

May 1987

EPA-700 8-87-016



***Hazardous Waste Ground-Water
Task Force
Evaluation of the
Black Hawk County Landfill
Waterloo, Iowa***

US Environmental Protection Agency

GROUND-WATER TASK FORCE BLACK HAWK COUNTY LANDFILL UPDATE.

Black Hawk County Landfill (BHCL) is located approximately one mile south of Waterloo Iowa. The 150 acre facility has three regulated units, the Co-disposal Area, Sludge Drying Beds, and the Neutral Trench, which have received hazardous waste or hazardous waste constituents during past operations. Hazardous waste was deposited with municipal solid waste in the Co-disposal area from 1975 to 1985. Incoming hazardous liquids and sludges were deposited in the Sludge Drying Beds for evaporation, then removed to the Neutral Trench for deposition along with containerized liquid hazardous waste from February 1982 to spring 1985.

Purchased from the Landfill Service Corporation (LSC) in December 1984, the landfill is currently owned by the Black Hawk County Solid Waste Management Commission. On July 30, 1985 BHCL ceased hazardous waste operations and became a solid waste landfill. Due to failure by the county to certify that the existing ground-water monitoring system was in compliance with applicable RCRA requirements, the facility lost Interim Status in November 1985.

An extensive ground-water monitoring proposal was submitted and approved by EPA in June 1986. A final Consent Order to install and operate this ground-water monitoring system was signed by the facility in September 1986. Actual installation of the new ground-water monitoring well network and detailed site characterization began in June and was essentially complete by late October 1986.

The EPA Groundwater Task Force Inspection was completed at the end of October 1986. At the time of the Task Force inspection, a Phase I ground-water monitoring system had just recently been completed. This new monitoring system consisting of 41 stainless steel wells are monitoring two separate permeable zones within a glacial till blanket approximately 100-feet in thickness and the upper fractured zone of the Silurian-Devonian bedrock aquifer. The bedrock aquifer is a primary source of drinking water for northeast Iowa and is the uppermost bedrock unit underlying the site.

Task Force sampling revealed that there was the presence of phenols, moderately high TOX, and chromium exceeding Drinking Water Standards in several monitoring wells. Furthermore, at the conclusion of an accelerated five month sampling schedule the facility reported several wells as failing the statistical analysis for indicator parameters. No specific organic hazardous waste or hazardous waste constituents were identified by Task Force or facility ground-water sampling. Sampling results for indicator parameters taken in July and October 1987 shows an increase in TOX for at least eight monitoring wells including one downgradient bedrock and one intermediate background well. In addition, seven wells including one shallow and one intermediate depth background well show increasing specific conductivity for the year. No statistical analysis has been submitted or any discussion offered to date in relation to these apparent increasing indicator parameters by BHCL.

Closure plans for the Neutral Trench were submitted by the facility in April 1987 and approved by EPA Region VII on September 30, 1987. Also in September 1987, the closure plan for the Co-disposal Area and the Drying Beds as well as the facility's post closure plans were submitted. These plans are currently under review by EPA Region VII. In addition, the post-closure permit application submitted by BHCL on February 27, 1987 is still under review by Region VII.

EPA issued a complaint against the Landfill Services Corporation (LSC) in 1986 for failure to report statistically significant increases in indicator parameters, immediately resample, and to submit a ground-water assessment plan. An accelerated decision by the Administrative Law Judge found in favor of EPA but reserved the issue of the penalty amount of \$130,581 that EPA had proposed for hearing. A hearing was held in Kansas City, Missouri on August 26, 1987 after which the Administrative Law Judge found that the amount of penalty proposed was appropriate and ordered the Respondent to pay that amount. LSC appealed this decision on November 25th and a reply to the appeal is due on January 4, 1988.

To date, neither a Phase II ground-water monitoring proposal as called for in the September 1986 Consent Order nor an adequate assessment plan has been submitted to EPA. Several issues related to the ground-water monitoring program at BHCL must be addressed including the apparent increase in indicator parameters in several wells, detection of phenols and high chromium levels by the Task Force and the relatively high concentrations of cyanide in two wells by the facility. Statistical analysis is needed to determine which monitoring wells are showing significant increases in indicator parameters and a proposal to identify the source of this increase. In addition, a confirmatory resampling of those wells which have shown phenols, chromium, and cyanide over background must be done immediately. Other items in need of attention by the facility is the possible impact of the site on three background monitoring wells and the fact that there appears to be only two downgradient bedrock wells in the Neutral Trench Area. An administrative order under Section 3008(a) of RCRA which includes the imposition of penalties is presently being considered by EPA Region VII in regards to the above mentioned ground-water monitoring deficiencies as well as other issues not covered by this report.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
HAZARDOUS WASTE GROUNDWATER TASK FORCE

EPA-700 8-87-016

GROUNDWATER MONITORING EVALUATION

BLACK HAWK COUNTY LANDFILL
Waterloo, Iowa

May 1986

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EXECUTIVE SUMMARY

INTRODUCTION

Concerns have recently been raised as to whether commercial hazardous waste treatment, storage, and disposal facilities (TSDFs), are in compliance with the ground-water monitoring requirements promulgated under the Resource Conservation and Recovery Act (RCRA). Specifically, the concerns focus on the ability of ground-water monitoring systems to detect contaminant releases from waste management units at TSDFs. In response to these concerns, the Administrator of the Environmental Protection Agency (EPA) established the Hazardous Waste Ground-water Task Force to evaluate the level of compliance at TSDFs and address the cause(s) of noncompliance. The Task Force comprises personnel from EPA Headquarters including the Offices of Solid Waste and Emergency Response (OSWER), the National Enforcement Investigations Center (NEIC), EPA Regional Offices and State Regulatory Agency personnel. To determine the status of facility compliance, the Task Force is conducting indepth facility investigations, including onsite inspections, of TSDFs. The objectives of these investigations are to:

- determine compliance with interim status ground-water monitoring requirements of 40 CFR Part 265 as promulgated under RCRA or the State equivalent where the State has received RCRA authorization,
- evaluate the ground-water monitoring program described in the facilities' RCRA Part B permit applications for compliance with 40 CFR Part 270.14(c),
- determine if the ground-water at the facility contains hazardous waste constituents,
- provide information to assist the Agency in determining if the TSDF meets EPA ground-water monitoring requirements for waste management facilities receiving waste from response actions conducted under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA, Public Law 91-510).

To address these objectives, this Task Force investigation has determined if Black Hawk County Landfill:

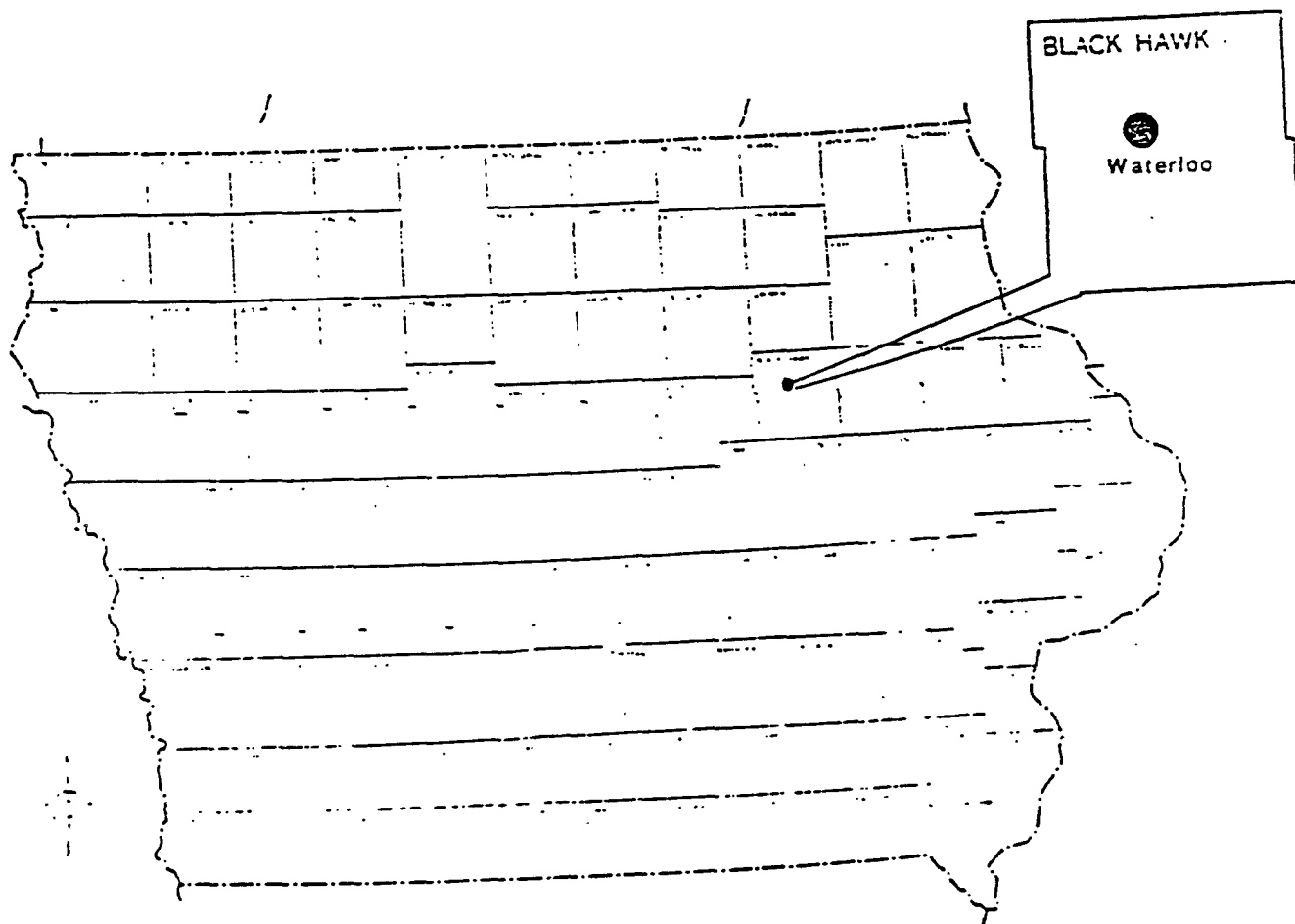
- has developed and is following an adequate ground-water sampling and analysis plan,
- has properly located and constructed RCRA ground-water monitoring wells,
- has performed the required analyses on samples taken from the RCRA monitoring well system,
- has an adequate ground-water quality assessment program outline or plan.

The Black Hawk County Landfill (BHCL) onsite inspection was conducted from October 26 to October 31, 1986. The inspection was coordinated and carried out by Region VII and Task Force personnel including the Task Force contract sample team from Versar, Inc. (Versar). The State regulatory agency, the Iowa Department of Natural Resources (IDNR), chose not to participate. Evaluation of the facility consisted of a records review, preliminary site visit, the onsite inspection and collection of samples, subsequent analysis of the samples collected, and evaluation of the analytical laboratory.

Situated in a rural setting, BHCL is located approximately one mile south of Waterloo, in the south central portion of Black Hawk County, Iowa (Figure 1). The 150 acre facility has three regulated units, the Co-disposal Area, Sludge Drying Beds, and the Neutral Trench, which have received hazardous waste or hazardous waste constituents during past operations. As illustrated on Figure 2, the Co-disposal area is located in the southeast quarter of the landfill. The Sludge Drying Beds are situated just west of

Figure 1.

Facility Location
Black Hawk County Landfill
Waterloo, Iowa



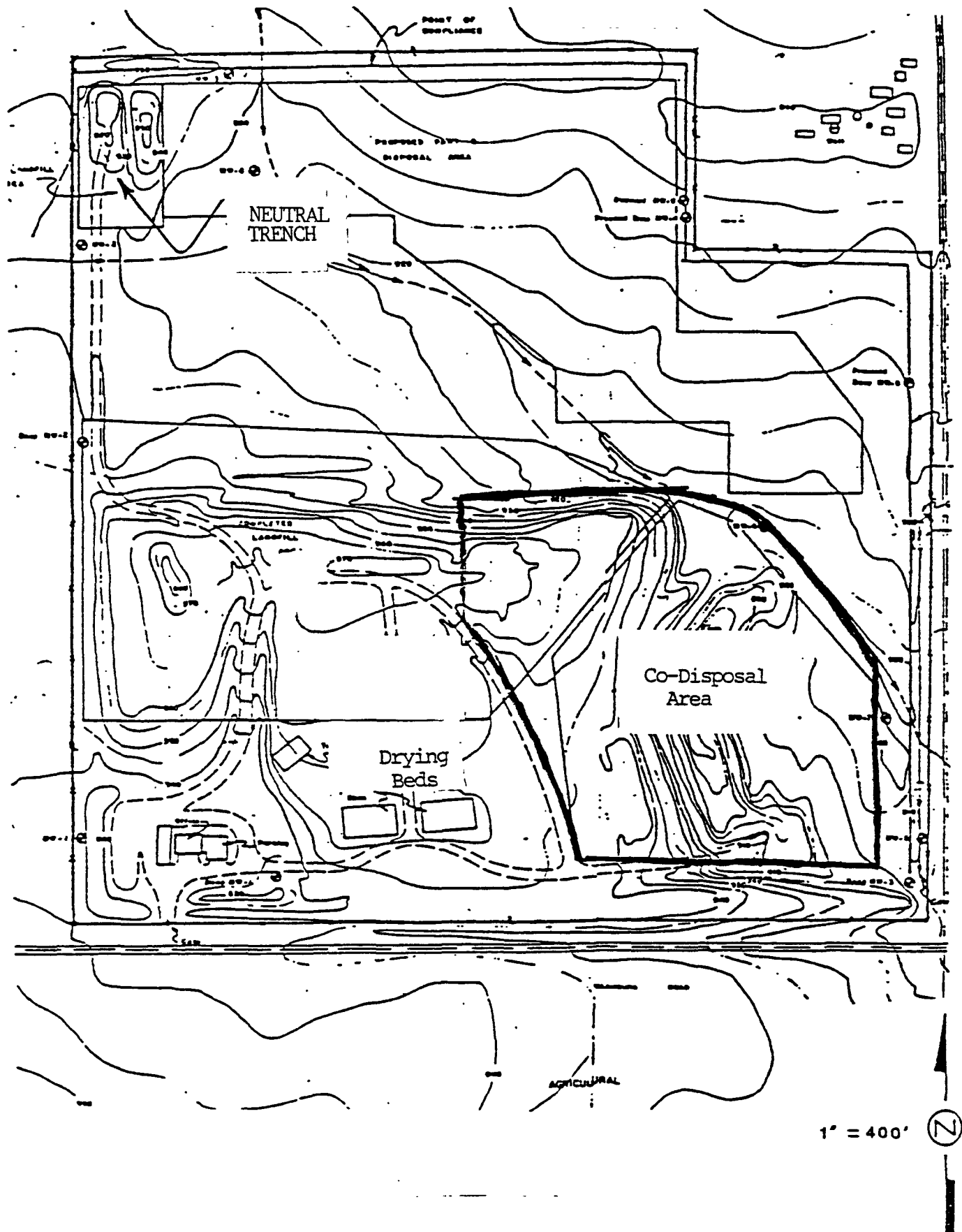


Figure 2. Waste Management Unit
Location Map

BLACK HAWK COUNTY, IOWA,

the Co-disposal area which corresponds to the south central part of the facility. In regards to ground-water monitoring requirements, the Sludge Drying Beds and Co-disposal area are considered as one waste management unit. The third regulated unit at BHCL is the Neutral Trench, located in the northwest corner of the site.

Industrial waste, some of which was later classified as hazardous, was deposited with municipal solid waste in the Co-disposal area from 1975 to 1985. From February 1982 to spring 1985, incoming hazardous liquids and sludges were deposited in the Sludge Drying Beds for evaporation, then removed to the Neutral Trench for deposition along with containerized liquid hazardous waste.

BHCL is currently owned by the Black Hawk County Solid Waste Management Commission (BHCSWMC) and is being operated by the Landfill Service Corporation (LSC). A Part B Application for operating additional waste management units was submitted in July 1983 by LSC but was not approved. Purchased from LSC in December 1984, BHCSWMC decided to cease hazardous waste operations and become a solid waste landfill on July 30, 1985. Later, in November 1985, Interim Status was withdrawn due to failure by the facility to certify that the existing ground-water monitoring system was in compliance with applicable RCRA ground-water monitoring requirements.

In an attempt to address some of the major inadequacies of the existing ground-water monitoring system, a proposal was submitted in 1986 but was also deemed inadequate by EPA. Finally, after prolonged negotiations, a

much expanded ground-water monitoring proposal was submitted and approved by EPA in June 1986. A final Consent Order to install and operate this ground-water monitoring system was signed by the facility in September 1986. A second phase was also specified in the Consent Order that would obligate BHCL to perform a complete assessment of any contamination detected during Phase I operations.

Installation of the expanded ground-water monitoring system and a more detailed hydrogeological site characterization was begun in June 1986. Installation of the monitoring well system was completed during October 1986, just prior to the Task Force inspection.

The newly installed ground-water monitoring system at BHCL consists of 14 well clusters, each of which are comprised of three stainless steel monitoring wells. Three subsurface zones are being monitored at the facility: a shallow, water table zone; an intermediate depth, glaciofluvial deposit within the glacial till overburden; and the upper part of the karst-like, dolomitic, Cedar Valley Formation. The Cedar Valley Formation is the uppermost bedrock unit encountered at BHCL and forms a major component of the Devonian-Silurian Aquifer which supplies most of the ground-water needs of Black Hawk County, Iowa.

SUMMARY OF FINDINGS AND CONCLUSIONS

Task Force personnel investigated the ground-water monitoring program at the Black Hawk County Landfill (BHCL) for the period of October through July 1987. The findings and conclusions presented below reflect conditions existing at the facility during this period.

At the time of the October 1986 inspection by the Task Force, installation of a Phase I ground-water monitoring system had just recently been completed. This new monitoring system consisting of 41 stainless steel wells replaced an earlier monitoring well network of 20 PVC wells which were considered inadequate by the EPA. A detailed hydrogeological site characterization undertaken by the facility in conjunction with installation of the Phase I monitoring wells was also evaluated at this time.

The analytical results of ground-water samples collected by the Task Force during the inspection indicates that a number of items are in need of further investigation. Low concentrations of phenols were reported in six monitoring wells and in the surface water sample from the southeast seep. Total chromium exceeding Drinking Water Standards were detected in two monitoring wells. Insignificant amounts of total arsenic and lead were discovered in nine and ten monitoring wells respectively with one well yielding trace concentrations of dissolved arsenic.

Other than very small concentrations of phthalates, methylene chloride, and acetone which are thought to be from sampling or laboratory contamination, no organic constituents were reported. However, moderately high TOX

concentrations were found in six wells and in both surface water samples taken by the Task Force. TOC data was deemed unusable for all Task Force ground-water samples.

The facility's analytical data was also evaluated during the writing of this report. Trace amounts of cadmium were detected in two monitoring wells and trace concentrations of arsenic in nine wells. Cyanide was detected in two wells but a duplicate in one of these showed no cyanide to be present. In addition, indicator parameters over background levels in shallow and intermediate wells of the Neutral Trench area were noted. Also revealed were indicator parameters above background for shallow monitoring wells associated with the Co-disposal area.

With the exception of small concentrations of phthalates similar to that of the Task Force results, no organic constituents were detected by the facility. Phenols were not reported exceeding detection limits set by BHCL's laboratory but these limits were higher than that used by the Task Force laboratory.

Compliance with Ground-Water Monitoring 40 CFR 265 Subpart F

Ground-Water Monitoring System

The Phase I monitoring program as detailed in the September 1986 Consent Order called for the installation of 15 well clusters, each of which was to consist of three stainless steel monitoring wells. Of the 45 monitoring wells called for in the Consent Order, 41 were actually installed

during the Phase I program. One well cluster was held on reserve for later installation during the Phase II investigation and one well was deleted during Phase I due to lack of an expected permeable zone.

Hydrogeologic data generated during and after installation indicates that shallow and intermediate monitoring wells are properly positioned in the appropriate zones. Deep monitoring wells are positioned in the correct configuration for the Co-disposal area. However, data from ground-water gradients indicate that in the Neutral Trench area there are two deep upgradient wells but only two deep downgradient wells.

Although hydrogeological data indicates that the background wells associated with the Co-disposal area are properly positioned, the ground-water quality data may indicate otherwise. Low levels of phenols were detected in one shallow and one intermediate well that have been designated as background. The detection of phenols in these upgradient wells will require further investigation by the facility.

Site Hydrogeology

A comprehensive hydrogeologic site characterization was carried out by BHCL in conjunction with installation of the Phase I monitoring system. The site characterization consisted of 41 continuously sampled soil borings, with coring of the upper portion of the bedrock at all deep monitoring sites. In addition, three deep stratigraphic core holes were advanced for definition of the uppermost aquifer and identification of aquitard units. Also, aquifer characteristics and ground-water flow was determined through in-situ testing.

Laboratory Evaluation

Prior to the sampling event, the EPA was informed by BHCL that University of Iowa Hygienic Laboratory which had been certified by an EPA evaluation in 1986, would be utilized for sample analyses. However, with receipt of BHCL's ground-water analysis report, it was discovered that BHCL used Donohue Analytical of Sheboygan, Wisconsin, for sample analyses. Donohue Analytical has not participated in the EPA's Performance Evaluation or Certified Laboratory programs. Donohue Analytical has indicated that they are certified by the state of Wisconsin, but this could not be verified with EPA Region V.

At EPA's request, BHCL submitted the raw laboratory data and operating standards and methods utilized by Donohue Analytical. This information was compared with the Task Force analytical results. Although results of the data from the Task Force and Donohue Analytical compare reasonably well with one another, further evaluation by the EPA Region VII Laboratory is recommended. Additional evaluation should consist of a thorough review of the standards and methods as well as a performance audit utilizing spiked samples.

Groundwater Sampling and Analysis Plan

In conjunction with BHCL's proposed ground-water monitoring and site characterization plans, a detailed Sampling and Analysis Plan which included the chain-of-custody procedures and a safety program was submitted for review by EPA. These plans were reviewed and approved by EPA Region VII personnel prior to the Task Force site inspection.

The Sampling and Analysis plan approved by EPA was kept at the site and followed by BHCL's sampling team. Observation by Task Force personnel during the first sampling event concluded that correct procedures were followed and the facility's sampling team demonstrated knowledge of sampling technique.

Groundwater Assessment Program

The September 1986 Consent Order signed by BHCL consisted of a two phased approach designed to address the issues of hydrogeological site characterization, detection monitoring and assessment of contaminant migration. Phase I included the site characterization and subsequent installation of a preliminary detection monitoring system. The Phase II portion of the investigation was to assess the extent of contaminant migration as well as address any additional site characterization that may remain in question.

The Phase II investigation was to be designed utilizing analytical data from samples collected during the first two sampling events. In addition, this Phase II plan was to be submitted to EPA for review by January 15, 1987. As of July 1987, this plan had not yet been received for review by EPA. Although sampling results are not considered conclusive, a Phase II assessment proposal must be submitted for review immediately.

Sampling and Monitoring Data Analysis

During the site inspection, Task Force personnel collected samples from 23 ground-water monitoring wells and two surface water samples. The monitoring wells sampled by the Task Force were purged and the samples were

obtained by a Versar sampling team. Prior to the sampling event, a Project Plan was developed which covered sampling procedures to be followed, safety protocol and a preliminary list of wells to be sampled.

A number of problems were encountered during the sampling event which necessitated deviations from the original Project Plan. Bladder pumps to be used for purging failed and all purging had to be done utilizing teflon bailers. This took considerable time, especially on the deeper wells, and may have contributed to the loss of two bailers in monitoring wells by the Versar team. Although these bailers were later recovered by Versar using stainless steel hooks, these monitoring wells could have been rendered unusable for detailed hydrological studies. Contamination of blanks was also noted in a number of cases and resulted in some sample parameter values being deemed unusable by Task Force laboratories.

As discussed earlier, low levels of phenols were detected in six monitoring wells including a shallow and an intermediate background well. In addition, chromium exceeding Drinking Water Standards were detected in two wells. Trace amounts of arsenic and lead were also detected in a number of wells and moderately high TOX values were noted in six wells and the southeast seep. The only organics that were identified by the Task Force laboratories were very low concentrations of phthalates, methylene chloride and acetone which may be related to laboratory and/or sampling contamination.

BHCL data was also evaluated during the writing of this report. Trace amounts of cadmium, cyanide and arsenic were noted for a number of monitoring wells. Similar to Task Force results were the presence of low concentrations

of phthalates in a few samples. No other organic constituents were noted in BHCL's sampling results. Phenols were not reported exceeding detection limits set by BHCL's laboratory but these limits were higher than that used by Task Force laboratories.

Several Phase I monitoring wells screened in the shallow and intermediate zones at both the Neutral Trench and Co-disposal area have failed the statistical analysis performed on the indicator parameter values. In addition, indicator values appear elevated for BHCL and Task Force results from the first sampling event when compared with later sampling by the facility. This may be due to wells not being stabilized at the time of the initial sampling. The majority of monitoring wells had just recently been or were undergoing development at the time of the site inspection. Therefore, the results from the statistical analysis should not be considered conclusive at this time.

It is recommended that additional sampling be initiated immediately at BHCL by the facility to determine if there has been release of hazardous waste or hazardous waste constituents into the ground-water underlying the site. This sampling should include monitoring all wells for indicator parameters until results stabilize or it is determined that there has been a statistical change in ground-water quality. Sampling for cadmium, arsenic, chromium, lead and cyanide in selected wells will also be needed for confirmation of earlier results. In addition, analysis for phenols at a lower detection limit than those used previously by BHCL's laboratory should be required.

TECHNICAL REPORT

INVESTIGATIVE METHODS

The Task Force evaluation of the BHCL site consisted of:

- review and evaluation of records and documents from EPA Region VII and BHCL,
- preliminary site visits including observation of the ground-water monitoring system installation and the Task Force site reconnaissance,
- a facility onsite inspection conducted October 26 through October 31, 1986,
- evaluation of the analytical laboratory,
- sampling and subsequent analysis and data evaluation for selected ground-water monitoring wells and leachate collection points.

Record/Documents Review

Specific documents and records of interest include the ground-water sampling and analysis plan, the ground-water assessment outline, monitoring well location, construction data and logs, reports of site hydrogeological conditions, site operation plans, facility permits, unit design reports, position descriptions and qualifications of selected personnel onsite, and operating records showing the general type and quantities of wastes disposed of at the facility including locations.

Records for the Sludge Drying Beds, Co-disposal Area, and Neutral Trench were also reviewed for construction details, waste received and any related monitoring data. The majority of the records and documents of interest were submitted by the facility to EPA in the July 25, 1983 Part B Post-Closure application package, as well as correspondence related to design of the ground-water monitoring system. During the preliminary site

reconnaissance and onsite inspection, details such as field boring logs, actual well placement, and construction details including that of a new disposal cell were reviewed.

Prior to the site inspection and preliminary reconnaissance, the sampling and analysis plan, including the chain-of-custody procedures, safety program to be followed, and various other details concerning well placement and development were reviewed and approved by Region VII. This information was supplemented by interviews with facility personnel and their consultants during site visits prior to and during the actual Task Force inspection.

Preliminary Site Visits

Region VII hydrogeologists visited BHCL on July 24, 1986 for the purpose of observing the installation of the new ground-water monitoring system. General drilling and logging procedures were observed in the field and discussed in detail with BHCL's consultants and drilling subcontractor. In addition, proposed monitoring sites and the waste management units were inspected during this preliminary site visit.

The site reconnaissance for the Task Force investigation of BHCL was conducted by EPA Task Force and Region VII personnel on September 25, 1986. Prior to visiting the site, an informal meeting was held to discuss progress of the drilling program and the logistics of the upcoming sampling event. The project plan and recent correspondence between the County and EPA was also distributed to Task Force personnel at this time to update them on field changes and brief them on the planned investigation.

A site tour was conducted for Task Force personnel and a representative of the Task Force sampling contractor, Versar. All wells installed at this time were inspected, on-going drilling and well installation procedures were observed, and the rationale used for the monitoring wells selected for sampling by EPA was discussed. Also noted during this site tour was possible problems that might arise during inclement weather conditions as they related to the movement of sampling equipment to each well location.

One issue that became apparent during the site reconnaissance was the fact that landfilling of Subtitle D municipal waste has continued over the top of the co-mingled, solid and hazardous waste in the southeast portion of the site. BHCL has proposed to continue disposing of this waste until the design height called for in the July 6, 1987 closure plan for the Co-disposal area is reached. At the time of the Task Force inspection, elevation of this area was at 900 feet on the east, lower side and up to 981 feet m.s.l. in the highest central portion. Design height as specified in the closure plan is at a maximum of 986 feet in elevation.

Facility Inspection

The facility inspection conducted October 26 through 31, 1986 included identification of waste management units, identification and assessment of waste management operations, pollution control practices and verification of the location of ground-water monitoring wells and leachate collection systems.

Laboratory Evaluation

Prior to the sampling event, the EPA was informed by BHCL that University of Iowa Hygienic Laboratory (UHL) which had been certified by an EPA evaluation

in 1986, would be utilized for sample analyses. However, with the April 1986 receipt of BHCL's ground-water analysis report, it was discovered that in place of UHL, BHCL used Donohue Analytical of Sheboygan, Wisconsin, for all ground-water sample analyses. Subsequent checking with EPA Region V has shown that Donohue Analytical has not participated in the EPA's Performance Evaluation or Certified Laboratory Programs. Donohue Analytical has indicated that they are certified by the state of Wisconsin, but this could not be verified with Region V.

BHCL was requested to obtain and submit to EPA Region VII all raw laboratory data, including chromatographs, generated laboratory results, operating standards and methods utilized by Donohue Analytical in sample analyses. This information was received by EPA in June, 1987 and has been compared with Task Force analytical results. Results of the data from both the Task Force and Donohue Analytical compare reasonably well with one another, however, further evaluation by the EPA Region VII Laboratory may be required for definite conclusions to be made.

Ground-Water, Surface-Water and Leachate Sampling and Analysis

During the onsite inspection, the Task Force collected ground-water samples from monitoring wells, the leachate collection system for the Neutral Trench area, and a surface water sample near the culvert that conducts water off the site under Hess Road along the southeast property line. Samples were taken by Versar for the Task Force and sent to the appropriate laboratories for analysis. Organic analyses were performed by Compu Chem Laboratories while inorganic and indicator analyses were by Centec Laboratories.

As requested by BHCL, split samples were provided in equal volumes to the facility where sufficient volumes were obtained for splits (See Table 3). Data from sampling analysis were reviewed to further evaluate the BHCL ground-water monitoring program and to identify possible contaminants in the ground-water and surface water collected onsite. Analytical results from the samples collected for the Task Force are presented in Appendix A.

Prior to the site reconnaissance and facility inspection, a Project Plan was developed. This plan discussed the sampling procedures to be followed, including a preliminary list of monitoring wells and surface water points to be sampled. Due to field conditions such as low well volumes and some equipment failures, minor deviations from the original plan became necessary. For example, 23 monitoring wells consisting of 10 deep, 9 intermediate and 4 shallow, were to be sampled as specified in the Project Plan. In actuality, 7 deep, 10 intermediate and 6 shallow wells were sampled. In addition to the ground-water samples taken from monitoring wells, 2 field blanks, 1 equipment blank, 2 duplicate and 2 surface samples were also taken.

WASTE MANAGEMENT UNITS AND OPERATIONS

Waste Management Units

The Co-disposal Area takes up approximately the entire southeast quarter of the facility (Figure 2). According to facility records, the eastern half of this area was formed by excavating the glacial till deposits to a depth of approximately 60 feet, which places the deepest portion within a minimum of 40 feet of the top of the Cedar Valley Formation (Figures 3-5). Municipal waste as well as hazardous waste, were co-disposed in this excavation,

then graded over with clay derived from the excavated till. Later, foundry sand, flyash, and foundry baghouse dust were disposed of over the western half of this area. At the time of the Task Force inspection, it was noted that foundry sand and solid municipal waste was still being deposited in this area.

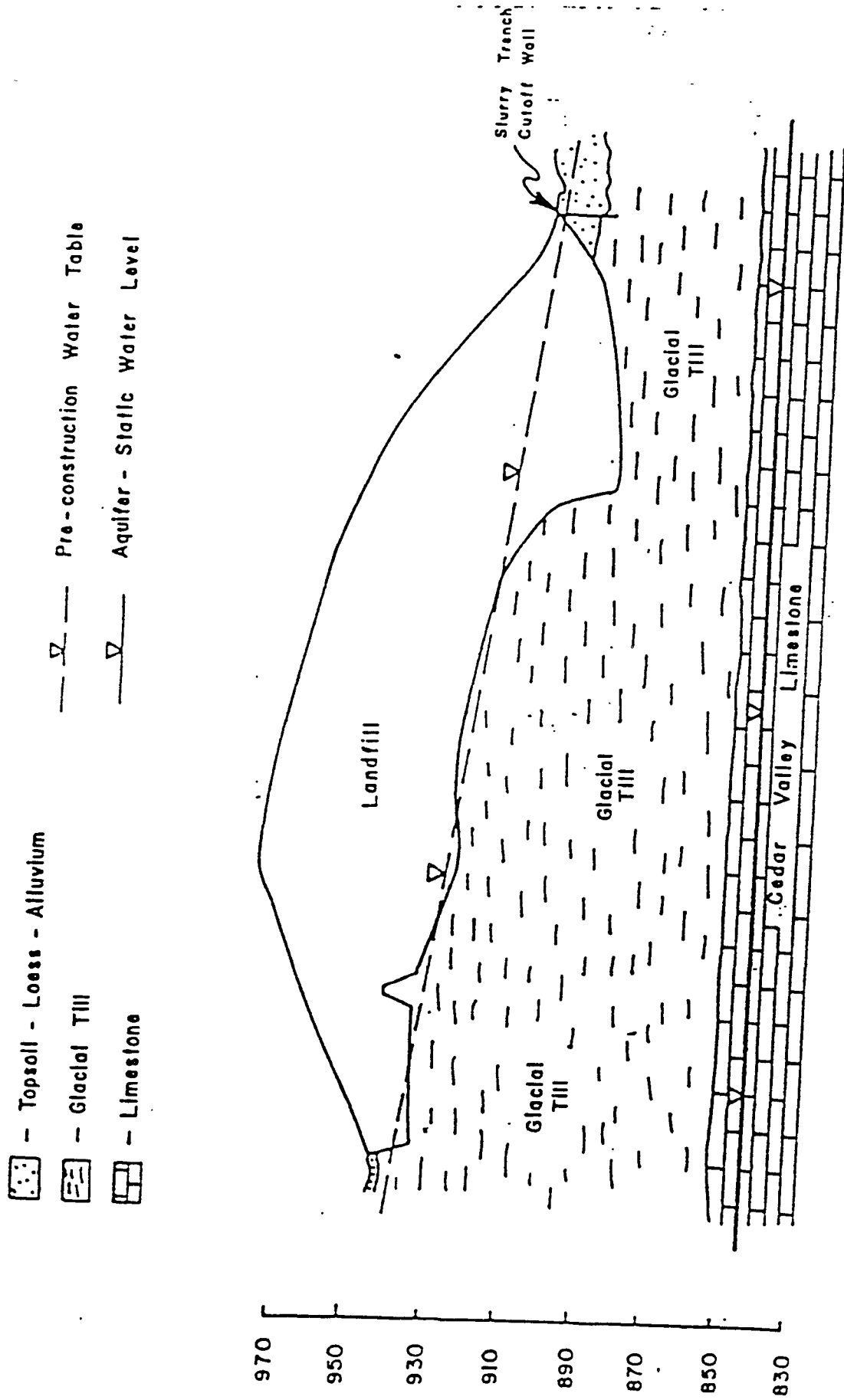


FIGURE 3
SECTION A - A'

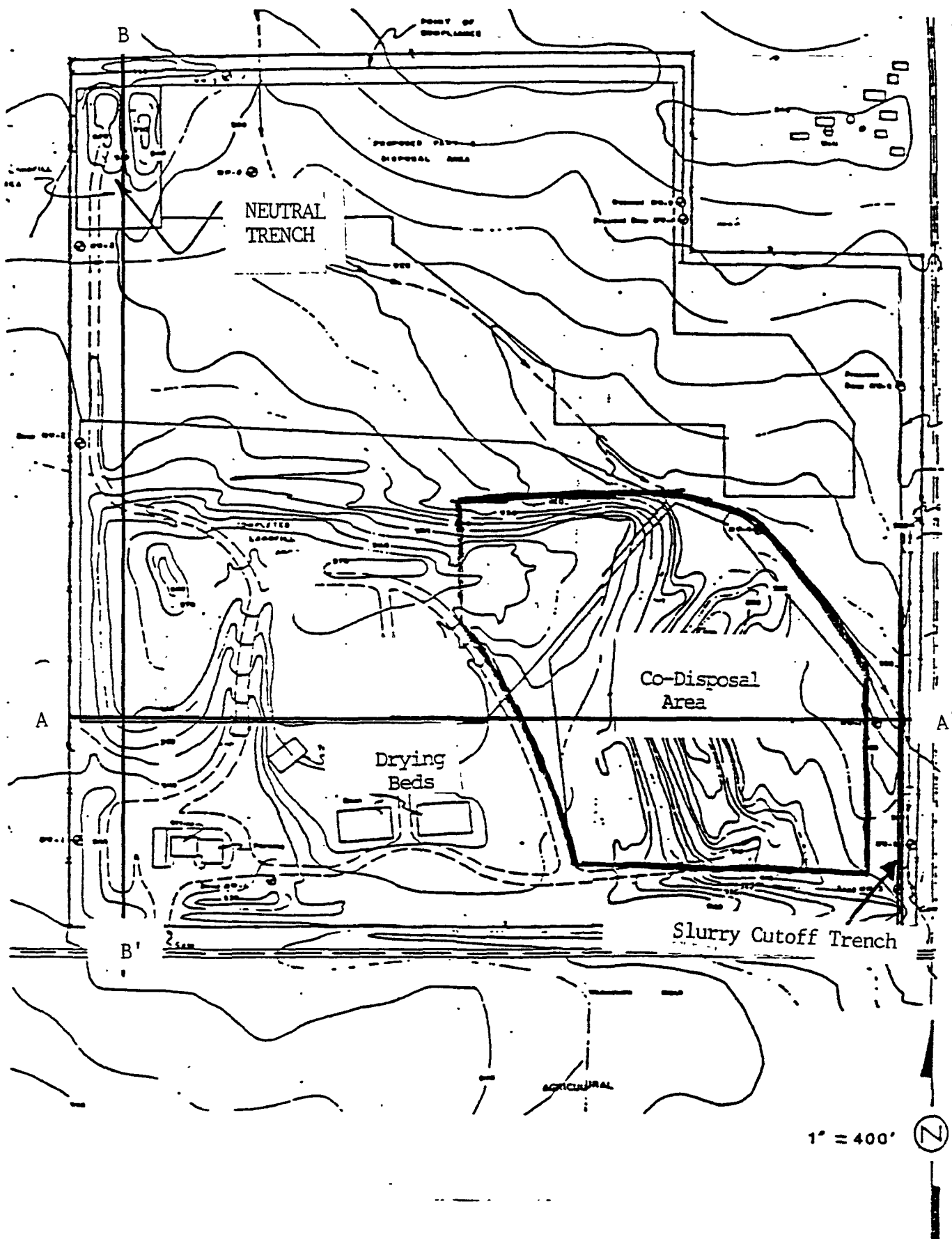


Figure 5. Cross Section Reference

BLACK HAWK COUNTY, IOWA,
HAZARDOUS WASTE LANDFILL

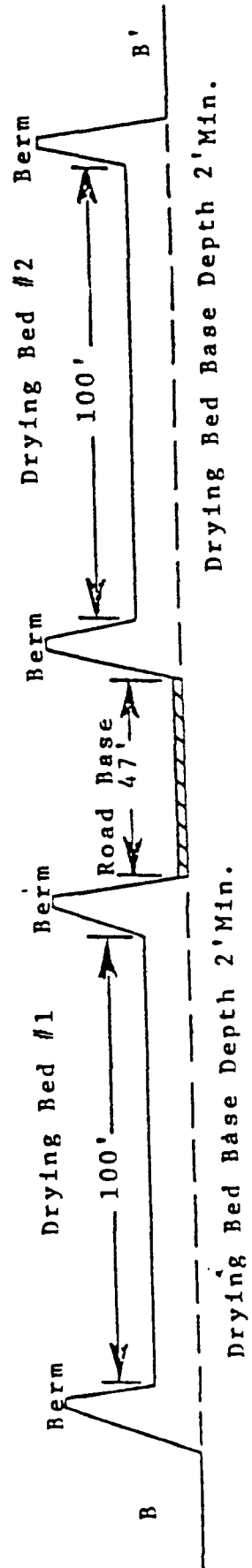
Two sludge drying beds, designated Drying Bed #1 and #2, were constructed on top of foundry sand along the west edge of the Co-disposal Area (Figure 2). Each drying bed covered an area of 100 square feet and had a six-foot high berm constructed of clay derived from onsite glacial till materials. Both drying beds had a two-foot thick base, also composed of clay from onsite glacial till material (Figure 6). The drying beds were originally constructed to stabilize wet wastes through evaporative drying. The beds became operational in February 1982, and were in use until Spring 1985. These units were removed in spring 1985 by excavating the sludges and the underlying clay base, and disposing of these materials in the Neutral Trench.

The Neutral Trench, also referred to as the Secure Trench, is located in the northwest corner of the site (Figure 2). Originally designed to consist of a series of five parallel trenches, the Neutral Trench area contains two trenches, of which one has been filled and covered with clay. The second trench, which has not been utilized for waste disposal, is at present an open excavation. At the time of the Task Force inspection, this open trench was about one-third full of liquid.

The filled and completed trench is reported to have been constructed by excavating a cut approximately 25 feet deep, 90 feet wide at the base and 450 feet in length. The bottom was sloped two degrees with three 12-inch deep and 18-inch wide leachate collection channels leading to a 24-inch deep sump at the north end of the trench. According to design plans, this sump is 6 feet in width. Crushed rock was used to fill the

Cross-Section Drying Beds #1 & #2

Vertical Scale 1" = 40'
Horizontal Scale 1" = 10'



Cross-Section Perimeter Berm

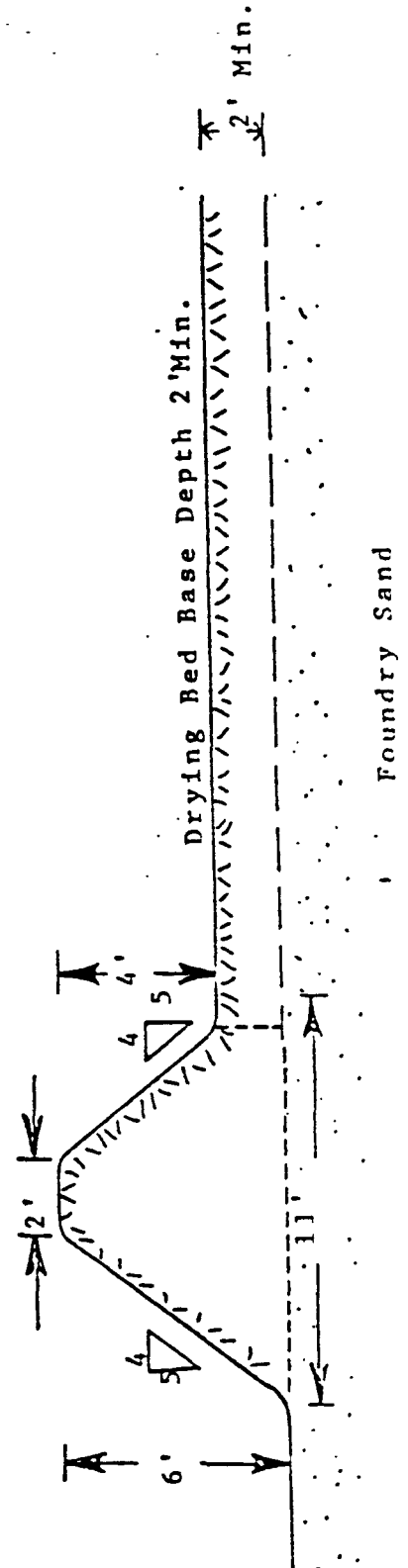


Figure 6.

sump and collection channels. A 4-inch diameter, slotted PVC pipe protected by a concrete culvert extends from the bottom of the sump to above ground level (Figure 7).

Maintenance of Landfill Cover

Cover over the Neutral Trench reportedly consists of a three-foot thick layer of fine-grained material from the excavated till deposits onsite. Although graded to promote runoff, it was noted during the site inspection that rainwater had ponded on the surface. Vegetation has been planted on top of the clay cover for erosion control, but it was sparse at the time of the inspection.

A clay cover derived from excavated till material is reportedly overlying the Co-disposal area with a thickness of two to three feet. Foundry sand, fly-ash, and solid municipal waste have been deposited over the western part of the Co-disposal area and, in fact, these wastes were being disposed of at the site during the Task Force inspection.

Closure plans dated April, 1987 for the Neutral Trench and July 1987 for the Co-disposal Area and Sludge Drying Beds were recently received by Region VII EPA. At the time of the writing of this report, these plans were still under review by the EPA.

Facility Operation

Municipal and industrial wastes, prior to classification as hazardous waste, were landfilled in that part of the facility now called the Co-disposal Area. The landfilling process was accomplished by placing the waste in lifts

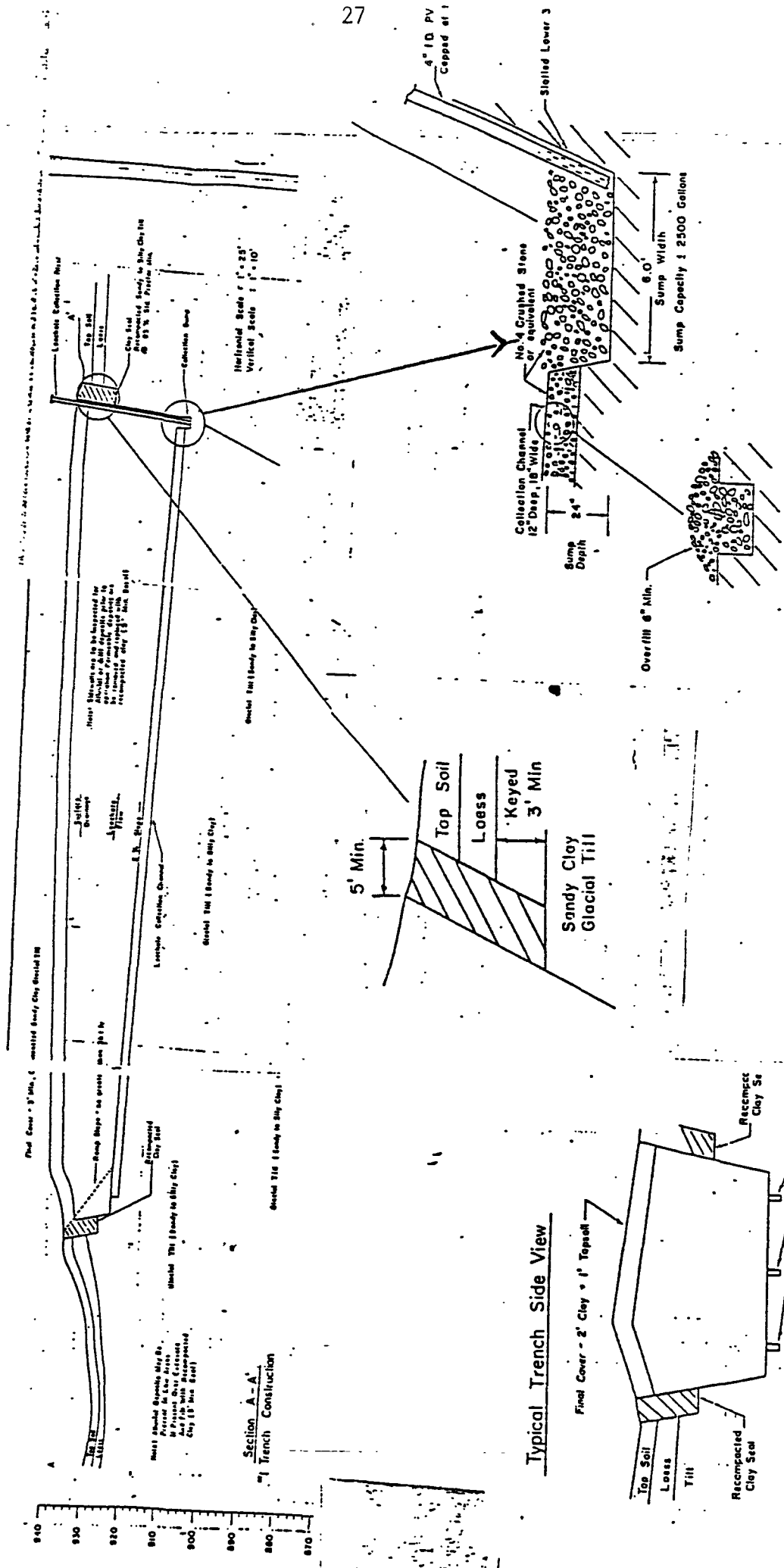


Figure 7. Detail Diagram of Neural Trench

within the excavated cell. Reportedly, these lifts consisted of an eight-foot layer of waste over which a two-foot cover of soil was placed.

In addition, incoming liquids and sludges were deposited into one of the two shallow sludge drying beds. The drying beds were originally designed to temporarily contain liquid wastes and sludges until the liquid fraction was sufficiently reduced through evaporation. Waste deposition, drying and subsequent removal of liquids was taken to constitute one complete cycle. Upon completion of a cycle, up to six inches of the contaminated clay base was removed for deposition into a portion of the Neutral Trench. Before a successive cycle was to begin, the clay base was restored to its full two-foot thickness.

Contaminated clay base and waste residue material removed from the drying beds, and some incoming solid hazardous waste were landfilled in the Neutral Trench. Although not confirmed by inspection, operation plans for the Neutral Trench consisted of construction of a small berm in the trench bottom at the end of working days so as to segregate the active from the non-active areas. By segregation, it was planned to isolate any contaminated rainfall accumulation from that which did not come into contact with hazardous waste in the trench. Contaminated rainwater was to be collected and placed in the Sludge Drying Beds for treatment.

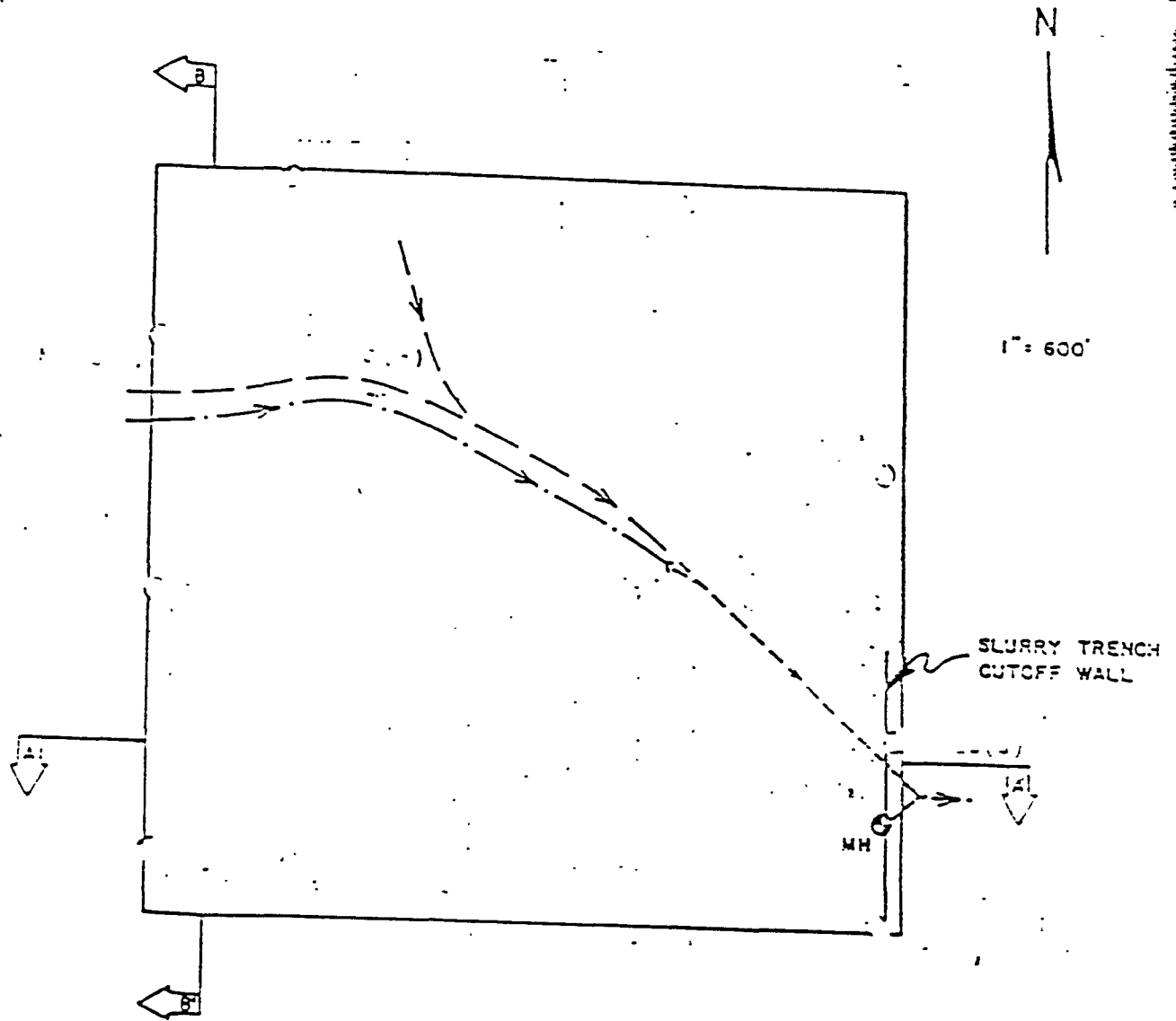
Leachate Collection

Due to water table conditions in the glacial till deposits, area landowners have installed field tile drainage systems to improve farmability of the area. For the most part, these tile systems had been left in place

by BHCL to collect surface water runoff prior to contact with hazardous waste units. A tile entering the site near the northwest corner and paralleling the drainageway flows to the southeast, emerging midway across the site where intermittent surface runoff combines with this drainage. Surface runoff and possibly shallow flow from the fill face of the Co-disposal Area, drain into this tile system as it flows across the site. This flow continues on to the southeast where it discharges through a culvert beneath Hess Road (Figure 8). At the time of the Task Force inspection, a moderate flow of water through the tile system was observed by way of a series of access manholes.

Along the eastern boundry of the site, a slurry trench was constructed for the purpose of intercepting shallow ground-water flow moving from the site in a southeasterly direction (Figure 8). Although not confirmed through field investigation, it is suspected that shallow ground-water flow in this location is intercepted by this trench. The subsequent mounding causes flow at the surface which ultimately reaches the drainageway under Hess Road. In the southeast corner of the site, water and apparently leachate from the Co-disposal Area, is collecting in a low area. During the site inspection it appeared that this water and/or leachate was being periodically pumped into the drainage exiting the site beneath Hess Road.

Leachate collection within the completed neutral trench is through the leachate collection channels and sump discussed previously. The facility's original waste management plans for any leachate accumulation in the Neutral Trenches was to pump it out of the culvert and remove it to the drying beds for treatment. Since the drying beds no longer exist, BHCL was to remove



SURFACE DRAINAGE (Intermittent) ————>———

SURFACE DRAINAGE (Steady Flow) - - - - ->- - - - -

UNDERGROUND TILE ————>———

CROSS SECTION KEY

FIGURE 8

GROUND WATER / SURFACE WATER
FEATURES

this leachate and dispose of it at a permitted facility offsite. This has never been done. It was noted during the site inspection that the liquid levels in the culverts were within a few feet of the ground surface and it is suspected that they have overflowed in the past.

HYDROGEOLOGICAL SITE CHARACTERIZATION

Site Characterization Prior To The 1986 Consent Order

Prior to characterization activities specified in the September, 1986 Consent Order, site characterization of hydrogeological conditions at BHCL consisted of a few improperly logged shallow borings, and a brief review of background information. The earlier hydrogeological interpretations were based on 20 soil borings that comprised three separate investigations. The first investigation took place in March, 1975 and consisted of fifteen borings, three of which were classified as deep by the facility. The second soil investigation was completed in August of 1980 and produced three borings also classified as deep. In August, 1982 an additional two borings were completed. Borings referred to as deep in these earlier investigations were terminated when bedrock was encountered.

The glacial till at the site was referred to in early reports by the facility as an aquitard which effectively separated the shallow alluvial materials and the underlying bedrock aquifer. These views were based on laboratory permeability studies, from which the facility estimated travel

time through this aquitard at several hundred years. Secondary permeability features such as vertical jointing and weathering effects were not taken into account during the earlier studies.

In addition, some early boring logs referred to clay deposits in the lower glacial till units as being a shale. This assumption was also used to demonstrate separation of the bedrock aquifer from any hazardous waste constituents that may have been released into the permeable zones within the overlying glaciofluvial deposits.

In the fall of 1985, detailed geologic logs were taken of an excavation opened in the west central part of the landfill for the purpose of municipal solid waste disposal (Appendix B). This excavation is approximately 1100 feet in length and at least 60 feet deep, exposing the till deposits almost to the top of bedrock. The geologic logs from this excavation indicated that the till deposits contained extensive vertical jointing and a high degree of fracturing. Although this fact was acknowledged by the facility, it was still their position that any seepage from landfilling operations would not reach the uppermost bedrock aquifer for a very long time, and if movement occurred, it would probably be carried through the shallow, permeable zones.

Phase I Site Characterization

A comprehensive hydrogeologic site characterization was carried out between June and October, 1986, in conjunction with installation of a new ground-water monitoring system as specified in the Consent Order that was signed in September 1986 (Addendix C). The site characterization consisted

of a total of 41 continuously sampled soil borings, with coring of the upper portion of the bedrock at all deep monitoring well sites. In addition, three deep stratigraphic core holes were advanced for definition of the uppermost aquifer. Also, aquifer characteristics and ground-water flow was studied through slug testing and a more thorough research of the available background literature.

The Consent Order called for a two phased approach that would address the issues of an adequate site characterization, detection monitoring and assessment of contaminant migration. Phase I included the site characterization and subsequent installation of a preliminary detection ground-water monitoring system. The Phase II portion would assess the extent of contaminant migration detected during the Phase I plus address any additional site characterization that may have remained in question.

The Phase II investigation as stated in Paragraph 17(F) of the Consent Order was to be designed utilizing analytical data from samples collected during the first two sampling months. Furthermore, Paragraph 17(G) states that the Phase II proposal was to be submitted to EPA for review by January 15, 1987. Although several months past due, this proposal had not been received by the time of the writing of this report.

Surface Drainage

Overall drainage of the site consist of three areas physically separated by drainageways. The principal drainage splits the site from north to south. Drainage from upland farm ground is carried through a portion of

the main drainageway by a subsurface field tile. The tile emerges midway through the site where intermittent surface runoff combines with this drainage. This flow is then joined by the intermittent discharge that collects in the southeast corner of the site and exits the property through a culvert beneath Hess Road (Figure 8).

Glacial Till Deposits

Excavation of a large municipal disposal cell in 1985 presented an opportunity for the till deposits at BHCL to be logged in detail (Appendix B). The following description was based on the open trench log and subsequent sample analysis of particle size by the Iowa Geological Survey. In general, the uppermost deposit consists of a thin mantle of Wisconsin age loess, the Peoria, which is 2 to 5 feet thick on the average. The loess mantles a Wisconsin age erosion surface, marked by a stone line in places that developed on the underlying Pre-Illinoian age glacial deposits. For the most part, the modern surface soil is developed in the loess, occasionally extending down into the underlying glacial till deposits.

The exposed Pre-Illinoian age glacial deposits consist of three basic units: an upper, somewhat homogeneous till which is overlain in places by a thin sand layer; a middle unit consisting of interbedded sand, gravel, silt, and till-like materials; and a lower till unit composed mainly of silty to sandy clays with occasional gravel. The upper till is part of the Wolf Creek Formation, the youngest formation of Pre-Illinoian age tills of eastern Iowa. The clay mineralogy of the upper till is typical for tills of the Wolf Creek Formation: expandable clay minerals also known as smectite or montmorillonite, and a greater percentage of kaolinite than illite clay

minerals. Correlation of the upper till with till members comprising the Wolf Creek Formation in eastern Iowa is not possible to a great degree of accuracy due to the resident till texture being intermediate to those units identified in type sections.

From a stratigraphic standpoint, the lower till is also fairly straightforward. The clay mineralogy of the lower till shows significantly lower percentages of expandable clay minerals and is also finer textured, with sand percentages typically ranging around 30 percent. This till is part of the Alburnett Formation, which comprises the oldest sequence of Pre-Illinoian tills in eastern Iowa. At present, individual tills within the Alburnett Formation are not formally subdivided as members because no properties of the individual tills have been found to be distinctive.

The middle unit of interbedded sand, gravel, silt and till-like deposits is difficult to put in a stratigraphic perspective. The clay mineralogy of the deposits is intermediate between that typical of the Wolf Creek and Alburnett Formations, though in general, it is closer to that of the Alburnett Formation. Although the exact origin and classification of the unit is uncertain, two possible scenarios include: the middle unit represents the sheared mixing of meltwater deposits with pre-existing Alburnett Formation tills by an advancing Wolf Creek glacier; or the middle unit was deposited by a separate Alburnett advance. Dr. George Hallberg, in detailed studies of Pre-Illinoian tills elsewhere in eastern Iowa, has commonly encountered situations that could be explained by the first scenario. He believes that this is the likely explanation also for the setting at BHCL, although confirmation would require further field studies.

Hydrogeologically the unit of most concern in the till is the middle unit of interbedded sand, gravel, silt and till-like deposits. It is an extensive deposit containing units with the highest hydraulic conductivity (the sands and gravels) found at the site. Without remedial measures, and if saturated conditions exist, the greatest seepage to, through or from the landfill would be expected from this unit. Actual seepage values would be variable from this unit, however, not only because of probable differences in hydraulic gradient along the extent of the unit, but also because of variations in the thickness and texture that occur along it. The continuity of this unit has not been established through field studies at the site, although its presence has been detected over the southern half of the site.

Because they are relatively well graded (poorly sorted), the upper and lower tills generally have relatively low primary porosity, and low primary hydraulic conductivity. Weathering effects, development of a blocky, secondary soil structure and jointing, impart a secondary porosity, which may result in bulk hydraulic conductivity several orders of magnitude greater than that of the till matrix alone. Field tests commonly show conductivities of 1 to 3 orders of magnitude over that derived from the intergranular conductivity that laboratory testing gives. This enhanced conductivity, especially via vertical jointing in the lower till units, is of major concern at BHCL and geologic logs of an open disposal cell confirm extensive vertical fracturing of the till units (Appendix B).

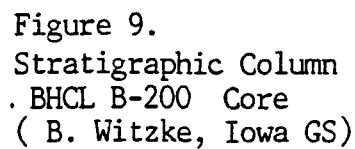
Bedrock Deposits

Underlying approximately 60 to 110 feet of unconsolidated deposits is the Cedar Valley Formation of Middle Devonian age. The stratigraphic units making up the Cedar Valley are presently in informal status, but at BHCL, the interpretation consists of four units (Figure 9). The uppermost portion of this formation is referred to as Unit B and is composed of mainly dolomite with minor dolomitic limestone containing abundant fossil molds and calcite-filled voids. This unit was found to be about 27 feet thick and underlain by a 2-foot thick Unit A4, which is a brecciated dolomite.

The next division of note is the Pints Member, also a dolomite but unfossiliferous with faint laminations, burrow mottling and a scattering of chert nodules.

Lower Unit A comprises the remaining Cedar Valley at BHCL and consists of a series of dolomite, limestone and dolomitic limestone facies with a total thickness of approximately 50 feet. This bottom most unit is conglomeratic at its base and overlies the Wapsipinicon Formation.

The Wapsipinicon Formation, also of Middle Devonian age, is composed of three members at BHCL. Brecciated near the top, the uppermost unit of the Wapsipinicon is the Davenport Member. Consisting of dolomite and dolomitic limestone, the Davenport Member is reported to be 17 feet thick. Underlying the Davenport is the very calcitic Spring Grove Member, a 20-foot thick dolomite which is finely laminated in its upper half. A 30-foot



silty to sandy shale, the Kenwood Member, makes up the base of the Devonian at BHCL. The Kenwood contains some argillaceous interbedded dolomite in the lower half, and has a very sandy shale and conglomeratic base directly overlying undifferentiated Silurian deposits.

Silurian deposits consist of an upper, relatively dense, residuum of dark gray to white chert nodules and clasts in an argillaceous dolomitic matrix. This cherty Silurian interval is about 21 feet in thickness and has been tentatively identified as the La Porte City Chert. Underlying the La Porte City is another very cherty, argillaceous dolomite thought to be the Hopkinton Formation. The Hopkinton encountered at BHCL contained abundant clay filled fractures and appears to be approximately 27 feet thick. At 92 feet thick, the Blanding Formation was the most extensive Silurian unit encountered at the site. Consisting predominately of thick bedded dolomite with chert bands, the Blanding was also noted for having an abundance of vugs, voids and solution enlarged vertical jointing as well as clay filled horizontal fractures.

Green shale partings with green and reddish mottling mark the somewhat gradual change from Silurian to Ordovician strata at BHCL. The Maquoketa Formation is the uppermost Ordovician unit at the site and is primarily comprised of argillaceous dolomite with abundant thin bedded shales and clay layers. Although only 40 feet were penetrated by coring operations at BHCL, the Maquoketa has been reported to be as much as 300 feet thick in northeast Iowa. Where this formation has been more extensively studied, it consists of predominately massive shales with dolomitic upper and lower zones.

The most important water-bearing bedrock units in the region are comprised of dolomite and limestone, collectively referred to as carbonate rocks. Such carbonate bedrock units make up the Silurian-Devonian aquifer of northeastern Iowa. Because this aquifer is found at relatively shallow depth and provides reliable quantities of water, it is the most economically accessible source of ground-water for the region. In fact, the Silurian-Devonian aquifer is a major source of public as well as private water supplies throughout eastern Iowa. Approximately one hundred Iowa municipalities, six of which are in Black Hawk County, utilize the aquifer for their water supply.

The Silurian-Devonian aquifer is recharged through the glacial till and alluvial deposits in a band approximately 70 miles wide by 400 miles long across northeast Iowa (Figure 10-12). Aquifer recharge is locally enhanced through alluvium along the Cedar River, and municipal supply wells in Waterloo and Cedar Falls reportedly yield up to 4,000 gallons per minute. The aquifer is also a major water supplier for domestic wells in the area.

Based on deep stratigraphic borings at the site, the absence of significant shale layers and the presence of fracture networks through this sequence suggests that the Cedar Valley and upper Wapsipinicon should be considered part of a single bedrock aquifer unit. The vertical extent of this bedrock aquifer was previously thought to be to the top of the Maquoketa Shale. However, the Kenwood Member of the lower Wapsipinicon Formation was found to be exceptionally shaley and contains apparently unfractured soft shale zones. In addition, the cherty residuum underlying the Kenwood appears relatively dense and may further enhance the aquitard properties of

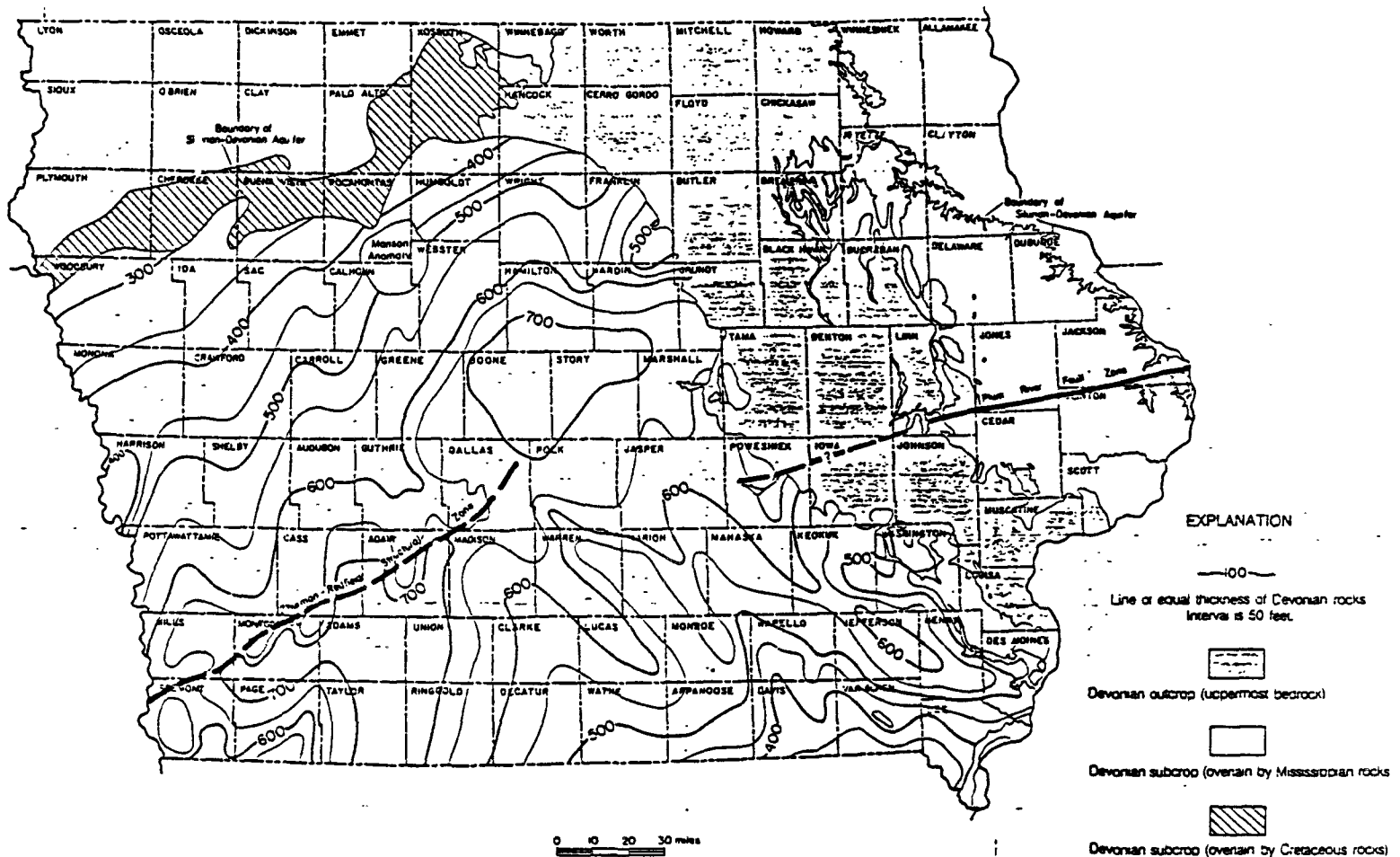
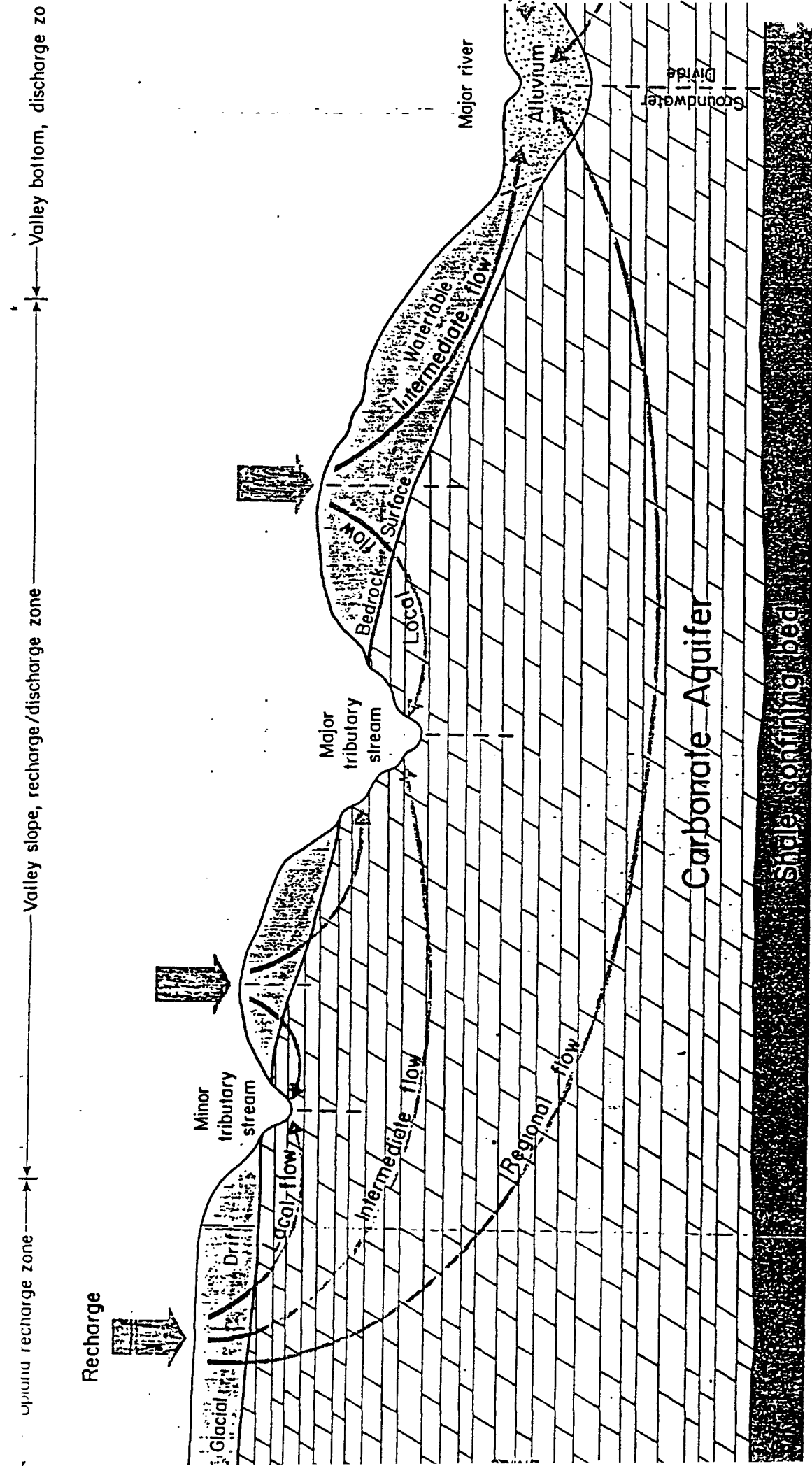


Figure 10.

DISTRIBUTION AND THICKNESS OF DEVONIAN ROCKS

Devonian rocks underlie approximately 78 percent of the state, excluding several northwestern and northeastern counties and the Manson Anomaly. They are composed mainly of shale strata in the upper part with carbonate strata dominant in the lower part. The shale units, the Maple Mill-Sheffield sequence and the Juniper Hill Member of the Lime Creek Formation, are the upper confining beds for the Silurian-Devonian aquifer. The Cedar Valley-Wapsipinicon carbonate sequence is the major water-bearing portion of the Devonian rock sequence. The Kenwood Shale Member in the lower part of the Wapsipinicon Formation is a confining bed locally in southeastern Iowa where the Silurian rocks and Maquoketa Shale are absent. Mississippian-age carbonates overlie the Devonian rocks in the southern, central, and western parts of the state, and Cretaceous shales and sandstones overlie the narrow band of Devonian rocks which extend beyond the Mississippian boundary in northwestern Iowa. Erosional remnants of Pennsylvanian-age shale and sandstone are found resting on Devonian and Silurian rocks in the outcrop area. Devonian rocks rest on Silurian dolostones in east-central, central, and southwestern Iowa, and on the Ordovician Maquoketa Formation where Silurian rocks are not present, except in southeastern Iowa, where the Devonian overlies the Ordovician Galena dolostone.



SCHEMATIC TWO-DIMENSIONAL DIAGRAM OF HYPOTHETICAL GROUNDWATER FLOW SYSTEM IN THE SILURIAN-DEVONIAN AQUIFER AND GLACIAL-DRIFT OVERBURDEN IN EASTERN IOWA

Figure 12.

this shale unit. A detailed log for the deepest stratigraphic boring as well as well as interpretation by an Iowa Geologic Survey expert is presented in Appendix D.

Groundwater Flow

In addition to an extensive soil boring and rock coring program, in-situ aquifer characterization by way of slug testing was carried out by BHCL in conjunction with installation of the new Phase I monitoring system. On the basis of water levels and slug testing, it has been concluded by the facility that three, interconnected, aquifer systems exist beneath the site: 1) a relatively shallow water table unit consisting of loess, topsoil and fill deposits; 2) the glacial till Wolf Creek and Alburnett Formations, termed by BHCL as a leaky aquitard; and, 3) the Silurian-Devonian aquifer made up by the bedrock units overlying the Kenwood Formation.

Water Table System

The water table was encountered for the most part 5 to 10 feet below ground level and included saturated portions of the loess and loessal topsoils and fill. Generally, ground-water flow through the northern portion of the aquifer follows the surface drainage pattern with a southeastern trend paralleling the drainageway. A northeast to eastward trend was identified in the co-disposal area (Figure 13). It was also noted that an apparent ground-water high exists in the neutral trench area resulting in radial flow away from both the filled trench and the unfilled excavation adjacent to it.

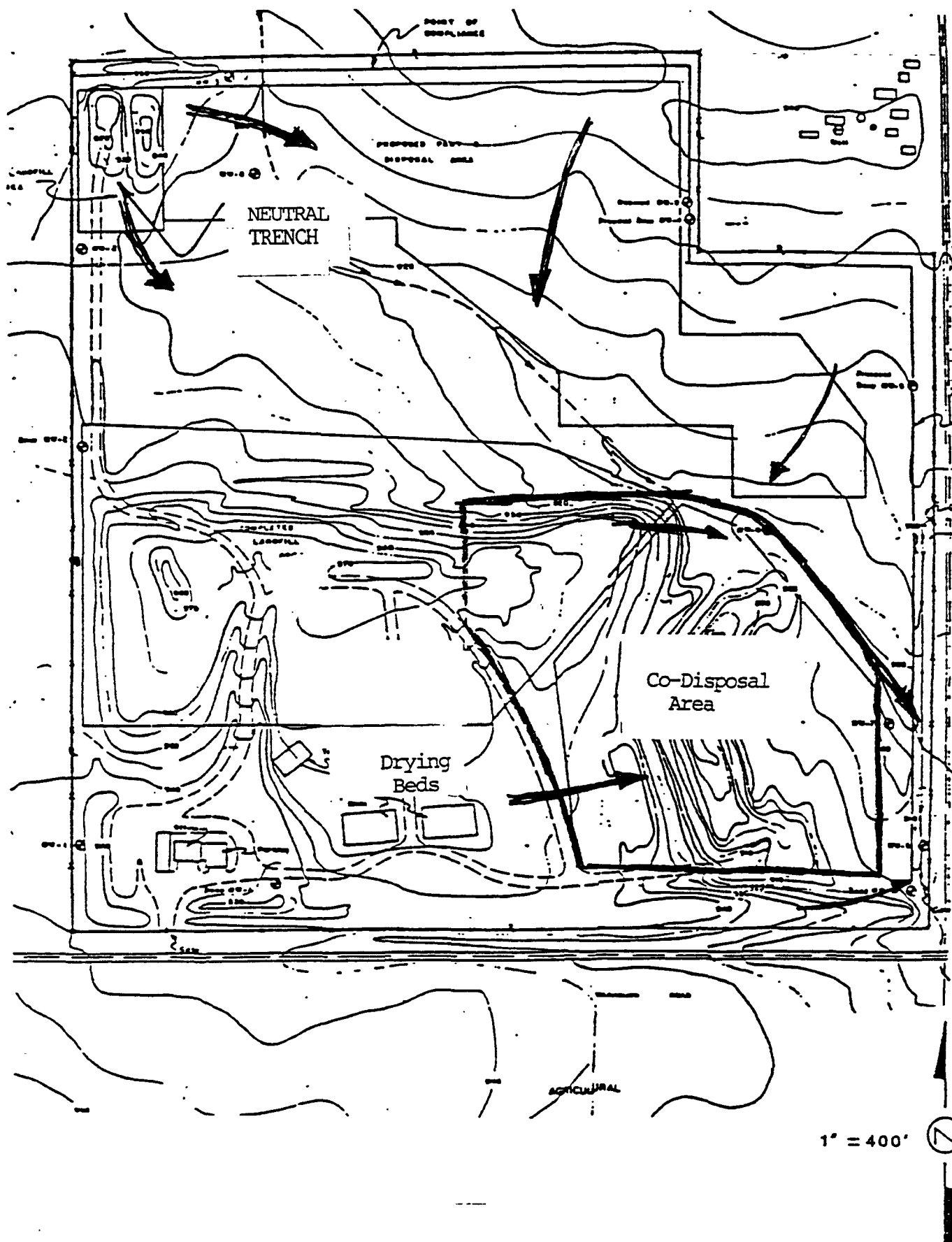


Figure 13. Shallow Groundwater Flow Directions

BLACK HAWK COUNTY, IOWA,
HAZARDOUS WASTE LANDFILL

Calculations by the facility based on estimated porosities and hydraulic conductivities resulted in an approximate horizontal velocity of 400 feet/year with a vertical component of 5 feet/year. However, as stated by BHCL, macro and micro structures such as vertical joints and fractures are not accounted for in these calculations. Due to the extensive vertical jointing and weathering of the unconsolidated deposits, the vertical component of flow may actually be an order or orders of magnitude greater. In addition, BHCL states that, based on gradients, ground-water flow will be predominantly in the vertical direction through this portion of the aquifer.

Leaky Aquitard

The Pre-Illinoian tills, made up for the most part by the Wolf Creek and Alburnett Formations and containing intermittent, discontinuous sand pockets and glaciofluvial deposits, is considered to be a leaky aquitard by BHCL. Monitoring wells screened in the till deposits demonstrate the existence of a ground-water high in the northeast section of the site. Ground-water flow from this area appears to be to the south toward the drainageway while that from the neutral trench area trends eastward. Flow from the co-disposal area will be to the north, also toward the drainageway.

In-situ testing for hydraulic conductivity produced values that ranged from 3.0×10^{-7} cm/sec for MW-103A which is screened in clay, to 1.9×10^{-3} for MW-112A, screened in a sandy zone. Average linear velocities of ground-water movement through the till deposits were calculated to be 314 feet/year for the sand pockets and 3 feet/year for clay zones. However, due to a

much greater vertical gradient, very high transmissivity values of the underlying bedrock aquifer, and the existence of a high degree of jointing and fracturing through the till, ground-water flow is predominantly in the downward direction.

Silurian-Devonian Bedrock Aquifer

The Silurian-Devonian aquifer, especially the uppermost Cedar Valley Formation, is composed of dolomitic limestone. Rock cores and aquifer testing show that this formation contains an extensive network of fractures and is highly jointed. Based on water levels, a ground-water high exists in the southwest corner of the site which results in a predominant ground-water flow direction to the northeast (Figure 14). A strong downward gradient exists between the overlying glacial till formations and the Silurian-Devonian aquifer. Therefore, ground-water movement will be primarily downward, draining water and possible waste constituents into the bedrock portion of the aquifer.

Pump testing of the Cedar Valley Formation in Black Hawk County gave transmissivity values ranging from 129,000 to 1,760,000 gallons per day per foot. Aquifer testing at BHCL produced recovery rates in the bedrock monitoring wells so rapid that accurate measurements could not be taken. However, based on a estimated hydraulic conductivity of 0.1 cm/second and an effective porosity of 40%, an average linear velocity of 10 feet/day for the ground-water of the Silurian-Devonian aquifer was presented by the facility. The actual ground-water flow rate will vary depending on the density of the fracture network and extent of jointing in this formation.

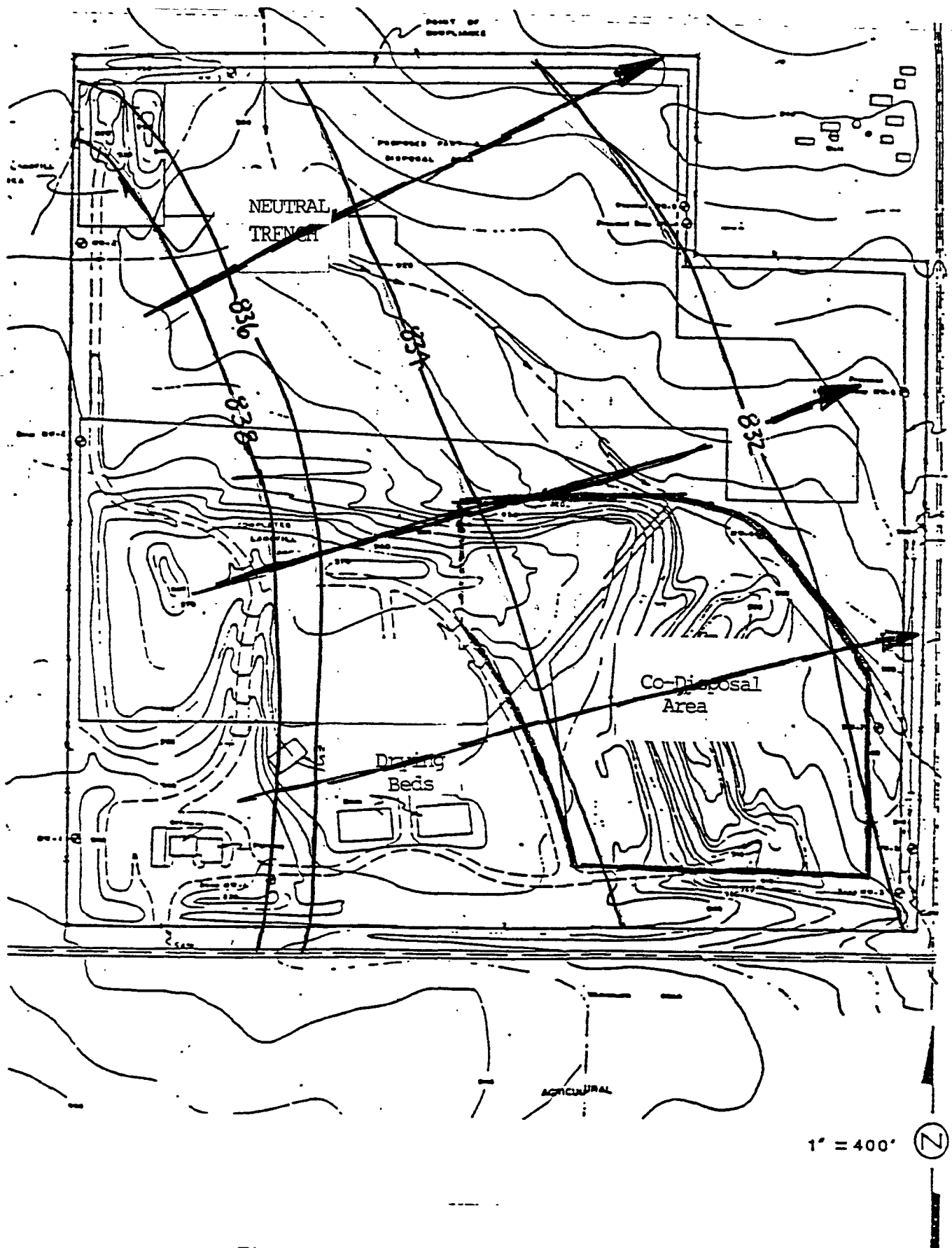


Figure 14. Silurian-Devonian Aquifer Potentiometric Surface Contours & Groundwater Flow Direction

BLACK HAWK COUNTY, IOWA,

EARLY GROUND-WATER MONITORING SYSTEM AND WATER QUALITY HISTORY

Landfill Services Corporation (LSC) Ground-Water Monitoring System

The first monitoring wells installed at the landfill were completed in the shallow, uppermost glacial till portion of the aquifer. These wells were installed in December 1974 and designated Monitoring Wells 1S, 2S and 3S. All three of these original monitoring wells were considered to be upgradient by the facility. Shallow Monitoring Wells 6S, 7S and 8S were installed in December 1980 and designated by LSC as being downgradient. In July 1982, the first monitoring wells to be installed in the bedrock portion of the aquifer, the upper Cedar Valley Formation, were in place and designated 1D, 2D and 3D. An additional two shallow (9S and 10S) and two deep (4D and 5D) were installed in May 1984. Therefore, prior to an EPA Comprehensive Ground-Water Monitoring Evaluation (CME) in 1984, there were 13 PVC monitoring wells in place at BHCL (Figure 15).

The five bedrock wells installed during the period of July 1982 through May 1984, were constructed of 6-inch diameter PVC casing. The screen in the bedrock wells was not slotted but drilled with 1/4 and 1/2-inch holes. These holes were reportedly drilled at two to three foot intervals along the length of the area to be monitored. Monitoring well diagrams did not explain how the PVC joints were joined but, as in the discussion of shallow well construction below, it is possible that solvent welds were employed.

Well construction details for bedrock wells, as described in LSC's Monitoring Well Documentation Forms, lack clarity with respect to backfill materials. The drilling contractor that installed the wells later stated

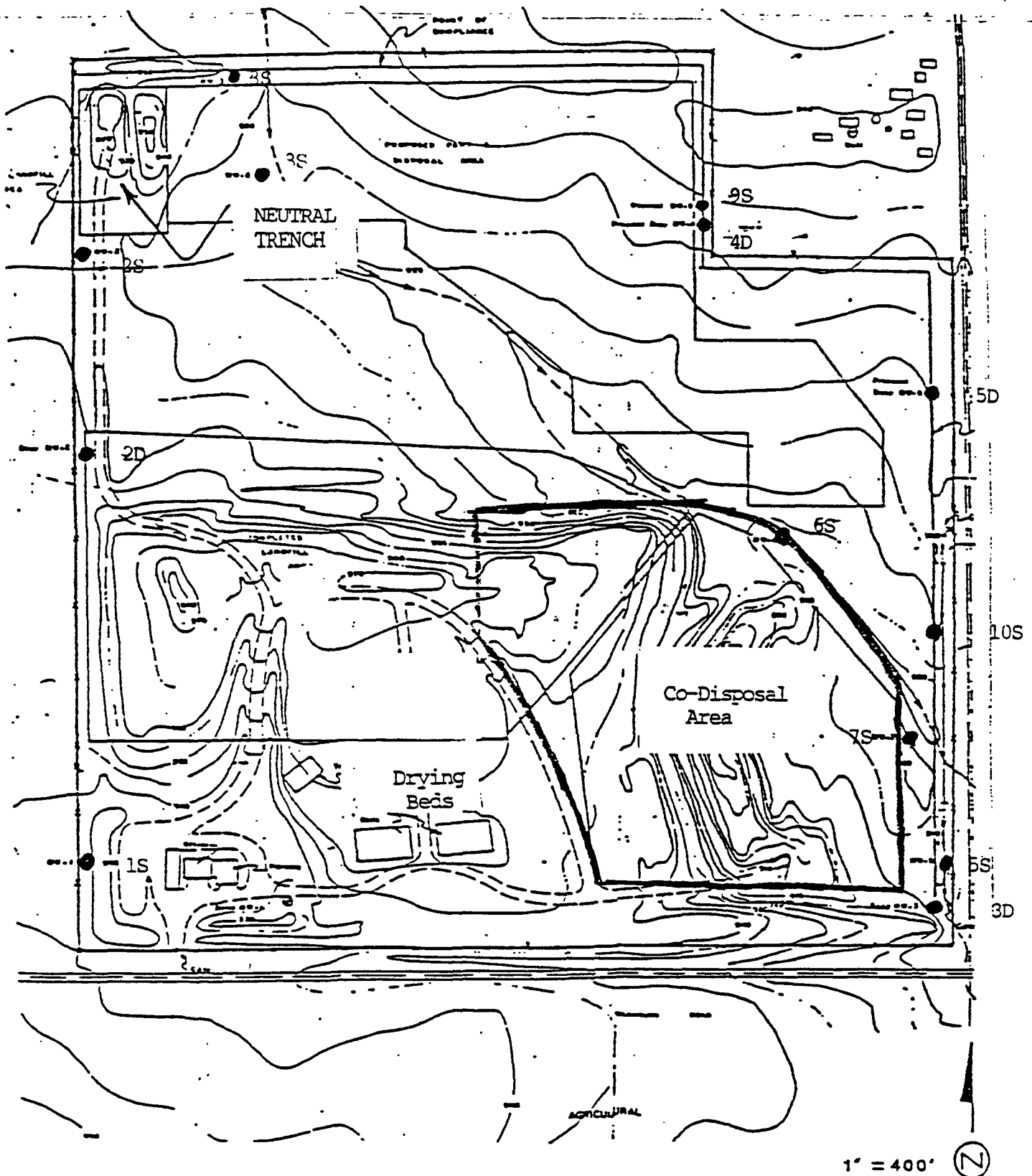


Figure 15. Early PVC Monitoring
Well Location Map

S= Shallow
D= Deep

BLACK HAWK COUNTY, IOWA,

that backfill for MW-1D, 2D and 3D was composed of drilling mud, glacial drift and limestone cuttings, although this was not recorded on the well diagrams. Other details of these three deep wells state that the filter packs consisted of limestone cuttings. A cement plug was installed from 20 feet in depth to the surface. In MW-1D, the filter pack extends from the bottom of the boring at 140 feet to 96 feet in depth. Similarly, MW-2D, also 140 feet deep, contains a filter pack of limestone cuttings in place from the bottom of the boring up to a 110-foot level. The 100-foot deep MW-3D was backfilled with limestone cuttings to 76 feet in depth.

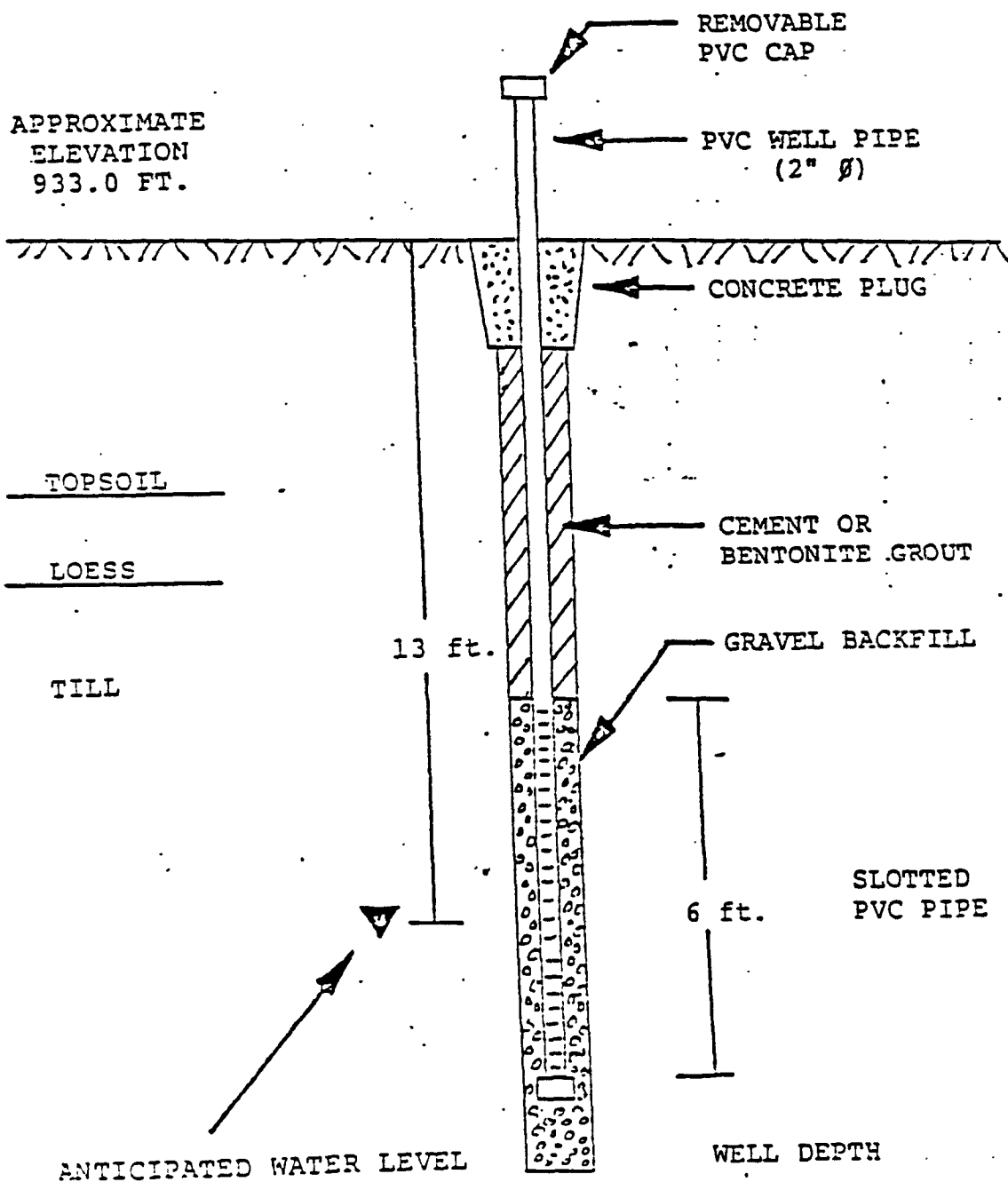
Filter pack description for the 140-foot MW-4D is lacking. This well is reportedly screened between 106 feet and 140 feet. The annulus for this well was reportedly backfilled with bentonite from an unknown depth up to 10 feet, and with cement from 10 feet to the surface. MW-5D was described as screened from the bottom of the boring, 117 feet, up to 77 feet. As with MW-4D, material composing the filter pack is not discussed, and the elevation of the top of the filter back not given. Bentonite backfill was reportedly placed on top of the filter back up to within 5 feet of the surface, and cement from 5 feet in depth to the surface.

All the shallow wells were constructed of 4-inch diameter PVC casing. Screens in the shallow wells were slotted with 0.020-inch slots and varied from 5.5 feet to 10 feet in length. A typical shallow PVC monitoring well diagram is illustrated by Figure 16. Six of the ten monitoring well diagrams specified that they were solvent welded. It is therefore assumed that all 10 shallow wells were solvent welded.

Figure 16. Diagram of Typical
PVC Monitoring Well

Black Hawk County Landfill Ground-Water Monitoring Well

MW-3



Backfill materials reported for the shallow well system were varied. In MW-1S, 2S, 3S and 8S, concrete or cement was placed directly over the filter pack. Loess or silty clay was placed as backfill on top of the filter packs of MW-6S and 7S. A cement and bentonite annular backfill was reported for MW-9S, 10S and replacement wells 2S and 3S. It was not clearly stated what mixture ratio of the cement and bentonite backfill was used. Filter packs used in construction of the shallow monitoring wells were reportedly composed of 1/2 to 1 inch, washed gravel.

An EPA inspection in 1984 concluded that the ground-water monitoring system at BHCL had major deficiencies. Specifically, construction details, accurate locations and elevations were lacking. The inspector went on to state that an accurate picture of the hydrogeological conditions at the site was not possible due to lack of detailed information. In addition, major problems associated with the monitoring system were noted by the facility during the ground-water monitoring up through 1984, including use of PVC solvent welds in the shallow wells, improper annular seals and inadequate development.

In December 1984, the landfill was purchased by BHCL from LSC. BHCL was issued a Letter of Warning from the EPA in July 1985, calling for a schedule addressing the upgrading of the ground-water monitoring system. Although proposals for upgrading the ground-water monitoring system were received by the EPA, major deficiencies were found. After prolonged negotiations with the Black Hawk County Solid Waste Commission and their consultant (Brice, Petrides and Donohue), a greatly modified ground-water

monitoring program was agreed upon in June, 1986. Installation of the new monitoring system began in July and was completed in October 1986.

Water Quality History (BHCL)

Monitoring results from the period of 1978 to 1983 revealed elevated levels of indicator parameters. Monitoring wells located in the northwest section of the landfill in the vicinity of the Neutral Trench have shown elevated pH, specific conductance and total organic halides (TOX). During this period of initial monitoring, it was unclear if disposal activities in this area were responsible for the increases. Poorly constructed wells were thought to be the reason for the elevated pH and specific conductance. It was postulated that improperly hydrated cement was deteriorating and seeping into the gravel packs of monitoring wells 2S and 3S. This has not been confirmed by subsequent testing.

Elevated levels of TOX were also noted in five other onsite monitoring wells. Conclusions were that additional monitoring and analysis were required. The inconclusive results of earlier monitoring and in response to concerns of citizens living near the site, the Iowa Department of Natural Resources (IDNR) initiated an accelerated monitoring program for BHCL in May, 1983. The Department contracted with University Hygienic Laboratory to monitor ten wells and a surface water point at BHCL as part of the accelerated monitoring program.

The objective of the accelerated monitoring program was to evaluate offsite and onsite ground-water quality to determine if there was an impact

from BHCL. Special emphasis was placed on the water quality of private wells in the vicinity. Both onsite and offsite wells and an onsite surface water point were sampled once a month from May through August 1983. A total of eleven points were monitored (Figure 17) and included the following:

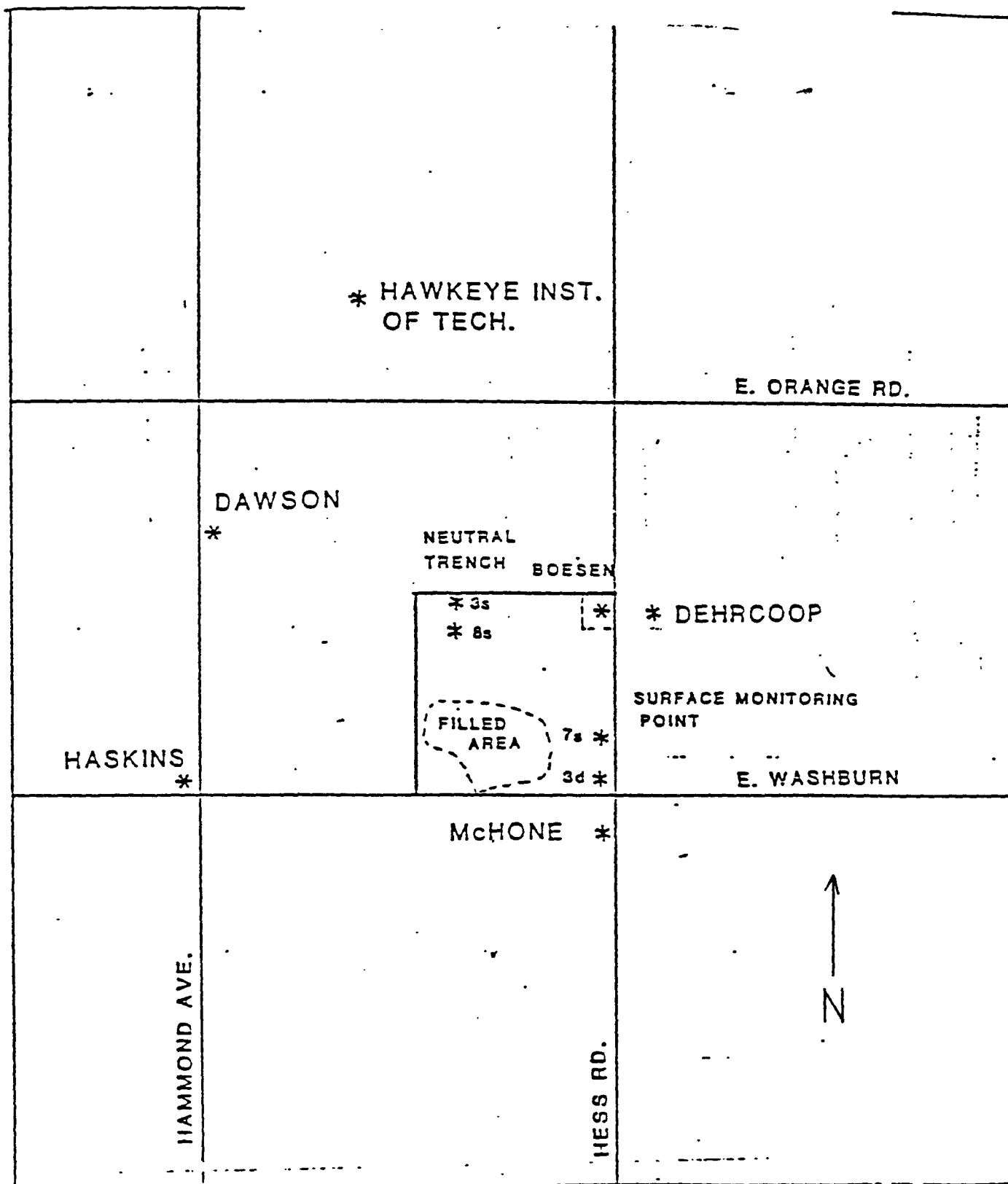
<u>Offsite</u>	<u>Onsite</u>
McHone Well	MW-3S
Dehrcoop well	MW-7S
Hawkeye Institute Well	MW-8S
Dawson Well	MW-3D
Hoskins Well	Surface Water at East Boundry
Boeson Well	

All of the offsite wells were thought to be deep wells, completed in the Cedar Valley Formation. However, details of these wells such as depth, method of construction or boring logs were not available to the Department. Of the four onsite wells, only one was completed in the bedrock portion of the aquifer. The surface water samples were taken at the point in the waterway where water leaves the landfill under Hess Road along the southeastern boundry of the facility.

The monitoring parameters set by this program included Total Chlorides, Conductivity, pH, Biological Oxygen Demand (BOD), Hexavalent Chromium and Zinc. In addition to the above mentioned parameters, Chemical Oxygen Demand (COD) was also monitored at the surface water sampling point.

One of the conclusions from the accelerated monitoring program as well as monitoring data from previous sampling was that there was evidence of possible leachate movement. Two offsite wells were reported to have elevated

Figure 17. Accelerated Monitoring
Locations (1983 Study)



* APPROXIMATE WELL LOCATION

zinc levels although this was not believed by the researchers to be from the landfill. However, one of the offsite wells with the poorest water quality was the Boesen well which is at the northeast corner of the landfill property. Not adequately explained in this monitoring program was the elevated levels of TOX that had occurred over several years in five shallow, onsite monitoring wells.

Although the study concluded that water drawn from private wells surrounding BHCL was within safe drinking water standards, there was evidence of contamination of the ground-water onsite. Therefore, it was recommended by IDNR that there be implemented an expanded ground-water monitoring program. Included in this expanded program were required quarterly sampling and analysis, and placement of two additional deep wells. In addition, the shallow monitoring wells 2S and 3S were to be replaced by two new shallow monitoring wells. These two monitoring wells were replaced the next year.

Later monitoring covering the period of April 1984 through May 1985 showed significant increases in pH, specific conductance, and total organic carbon (TOC) for shallow and deep onsite wells. Even though the elevated indicator parameters demonstrated that these wells failed statistically, LSC did not submit a ground-water quality assessment plan. The facility contended that these findings may be due to several factors related to well installation and/or sampling procedures, and did not truly reflect ground-water quality at BHCL. Factors thought responsible for the sample values included improper purging, use of PVC solvent welds in the shallow wells, improper sealing of the annulus in three deep and two shallow wells, and the fact that wells were not developed after installation.

GROUND-WATER MONITORING PROGRAM PROPOSED FOR RCRA COMPLIANCE

Well Construction

Ground-water monitoring wells proposed for compliance with the Phase I part of the 1986 Consent Order were constructed of 2-inch ID, type 316, flush threaded, stainless steel pipe and well screens. The well screens are factory slotted with a #10 (0.01inch) slot size. Screen lengths are 10 feet for the shallow and bedrock wells, and 5 feet for the intermediate wells. The bedrock well screens were 10 feet in length in order to monitor the upper, highly fractured portion of the Cedar Valley Formation. Ten-foot screen lengths were chosen in the shallow wells to compensate for possible ground-water fluctuations anticipated near the surface. Intermediate wells are monitoring a more discrete interval (sand lenses) and the 5-foot screen length should serve this function more effectively.

Filter packs placed in the intermediate and shallow monitoring wells consist of a clean washed, silica sand, graded to fit the #10 slot size of the screens. In the intermediate wells, this filter sand pack was extended 2 feet above the top of the screens. The filter packs were placed above the top of the screen to within 7 feet below ground level for the shallow monitoring wells. For bedrock wells, the filter pack consisted of course sand to fine gravel, with a 2-foot layer of fine grained silica sand on top. In these deeper wells, the filter pack fills the annular space up to 7 feet below the bedrock surface.

Sealant material placed over the sand filter packs is composed of bentonite pellets which were hydrated at least eight hours before placement

of the overlying grout. At a minimum, the bentonite seals in bedrock wells are seven feet thick, five feet thick in intermediate wells, and two feet thick in the shallow wells. Direct depth measurements were taken in all wells to assure proper placement of the bentonite seals before addition of the grout backfill.

Backfill material above the bentonite seals for the bedrock and intermediate monitoring wells is composed of American Colloid Volclay Grout. A density of 9.4 lbs./gal. was specified and verified in the field by mud balance measurements at installation. The grout placement was accomplished by use of a tremie pipe positioned three feet above the bentonite seal, then withdrawn as the annular space was filled. In the intermediate wells, the grout was placed to within five feet below the ground surface. The bedrock wells have a six-inch PVC casing placed into the bentonite seal and resting on the bedrock surface. Volclay grout fills the annular space inside the PVC casing, and cement-bentonite grout is placed on the outside of the casing to within five feet of the ground surface. Inside the outer PVC casing, two-inch stainless steel casing with 10-foot, #10 slot screens were installed. Double casing of the deep wells was utilized at BHCL to minimize any contaminant migration from overlying deposits into the Cedar Valley Aquifer.

Concrete caps were installed in all wells from five feet in depth to the ground surface. On top of the cap, reinforced concrete pads, four feet square and sloped away from the well casing, were constructed. Six-feet in length, six-inch diameter vented, locking steel protective casings were installed in the concrete.

Each monitoring well has a dedicated, stainless steel, five-foot bailer which is connected by stainless steel cable to a heavy duty downrigger. The downriggers are housed in lockable aluminum boxes which are installed directly onto the steel protective casings. General monitoring well diagrams are illustrated in Figures 18-20.

Well Locations and Number

A total of 14 monitoring well clusters were installed. Each, with the exception of MW-104, consisted of a shallow, an intermediate and a deep (bedrock) well. During the initial drilling operations, it was discovered that the intermediate depth permeable zone was absent at the location designated for MW-104A, and this well was deleted from the cluster. There are a total of 41 monitoring wells in the new Phase I ground-water monitoring system at BHCL.

Monitoring well clusters MW-105 through MW-109 and MW-113 are along the designated compliance line for the sludge Drying Bed and Co-Disposal Area which, for monitoring purposes, have been treated as one waste management unit. In the southeast corner of the facility, MW-110 cluster was placed for detection of possible contaminant migration associated with this low-lying area. A monitoring cluster, MW-112, was placed in the northeast portion of the facility for detection of possible contaminant migration through the upper bedrock aquifer in that direction. All the monitoring wells discussed above are considered downgradient with the exception of MW-112A and MW-112B which, at present, are designated upgradient with respect to shallow and intermediate ground-water flow.

Fig 18. RCRA Shallow Monitoring

SHEET ____ OF ____

BRICE, PETRIDES-
DONOHUE

Well Diagram

WELL NO. ____

SI

BY: _____

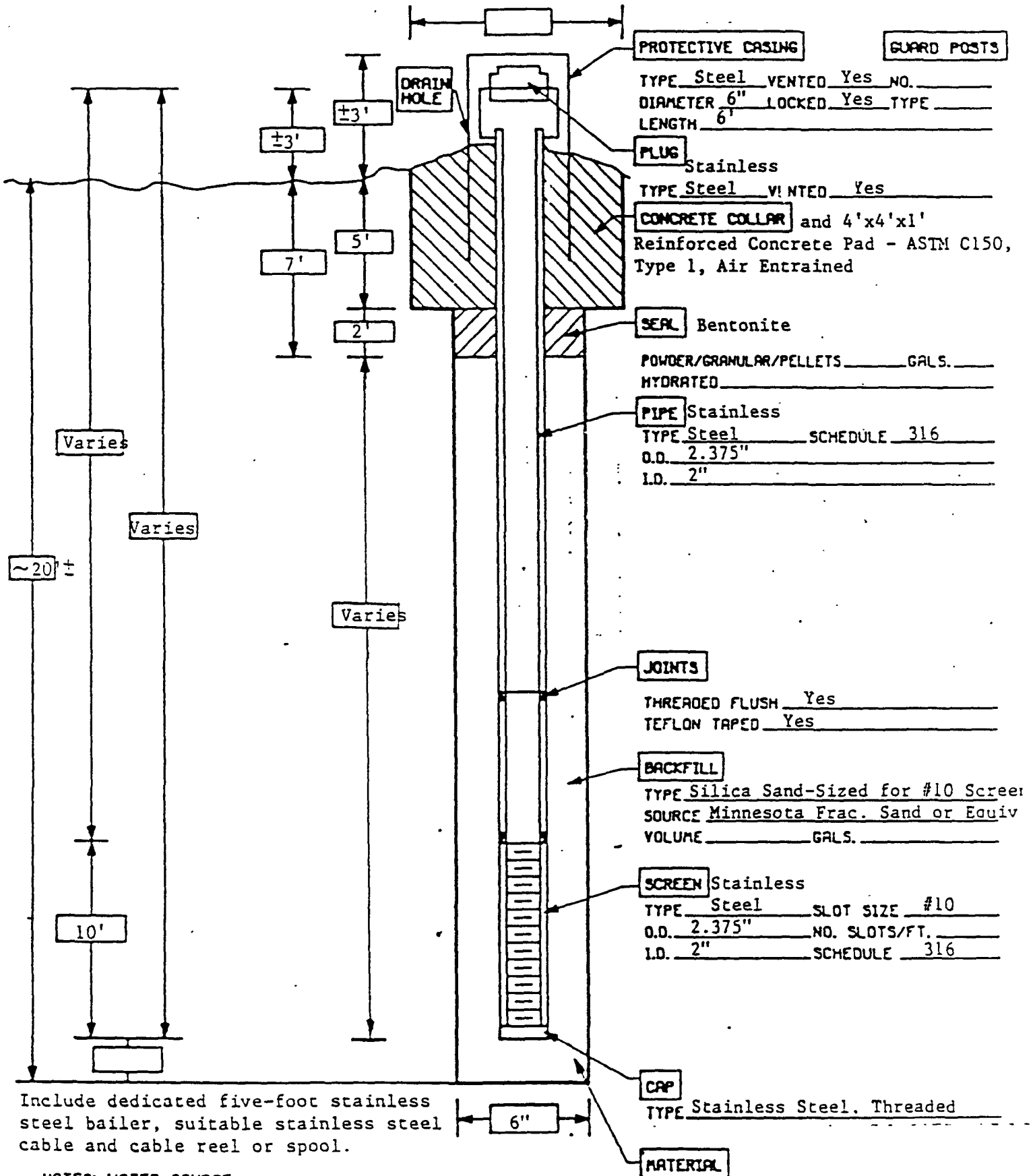


Figure 19. RCRA Intermediate
Monitoring Well Diagram

(A)

SHEET ____ OF ____

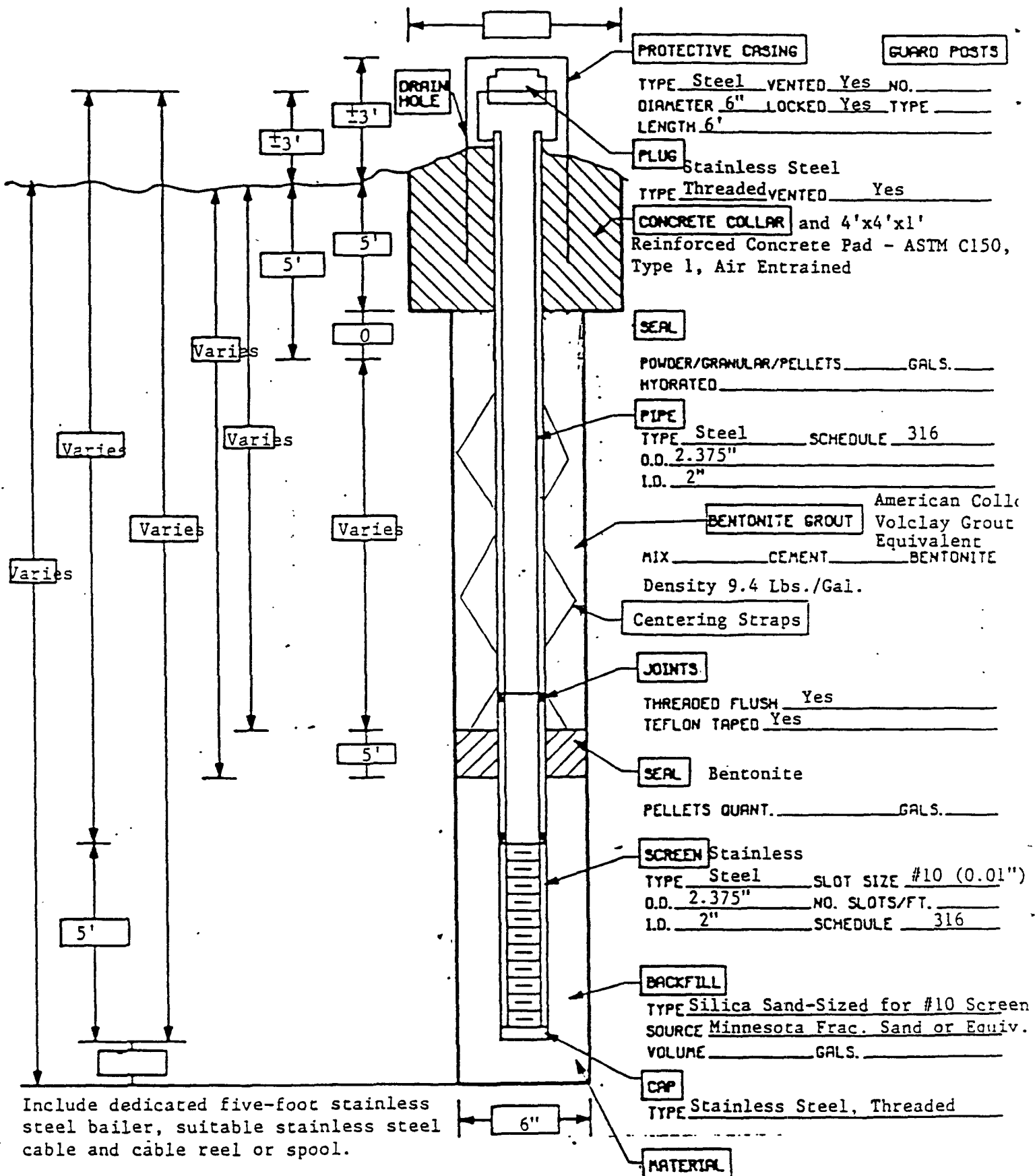
BI
DC

STALLATION DIAGRAM

WELL NO. _____

DATE:

DIS:

PROJECT NO. 50303.030

Include dedicated five-foot stainless steel bailer, suitable stainless steel cable and cable reel or spool.

NOTES: WATER SOURCE

Figure 20. RCRA Bedrock Monitoring
Well Diagram

BEDROCK WL (C)

SHEET ____ OF ____

BRICE, PETRIDES-
DONOHUE

PIEZOMETER INSTALLATION DIAGRAM

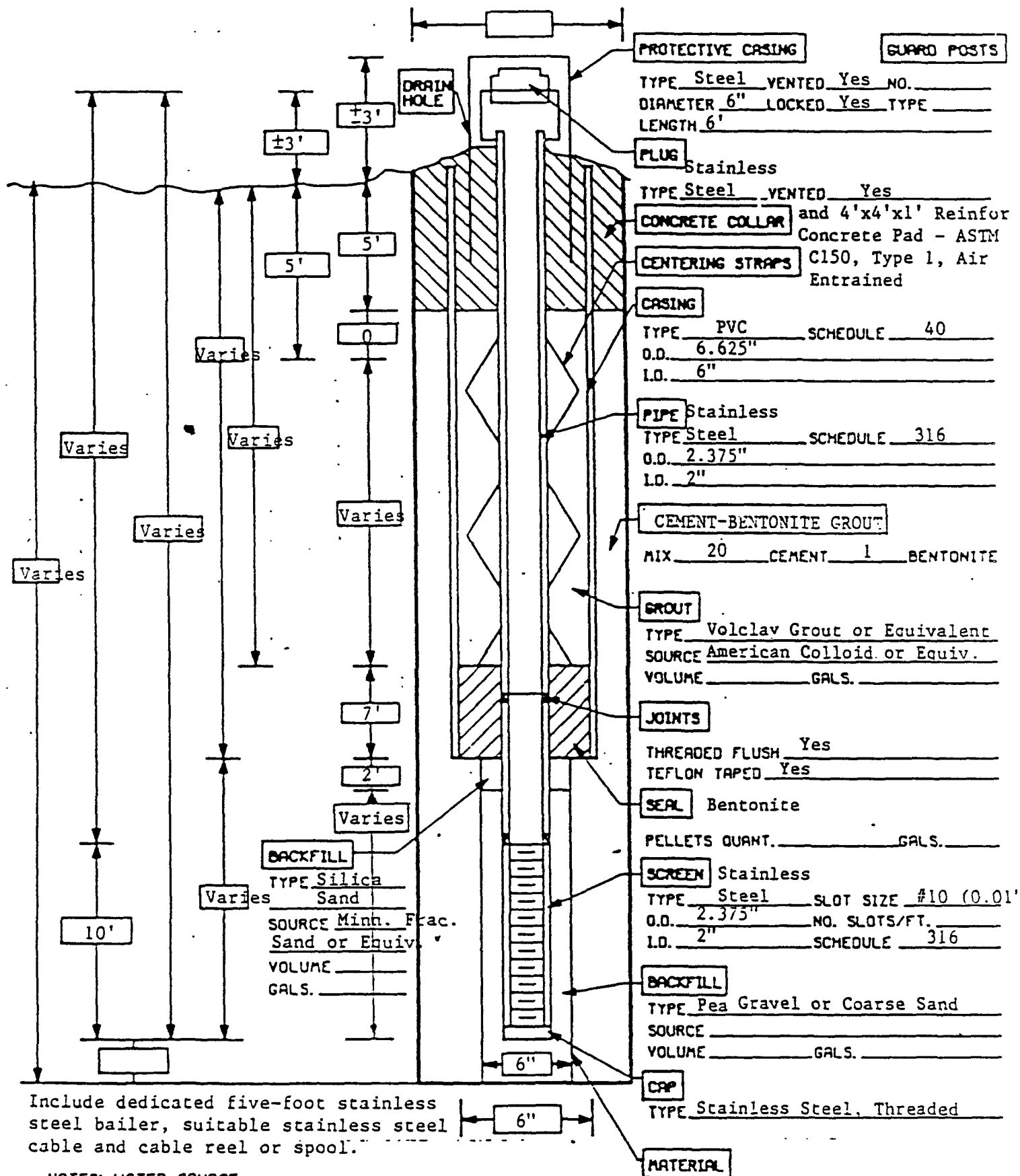
WELL NO. ____

SITE: Black Hawk County

DATE: ____

BY: Landfill

PROJECT NO. ____



Along the south central boundary of the site is the upgradient monitoring cluster, MW-111. At the time of installation, monitoring wells within this cluster were thought to be upgradient at all depths. Also designated upgradient at present is MW-114, which is located approximately 400 feet north of the southwest corner of the site. These two upgradient monitoring well clusters and the downgradient clusters discussed above each have three wells installed in shallow, intermediate and deep zones. The wells in each cluster are located within a 15-foot radius of one another. The close arrangement of the wells within clusters made it possible to select permeable zones to be screened from one continuously sampled boring at each cluster site. General monitoring well cluster locations in relation to waste management units are illustrated in Figure 21.

Based on a preview of historic data, it was determined that two ground-water flow directions exist in the Neutral Trench Area. The ground-water flow through the glacial till deposits are in a southeastern direction while that of the deeper bedrock flow is to the northeast. Therefore, the well cluster arrangement used elsewhere onsite was not used. Downgradient, shallow and intermediate monitoring wells were placed around the southeast edge of the neutral trench area while downgradient bedrock wells are on the eastern side. The upgradient, shallow and intermediate monitoring wells are placed northwest of the trench while the upgradient bedrock well is on the southwest corner (Figure 22).

A total of 11 monitoring wells were installed in this area of the site with 3 monitoring the intermediate zone, and 4 each screened in both the deep and shallow portions of the aquifer. Monitoring wells MW-101A, 101B and 101C

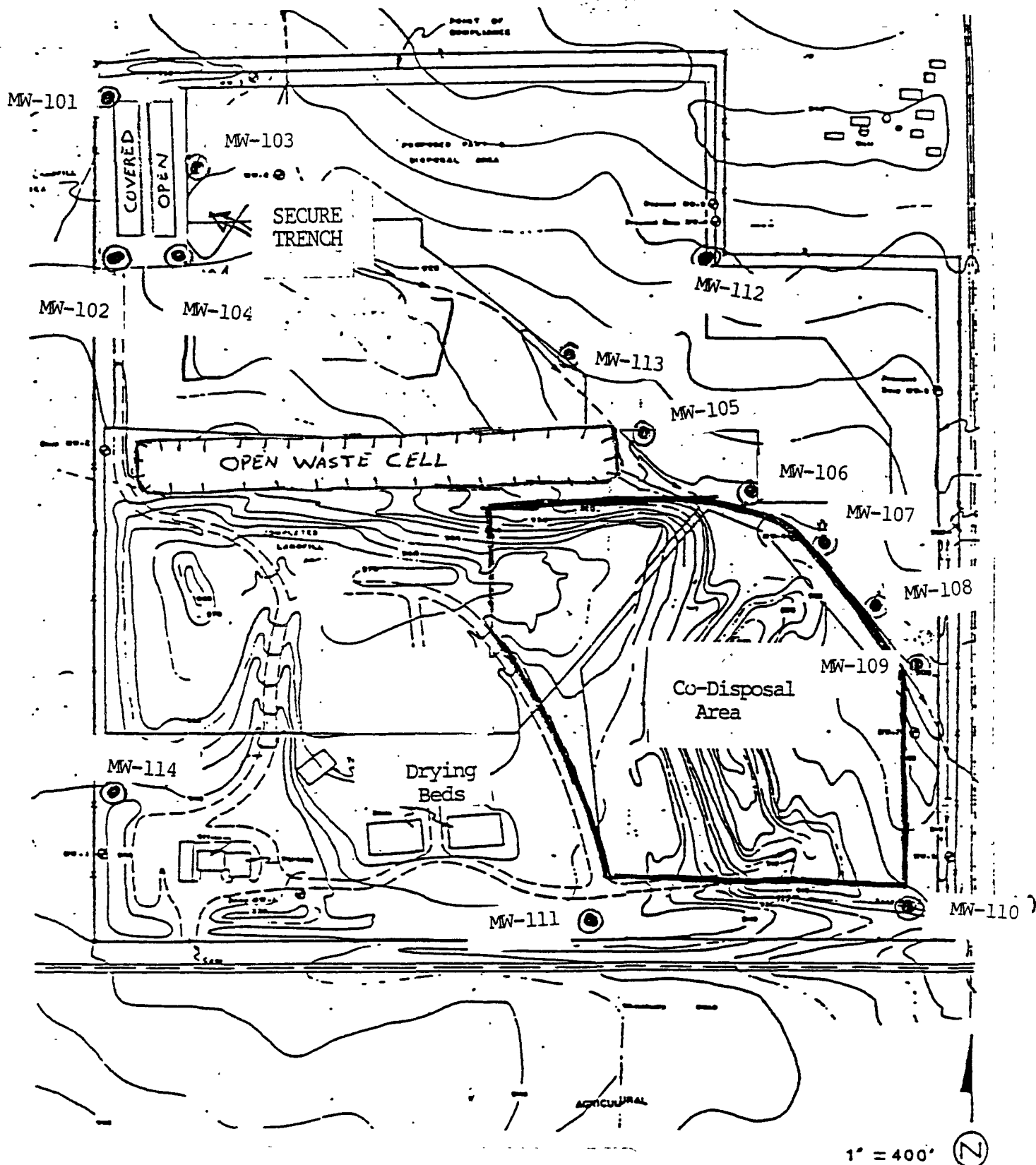


Figure 21. General Location Map of
RCRA Monitoring Well Clust
Clusters

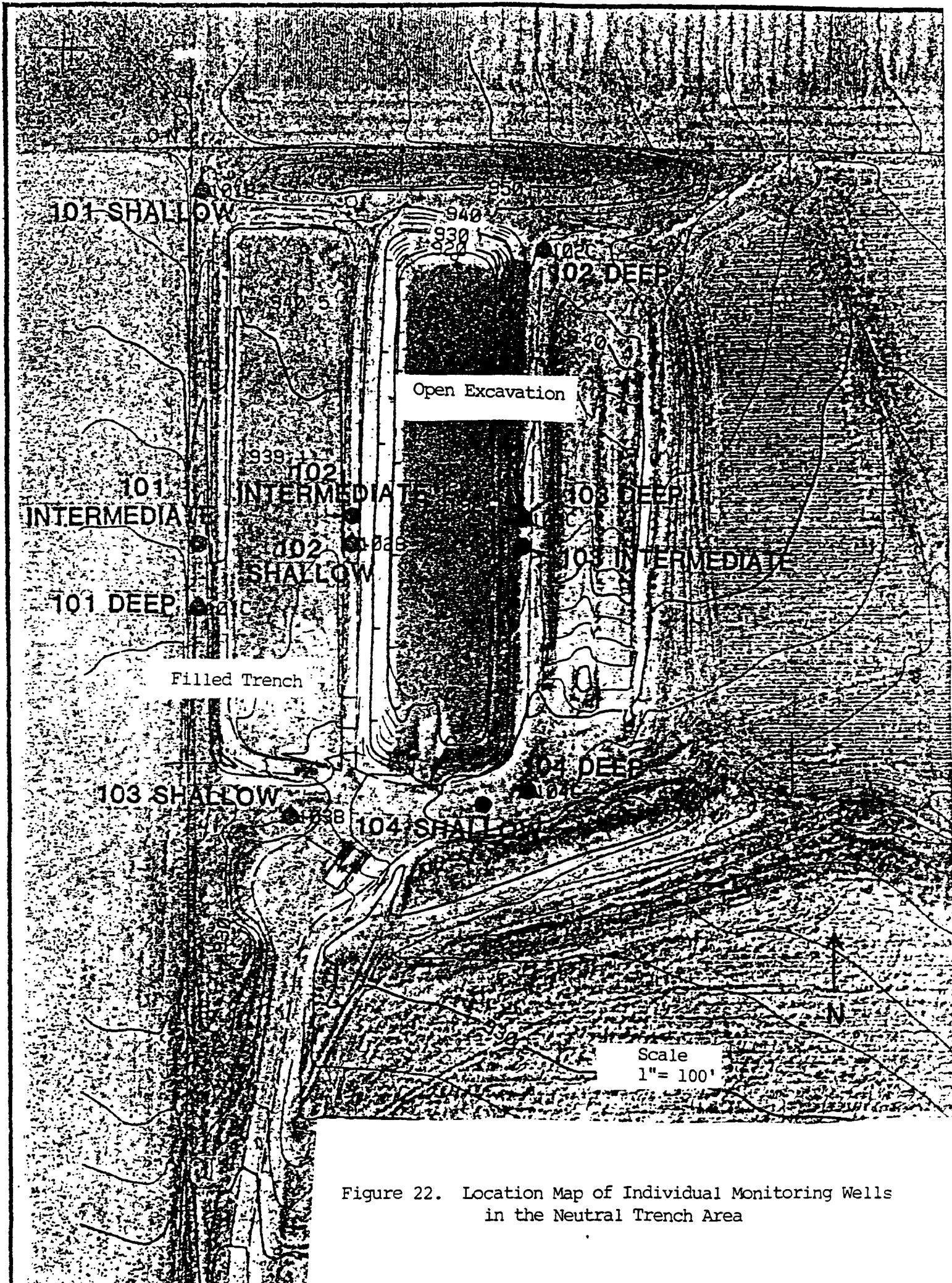


Figure 22. Location Map of Individual Monitoring Wells in the Neutral Trench Area

101C are designated as upgradient background wells. In addition, MW-104C was found to be upgradient upon analysis of the hydrogeological data. The other seven monitoring wells in this area are considered to be downgradient of which only two are completed in the bedrock aquifer.

SAMPLE COLLECTION AND HANDLING PROCEDURES

Task Force Sampling Methods

Samples for the Task Force evaluation were collected by Versar, Inc. (Versar), an EPA contractor, under supervision of Task Force and EPA Region VII personnel. Ground-water samples were obtained from 22 monitoring wells: 6 shallow, 9 intermediate, and 7 deep (bedrock) wells. In addition, 2 surface water samples were collected; one from the neutral trench culvert and the other from the southeast seep area. Sample locations were designated prior to the site visit by EPA Region VII personnel, and were included in the Project Plan generated for the investigation. Some deviation from the original designated locations did become necessary due to conditions found in the field, such as dry or very slow recharging monitoring wells. Other changes were caused by the as-built locations of monitoring wells around the Neutral Trench area. Their exact final positions were not known prior to the inspection due to the contemporaneous construction of the system. Samples collected, including blanks, are listed on Table 1.

Equipment failure in the field were another source of deviation from the project plan. Initially, Teflon bladder pumps were to be used for purging each monitoring well. Due to complete malfunction of the pumps, bailers were

utilized for all purging and sampling by the Task Force team. In addition, two bailers were lost in monitoring wells when they became disconnected from the end segments. These two bailers were later recovered by Versar using stainless steel hooks.

Accurate measurements of pH was not possible due to malfunction of the pH meter. Values listed for pH on Table 7 were obtained from pH paper or pH pen.

Table 1
BLACKHAWK COUNTY LANDFILL
SAMPLING SUMMARY

Well	Sampled	Shipped	Sample Parameters Collected*
----- (1986) -----			
MW-102A	10/28	10/28	Complete Set + duplicate
MW-103B	10/28	10/28	Complete Set
MW-105A	10/28-29	10/29	VOA, POC, POX, Extrac. Organics, Metals, Cyanides
MW-105C	10/28	10/29	Complete Set
MW-106A	10/29	10/30	VOA, POC, POX, Extrac. Organics, Total Metals
MW-106C	10/28	10/29	Complete Set
MW-107B	10/29	10/30	VOA, POC, POX, Total Metals
MW-107C	10/29	10/29	Complete Set
MW-108A	10/29	10/30	VOA, POC, POX, Extrac. Organics, total metals, phenols
MW-109A	10/28	10/29	Complete Set minus pest/herbs
MW-109C	10/29	10/29	Complete Set
MW-110B	10/30-31	10/31	Complete Set minus Cyanides, Pest/Herbs
MW-111A	10/29	10/29	Complete Set
MW-112A	10/27	10/28	Complete Set
MW-112B	10/27	10/28	Complete Set
Secure Trench			
Culvert	10/29	10/29	Complete Set
SE Seep	10/31	10/31	Complete Set
Equip. Blank (near MW110)	10/30	10/31	Complete Set
Field Blank #1 (near MW107)	10/29	10/30	Complete Set
Field Blank #2 (near MW103B)	10/31	10/31	Complete Set

(*Complete set refers to parameter list in Appendix E)

Open well heads were monitored for chemical vapors prior to purging with an HNU photo-ionizer. Versar then measured water levels and total depth of the well with an electronic water level indicator. From this data, exact purge volumes were calculated. Monitoring wells were purged of three well volumes, or until dry, with laboratory-decontaminated, bottom discharging, dedicated Teflon bailers attached by Teflon coated stainless steel cable.

Water removed from the well during purging was first discharged into a 5-gallon bucket for measurement and then poured into 55-gallon drums for holding until it could be tested for contamination. To reduce contact with potential contamination, latex gloves were worn at all times and plastic ground sheets were placed around the work area.

A small diameter Teflon bottom emptying device (BED) was attached to the bottom end of each bailer for obtaining the samples. All water samples were discharged directly into their appropriate containers to minimize contact with the atmosphere (Table 2). All sample bottles and preservatives were provided by Versar for Task Force samples. Field parameters such as pH, temperature and specific conductance were taken in quadruplicate sets at the well site immediately upon obtaining the sample. After field parameters were taken, sample collection proceeded in the order listed in Table 2. This table also lists parameters collected by container and preservatives used, if any. Upon filling, sample containers were placed in ice chests, then taken by Versar to a central collecting point located near the facility's office. At the central collecting point, samples for dissolved metals were filtered

through a .45 micron membrane filter by use of an electric vacuum pump. Sample splits were then distributed to BHCL contractor personnel following standard chain-of-custody procedures. In addition to obtaining signed receipts from the BHCL contractor, chain-of-custody forms were filled out and samples shipped to the EPA contractor laboratory at the end of each day.

Table 2 ORDER OF SAMPLE COLLECTION BOTTLE TYPE AND PRESERVATIVE LIST		
Parameter	Bottle	Preservative
Volatile Organics (VOA)	60 ml VOA vials	
Purgeable Organic Carbon (POC)	60 ml vial	
Purgeable Organic Halogen (POX)	60 ml vial	
Extractable Organics	1 qt amber glass	
Total Metals	1 qt plastic	HNO ₃
Dissolved Metals	1 qt plastic	HNO ₃
Total Organic Carbon (TOC)	4 oz glass	H ₂ SO ₄
Total Organic Halogen (TOX)	1 qt amber glass	
Phenols	1 qt amber glass	H ₂ SO ₄
Cyanide	1 qt plastic	NaOH
Nitrate/Ammonia	1 qt plastic	H ₂ SO ₄
Sulfate/Chloride	1 qt plastic	
Pesticide/Herbicide	1 gal amber glass	

For quality control, two field blanks and one equipment blank were prepared by the Versar sampling team. Blanks were prepared by pouring laboratory, grade de-ionized water through a laboratory-decontaminated Teflon bailer into an appropriate sample container. Field blank locations are noted on Table 1. For quality control/quality assurance (QA/QC), a duplicate set of samples were obtained from MW-102A.

Sample splits were taken by the Versar team for the facility in all monitoring wells that produced sufficient amounts of water for this purpose. The monitoring wells where splits were taken and the parameters collected at each are listed in Table 3. Splits were also made from two field blanks, an equipment blank and one surface water sample from the southeast seep.

Table 3 SAMPLE SPLITS PROVIDED FOR BHCL							
Sample Location	Parameter						
	VOA	Extract. Organic	Total Metals	Dissolved Metals	TOX	TOC	Cyanide
MW-101B	+	+	+	+	+	+	+
MW-103B	+	+	+	+	+	+	+
MW-107B	+	+	+	+	+	+	+
MW-110B	+	+	+	+	+	+	-
MW-112B	+	+	+	+	+	+	+
MW-114B	+	+	+	+	+	+	+
MW-102A	+	+	+	+	+	+	+
MW-103A	+	-	-	-	-	-	-
MW-108A	+	+	+	-	-	-	-
MW-110A	+	+	+	+	-	-	-
MW-112A	+	+	+	+	+	+	+
MW-102C	+	+	+	+	+	+	+
MW-112C	+	+	+	+	+	+	+
MW-114C	+	+	+	+	+	+	+
SE Seep	+	+	+	+	+	+	+
Eq. Blank	+	+	+	+	+	+	+
Field Blank #1	+	+	+	+	+	+	+
Field Blank #2	+	+	+	+	+	+	+

Decontamination procedures used on non-dedicated equipment such as the bailer cable, water level indicator probe, pH and specific conductance meter probes consisted of a hexane wipe followed by de-ionized water rinse and wipe. As mentioned above, Teflon bailers and BED's were cleaned and decontaminated, wrapped in plastic, and sealed with tape, by the Versar home station prior to the sampling event.

BHCL Sampling and Handling Methods

Observation by the Task Force of the BHCL sampling procedures utilized by the facility's contractor was an integral part of the site evaluation. At the time of the Task Force Investigation, BHCL was taking their first set of samples called for by the accelerated sampling schedule (Appendix E). As part of this first set of the program, BHCL was sampling all the new stainless steel monitoring wells recently installed for RCRA compliance.

The BHCL contractor sampling team used a submersible pump constructed of Teflon and stainless steel to purge most of the monitoring wells before sampling. Purge volumes were calculated by first taking a water level reading with an electronic water level indicator, then measuring total depth of the well. Purge volumes used by BHCL were five casing volumes, instead of the three casing volumes employed by the Task Force, or until low yield wells went dry. As discussed in the section of this report concerning design of the new monitoring well system at BHCL, each well has a dedicated stainless steel, top discharging bailer. At the time of the inspection, the downriggers had not yet been installed. Each bailer had been steam cleaned, wrapped in plastic and numbered to correspond with its respective monitoring well. The BHCL sampling team used these bailers with

nylon rope to obtain their ground-water samples from the wells. The nylon ropes are a temporary arrangement until the downrigger cables are installed. This rope was discarded after use in each well.

The BHCL sampling crew wore rubber gloves during the sampling event. In general, sample bottles, labels, preservatives and the order of sample collection were consisted with BHCL's EPA approved sampling and analysis plan. They adequately decontaminated non-dedicated items of equipment between monitoring wells, and in general were competent and knowledgeable of sampling techniques. VOA portions of the samples were poured very slowly from the top discharging bailers into the sample bottles which were handled in a manner to exclude air bubbles. Sampling and chain-of-custody procedures by BHCL were strictly followed and carried out in an adequate fashion during the entire sampling event.

MONITORING DATA ANALYSIS FOR INDICATIONS OF WASTE RELEASE

Task Force Sampling Results

Tabulation, evaluation and interpretation of analytical data for samples collected by Task Force personnel during the October 1986 inspection and analyzed by EPA contract laboratories is covered in detail in Appendix A. Included in the discussion of laboratory results is usability of the data, in which some values are reported to be quantitative, semi-quantitative, qualitative or unusable. Most unusable data resulted from detection of similar concentrations of parameters in blanks. Detection of these parameters was therefore determined to be a laboratory error.

Quality control data on the volatile organics (VOA's) indicated several problems including either acetone or methylene chloride contamination in some laboratory blanks. Because of this contamination, all positive acetone results except for MW-102A and all positive methylene chloride results with the exception of MW-114C were deemed unusable. Acetone concentration from MW-102A was reported at 11 ug/L while that for methylene chloride in MW-114C was 6 ug/L. No other positive VOA's were reported by the laboratory.

A number of semi-volatiles were reported in several of the ground-water samples (Table 4). Also listed on Table 4 are five monitoring wells and one surface water location in which unknown semi-volatiles were detected. (Of the five wells where semi-volatiles were detected, three are deep, one intermediate and one shallow). In addition, unknown semi-volatiles were also detected in both surface water samples. Concentrations of the unknown semi-volatiles varied, but all were below specified detection limits (Table 4). However, di-n-butyl phthalate and di-n-octyl phthalate were also detected in Task Force equipment and trip blanks. The presence of these compounds in blanks and the very low levels detected may indicate that their presence is due to contamination by sampling or laboratory equipment.

Table 4 SEMI-VOLATILE ORGANICS

Bis (2-3thylhexyl) -phtalate	Di-N-butyl -phtalate	Di-N-octyl -phthalate	Pentachloro- phenol	Unknown(s) Detected
MW-105A MW-109A MW-110A MW-111A MW-105C MW-107C MW-112C MW-114C	MW-105A MW-105C	MW-110A MW-105C	MW-102A MW-106A	MW-109A MW-114B MW-105C MW-106C MW-109C SE Seep NW Cul- vert

Results of total metal analyses are somewhat questionable at this time. For example, chromium was detected in 21 of the 23 monitoring well samples as well as in both surface samples. However, out of these samples, results were deemed unusable for 12 of them. Five of the total chromium results exceeded drinking water standards, but three of these results are regarded as qualitative only. The two results exceeding drinking water standards that are considered quantitative are 73 ug/L for MW105A and 95 ug/L for MW105C. Neither of these two monitoring wells were positive for dissolved chromium. Additional total metal analyses include arsenic in 9 ground-water samples, and lead in 10 monitoring wells and the Southeast seep. Concentrations of these two metals were very low, with arsenic present in trace amounts for the dissolved metals analyses in MW114C and the Southeast seep. Dissolved metals analysis for lead revealed a concentration of 14 ug/L for the Southeast seep, but was none reported in ground-water samples.

At the time of the Task Force sampling event at BHCL, most of the monitoring wells were still under development or had just been developed within the week of sampling. It was noted in the field that most ground-water samples were slightly to moderately turbid, indicating wells were not adequately developed at the time of sampling. In addition, some equipment and field blanks showed metal contamination did exist and did have an impact on certain parameters.

Ground-water samples from all the deep bedrock monitoring wells and the two surface samples had high levels of sulfate reported. Sulfate results from the bedrock wells ranged from 380 mg/L to 650 mg/L, which were on the average ten times that of the monitoring wells completed in till deposits.

Higher levels of sulfate in the bedrock aquifer are perceived as natural, possibly due to interbedded gypsum deposits present in the unit. Sulfate levels reported for the surface samples were high, with 780 mg/L for the Neutral Trench culvert and 1,600 mg/L in the Southeast seep.

Some additional indicator parameter highlights of this investigation include total organic carbon (TOC), total phenols, and total organic halogen (TOX). All the sampling blanks contained TOC at concentrations ranging from 200 ug/L to 2200 ug/L. The laboratory reported that TOC contamination has been a recurring problem with Task Force sampling blanks. It was further stated that although it is not known for sure, the source of this problem may be due to high levels of carbon dioxide or charcoal in the water used for the sampling blanks. All TOC levels reported for BHCL with the exception of the two surface water samples had been deemed unusable by the Task Force laboratory. TOC levels for the surface samples are 11 mg/L for the Neutral Trench culvert and 74 mg/L in the Southeast seep.

Total phenols are considered quantitative by the laboratory quality control report. Concentrations are given for six monitoring well groundwater samples as well as the Southeast seep surface water sample in Table 5. Values for total phenols ranged from 12 ug/L to 49 ug/L, the highest being found in MW-102A which is located adjacent to the Neutral Trench. Another Neutral Trench area monitoring well, MW-101B, shows phenol concentration at 30 ug/L but the surface sample from the Neutral Trench culvert does not indicate the presence of phenols. A rather disturbing feature

of the total phenol results are concentrations of 21 ug/L in MW-114B and 20 ug/L for MW-111A, which were thought to be upgradient wells. It is possible that these two monitoring wells are being impacted by fill material overlying the areas in which the wells were placed.

Table 5 TOTAL PHENOLS REPORTED	
Sample Location	ug/L
MW-101B	30
MW-110B	12
MW-114B	21
MW-102A	49
MW-111A	20
MW-109C	21
SE Seep	42

Total organic halides (TOX), like the total phenols, are considered accurate and usable in a quantitative manner. Reported TOX results ranged in concentration from a low of 5.7 ug/L to a high of 88 ug/L reported for MW-112A. The high TOX value for MW-112A may not be attributable to the landfill since ground-water flow from this area and depth is believed to be toward the facility. However, as can be seen in Table 6, other monitoring wells with apparent high TOX values are downgradient. Especially noted are three of the four bedrock wells sampled along the eastern compliance line of the codisposal area.

Table 6 TOTAL ORGANIC HALIDES (TOX) REPORTED (Only values over 10 ug/L are listed)		
Sample	Concentration (ug/L)	Sample Concentration (ug/L)
MW-102A	15	MW-106C 70
MW-112A	88	MW-107C 16
MW-114B	40	NW Culvert 39
MW-105C	30	SE Seep 67

Where sample volume was sufficient, quadruplicate samples were taken for the following field parameters: pH, temperature and specific conductance. Due to a malfunction of the pH meter, most pH readings were made with pH paper or pH pen. Therefore, the majority of pH values may be considered as approximate only. Specific conductance, pH and temperature are presented on Table 7. Values given for these parameters are listed as an average of the four measurements taken.

Table 7 Specific Conductivity and pH at Selected Monitoring Wells. (Values = average of four replicates)					
Well No.	Specific Conductivity	pH	Well No.	Specific Conductivity	pH
102A	670	7.0**	102C	942	7.4**
110A	1064	7.3**	105C	1257	7.4
112A	668	7.0*	106C	1309	7.4**
101B	649	7.5	107C	1140	6.8**
103B	656	7.0*	109C	1106	6.9**
112B	615	7.0*	112C	1112	7.3
114B	1363	7.2	114C	1124	7.3

* = pH paper — Suspect pH values
 ** = pH pen —

BHCL Sampling Results

Arsenic was detected in nine monitoring wells with the highest concentration being 6 ug/L in MW-114A. Lower concentrations of Arsenic were also detected in the deep and shallow zones at well cluster 114. Concentrations ranging from 2 ug/L to 4 ug/L were also detected in four shallow wells, one intermediate and one deep well (MW-112B, 113B, 123B, 124B, 102A and 105C).

Cyanide above the detection limit of 20 ug/L used by BHCL's laboratory, Donohue Analytical, was reported in two deep monitoring wells. Values given are 118 ug/L for MW-107C, and 256 ug/L in MW-108C. However, as BHCL points out, these values may be suspect because a duplicate sample for MW-108C showed no detectable cyanide at the above stated detection limits.

Values from the indicator parameters: pH, Specific Conductivity, TOC and TOX, were analyzed using the T-test and the Average Replicate test to determine if there was an indication of impact on the ground-water. Not all data had been analyzed at the time of BHCL's report, but there appears to be indications of impact on shallow and intermediate monitoring wells at both the Neutral Trench and Co-disposal areas. According to BHCL's report, evaluation of indicator parameter values demonstrate that bedrock monitoring wells have not been impacted at the Co-disposal or Neutral Trench areas.

Data submitted by BHCL indicated that no volatile or semivolatile organics exceeding their laboratory detection limits were detected. After

reviewing BHCL's laboratory data, this fact is confirmed with the exception of low levels of di-n-butyl phthalate and di-n-octyl phthalate in six monitoring well ground-water samples. Although phthalates were not detected in BHCL blanks, they were detected in Task Force equipment and trip blanks. Therefore, it is believed these contaminants may have originated on sampling or laboratory equipment.

Phenols were not reported by BHCL as exceeding their laboratory detection limits. However, detection limits for the phenol compounds listed in BHCL lab data are 0.01 mg/L. Total phenols reported by the Task Force ranged from 12 to 49 ug/L. Detection limits used by BHCL's laboratory may have been too high to detect phenols in the ug/L range.

Discussion

Phenols were detected in one shallow and one intermediate well in the Neutral Trench area, and one shallow and one bedrock well in the Co-disposal area. The detection of phenols by the Task Force laboratory in ground-water samples from monitoring wells at BHCL may indicate release of organic waste constituents (Table 5).

The detection of phenols in the bedrock monitoring well associated with the Co-disposal area but not in bedrock wells of the Neutral Trench area may be due to two factors. The Co-disposal area is the oldest active portion of the site. More time for vertical migration of contamination has therefore elapsed. Also, the glacial till overburden in the northwest

corner of the facility, where the Neutral Trench is located, is somewhat thicker than that found in the southeast. Therefore less distance for vertical migration and consequently shorter travel time in the Co-disposal area exists.

The Task Force sampling results may have indicated the presence of phenols in the shallow well of MW-114 and the intermediate well of MW-111. These two monitoring well clusters were designated as background locations for shallow, intermediate and bedrock zones in the original monitoring proposal. Ground-water gradients and estimated flow directions indicate that these monitoring sites are upgradient with respect to the Co-disposal area. However, the water quality data suggest that these apparently upgradient monitoring sites are being impacted by unknown sources of contaminants or possibly by contamination during drilling and/or sampling procedures.

In metal analyses, both BHCL and Task Force results indicate trace amounts of arsenic, lead, and cadmium in several monitoring wells. Chromium was not discussed by BHCL but was quantified at over the Drinking Water Standards of 50 ug/L in the bedrock and intermediate monitoring wells of cluster MW-105. There are indications of chromium release in a number of other monitoring wells sampled by the Task Force. Monitoring wells possibly impacted by chromium release are associated with the Co-disposal area and may be related to the large amounts of foundry sand being deposited there.

Cyanide was not tested for by the Task Force laboratory but was found by BHCL's laboratory in ground-water samples from two bedrock monitoring wells, 107-C and 108-C, at concentrations of 118 ug/L and 256 ug/L respectively. However, as discussed above, a duplicate sample from 108-C did not detect cyanide at Donohue Analytical's detection limit of 20 ug/L.

Indicator parameters appear elevated for the Task Force sampling event when compared with later results obtained by BHCL. This is probably due to wells that were not stabilized at the time of the initial measurements. The majority of monitoring wells had just recently been or were undergoing development at the time of the October sampling event. Several monitoring wells screened in the shallow and intermediate zones at both the Neutral Trench and Co-disposal area, have failed the statistical analysis performed on this data but it may in part be from well stabilization problems. A few bedrock monitoring wells showed high indicator values but these rapidly dropped after the first sampling event. Results from statistical analyses of indicator parameters should be considered inconclusive at present.

APPENDICES

- A TASK FORCE ANALYTICAL RESULTS**
- B GEOLOGIC LOG OF OPEN TRENCH**
- C SEPTEMBER, 1986 CONSENT ORDER**
- D BEDROCK GEOLOGIC BORING LOG (B-200)**
- E SAMPLING SCHEDULE AND PARAMETER LIST**

APPENDIX A
TASK FORCE ANALYTICAL RESULTS



Planning Research Corporation

303 East Wacker Drive
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312-938-0300

**EVALUATION OF QUALITY CONTROL ATTENDANT
TO THE ANALYSIS OF SAMPLES FROM THE
BLACKHAWK, IOWA FACILITY**

FINAL MEMORANDUM

Prepared for

**U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Waste Programs Enforcement
Washington, D.C. 20460**

Work Assignment No.	:	548
EPA Region	:	Headquarters
Site No.	:	N/A
Date Prepared	:	February 23, 1987
Contract No.	:	68-01-7037
PRC No.	:	15-5480-10
Prepared By	:	PRC Environmental Management, Inc. (Ken Partymiller)
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**PREPARED WORK PRODUCT PROVIDED
IN ANTICIPATION OF LITIGATION**

**ENFORCEMENT
CONFIDENTIAL**

MEMORANDUM

DATE: February 20, 1987

SUBJECT: Evaluation of Quality Control Attendant to the Analysis of Samples
from the Blackhawk, Iowa Facility

FROM: Ken Partymiller, Chemist
PRC Environmental Management

THRU: Paul H. Friedman, Chemist*
Studies and Methods Branch (WH-562B)

TO: HWGWTF: Tony Montrone*
Gareth Pearson (EPA 8231)*
Richard Steimle*
Dick Young, Region VII
Dale Bates, Region VII
John Haggard, Region VIII

This memo summarizes the evaluation of the quality control data generated by the Hazardous Waste Ground-Water Task Force (HWGWTF) contract analytical laboratories (1). This evaluation and subsequent conclusions pertain to the data from the Blackhawk, Iowa sampling effort by the Hazardous Waste Ground-Water Task Force.

The objective of this evaluation is to give users of the analytical data a more precise understanding of the limitations of the data as well as their appropriate use. A second objective is to identify weaknesses in the data generation process for correction. This correction may act on future analyses at this or other sites.

The evaluation was carried out on information provided in the accompanying quality control reports (2-3) which contain raw data, statistically transformed data, and graphically transformed data.

* HWGWTF Data Evaluation Committee Member

The evaluation process consisted of three steps. Step one consisted of generation of a package which presents the results of quality control procedures, including the generation of data quality indicators, synopses of statistical indicators, and the results of technical qualifier inspections. A report on the results of the performance evaluation standards analyzed by the laboratory was also generated. Step two was an independent examination of the quality control package and the performance evaluation sample results by members of the Data Evaluation Committee. This was followed by a meeting (teleconference) of the Data Evaluation Committee to discuss the foregoing data and data presentations. These discussions were to come to a consensus, if possible, concerning the appropriate use of the data within the context of the HWGWTF objectives. The discussions were also to detect and discuss specific or general inadequacies of the data and to determine if these are correctable or inherent in the analytical process.

Preface

The data user should review the pertinent materials contained in the accompanying reports (2-3). Questions generated in the interpretation of these data relative to sampling and analysis should be referred to Rich Steimle of the Hazardous Waste Ground-Water Task Force.

I. Site Overview

The Blackhawk facility is located in Blackhawk County, Iowa, just south of Waterloo, Iowa. The facility covers approximately 160 acres. There are two regulated units on the site. The first is a large co-disposal unit along the southern end of the site. The second is a smaller area referred to as the inert drying bed is located in the northwest corner of the site.

Geologically, there are approximately 70 feet of fractured glacial till overlaying the Cedar Valley Aquifer. The Cedar Valley Aquifer is the main aquifer in that part of the Iowa and serves as the drinking water supply for more than 500,000 people. The Cedar Valley Aquifer consists of dolomite, limestones which have been weathered, solution cavities, etc. It is suspected that there is a vertical flow from the surface, through the glacial till fractures, and directly into the top of this aquifer.

Types of wastes which have been sent to the facility are largely unknown. In the southern unit at the facility any hazardous wastes were comingled with municipal waste. Hazardous wastes include industrial refuse from local industrial sources. These include heavy metals, paint solvents, complex cyanide salts, and many unknowns. Hazardous wastes are no longer accepted at the facility although municipal waste is still accepted.

Past monitoring has shown the presence of high TOX, conductivity, and zinc.

Twenty-nine field samples including two field blanks (MQO904/QO904 and MQO915/QO915), one equipment blank (MQO911/QO911), one trip blank (MQO581/QO581), and a pair of duplicate samples (well P102A, MQO892/QO892 and MQO893/QO893) were collected at this facility. All samples were low concentration ground-water samples.

II. Evaluation of Quality Control Data and Analytical Data

1.0 Metals

1.1 Performance Evaluation Standards

Metal analyte performance evaluation standards were not evaluated in conjunction with the samples collected from this facility.

1.2 Metals QC Evaluation

Total and dissolved metal matrix spike recoveries were calculated for twenty-three metals spiked into low concentration ground-water samples. Tables 3-2a and 3-2b list which samples were spiked for each of the total and dissolved metals. Twenty-two of the twenty-three total metal average spike recoveries and all seventeen of the dissolved metal average spike recoveries (analysis of the six dissolved graphite furnace metals was not required) were within the data quality objectives (DQOs) for this Program. The total thallium average spike recovery was outside DQO with a value of 74 percent. Several individual total and dissolved metal spike recoveries were also outside DQO. These are listed in Tables 3-2a and 3-2b of Reference 2 as well as in the following Sections.

All calculable average relative percent differences (RPDs) for metallic analytes were within Program DQOs. RPDs were not calculated for some of the analytes because the concentrations of these metals in the field samples used for the RDP determination were less than the CRDL.

Required analyses were performed on all metals samples submitted to the laboratory.

No contamination was reported in the laboratory blanks. A trip blank (MQO581) contained 219 ug/L of total aluminum (CRDL equals 200 ug/L), 11,700 ug/L of total calcium (CRDL equals 5000 ug/L), 115 ug/L of total iron (CRDL equals 100 ug/L) and 19 ug/L of total manganese (CRDL equals 15 ug/L) and a field blank (MQO904) contained 14 ug/L of total chromium (CRDL equals 10 ug/L). As noted, all of these values are above the CRDL.

1.3 Furnace Metals

The graphite furnace metals (antimony, arsenic, cadmium, lead, selenium, and thallium) quality control, with exceptions, was acceptable.

The total arsenic and thallium matrix spike recoveries for sample MQO903 were below the DQO with values of 59 and 68 percent, respectively.

The method of standard addition (MSA) correlation coefficient for total lead in sample MQO890 was outside control limits. Total lead results for this sample should be considered qualitative.

The second injection reading for the eighth continuing calibration blank contained selenium at a concentration above the CRDL. This indicates possible contamination of this blank. Samples MQO890spk (spike) and 903 were associated with this blank but their data quality was not affected by the contamination.

All total and dissolved lead (with one exception), cadmium, antimony, and selenium results and all dissolved arsenic and thallium results should be considered quantitative. All total arsenic and thallium results should be considered semi-quantitative. Total lead results for sample MQO890 should be considered qualitative.

1.4 ICP Metals

The trip and field blanks contained contamination at concentrations greater than the CRDL. Trip blank MQO581 contained 219 ug/L of total aluminum, 11,700 ug/L of total calcium, 115 ug/L of total iron, and 19 ug/L of total manganese and field blank MQO904 contained 14 ug/L of total chromium.

The low level (twice CRDL) linear range checks for total and dissolved chromium, total and dissolved manganese, dissolved nickel, total and dissolved silver, and total and dissolved zinc had poor recoveries. The low level linear range check is an analysis of a solution with elemental concentrations near the detection limit. The range check analysis shows the accuracy which can be expected by the method for results near the detection limits. The accuracy reported for these elements is not unexpected. Due to the large number of samples affected, the data user should examine Comment B2 of Reference 3 for inorganics to determine the actual samples affected and the resulting biases.

An individual spike recovery was outside DQO for total manganese in samples MQO903 (45 percent). Low spike recoveries usually indicate results which are biased low.

All total and dissolved barium, beryllium, cobalt, copper, manganese, nickel, potassium, sodium, vanadium, and zinc results and dissolved aluminum, calcium, chromium, iron, and manganese results should be considered quantitative. Total iron, calcium, and manganese results, with exceptions listed below, should also be considered quantitative. Total chromium results for samples MQO901, 903 and 906, total aluminum results for samples MQO896, 907, 913, and 914, total calcium results for samples MQO889, 890, 891, 892, 893, 894, 896, 899, and 913, total iron results for samples MQO891 and 898, and total manganese results for samples MQO891, 899, and 910 should be considered qualitative. Total chromium results for samples MQO898, 899, 900, 902, 905, 907, 908, 909, 910, 912, 913, and 914, total aluminum results for samples MQO890, 898, 899, 902, 908, 909, and 912, and total manganese results for sample MQO896 should be considered unusable due to blank contamination at similar concentrations.

1.5 Mercury

All mercury results should be considered quantitative with an acceptable probability of false negatives.

2.0 Inorganic and Indicator Analytes

2.1 Performance Evaluation Standard

Inorganic and indicator analyte performance evaluation standards were not evaluated in conjunction with the samples collected from this facility.

2.2 Inorganic and Indicator Analyte QC Evaluation

The average spike recoveries of all of the inorganic and indicator analytes were within the accuracy DQOs (accuracy DQOs have not been established for bromide and nitrite nitrogen matrix spikes). The bromide and nitrite nitrogen average spike recoveries were 92 and 115 percent. The recoveries for all inorganic and indicator analytes are acceptable.

Average reported RPDs for all inorganic and indicator analytes were within Program DQOs. Average RPDs are not calculated if either one or both of the duplicate values are less than the CRDL. Precision DQOs have not been established for bromide and nitrite nitrogen.

Requested analyses were performed on all samples for the inorganic and indicator analytes.

No laboratory blank contamination was reported for any inorganic or indicator analyte. Sampling blank contamination was found in all four of the sampling blanks. This included TOC contamination at levels above CRDL (2000, 2100, 2100, and 2100 ug/L, CRDL equals 1000 ug/L). These contaminants and their concentrations are summarized below, as well as in Section 3.2.4 (page 3-3) of Reference 2.

2.3 Inorganic and Indicator Analyte Data

No quality control or other problems were found with the cyanide, sulfate, bromide, ammonia nitrogen, and total phenols data. All results for these analytes should be considered quantitative.

The holding times for the nitrate and nitrite nitrogen analyses ranged from 26 to 28 days from receipt of samples which is longer than the recommended 48 hour holding time for unpreserved samples. The nitrite nitrogen spike recovery for sample MQO890 was 120 percent. Although there are no formal nitrite nitrogen matrix spike recovery control limits, this recovery is slightly high. All nitrate and nitrite nitrogen results should be considered semi-quantitative.

Matrix spike recovery for chloride in sample MQO890 was above control limits with a value of 115 percent (DQO equals 110 percent). The chloride field duplicate precision for the duplicate pair (MQO892 and MQO893) was poor (24,000 versus 16,000 ug/L). These results were not used in the data usability determination as the results may be a reflection of poor duplicate sampling techniques or actual field variations. Field duplicate precision is reported for informational purposes only. The chloride results for all samples should be considered semi-quantitative.

All of the sampling blanks contained TOC at concentrations ranging from 2000 to 2200 ug/L which is above the CRDL of 1000 ug/L. TOC contamination exceeding the CRDL has been a recurring problem with HWGWTF sampling blanks. The source of this problem has not been adequately addressed. It may be due to high levels of carbon dioxide or charcoal in the water used for the sampling blanks. Although it is not possible to assess whether this contamination affects the TOC sample results, as a HWGWTF convention, all TOC results greater

that ten times the highest field blank concentration or less than the detection limit should be considered quantitative. All TOC results greater than five but less than ten times the highest concentration of sampling blank contamination are considered qualitative and all other data are considered unusable. The TOC results for samples MQO908 and 909 should be considered qualitative, and all other positive TOC results should not be used.

Initial and continuing calibration verification standards for POC were not analyzed. A POC spike solution was run during the analytical batch but the "true" value of the spike was not provided by the laboratory. EPA needs to supply the inorganic laboratory with a POC calibration verification solution. Until then, the instrument calibration can not be assessed. The POC results should be considered qualitative.

The TOX initial calibration blank and initial calibration verification were not analyzed on 11/12/86. This impacts the results for samples MQO895 and 896 which should be considered semi-quantitative. All other TOX results should be considered quantitative.

The POX holding times ranged from 12 to 13 days. These holding times exceeded the EPA EMSL/Las Vegas recommended holding time of seven days but were within the Sample Management Office directed 14 day holding time. POX results should be considered semi-quantitative.

3.0 Organics and Pesticides

3.1 Performance Evaluation Standard

Organic performance evaluation standards were not evaluated in conjunction with the samples collected from this facility.

3.2 Organic OC Evaluation

All matrix spike average recoveries were within established Program DQOs for accuracy. Individual matrix spike recoveries which were outside the accuracy DQO will be discussed in the appropriate Sections below. All surrogate spike average recoveries were within DQOs for accuracy except for 2-fluorophenol. Surrogate spike recoveries which were outside the accuracy DQO will be discussed in the appropriate Sections below.

All matrix spike/matrix spike duplicate average RPDs were within Program DQOs for precision. Individual matrix spike RPDs which were outside the precision DQO will be discussed in the appropriate Sections below. All average surrogate spike RPDs were within DQOs for precision.

All organic analyses were performed as requested.

Laboratory blank contamination was reported for organics and is fully enumerated in Reference 3 (for organics) and is discussed in the appropriate Sections below.

Detection limits for the organic fractions are summarized in Reference 3 (for organics) as well as in the appropriate Sections below.

3.3 Volatiles

Quality control data indicate that volatile organics were generally determined acceptably. Several problems were encountered with the tuning and mass calibrations, laboratory blanks, and matrix spike/matrix spike duplicates. Initial and continuing calibrations, and surrogate spikes, and chromatograms are acceptable.

Estimated method detection limits were CRDL for all samples.

Laboratory blanks analyzed on 10/29, 10/30, 11/5 and 11/6/86 contained either acetone or methylene chloride contamination or both at concentrations in the vicinity of the CRDL. All positive acetone results except for sample QO892 and all positive methylene chloride results except for samples QO907 should not be used. No other positive volatile results were reported.

According to the Traffic Report for sample QO899, volatile analysis was required. According to the organic laboratory no volatile sample was submitted.

The RPD for sample QO903MS/MSD was outside control limits for benzene. Also, the raw data submitted for sample QO903MSD was the same as that submitted for sample QO903MSD RE (reanalysis). There was also some confusion on the Tuning and Mass Calibration Form for 11/6/86 where data from sample QO903MS is confused with that from sample QO903MSD. These problems should be corrected by the organic analytical laboratory.

The volatiles data are acceptable. The volatile compound results should be considered quantitative.

3.4 Semivolatiles

Initial and continuing calibrations, blanks, and holding times were acceptable for the semivolatiles. Problems were encountered with chromatograms, tuning and mass calibrations, matrix spike/matrix spike duplicate recoveries, and surrogate recoveries. Overall, all semivolatile results were acceptable.

Semivolatile contamination was not detected in the laboratory or sampling blanks.

The matrix spike duplicate recovery of the pentachlorophenol (6 percent), the matrix spike and matrix spike duplicate recoveries of phenol, 2-chlorophenol, and 4-chloro-3-methylphenol (none of these three spikes were detected), and the RPD for pentachlorophenol and 4-nitrophenol all for sample QO908 were outside the control limits.

The surrogate percent recoveries for nitrobenzene-D5, 2-fluorobiphenyl, terphenyl-D14, phenol-D5, 2-fluorophenol, and 2,4,6-tribromophenol were below control limits in one or more of samples QO901, 908, 908RE, 908MS, and 908MSD with two exceptions. Terphenyl-D14 in sample QO908MS and 2-fluorobiphenyl in sample QO901 were above control limits. The recoveries of the phenols was especially poor, ranging from zero (no recovery) to seven percent.

Several problems were also detected with laboratory procedures and transcriptions of data. Sample QO893 was incorrectly denoted as sample QO6530 on the Form V for instrument 15 on 11/4/86. The 50 ng standard in the five point calibration for instrument 15 on 10/7/86 was not performed within the 12 hour tuning criteria. The chromatographic peak in scan 524 of sample QO900 was assigned two different TICs at two different concentrations. The chromatographic peak in scan 400 of sample QO907 was not addressed although it was greater than ten percent of the nearest internal standard's height.

The semivolatile data are acceptable and the results should be considered quantitative for all samples except QO908 which should be considered suspect due to poor surrogate recoveries. Estimated method detection limits are twice CRDL for all samples except QO894 which is four times CRDL. The probability of false negatives is acceptable for all samples.

3.5 Pesticides

The initial and continuing calibrations, blanks, matrix spike/matrix spike duplicates, surrogate spikes, and holding times for pesticides were generally acceptable. Some of the pesticide chromatograms appear to contain pesticide peaks which were not addressed by the laboratory.

Unaddressed peaks were found in the pesticide chromatograms for samples QO890, 895, 897, 898, 902, and 903. These sample numbers, as well as their retention time windows, and their tentative identification are given in Comment C4 of Reference 3 for organics. Their chromatograms are also attached to this Reference.

The date of pesticide analysis was not indicated on the Form VIII related to the standard which was run on 11/13/86. The peak area for aldrin in evaluation mixture C was not given for 10/31 and 11/4/86 although a calibration factor for aldrin was reported on the Form VIII.

The estimated method detection limits for the pesticides fraction were CRDL for all samples. The pesticides results should be considered qualitative. There is an enhanced probability of false negatives (unreported pesticides) due to the quality of the confirmation chromatography run by the laboratory.

3.6 Herbicides

Herbicides analyses were requested but not run.

III. Data Usability Summary

4.0 Graphite Furnace Metals

Quantitative: all total and dissolved iron results with one exception;
all total and dissolved antimony, cadmium, and selenium
results; all dissolved arsenic and thallium results
Semi-quantitative: all total arsenic and thallium results
Qualitative: total lead results for sample MQO890

4.1 ICP Metals

Quantitative: all total and dissolved barium, beryllium, cobalt, copper,
magnesium, nickel, potassium, sodium, vanadium, and zinc
results; all dissolved aluminum, calcium, chromium, iron,
and manganese results; total calcium, iron, and manganese
results with exceptions
Qualitative: total chromium results for samples MQO901, 903, and 906;
total aluminum results for samples MQO896, 907, 913, and
914; total calcium results for samples MQO889, 890, 891,
892, 893, 894, 896, 899, and 913; total iron results for
samples MQO891 and 898; and total manganese results for
samples MQO891, 899, and 910
Unusable: total chromium results for samples MQO898, 899, 900, 902,
905, 907, 908, 909, 910, 912, 913, and 914; total aluminum
results for samples MQO890, 898, 899, 902, 908, 909, and
912; total manganese results for sample MQO896

4.2 Mercurv

Quantitative: all mercury results

4.3 Inorganic and Indicator Analytes

Quantitative: all cyanide, sulfate, bromide, ammonia nitrogen, and total
phenols results; all TOX results with two exceptions listed
below
Semi-quantitative: all nitrite and nitrate nitrogen, chloride, and POX
results; TOX results for samples MQO895 and 896
Qualitative: all POC results; TOC results for samples MQO908 and 909
Unusable: all positive TOC results with the exception of samples
MQO908 and 909

4.4 Organics

Quantitative: all volatile results; semivolatile results with an
exception
Qualitative: all pesticides results
Unreliable: semivolatile results for samples QO908
Unusable: all positive acetone and methylene chloride results except
for acetone results for sample QO892 and methylene chloride
results for sample QO907 which should be considered
quantitative; all herbicide results

IV. References

1. Organic Analyses: CompuChem Laboratories, Inc.
P.O. Box 12652
3308 Chapel Hill/Nelson Highway
Research Triangle Park, NC 27709
(919) 549-8263

Inorganic and Indicator Analyses:
Centec Laboratories
P.O. Box 956
2160 Industrial Drive
Salem, VA 24153
(703) 387-3995

2. Revised Draft Quality Control Data Evaluation Report (Assessment of the Usability of the Data Generated) for site 24, Blackhawk, Iowa, 2/9/1987, Prepared by Lockheed Engineering and Management Services Company, Inc., for the US EPA Hazardous Waste Ground-Water Task Force.

3. Revised Draft Inorganic Data Usability Audit Report and Revised Draft Organic Data Usability Report, for the Blackhawk, Iowa facility, Prepared by Laboratory Performance Monitoring Group, Lockheed Engineering and Management Services Co., Las Vegas, Nevada, for US EPA, EMSL/Las Vegas, 2/9/1987.

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APPENDIX 2

SUMMARY OF CONCENTRATIONS FOR COMPOUNDS FOUND IN GROUND-WATER AND SAMPLING BLANK SAMPLES AT BLACKHAWK, IA

The following table lists the concentrations for compounds analyzed for and found in samples at the site. Table A2-1 is generated by listing all compounds detected and all tentatively identified compounds reported on the organic Form I, Part B. All tentatively identified compounds with a spectral purity greater than 850 are identified by name and purity in the table. Those with a purity of less than 850 are labeled, unknown.

Sample numbers are designated by the inorganic and corresponding organic sample number. Inorganic sample numbers are preceded by the prefix "MQO" organic sample numbers are preceded by the prefix "QO."

TABLE KEY

A value without a flag indicates a result above the contract required detection limit (CRDL).

- J Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicated the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero. If the limit of detection is 10 µg and a concentration of 3 µg is calculated, then report as 3J.
- B This flag is used when the analyte is found in the blank as well as a sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.

GW = ground-water

SW = surface-water

low and medium are indicators of concentration.

SITE: # 24 BLACKHAWK, IA
CASE NO: 6510/D/SAS/1944HQ

SAMPLE NO:	00501/M00501	00911/M00911	0915/M00915	00904/M00904	00892/M00892
SAMPLE LOCATION:	TRIP BLANK	EQUIP. BLANK	FIELD BLANK	FIELD BLANK	WELL P 102A
SAMPLE TYPE:	GW-LW	GW-LW	GW-LW	GW-LW	GW-LW DUP

VOA	ACETONE					11	
	METHYLENE CHLORIDE		2.5 J	1.4 J			
SEMI-VOA	BIS(2-ETHYLHEXYL)PHTHALATE						
	DI-N-BUTYLPHTHALATE	2.2 J	2.4 J				
	DI-N-OCTYLPHTHALATE						
	PENTACHLOROPHENOL					3.2 J	
PEST/PCB	NO HITS						
TIC-SEMI-VOA	UNKNOWN						
	UNKNOWN						
	UNKNOWN						
	UNKNOWN						
	UNKNOWN ACID						
TOTAL METALS	ALUMINUM	219	108	167	168	5350	
	ANTIMONY						
	ARSENIC					8.8	
	BARIUM					198	
	BERYLLIUM						
	CADMIUM						
	CALCIUM	11700		81	558	101000	
	CHROMIUM				14	34	
	COBALT					18	
	COPPER					28	
	IRON	115			48	18500	
	LEAD					15.2	
	MAGNESIUM	3850				37800	
	MANGANESE	19				356	
	MERCURY						
	NICKEL					62	
	POTASSIUM	909	564	693		4360	
	SELENIUM						
	SILVER						
	SODIUM	2000	298	379	578	21200	
	THALLIUM						
	VANADIUM					18	
	ZINC					86	
DIS METALS	ALUMINUM					141	
	ANTIMONY						
	ARSENIC						
	BARIUM	10	28	45	15	166	
	BERYLLIUM						

SITE: # 24 BLACKHAWK, IA
CASE NO: -4530/D/SAS/1944HQ

SAMPLE NO:	00591/M00591	00911/M00911	0915/M00915	00904/M00904	00892/M00892
SAMPLE LOCATION:	TRIP BLANK	EQUIP. BLANK	FIELD BLANK	FIELD BLANK	WELL P 102A
SAMPLE TYPE:	GW-LDW	GW-LDW	GW-LDW	GW-LDW	GW-LDW DWP

CADMIUM					
CALCIUM		233		250	
CHROMIUM				412	
CORALT				256	
COPPER				80800	
IRON					
LEAD					27
MAGNESIUM					
MANGANESE					33600
MERCURY					46
NICKEL					
POTASSIUM					3240
SELENIUM					
SILVER					
SODIUM		408		507	
THALLIUM				646	
VANADIUM				400	
ZINC				23	
INORG. AMMONIA NITROGEN					1000
INDIC. BROMIDE					750
CHLORIDE					24000
CYANIDE		NR		NR	
NITRATE NITROGEN				NR	
NITRITE NITROGEN					
POC					
POX					
SULFATE					38000
TOC		2000		2100	
TOTAL PHENOLS				2200	
TOX				2100	
				NR	
					13

SITE: # 24 BLACKHAWK, IA
CASE NO: 6530/D/SAS/19-1-MQ

SAMPLE NO:	00093/M00093	00797/M00797	00889/M00889	00890/M00890	00891/M00891
SAMPLE LOCATION:	WELL P 102A	WELL P103A	WELL OW 112B	WELL P-112A	WELL OW 103B
SAMPLE TYPE:	GW-LOW DUF	GW-LOW	GW-LOW	GW-LOW	GW-LOW

VOA	ACETONE						
	METHYLENE CHLORIDE						
SEMI-VOA	BIS(2-ETHYLHEXYL)PHTHALATE						
	DI-N-BUTYLPHTHALATE						
	DI-N-OCTYLPHTHALATE						
	PENTACHLOROPHENOL		4.4 J				
PEST/PCB	NO HITS						
TIC-SEMI-VOA	UNKNOWN						
	UNKNOWN						
	UNKNOWN						
	UNKNOWN						
	UNKNOWN ACID						
TOTAL METALS	ALUMINUM		4700		NR		2910
	ANTIMONY				NR		388
	ARSENIC		8.1		NR		3.2
	BARIUM		186		NR		207
	BERYLLIUM				NR		93
	CADMIUM				NR		0.4
	CALCIUM		101000		NR		95500
	CHROMIUM		38		NR		14
	COBALT		16		NR		12
	COPPER		31		NR		34
	IRON		15500		NR		6710
	LEAD		12.3		NR		45
	MAGNESIUM		38900		NR		30900
	MANGANESE		304		NR		197
	MERCURY				NR		172
	NICKEL		67		NR		33
	POTASSIUM		4390		NR		3710
	SELENIUM				NR		2380
	SILVER		5		NR		5
	SODIUM		21600		NR		12500
	THALLIUM				NR		26800
	VANADIUM		14		NR		10
	ZINC		83		NR		46
							85
DIS METALS	ALUMINUM				NR		101
	ANTIMONY				NR		105
	ARSENIC				NR		
	BARIUM		137		NR		226
	BERYLLIUM				NR		127
							364

SITE: # 24 BLACKHAWK, IA
CASE NO: 6530/O/SAS/1944HQ

SAMPLE NO:	Q0893/HQ0893	Q0797/HQ0797	Q0889/HQ0889	Q0890/HQ0890	Q0891/HQ0891
SAMPLE LOCATION:	WELL P 102A	WELL P103A	WELL OW 112B	WELL P-112A	WELL OW 103B
SAMPLE TYPE:	GW-LOW DUP	GW-LOW	GW-LOW	GW-LOW	GW-LOW
CADMIUM		NR	0.7		0.5
CALCIUM	822	NR	85600	89000	99800
CHROMIUM		NR		13	
COBALT		NR		22	
COPPER		NR			
IRON	28	NR			67
LEAD		NR			
MAGNESIUM	34300	NR	28500	37600	30500
MANGANESE	55	NR	102	152	111
MERCURY		NR			
NICKEL		NR			
POTASSIUM	3400	NR	3580	3100	3410
SELENIUM		NR			
SILVER		NR			
SODIUM	21800	NR	10300	28300	11800
THALLIUM		NR			
VANADIUM		NR			
ZINC	29	NR	83	66	
INDRS. AMMONIA NITROGEN	900	NR	200	500	400
INDIC. BROMIDE	480	NR			
CHLORIDE	16000	NR	6300	5900	1300
CYANIDE	NR		NR	NR	NR
NITRATE NITROGEN		NR	650		
NITRITE NITROGEN		NR			
PDC					
POX		6			
SULFATE	33000	NR	61000	66000	33000
TOC	3100	NR	2900	3200	3100
TOTAL PHENOLS	49	NR	NR		
TOX	15	NR	5.3	88	8

SITE: # 24 BLACKHAWK, IA
CASE NO: 6530/D/SAS/1944HQ

SAMPLE NO:		00894/M00894	00895/M00895	00896/M00896	00897/M00897	00898/M00898
SAMPLE LOCATION:		WELL P 105A	WELL P 105C	WELL P 109A	WELL P 106C	WELL P 107C
SAMPLE TYPE:		GW-LOW	GW-LOW	GW-LOW	GW-LOW	GW-LOW
VOA	ACETONE					
	METHYLENE CHLORIDE				1.6 J	1.6 J
SEMI-VOA	BIS(2-ETHYLHEXYL)PHTHALATE	4.4 J	8.2 J	3.2 J		2.6 J
	DI-N-BUTYLPHTHALATE	11 J	2 J			
	DI-N-OCTYLPHTHALATE		7.2 J			
	PENTACHLOROPHENOL					
PEST/PCB	NO HITS					
TIC-SEMI-VOA	UNKNOWN		20 J	25 J	15 J	
	UNKNOWN		10 J		7 J	
	UNKNOWN					
	UNKNOWN					
	UNKNOWN					
	UNKNOWN ACID					
TOTAL METALS	ALUMINUM	4280	7370	1480	3430	1090
	ANTIMONY					
	ARSENIC		5.1			
	BARIUM	316	50	126	46	29
	BERYLLIUM					
	CADMIUM		1.9			0.6
	CALCIUM	90800	237000	88800	211000	178000
	CHROMIUM	73	95	30	28	19
	COBALT	12	13			
	COPPER	34	35			
	IRON	13000	8130	3080	3150	858
	LEAD	7.8	9.9			
	MAGNESIUM	30600	85600	23800	71100	57500
	MANGANESE	392	522	70	455	203
	MERCURY					
	NICKEL	87	92		26	24
	POTASSIUM	7710	6100	3740	5620	4910
	SELENIUM					
	SILVER	8				
	SODIUM	13800	21200	27700	21000	18600
	THALLIUM					
	VANADIUM	22				
	ZINC	69	66	27	32	
DIS METALS	ALUMINUM		185			
	ANTIMONY					
	ARSENIC					
	BARIUM	272	49	138	56	60
	BERYLLIUM					

SITE: # 24 BLACKMAN, IA
CASE NO: 6530/O/S 011944HQ

SAMPLE NO:	00894/H00894	00895/H00895	00896/H00896	00897/H00897	00898/H00898
SAMPLE LOCATION:	WELL P 105A	WELL P 105C	WELL P 109A	WELL P 106C	WELL P 107C
SAMPLE TYPE:	GW-LOW	GW-LOW	GW-LOW	GW-LOW	GW-LOW

	CADMIUM			0.8					
	CALCIUM	77300		188000		81700		181000	172000
	CHROMIUM								
	COBALT								
	COPPER								
	IRON			315					
	LEAD								
	MAGNESIUM	26900		60500		22000		58900	57000
	MANGANESE	171		368		33		366	197
	MERCURY								
	NICKEL								
	POTASSIUM	6150		4740		3220		4590	4570
	SELENIUM								
	SILVER								
	SODIUM	13500		19800		26500		20200	18900
	THALLIUM								
	VANADIUM								
	ZINC			38		27		31	30
INORG.	AMMONIA NITROGEN	NR		1200		200		1200	1000
INDIC.	BROMIDE	NR							
	CHLORIDE	NR		1600		560		1400	6300
	CYANIDE	NR		NR		NR		NR	NR
	NITRATE NITROGEN	NR						50	400
	NITRITE NITROGEN	NR							
	POC								
	PDX							6	
	SULFATE	NR		580000		33000		580000	500000
	TOC	NR		2800		2900		2800	2700
	TOTAL PHENOLS	NR							
	TOX	NR		30				70	16

SITE: # 24 BLACKHAWK IA
CASE NO: 6530/D/SAS/1944HQ

SAMPLE NO:		00000/H00000	00000/H00000	00001/H00001	00002/H00002	00003/H00003
SAMPLE LOCATION:		WELL P 111A	WELL P 109C	WELL P 106A	WELL P 112C	WELL P 102C
SAMPLE TYPE:		GW-LOW	GW-LOW	GW-LOW	GW-LOW	GW-LOW
VOA	ACETONE	NR				
	METHYLENE CHLORIDE			1.7 J	1.4 J	
SEMI-VOA	BIS(2-ETHYLHEXYL)PHTHALATE	2.2 J			3.2 J	
	DI-N-BUTYLPHTHALATE					
	DI-N-OCTYLPHTHALATE					
	PENTACHLOROPHENOL			10 J		
PEST/PCB	NO HITS					
TIC-SEMI-VOA	UNKNOWN		7 J			
	UNKNOWN		8 J			
	UNKNOWN					
	UNKNOWN					
	UNKNOWN					
	UNKNOWN ACID					
TOTAL METALS	ALUMINUM	972	2440	14000	1030	11400
	ANTIMONY					
	ARSENIC			7.2		6
	BARIUM	118	31	316	26	76
	BERYLLIUM					
	CADMIUM		5.5	1		1.9
	CALCIUM	80500	169000	125000	194000	422000
	CHROMIUM	28	17	111	32	76
	COBALT	10		28		12
	COPPER		58	60		36
	IRON	3340	2000	37000	1190	19000
	LEAD	4.2		19.7		15.5
	MAGNESIUM	24500	52900	37900	55600	317000
	MANGANESE	113	291	897	256	1290
	MERCURY					
	NICKEL	28		90		57
	POTASSIUM	2880	4720	8230	5300	10100
	SELENIUM			3.4		
	SILVER					
	SODIUM	27400	18800	29400	20300	21600
	THALLIUM					
	VANADIUM			51		20
	ZINC	23	56	93	36	38
DIS METALS	ALUMINUM			NR		
	ANTIMONY			NR		
	ARSENIC			NR		
	BARIUM	132	52	NR	54	77
	BERYLLIUM			NR		

SITE: # 24 BLACKHAWK, IA
CASE NO: 6530/D/SAS/1944HQ

SAMPLE NO:	00899/H00899	00900/H00900	00901/H00901	00902/H00902	00903/H00903
SAMPLE LOCATION:	WELL P 111A	WELL P 109C	WELL P 106A	WELL P 112C	WELL P 102C
SAMPLE TYPE:	GW-LOW	GW-LOW	GW-LOW	GW-LOW	GW-LOW

CADMIUM		0.9	NR		
CALCIUM	81900	163000	NR	171000	135000
CHROMIUM			NR		
COBALT			NR		
COPPER			NR		
IRON			NR		
LEAD			NR		
MAGNESIUM	24800	52900	NR	54000	46400
MANGANESE	96	272	NR	213	303
MERCURY			NR		
NICKEL			NR		
POTASSIUM	2630	4330	NR	4680	4580
SELENIUM			NR		
SILVER			NR		
SODIUM	29700	19200	NR	19000	21400
THALLIUM			NR		
VANADIUM			NR		
ZINC	21	28	NR	33	48
INORG. AMMONIA NITROGEN	500	1000	NR	1000	800
INDIC. BROMIDE			NR		
CHLORIDE	1100	8000	NR	40000	150000
CYANIDE	NR	NR	NR	NR	NR
NITRATE NITROGEN		1300	NR	200	
NITRITE NITROGEN			NR		
POC					
POX					
SULFATE	25000	450000	NR	650000	320000
TOC	3300	2300	NR	2700	2100
TOTAL PHENOLS	20	21	NR		
TOX	6.2	8.8	NR	5.7	

SITE: # 24 BLACKHAWK, IA
CASE NO: 6530/O/SAS/1944HD

SAMPLE NO:		00905/M00905	00906/M00906	00907/M00907	00908/M00908	00909/M00909
SAMPLE LOCATION:		WELL P 108A	WELL OW 107B	WELL P 114C	SURFACE WATER	SO. EAST SEEP
SAMPLE TYPE:		GW-LW	GW-LW	GW-LW	GW-LW	GW-LW
VOA	ACETONE					
	METHYLENE CHLORIDE			6	1.6 J	
SEMI-VOA	BIS(2-ETHYLHEXYL)PHTHALATE			3.2 J		
	DI-N-BUTYLPHthalATE					
	DI-N-OCTYLPHthalATE					
	PENTACHLOROPHENOL					
PEST/ICB	NO HITS					
TIC-SEMI-VOA	UNKNOWN				10 J	38 J
	UNKNOWN				7 J	32 J
	UNKNOWN				33 J	43 J
	UNKNOWN				25 J	
	UNKNOWN				6 J	
	UNKNOWN ACID				19 J	
TOTAL METALS	ALUMINUM	9440	21500	1340	132	614
	ANTIMONY					
	ARSENIC	4.3	14	6.5		
	BARIUM	246	400	31	33	63
	BERYLLIUM					
	CADMIUM					1.1
	CALCIUM	137000	244000	167000	293000	463000
	CHROMIUM	55	104	34	22	72
	COBALT		21			
	COPPER	20	56			
	IRON	23000	48800	1670	4040	7190
	LEAD	11.7	25.5			45.6
	MAGNESIUM	33700	55000	58700	97900	100000
	MANGANESE	390	1140	295	3540	2650
	MERCURY					
	NICKEL		66		43	24
	POTASSIUM	6760	13700	5120	39500	15600
	SELENIUM				3.3	
	SILVER					
	SODIUM	25000	25500	24000	89300	36400
	THALLIUM					
	VANADIUM		76			
	ZINC	63	110	90		765
DIS METALS	ALUMINUM	NR	NR			101
	ANTIMONY	NR	NR			
	ARSENIC	NR	NR	4.3		3.4
	BARIUM	NR	NR	70	74	179
	BERYLLIUM	NR	NR			

SITE: # 24 BLACKHAWK, IA
CASE NO: 6530/D/SAS/1944HD

SAMPLE NO:	00905/MD0905	00906/MD0906	00907/MD0907	00908/MD0908	00909/MD0909
SAMPLE LOCATION:	WELL P 108A	WELL DW 107B	WELL P 114C	SURFACE WATER	SO. EAST CREEP
SAMPLE TYPE:	GW-LOW	GW-LOW	GW-LOW	GW-LOW	GW-LOW
CADMIUM	NR	NR			
CALCIUM	NR	NR	152000	280000	409000
CHROMIUM	NR	NR			
COBALT	NR	NR			
COPPER	NR	NR			
IRON	NR	NR	151	2190	1450
LEAD	NR	NR			14
MAGNESIUM	NR	NR	51600	93500	88600
MANGANESE	NR	NR	255	3360	2460
MERCURY	NR	NR			
NICKEL	NR	NR		39	34
POTASSIUM	NR	NR	4520	37200	15600
SELENIUM	NR	NR			
SILVER	NR	NR			
SODIUM	NR	NR	23600	87700	38600
THALLIUM	NR	NR			
VANADIUM	NR	NR			
ZINC	NR	NR	116	35	487
INDRS, AMMONIA NITROGEN	NR	NR	1200	400	
INDIC, BROMIDE	NR	NR		11000	
CHLORIDE	NR	NR	1600	420000	59000
CYANIDE	NR	NR	NR	NR	NR
NITRATE NITROGEN	NR	NR			
NITRITE NITROGEN	NR	NR			
POC					
POX			6		
SULFATE	NR	NR	450000	780000	1600000
TDC	NR	NR	3000	11000	74000
TOTAL PHENOLS		NR			42
TOX	NR	NR		39	67

SITE: # 24 BLACKHAWK, IA
CASE NO. 6530/D/SAS/1944HQ

SAMPLE NO:	00910/M00910	00912/M00912	00913/M00913	00914/M00914
SAMPLE LOCATION:	WELL P 110A	WELL DW 110B	WELL DW 101B	WELL DW 114B
SAMPLE TYPE:	GW-LW	GW-LW	GW-LW	GW-LW

VOA	ACETONE				20 B	11 B
	METHYLENE CHLORIDE				4.6 J	
SEMI-VOA	BIS(2-ETHYLHEXYL)PHTHALATE	20 J				
	DI-N-BUTYLPHTHALATE					
	DI-N-OCTYLPHTHALATE	3.2 J				
	PENTACHLOROPHENOL					
PEST/PCB	NO HITS					
TIC-SEMI-VOA	UNKNOWN					32 J
	UNKNOWN					
	UNKNOWN					
	UNKNOWN					
	UNKNOWN					
	UNKNOWN ACID					
TOTAL METALS	ALUMINUM	2660	662	2160		1550
	ANTIMONY					
	ARSENIC					
	BARIUM	41	90	179		142
	BERYLLIUM					
	CADMIUM					
	CALCIUM	140000	157000	93000		196000
	CHROMIUM	34	16	54		54
	COBALT					
	COPPER	22				
	IRON	3740	1220	7660		3940
	LEAD					
	MAGNESIUM	42000	45400	29000		57400
	MANGANESE	117	224	368		736
	MERCURY					
	NICKEL					
	POTASSIUM	5710	8000	5120		2320
	SELENIUM		2.4			
	SILVER					
	SODIUM	32900	10600	6040		23600
	THALLIUM					
	VANADIUM					
	ZINC	42		23		22
DIS METALS	ALUMINUM					
	ANTIMONY					
	ARSENIC					
	BARIUM	79	147	242		260
	BERYLLIUM					

SITE: # 24 BLACKHAWK, IA
CASE NO: 6530/D/SAS/1944HQ

SAMPLE NO:	00910/M00910	00912/M00912	00913/M00913	00914/M00914
SAMPLE LOCATION:	WELL P 110A	WELL OW 110B	WELL OW 101B	WELL OW 114B
SAMPLE TYPE:	GW-LDW	GW-LDW	GW-LDW	GW-LDW

CADMIUM				
CALCIUM	142000	154000	86100	200000
CHROMIUM				
COBALT				
COPPER				
IRON				
LEAD				
MAGNESIUM	41200	43600	27100	59100
MANGANESE	67	175	273	753
MERCURY				
NICKEL				
POTASSIUM	5250	8780	4120	1220
SELENIUM				
SILVER				
SODIUM	37200	12600	6930	26500
THALLIUM				
VANADIUM				
ZINC	36	52	68	43
INORG. AMMONIA NITROGEN	NR	NR		
INDIC. BROMIDE	NR	NR		37000
CHLORIDE	NR	NR	4800	70000
CYANIDE	NR	NR	NR	NR
NITRATE NITROGEN	NR	NR	8000	
NITRITE NITROGEN	NR	NR		
POC				
POX				8
SULFATE	NR	NR	43000	190000
TOC	NR	3100	3100	4200
TOTAL PHENOLS	NR	12	30	21
TOX	NR			40

APPENDIX B
GEOLOGIC LOG OF OPEN TRENCH

State of Iowa

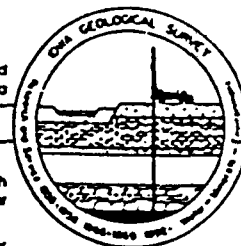
Iowa Geological Survey

123 North Capitol Street • Iowa City, Iowa 52242 • (319) 338-1173

Terry E. Branstad
Governor of Iowa

Donald L. Koch
State Geologist and Director

Bernard E. Moyer
Associate State Geologist



March 13, 1986

Ms. Leslie Knapp
Brice, Petrides & Associates, Inc.
191 W. Fifth St.
Waterloo, IA 50701

Dear Leslie:

Enclosed are data tables and stratigraphy/particle size profiles for the samples from the three sites at the Blackhawk County Landfill that you provided us. As you know, the stratigraphy at the site, in detail, is quite complex. Our data on texture (sand-silt-clay percentages) and clay mineralogy permit us to put the exposed landfill deposits into a regional, formally-defined stratigraphic framework. Even so, our formal stratigraphy essentially matches the informal stratigraphy outlined on the trench cross-section you provided us.

In the trench area, the uppermost deposit is a thin mantle of Wisconsinan-age loess (Peoria Loess), 2 to 4 feet thick. This loess mantles a Wisconsinan-age erosion surface, marked by a stone line (or pebble band), that developed on the underlying Pre-Illinoian age glacial deposits. The modern surface soil (agricultural soil) is developed in the loess, and in some places along the trench, this soil development extends down into the upper portion of the underlying glacial deposits.

As shown on your cross-section, the exposed Pre-Illinoian age glacial deposits consist of 3 basic units: an upper, somewhat homogeneous till (in places overlain by a thin sand layer); a middle unit consisting of interbedded sand, gravel, silt, and till-like materials; and a lower till unit. From our data the upper till is part of the Wolf Creek Formation, the youngest formation of Pre-Illinoian age tills in eastern Iowa. The clay mineralogy of the upper till is typical for tills of the Wolf Creek Formation: high percentages (over 60 percent) of expandable clay minerals (also known as smectite or montmorillonitic clay minerals), and a greater percentage of kaolinite plus chlorite clay minerals than illite clay minerals. Because the texture of the upper till (40% plus sand, clay content typically 10-15%) is intermediate to that of till members comprising the Wolf Creek Formation in eastern Iowa, the upper till cannot be correlated precisely with known till members of the Wolf Creek Formation. More detailed sampling between the landfill site and a site with more typical, known stratigraphy would be required for more precise stratigraphic classification at the member level of classification for the upper till at the landfill site. Such classification is unimportant, however, in the engineering use of the till at the landfill site.

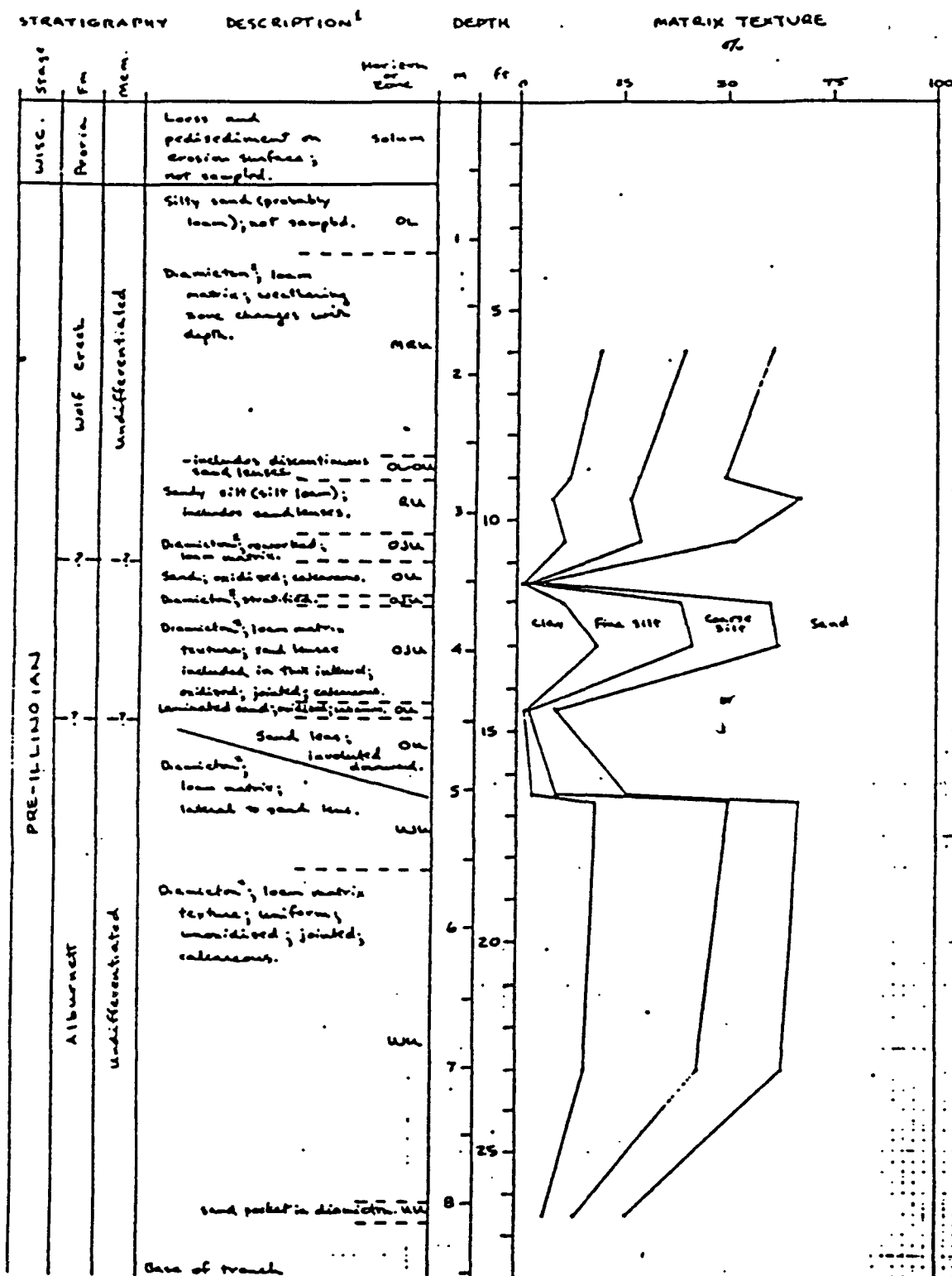
Ms. Leslie Knapp
Page 2
March 13, 1986

The lower till present in the trench exposures is also fairly straightforward, from a stratigraphic standpoint. The clay mineralogy of the lower till shows significantly lower percentages of expandable clay minerals. The lower till is also finer textured, with sand percentages typically in the thirty percent range. This till is part of the Alburnett Formation, which comprises the oldest sequence of Pre-Illinoian age tills in eastern Iowa. At present, individual tills within the Alburnett Formation are not formally subdivided as members because no properties of the individual tills have been found distinctive. It is likely that other Alburnett tills, and associated deposits, underlie the 'lower till' exposed in the trench at the landfill.

The middle unit of interbedded sand, gravel, silt, and till-like deposits is stratigraphically problematic. The till-like deposits generally have textures distinct from both the upper and lower tills. The clay mineralogy of the deposits is intermediate between that typical of the Wolf Creek and Alburnett Formations, though in general it is closer to that of the Alburnett Formation. Further field work would be required to examine contact relations laterally both within the middle unit and between the middle unit and the upper and lower tills in order to determine both the origin of the middle unit and its classification as either part of the Wolf Creek or Alburnett Formations. Since this is not possible at the present time, we can only speculate on the origin and classification of the unit. Two possible scenarios include: 1) the middle unit represents the sheared mixing of meltwater deposits (sand, gravels and silts) with pre-existing Alburnett Formation tills by an advancing Wolf Creek glacier or 2) the middle unit was deposited by a separate Alburnett advance. Dr. George Hallberg, in detailed studies of Pre-Illinoian age tills elsewhere in eastern Iowa, has commonly encountered situations that could be explained by the first scenario. He believes that this is the likely explanation also for the situation at the landfill, though this could only be confirmed by further field studies.

Regarding the hydrogeology of the site, there are a few general comments that can be made. The unit of most concern is the middle unit of interbedded sand, gravel, silt, and till-like deposits. It is an extensive deposit, being present along the entire length of the trench, and contains units with the highest hydraulic conductivity (the sands and gravels). Without remedial measures, and if saturated conditions existed, the greatest seepage to, through or from the landfill would be expected from this unit. Actual seepage values would be variable from this unit, however, not only because of probable differences in hydraulic gradient along the extent of this unit, but also because of variations in the thickness and texture (from gravel to silt) that occur along the unit's extent.

Because they are relatively well graded (poorly sorted), the upper and lower tills generally have relatively low primary porosity, and in this case, low hydraulic conductivity. Weathering effects (primarily development of a blocky, secondary soil structure as well as jointing), impart a secondary porosity, resulting in bulk hydraulic conductivity (both laterally and vertically) several orders of magnitude greater than that just of the till



¹ Description adapted from descriptions, profiles, and photos provided by Brice, Petrides & Associates, Inc. Contrasts between units vary in depth across the exposure.

² Diamicton is a purely descriptive term for well-sorted (poorly sorted deposits). As used here it refers to till and till-related glacial deposits.

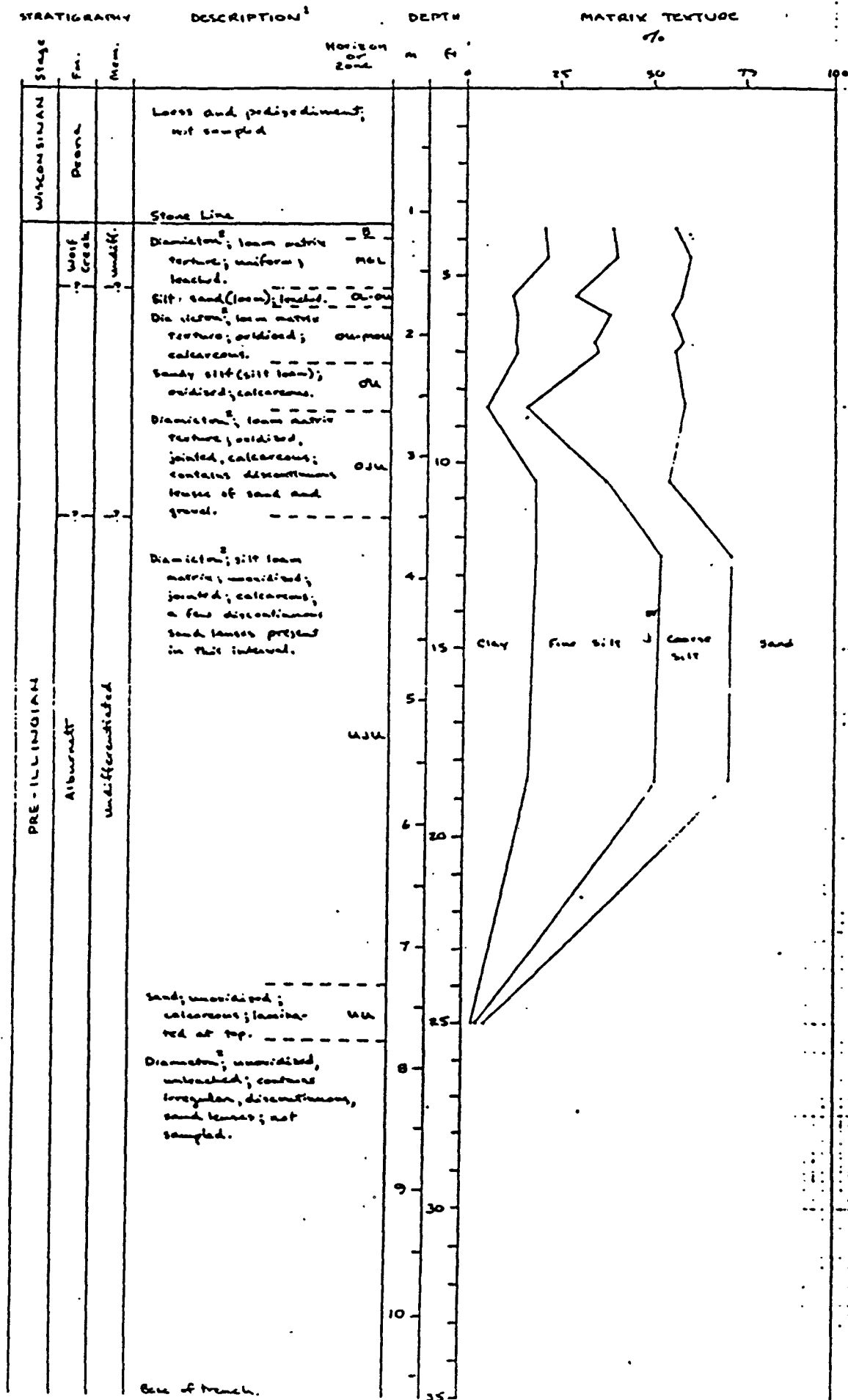
7 Blackhawk Co. Landfill
Profile A
0425

Proble A

[illegible]

Site: 7 Nishank Co Landfill
Profile D
 Location: NW 1/4 SE 1/4, T. 88N, R. 13W, Co. Blackhawk
Section 23
 Computer Site No. 0476

Computer Sample No.	Depth		Stage	Formation	Member	Deposit Type	Matrix Texture - %		Clay	Matrix Carbonate - %		Clay Mineralogy - %	K+ -	Weather Zone
	ft.	m					Sand	Co. Sil		Fi. Sil	Calite			
0010	3.0	0.6	Wisc.	Peoria	Undiff.	Loess	27.1	30.9	28.1	13.9				B
0020	4.0	1.2	Pre-III.	Wolf Creek	Undiff.	Drum	40.5	18.5	16.3	24.7	64	15	21	M & L
0030	4.5	1.35	Pre-III.	Wolf Creek	Undiff.	S(-)	90.4	2.0	1.0	6.1				OL
0040	5.0	1.5	Pre-III.	Wolf Creek	Undiff.	S(-)	78.2	7.3	3.0	16.5				β (OL)
0050	6.0	1.8	Pre-III.	Wolf Creek	Undiff.	S(+)	83.7	4.6	4.9	7.5				OL
0060	8.0	2.4	Pre-III.	Wolf Creek	Undiff.	S(+)	97.0	1.0	1.0	1.0				OL
0070	10.0	3.05	Pre-III.	Wolf Creek	Undiff.	S(+)	93.7	1.1	2.7	2.5				OL
0080	11.0	3.65	Pre-III.	Wolf Creek	Undiff.	Drum	43.5	22.1	21.4	13.0	64	18	18	M & L
0090	13.0	4.0	Pre-III.	Albion	Undiff.	Drum	39.6	23.1	22.9	14.4	50	20	30	RJH
0100	15.0	4.6	Pre-III.	Albion	Undiff.	Drum	31.3	18.6	32.2	17.7	34	27	39	WJH
								</						



¹ Description adapted from descriptions and profile provided

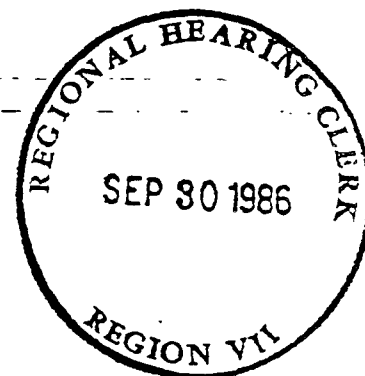
ما يفتقد

Computer Sample No.	Depth		Stage	Formation	Member	Deposit Type	Matrix Texture - %			Matrix Carbonate - %		Clay Mineralogy - %		Weather Zone
	ft.	m					Sand	Co. Silt	Fi. Silt	Clay	Calcite	Dolomite	Sm.	
0010	3.7	1.1	Pre-III.	Wolf Creek	Undiff.	Dm	44.3	15.4	15.4	70.1				B
0020	4.5	1.4	Pre-III.	Wolf Creek	Undiff.	Dm	40.0	19.9	18.5	21.6				MCL
0030	5.5	1.7	Pre-III.	?	Undiff.	Fm)	42.4	28.7	16.5	12.4				On-01
0040	6.0	1.8	Pre-III	?	Undiff.	Dm	44.9	15.7	25.0	13.4				On
0050	6.7	2.05	Pre-III.	?	Undiff.	Dm	41.9	23.5	21.7	12.9			17	MOU
0060	7.0	2.15	Pre-III	?	Undiff.	Dm	44.1	20.2	21.9	13.2				On
0070	8.5	2.6	Pre-III	?	Undiff.	Fm)	41.5	42.3	10.8	5.4				On
0080	10.5	3.2	Pre-III	?	Undiff.	Dm	45.5	17.0	19.1	18.4	37	24	29	On
0090	12.5	3.8	Pre-III.	Albion	Undiff.	Dm	26.8	17.8	33.6	16.8	31	27	42	On
0100	18.5	5.6	Pre-III.	Albion	Undiff.	Dm	29.6	12.9	33.5	17.0	34	26	40	On
0110	23.0	7.6	Pre-III.	Albion	Undiff.	S(-)	94.2	1.4	1.1	2.8				On

APPENDIX C

SEPTEMBER, 1986 CONSENT ORDER

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VII
726 MINNESOTA AVENUE
KANSAS CITY, KANSAS 66101



IN THE MATTER OF)

BLACK HAWK COUNTY SOLID)
WASTE MANAGEMENT COMMISSION)

Waterloo, Iowa,)

Respondent.)

Proceedings under Section 3013)
of the Resource Conservation)
and Recovery Act of 1976, as)
amended, 42 USC 6934 (1984).)

Docket No.
RCRA-VII-86-H-0002

CONSENT ORDER

PRELIMINARY STATEMENT

This Consent Order has been issued by the United States Environmental Protection Agency, Region VII (EPA) to the Black Hawk County Solid Waste Management Commission, Waterloo, Iowa, (SWMC). The Findings of Fact, Conclusions of Law, and all terms and conditions herein have been reviewed and agreed upon by the parties. The Order is issued pursuant to the authority vested in the Administrator of EPA by Section 3013 of the Resource Conservation and Recovery Act of 1976 (RCRA), as amended, 42 USC 6934 (1984). The Regional Administrator executes this Consent Order by the authority delegated to him in EPA Delegation Number 8-20, dated March 20, 1985. Respondent concedes the jurisdictional foundation for this Order. The Regional Administrator of EPA, Region VII, pursuant to the authority granted by EPA Delegation No. 8-20, dated March 20, 1983, has determined that the site described herein is a facility or site

where hazardous wastes have been treated, stored or disposed of in a manner which may present a substantial hazard to human health or the environment. Sampling, analyses, testing, monitoring and reporting conducted by Respondent pursuant to this Order is reasonable to ascertain the nature and extent of such hazard and shall be used by EPA to determine the extent and significance of such hazard. Notice of this Order has been given to the State of Iowa, Department of Natural Resources, Environmental Protection Division (IDNR).

FINDINGS OF FACT

1. Respondent SWMC is an intergovernmental agency of the State of Iowa consisting of several political subdivisions who by agreement formed a political subdivision under the authority of Chapter 28E of the Iowa Code, permitted to manage hazardous waste in the State of Iowa. SWMC's originating agreement was certified and filed with the Iowa Secretary of State on July 29, 1974.

2. The Black Hawk County Landfill (the Facility) is located at 1509 East Washburn, Waterloo, Iowa 50703. The Facility is located in the southeast quarter of Section 23, Township 88 North, Range 13 West, Black Hawk County, Iowa.

3. The Facility was used for storing or disposing of, and is a permanent repository for hazardous wastes as defined in Section 3001 of RCRA. See Part A application attached as "Exhibit A."

4. Specific toxicological information for the hazardous wastes referred to herein is contained in "Exhibit C."

5. SWMC is the current owner of the Facility and has been the owner of Facility since February 4, 1985. The previous owner is the Landfill Services Corporation, an Iowa corporation in good standing.

6. The Facility has been operated by the previous owners of the Facility from May 29, 1975.

7. The Facility is located in a predominantly agricultural area south of Waterloo, Iowa. An estimated 140,000 people reside or work within six miles of the Facility.

8. The findings of fact presented in subparagraphs (a) and (b) below are presumed by the parties to be substantially correct for the purposes of implementing the first phase of groundwater monitoring, as outlined beginning with paragraph 15. and following. It is understood, however, that such "findings of fact" are not fully substantiated by data obtained from onsite testing, but are in fact conclusions of fact based upon the incomplete information available to the parties. If the data obtained in the first phase of testing described herein establishes facts which require conclusions different from those conclusions stated in subparagraphs (a) and (b) below, then those new conclusions shall be used by the parties in determining the scope, extent and purpose of further groundwater monitoring as it may be required.

(a) The hydro-geologic setting of the site is such that releases from it may contaminate shallow groundwater, which is hydraulically connected to the groundwater of the deeper Cedar Valley limestone aquifer. Unconsolidated surficial sediments consist primarily of glacial drift deposits of up to 100 feet thick into which landfill trenches have been excavated. The uppermost bedrock formation beneath the Facility is the Cedar Valley Limestone Formation which is a major regional drinking water aquifer. Groundwater occurs as near (depending upon seasonal water table fluctuations) as 5-10 feet below ground surface. Shallow groundwaters are at risk of contamination by releases from the landfill cells into which hazardous wastes were disposed. Groundwater so contaminated by such releases may discharge to and contaminate Cedar River surface waters and sediments.

(b) Bedrock groundwater is hydraulically connected to the shallow groundwater system beneath the Facility and is therefore also at risk of contamination by releases from the Facility. Bedrock groundwater in the vicinity of the Facility is a significant source of drinking water for both private and public water supplies. Records available to EPA indicate that six domestic supply wells within one mile of the Facility are used as a source of drinking water.

9. The release of contamination from the Facility into the Cedar River may adversely affect the quality of that surface

water and its ability to support aquatic life. Contamination of the River would also adversely affect its usability as a recreational resource and as a habitat for game fish, sport fish, and other animals drinking its water or using it as a habitat.

CONCLUSIONS OF LAW

10. The wastes referred to in paragraph 3 and "Exhibit A" and "Exhibit C" are "hazardous wastes" as defined by Section 1004(5) of RCRA, 42 USC 6903(5).

11. The placing of hazardous wastes into the landfill or onto or into the land described in paragraph 3 and "Exhibit A" constitutes "storage" as defined by Section 1004(33) of RCRA, 42 USC 6903(33). The placing of hazardous wastes into the landfill or onto or into the land described in paragraph 3 and "Exhibit A" constitutes "disposal" as defined by Section 1004(3) of RCRA, 42 USC 6903(3).

12. The Black Hawk County Landfill is a "Facility" as used in Section 3013 of RCRA, 42 USC 6934 (1984) and as defined in 40 CFR 260.10 (1984).

13. SWMC is the "owner" and the "operator" of the facility as defined in 40 CFR 260.10 and as used in Section 3013 of RCRA, 42 USC 6934 (1984).

DETERMINATION

14. The Regional Administrator of the United States Environmental Protection Agency, Region VII hereby determines that the presence of hazardous wastes at this facility as

described in this Order, and that a release of such hazardous wastes into the environment, may present a substantial hazard to human health or the environment. The Regional Administrator has further deemed that the following described monitoring, testing, analysis, and reporting with respect to the facility, to ascertain the nature and extent of such hazard, is reasonable.

ORDER

15. The objective of the following required actions is to ascertain the nature and extent of the possible hazard to human health or the environment.

Groundwater Monitoring Plans

16. SWMC shall, unless otherwise specified, comply with the following requirements for an environmental monitoring program in two phases. The monitoring system installed under Phase I, which is based upon the inadequate data available, is not a fully adequate groundwater monitoring system to determine the facility's impact on the quality of the groundwater in the uppermost aquifer underlying the facility. Any activities to be accomplished during Phase II will be dependent in part upon receipt and evaluation of information provided in Phase I.

17. Respondent shall:

A. Design and implement a groundwater monitoring system for the Black Hawk County Landfill as specified in the monitoring plan submitted to EPA by SWMC on May 15, 1986, incorporating all modifications as specified

in correspondence between EPA and Respondent with the latest being two letters to EPA from Respondent dated August 18, 1986, and August 27, 1986, attached hereto as "Exhibit B."

B. Submit an acceptable sampling protocol for EPA approval prior to the initiation of the groundwater sampling program on Phase I wells.

C. Obtain samples from such groundwater monitoring system by November 1, 1986.

D. Analyze each sample for the compounds and the parameters listed in and in accordance with Exhibit D.

E. Obtain and analyze samples from each well on a monthly basis in accord with Exhibit D.

F. The analytical data obtained from samples collected during the first two sampling months will be utilized to design the Phase II groundwater monitoring system.

G. Develop a groundwater monitoring plan for Phase II groundwater monitoring system. The plan will be submitted to EPA for review by January 15, 1987, subject to request for extensions.

H. Upon approval by EPA, implement such Phase II groundwater monitoring plan in accordance with the schedules contained therein.

GENERAL REQUIREMENTS

18. The following general requirements must be addressed for the Phase I monitoring system, the Phase II plan

and any future plans submitted to EPA.

A. Each plan must specify an expeditious and reasonable schedule for the implementation and completion of its various components.

B. Each plan is to provide for monthly reports to EPA on the progress of the monitoring work, due on the 15th of each month after the initiation of Phase I.

C. Each plan shall specify the precautions which will be taken to insure the health and safety of the individuals associated with this project.

D. All sampling and analyses shall be done in accordance with EPA, National Enforcement Information Center (NEIC) protocols.

PHASE II PLAN REVIEW AND APPROVAL PROCESS

19. After EPA's receipt of SWMC's Phase II plan, EPA shall review the plan and notify SWMC in writing of its approval or disapproval.

20. Upon written approval of the Plan by EPA, SWMC shall within 30 days, initiate work according to the approved plan and monitoring system design.

21. In the event EPA does not approve the plan in whole or in part, EPA will specify in writing, the deficiencies of the plan, to SWMC's representatives as designated in Paragraph 23(a).

22. Within 30 days of receipt of a notice of disapproval, SWMC shall modify the plan to correct the

deficiencies and shall submit the revised plan to EPA for review and written approval.

23. Should SWMC take exception to all or part of EPA's disapproval, SWMC shall submit within 10 days to EPA in writing the statement of the grounds for such exception. Representatives of EPA and SWMC shall then confer by telephone or in person in an attempt to resolve any disagreement. At such conference, a resolution may be reached with regard to each area of disagreement and shall be reduced to writing and signed by representatives of each party.

24. In the event the parties cannot resolve their disagreement, the plan shall be implemented as directed by EPA.

25. Upon written approval by EPA of the plan as originally proposed, or as amended pursuant to conference, SWMC shall proceed to carry out the plan in accordance with the timetable(s) contained therein.

SITE AND INFORMATION ACCESS: CONFIDENTIALITY

26. SWMC shall provide access to the Facility site to EPA employees and to EPA contractors at reasonable times and shall permit such persons to be present and move freely in the area where any work is being conducted at all times when work is being conducted pursuant to this Order. SWMC shall provide EPA with copies of all charts, maps, letters, memoranda, invoices, shipping manifests or other records or documents considered by EPA to be relevant to the subject matter of this Order. Any information requested pursuant to this Order must be provided,

notwithstanding its possible characterization as Confidential Business Information (CBI). Respondent may assert a business confidentiality claim covering all or part of the information submitted pursuant to this Order. The information covered by such a claim will be disclosed by EPA only to the extent and by the procedures specified in 40 CFR Part 2, Subpart B (1985), as amended by 50 Federal Register 51654, December 18, 1985. Such a claim may be made by placing on or attaching to the information, at the time it is submitted to EPA, a cover sheet, stamped or typed legend or other suitable form of notice employing language such as "trade secret," "proprietary," or "company confidential". Allegedly confidential portions of otherwise non-confidential documents should be clearly identified and may be submitted separately to facilitate identification and handling by EPA. If confidential treatment is sought only until a certain date or occurrence of a certain event, the notice should so state. If no such claim accompanies the information when it is received by EPA, it may be made available to the public without further notice to Respondent.

SAMPLING SPLITTING

27. SWMC shall upon request from EPA provide EPA or EPA Contractors with splits of any or all samples taken pursuant to this Order.

EXCHANGE OF INFORMATION

23 (a). Whenever under the terms of this Order, notice is required to be given by one party to another, it shall be

directed to the individuals at the addresses specified below, unless those individuals or their successors give notice in writing to the parties of another individual designated to receive such communication:

Bruce Bottorff
Chairman --
Solid Waste Management
Commission
Black Hawk County
P.O. Box 208
Waterloo, Iowa 50704

Donald E. Sandifer, P.E.
Site Project Officer
RCRA/Iowa Section
United States Environmental
Protection Agency, Region VII
726 Minnesota Avenue
Kansas City, Kansas 66101

(b). Routine communications concerning the plans, reports, or any aspects of this Order may be exchanged by phone between the parties to facilitate the work required by this Order, but no verbal communication shall in any way alter or amend the provisions of this Order.

COMPLIANCE WITH APPLICABLE STATUTES AND REGULATIONS

29. All actions undertaken pursuant to this Order by SWMC or its duly authorized representatives shall be done in accordance with all applicable federal, state and local statutes and regulations.

AMENDMENT

30. The parties hereto may, by mutual agreement, modify this Order, only if such modification is in writing and executed by representatives of each party.

LIABILITY

31. Neither the United States Government nor any agent thereof shall be liable for any injuries or damage to persons or property resulting from acts or omissions of Respondent, its

officers, directors, employees, agents, servants, receivers, trustees, successors, or assigns, or of any persons, including but not limited to firms, corporations, subsidiaries, contractors or consultants, in carrying out activities pursuant to this Order, nor shall the United States Government or any agency thereof be held out as a party of any contract entered into by Respondent in carrying out activities pursuant to this Order.

ENFORCEMENT

32 (a) The Administrator may commence a civil action against any person who fails or refuses to comply with this order. Such action shall be brought in the United States District Court in which the Respondent is located, resides, or is doing business. Such court shall have jurisdiction, pursuant to 42 USC 6934 (e) (1984), to require compliance with this order and to assess a civil penalty of not to exceed \$5,000 for each day during which such failure or refusal occurs.

(b) Nothing contained herein shall be construed to prevent EPA from seeking legal or equitable relief to enforce the terms of this Order, or from taking other legal or equitable action as it deems appropriate or necessary with respect to the Facility, or from requiring future activities at the Facility, pursuant to RCRA, 42 USC 6901 - 6991i or other applicable law.

(c) If the Regional Administrator determines that SWMC is not able to undertake the ordered measures satisfactorily or deems any such action carried out by SWMC to be unsatisfactory,

the Regional Administrator may take the ordered measures or authorize a state or local authority or other person to carry out any such action and require, by order, SWMC to reimburse EPA or other authority or person for the costs of such activity.

MISCELLANEOUS

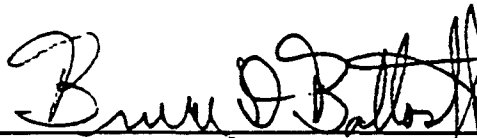
33 (a) The provisions of this Order shall be binding upon the employees, agents, successors and assigns of the parties hereto.

(b) This Order shall become effective upon receipt by SWMC of a fully executed copy.

HAVING FULLY REVIEWED the foregoing Findings of Fact, Conclusions of Law, Determination and Order, the United States Environmental Protection Agency and Solid Waste Management Commission stipulate to all findings and conclusions, are in agreement with regard to the determination and do hereby consent to the provisions of this Order:

Sept 25 1986

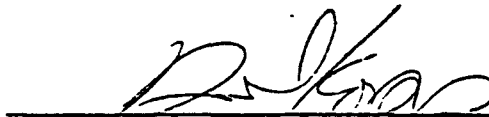
Date



Bruce Bottorff, Chairman
Black Hawk County Solid
Waste Management Commission
P.O. Box 208
Waterloo, Iowa 50704

September 8, 1986

Date

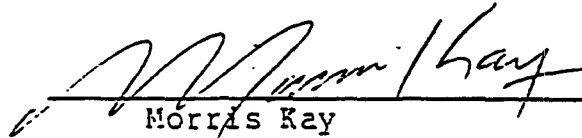


David Lamar Kopp
Assistant Regional Counsel
U. S. Environmental Protection
Agency, Region VII
726 Minnesota Avenue
Kansas City, Kansas 66101

IT IS SO DETERMINED AND ORDERED.

9-29-86

Date



Morris Kay
Regional Administrator
U. S. Environmental Protection
Agency, Region VII
726 Minnesota Avenue
Kansas City, Kansas 66101

APPENDIX D
BEDROCK GEOLOGIC BORING LOG (B-200)

State of Iowa

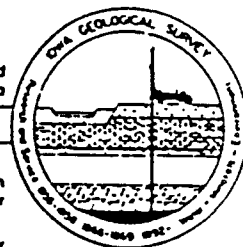
Iowa Geological Survey

123 North Capitol Street • Iowa City, Iowa 52242 • (319) 338-1173

Terry E. Branstad
Governor of Iowa

Donald L. Koch
State Geologist and Director

Bernard E. Hoyer
Associate State Geologist



October 31, 1986

Ms. Leslie Knapp
Brice-Petrides-Donohue, Inc.
191 W. 5th Street
Waterloo, Iowa 50701

Dear Leslie:

A preliminary look at the deep rock core on October 29 at the Black Hawk County Landfill has verified the general stratigraphy. Drilling had reached the top of the coherent Silurian dolomites prior to my departure. The general stratigraphic breakdown follows (see also enclosed graphic section). Stratigraphic units in the Cedar Valley Formation are presently in informal status. Gross lithologic characters are noted, but specific details are omitted pending further examination.

CEDAR VALLEY FORMATION (Middle Devonian)

- "Unit B" - 109.5-136.5 ft.; dolomite, minor dolomitic limestone, abundant fossil molds through most, calcite void fills.
- "Unit A4" - 136.5-138 ft. (approx.); dolomite, brecciated.
- "Pints Mbr." - 138-164.5 ft (approx.); dolomite, faintly laminated, unfossiliferous, part burrow mottled, chert nodules scattered throughout.
- "Lower Unit A" - 164.5-169 ft. (approx.); dolomitic limestone, laminar stromatoporoids scattered through.
- 169-196.7 ft.; dolomitic limestone, abundant burrow mottles through sparsely fossiliferous with thin skeletal stringers scattered 173-181 and base.
- 169.7-205.5 ft. (approx.); limestone and dolomitic limestone, abundant fossils (especially brachiopods).
- 205.5-215.3 ft.; dolomitic limestone and dolomite, fossiliferous, conglomeratic at base

WAPSIPINICON FORMATION (Middle Devonian)

- Davenport Mbr. - 215.3-232 ft. (approx); dolomite and dolomitic limestone, part argillaceous, brecciated near top (poor recovery).
- Spring Grove Mbr. - 232-251.5 ft. (approx.); dolomite, very calcitic, finely laminated in upper half.
- Kenwood Mbr. - 251.5-280.3 ft. (approx.); shale, silty to very sandy, conglomeratic lower 4 ft.; interbedded dolomite, argillaceous, part sandy.

SILURIAN UNDIFFERENTIATED

- Chert residuum (LaPorte City Chert) - 280.3-301.5 ft. (approx.); residuum or dark gray to white chert nodules and clasts in argillaceous dolomite matrix, some cherts with Silurian corals (poor recovery).
- Hopkinton Fm/? - 301.5 ft. (core continues below) dolomite, cherty.

October 31, 1986
Ms. Leslie Knäpp
Page -2-

Clay or shale stratigraphic leaks are noted in solutional openings at five positions in the Cedar Valley and upper Wapsipinicon formations. Open solutionally-enlarged fractures are present at various positions in the Cedar Valley and upper Wapsipinicon formations. The absence of significant shale layers and the presence of fracture networks (presumably interconnected) through this stratigraphic interval suggest that the Cedar Valley and upper Wapsipinicon should be considered part of a single bedrock aquifer unit. The Cedar Valley Formation and subjacent upper Wapsipinicon strata form part of a single carbonate aquifer system in most of Black Hawk County and areas to the south and southeast.

The Kenwood Member of the Wapsipinicon contains relatively impermeable shales over most of its geographic extent and is known to form an aquitard regionally, separating Cedar Valley and Silurian aquifers. The Kenwood at the Black Hawk County Landfill is exceptionally shaley and contains unfractured soft shale in part. The shaley nature at this locality should provide as good an aquitard as can be found at this stratigraphic position anywhere in eastern Iowa, since the Kenwood elsewhere is generally less shaley. The cherty residuum at the top of the Silurian interval is relatively dense and impermeable and should amplify the aquitard properties of the superjacent Kenwood.

I look forward to seeing the remainder of the core. If any further questions arise, feel free to contact me.

Sincerely,

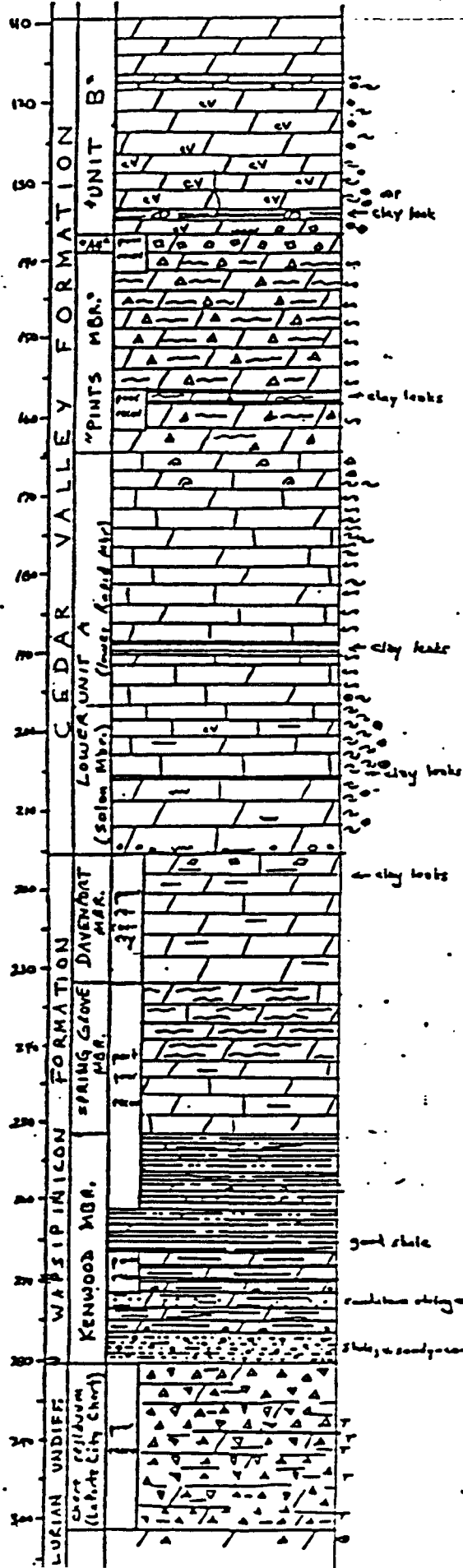


Brian J. Witzke
Research Geologist

BJW/mph
Enclosure

deep core Oct., 1966
 SW 1E sec. 27, T88N, R13W Black Hawk Co.
 271476

depth(ft)



KEY:

- dolomite
- dolomitic limestone
- limestone
- shale
- chert
- argillaceous
- chylolites
- brecciated
- conglomeratic
- laminated
- sandy-silty
- calcareous
- burrows
- animal debris
- brachiopods
- stromatopores
- corals

LOG OF TEST BORING

JOB NO 4800 86-873

VERTICAL SCALE 1" = 4'

BORING NO B 200

PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	R	WL	SAMPLE		LABORATORY TESTS			
					NO	TYPE	W	D	LL PL	RQD
105'	NOT SAMPLES taken from 0-109.5'	NO SAMPLES								
109.5	WEATHERED LIMESTONE, yellowish brown	*** CEDAR VALLEY FORMATION	75%		1	NQ				20%
			88%		2	NQ				53%
116.8	LIMESTONE, yellowish brown to gray		96%		3	NQ				46%
			100%		4	NQ				48%
126.5	DOLOMITE, yellowish brown to gray		58%		5	NQ				46%
132	DOLOMITIC BRECCIA, yellowish brown to gray		98%		6	NQ				38%
133.5	LEAN CLAY with pieces of gravel, dark gray									
135	Boring Continued Next Page									

LOG OF TEST BORING

JOB NO 4800 86-873

VERTICAL SCALE 1" = 4'

BORING NO B 200 (Cont'd)

PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	R	WL	SAMPLE		LABORATORY TESTS			
					NO	TYPE	W	D	1 1.1	RQD
135'	DOLOMITIC BRECCIA, yellowish brown to gray	CEDAR VALLEY FORMATION (continued)								
137.5	DOLOMITE, yellowish brown with Chert nodules, black		58%		7	NQ				8%
			92%		8	NQ				34%
			40%		9	NQ				8%
			68%		10	NQ				24%
156.5	a layer of Lean Clay, dark gray		46%		11	NQ				8%
162.5	DOLOMITE, yellowish brown to gray		64%		12	NQ				30%
165	Boring Continued Next Page									

LOG OF TEST BORING

JOB NO 4800 86-873

VERTICAL SCALE 1" = 4'

BORING NO B 200 (Cont'd)

PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	R	WL	SAMPLE		LABORATORY TESTS			
					NO	TYPE	W	D	U	RQD
165'	DOLOMITE, yellowish brown to gray (continued)	CEDAR VALLEY FORMATION (continued)								
			88%		13	NQ				32%
			90%		14	NQ				50%
			82%		15	NQ				28%
			76%		16	NQ				8%
			80%		17	NQ				0%
			100%		18	NQ				58%
195	Boring Continued Next Page									

LOG OF TEST BORING

JOB NO 4800 86-873

VERTICAL SCALE 1" = 4'

BORING NO B 200 (it'd)

PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	R	WL	SAMPLE		LABORATORY TESTS			
					NO	TYPE	W	D	$\frac{1}{2}$ P.L.	RQD
195'										
196.7	DOLOMITE, yellowish brown to gray	CEDAR VALLEY FORMATION (continued)								
	LIMESTONE, gray		90%		19	NQ				56%
			96%		20	NQ				62%
206.5	LIMESTONE, yellowish brown to gray									
			92%		21	NQ				68%
213.3	a layer of Shale, dark gray to black from 213.3'-213.5'		86%		22	NQ				0%
214.8	DOLOMITE, yellowish brown to gray	*** WAPSIPINICON FORMATION								
			24%		23	NQ				0%
			40%		24	NQ				0%
225	Boring Continued Next Page									

LOG OF TEST BORING

JOB NO 4800 86-873

VERTICAL SCALE 1" = 4'

BORING NO B 200 (Cont'd)

PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	R	WL	SAMPLE		LABORATORY TESTS			
					NO	TYPE	W	D	$\frac{1}{2}$ F	RQD
225'	DOLOMITE, yellowish brown to gray (continued)	WAPSIPINICON								
			30%		25	NQ				0%
			40%		26	NQ				7%
			84%		27	NQ				16%
			100%		28	NQ				16%
			80%		29	NQ				0%
251.5	SHALE, dark gray to greenish gray with gravel		64%		30	NQ				0%
255	Boring Continued Next Page									

LOG OF TEST BORING

JOB NO 4800 86-873

VERTICAL SCALE 1" = 4'

BORING NO B 200 (Cont'd)

PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	R	WL	SAMPLE		LABORATORY TESTS			
					NO	TYPE	W	D	$\frac{1}{2}$ in	ROD
255'	SHALE; dark gray to greenish gray with gravel (continued)	WAPSIPINICON	90%		31	NQ				0%
			76%		32	NQ				0%
266.5	DOLOMITE, brown to grayish brown		46%		33	NQ				0%
			88%		34	NQ				54%
276	SHALE, pale green		100%		35	NQ				52%
		*** LA PORTE CITY FORMATION	92%		36	NQ				0%
285	Boring Continued Next Page									

LOG OF TEST BORING

JOB NO 4800 86-873

VERTICAL SCALE 1" = 4'

BORING NO B 200 (Cont'd)

PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	R	WL	SAMPLE		LABORATORY TESTS			
					NO	TYPE	W	D	U C	ROD
285'	SHAPE, pale green (continued) with black Chert nodules	LA PORTE CITY FORMATION (continued)								
			40%		37	NQ				0%
			60%		38	NQ				0%
296.5	CHERT, white to black, with Dolomitic Matrix, yellowish brown		30%		39	NQ				0%
301.5	DOLOMITE, pale yellow with gray mottles	*** HOPKINTON FORMATION	70%		40	NQ				60%
			103%		41	NQ				103%
			100%		42	NQ				82%
315	Boring Continued Next Page									

LOG OF TEST BORING

JOB NO 4800 86-873

VERTICAL SCALE 1" = 4'

BORING NO B 200 (Cont'd)

PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	R	WL	SAMPLE		LABORATORY TESTS			
					NO	TYPE	W	D	$\frac{W}{D}$	RQD
315'	DOLOMITE, pale yellow with gray mottles (continued)	HOPKINTON FORMATION								
			100%		43	NQ				100%
			100%		44	NQ				80%
328	DOLOMITE, gray to brown	*** BLANDING FORMATION	100%		45	NQ				38%
			100%		46	NQ				90%
			100%		47	NQ				80%
			100%		48	NQ				80%
345	Boring Continued Next Page									

LOG OF TEST BORING

JOB NO 4800 86-873

VERTICAL SCALE 1" = 4'

BORING NO B 200 (Cont'd)

PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	R	WL	SAMPLE		LABORATORY TESTS			
					NO	TYPE	W	D	$\frac{W}{D}$	RQD
345'	DOLOMITE, gray to brown (continued)	BLANDING FORMATION (continued)								
			100%		49	NQ				50%
351.5	Dolomite, red nodule		100%		50	NQ				74%
			100%		51	NQ				72%
			100%		52	NQ				100%
366.5	Dolomite, red nodule		100%		53	NQ				80%
			100%		54	NQ				100%
375	Boring Continued Next Page									

LOG OF TEST BORING

JOB NO 4800 86-873

VERTICAL SCALE 1" = 4'

BORING NO B 200 (Cont'd)

PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	R	WL	SAMPLE		LABORATORY TESTS			
					NO	TYPE	W	D	LL	RQD
375'	DOLOMITE, gray to brown (continued)	BLANDING FORMATION (continued)								
			100%		55	NQ				90%
			100%		56	NQ				94%
			96%		57	NQ				94%
			100%		58	NQ				100%
396.5	DOLOMITE, light greenish gray to gray		100%		59	NQ				92%
			100%		60	NQ				96%
405	Boring Continued Next Page									

LOG OF TEST BORING

JOB NO 4800 85-873

VERTICAL SCALE 1" = 4'

BORING NO B 20U (Cont'd)

PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	R	WL	SAMPLE		LABORATORY TESTS			
					NO	TYPE	W	D	1 I	RQD
405'	DOLOMITE, light greenish gray to gray (continued)	BLANDING FORMATION (continued)								
			100%		61	NQ				96%
			101%		62	NQ				101%
416.5	DOLOMITE, red to dark gray	*** MAQUOKETA FORMATION	100%		63	NQ				94%
424.1	DOLOMITE, yellowish brown to gray		100%		64	NQ				100%
			96%		65	NQ				80%
431.5	DOLOMITE, gray with small layers of Shale, pale greenish gray		102%		66	NQ				102%
435	Boring Continued Next Page									

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 200 (Cont'd)
 PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	R	WL	SAMPLE		LABORATORY TESTS			
					NO	TYPE	W	D	LL PL	RQD
435'	DOLOMITE, gray with small Shale layers, pale greenish gray (continued)	MAQUOKETA FORMATION (continued)								
			98%		67	NQ				92%
			98%		68	NQ				94%
			100%		69	NQ				100%
			100%		70	NQ				100%
			100%		71	NQ				100%
461.5	END OF BORING									

WATER LEVEL MEASUREMENTS							START	COMPLETE
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL	10-21-86	10-31-86
					to		METHOD 6"FA 0-90':	@
					to		NRC 0-109.5'	
					to		NQ core 109.5'-461.5'	
					to		CREW CHIEF V. Munnsinger	

APPENDIX E
SAMPLING SCHEDULE AND PARAMETER LIST

1st Month - All Wells

- I. pH)
Specific Conductance (SC))
Total Organic Carbon (TOC))
Total Organic Halogen (TOX))

4 replicate analysis for each
upgradient wells

II. Cyanide, total

III. EP Toxicity, filtered and unfiltered for:

Arsenic
Barium
Cadmium
Chromium
Lead
Mercury
Selenium
Silver

IV. 31 Priority Pollutant - Volatile Compounds

Acrolein - 8240
Acrylonitrile - 8240
Benzene - 8240
Bis (Chloromethyl) Ether - unstable in
water
Bromoform - 8240
Carbon Tetrachloride - 8240
Chlorobenzene - 8240
Chlorodibromomethane - 8240
Chloroethane - 8240
2-Chloroethylvinyl Ether - 8240
Chloroform - 8240
Dichlorobromomethane - 8240
Dichlorodifluoromethane - 8240
1,1-Dichloroethane - 8240
1,2-Dichloroethane - 8240

1,1-Dichloroethylene - 8240
1,2-Dichloropropane - 8240
1,3-Dichloropropylene - 8240
Ethylbenzene - 8240
Methyl Bromide - 8240
Methyl Chloride - 8240
Methylene Chloride - 8240
1,1,2,2-Tetrachloroethane - 8240
Tetrachloroethylene - 8240
Toluene - 8240
1,2-Trans-Dichloroethylene - 8240
1,1,1-Trichloroethane - 8240
1,1,2-Trichloroethane - 8240
Trichloroethylene - 8240
Trichlorofluoromethane - 8240
Vinyl Chloride - 8240

V. 16 Solvents not on the Priority Pollutant List but contained in the
F002-F005 listing

1,1,2-trichloro - 1,2,2-
trifluoroethane - 8240
ortho-dichlorobenzene - 8240
xylene - 8240
acetone - 8240
ethyl acetate - 8240 (direct)
ethyl ether - 8240
methyl isobutyl ketone - 8240
n-butyl alcohol - 8240 (direct)

cyclohexanone - 8270
methanol - 8270
cresols - 8270
cresylic acid - 8270
methyl ethyl ketone - 8240
carbon disulfide - 8240
isobutanol - 8240 (direct)
pyridine - 8270

VI. Nitrobenzene - 8270

continued)

2nd Month thru 4th Month

Same as "I" for 1st month.

5th Month

Same as "I" for 1st month except that 4 replicate analysis will be required on all wells (both upgradient and downgradient). A statistical evaluation in accordance with §265 Subpart F will be performed.