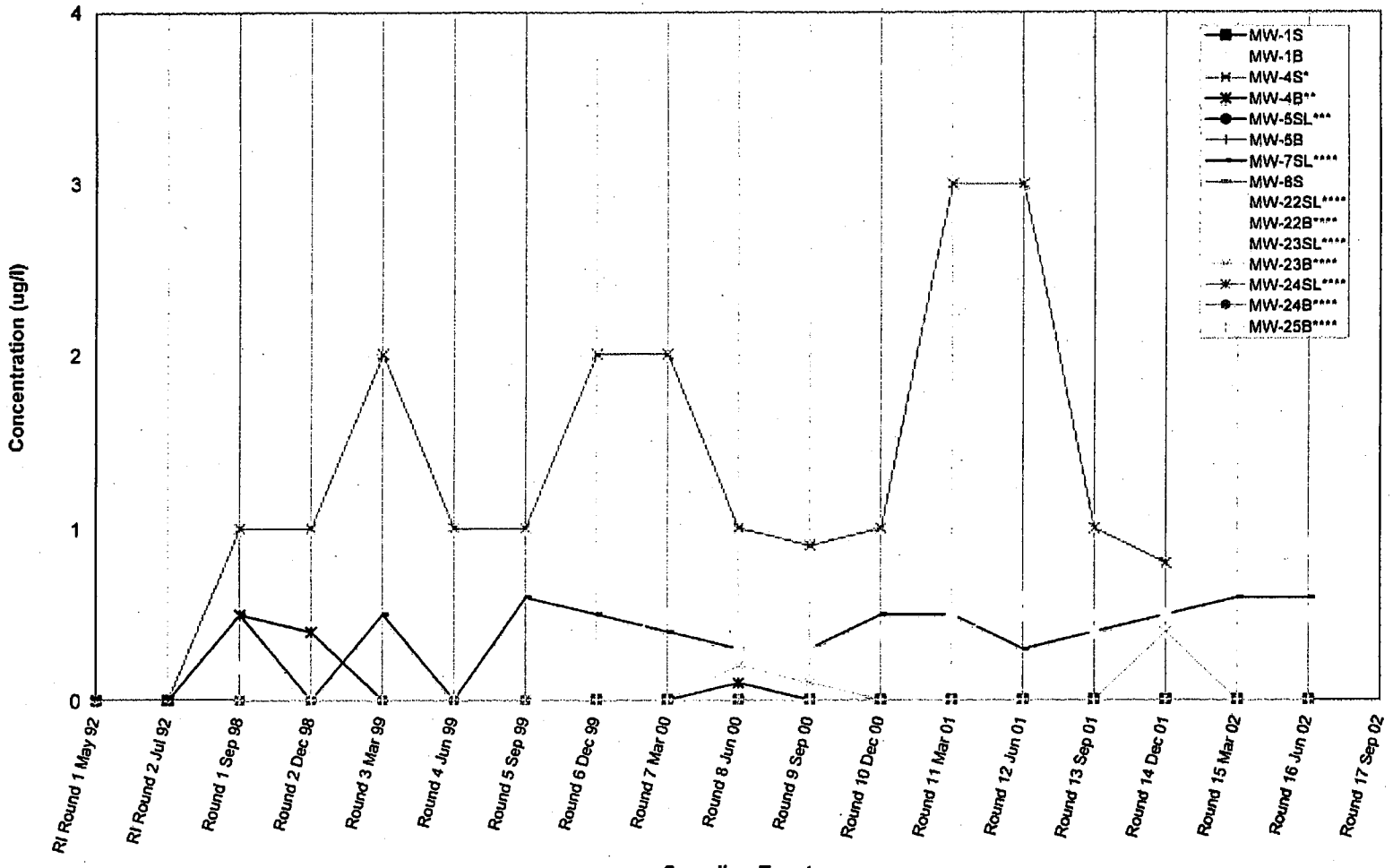
CDM



Buckingham County Landfill Superfund Site
Buckingham County, Virginia

Figure 4-4
Trichloroethene in Groundwater

CDM

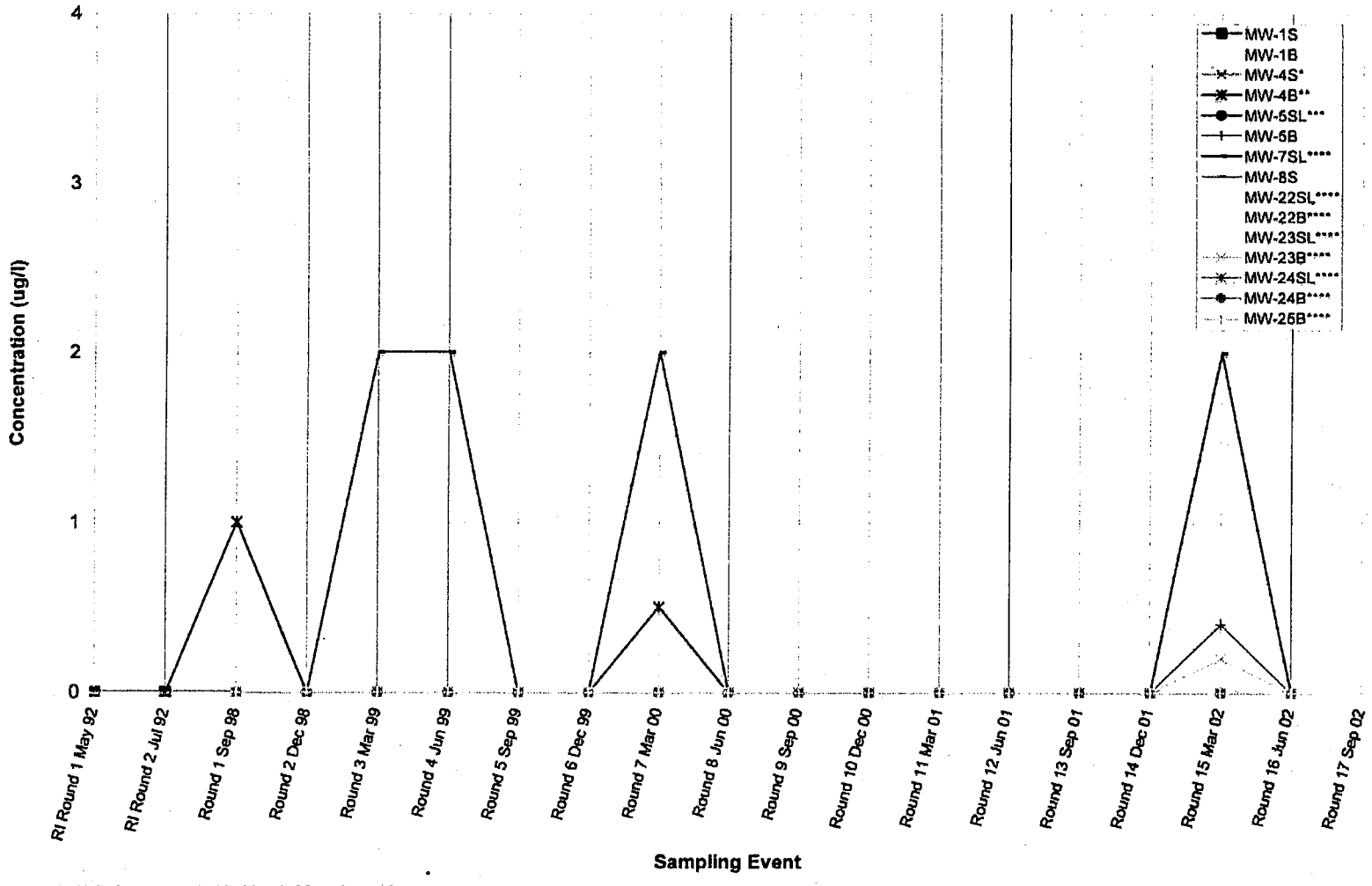


*MW-04S not sampled in March 02 or June 02
**MW-04BR starting in Round 6
*** MW-5S for Round 2 RI
**** Well not installed until after RI

Buckingham County Landfill Superfund Site
Buckingham County, Virginia

Figure 4-5
1,1 Dichloroethene in Groundwater

CDM



*MW-04S not sampled in March 02 or June 02
**MW-04BR starting in Round 6
*** MW-5S for Round 2 RI
**** Well not installed until after RI

Buckingham County Landfill Superfund Site
Buckingham County, Virginia

Figure 4-6
Methylene Chloride in Groundwater

CDM

APPENDIX B

Interviews

INTERVIEW DOCUMENTATION FORM

The following is a list of individual interviewed for this five-year review. See the attached contact record(s) for a detailed summary of the interviews.

Name	Title/Position	Organization	Date
Stella Price	Homeowner	—	8/28/03
Carroll Gillispie	Homeowner	—	8/29/03
Anne Gillispie	Homeowner	—	8/29/03
Dave Gillispie	Homeowner	—	8/29/03

INTERVIEW RECORD

Site Name: Buckingham County Landfill		EPA ID No.:	
Subject: Five-Year Review		Time:	Date:
Type: ☐ Telephone ☒ Visit ☐ Other Location of Visit: Home of Stella Price - Rt. 640		☐ Incoming ☐ Outgoing	
Contact Made By:			
Name: Vance Evans	Title: CIC	Organization: EPA Reg. 3	
Individual Contacted:			
Name: Stella Price	Title: Homeowner	Organization:	
Telephone No: 434-983-2528 Fax No: E-Mail Address:		Street Address: Rt. 640 City, State, Zip: Buckingham, VA	

Summary Of Conversation

Vance Evans (US EPA), Rich Opem (COM), & Nancy Ketterer (COM) interviewed Mrs. Price at her home just upgradient of the site.

Mrs. Price noted that she had not heard much about the site over the past 5 years until she decided to sell some of her property. A potential buyer of her property contacted Vance Evans when the Site appeared on an Internet search he had done. Thus, Mrs. Price is concerned about the site's potential impact on her property value. She assumes that EPA will remedy any health issues posed by the site, and believes that the County should take care of any threats, regardless of cost.

Mrs. Price has not heard any concerns about the Site from neighbors, or seen any evidence of site impacts, such as dead animals. C-9 In general, she reads the newspaper & feels well-informed about the site.

INTERVIEW RECORD

Site Name: Buckingham County Landfill		EPA ID No.:	
Subject: Five-Year Review		Time:	Date:
Type: ☐ Telephone ☒ Visit ☐ Other Location of Visit: Home of Mrs. Stella Price		☐ Incoming ☐ Outgoing	
Contact Made By:			
Name: Vance Evans	Title: CIC	Organization: US EPA Reg 3	
Individual Contacted:			
Name: Stella Price	Title: Homeowner	Organization:	
Telephone No: 434-983-2528 Fax No: E-Mail Address:		Street Address: City, State, Zip:	

Summary Of Conversation

Vance Evans explained the purpose of the 5-yr review and Mrs. Price noted that reviews should be done at least that often.

Mrs. Price asked about the vials of water required from her for testing. She noted that a green stain/crust appears in her percolator or tub if the water drips or settles. She was not sure of the dept of her well, but she has not been impacted by recent droughts although creeks in the area have been quite low. The well was installed 40-50 years ago.

Mrs. Price said that although she doesn't understand the technical issues concerning the site, she assumes EPA will take care of it. She doubts the quality of maintenance done at the site by the County.

Mrs. Price is a widow who also lost a son in the past year. Her property is now C-9 off the market, but she may still sell some of the land, but not the house, if she can stipulate how the land will be used

INTERVIEW RECORD

Site Name: Buckingham County Landfill		EPA ID No.:	
Subject: Five-Year Review		Time:	Date:
Type: ☐ Telephone ☒ Visit ☐ Other Location of Visit: Home of Carroll Gillispie		☐ Incoming ☐ Outgoing	
Contact Made By:			
Name: Vance Evans	Title: CIC	Organization: EPA Reg. 3	
Individual Contacted:			
Name: Dave Gillispie	Title: Homeowner	Organization: VA DEQ	
Telephone No: 804-698-4209 Fax No: E-Mail Address:		Street Address: Rt. 633 City, State, Zip: Buckingham, VA	

Summary Of Conversation

Vance Evans (EPA Reg. 3), Rich Opem (CDM), & Nancy Ketterer (CDM) visited Mr. Carroll Gillispie, his wife Anne, & his son Dave at his home downgradient of the site.

Dave Gillispie owns property directly across the street from his father. Both have wells and are primarily concerned with the safety of their drinking water. In 1984, they received a letter from EPA noting that chromium & beryllium were detected in their water at concentrations above MCLs. The letter recommended that they contact VA Dept. of Health regarding the potability of their water. DOH sent a letter stating that they should not drink water that exceeds EPA standards. Since then, the Gillispies

have not been drinking their water and are awaiting written notification that their water is safe to drink. A letter from EPA in 1999 stated C-9 that EPA would follow-up on the potability of their water. For the past 2-3 yrs, the Gillispies

INTERVIEW RECORD

Site Name: Buckingham County Landfill	EPA ID No.:	
Subject: Five-Year Review	Time:	Date:
Type: ☐ Telephone ☒ Visit ☐ Other Location of Visit: Home of Carroll Gillespie	☐ Incoming ☐ Outgoing	

Contact Made By:

Name: Vance Evans	Title: CIC	Organization: EPA Reg. 3

Individual Contacted:

Name: Dave Gillespie	Title: Homeowner	Organization: VA DEQ
Telephone No: 804-698-4209 Fax No: E-Mail Address:	Street Address: City, State, Zip:	

Summary Of Conversation

The Gillespies were not happy with the remedy selection process and the cleanup remedy implemented. We discussed the fact that this was not the remedy initially recommended by EPA, but a scaled-back remedy adopted due to extensive community input. Dave thought that EPA should have been more vocal when local and state government were telling the community that taxes would be raised and jobs lost if EPA's remedy was implemented. They feel that the few downgradient residents were disenfranchised by the State and County in their push for a non-active remedy

Mr. Gillespie explained that they had 4 healthy children prior to the start of waste disposal at the site. After the site started

operating, they had one baby die and one born with disabilities. Dave Gillespie said that VA DEQ's decision to allow the site permit to change from 50 gallons/month to basically unlimited waste was not a good evaluation of the clay soils ability to contain the additional waste

INTERVIEW RECORD

Site Name: Buckingham County Landfill	EPA ID No.:	
Subject: Five-Year Review	Time:	Date:
Type: ☐ Telephone ☒ Visit ☐ Other Location of Visit: Home of Carroll & Ann Gillespie	☐ Incoming ☐ Outgoing	

Contact Made By:

Name: Vance Evans	Title: CIC	Organization: EPA Reg. 3

Individual Contacted:

Name: Dave Gillispie	Title: Homeowner	Organization: VA DEQ
Telephone No: 804-698-4209 Fax No: E-Mail Address:	Street Address: City, State, Zip:	

Summary Of Conversation

The Gillispies are not confident of the protectiveness of the cap or the groundwater monitoring wells. A recent hit in one of the samples from their well, and no hits in monitoring wells, makes Dave G. believe that the monitoring wells are not correctly placed. He also noted that with DNAPLs in the groundwater, the cap doesn't do anything and its maintenance is irrelevant. He did submit comments on the design and his opinion that it was inadequate when EPA presented the revised proposed plan. Vance Evans explained that if it is found that the remedy is not protective during the Five-Year Review, additional work/investigation can be done.

We discussed the history of ownership at the site. BFI considered the site, but decided it was too small. WRC proposed building a hazardous waste incinerator at the site, but the community opposed it. The County claims to have bought site to prevent WRC from buying it.

INTERVIEW RECORD

Site Name: Buckingham County Landfill		EPA ID No.:	
Subject: Five-Year Review		Time:	Date:
Type: ☐ Telephone ☒ Visit ☐ Other Location of Visit: Home of Carroll & Anne Gillespie		☐ Incoming ☐ Outgoing	
Contact Made By:			
Name: Vance Evans	Title: CIC	Organization: EPA Reg. 3	
Individual Contacted:			
Name: Dave Gillespie	Title: Homeowner	Organization: VA DEQ	
Telephone No: 804-698-4209 Fax No: E-Mail Address:		Street Address: City, State, Zip:	

Summary Of Conversation

Dave G. thought that if the County had not purchased the site, they would have been able to recovered cleanup costs for a protective remedy from the responible parties.

The Gillespies believe that the rest of the community just forgot about the site. They, along with ~~members of~~ the Oak Hill Church (Munroe Spencer deacon), have the only wells near and down gradient of the site. As stated earlier, their main concern is getting EPA word on the potability of their water. They don't want to be referred to the state again, since the site is now under the Superfund program.

Rich Opem noted that the samples from their well have been

clean for several years, and the current hit detected is below MCLs. Vance Evans said that the 1999 letter did state that EPA has no problems with their C-9 water samples, but that he would follow-up on the Gillespie's request. Questionnaires were also

APPENDIX C

Site Inspection Checklist

Please note that "O&M" is referred to throughout this checklist. At sites where Long-Term Response Actions are in progress, O&M activities may be referred to as "system operations" since these sites are not considered to be in the O&M phase while being remediated under the Superfund program.

Five-Year Review Site Inspection Checklist (Template)

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION	
Site name: BUCKINGHAM COUNTY LANDFILL	**Date of inspection:** 9/17/03
Location and Region: Buckingham County, VA (RS. 3)	**EPA ID:**
Agency, office, or company leading the five-year review: U.S. EPA	**Weather/temperature:** Sunny, 80°F

Remedy ~~Includes:~~ (Check all that apply)

- (Landfill cover/containment)
- (Access controls)
- (Institutional controls) – DEED RESTRICTIONS
- Groundwater pump and treatment
- Surface water collection and treatment
- Monitored natural attenuation
- Groundwater containment
- Vertical barrier walls
- Other LONG-TERM GROUNDWATER MONITORING

Attachments: Inspection team roster attached Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** N/A _____ _____ _____
   Name Title Date
   Interviewed at site at office by phone Phone no. _____
   Problems, suggestions; Report attached _____

2. **O&M staff** N/A _____ _____ _____
   Name Title Date
   Interviewed at site at office by phone Phone no. _____
   Problems, suggestions; Report attached _____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency VA. DEPT. OF ENV. QUALITY (VDEQ)
Contact Thomas Modena Env. Eng. Consultant _____ (804) 698-4183
Name Title Date Phone no.
Problems; suggestions; Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; Report attached _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; Report attached _____

4. **Other interviews** (optional) Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents** N/A
   - O&M manual — Readily available — Up to date — (N/A)
   - As-built drawings — Readily available — Up to date — (N/A)
   - Maintenance logs — Readily available — Up to date — (N/A)

   Remarks_____

2. **Site-Specific Health and Safety Plan** N/A — Readily available — Up to date — (N/A)
   - Contingency plan/emergency response plan — Readily available — Up to date — (N/A)

   Remarks_____

3. **O&M and OSHA Training Records** — Readily available — Up to date — (N/A)

   Remarks_____

4. **Permits and Service Agreements**
   - Air discharge permit — Readily available — Up to date — (N/A)
   - Effluent discharge — Readily available — Up to date — (N/A)
   - Waste disposal, POTW — Readily available — Up to date — (N/A)
   - Other permits_____ — Readily available — Up to date — (N/A)

   Remarks_____

5. **Gas Generation Records** — Readily available — Up to date — (N/A)

   Remarks_____

6. **Settlement Monument Records** — Readily available — Up to date — (N/A)

   Remarks_____

7. **Groundwater Monitoring Records** — Readily available — Up to date — (N/A)

   Remarks GROUNDWATER MONITORING REPORTS ARE PROVIDED TO EPA ON A QUARTERLY BASIS

8. **Leachate Extraction Records** — Readily available — Up to date — (N/A)

   Remarks_____

9. **Discharge Compliance Records**
   - Air — Readily available — Up to date — (N/A)
   - Water (effluent) — Readily available — Up to date — (N/A)

   Remarks_____

10. **Daily Access/Security Logs** — Readily available — Up to date — (N/A)

    Remarks_____

IV. O&M COSTS

1. **O&M Organization**

State in-house — Contractor for State
PRP in-house — Contractor for PRP – PARSONS ENGINEERING SCIENCE
Federal Facility in-house — Contractor for Federal Facility
Other_____

2. **O&M Cost Records** N/A

Readily available — Up to date
Funding mechanism/agreement in place
Original O&M cost estimate_____ Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ Breakdown attached
Date Date Total cost

From_____ To_____ _____ Breakdown attached
Date Date Total cost

From_____ To_____ _____ Breakdown attached
Date Date Total cost

From_____ To_____ _____ Breakdown attached
Date Date Total cost

From_____ To_____ _____ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: N/A

V. ACCESS AND INSTITUTIONAL CONTROLS — Applicable — N/A

A. Fencing

1. **Fencing damaged** — Location shown on site map — Gates secured — N/A

Remarks FIVE LOCATIONS WERE OBSERVED WHERE A HOLE (ONE TO THREE FT² in AREA) WAS IN FENCE, BUT REPAIRED BY PRPs.

B. Other Access Restrictions

1. **Signs and other security measures** — Location shown on site map — N/A

Remarks SIGNS PROMINENTLY PLACED ON FENCE AND EASILY LEGIBLE.

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented — Yes — No — (N/A)
Site conditions imply ICs not being fully enforced — Yes — No — (N/A)

Type of monitoring (*e.g.*, self-reporting, drive by) _____
Frequency _____
Responsible party/agency _____
Contact _____ _____ _____ _____
Name — Title — Date — Phone no.

Reporting is up-to-date — Yes — No — N/A
Reports are verified by the lead agency — Yes — No — N/A

Specific requirements in deed or decision documents have been met — Yes — No — N/A
Violations have been reported — Yes — No — N/A
Other problems or suggestions: Report attached

_____
_____
_____
_____

2. **Adequacy** — ICs are adequate — ICs are inadequate — N/A
Remarks _____
_____
_____

D. General

1. **Vandalism/trespassing** — Location shown on site map — (No vandalism evident)
Remarks NO VANDALISM HOWEVER, IT APPEARS THAT ALL-TERRAIN VEHICLES MAY DRIVE ON ROADS OUTSIDE OF FENCED AREA (TRACKS SEEN).

2. **Land use changes on site** (N/A)
Remarks _____
_____

3. **Land use changes off site** (N/A)
Remarks _____
_____

VI. GENERAL SITE CONDITIONS

A. Roads — Applicable — N/A

1. **Roads damaged** — Location shown on site map — (Roads adequate) — N/A
Remarks _____
_____

B. Other Site Conditions

Remarks

VII. LANDFILL COVERS Applicable N/A

A. Landfill Surface

1. **Settlement** (Low spots) Location shown on site map (Settlement not evident)
   Areal extent_____ Depth_____
   Remarks NO SETTLEMENT OBSERVED ON SITE WALKOVER

2. **Cracks** Location shown on site map (Cracking not evident)
   Lengths_____ Widths_____ Depths_____
   Remarks

3. **Erosion** Location shown on site map (Erosion not evident)
   Areal extent_____ Depth_____
   Remarks EROSION NOTED OUTSIDE LANDFILL, WHERE DRAINAGE DITCH CROSSES ACCESS ROAD TO NORTH. SOME BARE SPOTS NORTH SIDE OF DRAINAGE SWALE

4. **Holes** Location shown on site map (Holes not evident)
   Areal extent_____ Depth_____
   Remarks

5. **Vegetative Cover** Grass Cover properly established No signs of stress
   (Trees/Shrubs) (indicate size and locations on a diagram)
   Remarks SEE ATTACHED PHOTO LOG FOR DETAILS

6. **Alternative Cover (armored rock, concrete, etc.)** (N/A)
   Remarks

7. **Bulges** Location shown on site map (Bulges not evident)
   Areal extent_____ Height_____
   Remarks

8. **Wet Areas/Water Damage** — Wet areas/water damage not evident
   - Wet areas — Location shown on site map — Areal extent 3 FT.2
   - Ponding — Location shown on site map — Areal extent 4 FT.2
   - Seeps — Location shown on site map — Areal extent
   - Soft subgrade — Location shown on site map — Areal extent

   Remarks PONDING/WET AREAS NOTED IN DRAINAGE SWALE IN FENCED AREA.

9. **Slope Instability** Slides — Location shown on site map — (No evidence of slope instability)
   Areal extent
   Remarks

B. Benches Applicable (N/A)

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** — Location shown on site map — (N/A) or okay
   Remarks

2. **Bench Breached** — Location shown on site map — (N/A) or okay
   Remarks

3. **Bench Overtopped** — Location shown on site map — (N/A) or okay
   Remarks

C. Letdown Channels Applicable (N/A)

(Channel lined with erosion control ~~mats~~, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** — Location shown on site map — No evidence of settlement
   Areal extent — Depth
   Remarks

2. **Material Degradation** — Location shown on site map — No evidence of degradation
   Material type — Areal extent
   Remarks

3. **Erosion** — Location shown on site map — No evidence of erosion
   Areal extent — Depth
   Remarks

E. Gas Collection and Treatment Applicable (N/A)

1. **Gas Treatment Facilities**
   Flaring Thermal destruction Collection for reuse
   Good condition Needs Maintenance
   Remarks_____

2. **Gas Collection Wells, Manifolds and Piping**
   Good condition Needs Maintenance
   Remarks_____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   Good condition Needs Maintenance N/A
   Remarks_____

F. Cover Drainage Layer Applicable N/A

1. **Outlet Pipes Inspected** (Functioning) N/A
   Remarks_____

2. **Outlet Rock Inspected** Functioning (N/A)
   Remarks_____

G. Detention/Sedimentation Ponds (Applicable) N/A

1. **Siltation** Areal extent_____ Depth_____ (N/A)
   Siltation not evident
   Remarks_____

2. **Erosion** Areal extent_____ Depth_____
   (Erosion not evident)
   Remarks_____

3. **Outlet Works** Functioning (N/A)
   Remarks_____

4. **Dam** Functioning N/A
   Remarks OVERGROWTH OF VEGETATION MAY BE IMPEDING THE RUNOFF OF SURFACE WATER.

H. Retaining Walls Applicable (N/A)

1. **Deformations** Location shown on site map Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks_____

2. **Degradation** Location shown on site map (Degradation not evident) N/A
   Remarks_____

I. Perimeter Ditches/Off-Site Discharge (Applicable) N/A

1. **Siltation** Location shown on site map (Siltation not evident)
   Areal extent_____ Depth_____
   Remarks_____

2. **Vegetative Growth** Location shown on site map N/A
   Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks VEGETATIVE GROWTH MAY BE IMPEDING SURFACE WATER RUNOFF IN SWALE WITHIN FENCED AREA.

3. **Erosion** Location shown on site map Erosion not evident
   Areal extent_____ Depth_____
   Remarks PERIMETER DITCH LOCATED WEST OF FENCED AREA SHOWS EROSION FEATURES.

4. **Discharge Structure** Functioning (N/A)
   Remarks_____

VIII. VERTICAL BARRIER WALLS Applicable (N/A)

1. **Settlement** Location shown on site map Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____

2. **Performance Monitoring** Type of monitoring_____
   Performance not monitored
   Frequency_____ Evidence of breaching
   Head differential_____
   Remarks_____

IX. GROUNDWATER/SURFACE WATER REMEDIES Applicable (N/A)

A. Groundwater Extraction Wells, Pumps, and Pipelines Applicable N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   Good condition All required wells properly operating Needs Maintenance N/A
   Remarks_____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   Good condition Needs Maintenance
   Remarks_____

3. **Spare Parts and Equipment**
   Readily available Good condition Requires upgrade Needs to be provided
   Remarks_____

B. Surface Water Collection Structures, Pumps, and Pipelines Applicable (N/A)

1. **Collection Structures, Pumps, and Electrical**
   Good condition Needs Maintenance
   Remarks_____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   Good condition Needs Maintenance
   Remarks_____

3. **Spare Parts and Equipment**
   Readily available Good condition Requires upgrade Needs to be provided
   Remarks_____

C. Treatment System Applicable (N/A)

1. **Treatment Train** (Check components that apply)
   - Metals removal — Oil/water separation — Bioremediation
   - Air stripping — Carbon adsorbers
   - Filters_____
   - Additive (*e.g.*, chelation agent, flocculent)_____
   - Others_____
   - Good condition — Needs Maintenance
   - Sampling ports properly marked and functional
   - Sampling/maintenance log displayed and up to date
   - Equipment properly identified
   - Quantity of groundwater treated annually_____
   - Quantity of surface water treated annually_____

   Remarks_____

2. **Electrical Enclosures and Panels** (properly rated and functional)
   N/A — Good condition — Needs Maintenance
   Remarks_____

3. **Tanks, Vaults, Storage Vessels**
   N/A — Good condition — Proper secondary containment — Needs Maintenance
   Remarks_____

4. **Discharge Structure and Appurtenances**
   N/A — Good condition — Needs Maintenance
   Remarks_____

5. **Treatment Building(s)**
   N/A — Good condition (esp. roof and doorways) — Needs repair
   Chemicals and equipment properly stored
   Remarks_____

6. **Monitoring Wells** (pump and treatment remedy)
   Properly secured/locked — Functioning — Routinely sampled — Good condition
   All required wells located — Needs Maintenance — N/A
   Remarks_____

D. Monitoring Data

1. Monitoring Data
   (Is routinely submitted on time) — Is of acceptable quality

2. Monitoring data suggests: SEE HYDROGEOLOGICAL ANALYSIS ON THE EFFECTIVENESS OF LONG-TERM GROUNDWATER MONITORING PROGRAM (BY COM 2003)
   Groundwater plume is effectively contained — Contaminant concentrations are declining

D. Monitored Natural Attenuation N/A

1. **Monitoring Wells** (natural attenuation remedy)
   Properly secured/locked Functioning Routinely sampled Good condition
   All required wells located Needs Maintenance N/A
   Remarks_____

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

REFER TO FIVE-YEAR REVIEW REPORT DATED SEPTEMBER 2003

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

REFER TO FIVE-YEAR REVIEW REPORT DATED SEPTEMBER 2003.

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

N/A

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

REFER TO RECOMMENDATIONS IN THE FIVE-YEAR REVIEW REPORT DATED SEPTEMBER 2003.

APPENDIX D

Photo Log

Photo 1 **Date:** 8/28/03 **View:** North
Description: View of gate area on east side of landfill. Note trees growing on cap.

Photo 2 **Date:** 8/28/03 **View:** West
Description: Overall view of western portion of cap.

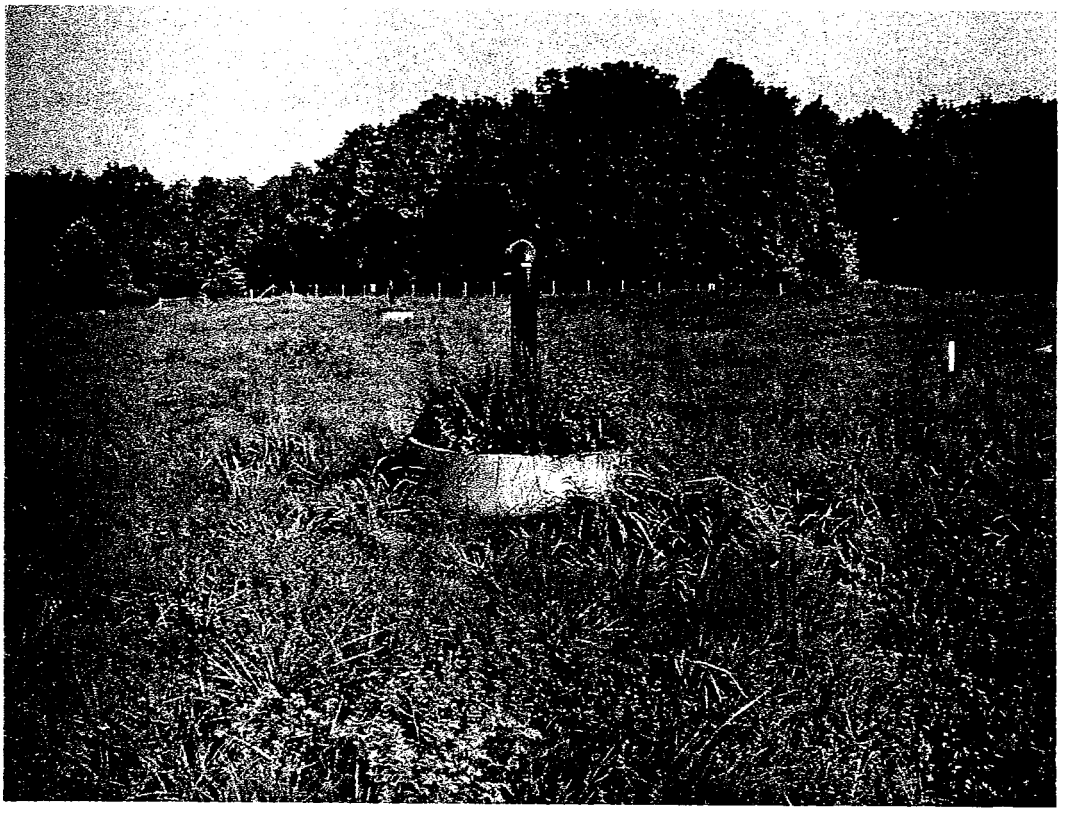


Photo 3 **Date:** 8/28/03 **View:** West
Description: Landfill gas vent pipes.

Photo 4 **Date:** 8/28/03 **View:** West
Description: Looking down at exposed jute matting for erosion.

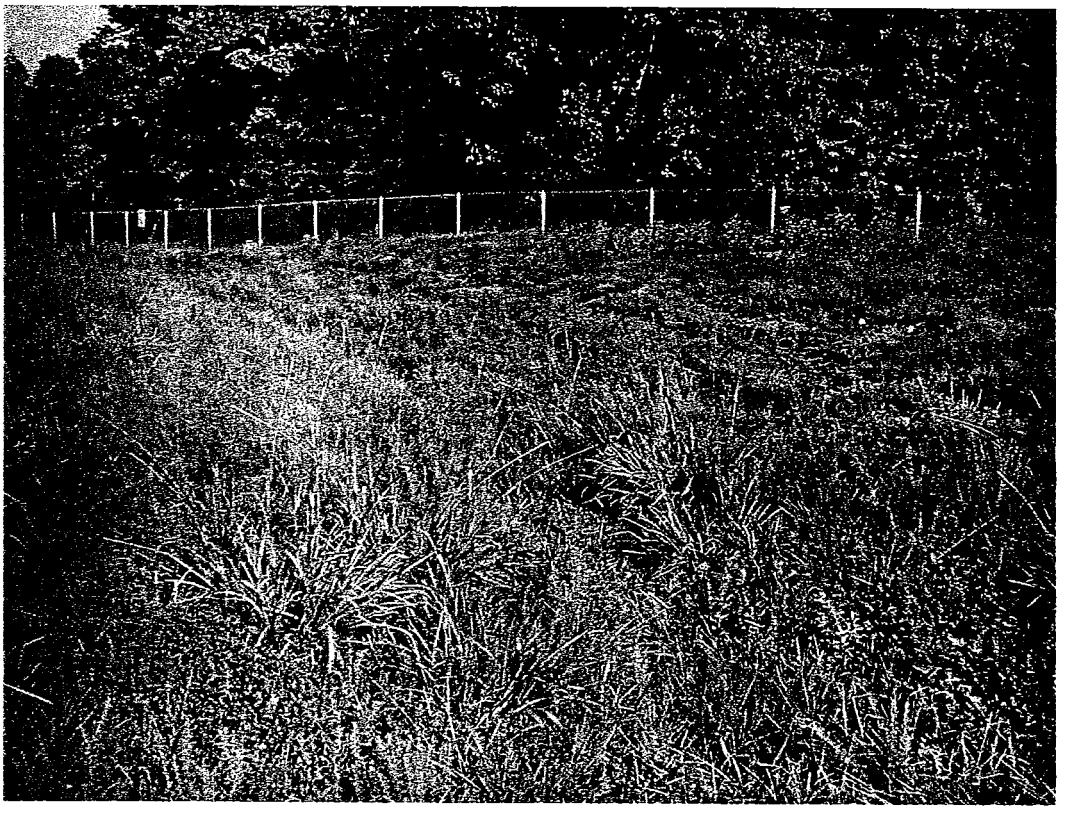


Photo 5 **Date:** 8/28/03 **View:** Northwest
Description: View of drainage swale, with bare soil spots to the right.

Photo 6 **Date:** 8/28/03 **View:** Northwest
Description: Bare soil from erosion next to drainage swale.

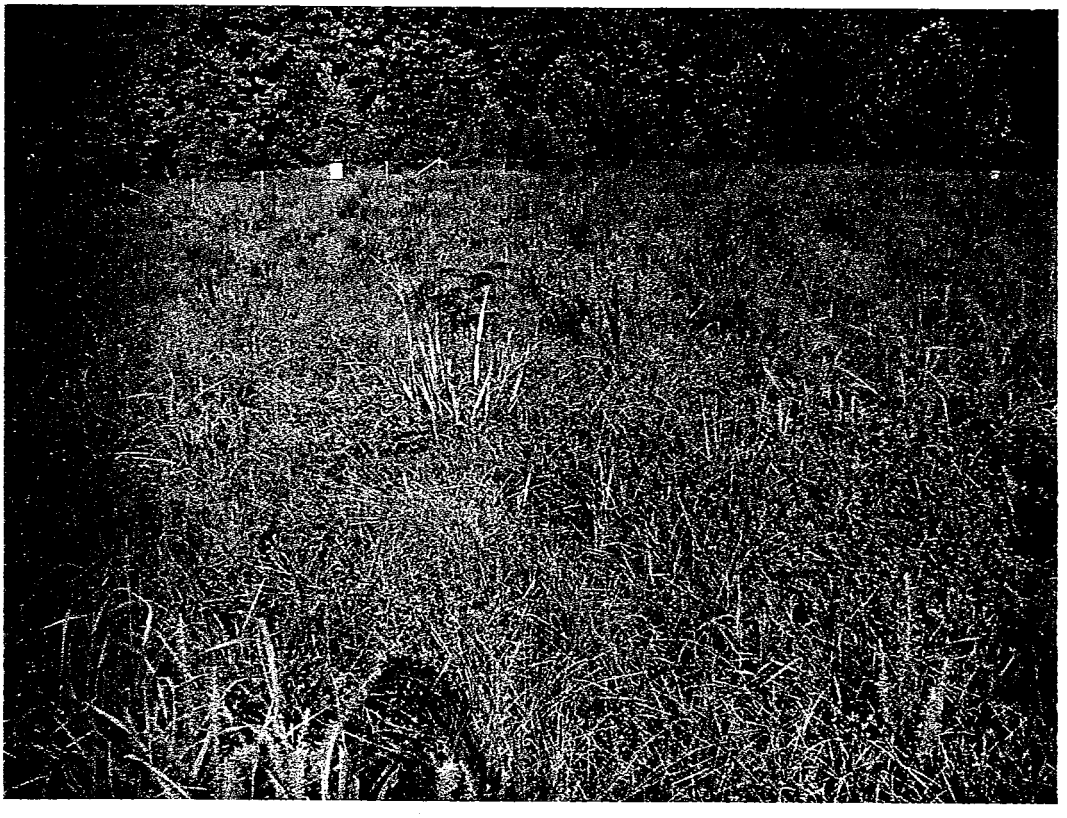


Photo 7 **Date:** 8/28/03 **View:** Southwest
Description: Southwest corner of landfill with large quantities of overgrowth.

Photo 8 **Date:** 8/28/03 **View:** Northeast
Description: Northeast corner of landfill, with overgrowth.

Photo 9 **Date:** 8/28/03 **View:** Southeast
Description: Monitoring well in southeast corner of landfill.

Photo 10 **Date:** 9/17/03 **View:** Southwest
Description: Repaired hole in fence at front gate.

Photo 11 **Date:** 8/28/03 **View:** East
Description: Mound of soil and monitoring well on northeast side of landfill.

Photo 12 **Date:** 8/28/03 **View:** West
Description: Monitoring well, with riprap trench used for runoff control in background.

Photo 13 **Date:** 8/28/03 **View:** Northwest
Description: Monitoring well with unused plastic tubing/piping.

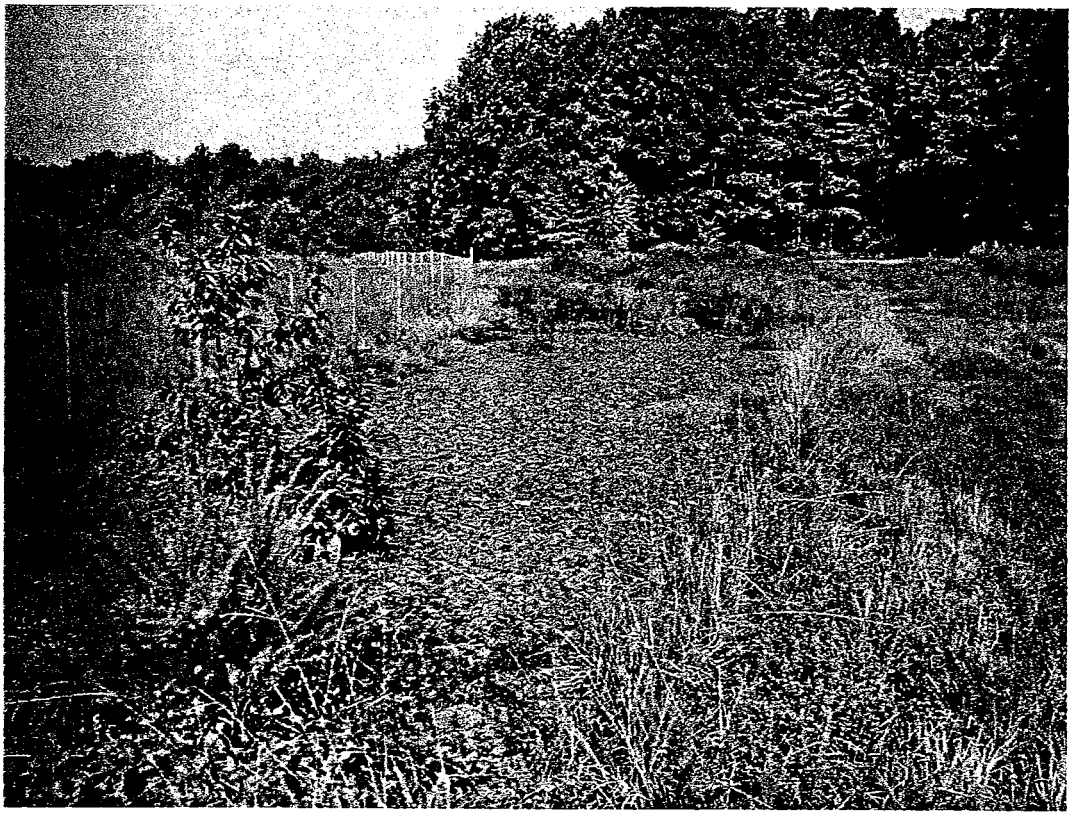


Photo 14 **Date:** 8/28/03 **View:** West
Description: Large runoff control trench consisting of riprap.

Photo 15 **Date:** 8/28/03 **View:** East
Description: Drainage ditch outside of perimeter fencing.

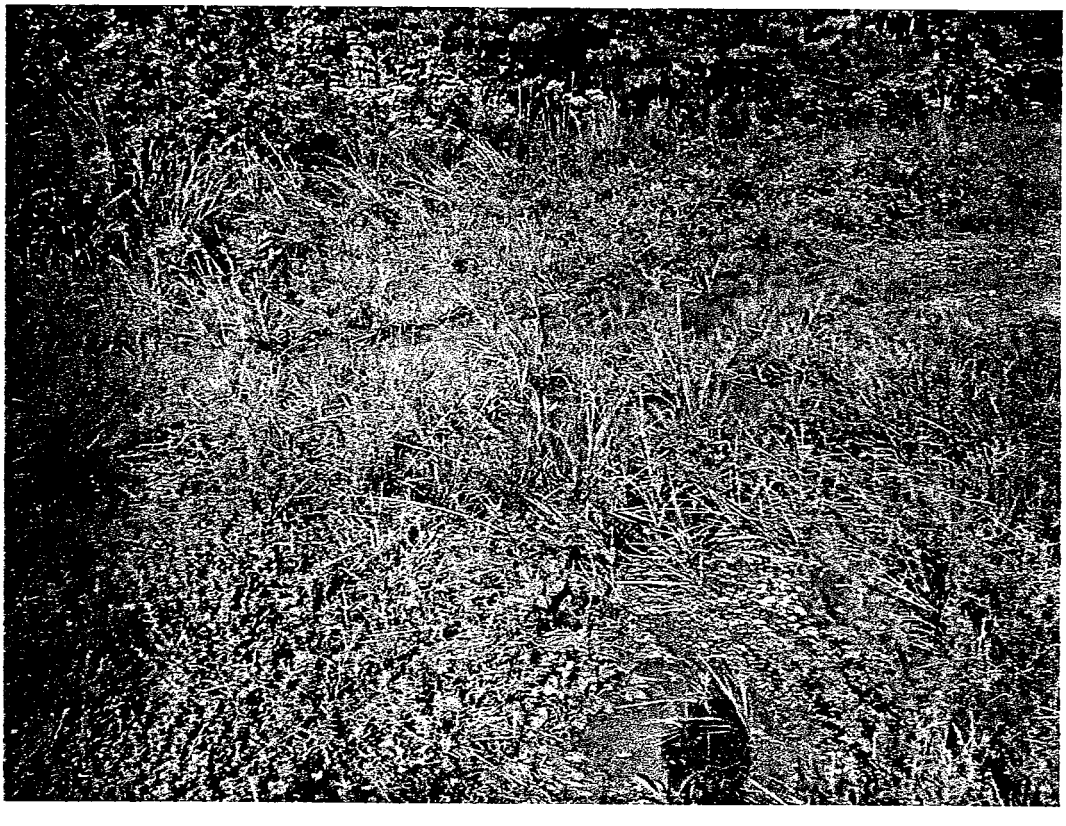


Photo 16 **Date:** 8/28/03 **View:** West
Description: Erosion along access road outside of fence on west side of landfill.

Photo 17 **Date:** 8/28/03 **View:** West
Description: Access gate and site sign at entrance to landfill.

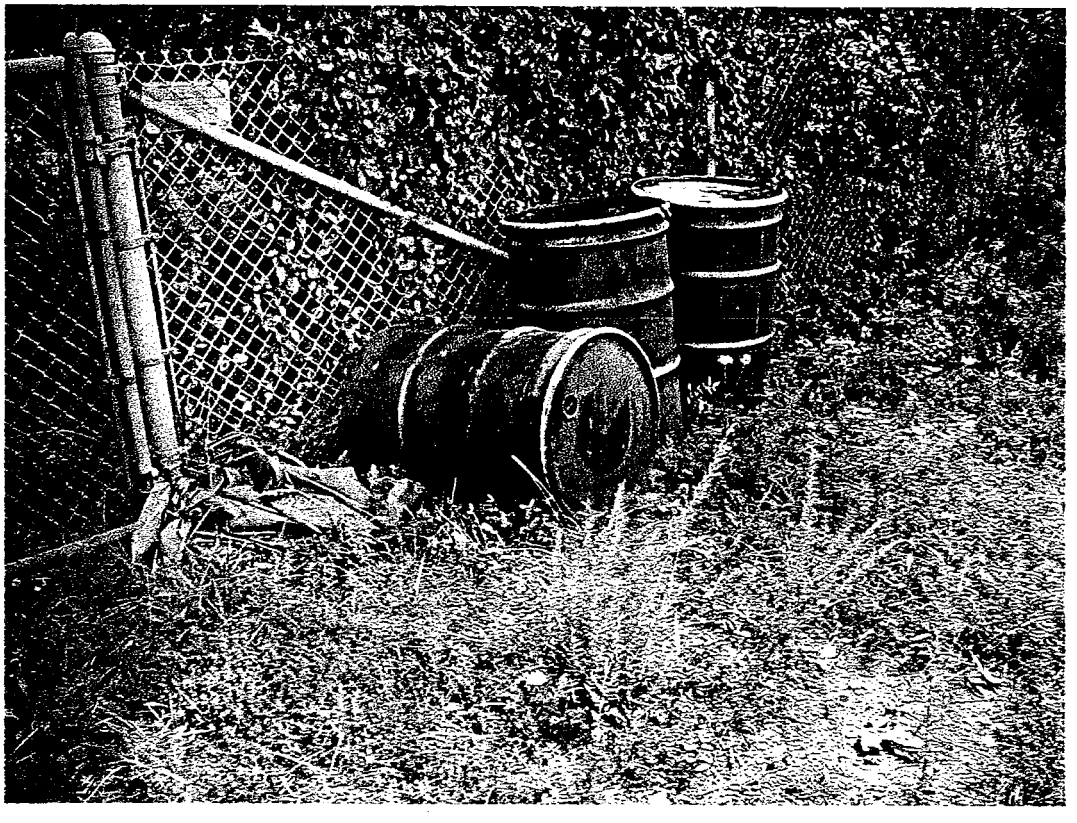


Photo 18 **Date:** 8/28/03 **View:** Southeast
Description: Drums of purge water from monitoring well sampling, near access gate.

Photo 19 **Date:** 8/28/03 **View:** Southeast
Description: Southeast corner of landfill. Note extensive overgrowth of vegetation.

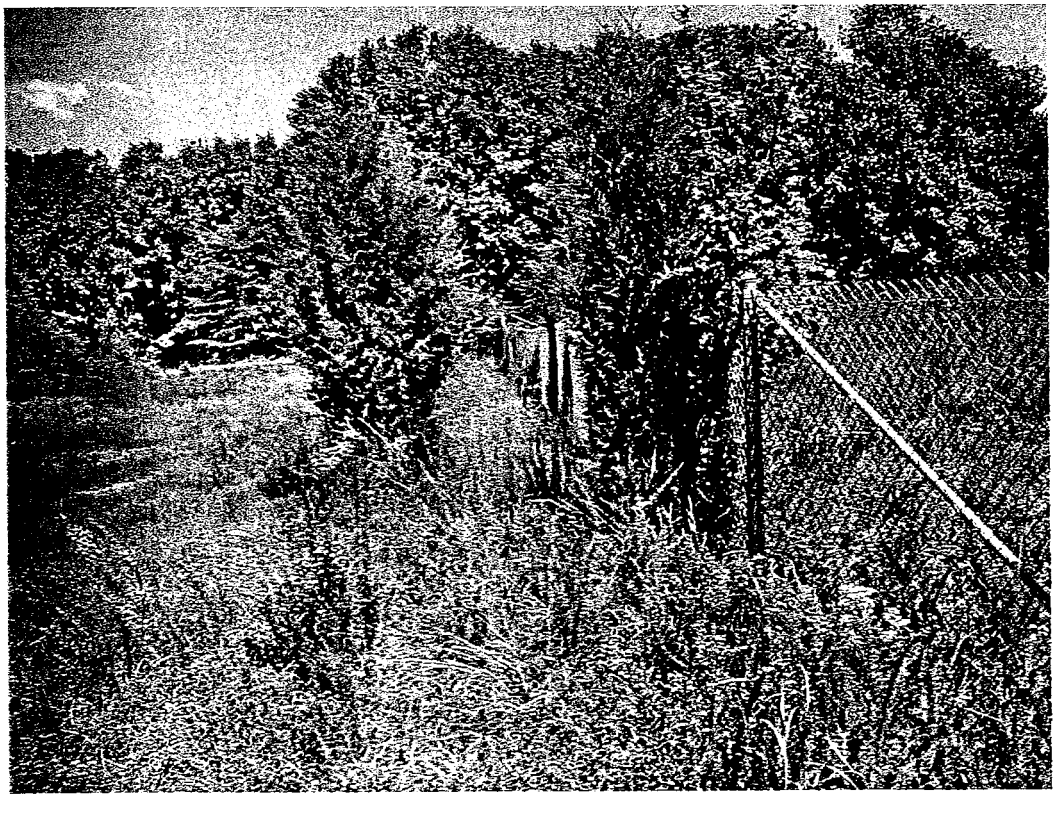


Photo 20 **Date:** 9/17/03 **View:** North
Description: Vegetation near security fence.